

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been
filed in the U.S. District Court _____ for the District of Delaware _____ on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT for the District of Delaware
PLAINTIFF Tigo Energy Inc.		DEFENDANT SMA Solar Technology America LLC
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,823,218	Sept. 2, 2014	Tigo Energy Inc.
2 8,933,321	Jan. 13, 2015	Tigo Energy Inc.
3 9,584,021	Feb. 28, 2017	Tigo Energy Inc.
4 9,966,848	May 8, 2018	Tigo Energy Inc.
5 10,256,770	Apr. 9, 2019	Tigo Energy Inc.
6 10,333,405	Jun. 25, 2019	Tigo Energy Inc.

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SUNSPEC ALLIANCE,
Petitioner,

v.

TIGO ENERGY, INC.,
Patent Owner.

IPR2021-01286
Patent 8,933,321 B2

Before KRISTINA M. KALAN, WESLEY B. DERRICK, and
JULIA HEANEY, *Administrative Patent Judges*.

HEANEY, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314, 37 C.F.R. § 42.4

I. INTRODUCTION

SunSpec Alliance (“Petitioner”) filed a Petition to institute an *inter partes* review of claims 1, 5–7, 12, and 13 of U.S. Patent No. 8,933,321 B2 (Ex. 1001, “the ’321 patent”). Paper 2 (“Petition” or “Pet.”). Tigo Energy, Inc. (“Patent Owner”) waived the filing of a Preliminary Response. Paper 7 (“Waiver”).

Institution of an *inter partes* review is authorized by statute when “the information presented in the petition . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2018). Upon consideration of the Petition and the evidence of record, we determine that Petitioner has established a reasonable likelihood that it would prevail in showing the unpatentability of at least one claim challenged in the Petition. Accordingly, we institute an *inter partes* review of all claims and all grounds asserted in the Petition.¹

A. *Related Proceedings*

The parties identify the following litigation involving the ’321 patent: *Tigo Energy Inc. v. Altenergy Power Sys. Inc.*, Case No. 5:20-cv-03622 (N.D. Cal.); and *Tigo Energy Inc. v. Altenergy Power Sys. Inc.*, Case No. 5:21-cv-02612 (N.D. Cal.). Pet. 56–57; Paper 4, 2. The parties further identify the following *inter partes* review proceeding involving the ’321 patent that was terminated prior to an institution decision: *Altenergy Power Sys. Inc. v. Tigo Energy Inc.*, Case No. IPR2021-00541 (PTAB). Pet. 57;

¹ *Guidance on the Impact of SAS on AIA Trial Proceedings* (Apr. 26, 2018), <https://www.uspto.gov/patents-application-process/patent-trial-and-appeal-board/trials/guidance-impact-sas-aia-trial>; see also *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018).

Paper 4, 2–3. The parties also identify IPR2021-01287 involving U.S. Patent No. 10,256,770, which is a continuation-in-part of the '321 patent. Pet. 56; Paper 4, 3.

B. The '321 Patent

The '321 patent, titled “Systems and Methods for an Enhanced Watchdog in Solar Module Installations,” relates to a system “for shutting down a photovoltaic energy generating unit when communication with a central controller is interrupted.” Ex. 1001, code (54), 1:49–51. Figure 1, reproduced below, illustrates an energy production system including a plurality of junction boxes each coupled between a solar module and a power bus. *Id.* at 2:37–39.

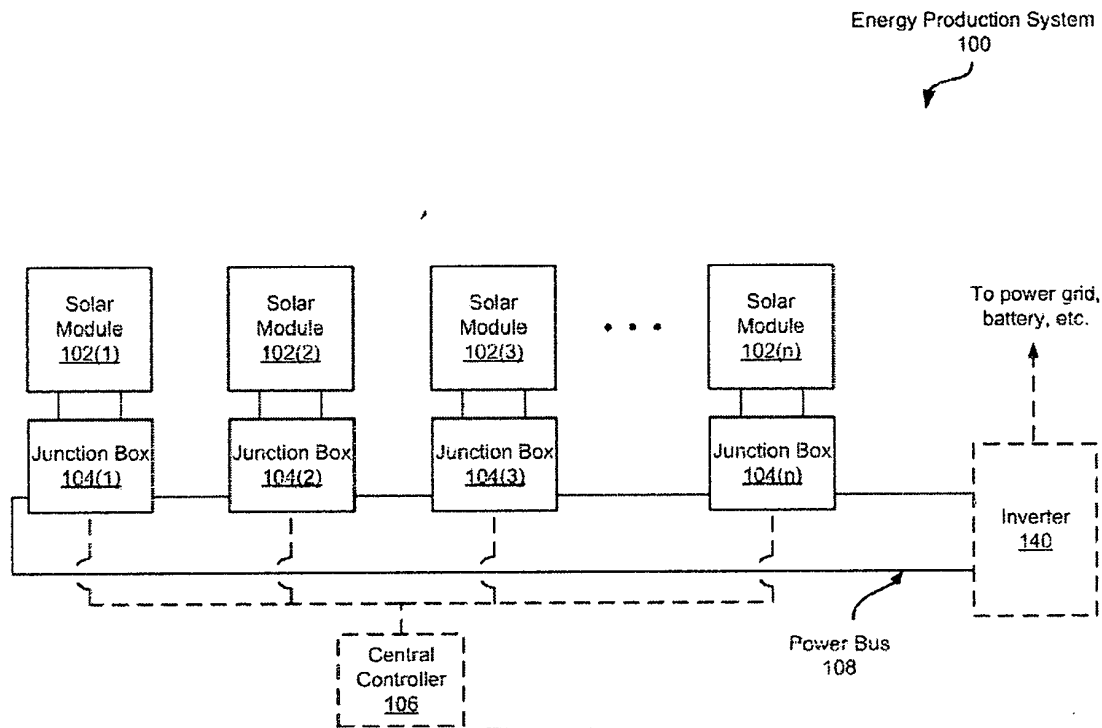


Figure 1

Figure 1 depicts energy production system 100 including a plurality of junction boxes 104 each coupled between solar module 102 and power bus 108. *Id.* at 3:10–12. The junction boxes control the voltage provided by the

solar modules to the power bus. *Id.* at 3:14–16. The junction boxes disconnect the solar modules from the power bus, or lower the voltage provided to the power bus. *Id.* at 3:18–20. The junction boxes each comprise a watchdog unit, which monitors a communication (or signal) from central controller 106 via a wireless or wired connection. *Id.* at 3:20–23. When the communication is interrupted, each watchdog unit renders its associated solar module safe by disconnecting the solar module from the power bus or by lowering the solar module voltage to a safe level. *Id.* at 3:23–27.

Figure 2, reproduced below, illustrates a solar module and a detail view of a junction box. *Id.* at 2:40–41.

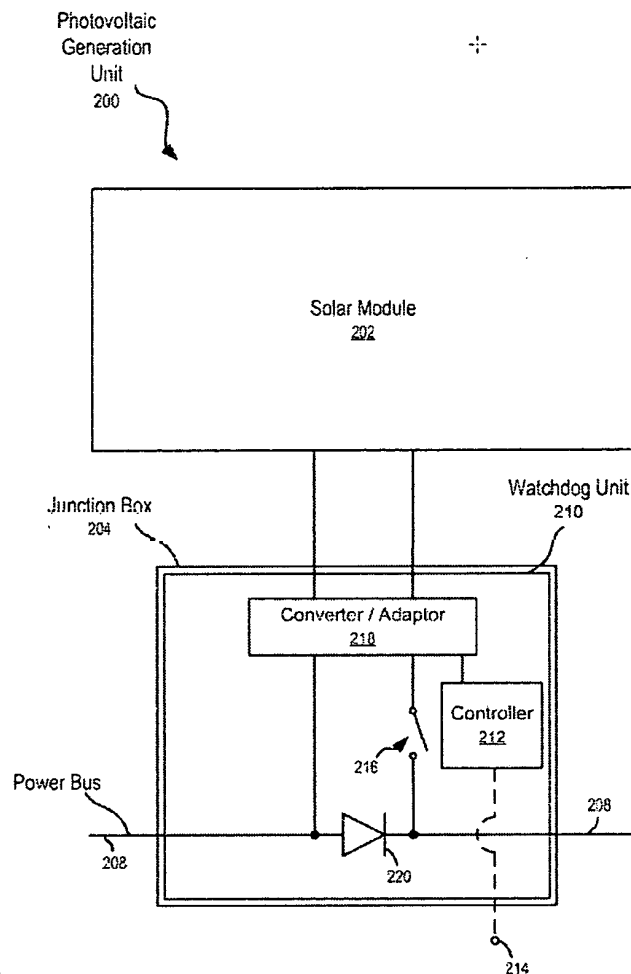


Figure 2

Figure 2 depicts solar module 202 and a detail view of junction box 204. *Id.* at 4:9–10. The junction box is coupled between the solar module and power bus 208. *Id.* at 4:10–11. The junction box includes controller 212 and switchable connection 216. *Id.* at 4:12–14. The junction box further includes watchdog unit 210. *Id.* at 4:16–17. The watchdog unit is configured to monitor a communication from central controller 106, determine that the communication has been interrupted, and disconnect the solar module from the power bus or lower the solar module voltage to a safe level. *Id.* at 4:17–21.

C. The Challenged Claims

Petitioner challenges claims 1, 5–7, 12, and 13 of the '321 patent.²

Pet. 1. Claims 1 and 12 are independent, claims 5–7 depend from claim 1, and claim 13 depends from claim 12. Claims 1 and 12, reproduced below, are illustrative of the subject matter of the challenged claims:

1. A system comprising:

a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog unit having:

a local controller configured to monitor a communication from a central controller remote from the solar module and determine whether the communication has been interrupted for a time period longer than a predetermined number of allowed skips; and

at least one switch configured to disconnect the solar module from the power bus in response to a determination by the location controller that the communication from the central controller has been interrupted for a time period longer than the predetermined number of allowed skips;

wherein the watchdog unit is configured to connect the solar module to the power bus when the communication is not interrupted.

Ex. 1001, 11:18–36.

12. A system comprising:

a watchdog device coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog device configured to:

² Petitioner argues that the Board should not exercise its discretion to deny institution. *See* Pet. 52–56. In light of Patent Owner's Waiver, it is not necessary to reach Petitioner's discretionary denial arguments, and thus, we do not exercise our discretion to deny institution.

verify communication with a central controller remote from the solar module; and

shutdown the solar module from the power bus if communication with the central controller cannot be verified for a time period longer than a predetermined number of allowed skips.

Id. at 12:11–20.

D. Asserted Grounds of Unpatentability

Petitioner asserts that claims 1, 5–7, 12, and 13 would have been unpatentable on the following grounds:

Challenged Claims	35 U.S.C. ³	Reference(s)/Basis
1, 6, 7, 12, 13	§ 102	Moine ⁴
1, 6, 7, 12, 13	§ 103	Moine, Kronberg ⁵
1, 5	§ 102	Adest '055 ⁶

Pet. 2. Petitioner relies on the Declaration of Randy Dunton (Ex. 1002).

II. ANALYSIS

A. Claim Construction

Petitioner contends the claim term “the location controller,” as recited in claim 1 of the '321 patent, should be construed to mean “the local controller,” because the term “location controller” has no apparent antecedent basis in the claim and does not appear anywhere in the

³ The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. §§ 102 and 103 that became effective on March 16, 2013. Because the '321 patent issued from an application filed before March 16, 2013, we apply the pre-AIA versions of the statutory bases for unpatentability.

⁴ FR Patent Application Publication No. 2894401 A1 to Moine, published June 8, 2007 (Ex. 1005).

⁵ US Patent No. 5,054,023 to Kronberg, issued October 1, 1991 (Ex. 1006).

⁶ US Patent No. 8,531,055 B2 to Adest et al., issued September 10, 2013 (Ex. 1007).

specification of the '321 patent, and further in light of the fact that claim 1 first recites “a local controller.” Pet. 10–11. Other than the aforementioned claim term, Petitioner states no express constructions of the claims are necessary to assess whether the prior art reads on the challenged claims. *Id.* at 9 (citing Ex. 1002 ¶ 35).

Having considered Petitioner’s argument, we can reach a determination of the reasonable likelihood of proving unpatentability of the challenged claims without explicitly construing any claim terms at this stage of the proceeding. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

B. Level of Ordinary Skill in the Art

Factors pertinent to a determination of the level of ordinary skill in the art include “(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.” *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.*

Petitioner argues a person of ordinary skill in the art at the time of the invention “would have had a bachelor’s degree or similar degree in electrical engineering and one year of experience in the design of solar power systems,

power control systems, and/or power safety systems.” Pet. 3–4 (citing Ex. 1002 ¶ 17).

For purposes of this Decision, we adopt Petitioner’s proposal regarding the level of ordinary skill in the art. Based on our review of the ’321 patent and the asserted prior art, we determine that Petitioner’s definition comports with the qualifications a person would have needed to understand and implement the teachings of the ’321 patent and prior art.

C. Principles of Law

“Anticipation requires that every limitation of the claim in issue be disclosed, either expressly or under principles of inherency, in a single prior art reference,” *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1255–56 (Fed. Cir. 1989), and that the claim limitations be “arranged or combined in the same way as recited in the claim[],” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1370 (Fed. Cir. 2008). However, “the reference need not satisfy an *ipsissimis verbis* test.” *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009).

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when available, evidence such as commercial success, long felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *see KSR*, 550 U.S.

at 407 (“While the sequence of these questions might be reordered in any particular case, the [Graham] factors continue to define the inquiry that controls.”).

The Supreme Court made clear that we apply “an expansive and flexible approach” to the question of obviousness. *KSR*, 550 U.S. at 415. Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. Reaching this conclusion, however, requires more than merely showing that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness additionally requires that a person of ordinary skill at the time of the invention “would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention.” *Id.*

D. Alleged Anticipation by Moine

Petitioner contends Moine anticipates claims 1, 6, 7, 12, and 13. Pet. 11–24.

1. Moine (Ex. 1005)

Moine is titled “System for Controlling an Electric Power Generation Facility and Electric Power Generation Facility Implementing Such a System,” and relates to “a system for controlling an electrical power production facility” including “photovoltaic modules mounted in series and/or in parallel” to constitute “an electrical circuit,” where the electrical circuit incorporates “an electric switch capable of neutralizing the electric

power provided by the output of the power terminals of [the photovoltaic] modules.” Ex. 1005, code (54), 3:11–16.

Figure 1 of Moine, reproduced below, is an illustration of a circuit in which the electrical power production facility is connected either to a domestic power supply or to an electrical load using the electricity produced. *Id.* at 4:24–26.

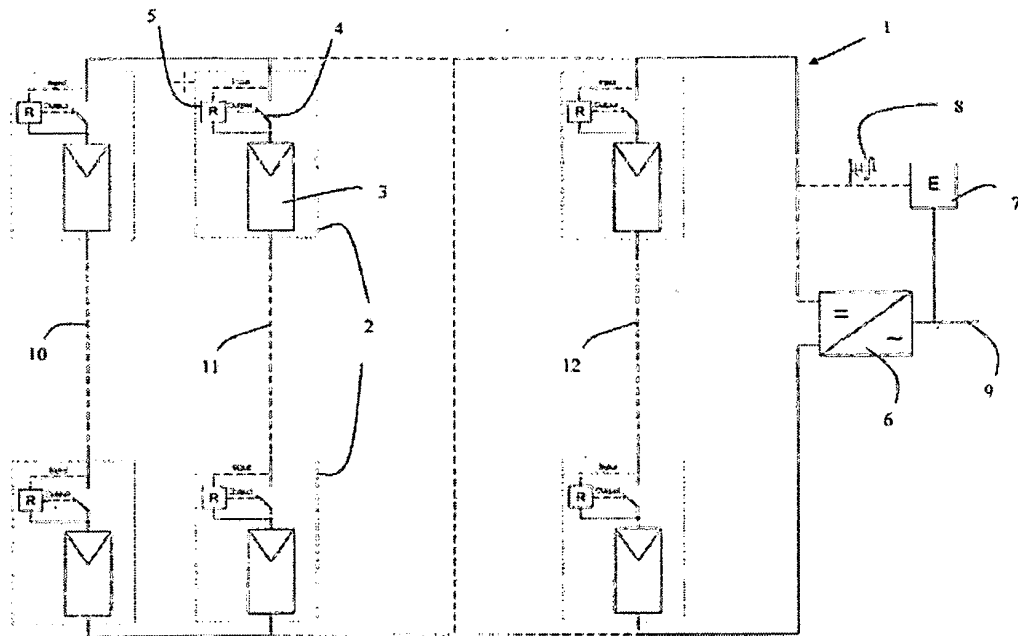


Figure 1

Figure 1 shows an electrical diagram of a photovoltaic electric power production facility. *Id.* at 4:32–33. The facility includes three series of electric generators 2 mounted in parallel. *Id.* at 5:1–3. Each of the generators is composed of a photovoltaic power module 3 that converts solar radiation into direct electric current. *Id.* at 5:5–7. Each of the modules further includes electronic switch 4, specifically a field-effect transistor. *Id.* at 5:9–10. The operation of the transistor is controlled by receiver 5, which causes the switch to open or close according to a coded signal sent as an alternating signal through power circuit 1, where the alternating signal is

generated by electrically-powered transmitter 7 upstream or downstream from inverter or converter 6. *Id.* at 5:19–21, 23–27. Thus, if the transmitter detects a lack of current in a domestic power supply network or failure thereof, it stops the periodic transmission of the coded alternating signal through the circuit, whose absence, identified by the receivers, causes the latter to open the corresponding switches, such that the circuit powers down. *Id.* at 6:1–5.

2. *Analysis*

a) *Claim 1*

Petitioner contends to the extent the preamble of claim 1 is limiting, Moine discloses “a system” based on its disclosure of a “system for controlling an electric power production facility.” Pet. 11 (citing Ex. 1005, 3:11).

Claim 1 recites “a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter.” Ex. 1001, 11:19–22. Petitioner contends Moine’s disclosure in Figure 1 of receiver 5 controlling switch 4, and connected to photovoltaic power modules 3 and inverter 6 via circuit 1, satisfies this limitation. Pet. 13 (citing Ex. 1005, 4:33–5:27; Ex. 1002 ¶¶ 43–46). Petitioner contends a person of ordinary skill in the art would have understood that Moine’s receiver 5 and switch 4 together are the “watchdog unit,” and that circuit 1 corresponds to the “power bus.” *Id.* at 14–15 (citing Ex. 1002 ¶ 45).

Claim 1 next recites “the watchdog unit having: a local controller configured to monitor a communication from a central controller remote from the solar module and determine whether the communication has been interrupted for a time period longer than a predetermined number of allowed

skips.” Ex. 1001, 11:22–27. Petitioner contends Moine discloses this limitation because receiver 5 controls the operation of a transistor that opens and closes switch 4 based on a signal received by receiver 5, and thus a person of ordinary skill in the art would have understood that Moine’s receiver 5 is a “local controller.” Pet. 15–17 (citing Ex. 1005, 5:19–21, 5:58–6:1; Ex. 1002 ¶¶ 51–53). Petitioner further contends a person of ordinary skill in the art would have understood Moine discloses a “central controller” because Moine’s transmitter 7 is configured to transmit a periodic signal, and causes switches 4 to close or open by either transmitting or not transmitting the signal. *Id.* at 17 (citing Ex. 1005, 7:1–28; Ex. 1002 ¶ 55). Petitioner further contends Moine’s receiver 5 is configured to determine whether the signal from transmitter 7 “has been interrupted for a time period longer than a predetermined number of allowed skips” because the signal is both an alternating signal and sent according to set timing, so that receiver 5 would necessarily only be able to detect the absence of the signal once the set timing had elapsed, indicating that communication had been interrupted for at least one skip. *Id.* at 18–19 (citing Ex. 1005, 7:1–4; Ex. 1002 ¶¶ 56–60).

Claim 1 next recites “at least one switch configured to disconnect the solar module from the power bus in response to a determination by the location controller that the communication from the central controller has been interrupted for a time period longer than the predetermined number of allowed skips.” Ex. 1001, 11:28–33. Petitioner contends Moine discloses this limitation because receiver 5, upon detecting the absence of the signal, causes switch 4 to open, which disconnects photovoltaic power module 3 from circuit 1 and powers down the circuit. Pet. 19–20 (citing Ex. 1005, 6:6–10; Ex. 1002 ¶ 61).

Claim 1 next recites “wherein the watchdog unit is configured to connect the solar module to the power bus when the communication is not interrupted.” Ex. 1001, 11:34–36. Petitioner contends Moine discloses this limitation for the reasons discussed for the previous limitation (i.e., when the communication has been interrupted), and because a person of ordinary skill in the art would have understood that in the converse, when the signal is not interrupted, the switch is closed and the photovoltaic power module is connected to the power circuit. Pet. 20 (citing Ex. 1005, 5:19–21; Ex. 1002 ¶ 62). Petitioner further notes that Moine discloses when the signal is interrupted “the switches opened by the receivers *no longer* connect said modules in the circuit (1)” which indicates that before the signal was interrupted, the switches connected the solar modules to the circuit. *Id.* (citing Ex. 1005, 6:1–10).

Having reviewed Petitioner’s undisputed evidence and argument regarding claim 1, we find that Petitioner has demonstrated sufficiently that Moine discloses all of the limitations of claim 1. Thus, we are persuaded Petitioner has established a reasonable likelihood of prevailing on its anticipation challenge with respect to claim 1.

b) Claim 12

Petitioner’s contentions as to anticipation of claim 12 rely on substantially the same disclosures of Moine as discussed above for claim 1. *See* Pet. 22–24 (citing Ex. 1005; Ex. 1002 ¶¶ 70–74). Petitioner contends Moine’s transmitter and receiver “verify communication with a central controller remote from the solar module” by transmitting an alternating signal according to a set timing and detecting the absence or presence of a signal. *Id.* at 23 (citing Ex. 1005, 7:1–4; Ex. 1002 ¶ 72).

Claim 12 further recites that the watchdog device is configured to “shutdown the solar module from the power bus if communication with the central controller cannot be verified for a time period longer than a predetermined number of allowed skips.” Ex. 1001, 12:17–20. Petitioner contends Moine discloses this limitation because its transmitter and receiver communicate as described above, and Moine further discloses that when the receiver detects the absence of the alternating signal, it causes the switch to open and disconnect the photovoltaic power module, thus powering down the circuit. *Id.* at 24 (citing Ex. 1005, 6:1–5; Ex. 1002 ¶¶ 73–74).

Having reviewed Petitioner’s undisputed evidence and argument regarding claim 12, we find that Petitioner has demonstrated sufficiently that Moine discloses all of the limitations of claim 12. Thus, we are persuaded Petitioner has established a reasonable likelihood of prevailing on its anticipation challenge with respect to claim 12.

c) Dependent Claims 6, 7, 13

Claims 6, 7, and 13 depend directly or indirectly from claims 1 and 12. Petitioner directs us to portions of Moine that Petitioner asserts disclose the additional limitations of these claims. Pet. 21–22, 24.

After reviewing the undisputed evidence and arguments in the Petition, we are persuaded Petitioner has established a reasonable likelihood of prevailing on its anticipation challenge with respect to these dependent claims.

3. Conclusion

For the foregoing reasons, we determine Petitioner has demonstrated a reasonable likelihood of prevailing with respect to its argument that Moine anticipates claims 1, 6, 7, 12, and 13.

E. Alleged Obviousness over Moine and Kronberg

Petitioner contends the combination of Moine and Kronberg renders obvious claims 1, 6, 7, 12, and 13. Pet. 24–36.

1. Kronberg (Ex. 1006)

Kronberg is titled “‘Smart’ Watchdog Safety Switch,” and relates to “a method and apparatus for monitoring the output signal of process control equipment and for shutting down process equipment in the event of control equipment failure” through the usage of a “‘smart’ watchdog safety switch.” Ex. 1006, code (54), 2:5–9, 30.

Figure 1 of Kronberg, reproduced below, shows the circuitry of process equipment including a “smart” watchdog safety switch. *Id.* at 2:50–51.

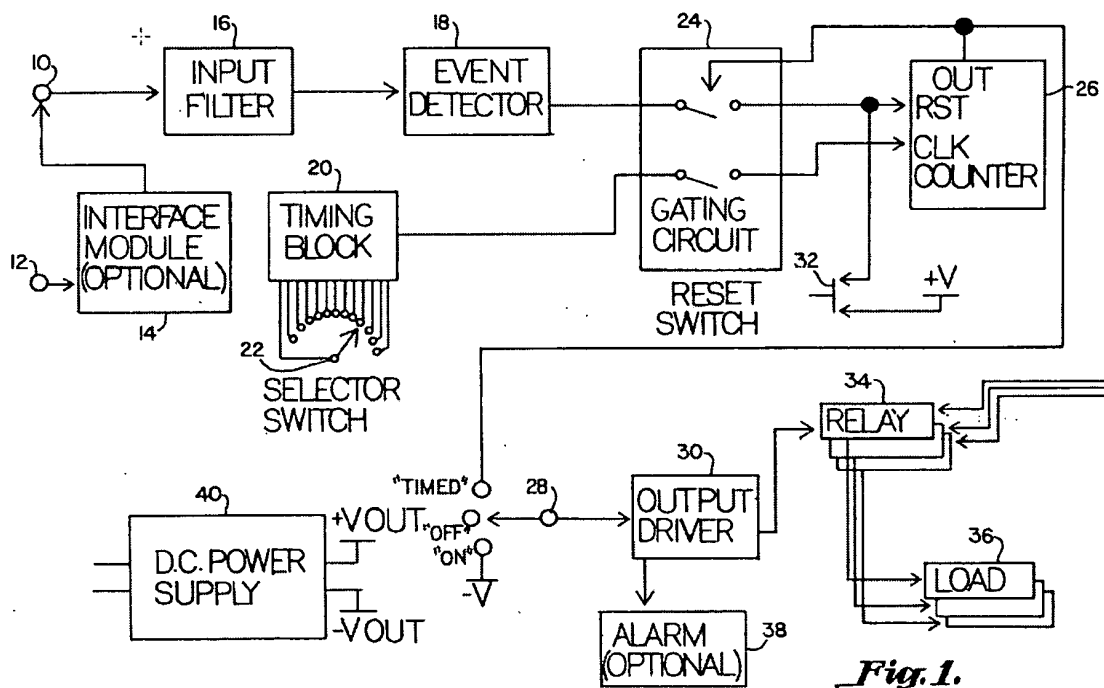


Figure 1 depicts components that make up the circuit corresponding to the process equipment. *Id.* at 3:4–12. The signal to be monitored is introduced at input 10. *Id.* at 3:13. A filtered output of input filter 16 enters event

detector section 18 where valid transitions in the signal are identified and marked by a series of short “event” pulses. *Id.* at 3:23–26. In timing block 20, a train of timing pulses is continuously generated having a frequency determined by the position of selector switch 22. *Id.* at 3:27–29. The timing pulses pass to gating circuit 24, which normally allows free passage to multistage binary counter 26 incremented by each timing pulse. *Id.* at 3:29–32. If no further event pulses arrive before a specified number of timing pulses, counter 26 is incremented and the output of counter 26 changes state from a logic “0” to a logic “1.” *Id.* at 3:38–43. When logic “1” appears, gating circuit 24 blocks timing and event pulses from reaching counter 26, so that the count is frozen and the output of counter 26 remains at logic “1” until manually reset by reset switch 32. *Id.* at 3:47–51. Through the described interactions, prompt shutdown of critical load elements 36 is implemented whenever valid transitions fail to arrive at input 10 within the period set by timing block 20 and counter 26. *Id.* at 4:5–9.

2. Analysis

Petitioner contends Moine discloses the limitations of claim 1, and to the extent there is a dispute that Moine discloses the “watchdog unit” limitation, a person of ordinary skill in the art “could use the watchdog as taught by Kronberg to implement at least part of the receiver (5) taught by Moine.” Pet. 25–26 (citing Ex. 1002 ¶¶ 76–85). Petitioner contends a person of ordinary skill would have been motivated to do so because the watchdog taught by Kronberg was a well-known technique for detecting malfunctions at the time of the invention, and would have been one of a finite number of solutions for detecting the absence of a periodic signal as taught by Moine. *Id.* at 26 (citing Ex. 1002 ¶¶ 79–80; Ex. 1006, 1:53–55; Ex. 1013, 1269). Petitioner further contends both Moine and Kronberg are

concerned with automatic shutdown as a safety feature or in the event of failure, and that a person of ordinary skill looking to implement such a safety feature would look to similar electronic safety devices in similar fields that utilize electronic safety mechanisms for electronically controlled equipment. *Id.* at 27 (citing Ex. 1002 ¶ 81). Petitioner further contends a person of ordinary skill in the art would have had a reasonable expectation of success using Kronberg’s watchdog timer to implement Moine’s receiver, because Kronberg’s watchdog detects the absence of a periodic signal and “is able to shutdown a system in a mere fraction of a second.” Pet. 28 (citing Ex. 1006, 3:38–42, 4:9–12; Ex. 1002 ¶¶ 83–85).

Petitioner further contends Moine discloses “a local controller” as recited in claim 1, and to the extent there is a dispute that Moine alone discloses the “local controller” limitation, it would have been obvious to a person of ordinary skill in the art to use Kronberg’s watchdog apparatus to implement Moine’s receiver, in order to determine when communication had been interrupted for a specified number of skips. Pet. 29–32 (citing Ex. 1002 ¶¶ 86–92). Petitioner further contends it would have been obvious to a person of ordinary skill in the art to use Kronberg’s watchdog apparatus to implement Moine’s switch to disconnect the photovoltaic power module from the circuit. *Id.* at 32–33 (citing Ex. 1002 ¶¶ 93–94).

As to claims 12 and 13, Petitioner relies on substantially the same disclosures of Moine and Kronberg in support of its obviousness contention as to claim 1, and argues that it would have been obvious to a person of ordinary skill in the art to use Kronberg’s watchdog apparatus to implement Moine’s receiver and switch, for the reasons discussed above for claim 1. *Id.* at 34–36. As to the additional limitations of dependent claims 6 and 7,

Petitioner relies on the same disclosures of Moine as discussed above for its anticipation challenge. *See id.* at 33–34 (citing Ex. 1002 ¶¶ 96–97).

After reviewing Petitioner’s undisputed evidence and arguments regarding claims 1, 6, 7, 12, and 13, we find that Petitioner has demonstrated sufficiently that the combination of Moine and Kronberg would have rendered those claims obvious. Further, as discussed above, we find that the record at this stage of the proceeding sufficiently supports Petitioner’s anticipation challenge based on Moine. A disclosure that anticipates under § 102 also renders the claim invalid under § 103, for “anticipation is the epitome of obviousness.” *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1373 (Fed. Cir. 2019) (citing *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983) (internal citations omitted)).⁷ Accordingly, based on Petitioner’s showing of anticipation of claims 1, 6, 7, 12, and 13 by Moine, we find that the record at this stage of the proceeding also sufficiently supports Petitioner’s obviousness contention.

3. Conclusion

For the foregoing reasons, we determine Petitioner has demonstrated a reasonable likelihood of prevailing with respect to its argument that the combination of Moine and Kronberg renders obvious claims 1, 6, 7, 12, and 13.

F. Alleged Anticipation by Adest

Petitioner contends Adest ’055 anticipates claims 1 and 5. Pet. 37–52.

As discussed above, we determine Petitioner has met its burden of showing a reasonable likelihood of prevailing in showing that claims 1, 6, 7,

⁷ The record at this stage of the proceeding does not reflect any evidence of objective indicia of nonobviousness.

12, and 13 are anticipated by Moine and rendered obvious over Moine and Kronberg. Because there is a reasonable likelihood that Petitioner would prevail on those challenges of claims 1, 6, 7, 12, and 13, we institute an *inter partes* review as to all challenges raised in the Petition. See Patent Trial and Appeal Board Consolidated Trial Practice Guide 64 (Nov. 2019), <http://www.uspto.gov/TrialPracticeGuideConsolidated> (“The Board will not institute on fewer than all claims or all challenges in a petition.”); see also *SAS Inst., Inc.* 138 S. Ct. at 1359–60.

III. CONCLUSION

Based on the arguments and evidence in the Petition, we determine that Petitioner has established a reasonable likelihood of prevailing in showing that at least one claim of the ’321 patent is unpatentable. Accordingly, we institute an *inter partes* review on all the challenged claims and all of the grounds presented in the Petition. See *PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”). At this stage of the proceeding, we have not made a final determination as to the patentability of the challenged claims. Our final decision will be based on the record as fully developed during trial.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that an *inter partes* review of all challenged claims of the ’321 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(a), *inter partes* review of the '321 patent is hereby instituted commencing on the entry date of this Decision, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial.

IPR2021-01286
Patent 8,933,321 B2

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALTENERGY POWER SYSTEMS INC.,
Petitioner,

v.

TIGO ENERGY INC.,
Patent Owner.

IPR2021-00540 (Patent 10,256,770 B2)
IPR2021-00541 (Patent 8,933,321 B2)

Before CHRISTOPHER L. CRUMBLEY, JO-ANNE M. KOKOSKI, and
AVELYN M. ROSS, *Administrative Patent Judges*.

ROSS, *Administrative Patent Judge*.

DECISION
Dismissal Prior to Institution of Trial
35 U.S.C. § 314

IPR2020-01296 (Patent 8,168,147 B2)
IPR2020-01297 (Patent 8,168,147 B2)

On February 16, 2021 Altenergy Power Systems Inc. filed two petitions requesting *inter partes* review of certain claims of U.S. Patent Nos. 10,256,770 and 8,933,321 (collectively “challenged patents”) owned by Tigo Energy Inc. See IPR2021-00540, Paper 1; IPR2021-00541, Paper 1. On April 26, 2021, with Board authorization, the parties filed Joint Motions to Terminate Proceedings in each *inter partes* review. IPR2021-00540, Paper 6; IPR2021-00541, Paper 6 (collectively “Motion to Terminate”). The Motions filed in each *inter partes* review are substantively identical. *Id.* The parties also filed Joint Motions to File the Agreement as Business Confidential Information Pursuant to 35 U.S.C. § 317. IPR2021-00540, Paper 7; IPR2021-00541, Paper 7.

The parties explain that “[t]ermination is appropriate because no patent owner response or further papers have been filed, oral argument has not been held, the Board has not decided the merits of the proceeding, and a final written decision has not been issued.” Motion to Terminate 2. The parties further assert that they have “resolved their disputes and executed an agreement which contemplates requesting termination of this proceeding and dismissing the Parties’ related proceeding regarding the [challenged patents] in *Tigo Energy Inc. v. Altenergy Power Sys. Inc. et al.*, 5:20-cv-03622 (N.D. Cal.)” *Id.*; Ex. 1025. According to the parties, “[a] joint stipulation of dismissal was submitted in [the district court] action” and “[t]here are no other pending district court actions in which the [challenged patents are] asserted.” Motion to Terminate 2. The parties represent that they have fully resolved the issues between them (Ex. 1025, “Settlement Agreement”) and “[t]here are no other agreements, oral or written, between the parties”

IPR2020-01296 (Patent 8,168,147 B2)
IPR2020-01297 (Patent 8,168,147 B2)

(Motion to Terminate 3). Accordingly, the parties jointly request that we terminate this proceeding. *Id.* at 4.

Our “regulations expressly provide the Board with broad authority to dismiss a petition where appropriate.” *Facebook, Inc. v. EveryMD.com*, IPR2018-00050, Paper 19 at 4 (PTAB Oct. 9, 2018); *see* 37 C.F.R. § 42.71(a) (“The Board . . . may grant, deny, or dismiss any petition or motion.”). Under these circumstances, we determine that it is appropriate to dismiss the Petition and terminate the proceeding. After reviewing the Settlement Agreement, we further find that it contains confidential business information regarding the terms of the settlement and that good cause exists to grant the Motion to File and treat the Settlement Agreement as business confidential information to be kept separate from the patent files. *See* 35 U.S.C. § 317(b); 37 C.F.R. § 42.74(c).

This Order does not constitute a final written decision pursuant to 35 U.S.C. § 318(a).

ORDER

In view of the foregoing, it is,

ORDERED that the Parties’ Joint Motion to Terminate Proceedings (Paper 6) in each case is *granted*;

FURTHER ORDERED that the Petition in each case is dismissed, and IPR2021-00540 and IPR2021-00541 are terminated;

FURTHER ORDERED that the Joint Motion to File the Agreement as Business Confidential (Paper 7) in each case is *granted*;

FURTHER ORDERED that the Settlement Agreement (Ex. 1025) shall be kept separate from the files of U.S. Patent Nos. 10,256,770 and 8,933,321.

IPR2020-01296 (Patent 8,168,147 B2)
IPR2020-01297 (Patent 8,168,147 B2)

For PETITIONER:

Philip Marsh
Michael Nguyen
Arnold & Porter Kaye Scholer LLP

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Michael.nguyen@arnoldporter.com

For PATENT OWNER:

Heath J. Briggs (Reg. No. 54,919)
John P. Ward (Reg. No. 40,216)
Leif Olson (Reg. No. 79,428)
Greenberg Traurig, LLP

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wardj@gtlaw.com
olsonl@gtlaw.com



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/628,977	01/13/2015	8933321	108144-202701/US (TGY027)	6958

64494 7590 12/23/2014
GREENBERG TRAURIG, LLP (SV)
c/o: Greenberg Traurig LLP - Chicago Office
77 West Wacker Drive, Suite 3100
Intellectual Property Department
Chicago, IL 60601

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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 676 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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

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

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

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

Ron HADAR, Cupertino, CA;
Shmuel ARDITI, Los Gatos, CA;

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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1728		
	Examiner Name			
	Attorney Docket Number	108144-202701 (TGY027)		

U.S.PATENTS							Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	
Change(s) applied to document, JLB/M.M./9/25/2014	1	7807919		2010-10-05	Powell et al.		

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS							Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	
	1						

If you wish to add additional U.S. Published Application citation information please click the Add button.

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

If you wish to add additional Foreign Patent Document citation information please click the Add button.

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NON-PATENT LITERATURE DOCUMENTS				Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵	

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(571)-273-2885**

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

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

64494
 GREENBERG TRAURIG, LLP (SV)
 c/o Greenberg Traurig LLP - Chicago Office
 77 West Wacker Drive, Suite 3100
 Intellectual Property Department
 Chicago, IL 60601

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 facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Meng Sui	(Depositor's name)
/Meng Sui/	(Signature)
December 11, 2014	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

12/628,977 12/01/2009 Ron Hadar 108144-202701/US (TGY027) 6958

TITLE OF INVENTION:

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional SMALL \$480 \$0 \$0 \$480 12/16/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
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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/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form 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,

1 Greenberg Traurig LLP

(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.

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 has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

TIGO ENERGY, INC.

LOS GATOS, CALIFORNIA

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

4a. The following fee(s) are submitted:

☒ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s); (Please first reapply any previously paid issue fee shown above)

☐ A check is enclosed.

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

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 502638 (enclose an extra copy of this form).

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

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Meng Sui/

Date December 11, 2014

Typed or printed name Meng Sui

Registration No. 62,633

This collection of information 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 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, 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.

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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Ron Hadar et al.	Examiner:	Matthew Martin
Serial No.:	12/628,977	Group Art Unit:	1728
Filed:	December 1, 2009	Confirmation:	6958
Title:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations		

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

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Applicant respectfully provides the following comments on the Statement of Reasons for Allowance provided in the Notice of Allowability mailed Sep 16, 2014.

Applicant assumes that the claims are to be interpreted based on the features recited in the claims and that the Statement of Reasons for Allowance is to be taken in light of the exact limitations recited in the claims. The claims should not be interpreted to include the features that are not explicitly recited in the claims.

Respectfully submitted,

Date: December 11, 2014

/Lehua Wang/
Lehua Wang
Reg. No. 48,023

GREENBERG TRAURIG, LLP
CUSTOMER NUMBER **95352**
Phone: (650) 328-8500
Fax: (650) 328-8508

Electronic Patent Application Fee Transmittal

Application Number:	12628977			
Filing Date:	01-Dec-2009			
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations			
First Named Inventor/Applicant Name:	Ron HADAR			
Filer:	John Patrick Ward/Meng Sui			
Attorney Docket Number:	108144-202701/US (TGY027)			
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				480

Electronic Acknowledgement Receipt

EFS ID:	20931205
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	John Patrick Ward/Meng Sui
Filer Authorized By:	John Patrick Ward
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	11-DEC-2014
Filing Date:	01-DEC-2009
Time Stamp:	17:37:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$480
RAM confirmation Number	4562
Deposit Account	502638
Authorized User	

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	108144-202701_IssueFee.pdf	76720	no	2
			05f0c9627fe7523326a89b01a64ba6c9be4042b9		
Warnings:					
Information:					
2	Miscellaneous Incoming Letter	108144-202701_CommentsonStatementofReasonsforAllowance.pdf	75527	no	1
			a66b9117ee401f229ec4c00cde39b9409a81cec1		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30591	no	2
			fe8a3c76e2268a80e5a617894463acde2bfa27aa		
Warnings:					
Information:					
Total Files Size (in bytes):			182838		

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

New Applications Under 35 U.S.C. 111

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

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

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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



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NOTICE OF ALLOWANCE AND FEE(S) DUE

64494 7590 09/16/2014
GREENBERG TRAURIG, LLP (SV)
c/o: Greenberg Traurig LLP - Chicago Office
77 West Wacker Drive, Suite 3100
Intellectual Property Department
Chicago, IL 60601

EXAMINER

MARTIN, MATTHEW T

ART UNIT

PAPER NUMBER

1758

DATE MAILED: 09/16/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

12/628,977

12/01/2009

Ron HADAR

108144-202701/US
(TGY027)

6958

TITLE OF INVENTION: Systems and Methods for an Enhanced Watchdog in Solar Module Installations

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	12/16/2014

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 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity 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 and an extra copy of the form should be submitted. 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: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

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Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

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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.

64494 7590 09/16/2014
GREENBERG TRAUIG, LLP (SV)
c/o: Greenberg Traurig LLP - Chicago Office
77 West Wacker Drive, Suite 3100
Intellectual Property Department
Chicago, IL 60601

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 facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/628,977	12/01/2009	Ron HADAR	108144-202701/US (TGY027)	6958

TITLE OF INVENTION: Systems and Methods for an Enhanced Watchdog in Solar Module Installations

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	12/16/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
MARTIN, MATTHEW T	1758	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/SB/122) attached. ☐ "Fee Address" indication (or "Fee Address" Indication form 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 has been filed for recordation as set forth in 37 CFR 3.11. 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. The following fee(s) are submitted: ☐ Issue Fee ☐ Publication Fee (No small entity discount permitted) ☐ Advance Order - # of Copies _____	4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above) ☐ A check is enclosed. ☐ Payment by credit card. Form PTO-2038 is attached. ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).
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5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/628,977	12/01/2009	Ron HADAR	108144-202701/US (TGY027)	6958
64494 7590 09/16/2014 GREENBERG TRAURIG, LLP (SV) c/o: Greenberg Traurig LLP - Chicago Office 77 West Wacker Drive, Suite 3100 Intellectual Property Department Chicago, IL 60601			EXAMINER MARTIN, MATTHEW T	
			ART UNIT	PAPER NUMBER
			1758	
DATE MAILED: 09/16/2014				

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 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 12/628,977	Applicant(s) HADAR ET AL.	
	Examiner MATTHEW MARTIN	Art Unit 1758	AIA (First Inventor to File) Status No

-- 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 the RCE filed 10/12/2011.
☐ 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 1-20. 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 <u>See Continuation Sheet</u> 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	5. ☐ Examiner's Amendment/Comment 6. ☒ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
---	--

/MATTHEW MARTIN/ Primary Examiner, Art Unit 1758	
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Continuation of Attachment(s) 2. Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date: 10/12/2011, 1/18/2012, 4/2/2012.

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

Status of Claims

2. Claims 1-20 are pending and are allowed.

Allowable Subject Matter

3. The following is an examiner's statement of reasons for allowance:

The prior art does not teach or suggest the features amended into the present independent claims. Notably, the structure requiring a central controller, local controller and the monitoring of a predetermined number of skips is not taught or suggested by the prior art in combination with the other claimed features. As such, claims 1-20 are allowed.

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 MATTHEW MARTIN whose telephone number is (571)270-7871. The examiner can normally be reached on 8:30 to 5:00 EST Monday through Friday.

Art Unit: 1758

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Michener can be reached on (571)272-1424. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MATTHEW MARTIN/
Primary Examiner, Art Unit 1758

Receipt date: 10/12/2011

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

12628977 - GAI: 1758

Approved for use through 07/31/2012. OMB 0651-0031

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

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977
	Filing Date		2009-12-01
	First Named Inventor	Ron Hadar	
	Art Unit	1728	
	Examiner Name	Matthew Martin	
	Attorney Docket Number	108144-202701/US (TGY027)	

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	1	20090182532		2009-07-16	Stoeber et al.	
	2	20100326809		2010-12-30	Lang et al.	
	3	20110172842		2011-07-14	Makhota et al.	
	4	20110218687		2011-09-08	Hadar	

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	Art Unit	1728		
	Examiner Name	Matthew Martin		
	Attorney Docket Number	108144-202701/US (TGY027)		

	1	102005012213	DE		2009-01-15	G. Spelsberg GmbH & Co. KG		☐
	2	102005018173	DE		2009-05-14	Swiontek et al.		☐
	3	100725755	KR		2007-06-08	Tenkorea Co. Ltd		☐
	4	100912892	KR		2009-08-20	Seoul Marine Co. Ltd		☐
	5	200402282	KR		2005-11-28	S-Energy Co. Ltd		☐

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NON-PATENT LITERATURE DOCUMENTS

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	International Patent Application No. PCT/US2010/046274, International Search Report and Written Opinion, April 22, 2011.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Matthew Martin/	Date Considered	09/05/2014
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*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.

Receipt date: 10/12/2011 INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	12628977 - GAU: 1758
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	Art Unit	1728		
	Examiner Name	Matthew Martin		
	Attorney Docket Number	108144-202701/US (TGY027)		

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	/Lehua Wang/	Date (YYYY-MM-DD)	2011-10-12
Name/Print	Lehua Wang	Registration Number	48023

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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Receipt date: 04/02/2012

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

12628977 - GAI: 1758

Approved for use through 07/31/2012. OMB 0651-0031

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

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	Art Unit	1728	
	Examiner Name	MARTIN, MATTHEW T	
	Attorney Docket Number	108144-202701/US (TGY027)	

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	1	20080147335		2008-06-19	Adest et al.	
	2	20080164766		2008-07-10	Adest et al.	
	3	20090066357		2009-03-12	Fornage	
	4	20090179662		2009-07-16	Moulton et al.	
	5	20090207543		2009-08-10	Boniface et al.	

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	Art Unit	1728		
	Examiner Name	MARTIN, MATTHEW T		
	Attorney Docket Number	108144-202701/US (TGY027)		

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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	1	International Patent Application No. PCT/US2011/033658, International Search Report and Written Opinion, Janaury 13, 2012.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Matthew Martin/	Date Considered	09/05/2014
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OR

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Signature	/John P. Ward/	Date (YYYY-MM-DD)	2012-04-02
Name/Print	John P. Ward	Registration Number	40216

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Search Notes 	Application/Control No. 12628977	Applicant(s)/Patent Under Reexamination HADAR ET AL.
	Examiner MATTHEW T MARTIN	Art Unit 1795

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
136	243, 244, 251	5/24/2010	mtm
307	19, 20, 64-66	5/24/2010	mtm

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	6/2/2010	mtm
NPL Search	5/24/2010, 6/2/2010	mtm
EAST Search	5/24/2010, 6/2/2010	mtm
Updated Search	11/17/2010, 5/5/2011, 9/4/2014- 9/6/2014	mtm

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
136	243-252	9/6/2014	MTM
307	19. 20. 64-66	9/6/2014	MTM

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Receipt date: 01/18/2012

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

12628977 - GAI: 1758

Approved for use through 07/31/2012. OMB 0651-0031

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

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1728		
	Examiner Name	MARTIN, MATTHEW T		
	Attorney Docket Number	108144-202701/US (TGY027)		

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7884278		2011-02-08	Powell et al.	

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	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
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	Examiner Name	MARTIN, MATTHEW T		
	Attorney Docket Number	108144-202701/US (TGY027)		

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Examiner Signature	/Matthew Martin/	Date Considered	09/05/2014
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Receipt date: 01/18/2012 INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	12628977 - GAU: 1758
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Signature	/John P. Ward/	Date (YYYY-MM-DD)	2012-01-18
Name/Print	John P. Ward	Registration Number	40216

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CONFIRMATION NO. 6958

SERIAL NUMBER 12/628,977	FILING or 371(c) DATE 12/01/2009 RULE	CLASS 136	GROUP ART UNIT 1758	ATTORNEY DOCKET NO. 108144-202701/US (TGY027)	
APPLICANTS INVENTORS Ron HADAR, Cupertino, CA; Shmuel ARDITI, Los Gatos, CA; ** CONTINUING DATA ***** This appln claims benefit of 61/275,977 09/03/2009 and claims benefit of 61/276,753 09/16/2009 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED *** SMALL ENTITY ** 12/10/2009					
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and /MATTHEW T MARTIN/ Acknowledged Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 5	TOTAL CLAIMS 20	INDEPENDENT CLAIMS 3
ADDRESS GREENBERG TRAURIG, LLP (SV) c/o: Greenberg Traurig LLP - Chicago Office 77 West Wacker Drive, Suite 3100 Intellectual Property Department Chicago, IL 60601 UNITED STATES					
TITLE Systems and Methods for an Enhanced Watchdog in Solar Module Installations					
FILING FEE RECEIVED 762	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

Issue Classification 	Application/Control No. 12628977	Applicant(s)/Patent Under Reexamination HADAR ET AL.	
	Examiner MATTHEW MARTIN	Art Unit 1758	

CPC						
Symbol					Type	Version
H01L		31	/	0485	F	2013-01-01
H01L		31	/	02021	I	2013-01-01
Y02E		10	/	50	A	2013-01-01
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CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/MATTHEW MARTIN/ Primary Examiner.Art Unit 1758 (Primary Examiner) _____ (Date) _____		09/06/2014 O.G. Print Claim(s) 1	O.G. Print Figure 1

Issue Classification 	Application/Control No. 12628977	Applicant(s)/Patent Under Reexamination HADAR ET AL.
	Examiner MATTHEW MARTIN	Art Unit 1758

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION												
CLASS			SUBCLASS			CLAIMED					NON-CLAIMED							
136			244			H	0	1	L	31 / 042 (2014.01.01)								
CROSS REFERENCE(S)																		
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																	
136	243	245	246	247	248													
136	250	251																
200	506																	
439	135	150	152	160														

NONE		Total Claims Allowed:	
		20	
(Assistant Examiner) /MATTHEW MARTIN/ Primary Examiner.Art Unit 1758 (Primary Examiner)	(Date) 09/06/2014 (Date)	O.G. Print Claim(s)	O.G. Print Figure
		1	1

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977
	Filing Date		2009-12-01
	First Named Inventor	Ron Hadar	
	Art Unit	1728	
	Examiner Name	MARTIN, MATTHEW T	
	Attorney Docket Number	108144-202701/US (TGY027)	

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	1	20080147335		2008-06-19	Adest et al.	
	2	20080164766		2008-07-10	Adest et al.	
	3	20090066357		2009-03-12	Fornage	
	4	20090179662		2009-07-16	Moulton et al.	
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	1	International Patent Application No. PCT/US2011/033658, International Search Report and Written Opinion, Janaury 13, 2012.	☐

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(Not for submission under 37 CFR 1.99)

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Filing Date	2009-12-01
First Named Inventor	Ron Hadar
Art Unit	1728
Examiner Name	MARTIN, MATTHEW T
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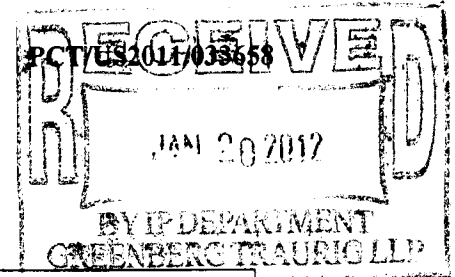
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Applicant's or agent's file reference 108144204001	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2011/033658	International filing date (day/month/year) 22 APRIL 2011 (22.04.2011)	(Earliest) Priority Date (day/month/year) 22 APRIL 2010 (22.04.2010)
Applicant TIGO ENERGY, INC. et al		

108144-
204001/US

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1 Basis of the report

a With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2 ☐ **Certain claims were found unsearchable** (See Box No. II)

3 ☐ **Unity of invention is lacking** (See Box No. III)

4 With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5 With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6 With regard to the **drawings**,

- a the figure of the **drawings** to be published with the abstract is Figure No. 1
☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
b ☐ none of the figure is to be published with the abstract.

File 152 in U.S.

GT-LA

DUE DATE: 2-12-2012
DEADLINE:
DOCKETED: 1-20-2012
BY (INITIALS):

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/033658**A. CLASSIFICATION OF SUBJECT MATTER***H02J 7/35(2006.01)i, H02J 13/00(2006.01)i, H01L 31/042(2006.01)i*

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H02J 7/35; G01R 31/26; G05F 5/00; G06F 15/00; G01R 31/40; H02H 3/00; G01R 19/00; H02J 3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: solar array, anomaly, fault, network, communication, switch

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2009-0066357 A1 (FORNAGE MARTIN) 12 March 2009 See the abstract; paragraph [0024]; claims 1, 8-9; figures 1-2, 6-7.	1-5, 15-18 6-14, 19-20
A	US 2008-0164766 A1 (ADEST MEIR et al.) 10 July 2008 See the abstract; claim 1; figure 1.	1-20
A	US 2008-0147335 A1 (ADEST MEIR et al.) 19 June 2008 See the abstract; claim 1; figures 3-5.	1-20
A	US 2009-0207543 A1 (BONIFACE TONY et al.) 20 August 2009 See the abstract; claims 1, 10.	1-20
A	US 2009-0179662 A1 (MOULTON THOMAS A. et al.) 16 July 2009 See the abstract; figure 1.	1-20

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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

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

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

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

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

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

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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

12 JANUARY 2012 (12.01.2012)

Date of mailing of the international search report

13 JANUARY 2012 (13.01.2012)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsu-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

WEE Jac Woo

Telephone No. 82-42-481-8540



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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/033658

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009-0066357 A1	12.03.2009	EP 2034323 A2 JP 2009-065164 A	11.03.2009 26.03.2009
US 2008-0164766 A1	10.07.2008	CN 101636847 A CN 101636847 B CN 101933209 A CN 101953060 A EP 2089913 A2 EP 2092625 A2 EP 2092631 A2 EP 2135348 A2 EP 2225778 A1 EP 2232663 A1 EP 2232690 A1 EP 2374190 A1 JP 2010-512139 A JP 2010-521720 A JP 2011-507465 A US 2008-0143188 A1 US 2008-0150366 A1 US 2009-0140715 A1 US 2009-0141522 A1 US 2009-0145480 A1 US 2009-0146667 A1 US 2009-0146671 A1 US 2009-0147554 A1 US 2009-0206666 A1 US 2011-0084553 A1 US 2011-0121652 A1 US 2011-0125431 A1 US 2011-0140536 A1 US 7900361 B2 US 8004117 B2 US 8013472 B2 US 8049523 B2 WO 2008-125915 A2 WO 2008-125915 A3 WO 2008-132551 A2 WO 2008-132551 A3 WO 2008-132553 A2 WO 2008-132553 A3 WO 2008-142480 A2 WO 2008-142480 A3 WO 2008-142480 A4 WO 2009-007782 A2 WO 2009-007782 A3 WO 2009-007782 A4 WO 2009-072075 A2 WO 2009-072075 A3	27.01.2010 04.05.2011 29.12.2010 19.01.2011 19.08.2009 26.08.2009 26.08.2009 23.12.2009 08.09.2010 29.09.2010 29.09.2010 12.10.2011 15.04.2010 24.06.2010 03.03.2011 19.06.2008 26.06.2008 04.06.2009 04.06.2009 11.06.2009 11.06.2009 11.06.2009 11.06.2009 20.08.2009 14.04.2011 26.05.2011 26.05.2011 16.06.2011 08.03.2011 23.08.2011 06.09.2011 01.11.2011 23.10.2008 23.10.2008 06.11.2008 06.11.2008 06.11.2008 06.11.2008 27.11.2008 27.11.2008 27.11.2008 15.01.2009 15.01.2009 15.01.2009 11.06.2009 11.06.2009

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/033658

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		WO 2009-072076 A2	11.06.2009
		WO 2009-072076 A3	11.06.2009
		WO 2009-072077 A1	11.06.2009
		WO 2009-073867 A1	11.06.2009
		WO 2009-073868 A1	11.06.2009
		WO 2010-065043 A1	10.06.2010
US 2008-0147335 A1	19.06.2008	None	
US 2009-0207543 A1	20.08.2009	None	
US 2009-0179662 A1	16.07.2009	None	

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

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To

TICHANE DAVID M.

GREENBERG TRAURIG, LLP 2450 COLORADO
AVENUE SUITE 400E SANTA MONICA CA 90404 USA

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) 13 JANUARY 2012 (13.01.2012)

Applicant's or agent's file reference

108144204001

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2011/033658

International filing date (day/month/year)

22 APRIL 2011 (22.04.2011)

Priority date(day/month/year)

22 APRIL 2010 (22.04.2010)

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

H02J 7/35(2006.01)i, H02J 13/00(2006.01)i, H01L 31/042(2006.01)i

Applicant

TIGO ENERGY, INC. et al

1 This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2 FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 189
Cheongsu-ro, Seo-gu, Daejeon 302-
701, Republic of Korea
Facsimile No. 82-42-472-7140



Date of completion of this opinion

12 JANUARY 2012 (12.01.2012)

Authorized officer

WEE Jae Woo

Telephone No. 82-42-481-8540



Form PCT/ISA/237 (cover sheet) (July 2011)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2011/033658

Box No. 1 Basis of this opinion

- 1 With regard to the **language**, this opinion has been established on the basis of:
- ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
- 2 ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
- 3 With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
- a. a sequence listing filed or furnished
 - ☐ on paper
 - ☐ in electronic form
 - b. time of filing or furnishing
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in electronic form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
- 4 ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
- 5 Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2011/033658

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Statement

Novelty (N)	Claims	<u>6-14,19-20</u>	YES
	Claims	<u>1-5,15-18</u>	NO
Inventive step (IS)	Claims	<u>6-14,19-20</u>	YES
	Claims	<u>1-5,15-18</u>	NO
Industrial applicability (IA)	Claims	<u>1-20</u>	YES
	Claims	<u>NONE</u>	NO

2 Citations and explanations :

Reference is made to the following document:

D1: US 2009-0066357 A1 (FORNAGE MARTIN) 12 March 2009
D2: US 2008-0164766 A1 (ADEST MEIR et al.) 10 July 2008
D3: US 2008-0147335 A1 (ADEST MEIR et al.) 19 June 2008
D4: US 2009-0207543 A1 (BONIFACE TONY et al.) 20 August 2009
D5: US 2009-0179662 A1 (MOULTON THOMAS A. et al.) 16 July 2009

1. Novelty and Inventive step

1.1. Claims 1-14

1.1.1. Independent claim 1

D1, which is considered to be the closest prior art to the subject matter of claim 1, discloses a CPU(200), micro inverters(102), an array monitoring device(114), solar panel sub arrays(108) (See figures 1-2). As all of the features of claim 1 are disclosed in D1, claim 1 is anticipated by D1. Therefore, claim 1 lacks novelty under PCT Article 33(2).

1.1.2. Dependent claims 2-5

The additional features of claims 2-3 dependent on claim 1 are identical to the feature of the impairment detection module generating an alert message upon determining that the impairment exists in D1 (See claim 8). Therefore, claims 2-3 lack novelty under PCT Article 33(2).

The additional features of claim 4 dependent on claim 1 are identical to the feature of the impairment detection module automatically correcting the impairment upon determining that the impairment exists in D1 (See claim 9). Therefore, claim 4 lacks novelty under PCT Article 33(2).

The additional features of claim 5 dependent on claim 1 are identical to the feature of power production data which may be obtained by a local device coupled to the solar array and transmitted to the array monitoring device via a communications network, such as the Internet in D1 (See paragraph [0024]). Therefore, claim 5 lacks novelty under PCT Article 33(2).

(Continued on the Supplemental box.)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient,
Continuation of:

Box No. V

1.1.3. Dependent claims 6-14

The subject matter of claim 6 differs from these prior art document in that claim 6 includes a watchdog unit to monitor a communication in a solar array between the master management unit (MMU) and a respective local management unit (LMU).

And it is not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, claim 6 meets the requirements of PCT Article 33(2) and (3) with respect to novelty and inventive step.

Claims 7-8 are dependant on claim 6 and therefore meet the requirements of PCT Article 33(2) and (3).

The subject matter of claim 9 differs from these prior art document in that claim 9 includes a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog unit having.

And it is not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, claim 9 meets the requirements of PCT Article 33(2) and (3) with respect to novelty and inventive step.

Claims 10-14 are dependant on claim 9 and therefore meet the requirements of PCT Article 33(2) and (3).

1.2. Claims 15-18

Claims 15-18 are the same as claims 1-5 in the aspect of technical concept. Therefore, claims 15-18 lack novelty under PCT Article 33(2).

1.3. Claims 19-20

The subject matter of claim 19 differs from these prior art document in that claim 19 includes the process for polling, via the computing device, the central controller to determine if the loss of signal is transient.

And it is not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, claim 19 meets the requirements of PCT Article 33(2) and (3) with respect to novelty and inventive step.

Claim 20 is dependant on claim 19 and therefore meets the requirements of PCT Article 33(2) and (3).

2. Industrial Applicability

Claims 1-20 are considered to be industrially applicable under PCT Article 33(4).

Electronic Acknowledgement Receipt

EFS ID:	12447936
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	John Patrick Ward/Patricia Caldwell
Filer Authorized By:	John Patrick Ward
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	02-APR-2012
Filing Date:	01-DEC-2009
Time Stamp:	15:09:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	108144-202701US_IDS.pdf	612690 f/dff88ac86d3808111e368ec18fc9c9ea5a c1b	no	4

Warnings:

Information: Exhibit 1016 (Pt. 1 of 2)

2	Non Patent Literature	PCTUS2011033658_ISR_WO. pdf	314836 c1317e4ec1321f1217694160a8e7b5aa981 4c1d9	no	8
Warnings:					
Information:					
Total Files Size (in bytes):				927526	
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. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.					

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1728		
	Examiner Name	MARTIN, MATTHEW T		
	Attorney Docket Number	108144-202701/US (TGY027)		

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7884278		2011-02-08	Powell et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

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U.S.PATENT APPLICATION PUBLICATIONS						Remove
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	1					

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	1							☐

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NON-PATENT LITERATURE DOCUMENTS				Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	12628977
	Filing Date	2009-12-01
	First Named Inventor	Ron Hadar
	Art Unit	1728
	Examiner Name	MARTIN, MATTHEW T
	Attorney Docket Number	108144-202701/US (TGY027)

	1		☐
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If you wish to add additional non-patent literature document citation information please click the Add button **Add**

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	12628977
Filing Date	2009-12-01
First Named Inventor	Ron Hadar
Art Unit	1728
Examiner Name	MARTIN, MATTHEW T
Attorney Docket Number	108144-202701/US (TGY027)

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	/John P. Ward/	Date (YYYY-MM-DD)	2012-01-18
Name/Print	John P. Ward	Registration Number	40216

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.**

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

Electronic Acknowledgement Receipt

EFS ID:	11868207
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	John Patrick Ward/Patricia Caldwell
Filer Authorized By:	John Patrick Ward
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	18-JAN-2012
Filing Date:	01-DEC-2009
Time Stamp:	19:36:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	108144-202701US_IDS.pdf	612432 9490124dc9677bb721e18d8da592991f7d5d41fc	no	4

Warnings:

Information: Exhibit 1016 (Pt. 1 of 2)

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

New Applications Under 35 U.S.C. 111

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

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

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL (Submitted Only via EFS-Web)

Application Number	12/628,977	Filing Date	2009-12-01	Docket Number (if applicable)	108144-202701/US (TGY027 ⁺)	Art Unit	1728
First Named Inventor	Ron Hadar			Examiner Name	Matthew T. Martin		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

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

SUBMISSION REQUIRED UNDER 37 CFR 1.114

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

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

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

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

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

☐ Other _____

FEES

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

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to
Deposit Account No 502638

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

Signature of Registered U.S. Patent Practitioner			
Signature	/Lehua Wang/	Date (YYYY-MM-DD)	2011-10-12
Name	Lehua Wang	Registration Number	48023

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

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 the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Ron Hadar et al.	Examiner:	Matthew Martin
Serial No.:	12/628,977	Group Art Unit:	1728
Filed:	December 1, 2009	Confirmation:	6958
Title:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations		

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

RESPONSE TO FINAL OFFICE ACTION

Sir/Madam:

In response to the Final Office Action mailed July 12, 2011, please kindly enter the following amendments and consider the following remarks/arguments in support of a request for continued examination:

Amendments to the Claims are reflected in the list of claims that begins on page 2 of this paper;

Remarks/Arguments begin on page 6 of this paper.

CLAIMS

1. (Currently Amended) A system comprising:
a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog unit having:
a local controller configured to monitor a communication from a central controller remote from the solar module and determine whether the communication [[is]] has been interrupted for a time period longer than a predetermined number of allowed skips; and
at least one switch configured to disconnect the solar module from the power bus [[when]] in response to a determination by the location controller that the communication from the central controller has been [[is]] interrupted for a time period longer than the predetermined number of allowed skips;
wherein the watchdog unit is configured to connect the solar module to the power bus when the communication is not interrupted.
2. (Previously Presented) The system of claim 1, further comprising a junction box housing the watchdog unit, the junction box to provide connectivity between the solar module and the power bus.
3. (Previously Presented) The system of claim 2, wherein the local controller is configured to control a duty cycle of the switch to control an output voltage from the junction box.
4. (Previously Presented) The system of claim 3, wherein the local controller is configured to operate using power from the solar module.
5. (Previously Presented) The system of claim 1, further comprising a bypass circuit configured to enable current in the power bus to bypass the solar module when the switch disconnects the solar module from the power bus.

6. (Previously Presented) The system of claim 1, wherein the watchdog unit is configured to determine irregularity in periodicity of the communication to determine whether the communication is interrupted.
7. (Original) The system of claim 1, wherein the communication is interrupted when a threshold of irregularity is surpassed.
8. (Original) The system of claim 1, wherein the communication is interrupted when the central controller fails to send a communication.
9. (Previously Presented) The system of claim 1, further comprising the solar module; and a junction box coupled with the solar module to provide connectivity to the power bus, wherein the watchdog unit resides in the junction box.
10. (Original) The system of claim 1, further configured to disconnect the solar module from the power bus when the watchdog unit receives a shutdown signal.
11. (Original) The system of claim 1, wherein the watchdog unit wirelessly communicates with the central controller.
12. (Currently Amended) A system comprising:
a watchdog device coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog device configured to:
verify communication with a central controller remote from the solar module; and
shutdown the solar module from the power bus if communication with the central controller cannot be verified for a time period longer than a predetermined number of allowed skips.

13. (Original) The system of claim 12, wherein to shutdown the solar module entails disconnecting the solar module from the power bus.
14. (Original) The system of claim 12, wherein to verify communication:
a challenge is sent to the central controller; and
a response to the challenge is received.
15. (Original) The system of claim 12, wherein to verify communication, a communication is received within a set time from when a last communication was received.
16. (Original) The system of claim 12, further configured to shutdown the solar module if a shutdown signal is received.
17. (Original) The system of claim 12, further configured to wait for a restart signal.
18. (Original) The system of claim 12, further configured to draw energy from a backup energy source when a primary energy source is not available.
19. (Currently Amended) A computer-implemented method comprising:
monitoring, via a computing device, a signal from a central controller remote from the computing device;
determining, via the computing device, if the signal has been lost more than a predetermined number of times;
disconnecting, via the computing device, one or more solar modules from a power bus if the signal has been lost more than the predetermined number of times, the power bus configured to connect a plurality of solar modules to an inverter;
waiting, via the computing device, for a restart signal; and
connecting, via the computing device, the one or more solar modules to the power bus when the restart signal is received.

20. (Original) The method of claim 19, further comprising:
enabling, via the computing device, a bypass circuit when the one or more solar modules
are disconnected from the power bus, so that current continues to flow in the
power bus.

REMARKS

The foregoing amendment and the following arguments are provided generally to impart precision to the claims, by more particularly pointing out the invention, rather than to avoid prior art.

Rejections under 35 U.S.C. §103(a)

Claims 1-13 and 16-18 were rejected under 35 U.S.C. §103(a) over U.S. Pat. App. Pub. No. 2008/0142071 (Dorn) in view of Wiles (“Photovoltaic Power Systems and the national Electrical Code: Suggested Practices,” Sandia, 1999), and further in view of U.S. Pat. App. Pub. No. 2010/0057267 (Liu). The rejection is respectfully traversed.

Applicant respectfully submits that the cited references, as a whole, do not include the feature of “at least one switch configured to disconnect the solar module from the power bus in response to a determination by the location controller that the communication from the central controller has been interrupted for a time period longer than the predetermined number of ***allowed skips***” recited in claim 1. The combination of the cited references, as applied by the Examiner in Office Action mailed July 12, 2011, includes “the PV system must respond to voltage interrupts for safety purposes” (page 4, lines 18-19, Office Action of July 12, 2011), which does not meet the requirement of “the communication from the central controller has been interrupted for a time period longer than the predetermined number of ***allowed skips***.”

Thus, at least for this reason, claim 1 and its dependent claims are patentable.

Similarly, claim 12 recites “shutdown the solar module from the power bus if communication with the central controller cannot be verified for a time period longer than a predetermined number of ***allowed skips***,” which features is not in the cited references. Thus, claim 12 and its dependent claims are patentable.

Claims 14, 15, 19 and 20 were rejected under 35 U.S.C. §103(a) over Dorn, in view of Wiles and Liu, and further in view of U.S. Pat. No. 6,101,073 (Takahara). The rejection is respectfully traversed.

Takahara is not sufficient to cure the deficiency of Dorn, Wiles and Liu in meeting the requirements of claim 12, from which claims 14 and 15 depend. Thus, claims 14 and 15 are patentable.

Claim 19 recites “disconnecting, via the computing device, one or more solar modules from a power bus if the signal has been lost more than the predetermined number of times,” which feature is not found in the cited references. Thus, claim 19 and its dependent claim 20 are patentable.

CONCLUSION

It is respectfully submitted that all of the Examiner’s objections have been successfully traversed and that the application is now in order for allowance. Accordingly, reconsideration of the application and allowance thereof is courteously solicited.

Respectfully submitted,

Date: October 12, 2011

/Lehua Wang/
Lehua Wang
Reg. No. 48,023

GREENBERG TRAURIG, LLP
CUSTOMER NUMBER **64494**
1900 University Avenue, Fifth Floor
East Palo Alto, CA 94303
Phone: (650) 328-8500
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Electronic Patent Application Fee Transmittal

Application Number:	12628977			
Filing Date:	01-Dec-2009			
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations			
First Named Inventor/Applicant Name:	Ron HADAR			
Filer:	Lehua Wang/Anne Collette			
Attorney Docket Number:	108144-202701/US (TGY027)			
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Request for continued examination	2801	1	465	465
Total in USD (\$)				465

Electronic Acknowledgement Receipt

EFS ID:	11170522
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	Lehua Wang/Anne Collette
Filer Authorized By:	Lehua Wang
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	12-OCT-2011
Filing Date:	01-DEC-2009
Time Stamp:	20:30:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$465
RAM confirmation Number	6698
Deposit Account	502638
Authorized User	

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

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	108144-202701US_IDS.pdf	612734	no	4
			09583df1ce714cdf439d37a7ea7499d546f20244		
Warnings:					
Information:					
2	Foreign Reference	DE102005018173.pdf	444574	no	14
			8bc1be5da0e057201697de5784b8d0dd3ec47712		
Warnings:					
Information:					
3	Foreign Reference	KR_100725755B1.pdf	422088	no	9
			c59ba11bf8acc4774b395a56cad78b6845b0d04		
Warnings:					
Information:					
4	Foreign Reference	KR_100912892B1.pdf	928851	no	17
			5881867204de101db3d9d205599f1a0ff8e97944		
Warnings:					
Information:					
5	Foreign Reference	KR_200402282.pdf	226398	no	7
			c2e36d51614e0aed6d056e8d11deb19d07a8f452		
Warnings:					
Information:					
6	Non Patent Literature	PCTUS10_046274_ISR_WO.pdf	261887	no	8
			968135059a78a8920cb905ac53da1ce51de53ea7		
Warnings:					
Information:					
7	Foreign Reference	DE102005012213.pdf	683885	no	12
			b600511ce269775b9ba04f41d3c136b0df255dd		
Warnings:					
Information:					
8	Request for Continued Examination (RCE)	108144-202701US_RCE.pdf	697449	no	3
			9710829a4f3044e54b289ea838abc57d45aa8e70		

Warnings:					
Information:					
9		108144-202701US_Response.pdf	110535 49b5334ac5b31940147f1a61b72946fd10dd743a	yes	7
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment Submitted/Entered with Filing of CPA/RCE		1	1	
	Claims		2	5	
	Applicant Arguments/Remarks Made in an Amendment		6	7	
Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	30217 5c684b97b4205b4cec2ca77818b2509d4e996a5c	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			4418618		
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1728		
	Examiner Name	Matthew Martin		
	Attorney Docket Number	108144-202701/US (TGY027)		

U.S.PATENTS						Remove
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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20090182532		2009-07-16	Stoeber et al.	
	2	20100326809		2010-12-30	Lang et al.	
	3	20110172842		2011-07-14	Makhota et al.	
	4	20110218687		2011-09-08	Hadar	

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		12628977
Filing Date		2009-12-01
First Named Inventor	Ron Hadar	
Art Unit	1728	
Examiner Name	Matthew Martin	
Attorney Docket Number	108144-202701/US (TGY027)	

1	102005012213	DE		2009-01-15	G. Spelsberg GmbH & Co. KG		☐
2	102005018173	DE		2009-05-14	Swiontek et al.		☐
3	100725755	KR		2007-06-08	Tenkorea Co. Ltd		☐
4	100912892	KR		2009-08-20	Seoul Marine Co. Ltd		☐
5	200402282	KR		2005-11-28	S-Energy Co. Ltd		☐

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NON-PATENT LITERATURE DOCUMENTS

Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	International Patent Application No. PCT/US2010/046274, International Search Report and Written Opinion, April 22, 2011.	☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
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*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	12628977
Filing Date	2009-12-01
First Named Inventor	Ron Hadar
Art Unit	1728
Examiner Name	Matthew Martin
Attorney Docket Number	108144-202701/US (TGY027)

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	/Lehua Wang/	Date (YYYY-MM-DD)	2011-10-12
Name/Print	Lehua Wang	Registration Number	48023

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:

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.
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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.



⁽¹⁰⁾ **DE 10 2005 018 173 B4** 2009.05.14

(12)

Patent

(21) Application number: **10 2005 018 173.2**

(22) Filing date: **4/19/2005**

(43) Publication date: **10/26/2006**

(45) Date of patent issue: **5/14/2009**

(51) Int. Cl.⁸. **H02N 6/00 (2006.01)**
H02H 7/20 (2006.01)

Within three months after the patent issue in accordance with § 59 of the Patent Law, an objection can be raised against the patent. The objection must be submitted in writing giving reasons. Within the objection period, an objection fee in the amount of 200 Euros must be paid (§ 6 of the Patent Cost Law in connection with the attachment to § 2 Para. 1 of the Patent Cost Law).

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(56) Publications taken into account in evaluating patentability:

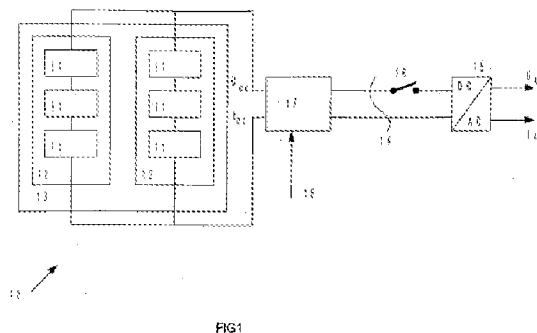
DE 40 41 672 A1

EP 03 72 823 B1

EP 03 72 823 B1

(54) Title: **Switching device for the safe interruption of operation of photovoltaic installations**

(57) Main claim: Switching device for the safe shutdown of photovoltaic installations on buildings with a generator field that is connected to an inverter through DC cables, the switching device having a protective device which can be activated by a control signal, which protective device switches the generator field into a safe working point, which makes it impossible to deliver energy into the building, the generator field remaining at the safe working point until it is reactivated by intervention at the protective device, characterized in that, the protective device (17) is connected through a control lead (18) to an activating device placed at a distance from the protective device, by means of which the protective device can be actuated.



Description

[0001] The present invention relates to a switching device for the safe interruption of the operation of photovoltaic installations so that photovoltaic installations are switched to a safe working point in order to protect people and prevent property damage in hazardous situations.

[0002] Photovoltaic elements (**Fig. 1**) (**11**) have a certain current-voltage graph (**Fig. 2**). The power output of each element is the product of the voltage and current of the working point on the graph at which it is being operated. No power output occurs in the case of short circuit, the current I_k is then stopped and the voltage becomes zero, or in no-load operation, where the voltage U_o is stopped and the current becomes zero.

[0003] Switching devices for shutting down photovoltaic installations are usually located in the vicinity of the inverter and are not reachable in hazardous situations or the location of their installation is unknown to rescue personnel.

[0004] Even after successful shutdown, leads located in the building continue to conduct hazardous DC voltages which endanger people through current or arcing and can cause further property damage.

[0005] From DE 40 41 672 A1, a device is known for the monitoring of a DC circuit of a photovoltaic installation on buildings which includes a solar generator which is connected through DC cables to an inverter. A printed circuit board of a protective circuit, preferably enclosed in a weather-proof housing, is installed in the immediate vicinity of the output terminals of the solar generator. The protective circuit short circuits the solar generator when a problem is recognized in the lead segments of the DC cables monitored by the protective device. For this purpose, an increased voltage drop caused by the problem is recognized in each of the two DC cables and subsequently

interrupted by the protective device. Such lead problem can, for example, be caused by loose terminals or a cable break, resulting in the formation of an arc and thereby an accompanying fire hazard. The monitoring device is therefore placed in the immediate vicinity of the solar generator so that practically the entire DC cable is within the lead segment monitored. In order to be sure of recognizing this lead problem with the monitoring device, there are two monitoring leads connected in parallel in addition to the actual current cables and these monitoring leads are connected at the inverter to the current carrying cables in a conducting manner. The protective circuit recognizes a too-large voltage drop between the current cable and the appropriate monitoring lead in case of a cable problem and interrupts the flow of current through the DC cables by immediately short circuiting the connecting terminals of the solar generator with the aid of a relay so that no more energy can be delivered to the building. The reactivation of the solar generator after a cable problem is carried out using a manually operated reset by means of the switch situated directly on the protective circuit.

[0006] Based on this background art, it is the object of the invention to create a switching device for the safe shutdown of photovoltaic installations which makes possible an immediate shutdown of the photovoltaic installation in hazardous situations regardless of whether or not a cable problem is present.

[0007] This object is achieved, based on a monitoring device according to DE 40 41 672 A1, by connecting the protective circuit or protective device by way of a control lead to an activating device which is placed at a distance from the protective device, through which the protective device can be actuated.

[0008] After activating the switching device in accordance with the invention, the generator field is switched to short circuit or no-load and the energy transmission into the building is

interrupted, as a result of which no further hazard originates from it.

[0009] Rescue personnel can actuate the protective device remotely using key switches or other devices; persons in the building can do that using emergency switches. The actuation can also be done using existing warning systems such as fire, water or gas alarm installations.

[0010] The reactivation after correction of the cause of the hazard can be done automatically or manually.

[0011] The invention serves to protect personnel in buildings with photovoltaic installation(s) in hazardous situations such as fire, flood, gas leaks and other unusual events. Photovoltaic installations (**Fig. 1**) (**10**) consist of multiple photovoltaic elements (**Fig. 1**) (**11**), which are connected together in varying numbers into strings (**Fig. 1**) (**12**). Multiple strings can be operated in parallel in a generator field (**Fig. 1**) (**13**). The DC produced by one or more strings is transmitted by means of DC cables (**Fig. 1**) (**14**) to an inverter (**Fig. 1**) (**15**) and, if needed, can be interrupted with an open switch (**Fig. 1**) (**16**) or an appropriate plug connector. The inverter modulates the electrical energy generated by the generator field into a sine-wave AC voltage, in order to provide isolated networks, or into a sine-wave power in order to feed into the public power grid. In hazardous situations, the photovoltaic installation involves substantial risks for people located in the building and for rescue personnel.

[0012] The usually high DC voltages can, in the case of firefighting efforts or damaged DC cables, lead to serious power injuries or form non-self-extinguishing arcs which can injure personnel or cause fires. The invention includes a protective device (**Fig. 1**) (**17**) which switches the generator field upon demand, using a control lead (**Fig. 1**) (**18**), into a low power working point, so that no further hazard originates from it.

Exemplary embodiment (**Fig. 3**)

[0013] The capacitor C is charged through the resistor R from the voltage of the solar generator. The zener diode V1 limits the voltage across C to the value of its zener voltage. If the switch S closes, then the thyristor V2 fires and takes over the current from the solar generator DC+ and DC-. The output terminals DC+ out and DC- out remain free of current and voltage until the generator current becomes zero after sunset. If S remains closed, the thyristor V2 relights again at first daylight and the installation remains in short circuit. If S is opened, the solar installation can resume its operation.

Patent Claims

1. A switching device for the safe shutdown of photovoltaic installations on buildings having a generator field which is connected to an inverter by means of DC cables, the switching device having a protective device which can be activated by a control signal which protection device switches the generator field to a safe working point, which no longer makes possible to deliver energy into the building, the generator field remaining at the safe working point until it is reactivated by an intervention on the protective device, **characterized in that**, the protective device (**17**) is connected through a control lead (**18**) to an activating unit, which is situated at a distance from the protective device, through which the protective device can be actuated.

2. The switching device according to Claim 1, characterized in that the activating device is a switch which can be manually actuated, namely an emergency switch or a key switch.

3. The switching device according to Claim 1, characterized in that the activating device is an automatically activating sensor, namely a smoke, water or gas sensor.

4. The switching device according to one of the Claims 1 through 3, characterized in that the activating device is placed outside the building with the photovoltaic installation.

5. The switching device according to one of the Claims 1 through 3, characterized in that the activating device is situated inside the building with the photovoltaic installation.

6. The switching device according to one of the Claims 1 through 5, characterized in that the protective device **(17)** is installed in the immediate vicinity of the generator field **(13)**, inside or outside the building.

7. The switching device according to one of the Claims 1 through 6, characterized in that the protective device is designed in such a manner that it short circuits the generator field.

8. The switching device according to one of the Claims 1 through 6, characterized in that the protective device is designed in such a manner that it switches the generator field to the working point of no-load.

9. The switching device according to one of the Claims 1 through 8, characterized in that the generator field **(13)** can be reactivated with the control signal without intervention at the protective device **(17)** by means of the control lead **(18)**.

10. The switching device according to one of the Claims 1 through 8, characterized in that

the generator field **(13)** can be reactivated through a direct intervention at the protective device **(17)**.

11. The switching device according to one of the Claims 1 through 8, characterized in that the generator field **(13)** can be reactivated with the control signal without intervention at the protective device **(17)** through an additional control lead.

12. The switching device according to one of the Claims 1 through 8, characterized in that the reactivation of the generator field takes place automatically after a predetermined or adjustable time.

13. The switching device according to one of the Claims 1 through 8, characterized in that the reactivation of the generator field takes place automatically after the occurrence of an event.

14. The switching device according to one of the Claims 1 through 8, characterized in that the reactivation of the generator field takes place only by means of replacement of the protective device **(17)** or of a part of the protective device **(17)**.

Three pages of drawings follow.

Attached drawings

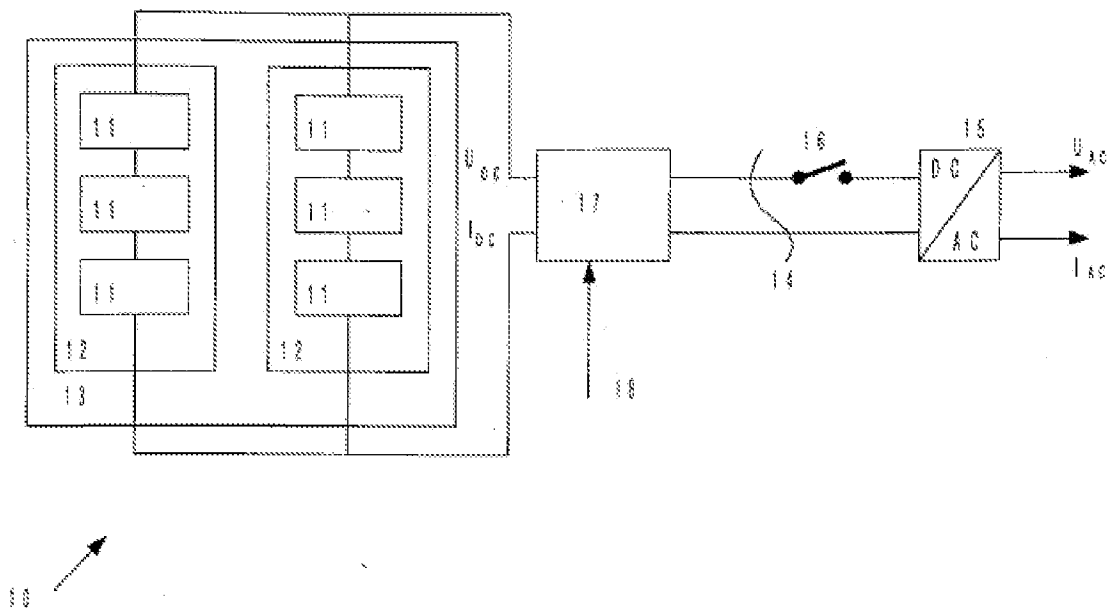


FIG 1

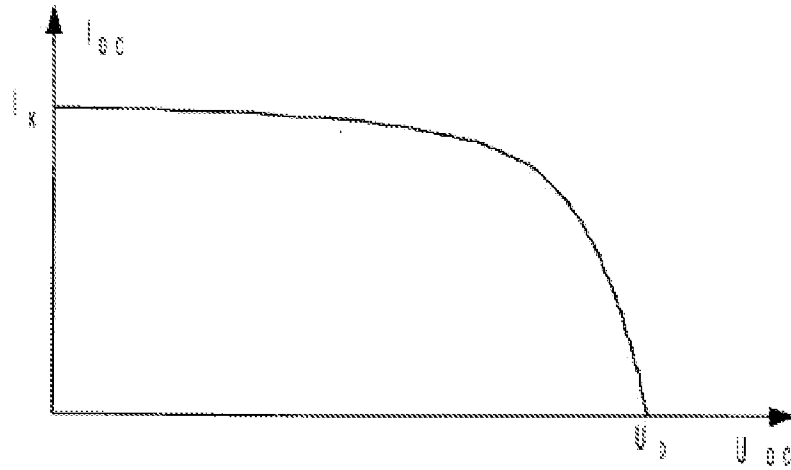


FIG2

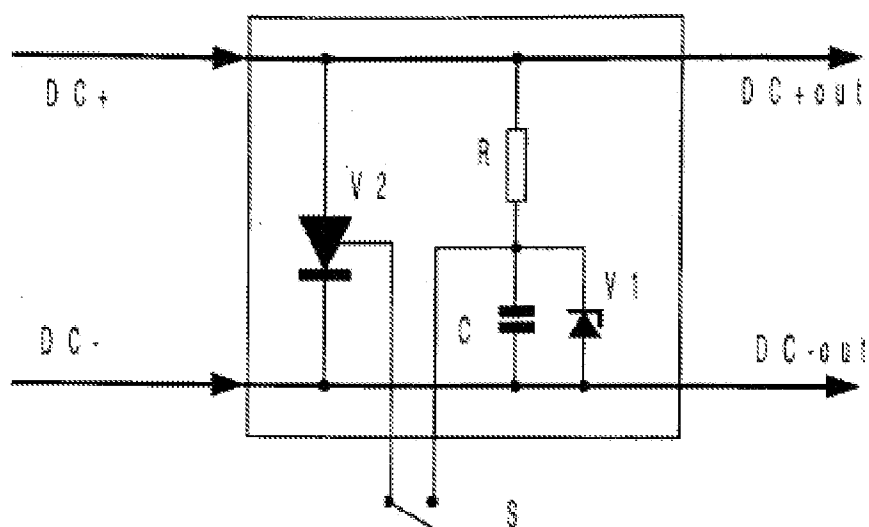


FIG 3



(10) **DE 10 2005 018 173 B4 2009.05.14**

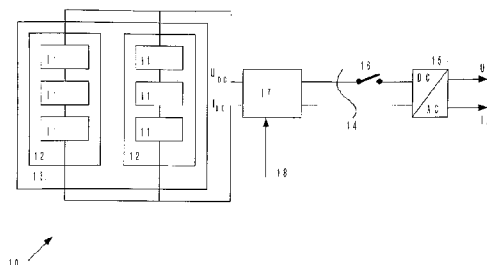
Patentschrift

(51) Int Cl.⁸: **H02N 6/00** (2006.01)
H02H 7/20 (2006.01)

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(56) Für die Beurteilung der Patentfähigkeit in Betracht
gezogene Druckschriften:
DE 40 41 672 A1
EP 03 72 823 B1
EP 03 72 823 B1

(57) **Hauptanspruch:** Schalteinrichtung zur sicheren Abschaltung von Photovoltaikanlagen an Gebäuden mit einem Generatorfeld, das mittels Gleichstromkabeln mit einem Wechselrichter verbunden ist, wobei die Schalteinrichtung eine durch ein Steuersignal auslösbare Schutzeinrichtung aufweist, die das Generatorfeld in einen sicheren Arbeitspunkt schaltet, der keine weitere Energieabgabe in das Gebäude mehr ermöglicht, wobei das Generatorfeld solange im sicheren Arbeitspunkt verbleibt, bis es durch Eingriff an der Schutzeinrichtung wieder aktiviert wird, dadurch gekennzeichnet, dass die Schutzeinrichtung (17) über eine Steuerleitung (18) mit einer entfernt von der Schutzeinrichtung angeordneten Auslöseeinrichtung verbunden ist, über die die Schutzeinrichtung aktivierbar ist.



Beschreibung

[0001] Die vorliegende Erfindung betrifft eine Schalteinrichtung zur sicheren Betriebsunterbrechung von Photovoltaikanlagen, so dass Photovoltaikanlagen zum Schutz von Menschen und zur Vermeidung von Sachschäden in gefährlichen Situationen in einen sicheren Arbeitspunkt geschaltet werden.

[0002] Photovoltaik Elemente (Fig. 1) (11) weisen eine bestimmte Strom-Spannungskennlinie (Fig. 2) auf. Die Leistungsabgabe jedes Elementes ist das Produkt aus Spannung und Strom des Arbeitspunktes auf der Kennlinie in dem es betrieben wird. Keine Leistungsabgabe erfolgt im Kurzschlussfall, es stellt sich dann der Strom I_k ein und die Spannung wird zu Null, oder im Leerlauf, wo sich die Spannung U_0 einstellt und der Strom zu Null wird.

[0003] Schalteinrichtungen zum Abschalten von Photovoltaikanlagen befinden sich meist in Nähe des Wechselrichters und sind in Gefahrensituationen nicht erreichbar oder der Ort ihrer Anbringung ist den Rettungskräften unbekannt.

[0004] Auch nach erfolgreicher Abschaltung führen im Gebäude befindliche Leitungen weiterhin gefährliche Gleichspannungen, die Personen durch Strom oder Lichtbögen gefährden und weitere Sachschäden verursachen können.

[0005] Aus der DE 40 41 672 A1 ist eine Einrichtung zur Überwachung eines Gleichstromkreises einer Photovoltaikanlage an Gebäuden bekannt, die einen Solargenerator der mittels Gleichstromkabeln mit einem Wechselrichter verbunden ist, umfasst. Eine vorzugsweise in einem witterungsfesten Gehäuse untergebrachte Platine einer Schutzschaltung ist in unmittelbarer Nähe der Ausgangsanschlüsse des Solargenerators angebracht. Die Schutzschaltung schließt den Solargenerator kurz, wenn eine Leitungsstörung in den von der Schutzeinrichtung überwachten Leitungsabschnitten der Gleichstromkabel erkannt wird. Zu diesem Zweck wird ein störungsbedingt erhöhter Spannungsabfall in jeder der beiden Gleichstromkabel erkannt und von der Schutzeinrichtung anschließend unterbrochen. Eine solche Leitungsstörung kann beispielsweise durch lockere Klemmen oder einen Kabelbruch hervorgerufen werden, wodurch es dann zur Entstehung eines Lichtbogens und damit einhergehender Brandgefahr kommt. Die Überwachungseinrichtung wird deshalb in unmittelbarer Nähe des Solargenerators angeordnet, damit nahezu das gesamte Gleichstromkabel innerhalb der überwachten Leitungsstrecke liegt. Um diese Leitungsstörung mit der Überwachungseinrichtung sicher zu erkennen, sind zu den eigentlichen Stromkabeln jeweils zwei Überwachungsleitungen parallel geschaltet und am Wechselrichter leitend mit den

stromführenden Kabeln verbunden. Die Schutzschaltung erkennt einen zu großen Spannungsabfall zwischen dem jeweiligen Stromkabel und der zugeordneten Überwachungsleitung im Falle einer Leitungsstörung und unterbricht den Stromfluss durch die Gleichstromkabel, indem mit Hilfe eines Relais die Anschlussklemmen des Solargenerators unmittelbar kurzgeschlossen werden, so dass keine weitere Energieabgabe in das Gebäude mehr möglich ist. Die Reaktivierung des Solargenerators nach einer Leitungsstörung erfolgt über eine handbetätigte Rücksetzung mittels des Schalters direkt an der Schutzschaltung.

[0006] Ausgehend von diesem Stand der Technik liegt der Erfindung die Aufgabe zu Grunde, eine Schalteinrichtung zur sicheren Abschaltung von Photovoltaikanlagen zu schaffen, die unabhängig davon, ob bereits eine Leitungsstörung vorliegt oder nicht, in gefährlichen Situationen eine umgehende Abschaltung der Photovoltaikanlage ermöglicht.

[0007] Diese Aufgabe wird ausgehend von einer Überwachungseinrichtung nach der DE 40 41 672 A1 dadurch gelöst, dass die Schutzschaltung bzw. Schutzeinrichtung über eine Steuerleitung mit einer entfernt von der Schutzeinrichtung angeordneten Auslöseeinrichtung verbunden ist, über die die Schutzeinrichtung aktivierbar ist.

[0008] Nach Auslösung der erfindungsgemäßen Schalteinrichtung wird das Generatorfeld in den Kurzschluss oder Leerlauf geschaltet und die Energieübertragung in das Gebäude unterbrochen, wodurch keine weitere Gefahr mehr von ihm ausgeht.

[0009] Rettungskräfte können die Schutzeinrichtung aus der Ferne über Schlüsselschalter oder andere Einrichtungen aktivieren, Personen im Gebäude können dies über Notschalter. Die Aktivierung kann auch über vorhandene Warnsysteme wie Brand-, Wasser- oder Gasalarmanlagen erfolgen.

[0010] Die Reaktivierung nach Beseitigung der Gefahrenursache kann automatisch oder manuell erfolgen.

[0011] Die Erfindung dient zum Personenschutz in Gebäuden mit Photovoltaikanlage(n) in Gefahrensituationen wie Feuer, Hochwasser, Gaslecks und anderen außergewöhnlichen Ereignissen. Photovoltaikanlagen (Fig. 1) (10) bestehen aus mehreren Photovoltaik Elementen (Fig. 1) (11), die in unterschiedlicher Anzahl zu Strings (Fig. 1) (12) verschaltet werden. Mehrere Strings können in einem Generatorfeld (Fig. 1) (13) parallel betrieben werden. Der von einem oder mehreren Strings produzierte Gleichstrom wird mittels Gleichstromkabel (Fig. 1) (14) zu einem Wechselrichter (Fig. 1) (15) übertragen und kann im Bedarfsfall mit einem Freischalter (Fig. 1) (16) oder

einem geeigneten Steckverbinder unterbrochen werden. Der Wechselrichter moduliert die vom Generatorfeld erzeugte elektrische Energie zur Versorgung von Inselnetzen in eine sinusförmige Wechselspannung oder zur Einspeisung in das öffentliche Stromnetz in einen sinusförmigen Strom. In Gefahrensituationen birgt die Photovoltaikanlage erhebliche Risiken für im Gebäude befindliche Personen und Rettungskräfte.

[0012] Die meist hohen Gleichspannungen können bei Löscheinsätzen oder beschädigten Gleichspannungsleitungen zu erheblichen Stromverletzungen führen oder nicht selbstverlöschende Lichtbögen bilden, die Personen verletzen oder Brandherde erzeugen können. Die Erfindung umfasst eine Schutzzeineinrichtung (**Fig. 1**) (**17**), die das Generatorfeld auf Anforderung über eine Steuerleitung (**Fig. 1**) (**18**) in einen energiearmen Arbeitspunkt schaltet, so dass keine weitere Gefahr von ihm ausgeht.

Ausführungsbeispiel (**Fig. 3**)

[0013] Der Kondensator C wird über den Widerstand R aus der Spannung des Solargenerators aufgeladen. Die Zenerdiode V1 begrenzt die Spannung über C auf den Wert ihrer Zenerspannung. Schließt der Schalter S wird der Thyristor V2 gezündet und übernimmt den Strom aus dem Solargenerator DC+ und DC-. Die Ausgangsklemmen DC + out und DC - out bleiben strom- und spannungsfrei bis der Generatorstrom nach Einbruch der Dunkelheit zu Null wird. Bleibt S geschlossen wird der Thyristor V2 beim ersten Tageslicht wieder gezündet und die Anlage verbleibt im Kurzschluss. Wird S geöffnet, kann die Solaranlage ihren Betrieb wieder aufnehmen.

Patentansprüche

1. Schalteinrichtung zur sicheren Abschaltung von Photovoltaikanlagen an Gebäuden mit einem Generatorfeld, das mittels Gleichstromkabeln mit einem Wechselrichter verbunden ist, wobei die Schalteinrichtung eine durch ein Steuersignal auslösbare Schutzzeineinrichtung aufweist, die das Generatorfeld in einen sicheren Arbeitspunkt schaltet, der keine weitere Energieabgabe in das Gebäude mehr ermöglicht, wobei das Generatorfeld solange im sicheren Arbeitspunkt verbleibt, bis es durch Eingriff an der Schutzzeineinrichtung wieder aktiviert wird, **dadurch gekennzeichnet**, dass die Schutzzeineinrichtung (**17**) über eine Steuerleitung (**18**) mit einer entfernt von der Schutzzeineinrichtung angeordneten Auslöseeinrichtung verbunden ist, über die die Schutzzeineinrichtung aktivierbar ist.

2. Schalteinrichtung nach Anspruch 1, dadurch gekennzeichnet, dass die Auslöseeinrichtung ein manuell auslösbarer Schalter, nämlich ein Notschalter oder ein Schlüsselschalter ist.

3. Schalteinrichtung nach Anspruch 1, dadurch gekennzeichnet, dass die Auslöseeinrichtung ein automatisch auslösender Sensor, nämlich ein Rauch-, Wasser-, oder Gassensor ist.

4. Schalteinrichtung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass die Auslöseeinrichtung außerhalb des Gebäudes mit der Photovoltaikanlage angeordnet ist.

5. Schalteinrichtung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass die Auslöseeinrichtung innerhalb des Gebäudes mit der Photovoltaikanlage angeordnet ist.

6. Schalteinrichtung nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, dass die Schutzzeineinrichtung (**17**) in unmittelbarer Nähe des Generatorfeldes (**13**) innerhalb oder außerhalb des Gebäudes angebracht ist.

7. Schalteinrichtung nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, dass die Schutzzeineinrichtung derart ausgestaltet ist, dass sie das Generatorfeld kurzschließt.

8. Schalteinrichtung nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, dass die Schutzzeineinrichtung derart ausgestaltet ist, dass sie das Generatorfeld in den Arbeitspunkt Leerlauf schaltet.

9. Schalteinrichtung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass das Generatorfeld (**13**) ohne Eingriff in die Schutzzeineinrichtung (**17**) über die Steuerleitung (**18**) mit dem Steuersignal reaktivierbar ist.

10. Schalteinrichtung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass das Generatorfeld (**13**) durch direkten Eingriff an der Schutzzeineinrichtung (**17**) reaktivierbar ist.

11. Schalteinrichtung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass das Generatorfeld (**13**) ohne Eingriff in die Schutzzeineinrichtung (**17**) über eine zusätzliche Steuerleitung mit dem Steuersignal reaktivierbar ist.

12. Schalteinrichtung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass die Reaktivierung des Generatorfeldes nach einer bestimmten oder einstellbaren Zeit automatisch erfolgt.

13. Schalteinrichtung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass die Reaktivierung des Generatorfeldes nach Eintritt eines Ereignisses automatisch erfolgt.

14. Schalteinrichtung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass die Reaktivierung

zung des Generatorfeldes nur durch Austausch der Schutz-
einrichtung (17) oder eines Teils der Schutz-
einrichtung (17) erfolgt.

Es folgen 3 Blatt Zeichnungen

Anhängende Zeichnungen

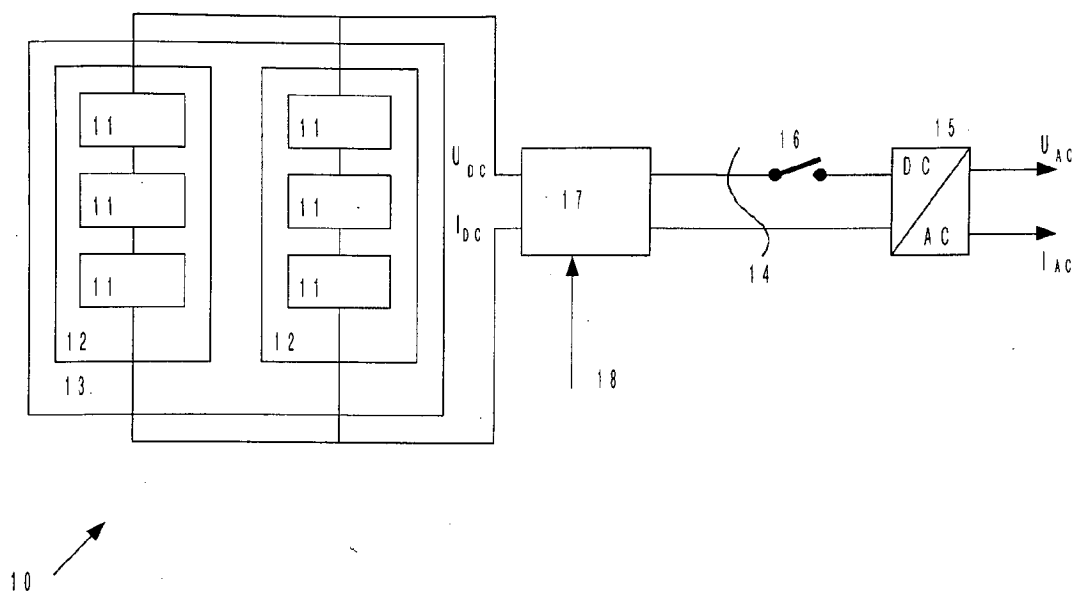


FIG1

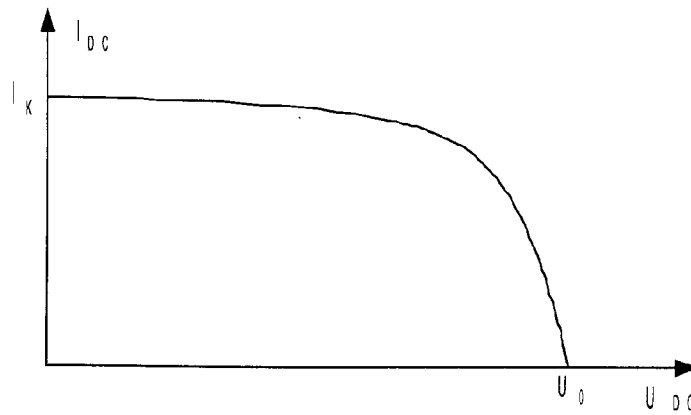


FIG2

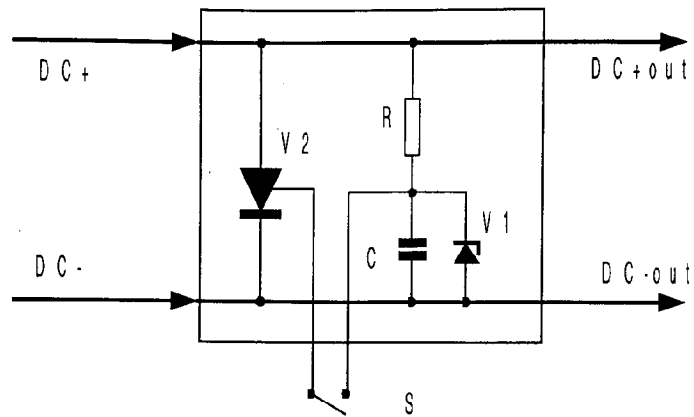


FIG 3



Espacenet

Bibliographic data: KR 100725755 (B1)

PHOTOVOLTAIC POWER GENERATION APPARATUS

Publication date:	2007-05-31				
Inventor(s):	LEE PYUNG HWA [KR] ±				
Applicant(s):	TEN KOREA CO LTD [KR] ±				
Classification:	<table><tbody><tr><td>- international:</td><td>H02J11/00; H02J7/35</td></tr><tr><td>- European:</td><td>Y02E10/56D</td></tr></tbody></table>	- international:	H02J11/00; H02J7/35	- European:	Y02E10/56D
- international:	H02J11/00; H02J7/35				
- European:	Y02E10/56D				
Application number:	KR20060113599 20061117				
Priority number(s):	KR20060113599 20061117				

Abstract of KR 100725755 (B1)

A photovoltaic power generating apparatus is provided to accurately monitor and control even in various situations of generating capacity. A photovoltaic power generating apparatus includes a system duplexing apparatus(25), a GPS auto time receiving apparatus(60), an auto weather observing apparatus(70), and an image monitoring apparatus(80). The system duplexing apparatus(25) allows the other system to automatically switch a system in case of abnormality such as erroneous operation of the system at an engineering station(20), and operates and protects the whole system. The GPS auto time receiving apparatus(60) has a time data function by receiving GPS reference time to make identical accuracy of time for measuring and controlling the whole apparatus. The auto weather observing apparatus(70) measures, maintains, and repairs data of temperature, solar radiation, rainfall, direction and velocity of wind to have a weather measuring function and a display function. The image monitoring apparatus(80) has an image monitoring function of the whole apparatus, a visitor monitoring function, and an alarming function.

Last updated: 26.04.2011 Worldwide Database 5 7 22; 92p



(19)대한민국특허청(KR)
(12) 등록특허공보(B1)

(51) 。 Int. Cl.	(45) 공고일자	2007년06월08일
H02J 11/00 (2006.01)	(11) 등록번호	10-0725755
H02J 7/35 (2006.01)	(24) 등록일자	2007년05월31일

(21) 출원번호	10-2006-0113599	(65) 공개번호
(22) 출원일자	2006년11월17일	(43) 공개일자
심사청구일자	2006년11월17일	

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전체 청구항 수 : 총 2 항

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(57) 요약

본 발명은 태양광 발전장치에 관한 것으로, 더욱 구체적으로는 원격지에 설치된 태양광 발전설비의 각종 데이터를 수집, 분석, 저장하고 분석된 자료를 이용하여 설치된 설비를 최적의 상태에서 제어하여 태양광의 발전효율성을 높일 수 있도록 한 것이다.

즉, 중앙통제본부에 설치되는 원격지제어시스템과, 상기 원격지제어시스템과 연결된 중앙제어메인장치와, 네트워크망, 전력변환장치, 태양광어레이 표시장치, 전력계통도 표시장치로 이루어진 것에 있어서, 하나의 중앙제어메인장치에서 시스템의 오동작등 이상발생시 다른 시스템이 자동으로 시스템을 절제하여 전체 시스템을 운영 보호하는 이중화기능의 중앙제어메인장치(MCS DUAL)와, 전 장비의 계측 및 제어를 위하여 시간의 정확도를 일치시키기 위해 GPS 기준시간 수신에 의한 시간데이터 기능의 GPS 자동시간 수신장치와, 기상계측 기능과 표시기능을 갖기위해 온도,온도,일사량,강수량,풍향,풍속의 데이터를 계측하고 유지보수를 할수 있도록 설치되는 자동기상관측장치와, 전체 시스템 설치장비의 영상감시기능 및 정보센서가 설치된 장소의 출입자 감시 및 정보기능등을 하는 영상감시장치로 이루어진 태양광 발전장치를 특징으로 한다.

대표도

도 1

특허청구의 범위

청구항 1.

중앙통제본부에 설치되는 원격지제어시스템(10)과, 상기 원격지제어시스템과 연결된 중앙제어메인장치(20)와, 네트워크 망(30), 전력변환장치(40), 태양광어레이 계측장치(45), 전력계통도 표시장치(50)로 이루어진 것에 있어서,

하나의 중앙제어메인장치(20)에서 시스템의 오동작등 이상발생시 다른 시스템이 자동으로 시스템을 절체하여 전체 시스템을 운영 보호하는 이중화기능의 시스템 이중화장치(MCS DUAL)(25)와,

전 장비의 계측 및 제어를 위하여 시간의 정확도를 일치시키기 위해 GPS 기준시각 수신에 의한 시간데이터 기능의 GPS 자동시각 수신장치(60)와,

기상계측 기능과 표시기능을 갖기위해 온도,온도,일사량,강수량,풍향,풍속의 데이터를 계측하고 유지보수를 할수 있도록 설치되는 자동기상관측장치(70)와,

전체 시스템 설치장비의 영상감시기능 및 정보센서가 설치된 장소의 출입자 감시 및 정보기능등을 하는 영상감시장치(80)로 이루어진 것을 특징으로 하는 태양광 발전장치

청구항 2.

제 1항에 있어서, 상기 발전장치의 운전상황을 관리자가 수동으로 감시하여 웹 기반의 시스템 관리가 가능하고 원격제어할 수 있는 인터넷폰장치(90)를 더 포함하여서 됨을 특징으로 하는 태양광 발전장치

명세서

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 태양광 발전장치에 관한 것으로, 더욱 구체적으로는 원격지에 설치된 태양광 발전설비의 각종 데이터를 수집,분석,저장하고 분석된 자료를 이용하여 설치된 설비를 최적의 상태에서 제어하여 태양광의 발전효율성을 높일 수 있도록 한 것이다.

일반적으로 태양광 발전 시스템(PV: Power Generation System)은 태양 에너지의 무공해성, 무한정성에 힘입어 지구 환경 문제와 미래 에너지원의 다각화 대책으로서 선진 각국에서 활발히 연구 개발이 진행되고 있다.

특히,우리나라는 자원이 부족하기 때문에 대체에너지의 개발이 절대적으로 필요하며, 특히 환경오염을 방지하기 위한 친환경적 에너지 개발이 필요하다. 이를 위해 태양광 발전시스템의 개발이 활성화되고 있다.

이러한 태양광 발전시스템은 태양광 집점판에서 생산된 직류전기를 출력조절장치를 거쳐 축전지에 충전하거나 인버터에서 교류로 변환하여 수용가에 공급하는 설비이다. 이 태양광 발전시스템은 야간에는 일조량이 없으므로 주간에 축전지에 충전된 전기를 야간에 사용하고 있으며, 우천시나 일조량이 부족하여 전기를 생산하지 못할 경우에는 발전기를 운전하여 전기를 생산하여 수용자에게 공급한다.

이때, 원격지에 설치된 태양광 발전설비의 각종 데이터를 수집,분석,저장하고 분석된 자료를 이용하여 설치된 설비를 최적의 상태에서 제어할 수 있어야 한다.

발명이 이루고자 하는 기술적 과제

본 발명의 태양광 발전장치는 감시시스템의 안정성, 계측 및 제어를 위한 시간의 정확도, 발전설비의 실시간 감시, 다양한 기상상태변화와 같이 발전용량의 여러가지 상황변화등에도 정확하게 감시제어 할 수 있는 발전설비의 다양하고 정확한 통합 감시시스템으로 발전효율성을 높일 수 있도록 한 태양광 발전장치를 제공함에 있다.

발명의 구성

본 발명의 태양광 발전장치는 중앙통제본부에 설치되는 원격지제어시스템(10)과, 상기 원격지제어시스템과 연결된 중앙 제어메인장치(20)와, 네트워크망(30), 전력변환장치(40), 태양광어레이 계측장치(45), 전력계통도 표시장치(50)로 이루어진 것에 있어서, 하나의 중앙제어메인장치(20)에서 시스템의 오동작등 이상발생시 다른 시스템이 자동으로 시스템을 절체하여 전체 시스템을 운영 보호하는 이중화기능의 시스템 이중화장치(MCS DUAL)(25)와, 전 장비의 계측 및 제어를 위하여 시간의 정확도를 일치시키기 위해 GPS 기준시각 수신에 의한 시간데이터 기능의 GPS 자동시각수신장치(60)와, 기상 계측 기능과 표시기능을 갖기위해 온도, 온도, 일사량, 강수량, 풍향, 풍속의 데이터를 계측하고 유지보수를 할수 있도록 설치되는 자동기상관측장치(70)와, 전체 시스템 설치장비의 영상감시기능 및 정보센서가 설치된 장소의 출입자 감시 및 경보 기능등을 하는 영상감시장치(80)로 이루어져 있다.

또한, 상기 발전장치의 운전상황을 관리자가 수동으로 감시하여 웹 기반의 시스템 관리가 가능하고 원격제어할 수 있는 인터넷폰장치(90)를 더 포함한다.

도면중 미설명부호 S는 송전계통부문을 나타낸다.

이하 본 발명에 따른 바람직한 구성 실시예를 보다 상세히 설명하면 다음과 같다.

중앙통제본부에 설치되는 원격지제어시스템(10)은; 관리자가 컴퓨터(Computer)를 통하여 태양광 발전설비를 감시 제어하기 위한 장치로서 중앙제어메인장치(Engineering Station)와 연동되며 인터넷(Internet), 네트워크(Network), CDMA 무선통신을 기반으로 감시제어를 용이하게 하도록 하는 것으로, CCTV 원격제어 PC (11)와, MMI 원격제어 PC (12)와 프린터(13)가 구비되어 있다.

또, 원격지제어시스템(10)은 통합 감시제어를 위하여 인터넷기반으로 구축되어지는 통합 감시제어에 적용되는 소프트웨어는 최신포스 (Linux, Unix, MS_Windows) 소프트웨어들을 시스템의 기본 환경으로 사용하여 사용자로 하여금 각종 설정 작업 및 전체 시스템의 운전/감시 작업을 용이하게 하여야 하고, 최적화된 성능으로 실행될 수 있도록 실시간 다중작업 및 풍부한 확장성을 가진 OS(Operating System)환경을 제공하여야 하고, 통신은 이더넷 TCP/IP를 지원하는 시스템으로 구축되도록 하며, 화면구성은 웹 브라우저를 통한 감시, 제어 화면으로 기타 필요한 상태 및 메뉴는 아이콘형태로 표시하고, 주요 설비별 상태를 전체적으로 한 화면에서 감시할 수 있게 한다.

또한, 원격지제어시스템(10)은 발생하는 모든 정보를 일괄적으로 정리한 화면으로, 정보 발생 순서별로 발생 시, 분, 초, Tag Name, Tag Comment, Alarm-Status등을 한 행에 표시하여 정보 상태를 전체적으로 간단한 파악할 수 있어야 하며, 최소한 24시간 이상의 데이터를 표시되어야 하고, 측정값의 시간에 따른 변화를 표시하는 화면으로 좌표 상에 다른 색상으로 표현된 4개까지의 측정값의 기록 점을 한 화면에 표시하여 과거의 정보들에 대한 상태 추이를 감시 및 분석 할 수 있어야 하고, 각 화면별로 필요한 경우 특정 측정값만을 선정하여 선정된 색상으로 쉽게 측정값 변화를 확인 할 수 있도록 하고, 그래픽 화면을 포함한 모든 운전 화면에서 측정값의 감시, 운전 및 각종 형식의 윈도우 화면을 동시에 표시 할 수 있어야 하며, 일보, 주보, 월보, 알람, 운전자의 조작 상황등의 보고서 작성기능과 각 측정 장치로부터 전달되는 각종 데이터를 분류 처리하여 이들 데이터를 필요로 하는 다른 기능에서 액세스(Access) 할 수 있는 데이터처리기능을 갖도록 함이 바람직하다.

상기와 같이 중앙통제본부에 설치되는 원격지제어시스템(10)은, 시스템모니터링으로 장비의 상태정보와 실시간 데이터를 확인 할 수 있고, 데이터 분석으로 저장된 데이터와 실시간 데이터를 그래프 형식으로 볼 수 있고, 관리되어지는 장비에서 검출된 데이터를 데이터베이스에 저장. 일별, 월별, 년별의 형식으로 보고서 확인, 현장 및 장비에서 검출된 데이터에서 이상이 발생되었을 경우 데이터베이스에 기록된 이벤트를 확인 할 수 있는 알람보기, 시스템 구성도를 이미지로 볼 수 있고, 이용자설정을 할 수 있게 된다.

중앙제어메인장치(20)는; 태양광 발전설비의 각종 데이터(Data)를 수집,분석, 저장하고 분석된 자료를 이용하여 설치된 설비를 제어하는 전용 소프트웨어(Software)가 내장되어지는 것으로, CCTV 지역제어 PC (21),웹서버(Web Server)(22),프린터(23)가 구비되고 하나의 시스템에서 시스템 FAIL 이나 이상시 다른 시스템이 자동으로 시스템을 절체하여 전체 시스템을 운영 보호하기 위한 MCS 가 두대로 구성되는 시스템 이중화장치(MCS DUAL)(25)가 구비된다.

또, 중앙제어메인장치(20)는 다양한 방식의 통신과 전력제어 및 전력감시 통신기기들 간의 데이터 통신의 안정성을 위한 기능을 가지는 안정화기능과, 시스템의 제어 계측 감시를 위하여 고속 데이터 통신기능을 가지는 고속 데이터 통신기능과, 추후 태양광 어레이 모듈 증설시 모듈의 계측이 가능한 시스템 확장성 기능과, 전력 계측 장치 증설시 별도의 장치 추가 없이 소프트웨어 업그레이드(S/W upgrade)가 가능 하여야 한다.

상기와 같은 중앙제어메인장치(20)에서는 전체 시스템을 제어 및 감시, 웹 시스템 과 원격 제어 프로그램과의 데이터 통신,전력 계측 기능 및 전력 감시 기능, DVR 제어 시스템과의 인터페이스, 경보 및 센서 정보 수신을 위한 인터페이스 기능과 함께 시스템 이중화장치(MCS DUAL)(25)에 의해 하나의 시스템에서 시스템 FAIL 이나 이상시 다른 시스템이 자동으로 시스템을 절체하여 전체 시스템을 운영 보호하므로 통신과 전력제어 및 전력감시 통신기기들 간의 데이터 통신의 안정성을 크게 높여 발전신뢰도를 향상시키게 된다.

네트워크망(30)은; 수집된 데이터를 TCP/IP 포트를 통하여 수신하여 시리얼 게이트웨이(serial Gate Way)(31) 및 발전네트워크와 접속하고 TCP/IP 포트, USB 포트, 유선 및 무선 인터넷 접속소프트가 구비되어야 한다.

상기 네트워크망(30)은 시리얼 게이트웨이에서 인터페이스된 데이터를 이더넷(Ethernet)을 통하여 수신하여 표준화된 데이터 프로토콜로 변환하여 통합 서버로, 발전장치의 광 통신망을 이용하여 데이터를 전송하는 기능을 수행하고 전력변환장치(40),태양광어레이 계측장치(45),전력계통도 표시장치(50)등의 전력관련 기기 들을 원격지 제어시스템에서 제어 할 수 있게 한다.

시리얼 게이트웨이(31)는, 태양광 발전설비의 인버터, 디지털계전기 및 추후 인터페이스(Interface)될 수 있는 장비들과의 데이터 인터페이스(Data Interface)를 하기위한 장치로서 개별Input, 개별Output, 아날로그 Input, 아날로그Output, 시리얼통신 포트가 구비된다.

전력변환장치(40)는; 태양전지모듈(A)로부터 출력된 직류전력을 교류전력으로 변환하여 계통에 공급하는 전력변환수단으로, 현재 장치의 운영 및 제어 상태를 감시하며 데이터 수집 및제어 상태를 표시하고 그 상태 및 데이터를 메인장치로 통보 및 전달한다.

태양광어레이 계측장치(45)는; 그룹별 태양전지 모듈 어레이 슬레이브 계측장치가 수집한 전압,전류의 데이터를 수집 및 상위시스템 으로 데이터 통보및 전달,각 그룹별 PV 어레이 모듈의 상태 감시 및 제어, 태양전지 어레이 모듈의 전압,전류를 계측 및 연산 기능 ,그룹별 태양전지 어레이 모듈의 이상상태 감지시 상위시스템으로 전달하고 태양광 어레이 개폐기를 차단하며 정상상태로인지 된 경우 자동으로 슬레이브 장치는 개폐기를 연결하며, 원격지 시스템에서 접속만 개폐기를 제어하는 경우 슬레이브장치는 상위 시스템으로부터의 제어 명령에 의한 기능을 수행 하며 그 결과와 상태를 상위 시스템으로 전달한다.

전력계통도 표시장치(50)는; 전력 계통의 흐름을 직관적으로 알수 있고 그 상태(전력장비의 상태 및 개폐 스위치 상태)가 표시되어야 한다.

상기 전력계통도 표시장치(50)는 현재 전력의 흐름 및 상태를 LED 현황판으로 표시하며 이 표시장치에는 기상데이터 및 시간 및 현재 전력 계통의 흐름과 발전량,송전량이 포함된다.

GPS 자동시각수신장치(60)는; 위성으로 부터 데이터를 수신 하여 시간 정보를 추출 연산하고 전체 시스템에 통보 전달 및 자체 세그먼트 또는 LCD 로 기준시각을 표시한다.

상기 GPS 자동시각수신장치(60)에 의해 GPS 기준 시각 수신에 의한 시간 데이터 일치기능과 전 장비의 계측 및 제어를 위하여 시간의 정확도를 일치시켜 발전안정성을 높여주게 된다.

자동기상관측장치(70)는; 기상 계측 기능 과 표시기능을 갖되 온도, 습도, 일사량, 강수량, 풍향, 풍속의 데이터를 계측하고 유지보수를 위하여 설치된 그 위치에서 표시되어야 한다.

상기 자동기상관측장치(70)에 의해 시간대별, 일별, 주간별, 월별 기상현황(경사면 일사량, 수평면 일사량, 외기온도, 태양전지 표면온도), 태양전지 발전 현황, 부하 현황 등을 평균, 최소, 최대, 누적치로 표시하여 발전용량을 정확하게 예측할 수 있게 된다.

영상감시장치(80)는: 전체 시스템 설치장비의 영상감시기능 및 정보센서가 설치된 장소의 출입자 감시 및 정보기능등을 하되 위치센서 및 정보센서 인터페이스를 위한 H/W 접속으로 이루어진 아날로그 다중신호수신부, 아날로그 다중신호 (ANALOG MUX)로 부터 인터페이스된 데이터를 수신하여 그 종류에 따라 상위 시스템(원방감시 시스템) 및 시스템으로 전달하는 위치 센서 감시부, 원격지 제어 컴퓨터로 부터 명령을 수신하여 카메라의 방향을 제어하는 카메라 제어부로 이루어지고 녹화(DVR) 시스템에서 화면녹화, 화면 저장, 화면 검색 기능을 수행한다.

상기 영상감시장치(80)에 의해 카메라 방향제어에 따른 영상 감시 기능, 움직임 감지 및 센서 작동에 의한 자동 녹화 기능, 정보센서가 설치된 장소의 출입자 감시 및 정보기능, 실내 특정 장비에 접근할 경우 그 상태 표시기능, 다양한 형태의 분할 화면 제공 (1~16분할)을 통한 동시영상 감시 기능, 각각의 카메라에 요일 별, 시간 별, 녹화 지정 기능, 특정 카메라에 대한 집중 감시 기능, 재생 속도 조절 기능, 저장 및 검색기능, 녹화된 특정 장면을 저장 또는 인쇄 기능, 영상 보정 기능: 명암, 밝기를 현장의 조건에 맞게 조절하여 최적의 화상을 보정하는 기능, 원격지 네트워크를 통한 실시간 영상 및 각종 작동상황 전송기능, 원격지 사용자의 요청에 따른 녹화 영상 전송으로 상시 감시하여 모니터링 할 수 있게되어 전반적인 시스템의 상황변화에 신속히 대처할 수 있게 된다.

인터넷폰장치(90)는 스피커폰 기능 제공, 다양한 기능 키 지원, 인터넷 상의 다양한 지연 및 패킷 오류에 대응하기 위한 QoS 기술을 적용해 최적의 음질제공, PoE(Power over Ethernet) 기능 지원, 다양한 Network관리 기능 지원, 체계적인 장비 관리를 위한 표준 SNMP Agent 와 MIB II, Bridge MIB 등을 지원, 원격 제어 기능을 가능하게 하는 Telnet 및 Rlogin 기능 지원, 웹 기반의 장비 관리가 가능하도록 기능 지원, TFTP 및 FTP 에 의한 원격 소프트웨어 업그레이드기능을 지원하도록 한다.

상기 인터넷폰장치(90)에 의해 관리자가 발전장치의 운전상황을 수동으로 감시하여 웹 기반의 시스템 관리가 가능하고 원격제어할 수 있는 특징을 갖게 된다.

한편 상기 원격지제어시스템(10)에 구비되는 모니터 및 인터넷(Internet), 네트워크(Network), CDMA 무선통신을 기반으로 감시제어를 하기위한 콘트롤러와 각종 서버는 도 3에서와 같이 하나의 하우징 내에 내장되어 보호 및 감시를 효과적으로 수행할 수 있도록 함이 바람직하다.

발명의 효과

이와 같이 된 본 발명의 태양광 발전장치는 중앙제어메인장치의 시스템 이중화장치(MCS DUAL)에 의해 감시시스템의 안정성, GPS 자동시각 수신장치에 의해 계측 및 제어를 위한 시간의 정확도, 자동기상관측장치에 의해발전설비의 실시간 감시, 다양한 기상상태변화와 같이 발전용량의 여러가지 상황변화등에도 정확하게 감시제어 할 수 있는 발전설비의 다양하고 정확한 통합감시시스템을 갖게 되는 특징이 있다.

또한, 인터넷폰장치에 의해 관리자가 발전장치의 운전상황을 수동으로 감시하여 웹 기반의 시스템 관리가 가능하고 원격제어할 수 있는 등 태양광의 발전효율성을 높일 수 있는 효과가 있다.

도면의 간단한 설명

도 1은 본 발명의 전체적인 구성을 나타낸 구성도

도 2는 본 발명의 영상감시장치의 구성예시도

도 3은 본 발명의 원격지제어시스템의 설치상태 전면예시도

* 도면의 주요부분에 대한 부호의 설명

10 : 원격지제어시스템 20 : 중앙제어메인장치

25 : 시스템 이중화장치 30 : 네트워크망

31 : 시리얼 게이트웨이 40 : 전력변환장치

45 : 태양광어레이 계측장치 50 : 전력계통도 표시장치

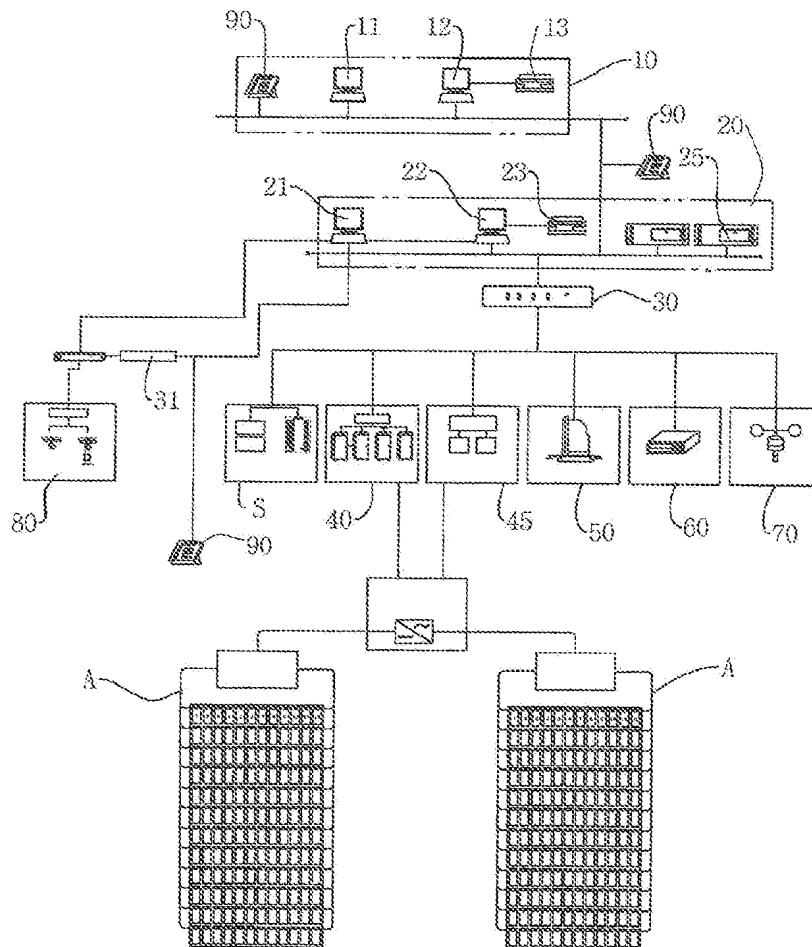
60 : GPS 자동시각수신장치 70 : 자동기상관측장치

80 : 영상감시장치 90 : 인터네트폰장치

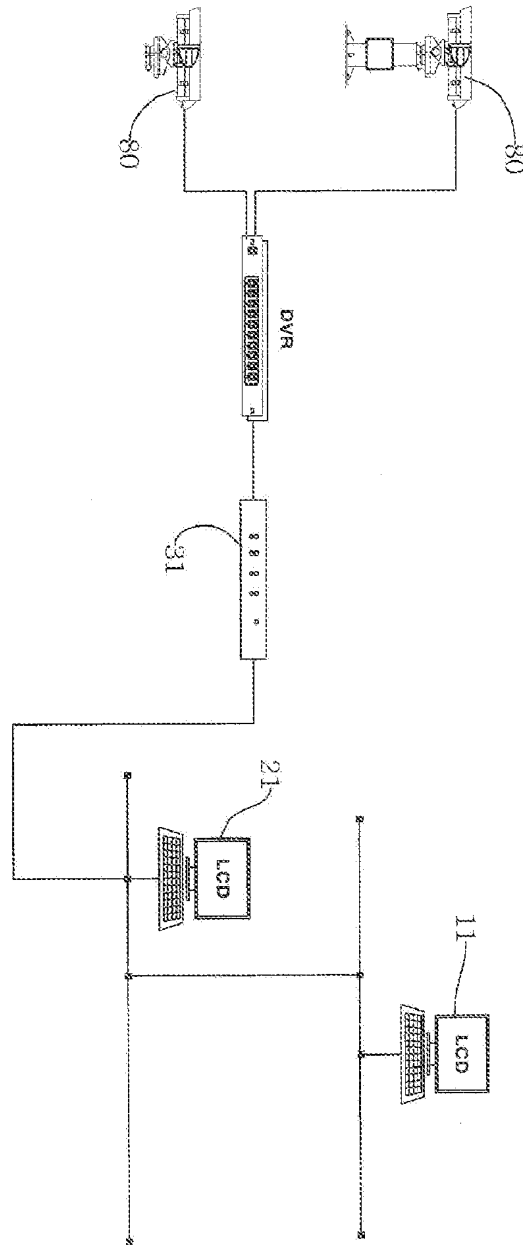
A : 태양전지모듈 S : 충전계통부분

도면

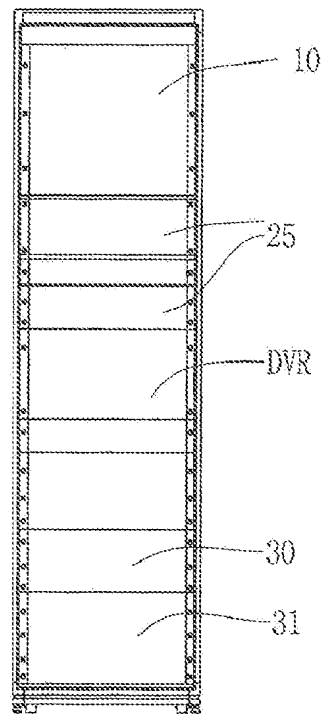
도면1



도면2



도면3





Espacenet

Bibliographic data: KR 100912892 (B1)

REMOTE SELF TEST MONITORING AND REMOTE CONTROL SYSTEM OF SOLAR POWER APPARATUS

Publication date: 2009-08-20
Inventor(s): WOO HYEOK JAE [KR]; HAN MIN GWAN [KR]; SHIN KYOO JAE [KR] ±
Applicant(s): SEOUL MARINE CO LTD [KR] ±
Classification: - international: H02J13/00
- European:
Application number: KR20080036828 20080421
Priority number(s): KR20080036828 20080421

Abstract of KR 100912892 (B1)

A remote self-test monitoring and controlling system of a solar energy generating apparatus is provided to prevent damage to a tracker by remotely controlling the tracker according to a monitoring result of environment of a solar energy power plant. A solar energy generating apparatus(10) includes a tracker(11), a solar energy generation module(12), a magnet switch(13), a DC/AC measuring board(14), and an inverter(15). The solar energy generation module has power generation capacity more than 100KW. The magnet switch is connected to the solar energy generation module. The DC/AC measuring board receives a DC power of the solar energy generation module and an AC power of the inverter. The inverter converts the DC power more than 100KW into the AC power. A supply type solar energy generation apparatus(20) includes a solar energy generation module(22) and a supply type inverter(25). The solar energy generation module has power generation capacity less than 100KW. The supply type inverter converts the DC power less than 100KW into the AC power.

Last updated: 26.04.2011 Worldwide Database 5.7.22; 92p



(19) 대한민국특허청(KR)
(12) 등록특허공보(B1)

(45) 공고일자 2009년08월20일
(11) 등록번호 10-0912892
(24) 등록일자 2009년08월12일

(51) Int. Cl.

H02J 13/00 (2006.01)

(21) 출원번호 10-2008-0036828

(22) 출원일자 2008년04월21일

심사청구일자 2008년04월21일

(56) 선행기술조사문헌

KR1020070080959 A

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전체 청구항 수 : 총 5 항

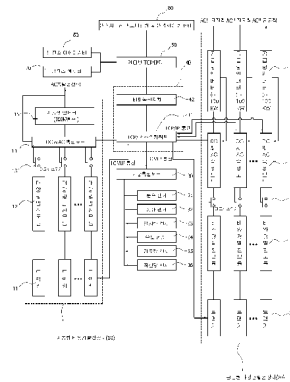
심사관 : 진수영

(54) 태양광 발전장치 원격 자가진단 모니터링 및 원격제어시스템

(57) 요약

본 발명은 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 관한 것으로, 복수의 트래커와, 상기 복수의 트래커에 의해 구동되는 복수의 태양광 발전모듈과, 상기 복수의 태양광 발전모듈에 연결된 복수의 마그넷 스위치와, 상기 복수의 마그넷 스위치를 통해 상기 복수의 태양광 발전모듈의 DC 발전전력이 입력되며 상기 하나의 계통형 인버터로부터 출력되는 AC 총발전전력이 피드백 입력되는 하나의 DC & AC 측정보드와, 상기 하나의 DC & AC 측정보드로부터 출력되는 DC 총발전전력을 AC 총발전전력으로 전력변환하여 전원으로 출력하는 하나의 계통형 인버터를 포함하는 계통형 태양광 발전장치와; 상기 DC & AC 측정보드로부터 출력되는 복수의 태양광 발전모듈의 발전데이터를 TCP/IP 스위치 허브를 통해 수신하여 실시간으로 버퍼링하는 버퍼통신장치를 포함하는 발전소 지역망과; 상기 발전소 지역망과 연결된 인터넷 TCP/IP망과; 상기 버퍼통신장치로부터 실시간 출력되는 발전데이터를 포함하는 모니터링 데이터가 상기 인터넷 TCP/IP망을 통해 저장되는 발전소 데이터 서버; 및 상기 발전소 데이터 서버를 통해 모니터링 데이터를 제공하는 발전소 웹서버를 포함하는 복수의 태양광 발전소와, 상기 인터넷 TCP/IP망에 의해 상기 복수의 태양광 발전소의 각 발전소 웹서버에 접속하여 상기 발전소 데이터 서버가 발전소 웹서버의 웹페이지를 통해 제공하는 모니터링 데이터에 의해 각 태양광 발전소의 원격 자가진단 모니터링을 수행하는 한편, 상기 발전소 웹서버를 통해 DC & AC 측정보드에 원격 자가진단 모니터링 제어신호를 송신하여 각 태양광 발전소의 복수의 태양광 발전모듈의 발전전력 선로의 고장 자가진단을 포함하는 태양광 발전모듈의 원격 자가진단 모니터링 및 원격제어가 가능한 원격 자가진단 모니터링 및 원격제어 컴퓨터로 이루어진다.

도 1



특허청구의 범위

청구항 1

인터넷 TCP/IP망과, 상기 버퍼통신장치로부터 실시간 출력되는 발전데이터를 포함하는 모니터링 데이터가 상기 인터넷 TCP/IP망을 통해 저장되는 발전소 데이터 서버, 및 상기 발전소 데이터 서버를 통해 모니터링 데이터를 제공하는 발전소 웹서버를 포함하는 복수의 태양광 발전소와; 상기 인터넷 TCP/IP망에 의해 상기 복수의 태양광 발전소의 각 발전소 웹서버에 접속하여 상기 발전소 데이터 서버가 발전소 웹서버의 웹페이지를 통해 제공하는 모니터링 데이터에 의해 각 태양광 발전소의 원격 자가진단 모니터링을 수행하는 원격 자가진단 모니터링 및 원격 제어 컴퓨터로 이루어진 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 있어서,

상기 복수의 태양광 발전소는 복수의 트랙커와, 상기 복수의 트랙커에 의해 구동되는 복수의 태양광 발전모듈과, 상기 복수의 태양광 발전모듈에 연결된 복수의 마그넷 스위치와, 상기 복수의 마그넷 스위치를 통해 상기 복수의 태양광 발전모듈의 DC 발전전력이 입력되며 하기 하나의 계통형 인버터로부터 출력되는 AC 총발전전력이 피드백 입력되는 하나의 DC & AC 측정보드와, 상기 하나의 DC & AC 측정보드로부터 출력되는 DC 총발전전력을 AC 총발전전력으로 전력변환하여 전원으로 출력하는 하나의 계통형 인버터를 포함하는 계통형 태양광 발전장치와; 상기 인터넷 TCP/IP망과 연결되어 상기 DC & AC 측정보드로부터 출력되는 복수의 태양광 발전모듈의 발전데이터를 TCP/IP 스위치 허브를 통해 수신하여 실시간으로 버퍼링하는 버퍼통신장치를 포함하는 발전소 지역망을 더 포함하며,

상기 DC & AC 측정보드는 복수의 태양광 발전모듈 각각의 DC 발전전력을 입력받아 각각의 발전량을 측정하는 전류센서 및 전압센서와; 상기 전류센서 및 전압센서로부터 측정된 각각의 발전량에 대한 각각의 발전데이터가 입력되는 마이컴; 및 상기 마이컴으로부터 출력되는 각각의 발전데이터를 송신하는 TCP/IP 통신모듈을 포함하며,

상기 태양광 발전소는 태양광 발전소 주변의 기후변화를 측정하는 풍속센서, 풍향센서, 일사량센서, 온도센서, 강수량센서 및 적설량센서와 이들 센서에 의해 측정된 기상데이터를 수신하는 기상측정보드를 더 포함하는데, 상기 기상측정보드는 TCP/IP 스위치 허브에 접속되어 모니터링 데이터인 기상데이터를 버퍼통신장치와 인터넷 TCP/IP망을 통해 실시간 송신하여 발전소 웹서버와 연결된 발전소 데이터 서버에 저장하고,

상기 발전소 데이터 서버에는 TCP/IP 스위치 허브에 접속된 트랙커로부터 송신되는 모니터링 데이터인 태양광 발전모듈 구동데이터가 저장되며,

상기 원격 자가진단 모니터링 및 원격제어 컴퓨터는 상기 발전소 웹서버를 통해 DC & AC 측정보드에 원격 자가진단 모니터링 제어신호를 송신하여 이 원격 자가진단 모니터링 제어신호에 의해 상기 DC & AC 측정보드가 상기 마그넷 스위치를 오픈시켜 각 태양광 발전소의 복수의 태양광 발전모듈의 발전전력 선로의 고장 자가진단을 하고, 상기 기상데이터를 웹서버의 웹페이지를 통해 모니터링하여 트랙커를 원격제어하거나 또는 상기 버퍼통신장치와 인터넷 TCP/IP망을 통해 수신하여 모니터링함으로써 트랙커를 원격제어하며, 상기 태양광 발전모듈 구동데이터의 모니터링을 통해 트랙커를 원격제어하는 태양광 발전모듈의 원격 자가진단 모니터링 및 원격제어가 가능한 것을 특징으로 하는 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템.

청구항 2

청구항 1에 있어서,

복수의 트랙커와, 상기 복수의 트랙커에 의해 구동되는 복수의 태양광 발전모듈과, 상기 복수의 태양광 발전모듈에 연결된 복수의 마그넷 스위치와, 상기 복수의 마그넷 스위치를 통해 상기 복수의 태양광 발전모듈의 DC 발전전력이 입력되며 하기 복수의 공급형 인버터로부터 출력되는 AC 발전전력이 피드백 입력되는 복수의 DC & AC 측정보드와, 상기 복수의 DC & AC 측정보드로부터 출력되는 DC 발전전력을 AC 발전전력으로 전력변환하여 전원으로 출력하는 복수의 공급형 인버터를 포함하는 공급형 태양광 발전장치를 더 포함하되,

상기 DC & AC 측정보드는 하나의 태양광 발전모듈의 DC 발전전력을 입력받아 발전량을 측정하는 전류센서 및 전압센서와; 상기 전류센서 및 전압센서로부터 측정된 하나의 발전량에 대한 하나의 발전데이터가 입력되는 마이컴; 및 상기 마이컴으로부터 출력되는 하나의 발전데이터를 송신하는 TCP/IP 통신모듈을 포함하는 것을 특징으로 하는 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템.

청구항 3

청구항 1에 있어서,

상기 원격 자가진단 모니터링 및 원격제어 컴퓨터는 각 태양광 발전소의 인터넷 TCP/IP망의 고유 IP에 직접 접속하여 버퍼통신장치로부터 송신된 모니터링 데이터를 수신하여 각 태양광 발전소의 원격 자가진단 모니터링을 수행하는 한편, 버퍼통신장치를 통해 DC & AC 측정보드에 원격 자가진단 모니터링 제어신호를 송신하여 각 태양광 발전소의 복수의 태양광 발전모듈의 발전전력 선로의 고장 자가진단을 더 포함하는 태양광 발전모듈의 원격 자가진단 모니터링 및 원격제어가 가능한 것을 특징으로 하는 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템.

청구항 4

청구항 2에 있어서,

상기 원격 자가진단 모니터링 및 원격제어 컴퓨터는 각 태양광 발전소의 인터넷 TCP/IP망의 고유 IP에 직접 접속하여 버퍼통신장치로부터 송신된 모니터링 데이터를 수신하여 각 태양광 발전소의 원격 자가진단 모니터링을 수행하는 한편, 버퍼통신장치를 통해 DC & AC 측정보드에 원격 자가진단 모니터링 제어신호를 송신하여 각 태양광 발전소의 복수의 태양광 발전모듈의 발전전력 선로의 고장 자가진단을 더 포함하는 태양광 발전모듈의 원격 자가진단 모니터링 및 원격제어가 가능한 것을 특징으로 하는 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템.

청구항 5

삭제

청구항 6

삭제

청구항 7

삭제

청구항 8

삭제

청구항 9

트랙커와, 상기 트랙커에 의해 구동되는 태양광 발전모듈과, 상기 태양광 발전모듈에 연결된 마그넷 스위치와, 상기 마그넷 스위치를 통해 상기 태양광 발전모듈의 DC 발전전력이 입력되며 하기 독립형 인버터로부터 출력되는 AC 발전전력이 피드백 입력되는 DC & AC 측정보드와, 상기 DC & AC 측정보드로부터 출력되는 DC 발전전력을 AC 발전전력으로 전력변환하여 전원으로 출력하는 독립형 인버터를 포함하는 독립형 태양광 발전장치와;

상기 DC & AC 측정보드와 연결된 인터넷 TCP/IP망와;

상기 인터넷 TCP/IP망을 통해 DC & AC 측정보드의 고유 IP에 직접 접속하여 DC & AC 측정보드가 제공하는 태양광 발전모듈의 모니터링 데이터인 발전데이터를 통해 상기 태양광 발전장치의 원격 자가진단 모니터링을 수행하는 한편, 상기 DC & AC 측정보드에 원격 자가진단 모니터링 제어신호를 송신하여 이 원격 자가진단 모니터링 제어신호에 의해 상기 DC & AC 측정보드가 상기 마그넷 스위치를 오프시켜 상기 독립형 태양광 발전장치의 태양광 발전모듈의 발전전력 선로의 고장 자가진단을 포함하는 태양광 발전모듈의 원격 자가진단 모니터링 및 원격제어가 가능한 원격 자가진단 모니터링 및 원격제어 컴퓨터; 및

상기 독립형 태양광 발전장치의 설치지역의 기후변화를 측정하는 풍속센서, 풍향센서, 일사량센서, 온도센서, 강우량센서 및 적설량센서와 이들 센서에 의해 측정된 기상데이터를 수신하는 기상측정보드로 이루어지되,

상기 DC & AC 측정보드는 상기 태양광 발전모듈의 DC 발전전력을 입력받아 발전량을 측정하는 전류센서 및 전압센서와; 전류센서 및 전압센서로부터 측정된 발전데이터가 입력되는 마이컴; 및 상기 마이컴으로부터 출력되는 발전데이터를 송신하는 TCP/IP 통신모듈을 포함하며,

상기 기상측정보드와 트랙커는 인터넷 TCP/IP망에 접속되어 각각 모니터링 데이터인 기상데이터와 태양광 발전

모듈 구동데이터를 인터넷 TCP/IP망을 통해 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터에 송신하며, 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터는 수신된 기상데이터와 태양광 발전모듈 구동데이터를 모니터링하여 트랙커를 원격제어하는 것을 특징으로 하는 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템.

청구항 10

삭제

청구항 11

삭제

청구항 12

삭제

명세서

발명의 상세한 설명

기술 분야

- <1> 본 발명은 태양광 발전에 관한 것으로, 특히 태양광 발전장치의 스트링 단위의 태양광 발전모듈 각각을 원격에서 자가진단 모니터링과 유지보수 및 태양광 발전모듈을 구동하는 트랙커(태양광 서보제어 추적장치)를 원격제어할 수 있는 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 관한 것이다.

배경 기술

- <2> 종래의 태양광 발전소의 태양광 발전장치의 모니터링 방식은 태양광 발전장치의 복수의 태양광 발전모듈을 병렬지대로 연결하여 복수의 태양광 발전모듈 각각에서 발전되어 병렬지로의 종단에서 모아진 총발전량 100KW~300KW급 용량의 태양광 발전모듈의 발전전압과 발전전류를 모니터링하는 방식하기 때문에 태양광 발전모듈 각각의 발전전압과 발전전류를 모니터링 할 수 없었을 뿐만 아니라 태양광 발전모듈 각각의 세부적인 고장 여부를 진단할 수 없었다.
- <3> 종래의 100KW~300KW급 용량의 총발전량 데이터는 RTU(Real Time Unit)와 RS-422 통신방식에 의해 발전소 통신망을 구축하여 태양광 발전소 운용자 컴퓨터에 전송하는 방식이 사용되고 있기 때문에 총발전량이 아닌 태양광 발전모듈 각각의 발전량을 모니터링할 경우에 수백 미터 길이로 매우 복잡한 통신선로 작업이 필요하며, 이에 따른 통신설비 구축의 어려움과 과다한 설치비용 발생으로 인해 경제적 부담이 상당하고 또한 통신선로의 유지보수가 매우 어렵고, 복잡한 통신선로로 인해 데이터 전송시에 발생하는 노이즈로 인해 통신오류가 발생하여 측정된 총발전량 데이터의 신뢰성이 저하되었다.
- <4> 그리고 종래는 태양광 발전에 필요한 모니터링 기능만을 제공하고 있고, 발전전력 선로가 외부적 요인, 즉 태양광 발전소의 주변환경 즉 풍속, 풍향, 습도, 온도, 강우량, 적설량 등의 기후에 의하여 발생하는 발전전력 선로의 누전과 단락이 발생한 경우에 대한 모니터링 기능을 제공하고 있지 못하여 고장 자가진단을 하지 못하고, 특히 태풍과 적설로 인한 태양광 발전모듈의 손상에 대한 고장 자가진단을 하지 못하는 문제가 있었다.
- <5> 한편, 최근에는 고장진단 및 유지보수를 위하여 태양광 발전모듈의 발전량을 복수의 태양광 발전모듈의 총발전량이 아닌 태양광 발전모듈 각각의 발전량을 계측하는 것이 필요하고, 고장진단을 위하여 발전전력 선로의 누전 및 손실을 주기적으로 분석하는 것이 필요하지만 복수의 태양광 발전모듈의 총발전량만을 모니터링하는 방식이기 때문에 태양광 발전계통의 유지보수를 위한 기능이 미비하였다.

발명의 내용

해결 하고자 하는 과제

- <6> 상술한 문제점을 고려하여 본 발명은 원격에서 태양광 발전소에 설치되거나 또는 주택이나 공장에 설치된 태양광 발전장치의 스트링 단위(0.8KW~5.0KW)의 태양광 발전모듈 각각을 통신선로가 간단하고 설치비용이 적게 드는 TCP/IP 통신을 통하여 개별적으로, 즉 스트링 단위로 원격 자가진단 모니터링을 하여 이에 따른 고장진단을 함

으로써 적절한 유지보수를 할 수 있도록 하고, 태양광 발전소 주변의 기상변화를 측정하여 이 기상변화에 따라 적절하게 태양광 발전모듈을 구동하는 트랙커를 원격으로 제어할 수 있도록 하며, 전력공급업체에 생산된 전력의 판매뿐만 아니라 주변 주택 또는 공장에 저렴하게 공급할 수 있도록 한 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템을 제공하는데 그 목적이 있다.

각개 해결수단

- <7> (1) 본 발명의 목적은 복수의 트랙커와, 상기 복수의 트랙커에 의해 구동되는 복수의 태양광 발전모듈과, 상기 복수의 태양광 발전모듈에 연결된 복수의 마그넷 스위치와, 상기 복수의 마그넷 스위치를 통해 상기 복수의 태양광 발전모듈의 DC 발전전력이 입력되며 하기 하나의 계통형 인버터로부터 출력되는 AC 총발전전력이 피드백 입력되는 하나의 DC & AC 측정보드와, 상기 하나의 DC & AC 측정보드로부터 출력되는 DC 총발전전력을 AC 총발전전력으로 전력변환하여 전원으로 출력하는 하나의 계통형 인버터를 포함하는 계통형 태양광 발전장치와; 상기 하나의 DC & AC 측정보드로부터 출력되는 복수의 태양광 발전모듈의 발전데이터를 TCP/IP 스위치 허브를 통해 수신하여 실시간으로 버퍼링하는 버퍼통신장치를 포함하는 발전소 지역망과; 상기 발전소 지역망과 연결된 인터넷 TCP/IP망과; 상기 버퍼통신장치로부터 실시간 출력되는 발전데이터를 포함하는 모니터링 데이터가 상기 인터넷 TCP/IP망을 통해 저장되는 발전소 데이터 서버; 및 상기 발전소 데이터 서버를 통해 모니터링 데이터를 제공하는 발전소 웹서버를 포함하는 복수의 태양광 발전소와,
- <8> 상기 인터넷 TCP/IP망에 의해 상기 복수의 태양광 발전소의 각 발전소 웹서버에 접속하여 상기 발전소 데이터 서버가 발전소 웹서버의 웹페이지를 통해 제공하는 모니터링 데이터에 의해 각 태양광 발전소의 원격 모니터링을 수행하는 한편, 상기 발전소 웹서버를 통해 DC & AC 측정보드에 원격 자가진단 모니터링 제어신호를 송신하여 각 태양광 발전소의 복수의 태양광 발전모듈의 발전전력 선로의 고장 자가진단을 포함하는 태양광 발전모듈의 원격 자가진단 모니터링 및 원격제어가 가능한 원격 자가진단 모니터링 및 원격제어 컴퓨터로 이루어진 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 의해 달성된다.
- <9> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 있어서, 복수의 트랙커와, 상기 복수의 트랙커에 의해 구동되는 복수의 태양광 발전모듈과, 상기 복수의 태양광 발전모듈에 연결된 복수의 마그넷 스위치와, 상기 복수의 마그넷 스위치를 통해 상기 복수의 태양광 발전모듈의 DC 발전전력이 입력되며 하기 복수의 공급형 인버터로부터 출력되는 AC 발전전력이 피드백 입력되는 복수의 DC & AC 측정보드와, 상기 복수의 DC & AC 측정보드로부터 출력되는 DC 발전전력을 AC 발전전력으로 전력변환하여 전원으로 출력하는 복수의 공급형 인버터를 포함하는 공급형 태양광 발전장치를 더 포함하는 것을 특징으로 한다.
- <10> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 있어서, 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터는 각 태양광 발전소의 인터넷 TCP/IP망의 고유 IP에 직접 접속하여 버퍼통신장치로부터 송신된 모니터링 데이터를 수신하여 각 태양광 발전소의 원격 자가진단 모니터링을 수행하는 한편, 버퍼통신장치를 통해 DC & AC 측정보드에 원격 자가진단 모니터링 제어신호를 송신하여 각 태양광 발전소의 복수의 태양광 발전모듈의 발전전력 선로의 고장 자가진단을 더 포함하는 태양광 발전모듈의 원격 자가진단 모니터링 및 원격제어가 가능한 것을 특징으로 한다.
- <11> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템의 계통형 태양광 발전장치에 있어서, 상기 DC & AC 측정보드는 복수의 태양광 발전모듈 각각의 DC 발전전력을 입력받아 각각의 발전량을 측정하는 전류센서 및 전압센서와; 상기 전류센서 및 전압센서로부터 측정된 각각의 발전량에 대한 각각의 발전데이터가 입력되는 마이컴; 및 상기 마이컴으로부터 출력되는 각각의 발전데이터를 송신하는 TCP/IP 통신모듈을 포함하는 것을 특징으로 한다.
- <12> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템의 공급형 태양광 발전장치에 있어서, 상기 DC & AC 측정보드는 하나의 태양광 발전모듈의 DC 발전전력을 입력받아 발전량을 측정하는 전류센서 및 전압센서와; 상기 전류센서 및 전압센서로부터 측정된 하나의 발전량에 대한 하나의 발전데이터가 입력되는 마이컴; 및 상기 마이컴으로부터 출력되는 하나의 발전데이터를 송신하는 TCP/IP 통신모듈을 포함하는 것을 특징으로 한다.
- <13> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 있어서, 상기 태양광 발전소는 태양광 발전소 주변의 기후변화를 측정하는 풍속센서, 풍향센서, 일사량센서, 온도센서, 강우량센서 및 적설량센서와 이들 센서에 의해 측정된 기상데이터를 수신하는 기상측정보드를 더 포함하는데, 상기 기상측정보드는 TCP/IP 스위치 허브에 접속되어 모니터링 데이터인 기상데이터를 버퍼통신장치와 인터넷 TCP/IP망을 통해 실시

간 송신하여 발전소 웹서버와 연결된 발전소 데이터 서버에 저장하고, 상기 원격 자가진단 모니터링 및 원격 제어 컴퓨터는 상기 기상데이터를 웹서버의 웹페이지를 통해 모니터링하여 트랙커를 원격제어하거나 또는 상기 버퍼통신장치와 인터넷 TCP/IP망을 통해 수신하여 모니터링함으로써 트랙커를 원격제어하는 것을 특징으로 한다.

<14> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 있어서, 상기 발전소 데이터 서버에는 TCP/IP 스위치 허브에 접속된 트랙커로부터 송신되는 모니터링 데이터인 태양광 발전모듈 구동데이터가 저장되며, 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터는 상기 태양광 발전모듈 구동데이터의 모니터링을 통해 트랙커를 원격제어하는 것을 특징으로 한다.

<15> (2) 또한 본 발명의 목적은 트랙커와, 상기 트랙커에 의해 구동되는 태양광 발전모듈과, 상기 태양광 발전모듈에 연결된 마그넷 스위치와, 상기 마그넷 스위치를 통해 상기 태양광 발전모듈의 DC 발전전력이 입력되며 하기 독립형 인버터로부터 출력되는 AC 발전전력이 피드백 입력되는 DC & AC 측정보드로, 상기 DC & AC 측정보드로부터 출력되는 DC 발전전력을 AC 발전전력으로 전력변환하여 전원으로 출력하는 독립형 인버터를 포함하는 독립형 태양광 발전장치와; 상기 DC & AC 측정보드와 연결된 인터넷 TCP/IP망; 및 상기 인터넷 TCP/IP망을 통해 DC & AC 측정보드의 고유 IP에 직접 접속하여 DC & AC 측정보드가 제공하는 태양광 발전모듈의 모니터링 데이터인 발전데이터를 통해 상기 독립형 태양광 발전장치의 원격 자가진단 모니터링을 수행하는 한편, 상기 DC & AC 측정보드에 원격 자가진단 모니터링 제어신호를 송신하여 상기 독립형 태양광 발전장치의 태양광 발전모듈의 발전전력 신호의 고장 자가진단을 포함하는 태양광 발전모듈의 원격 자가진단 모니터링 및 원격제어가 가능한 원격 자가진단 모니터링 및 원격제어 컴퓨터로 이루어진 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 의해 달성된다.

<16> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 있어서, 상기 DC & AC 측정보드는 상기 태양광 발전모듈 각각의 DC 발전전력을 입력받아 발전량을 측정하는 전류센서 및 전압센서와; 전류센서 및 전압센서로부터 측정된 발전데이터가 입력되는 마이컴; 및 상기 마이컴으로부터 출력되는 발전데이터를 송신하는 TCP/IP 통신모듈을 포함하는 것을 특징으로 한다.

<17> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 있어서, 독립형 태양광 발전장치의 설치지역의 기후변화를 측정하는 풍속센서, 풍향센서, 일사량센서, 온도센서, 강수량센서 및 적설량센서와 이들 센서에 의해 측정된 기상데이터를 수신하는 기상측정보드를 더 포함하는데, 상기 기상측정보드는 인터넷 TCP/IP망에 접속되어 모니터링 데이터인 기상데이터를 인터넷 TCP/IP망을 통해 상기 원격 자가진단 모니터링 및 원격 제어 컴퓨터에 송신하며, 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터는 수신된 기상데이터를 모니터링하여 트랙커를 원격제어하는 것을 특징으로 한다.

<18> 본 발명의 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 있어서, 상기 트랙커는 모니터링 데이터인 태양광 발전모듈 구동데이터를 원격 자가진단 모니터링 및 원격제어 컴퓨터에 송신하며, 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터는 수신된 태양광 발전모듈 구동데이터의 모니터링을 통해 트랙커를 원격제어하는 것을 특징으로 한다.

효 율

<19> 상기한 본 발명의 기술구성에 의해

<20> 1. 계통형 태양광 발전장치와 공급형 태양광 발전장치를 가진 태양광 발전소와 주택 또는 공장 자가발전용 독립형 태양광 발전장치의 DC & AC 측정보드를 이용하여

<21> 첫째, 복수의 태양광 발전모듈 각각이 가진 발전량 0.8KW-5.0KW 용량의 스트링 단위로 태양광 발전모듈 각각의 DC & AC 발전전압/전류정보를 원격 모니터링함으로써 전력생산관리와 유지보수를 손쉽게 할 수 있으며,

<22> 둘째, 마그넷 스위치를 오프제어하여 태양광 발전모듈 각각의 발전전력 신호의 발전전력(발전전압과 발전전류)을 측정함으로써 발전전력 신호의 이상 유무를 원격으로 자가진단할 수 있으므로 태양광 발전소를 효율적으로 관리 및 유지보수할 수 있다.

<23> 2. 발전소 지역망을 TCP/IP 통신망으로 구축함으로써 DC & AC 측정보드, 기상측정보드 및 트랙커와 TCP/IP 통신을 수행할 수 있어 통신선로가 간단하고 설치비용이 감소된다.

<24> 3. 태양광 발전소 주변의 기후변화를 풍속센서, 풍향센서, 일사량센서, 온도센서, 강수량센서와 적설량센서를 이용해서 측정하여 태양광 발전소의 기후환경을 모니터링할 수 있고, 이 모니터링 결과로 원격으로 트랙커를 제

어함으로써 효율적인 태양광 발전 및 강풍 또는 적설로부터 트랙커의 손상을 방지할 수 있다.

<25> 4. 한국전력과 같은 전력공급업체에 상용전원으로 판매하기 위한 계통형 태양광 발전뿐만 아니라 공급형 태양광 발전을 함으로써 주변 주택 또는 공장에 직접 전력을 저렴하게 공급할 수 있다.

<26> 5. 공장 또는 주택에 독립형 태양광 발전장치를 설치하여 운용중에 전문관리업체의 관리전문가가 원격 자가진단 모니터링 및 원격제어 컴퓨터의 운용프로그램에 의해 원격 자가진단 모니터링 및 원격제어를 수행함으로써 독립형 태양광 발전장치의 발전상태를 실시간으로 관리 및 유지보수할 수 있다.

발명의 실시를 위한 구체적인 내용

<27> 본 발명은 전력공급업체에 판매하는 계통형 태양광 발전장치와 주변 주택 또는 공장에 직접공급하는 공급형 태양광 발전장치를 포함하는 제1실시예의 태양광 발전소와 주택 또는 공장의 태양광 자가발전을 위해 설치되는 제2실시예의 독립형 태양광 발전장치에 대한 태양광 발전장치 원격 자가진단 모니터링 및 원격 제어시스템에 관한 것이다.

<28> 상기한 계통형, 공급형 및 독립형 태양광 발전장치는 4개~16개의 태양광 셀이 결선되어 스트링 단위(0.8KW~5.0KW)로 출력하여 발전하는 태양광 발전모듈로부터 태양광 발전전력을 생산하게 된다.

<29> 상기한 제1실시예의 태양광 발전소의 계통형 태양광 발전장치는 100KW 이상의 중대용량 발전단위이고, 상기 공급형 태양광 발전장치는 100KW 이하의 소용량 발전단위로써 태양광 발전소의 웹서버에서 지원하는 웹페이지를 통하거나 또는 원격 자가진단 모니터링 및 원격제어 컴퓨터의 운용프로그램에 의해 인터넷 TCP/IP망의 각 태양광 발전소의 고유 IP에 직접 접속하여 비퍼통신장치를 통하여 발전용량에 대해서 스트링 단위(0.8KW~5.0KW)로, 즉 각 태양광 발전모듈을 원격 자가진단 모니터링 및 원격제어를 수행함으로써 고장 자가진단 및 유지보수가 가능하다.

<30> 한편, 제2실시예로서 공장 또는 주택에 자가 태양광 발전을 위하여 보급되어 설치된 독립형 태양광 발전장치는 100KW 이하의 소용량 발전단위로써 원격 자가진단 모니터링 및 원격제어 컴퓨터의 운용프로그램에 의해 DC & AC 측정보드에 내장된 TCP/IP 통신모듈의 고유 IP에 접속하여 발전상태에 대한 원격 자가진단 모니터링 및 원격제어를 수행함으로써 A/S를 지원하는 것이 가능하다.

<31> 상술한 개략적인 본 발명의 제1실시예와 제2실시예의 구체적인 기술구성과 그 작용에 대하여 첨부한 도면에 의거하여 상세하게 이하에서 기술하기로 한다.

<32> [제1실시예]

<33> 도 1은 본 발명의 계통형 및 공급형 태양광 발전장치의 원격 자가진단 모니터링 및 원격제어 시스템의 제1실시예의 구성도이다.

<34> 본 발명은 태양광 발전소와 이 태양광 발전소로부터 수신하는 모니터링 데이터로 계통형 태양광 발전장치의 계통형 발전전력 선로와 공급형 태양광 발전장치의 공급형 발전전력 선로의 원격 자가진단 모니터링 및 트랙커의 원격제어를 하는 원격 자가진단 모니터링 및 원격제어 컴퓨터로 구성된다.

<35> 본 발명의 태양광 발전소는 복수의 트랙커, 복수의 태양광 발전모듈, 복수의 마그넷 스위치, DC & AC 측정보드, 인버터로 이루어진 계통형 및 공급형 태양광 발전장치와; 발전소 지역망과; 인터넷 TCP/IP망과; 발전소 데이터 서버; 및 발전소 웹서버를 포함한다.

<36> 상기 계통형 태양광 발전장치(10)는 복수의 트랙커(11)와, 상기 복수의 트랙커에 의해 구동되는 100KW 이상의 중대형 발전용량을 가진 복수의 태양광 발전모듈(12)과, 상기 복수의 태양광 발전모듈에 연결된 복수의 마그넷 스위치(13)와, 상기 복수의 마그넷 스위치를 통해 상기 복수의 태양광 발전모듈의 DC 발전전력이 입력되며 하기 계통형 인버터(15)로부터 출력되는 AC 총발전전력이 피드백 입력되는 DC & AC 측정보드(14) 및 상기 DC & AC 측정보드로부터 출력되는 100KW 이상의 DC 총발전전력을 AC 총발전전력으로 전력변환하여 전원으로 출력하는 계통형 인버터(15)를 포함하는데, 이와 같이 복수의 트랙커, 복수의 태양광 발전모듈, 복수의 마그넷 스위치, DC & AC 측정보드, 계통형 인버터로 이루어진 계통형 발전전력 선로에 의해 발전되어 생산된 태양광 발전전력을 전력 공급업체에 상용전원으로 판매한다.

<37> 상기 공급형 태양광 발전장치(20)는 복수의 트랙커(21)와, 상기 복수의 트랙커에 의해 구동되는 100KW 이하의 소형 발전용량을 가진 복수의 태양광 발전모듈(22)과, 상기 복수의 태양광 발전모듈에 연결된 복수의 마그넷 스위치(23)와, 상기 복수의 마그넷 스위치를 통해 상기 복수의 태양광 발전모듈의 DC 발전전력이 입력되며 하기

복수의 공급형 인버터(25)로부터 출력되는 AC 발전전력이 피드백 입력되는 복수의 DC & AC 측정보드(24)와, 상기 DC & AC 측정보드(24)로부터 출력되는 100KW 이하의 DC 발전전력을 AC 발전전력으로 전력변환하여 전원으로 출력하는 복수의 공급형 인버터(25)를 포함하는데, 이와 같이 복수의 트랙커, 복수의 태양광 발전모듈, 복수의 마그넷 스위치, 복수의 DC & AC 측정보드, 복수의 공급형 인버터로 이루어진 공급형 발전전력 선로에 의해 발전되어 생산된 태양광 발전전력을 주변 주택 또는 공장에 직접 공급한다.

- <38> 상기 발전소 지역망(40)은 DC & AC 측정보드(14)(24)로부터 출력되는 복수의 태양광 발전모듈(12)(22)의 발전데이터를 TCP/IP 스위치 허브(41)를 통해 수신하여 실시간으로 버퍼링하는 버퍼통신장치(42)를 포함한다. 상기 발전소 데이터 서버(60)에는 버퍼통신장치(42)로부터 실시간 출력되는 발전데이터를 포함하는 모니터링 데이터가 인터넷 TCP/IP망(50)을 통해 저장된다. 상기 발전소 웹서버(70)는 상기 발전소 데이터 서버(60)를 통해 모니터링 데이터를 웹페이지에 의해 제공한다.
- <39> 상기 계통형 태양광 발전장치(10)와 공급형 태양광 발전장치(20)의 DC & AC 측정보드(14)(24)는 도 2에 도시한 바와 같이, 그 구성요소인 DC 전류와 DC 전압을 측정하기 위한 전류센서 및 전압센서, 마이컴 및 TCP/IP 통신모듈은 동일하지만 계통형 태양광 발전장치(10)의 하나의 DC & AC 측정보드(14)에는 복수의 마그넷 스위치(13)에 의해 복수의 태양광 발전모듈(12)이 접속되어 있고, 공급형 태양광 발전장치(20)의 하나의 DC & AC 측정보드(24)에는 하나의 마그넷 스위치(23)에 의해 하나의 태양광 발전모듈(22)이 접속되어 있어 DC & AC 측정보드(14)(24)의 기능이 다르다.
- <40> 즉, 계통형 태양광 발전장치(10)의 DC & AC 측정보드(14)의 전류센서 및 전압센서는 복수의 태양광 발전모듈(12) 각각의 DC 발전전력을 입력받아 각각의 발전량을 측정하고, 마이컴에는 상기 전류센서 및 전압센서로부터 측정된 각각의 발전데이터가 입력되며, TCP/IP 통신모듈은 상기 마이컴으로부터 출력되는 각각의 발전데이터를 송신한다.
- <41> 하지만 공급형 태양광 발전장치(20)의 DC & AC 측정보드(24)의 전류센서 및 전압센서는 하나의 태양광 발전모듈의 DC 발전전력을 입력받아 발전량을 측정하고, 마이컴에는 전류센서 및 전압센서로부터 측정된 하나의 발전량에 대한 하나의 발전데이터가 입력되며, TCP/IP 통신모듈은 상기 마이컴으로부터 출력되는 하나의 발전데이터를 송신한다.
- <42> 상기 마그넷 스위치(13)(23)는 계통형 및 공급형 발전전력 선로의 고장 자가진단이 필요할 때 오프되어 발전전력 선로 개방된 상태에서 DC & AC 발전전력 선로 상의 발전전압과 발전전류의 "0(zero)"상태 여부에 의해 누전 및 단락상태를 모니터링하게 된다.
- <43> 한편, 상기 DC & AC 측정보드(14)(24)는 계통형 및 공급형 인버터(15)(25)가 전력변환한 AC 발전전력, 즉 AC 발전전류와 전압을 피드백 입력받아 계측하는데, 계통형 인버터(15)는 총 AC 발전전력을 피드백 입력받고, 공급형 인버터(25)는 개별 AC 발전전력을 피드백 입력받는다.
- <44> 상기 트랙커(11)(21)는 태양광 발전모듈(12)(22)의 설치각도를 구동제어하는 태양광 서보제어 추적장치로서, TCP/IP 스위치 허브(41)에 접속되어 모니터링 데이터인 태양광 발전모듈 구동데이터를 발전소 데이터 서버(60)에 송신하여 저장한다.
- <45> 상기 태양광 발전소에는 기상측정보드(30)가 더 포함되는데, 이 기상측정보드(30)는 TCP/IP 스위치 허브(41)에 접속되어 천체지반으로부터 태양광 발전모듈(12)(22)을 보호하기 위한 목적으로 태양광 발전소 주변에 설치되어 기후변화를 측정하는 풍속센서(31), 풍향센서(32), 일사량센서(33), 온도센서(34), 강우량센서(35) 및 적설량센서(36)로부터 측정된 모니터링 데이터, 즉 풍속, 풍향, 일사량, 온도, 강우량, 적설량 데이터인 기상데이터를 수신하여 버퍼통신장치(42)와 인터넷 TCP/IP망(50)을 통해 실시간으로 발전소 데이터 서버(60)에 송신하여 저장한다.
- <46> 이상 기술한 바에 의하면 태양광 발전소가 제공하는 모니터링 데이터는 태양광 발전모듈(12)(22)의 발전데이터, 기상측정보드(30)가 제공하는 기상데이터, 트랙커(11)(21)가 제공하는 태양광 발전모듈 구동데이터를 포함한다. 상기 태양광 발전모듈 구동데이터에는 트랙커의 구동모터 상전류와 구동모터 회전각 정보를 포함한다.
- <47> 그리고 상기 기상측정보드(30)와 트랙커(11)(21)에도 DC & AC 측정보드(14)(24)와 마찬가지로 TCP/IP 통신을 위하여 마이컴 및 TCP/IP 통신모듈이 내장되어 있다.
- <48> 상술한 태양광 발전소와 인터넷 TCP/IP망(50)을 통해 통신하는 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 인터넷 TCP/IP망(50)을 통해 발전소 웹서버(70)에서 지원하는 웹페이지에 의하거나 또는 자체 운용프로그램에 의해 각 태양광 발전소의 인터넷 TCP/IP망(50)의 고유 IP에 직접 접속하여 버퍼통신장치(42)에 의해 모니

터링 데이터로서 발전데이터, 기상데이터 및 태양광 발전모듈 구동데이터를 수신하여 모니터링하고, 이 수신한 모니터링 데이터를 통해 계통형 및 공급형 태양광 발전장치(10)(20)의 발전량 등의 이상유무를 판단하여 계통형 발전전력 선로와 공급형 발전전력 선로의 마그넷 스위치(13)(23)를 오프시켜 발전전력 선로를 개방시킨 상태에서 DC & AC 발전전력 선로 상의 발전전압과 발전전류가 "0(zero)"임을 확인하여 누전 및 단락상태에 대한 원격 자가진단 모니터링을 실시하기도 하고, 트래커(11)(21)의 원격제어를 수행하여 고장 자가진단 및 유지보수를 하게 된다.

- <49> 또한, 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 계통형 및 공급형 인버터(15)(25)에 의해 전격변환된 총 및 개별 AC 발전 전류와 전압을 피드백 입력받아 계속하는 DC & AC 측정보드(14)(24)의 계속된 총 및 개별 AC 발전데이터를 발전소 웹서버(70) 또는 버퍼통신장치(42)에 접속하여 모니터링이 가능하다. 따라서 상기 발전 데이터는 DC 발전데이터와 AC 발전데이터의 두 종류가 된다.
- <50> 여기서 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)가 각 발전소 웹서버(70)의 웹페이지에 접속하여 원격 자가진단 모니터링 및 원격제어하는 방식은 일반 관리자 또는 발전소 사업주가 태양광 발전소의 보수 및 유지관리를 하도록 구축된 것이고, 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)의 운용프로그램에 의해 각 태양광 발전소의 인터넷 TCP/IP망(50)의 고유 IP에 직접 접속하여 원격 자가진단 모니터링 및 원격제어하는 방식은 전문 관리업체의 관리전문가가 태양광 발전소의 보수 및 유지관리를 하도록 구축된 것이다. 즉, 각 발전소마다 고유 IP를 보유하고 있어서 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 고유 IP에 직접 접속하여 각 발전소의 원격 자가진단 모니터링 및 원격제어가 가능하다.
- <51> 일반 관리자 또는 발전소 사업주는 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)를 이용하여 인터넷 TCP/IP 망(50)에 의해 복수의 태양광 발전소의 각 발전소 웹서버(70)에 접속하여 발전소 데이터 서버(60)가 발전소 웹서버(80)의 웹페이지를 통해 제공하는 상기 모니터링 데이터에 의해 각 발전소의 원격 자가진단 모니터링을 수행하는 한편, 상기 발전소 웹서버(70)를 통해 DC & AC 측정보드(14)(24)에 원격 자가진단 모니터링 제어신호를 송신하여 각 태양광 발전소의 복수의 태양광 발전모듈(12)(22)의 계통형 및 공급형 발전전력 선로의 누전 및 단락 등의 고장 자가진단을 하게 된다.
- <52> 전문 관리업체의 관리전문가는 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)의 운용프로그램을 이용하여 인터넷 TCP/IP망(50)을 통해 각 태양광 발전소의 고유 IP에 직접 접속하여 버퍼통신장치(42)로부터 송신된 모니터링 데이터를 수신하여 각 태양광 발전소의 원격 자가진단 모니터링을 수행하는 한편, 버퍼통신장치(42)를 통해 DC & AC 측정보드(14)(24)에 원격 자가진단 모니터링 제어신호를 송신하여 각 태양광 발전소의 복수의 태양광 발전모듈의 계통형 및 공급형 발전전력 선로의 누전 및 단락 등의 고장 자가진단을 하게 된다.
- <53> 또한 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 기상측정보드(30)의 기상데이터를 발전소 웹서버(70)의 웹페이지를 통해 모니터링하여 트래커(11)(21)를 원격제어하거나 또는 운용프로그램에 의해 버퍼통신장치(42)와 인터넷 TCP/IP망(50)을 통해 수신하여 모니터링함으로써 트래커(11)(21)를 원격제어한다.
- <54> 즉, 온도 및 일사량 데이터의 모니터링을 통해 트래커(11)(21)에 원격제어신호를 송신하여 태양광 발전모듈을 일사량이 최고인 위치로 원격구동시킬 수 있고, 풍속 및 풍향 데이터의 모니터링을 통해 강풍이 불어오는 경우에 태양광 발전모듈의 손상을 방지하기 위해서 트래커에 원격제어신호를 송신하여 태양광 모듈의 적절한 위치, 예를 들면 풍향이 수평이면 수평위치로 원격구동시킬 수 있으며, 강우량 및 적설량 데이터의 모니터링을 통해 비나 눈이 많이 오는 경우에 태양광 발전모듈의 손상을 방지하기 위해서 트래커에 원격제어신호를 송신하여 적절한 위치, 예를 들면 수직위치로 원격구동시킬 수 있다.
- <55> DC & AC 측정보드(14)(24)와, 태양광 발전소 주변의 기후환경계측을 위한 기상측정보드(30) 및 태양광 발전모듈의 설치각도를 구동제어하는 트래커(11)(21)의 각각이 발전소 지역망(40)의 버퍼통신장치(42)에 접속된 TCP/IP 스위치 허브(41)에 접속되어 태양광 발전모듈(12)(22)로부터 발전된 발전데이터가 DC & AC 측정보드(14)(24)에서, 복수의 센서가 측정한 기상데이터가 기상측정보드(30)에서, 태양광 발전모듈의 구동데이터가 트래커(11)(21)에서 TCP/IP 통신에 의해 TCP/IP 스위치 허브(41)를 통해 버퍼통신장치(42)에 전송되고, 버퍼통신장치(42)는 모니터링 데이터인 발전데이터, 기상데이터 및 구동데이터를 버퍼링하여 실시간으로 인터넷 TCP/IP망(50)을 통하여 각 태양광 발전소의 발전소 웹서버(70)와 접속된 발전소 데이터 서버(60)에 저장한다.
- <56> 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 인터넷 TCP/IP망(50)을 통하여 상기 발전소 웹서버(70)에 접속하거나 운용프로그램에 의해 버퍼통신장치(42)에 접속하여 상기 발전데이터, 기상데이터 및 구동데이터를 모니터링함으로써 각 태양광 발전소의 계통형 및 공급형 발전전력 선로의 자가진단 모니터링 및 트래커(11)(21)의

원격제어가 가능하게 된다. 즉, 각 태양광 발전소를 무인운용하는 것이 가능하게 되는 것이다.

- <57> 즉, 계통형 및 공급형 발전전력 선로의 자가진단을 위하여 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에서 인터넷 TCP/IP망(50)과 발전소 지역망(40)을 통하여 자가진단을 위한 원격 자가진단 모니터링 제어신호를 송신하면, DC & AC 측정보드(14)(24)에서 상기 제어신호를 수신하여 DC & AC 측정보드(14)(24)가 태양광 발전모듈(12)(22)과 접속된 마그넷 스위치(13)(23)를 오프(OFF)시켜 상기 계통형 및 공급형 발전전력 선로를 개회로로 구성한 상태에서 계통형 및 공급형 발전전력 선로의 전압 및 전류를 측정하여 발전전력 선로의 누전 및 단락을 주기적으로 계측하여 분석함으로써 계통형 및 공급형 발전전력 선로의 이상 유무를 자가진단하게 된다.
- <58> 이상 기술한 바처럼, 효율적이고 경제적으로 태양광 발전소의 운용관리를 위하여 DC & AC 측정보드(14)(24)가 각각 0.8KW~5.0KW의 스트링 단위의 발전용량을 가진 각각의 태양광 발전모듈(12)(22)이 생산한 DC 발전전류와 발전전압을 측정하는 한편, 이 DC 발전전류와 발전전압을 계통형 인버터(15)와 공급형 인버터(25)를 통해 AC 발전전류와 발전전압으로 변환하여 계통망과 아울러 상기 변환된 AC 발전전류와 전압을 계측한다. 이 계측된 신호는 발전소 지역망(40)을 이용하여 TCP/IP 통신과 인터넷 TCP/IP망(50)을 통하여 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 제공된다.
- <59> 이와 같이 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 태양광 발전소의 계통형 및 공급형 발전계통의 DC 발전전류와 발전전압 그리고 계통형 및 공급형 인버터(15)(25)의 AC 발전전류와 발전전압도 수신받아 분석할 수 있고, 계통형 및 공급형 발전전력 선로를 오프시켜 발전전력 선로의 이상 유무를 원격으로 모니터링할 수 있다.
- <60> 그리고 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 TCP/IP 통신에 의해 트랙커(11)(21)의 동작상태 모니터링이 가능하고, 원격으로 구동제어할 수 있다.
- <61> 또한 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 풍속센서(31), 풍향센서(32), 일사량센서(33), 온도센서(34), 강우량센서(35), 적설량센서(35)가 측정한 기상데이터를 기상측정보드(30)로부터 수신받아 태양광 발전소를 천재지변으로 보호하기 위한 기후환경을 모니터링할 수 있다.
- <62> **[제2실시예]**
- <63> 도 3은 본 발명의 독립형 태양광 발전장치의 원격 자가진단 모니터링 및 원격제어 시스템의 제2실시예의 구성도이다.
- <64> 본 발명의 제2실시예에서는 독립형 태양광 발전장치(200)를 제외한 나머지 구성요소에 대해서는 제1실시예와 동일한 부호를 사용하기로 한다.
- <65> 본 발명의 제2실시예는 각 주택 또는 공장에 태양광 자가발전을 위해 설치되는 100KW 이하의 소용량 발전단위의 독립형 태양광 발전장치(210)로서, 제1실시예에서 공급형 태양광 발전장치(20), 발전소 데이터 서버(60), 발전소 웹서버(70) 및 발전소 지역망(40)이 생략되어 있고, 제2실시예의 기상측정보드(30), 트랙커(210) 및 DC & AC 측정보드(240)가 인터넷 TCP/IP망(50)에 직접 접속된다는 점에 특징이 있는 것이다.
- <66> 즉, 제2실시예의 독립형 태양광 발전장치(200)와 기상측정보드(30) 및 복수의 센서(31)(32)(33)(34)(35)(36)는 제1실시예의 공급형 태양광 발전장치(20)와 기상측정보드(30) 및 복수의 센서(31)(32)(33)(34)(35)(36)의 구성요소는 동일하다.
- <67> 하지만, 제1실시예는 각 태양광 발전소에 설비되는 관계로 트랙커(21), 태양광 발전모듈(22), 마그넷 스위치(23), DC & AC 측정보드(24), 공급형 인버터(25)로 이루어진 태양광 발전장치의 복수개가 공급형 태양광 발전장치로 정의되는 것이고, 제2실시예는 공장 또는 주택에 자가 태양광 발전을 위해 설치되는 관계로 트랙커(210), 태양광 발전모듈(220), 마그넷 스위치(230), DC & AC 측정보드(240), 공급형 인버터(250)로 이루어진 태양광 발전장치의 하나가 독립형 태양광 발전장치로 정의되는 것에 개념상 차이가 있다.
- <68> 또한, DC & AC 측정보드(230), 기상측정보드(30) 및 트랙커(210)가 인터넷 TCP/IP망(50)에 직접 접속되어 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)와 통신을 한다는 점에 차이가 있다.
- <69> 따라서 본 발명의 제2실시예를 기술하는데 있어서, 이하에서 기본적인 구성요소와 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)와 DC & AC 측정보드(240), 기상측정보드(30) 및 트랙커(210)의 통신관계에 대해서만 기술하기로 하고, 각 구성요소의 세부적인 기술사항과 그 기능은 상술한 제1실시예를 참조하기 바란다.
- <70> 본 발명의 제2실시예는 트랙커(210)와, 태양광 발전모듈(220)과, 마그넷 스위치(230)와, DC & AC 측정보드(240) 및 독립형 인버터(250)를 포함하는 독립형 태양광 발전장치(200)와; 상기 DC & AC 측정보드(240)와 연결된 인터

넷 TCP/IP망(50); 및 상기 인터넷 TCP/IP망(50)과 연결된 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)를 포함한다.

- <71> 상기 트랙커(210)는 태양광 발전모듈(220)을 구동시키는 태양광 서보제어 추적장치로서, 모니터링 데이터인 태양광 발전모듈 구동데이터를 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 인터넷 TCP/IP망(50)을 통해 송신하며, 상기 태양광 발전모듈(220)은 스트링 단위(0.8KW~5.0KW)의 출력을 발전하는 4개~16개의 태양광 셀이며, 상기 DC & AC 측정보드(240)는 상기 마그넷 스위치(230)를 통해 상기 태양광 발전모듈(220)로부터 DC 발전전력을 입력받아 계측하여 이 계측된 모니터링 데이터인 발전데이터를 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 인터넷 TCP/IP망(50)을 통해 송신하며, 상기 마그넷 스위치(230)는 발전전력 선로의 고장 자가진단을 위하여 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 의해 오프(OFF) 제어되며, 상기 독립형 인버터(250)는 상기 DC & AC 측정보드(240)로부터 출력되는 DC 발전전력을 AC 발전전력으로 전력변환하여 전원으로 출력하여 주택 또는 공장에 제공한다.
- <72> 한편, 상기 독립형 인버터(250)로부터 출력되는 AC 발전전력의 전압과 전류는 피드백되어 DC & AC 측정보드(240)로도 입력되어 계측된다.
- <73> 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 자체 운용프로그램에 의해 인터넷 TCP/IP망(50)을 통해 DC & AC 측정보드(240)의 고유 IP에 직접 접속하여 DC & AC 측정보드(240)가 제공하는 태양광 발전모듈(220)의 모니터링 데이터를 통해 상기 독립형 태양광 발전장치(200)의 원격 자가진단 모니터링을 수행하는 한편, 상기 DC & AC 측정보드(240)에 원격 자가진단 모니터링 제어신호를 송신하여 상기 독립형 태양광 발전장치(200)의 태양광 발전모듈(220)의 발전전력 선로의 고장 자가진단을 포함하는 태양광 발전모듈(220)의 원격 자가진단 모니터링 및 원격제어가 가능하다.
- <74> 그리고 본 발명의 제2실시예에는 독립형 태양광 발전장치(200)가 설치되는 공장 또는 주택지역의 기후변화를 측정하기 위한 풍속센서(31), 풍향센서(32), 일사량센서(33), 온도센서(34), 강우량센서(35) 및 적설량센서(36)와 이들 센서로부터 측정된 기상데이터를 입력받는 기상측정보드(30)가 더 포함된다.
- <75> 상기 기상측정보드(30)는 인터넷 TCP/IP망(50)에 접속되어 모니터링 데이터인 기상데이터를 인터넷 TCP/IP망(50)을 통해 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 송신한다. 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)는 수신된 기상데이터 또는 태양광 발전모듈 구동데이터의 모니터링을 통해 트랙커(210)를 원격제어한다.
- <76> 이상 기술한 바에 의하면, 공장 또는 주택에 설치된 독립형 태양광 발전장치(200)는 태양광 발전모듈을 통해 100KW 이하의 소용량 발전을 하여 마그넷 스위치를 통해 DC & AC 측정보드(240)에 출력하고, DC & AC 측정보드(240)는 DC 발전전력을 계측함과 아울러 독립형 인버터에 출력한다. 독립형 인버터는 DC 발전전력을 AC 발전전력으로 전력변환하여 공장 또는 주택에 전원으로 제공한다.
- <77> 이때, DC & AC 측정보드(240)가 계측한 DC 발전전력은 인터넷 TCP/IP망(50)을 통해 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 송신되고 아울러서 현재 트랙커에 의해 구동된 태양광 발전모듈의 현재상태의 구동데이터, 즉 구동모터 상전류와 회전각 정보도 인터넷 TCP/IP망(50)을 통해 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 송신된다.
- <78> 그리고 복수의 센서로부터 측정된 기상데이터를 실시간으로 입력받는 기상측정보드(30)도 기상데이터를 인터넷 TCP/IP망(50)을 통해 상기 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 송신한다. 여기서 기상데이터는 풍속, 풍향, 일사량, 온도, 강우량, 적설량 데이터로서 기상측정보드(30)는 이 각각의 데이터를 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 송신한다.
- <79> 이와 같은 독립형 태양광 발전장치에 의해 공장 또는 주택에 전원이 공급되는 상황에서 전문관리업체의 관리전문가는 모니터링 데이터인 발전데이터, 기상데이터, 태양광 발전모듈 구동데이터를 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)의 운용프로그램을 통해 확인하다가 발전데이터에 문제가 있을 경우에는 인터넷 TCP/IP망(50)을 통해 DC & AC 측정보드(240)에 내장된 TCP/IP 통신모듈의 고유 IP에 접속해서 DC & AC 측정보드(240)에 원격 자가진단 모니터링 제어신호를 송신하여 DC & AC 측정보드(240)가 마그넷 스위치(230)를 오프시키도록 함으로써 발전전력 선로를 개방시킨 상태에서 DC & AC 발전전력 선로 상의 발전전압과 발전전류가 "0(zero)"임을 확인하여 누전과 단락상태를 자가진단 모니터링 할 수 있다.
- <80> 그리고 기상데이터, 특히 온도 및 일사량 데이터의 모니터링을 통해 트랙커(210)에 원격제어신호를 송신하여 태양광 발전모듈을 일사량이 최고인 위치로 원격구동시킬 수 있고, 풍속 및 풍향 데이터의 모니터링을 통해 강풍

이 들어오는 경우에 태양광 발전모듈의 손상을 방지하기 위해서 트랙커에 원격제어신호를 송신하여 태양광 모듈의 적절한 위치, 예를 들면 풍향이 수평이면 수평위치로 원격구동시킬 수 있으며, 강우량 및 적설량 데이터의 모니터링을 통해 비나 눈이 많이 오는 경우에 태양광 발전모듈의 손상을 방지하기 위해서 트랙커에 원격제어신호를 송신하여 적절한 위치, 예를 들면 수직위치로 원격구동시키는 것은 제1실시예와 동일하다.

- <81> 상술한 바와 같이, 본 발명의 제2실시예는 공장 또는 주택에 설치된 독립형 태양광 발전장치를 원격에서 전문관리자가 관리 및 유지보수를 위한 A/S의 수행이 가능하다.
- <82> 이상 기술한 본 발명에 의해 종래는 태양광 발전모듈의 총발전량만을 모니터링하기 때문에 태양광 발전모듈 각각의 고장발생 시에 고장진단이 어려웠지만 본 발명은 DC & AC 측정보드(14)(24)에 의해 제어되어 발전소 지역망(40)과 인터넷 TCP/IP망(40)을 통해 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 0.8KW~5.0KW 용량의 스트링 단위의 태양광 발전모듈 각각의 DC & AC 발전전압과 발전전류의 발전량에 대한 발전데이터가 송신되기 때문에 태양광 발전모듈 각각의 발전량을 스트링 단위로 모니터링할 수 있어 각각의 태양광 발전모듈(12)(22)의 고장 여부를 자가진단할 수 있다.
- <83> 즉, 본 발명은 태양광 발전소의 고장진단 및 유지보수를 위하여 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에서 인터넷망 TCP/IP(50) 및 버퍼통신장치(42)와 TCP/IP 스위치 허브(41)를 포함하는 발전소 지역망(40)을 통하여 원격 자가진단 모니터링 제어신호를 송신하면, DC & AC 측정보드(14)(24)에서 원격 자가진단 모니터링 제어신호를 수신하여 복수의 태양광 발전모듈(12)(22)과 접속된 복수의 마그넷 스위치(13)(23)를 오프(OFF)시켜 발전전력 선로를 개방시킨 상태에서 발전전력 선로의 전압과 전류를 측정함으로써 발전전력 선로의 누전 및 단락상태를 주기적으로 계측하여 분석함으로써 발전전력 선로의 이상 유무를 자가진단할 수 있다.
- <84> 또한 종래의 RTU(Real Time Unit)와 RS-422 통신방식은 스트링 단위로 태양광 발전모듈을 모니터링할 경우에 통신선로가 매우 복잡하고 이에 따른 과도한 통신선로의 설치비용이 들고 통신선로의 유지보수가 어려웠지만 본 발명은 복수의 태양광 발전모듈을 스트링 단위로 각각 모니터링하되, 발전소 지역망(40)의 TCP/IP 스위치 허브(41)와 DC & AC 측정보드(14)(24) 및 인터넷 TCP/IP망(50)을 이용하여 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)와 TCP/IP 통신망을 구축하는 한편, 트랙커(11)(21)와 기상측정보드(30)와도 TCP/IP 통신망을 구축하여 TCP/IP 통신을 수행함으로써 통신선로가 매우 간단해져 스트링 단위의 발전데이터 전송시에 노이즈가 유입되지 않음과 아울러 설치비용이 1/20 이하로 감소되고, 통신선로의 유지보수가 쉬워진다.
- <85> 또한 종래 태양광 발전소의 주변환경의 기후를 측정하지 못하여 기후에 따른 태양광 발전의 문제에 신속히 대처하지 못하였지만 본 발명은 풍속센서(31), 풍향센서(32), 일사량센서(33), 온도센서(34), 강우량센서(35), 적설량센서(36)를 이용하여 태양광 발전소 주변의 기후변화를 기상측정보드(30)에서 측정된 기상데이터를 TCP/IP 통신에 의해 발전소 지역망(40)과 인터넷 TCP/IP망(40)을 통하여 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)에 실시간으로 송신하여 신속히 기후변화에 태양광 발전소 운용자(일반 관리자 또는 발전소 사업주나 전문관리업체의 관리전문가)가 대처할 수 있다.
- <86> 그리고 강풍 또는 적설로 인한 피해를 예방하기 위한 목적으로 기준 설정치 이상의 풍속이나 폭설이 발생한 경우에 원격 자가진단 모니터링 및 원격제어 컴퓨터(80)가 인터넷 TCP/IP망(50)을 통하여 발전소 지역망(40)의 TCP/IP 스위치 허브(41)에 접속된 트랙커(11)(21)를 원격제어하여 태양광 발전모듈의 위치를 강풍시에는 예를 들면 수평으로 또는 적설시에는 예를 들면 수직으로 적절하게 제어하여 강풍 또는 폭설에 의하여 태양광 발전모듈의 손상을 방지할 수 있다.

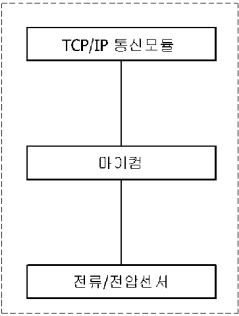
도면의 간단한 설명

- <87> 도 1은 본 발명의 제1실시예로써, 계통형 및 공급형 태양광 발전장치의 원격 자가진단 모니터링 및 원격제어 시스템의 제1실시예의 구성도이다.
- <88> 도 2는 본 발명의 DC & AC 측정보드의 구성도이다.
- <89> 도 3은 본 발명의 제2실시예로써, 독립형 태양광 발전장치의 원격 자가진단 모니터링 및 원격제어 시스템의 구성도이다.
- <90> ** 도면의 주요부분에 대한 부호의 설명 **
- <91> 10 : 계통형 태양광 발전장치 20 : 공급형 태양광 발전장치
- <92> 200 : 독립형 태양광 발전장치 11,21,210 : 트랙커

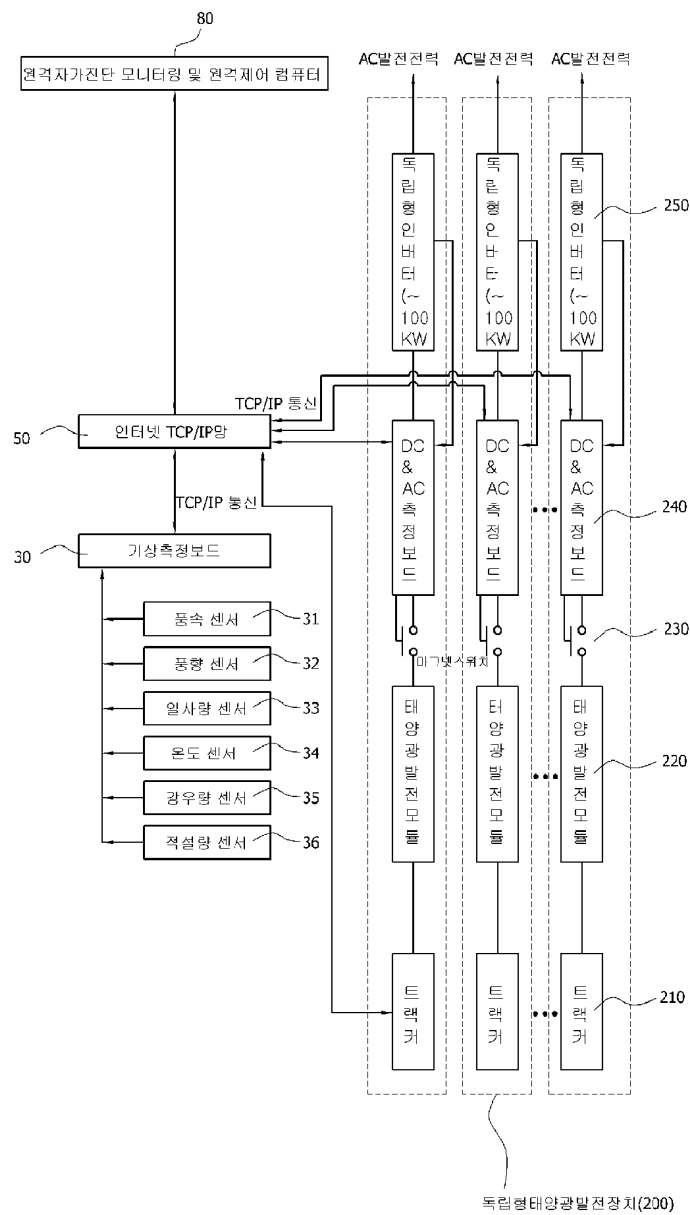
<93>	12,22,220 : 태양광 발전모듈	13,23,230 : 마그넷 스위치
<94>	14,24,240 : DC & AC 측정보드	15 : 계통형 인버터
<95>	25 : 공급형 인버터	250 : 독립형 인버터
<96>	30 : 기상측정보드	31 : 풍속센서
<97>	32 : 풍향센서	33 : 일사량 센서
<98>	34 : 온도센서	35 : 강우량 센서
<99>	36 : 적설량 센서	40 : 발전소 지역망
<100>	41 : TCP/IP 스위치 허브	42 : 버퍼통신장치
<101>	50 : 인터넷 TCP/IP망	60 : 발전소 데이터 서버
<102>	70 : 발전소 웹서버	
<103>	80 : 원격 자가진단 모니터링 및 원격제어 컴퓨터	



도면2



도면3



KR 20-0402282 Y1

Applicant: S-Energy Co., Ltd.

Pub. Date: November 28, 2005

ABSTRACT*

The present invention relates to a photovoltaic array, monitoring devices, to pursue a goal of the solar side, a plurality of input currents and inverting the output currents of each measurement / monitoring by comparing the power generation, while the inverter is connected in parallel is different from the structure of the transformer to supply power generation is low on the DC side, the two inverters and transformers to get up and to prevent a loss in power generation

Keywords: photovoltaic solar cells, modules, power generation, an array

*Online machine translation provided by Applied Language Solutions. No representations are made regarding the accuracy of the translation.

(19)대한민국특허청(KR)
(12) 등록실용신안공보(Y1)

(51) 。 Int. Cl.⁷
H02J 7/35

(45) 공고일자 2005년11월28일
(11) 등록번호 20-0402282
(24) 등록일자 2005년11월22일

(21) 출원번호 20-2005-0026332
(22) 출원일자 2005년09월13일

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(54)태양광 어레이 모니터링 장치

요약

본 고안은 태양광 어레이 모니터링 장치에 관한 것으로, 추구하는 목적은 다수개의 태양전지측에서 입력되는 전류값과 인버터 출력되는 전류값 각각을 측정/비교하여 발전량을 모니터링하는 한편, 인버터가 병렬로 연결되어 각기 다른 변압기로 공급하는 구조에서 DC 측 발전량이 적을 경우, 두 대의 인버터와 변압기가 가동되어 발전량에 손실을 가져오는 것을 방지하는데 있다.

배표도

도 1

색인어

태양광, 태양전지모듈, 발전, 어레이

명세서

도면의 간단한 설명

도 1은 본 고안의 전체 구성을 간략히 보인 블록도,

도 2는 본 고안의 전체 구성을 보다 구체적으로 보인 회로도이다.

도면의주요부분에대한부호설명

10 ... 태양전지 20 ... 입력측모니터링수단

30 ... 회로보호수단 40 ... 인버터

41 ... D/A변환부 42 ... 제어부

50 ... 스위칭수단

고안의 상세한 설명

고안의 목적

고안이 속하는 기술 및 그 분야의 종래기술

본 고안은 태양광 어레이 모니터링 장치에 관한 것으로, 추구하는 목적은 다수개의 태양전지측에서 입력되는 전류값과 인버팅 출력되는 전류값 각각을 측정/비교하여 발전량을 모니터링 하는 한편, 인버터가 병렬로 연결되어 각기 다른 변압기로 공급하는 구조에서 DC 측 발전량이 적을 경우, 두 대의 인버터와 변압기가 가동되어 발전량에 손실을 가져오는 것을 방지하는데 있다.

일반적으로, 태양광 발전 장치는 태양으로부터 입사되는 빛에너지를 전기에너지로 변환하여 수집하고, 수집된 전기에너지를 저장하는 한편, 수집단계에서 직류로 변환된 전기에너지를 교류에너지로 변환시켜 변압기로 입력시키도록 된 것이다.

이러한, 태양광 발전 장치는 입사되는 태양광을 수집하는 집광판이 다수개 구비되며, 각각의 집광판에 전술한 태양광 발전시스템이 구비되는 것이 보통이다.

이때, 각 태양광 발전 장치에는 예기치 못한 급격한 전압이 발생하여 회로를 손상시키기도 하며, 직류전압을 교류전압으로 변환하는 인버터가 병렬로 연결되어 각기 다른 변압기로 발전을 하게 되는데, DC 측 발전량이 적을 경우, 두 대의 인버터와 변압기가 가동되게 되므로, 발전량에 손실이 발생하는 문제점이 있는 것이었다.

고안이 이루고자 하는 기술적 과제

본 고안은 상기와 같은 문제점을 고려하여 창출된 것으로, 추구하는 목적은 태양 집광 어레이 측의 부분적인 외란 발생에 대하여 각각의 어레이 전류를 측정 비교함으로써, 입력측의 상태를 정확히 파악할 수 있도록 하고, DC측에서 발생하는 Surge 전압을 대지로 방출함으로써, 장치를 보호하며, 다수개의 인버터를 병렬로 사용함에 있어, 특정 인버터가 발전을 하지 못하는 경우, 그 외의 인버터에서 전체 태양광 발전량을 감당할 수 있도록 바이패싱함으로써, 출력 전압을 항상 일정하면서도 안정적으로 얻을 수 있도록 하는 태양광 어레이 모니터링 장치를 제공함에 있다.

고안의 구성 및 작용

이와 같은 목적을 달성하기 위한 본 고안은, 태양으로부터 입사되는 광에너지를 전기에너지로 변환하여 수집하는 다수개의 태양전지 출력측에 구비되어, 각각의 태양전지로부터 입력되는 전류값을 수집하여 후술할 제어부로 전송하는 입력측모니터링수단과; 입력측에서 발생하는 서지(Surge)전압을 대지로 방출하여 다음 단의 회로를 보호하는 회로보호수단과; 전술한 각각의 태양전지에서 입력된 DC전압을 각각 AC전압으로 변환하는 D/A변환부 및 전술한 입력측모니터링수단에서 수집된 전류값과 D/A변환부에서 입력되는 전류값을 비교하여 발전량을 판단하는 제어부로 이루어진 다수개의 인버터와; 전술한 인버터 중 어느 하나가 작동하지 않는 경우, 다른 인버터에서 전체 발전량을 감당하도록 바이패스(Bypass)하는 스위칭수단을 포함하여 구성됨을 특징으로 한다.

이와 같이 구성된 본 고안은 다수개의 태양전지가 태양으로부터 입사되는 광에너지를 전기에너지로 변환하여 수집/공급하면, 전술한 인버터에 포함된 D/A변환부가 태양전지에 의해 DC로 변환된 신호를 AC로 변환하여, 해당 변압기측으로 공급하게 된다.

여기서, 전술한 입력측모니터링수단은 각 입력 전류값을 측정하여, 전술한 인버터에 포함된 제어부로 RS485를 통해 전송하게 되며, 이때, 제어부는 전술한 D/A변환부를 통해 교류로 변환되는 값과 입력 전류값을 비교하여 발전량을 판단하게 된다.

한편, 본 고안에서 태양전지로부터 전류가 입력/공급되는 과정에서 예기치 못하게 급격히 과전압이 발생하는 경우, 회로 보호수단이 서지(Surge)전압을 대지로 방출시켜 다음 단의 회로를 보호하게 된다.

또 한편, 전술한 바와 같이, 인버터가 병렬로 다수개 연결되어 각기 다른 변압기로 발전을 하게 되는데, 이때, DC 측 발전량이 적을 경우 두 대의 인버터와 변압기가 가동될 경우 손실이 발생하게 되므로, DC 측의 모든 발전량을 전술한 스위칭수단이 한 대의 인버터와 변압기로 bypass 시킬 경우, 두 대의 인버터와 변압기를 사용하게 되면 손실이 감소하게 되므로, AC측 출력은 증가하게 되어 동등 입력 대비 발전량을 증가시키게 된다.

이러한, 본 고안 중 전술한 입력측모니터링수단은 예컨대, 분로(Shunt; 分路)회로로서, 태양전지와 연결된 각각의 입력단에 접속될 수 있으며, 그밖에도 전류를 계측 가능한 수단이면 모두 만족한다.

한편, 본 고안 중 전술한 회로보호수단은 예컨대, 정상상태에서는 Open 회로로 동작되고, 정상상태 이상의 서지전압이 입력 시, Short 되는 회로일 수 있으며, 일 예로 퓨즈를 포함한 과전압 보호회로일 수 있다.

또 한편, 본 고안 중 전술한 인버터 중 제어부는 사전에 입력되는 전류값과 출력되는 전류값을 비교하여 발전량을 판단하도록 프로그램 되어 저장되거나, 논리회로적으로 설계된 IC칩 또는 회로로서, 예컨대, RTU(Remote Terminal unit)과 시리얼 통신 접속되어, 상위의 IDC내의 데이터 서버로 연결될 수 있다.

참고로, 전술한 RTU는 네트워크망을 통하여 상위의 데이터베이스 서버와 TCP/IP 프로토콜에 의해 데이터를 전송한다.

또한, RTU는 IP 공유기능을 내장시키도록 하여 기존의 네트워크망을 통해 태양광 발전 설비들을 모니터링 할 수 있다. 한편, 전술한 서버는 데이터베이스 서버와 웹서버로 구성될 수 있다. 전술한 데이터베이스 서버는 데이터베이스 관리 툴을 이용하여 전국에 설치되어 있는 RTU로부터 실시간 데이터 수집하여 사용자의 설정 주기에 따른 이력데이터를 데이터베이스에 저장시키며, 시스템 운영을 위해 필요한 사이트 정보, 데이터 항목 정보, 운영자 정보 데이터베이스 구축되어 중앙감시 모니터링 시스템과 관련기관으로 웹 서버에 실시간 데이터 및 이력 데이터 및 저장 프로시저에 의한 생성된 통계 데이터를 제공한다. 또한, 전술한 웹서버는 데이터베이스 서버의 데이터베이스에 접속하여 인터넷 상에서 사용자가 조회하고자 하는 데이터를 서비스한다. 또한, RUT에 연결된 컴퓨터를 가 네트워크망을 통하여 태양광 발전의 전국 발전현황 조회, 전국 발전현황 조회에 따른 지역별 발전현황 조회, 각 사이트별 발전현황 조회, 사이트별 운영자 정보 통제, 태양광발전 시스템 계통도 조회, 태양광발전현황 상세정보 조회, 발전현황 그래프 조회, 사이트 설치정보 조회 기능 및 시스템 상태감시 등을 조회하여 볼 수 있도록 한 데이터들을 네트워크망을 통하여 중앙감시 모니터링 시스템과 관련기관으로 제공할 수도 있다. 전술한 중앙감시모니터링 시스템은 웹서버로부터 데이터베이스화된 태양광 발전 시스템 설비의 지역별 발전현황 조회, 각 사이트별 발전현황 조회, 사이트별 운영자 정보 통제, 태양광 발전 시스템 계통도 조회, 태양광발전현황 상세정보 조회, 발전현황 그래프 조회, 사이트 설치정보 조회 기능 및 시스템 상태감시 등을 조회하여 볼 수 있도록 하였다. 또한, 전술한 조회에 따른 대응하는 보고서를 일보, 월보 및 연보에 따라 출력할 수 있도록 구성될 수 있다. 또한, 전술한 관련기관도 웹서버로부터 중앙감시모니터링 시스템과 마찬가지로 데이터베이스화된 태양광발전 시스템 설비의 지역별 발전현황 조회, 각 사이트별 발전현황 조회, 사이트별 운영자 정보 통제, 태양광발전 시스템 계통도 조회, 태양광발전현황 상세정보 조회, 발전현황 그래프 조회, 사이트 설치정보 조회 기능 및 시스템 상태감시 등을 조회할 수 있도록 될 수도 있다.

끝으로, 본 고안 중 전술한 스위칭수단은 예컨대, 각 인버터의 입력단에 병렬 연결되어, 전술한 입력측모니터링수단을 통해 입력되는 입력측의 전류값의 상태에 따라 제어부의 제어 하에 스위칭 동작하여 비정상인 인버터로 입력되는 전류를 다른 인버터로 바이패스시키는 스위치회로일 수 있다.

이와 같이 구성되는 본 고안의 일 실시예를 첨부 도면을 참고로 하여 설명하면 다음과 같다.

먼저, 본 고안은 첨부 도면 도 1의 도 2에서 보는 바와 같이, 태양으로부터 입사되는 광에너지를 전기에너지로 변환하여 수집하는 다수개의 태양전지(10) 출력측에 구비되어, 각각의 태양전지(10)로부터 입력되는 전류값을 수집하여 후술할 제어부로 전송하는 입력측모니터링수단(20)과; 입력측에서 발생하는 서지전압을 대지로 방출하여 다음 단의 회로를 보호하는 회로보호수단(30)과; 전술한 각각의 태양전지(10)에서 입력된 DC전압을 각각 AC전압으로 변환하는 D/A변환부(41) 및 전술한 입력측모니터링수단(20)에서 수집된 전류값과 전술한 D/A변환부(41)에서 입력되는 전류값을 비교하여 발전량을 판단하는 제어부(42)로 이루어진 다수개의 인버터(40)와; 전술한 인버터(40) 중 어느 하나가 작동하지 않는 경우, 다른 인버터에서 전체 발전량을 감당하도록 바이패스하는 스위칭수단(50)을 포함하여 구성된다.

여기서, 전술한 입력측모니터링수단(20)은 태양전지(10)와 연결된 각각의 입력단에 접속되는 분회로이다.

이는, 전술한 태양전지(10) 측의 부분적인 외란(그림자 등)발생에 대하여 각각의 Array 전류를 측정 비교하여 RS485 통신 방식으로 제어부로 측정값을 전송한다.

또한, 전술한 회로보호수단(30)은 정상상태에서는 Open 회로로 동작되고, 정상상태 이상의 서지전압이 입력시, Short 되는 퓨즈를 포함한 과전압보호회로이다.

이는, DC측에 발생하는 서지전압을 대지로 방출함으로써, 전체 장치와 2 차측 장치를 보호한다.

또한, 전술한 스위칭수단(50)은 각 인버터(40)의 입력단에 병렬 연결되어, 전술한 입력측모니터링수단(20)을 통해 입력되는 입력측의 전류값의 상태에 따라 제어부(42)의 제어하에 스위칭 동작하여 비정상인 인버터로 입력되는 전류를 다른 인버터로 바이패스시키는 스위치회로 또는 스위치이다.

이는, 예컨대, 2대의 인버터의 입력상태를 파악하여 각 인버터의 불균형으로 인한 손실을 최소화하고 인버터 고장 시, 제어부(42)의 제어하에 입력단을 고장상태인 인버터가 아닌 다른 인버터측과 접속(단락)시켜, 정상상태 인버터의 입력으로 공급하게 된다.

그러면, DC 측 발전량이 적을 경우 두 대의 인버터와 변압기가 가동됨에 따라 손실이 발생하게 되므로, DC 측의 모든 발전량을 전술한 스위칭수단이 한 대의 인버터와 변압기로 bypass 시킬 경우, 두 대의 인버터와 변압기를 사용하게 되면 손실이 감소하게 되므로, AC측 출력은 증가하게 되어 동등 입력 대비 발전량을 증가시키게 된다.

고안의 효과

이와 같이 구성된 본 고안은 다수개의 태양전지측에서 입력되는 전류값과 인버터 출력되는 전류값 각각을 측정/비교하여 발전량을 모니터링하여 관리할 수 도 있으며, 전술한 모니터링 데이터를 외부에서 원격 감시할 수 있도록 하는 한편, 인버터가 병렬로 연결되어 각기 다른 변압기로 공급하는 구조에서 DC 측 발전량이 적을 경우, 두 대의 인버터와 변압기가 가동되어 발전량에 손실을 가져오는 것을 방지하도록 다른 인버터로 바이패스함으로써, 인버터의 불균형으로 인한 발전량 손실을 최소화하는 효과를 얻는다.

(57) 청구의 범위

청구항 1.

태양으로부터 입사되는 광에너지를 전기에너지로 변환하여 수집하는 다수개의 태양전지(10) 출력측에 구비되어, 각각의 태양전지(10)로부터 입력되는 전류값을 수집하여 후술할 제어부로 전송하는 입력측모니터링수단(20)과;

입력측에서 발생하는 서지전압을 대지로 방출하여 다음 단의 회로를 보호하는 회로보호수단(30)과;

전술한 각각의 태양전지(10)에서 입력된 DC전압을 각각 AC전압으로 변환하는 D/A변환부(41) 및 전술한 입력측모니터링수단(20)에서 수집된 전류값과 전술한 D/A변환부(41)에서 입력되는 전류값을 비교하여 발전량을 판단하는 제어부(42)로 이루어진 다수개의 인버터(40)와;

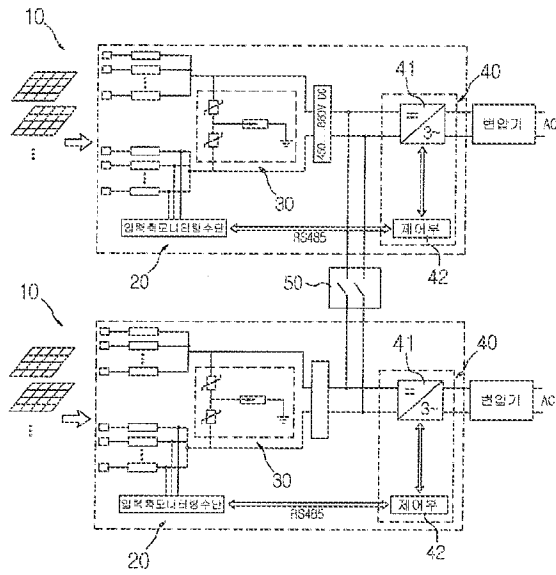
제 1 항에 의해서 상기 인력추진터널(20)은 태양저지(10)와 연결된 각각의 인력대에 접속되는 부러히르로 구성된다.

제 1 항에 있어서, 상기 히로보흐수다(30)은 정상상태에서는 Open 히로로 동작되고, 정상상태 이상의 서지저압이 입력

제 1 항에 있어서, 상기 스위치수단(50)은 각 인버터(40)의 입력단에 별력 연결되어, 상기 입력측 모니터링수단(20)은 토

[illegible]

도면2



PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 108144202701	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2010/046274	International filing date (day/month/year) 23 AUGUST 2010 (23.08.2010)	(Earliest) Priority Date (day/month/year) 03 SEPTEMBER 2009 (03.09.2009)
Applicant TIGO ENERGY, INC. et al		

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (See Box No. III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 3
☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
 b. ☐ none of the figure is to be published with the abstract.

ADS-File ISRM U.S.

GT-LA
 DUE DATE: 5-22-2011
 DEADLINE:
 BOOKING: 4-29-2011
 BY (INITIALS):

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/046274**A. CLASSIFICATION OF SUBJECT MATTER****H01L 31/042(2006.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01L 31/042; H02J 7/35; H02J 13/00; H02J 11/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: solar cell, power, switch

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-0912892 B1 (SEOUL MARINE CO., LTD.) 20 August 2009 See abstract and figures 1-3.	1-20
A	KR 20-0402282 Y1 (S-ENERGY CO., LTD.) 28 November 2005 See abstract and figure 2.	1-20
A	KR 10-0725755 B1 (TENKOREA CO., LTD.) 08 June 2007 See abstract and figure 1.	1-20
A	US 2008-0142071 A1 (DORN RANDY et al.) 19 June 2008 See abstract and paragraph [0017].	1-20
PX	US 2010-0139734 A1 (HADAR RON et al.) 10 June 2010 See abstract and claims 1-20.	1-20

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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

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

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

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

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

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

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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

22 APRIL 2011 (22.04.2011)

Date of mailing of the international search report

22 APRIL 2011 (22.04.2011)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsu-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KIM Min Soo

Telephone No. 82-42-481-8249



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2010/046274

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-0912892 B1	20.08.2009	None	
KR 20-0402282 Y1	28.11.2005	None	
KR 10-0725755 B1	08.06.2007	None	
US 2008-0142071 A1	19.06.2008	None	
US 2010-0139734 A1	10.06.2010	None	

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

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

WARD JOHN P.

GREENBERG TRAURIG, LLP 2450 COLORADO
AVENUE SUITE 400 EAST SANTA MONICA CA 90404
USA

PCT

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) **22 APRIL 2011 (22.04.2011)**

Applicant's or agent's file reference
108144202701

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2010/046274

International filing date (day/month/year)

23 AUGUST 2010 (23.08.2010)

Priority date(day/month/year)

03 SEPTEMBER 2009 (03.09.2009)

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

H01L 31/042(2006.01)i

Applicant

TIGO ENERGY, INC. et al

1 This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2 FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 189
Cheongsu-ro, Seo-gu, Daejeon 302-
701, Republic of Korea
Facsimile No. 82-42-472-7140



Date of completion of this opinion

22 APRIL 2011 (22.04.2011)

Authorized officer

KIM Min Soo

Telephone No. 82-42-481-8249



Form PCT/ISA/237 (cover sheet) (July 2009)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2010/046274

Box No. 1 Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:

a. a sequence listing filed or furnished

- ☐ on paper
- ☐ in electronic form

b. time of filing or furnishing

- ☐ contained in the international application as filed.
- ☐ filed together with the international application in electronic form.
- ☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2010/046274

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Statement

Novelty (N)	Claims	1-20	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-20	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	NONE	NO

2 Citations and explanations :

Reference is made to the following documents:

D1: KR 10-0912892 B1 (SEOUL MARINE CO., LTD.) 20 August 2009
D2: KR 20-0402282 Y1 (S-ENERGY CO., LTD.) 28 November 2005
D3: KR 10-0725755 B1 (TENKOREA CO., LTD.) 08 June 2007

1.1 Claims 1-11

D1 is regarded as the closest prior art to the subject matter of claim 1. The subject matter of claim 1 differs from that of D1 in that the system in claim 1 includes a watchdog unit configured to disconnect a solar module from a power bus when a communication is interrupted. This feature of claim 1 is also not shown in any other prior art documents, nor does it fall under the general knowledge of a person skilled in the art. Accordingly, the subject matter of claim 1 is not anticipated by the prior art, nor would it be obvious to a person skilled in the art. Therefore, claim 1 is considered to be novel and to involve an inventive step under PCT Article 33(2)-(3).

Claims 2-11 are directly or indirectly dependent on claim 1 and are therefore also considered to be novel and to involve an inventive step under PCT Article 33(2)-(3).

1.2 Claims 12-18

D1 is regarded as the closest prior art to the subject matter of claim 12. The subject matter of claim 12 differs from that of D1 in that the system in claim 12 includes a watchdog device configured to shutdown a solar module if a communication with a central controller cannot be verified. This feature of claim 12 is also not shown in any other prior art documents, nor does it fall under the general knowledge of a person skilled in the art. Accordingly, the subject matter of claim 12 is not anticipated by the prior art, nor would it be obvious to a person skilled in the art. Therefore, claim 12 is considered to be novel and to involve an inventive step under PCT Article 33(2)-(3).

Claims 13-18 are dependent on claim 12 and are therefore also considered to be novel and to involve an inventive step under PCT Article 33(2)-(3).

1.3 Claims 19-20

D1 is regarded as the closest prior art to the subject matter of claim 19. The subject matter of claim 19 differs from that of D1 in that the method in claim 19 includes disconnecting one or more solar modules from a power bus if a signal from a central controller has been lost. This feature of claim 19 is also not shown in any other prior art documents, nor does it fall under the general knowledge of a person skilled in the art. Accordingly, the subject matter of claim 19 is not anticipated by the prior art, nor would it be obvious to a person skilled in the art. Therefore, claim 19 is considered to be novel and to involve an inventive step under PCT Article 33(2)-(3).

Claim 20 is dependent on claim 19 and is therefore also considered to be novel and to involve an inventive step under PCT Article 33(2)-(3).

Continued on Supplemental Box

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2010/046274

Box No. VI Certain documents cited

1. Certain published documents (Rule 43bis.1 and 70.10)

	<u>Application No. Patent No.</u>	<u>Publication date (day/month/year)</u>	<u>Filing date (day/month/year)</u>	<u>Priority date (valid claim) (day/month/year)</u>
P.X	US 12/628,977	10/06/2010	1/12/2009	None

Application No. US 12/628,977(publication No. US 2010/139734 A1) does not constitute prior art within the meaning of PCT Rule 64.3, but appears to disclose all the features of claims 1-20. In case the priority of the present application is not valid, this document is relevant for assessing novelty and inventive step.

2. Non-written disclosures (Rule 43bis.1 and 70.9)

<u>Kind of non-written disclosure</u>	<u>Date of non-written disclosure (day/month/year)</u>	<u>Date of written disclosure referring to non-written disclosure (day/month/year)</u>
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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2010/046274

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Box No. V

2. Industrial Applicability

Claims 1-20 are considered to be industrially applicable under PCT Article 33(4).



(12)

Patent

(21) Application number: **10 2005 012 213.2**

(22) Filing date: **March 15, 2005**

(43) Pub. date: **August 3, 2006**

(45) Date of patent issue:

Jan. 15, 2009

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

Within three months after the patent issue in accordance with § 59 of the Patent Law, an objection can be raised against the patent. The objection must be submitted in writing giving reasons. Within the objection period, an objection fee in the amount of 200 Euros must be paid (§ 6 of the Patent Cost Law in connection with the attachment to § 2 Para. 1 of the Patent Cost Law).

(66) Internal priority:

10 2005 003 720.8 26.01.2005

(73) Assignee:

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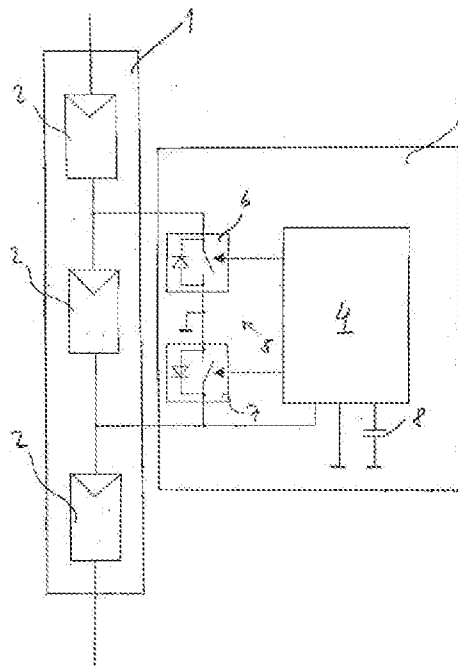
**Quardt, Dirk, Dipl.-Ing., 58638 Iserlohn, DE;
Grosch, Volker, Dipl.-Ing., 45549 Sprockhövel, DE;
Großen, Thomas, Dipl.-Ing., 58239 Schwerte, DE;
Mundinger, Harald, Dipl.-Ing., 58849 Herscheid, DE**

(56) Publications taken into account in evaluating patentability:

**DE 103 31 780 A1
DE 33 07 202 A1
Horowitz, Paul et.al.: The art of electronics. 2.
Edition, Cambridge University Press, 1989, Page
229-232; Data sheet "Voltage Detectors MAX
6461-MA
X 6466 of MAXIM Integrated Products, Canada,
1/03 Edition;**

(54) Title: **Connection circuit**

(57) Principal Claim: A connection circuit, for electrically connecting the solar cells of a solar cell module (1), having a protective device, which in the case of a shaded solar cell acts as a current-bypass for the shaded solar cell, characterized in that the connection circuit has a controlled electronic circuit arrangement (3) as a protective device.



Description

[0001] The invention relates to a connection circuit, for electrically connecting the solar cells of a solar cell module.

[0002] Connection circuits for electrically connecting the solar cells of a solar cell module are well known in the art in various embodiments. In the main, multiple solar cells are connected together in solar cell modules. For this purpose, the solar cells can be connected either in series or in parallel in the solar cell module.

[0003] When the solar cells are connected in parallel, the total current is the sum of the individual currents of the solar cells. Here, the solar cells connected in parallel should have essentially the same physical characteristics, so that parallel connection of solar cells has not become common practice, also in particular because an individual solar cell alone, can deliver a current of a few amps, and the output voltage of individual solar cells is typically too low to power electrical equipment such as household appliances.

[0004] Therefore when solar cell modules are assembled from individual solar cells, they are often connected in series. However a problem can arise when the solar cell module is partially shaded during operation, so that one or a majority of solar cells of the solar cell module receive less solar radiation or none at all. The reason for such a reduction of solar radiation can for example be in the dirtying of the solar cells and/or shadows from trees, building fixtures or the buildings themselves.

[0005] Contrary to the solar cell module being shaded evenly over its entire surface, which only leads to an overall diminished power output, partial shading leads to the following problem: a common current flows through the series-connected solar cells of the solar cell module, where each individual solar cell with its respective voltage contributes to the overall voltage of the solar cell module. If one solar cell becomes shaded, it no longer produces a voltage, and virtually becomes a diode blocking the direction of the current flow in the solar cell module. However, this means that the entire solar cell module can no longer deliver current, impairing the overall function of the solar cell module.

[0006] Furthermore, it is also the case that there is a voltage across the shaded solar cell, which is dependent on the position of the shaded solar cell in the

series circuit. If the voltage across the shaded solar cell is greater than its blocking voltage, a breakdown will result in the solar cell leading to permanent damage of the solar cell.

[0007] Even if the solar cell is not damaged by a breakdown, a large amount of power is dissipated in the shaded solar cell, thus heating it up. This heating-up can also lead to damaging the shaded solar cell as well as the solar cells adjacent to it.

[0008] To avoid the problem associated with partially shaded solar cells, protective devices are used, generally bypass-diodes connected in anti-parallel to the solar cells. In this way the shaded solar cell no longer contributes to the total solar cell voltage of the solar cell module, but the current flow is maintained. The solar cell module thus shows only a reduced operating voltage, but does not break down completely. Moreover, power is no longer dissipated in the shaded solar cell, so that damage to the shaded solar cell can be avoided.

[0009] In principle, each solar cell of a solar module could be assigned exactly one bypass-diode. However, the usual procedure is that a plurality of solar cells connected in series, i.e., a so-called string of solar cells, is safeguarded by one common bypass-diode.

[0010] Connection circuits for electrically connecting the solar cells of a solar cell module, generally thus have at least one bypass-diode, often a plurality of bypass-diodes. This, however, is associated with the problem that connection circuits used for electrically connecting the solar cells of a solar cell module are greatly heated by the power dissipated in the bypass-diodes, which is disadvantageous from a number of standpoints.

[0011] An electrical connection and junction box having a housing for connecting leads inserted into the housing to one another or to electrical and/or electronic devices provided in the housing, is known from patent DE 103 31 780 A1. A plug-in module having electrical and/or electronic devices is also provided which is plugged into the housing by means of a plug connection, so that the electrical and/or electronic devices of the plug-in module

are connected to leads provided in the housing or electrical and/or electronic devices. Such an electrical connection and junction box is particularly suited as a solar junction box, i. e., as a connection and junction box for solar cells of a solar cell module. The plug-in module is provided with bypass-diodes, so that if the bypass-diodes are defective, they can be easily changed without tools by changing the plug-in module.

[0012] DE 33 07 202 A1 further describes a solar cell module consisting of individual solar cells arranged in series, at least some of which are electrically connected in series. Bypass-diodes are connected in parallel to individual strings of these solar cells, in order to restrict the heat output of the partially shaded solar cells. These bypass-diodes are integrated directly into the solar cell module, so that no complex connection box is required.

[0013] From prior art, other so-called comparator circuits are known, for example, as separate components. Such comparator circuits have at least two inputs, specifically one input for the voltage to be monitored and one input for a reference potential (mass/earth), as well as one output, by means of which, depending on whether the monitored voltage is above or below a predetermined threshold, an output signal is activated or inactivated. See for example the "Voltage Detectors MAX 6461-MAX 6466" by MAXIM Integrated Products and the relevant data sheets. Furthermore, such comparator circuits can obviously also be built discretely, see the textbook "The Art of Electronics" by Paul Horowitz and Winfried Hill, 2nd Edition, 1989, pp. 229-232 for reference.

[0014] The object of the invention, is to provide a connection circuit for electrically connecting the solar cells of a solar cell module, which warms up only slightly during operation.

[0015] This object is achieved by the subject matter of Claim 1.

[0016] Thus it is provided according to the invention that, to avoid the aforementioned problems related to partially shaded solar cells, a controlled electronic circuit arrangement is used as a protective device, so that the use of bypass-diodes can be reduced or avoided altogether. By replacing the bypass-diodes with a controlled electronic circuit arrangement, which is in essence functionally equivalent to bypass-diodes, a decrease in heating up of the circuit arrangement can be achieved, implemented as follows.

[0017] According to a preferred embodiment of the invention provision has been made that the controlled electronic circuit arrangement is designed in such a way that in the case of a shaded solar cell, it acts as a current bypass for the shaded solar cell. This functional equivalence to bypass-diodes known from prior art can be achieved in various different ways.

[0018] According to a preferred further embodiment of the invention, provision has been made for the controlled electronic circuit arrangement to have a control circuit and a switching device controllable by the control circuit, the switching device being connected in parallel to at least one solar cell, preferably in parallel to a string of solar cells, and being at least temporarily activated by the control circuit if a solar cell to which it is connected in parallel becomes shaded, so that a current-bypass for the shaded solar cell is achieved.

[0019] Suitable switching devices can also be implemented in various different ways. According to a preferred further embodiment of the invention, provision has also been made for the switching device to have two electrical or electronic switching elements connected in series and controlled by the control circuit. According to a preferred further embodiment of the invention, specific provision has been made that two transistors with opposite polarities, preferably MOSFETS, are provided as switching elements. Furthermore, according to a preferred further embodiment of the invention, provision has been made for the current produced by the unshaded solar cells of the solar cell module to provide the power for the control circuit, where according to a preferred further embodiment of the invention, specific provision has been made to provide the control circuit with a storage capacitor.

[0020] Furthermore, one problem in the use of solar cell modules having a plurality of solar cells is that the level of efficiency of the solar cell modules as a whole is often unsatisfactory.

[0021] Consequently, another object of the invention is to provide a connection circuit for solar cells of a solar cell module with which greater efficiency of the solar cell module as a whole can be achieved.

[0022] This object is achieved by a connection circuit having a controlled electronic circuit arrangement for individually controlling or regulating one individual solar cell or a plurality of solar cells of the solar cell module.

[0023] From this standpoint, provision has therefore been made for individually adjusting the operating parameters of the individual solar cells of the solar cell module, to attain maximum overall operational efficiency. In particular, in this way it is possible to operate every individual solar cell at its maximum operating level, whereas in conventional systems, the operation of the entire solar cell module has often been determined by the weakest unit, i.e., the weakest solar cell. The same is true when a plurality of solar cell modules are connected together.

[0024] The fact that the connection circuit according to the invention, having a controlled electronic circuit arrangement for individually controlling or regulating one individual solar cell or a plurality of solar cells of the solar cell module, is also advantageous in that it is possible not only to adjust the control or regulation to the actual state of the solar cells when the solar installation begins operation with the appropriate solar cells, but it rather becomes possible to compensate for the effects of the aging of the relevant solar cells, so that by using an "intelligent" circuit over the entire lifetime of the solar cells or solar installation, maximum operational efficiency can be attained.

[0025] To achieve the last-named object, provision has been made in addition or alternatively to the above that bus control is performed by means of the connection cables of the connection circuit.

[0026] In particular, provision can be made for query and/or adjustment of operating parameters of the solar cells and/or the solar cell modules via the bus control. This is helpful, in particular, for achieving maximum operational efficiency of the solar cells of the solar cell module described above, in particular regarding aging effects. According to a preferred further embodiment, provision can also be made for the bus control to include solar tracking astronomical functions. I.e., by simply inputting geographical location data along with the date and time, an optimal orientation of the movable and trackable solar cells can be achieved. Thus the solar cells are always at the optimal angle relative to the incident sunlight, resulting in the energy yield being maximized.

[0027] In conclusion, in all of the aforementioned embodiments of connection circuits for the solar cells of a solar cell module according to a preferred further embodiment of the invention, provision has been made to use a surge protection element to protect the connection circuit as well as the solar cells against surges from a nearby

lightning strike, for example.

[0028] There are a multitude of possibilities for configuring and refining connection circuits according to the invention. For this information, please see the patent claims subordinate to the independent patent claims, as well as a detailed description of a preferred exemplary embodiment of the invention below. In the drawing, the only figure shows a schematic view of a connection circuit according to a preferred exemplary embodiment of the invention.

[0029] The Figure shows a solar cell 1, which has a plurality of strings 2 connected in series, which in turn also consist of solar cells connected in series, not shown in the detail. The provision of three strings 2 for solar cell module 1 is merely exemplary. Likewise exemplary, the protection by means of a connection circuit according to a preferred exemplary embodiment of the invention is shown only for a string 2. An appropriate protection can naturally be provided for each string.

[0030] As indicated above, the purpose of such a connection circuit is to ensure the protection of the shaded string, by achieving a current bypass for the shaded string, so that on the one hand, solar cell module 1 continues to be operational, and thus produces a current, and on the other, damage to the shaded string 2 is prevented. To that end, the connection circuit has a controlled electronic circuit arrangement 3, which has a control circuit 4 and a switching device 5. The switching device 5 consists of two switching elements, specifically two MOSFETS 6, 7 with opposite polarities, which can be controlled by the control circuit 4. Moreover, the control circuit 4 is provided with a storage capacitor 8, so that in the case of the shading of string 2 which is protected by the connection circuit, the following process is made possible:

When protected string 2 is shaded, and the rest of string 2 of solar cell module 1 continues to be illuminated, a voltage is built up across the lower, blocking MOSFET 7 due to the parasitic diode of the upper MOSFET 6. The control circuit 4 is so designed, that it limits this voltage, by a partial activation of at least MOSFET 7 to approximately 20 V, so that damage to the protected string 2 is avoided. In this phase, current limited storage capacitor 8 is charged by the voltage across MOSFET 7. As soon as storage capacitor 8 has been loaded to approximately 15 V, MOSFETS 6, 7 are completely activated, whereby the adjacent voltage across the MOSFETS 6, 7 collapses. The time that elapses between the initial

activation of the blocking voltage and the point that the voltage collapses is only a few microseconds.

[0031] Due to the current used by the control circuit 4, the voltage across the storage capacitor 8 and the gates of MOSFET 6, 7, drops gradually. As soon as the voltage drops below a certain value, where complete control of the MOSFETS 6, 7 can no longer be guaranteed, control circuit 4 disconnects at least MOSFET 7. A voltage then builds up across MOSFET 7, which in turn, as described above, is limited. The control phase of MOSFETS 6, 7 lasts several tens of milliseconds. Because of the very short voltage-limited blocking phase compared to the control phase, the momentary high performance losses across MOSFETS 6, 7 during the blocking phase, are negligible compared to the control losses, so that the overall loss is clearly less than that of a Schottky-Diode.

[0032] The control circuit 4 is moreover designed in such a way that in case of illumination of string 2 which is protected by the control circuit, the control circuit receives no current, so that MOSFETS 6, 7 block. Besides the small restraint currents of MOSFETS 6, 7, no further losses occur through controlled electronic circuit arrangement 3, so that the overall losses are in practice even lower than those of Schottky-Diodes. Furthermore, it is essential for the connection circuit described here according to a preferred exemplary embodiment of the invention, that during the voltage-limited blocking phase, the controlled electronic circuit arrangement is supplied with current from the remaining, i.e., unshaded strings 2, so that no external power supply is needed.

[0033] The result thus achieved is a connection circuit for solar cells of a solar cell module, which can be used just as uncomplicatedly as a connection circuit with bypass-diodes, but has significantly lower power losses, with significantly less heat being generated.

Patent Claims

1. A connection circuit, for electrically connecting the solar cells of a solar cell module (1), having a protective device, which in the case of a shaded solar cell acts as a current-bypass for the shaded solar cell, **characterized in that** the connection circuit has a controlled electronic circuit arrangement (3) as protective device.

2. The connection circuit according to Claim 1, characterized in that the controlled electronic circuit arrangement (3) has a control circuit (4) and

a switching device (5) controllable by the control circuit, the switching device (5) being connected in parallel to at least one solar cell and being activated by the control circuit (4) at least temporarily if the solar cell is shaded, so that a current-bypass for the shaded solar cell is achieved.

3. The connection circuit according to Claim 2, characterized in that the switching device (5) has two electrical or electronic switching elements (6, 7) connected in series and controlled by the control circuit (4).

4. The connection circuit according to Claim 3, characterized in that it has two transistors with opposite polarities, preferably MOSFETS, as switching elements (6, 7).

5. The connection circuit according to one of the Claims 2 through 4, characterized in that the current produced by the unshaded solar cells of the solar cell module (1) provides the power for the control circuit (4).

6. The connection circuit according to one of the Claims 2 through 5, characterized in that a storage capacitor (8) is provided for the control circuit (4).

7. The connection circuit according to one of the Claims 1 through 6, characterized in that the connection circuit has a controlled electronic circuit arrangement for individually controlling or regulating one individual solar cell or a plurality of solar cells of the solar cell module.

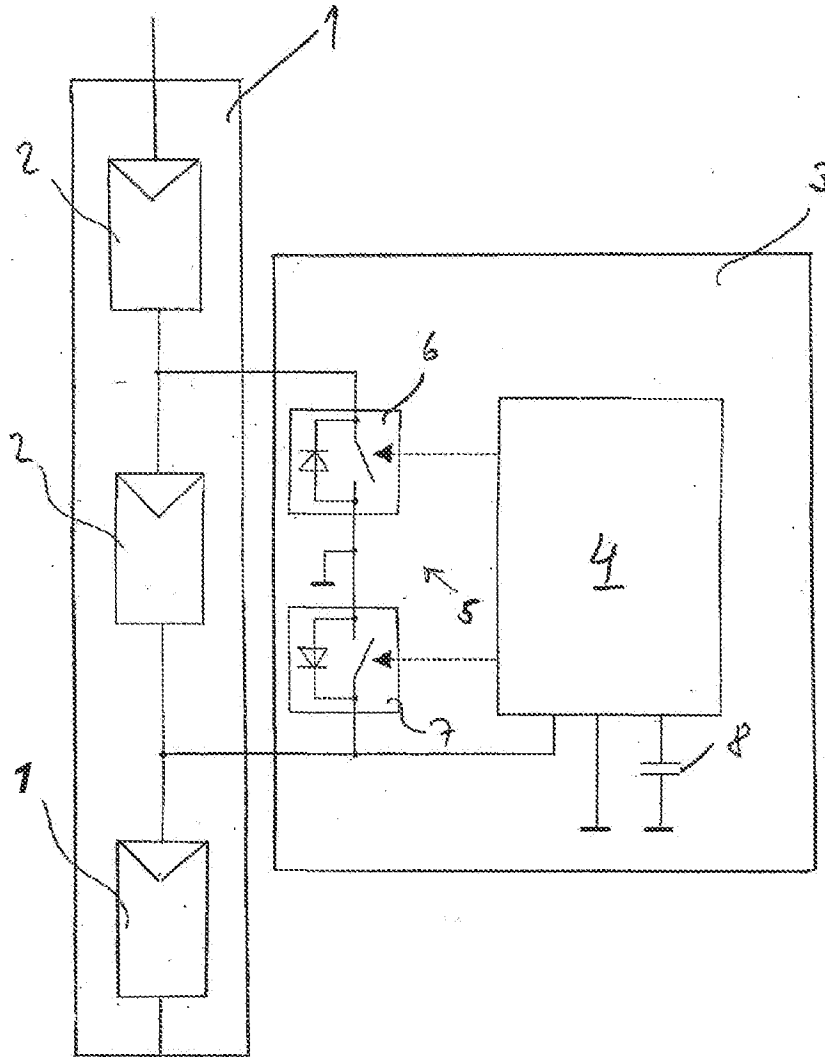
8. The connection circuit according to one of the Claims 1 through 7, characterized in that a bus control is provided by means of the connection cables of the connection circuit.

9. The connection circuit according to Claim 8 characterized in that a query and/or adjustment of operating parameters occurs via the bus control.

10. The connection circuit according to Claim 8 or 9, characterized in that the bus control includes astronomical functions, specifically for solar tracking.

11. The connection circuit according to one of the Claims 1 through 10, characterized in that a surge protection element is provided to protect the connection circuit as well as the solar cells against surges.

The next page consists of drawings





(19)
Bundesrepublik Deutschland
Deutsches Patent- und Markenamt

(10) **DE 10 2005 012 213 B4** 2009.01.15

(12)

Patentschrift

(21) Aktenzeichen: **10 2005 012 213.2**

(22) Anmeldetag: **15.03.2005**

(43) Offenlegungstag: **03.08.2006**

(45) Veröffentlichungstag
der Patenterteilung: **15.01.2009**

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

Innerhalb von drei Monaten nach Veröffentlichung der Patenterteilung kann nach § 59 Patentgesetz gegen das Patent Einspruch erhoben werden. Der Einspruch ist schriftlich zu erklären und zu begründen. Innerhalb der Einspruchsfrist ist eine Einspruchsgebühr in Höhe von 200 Euro zu entrichten (§ 6 Patentkostengesetz in Verbindung mit der Anlage zu § 2 Abs. 1 Patentkostengesetz).

(66) Innere Priorität:
10 2005 003 720.8 26.01.2005

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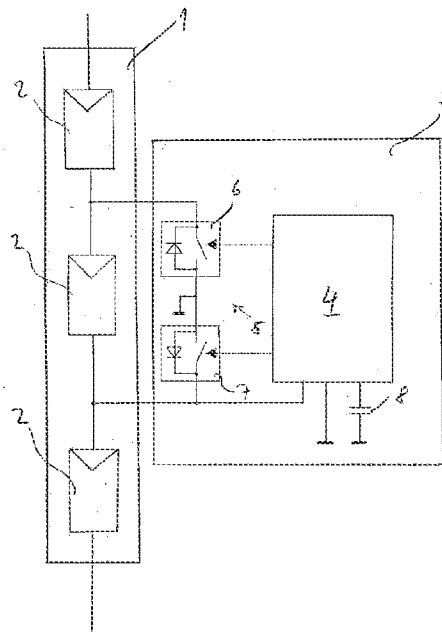
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(56) Für die Beurteilung der Patentfähigkeit in Betracht
gezogene Druckschriften:
**DE 103 31 780 A1
DE 33 07 202 A1
Horowitz, Paul et al.: The art of electronics. 2.
Auflage, Cambridge University Press, 1989, Seite
229-232; Datenblatt "Voltage Detectors MAX
6461-MA
X 6466 vom MAXIM Integrated Products, Kanada,
Ausg
abe 1/03;;**

(54) Bezeichnung: **Anschlußschaltung**

(57) Hauptanspruch: Anschlußschaltung, zum elektrischen Anschluß von Solarzellen eines Solarzellenmoduls (1), mit einer Schutzeinrichtung, die im Fall einer abgeschatteten Solarzelle als Strom-Bypass für die abgeschattete Solarzelle wirkt, dadurch gekennzeichnet, daß die Anschlußschaltung als Schutzeinrichtung eine gesteuerte elektronische Schaltenordnung (3) aufweist.



Beschreibung

[0001] Die Erfindung betrifft eine Anschlußschaltung, zum elektrischen Anschluß von Solarzellen eines Solarzellenmoduls.

[0002] Anschlußschaltungen zum elektrischen Anschluß von Solarzellen eines Solarzellenmoduls sind aus der Praxis in vielfältiger Ausgestaltung gut bekannt. Dabei werden im allgemeinen mehrere Solarzellen zu Solarzellenmodulen zusammengeschaltet. Dazu besteht entweder die Möglichkeit der Reihenschaltung oder die Möglichkeit der Parallelschaltung der Solarzellen im Solarzellenmodul.

[0003] Durch ein Parallelschalten der Solarzellen addieren sich die einzelnen Ströme der Solarzellen zu einem Gesamtstrom. Dabei sollten die parallel geschalteten Solarzellen allerdings im wesentlichen die gleichen physikalischen Eigenschaften aufweisen, so daß sich in der Praxis das Parallelschalten von Solarzellen kaum durchgesetzt hat, insbesondere auch da eine einzelne Solarzelle bereits einen Strom von einigen Ampere liefern kann und die Ausgangsspannung einzelner Solarzellen typischerweise zu gering ist, um elektrische Geräte, wie Haushaltsgeräte, betreiben zu können.

[0004] Bei der Zusammenstellung von Solarzellenmodulen aus einzelnen Solarzellen werden diese daher häufig in Reihe geschaltet. Ein Problem kann sich dabei jedoch dann ergeben, wenn ein Solarzellenmodul im Betrieb partiell abgeschattet wird, also eine Solarzelle oder eine Mehrzahl von Solarzellen des Solarzellenmoduls weniger oder gar keine Sonnenbestrahlung erhält. Der Grund für eine derartig verringerte Sonnenbestrahlung kann z. B. in einer Verschmutzung der Solarzellen und/oder in Schattenschwürfen von Bäumen, Gebäudeeinrichtungen oder Gebäuden selbst liegen.

[0005] Im Gegensatz zu einer Abschattung des Solarzellenmoduls gleichmäßig über seine gesamte Fläche, die nur zur einer Leistungsverringerung insgesamt führt, ergibt sich bei einer partiellen Abschattung folgendes Problem: Durch die in Reihe geschalteten Solarzellen des Solarzellenmoduls fließt ein gemeinsamer Strom, wobei jede einzelne Solarzelle mit ihrer jeweiligen Spannung zur Gesamtspannung des Solarzellenmoduls beiträgt. Wird nun eine Solarzelle abgeschattet, so erzeugt diese keine Spannung mehr und setzt dem Stromfluß im Solarzellenmodul praktisch eine Diode in Sperrichtung entgegen. Dies bedeutet jedoch, daß das gesamte Solarzellenmodul keinen Strom mehr liefern kann, so daß die gesamte Funktion des Solarzellenmoduls beeinträchtigt ist.

[0006] Weiterhin gilt, daß an der abgeschatteten Solarzelle eine Spannung anliegt, die abhängig ist von der Position der abgeschatteten Solarzelle in der

Reihenschaltung. Ist diese an der abgeschatteten Solarzelle anliegende Spannung größer als ihre Sperrspannung, so wird es in der Solarzelle zu einem Durchschlag und damit zu einer dauerhaften Beschädigung kommen.

[0007] Selbst wenn es zu keiner Beschädigung der Solarzelle durch einen Durchschlag kommen sollte, wird in einer abgeschatteten Solarzelle eine große Verlustleistung umgesetzt, so daß sich die abgeschattete Solarzelle aufheizt. Auch eine solche Aufheizung kann zu Beschädigungen an der abgeschatteten Solarzelle sowie an den ihr benachbarten Solarzellen führen.

[0008] Um die mit teilweise abgeschatteten Solarzellen verbundene Problematik zu vermeiden, werden Schutzvorrichtungen verwendet, im allgemeinen nämlich Bypass-Dioden, die antiparallel zu den Solarzellen geschaltet werden. Auf diese Weise wird erreicht, daß eine abgeschattete Solarzelle zwar keinen Anteil mehr zur Gesamtspannung des Solarzellenmoduls leistet, der Stromfluß jedoch trotzdem erhalten bleibt. Das Solarzellenmodul zeigt somit lediglich eine verminderte Betriebsspannung, fällt jedoch nicht vollständig aus. Außerdem wird in der abgeschatteten Solarzelle keine Leistung mehr umgesetzt, so daß eine Beschädigung der abgeschatteten Solarzelle vermieden werden kann.

[0009] Grundsätzlich könnte jeder Solarzelle eines Solarzellenmoduls genau eine Bypass-Diode zugeordnet sein. Häufig jedoch wird so vorgegangen, daß eine Mehrzahl hintereinander geschalteter Solarzellen, also ein sogenannter String von Solarzellen, jeweils durch eine gemeinsame Bypass-Diode abgesichert wird.

[0010] Anschlußschaltungen zum elektrischen Anschluß von Solarzellen eines Solarzellenmoduls weisen somit im allgemeinen wenigstens eine Bypass-Diode, häufig eine Mehrzahl von Bypass-Dioden auf. Damit ist jedoch das Problem verbunden, daß die zum elektrischen Anschluß von Solarzellen eines Solarzellenmoduls verwendeten Anschlußschaltungen durch die in den Bypass-Dioden umgesetzte Leistung stark erwärmt werden, was unter verschiedenen Aspekten nachteilig ist.

[0011] Aus der DE 103 31 780 A1 ist eine elektrische Anschluß- und Verbindungsdose bekannt, die ein Gehäuse zum Anschließen und Verbinden in das Gehäuse eingeführter Leitungen miteinander bzw. mit in dem Gehäuse vorgesehenen elektrischen oder/und elektronischen Einrichtungen aufweist. Ferner ist ein elektrischer oder/und elektronischer Einrichtungen aufweisendes Steckmodul vorgesehen, das mittels einer Steckverbindung an das Gehäuse angesteckt ist, so daß die elektrischen oder/und elektronischen Einrichtungen des Steckmoduls mit den

in dem Gehäuse vorgesehenen Leitungen bzw. elektrischen oder/und elektronischen Einrichtungen verbunden ist. Eine solche elektrische Anschluß- und Verbindungsdose ist insbesondere als Solardose geeignet, also als Anschluß- und Verbindungsdose für Solarzellen eines Solarzellenmoduls. Dabei werden in dem Ansteckmodul Bypass-Dioden vorgesehen, so daß bei defekten Bypass-Dioden ein Auswechseln derselben einfach und ohne Werkzeug durch Wechseln des Ansteckmoduls erfolgen kann.

[0012] Die DE 33 07 202 A1 beschreibt ferner ein Solarzellenmodul aus einzelnen, in Reihe angeordneten Solarzellen, die wenigstens teilweise elektrisch in Serie geschaltet sind. Bypass-Dioden sind parallel zu einzelnen Ketten dieser Solarzellen geschaltet, um die Heizleistung in partiell abgeschatteten Solarzellen zu begrenzen. Diese Bypass-Dioden sind direkt in das Solarzellenmodul integriert, so dass kein aufwendiger Anschlußkasten erforderlich ist.

[0013] Aus dem Stand der Technik sind ferner sogenannte Komparatorschaltungen z. B. als separate Bauteile bekannt. Solche Komparatorschaltungen weisen wenigstens zwei Eingänge, nämlich einen Eingang für die zu überwachende Spannung und einen Eingang für ein Referenzpotential (Masse/Erde), sowie einen Ausgang auf, über den abhängig davon, ob die überwachte Spannung oberhalb oder unterhalb einer vorbestimmten Schwelle liegt, ein Ausgangssignal aktiviert oder deaktiviert wird. Exemplarisch sei dazu verwiesen auf die "Voltage Detectors MAX 6461-MAX 6466" von MAXIM Integrated Products und die zugehörigen Datenblätter. Im übrigen können entsprechende Komparatorschaltungen natürlich auch diskret aufgebaut werden, wozu auf das Lehrbuch "The Art of Electronics" von Paul Horowitz und Winfried Hill, 2. Edition, 1989, Seite 229-232, verwiesen wird.

[0014] Es ist die Aufgabe der Erfindung, eine derartige Anschlußschaltung zum elektrischen Anschluß von Solarzellen eines Solarzellenmoduls anzugeben, die sich im Betrieb nur gering erwärmt.

[0015] Diese Aufgabe ist gelöst, durch den Gegenstand des Patentanspruchs 1.

[0016] Erfindungsgemäß ist also vorgesehen, daß zur Vermeidung der oben beschriebenen, mit teilweise abgeschatteten Solarzellen verbundenen Problematik als Schutzvorrichtung eine gesteuerte elektronische Schaltanordnung verwendet wird, so daß die Verwendung von Bypass-Dioden reduziert oder ganz vermieden werden kann. Durch den Ersatz von Bypass-Dioden durch eine gesteuerte elektronische Schaltanordnung, die zu den Bypass-Dioden funktional im wesentlichen gleichwirkend ist, kann eine Verringerung der Erwärmung der Schaltanordnung erzielt werden, wie nachfolgend ausgeführt.

[0017] Gemäß einer bevorzugten Weiterbildung der Erfindung ist dabei vorgesehen, daß die gesteuerte elektronische Schaltanordnung derart ausgelegt ist, daß sie im Fall einer abgeschatteten Solarzelle als Strom-Bypass für die abgeschattete Solarzelle wirkt. Diese funktionale Gleichwirkung zu den aus dem Stand der Technik bekannten Bypass-Dioden kann nun auf unterschiedliche Arten und Weisen erzielt werden.

[0018] Gemäß einer bevorzugten Weiterbildung der Erfindung ist dabei vorgesehen, daß die gesteuerte elektronische Schaltanordnung eine Ansteuerschaltung und eine von der Ansteuerschaltung ansteuerbare Schalteinrichtung aufweist, wobei die Schalteinrichtung parallel zu wenigstens einer Solarzelle, vorzugsweise parallel zu einem String von Solarzellen, geschaltet ist und im Falle einer Abschattung einer der Solarzellen, zu der sie parallel geschaltet ist, von der Ansteuerschaltung wenigstens zeitweise aufgesteuert wird, so daß ein Strom-Bypass für die abgeschattete Solarzelle erzielt wird.

[0019] Entsprechende Schalteinrichtungen lassen sich ebenfalls auf verschiedene Arten und Weisen realisieren. Gemäß einer bevorzugten Weiterbildung der Erfindung ist jedoch vorgesehen, daß die Schalteinrichtung zwei in Reihe geschaltete und von der Ansteuerschaltung angesteuerte elektrische oder elektronische Schaltelemente aufweist. Gemäß einer bevorzugten Weiterbildung der Erfindung ist dabei insbesondere vorgesehen, daß als Schaltelemente zwei gegeneinander gepolte Transistoren, vorzugsweise zwei MOSFETS, vorgesehen sind. Weiterhin gilt, daß gemäß einer bevorzugten Weiterbildung der Erfindung vorgesehen ist, daß die Stromversorgung der Ansteuerschaltung über den von den nicht abgeschatteten Solarzellen des Solarzellenmoduls erzeugten Strom erfolgt, wobei gemäß einer bevorzugten Weiterbildung der Erfindung insbesondere vorgesehen ist, daß die Ansteuerschaltung mit einem Speicherkondensator versehen ist.

[0020] Weiterhin liegt eine Problematik beim Einsatz von Solarzellenmodulen mit einer Mehrzahl von Solarzellen darin, daß die Solarzellenmodule insgesamt häufig nur einen unbefriedigenden Wirkungsgrad aufweisen.

[0021] Dementsprechend liegt eine weitere Aufgabe darin, eine Anschlußschaltung für Solarzellen eines Solarzellenmoduls anzugeben, mit der ein hoher Wirkungsgrad des Solarzellenmoduls insgesamt erzielt werden kann.

[0022] Diese Aufgabe ist dadurch gelöst, daß die Anschlußschaltung eine gesteuerte elektronische Schaltanordnung zum individuellen Steuern bzw. Regeln einer jeweiligen Solarzelle einer Mehrzahl von Solarzellen des Solarzellenmoduls aufweist.

[0023] Unter diesem Aspekt ist also vorgesehen, die Betriebsparameter der einzelnen Solarzellen des Solarzellenmoduls individuell zu beeinflussen, um insgesamt einen optimalen Wirkungsgrad zu erzielen. Insbesondere ist es auf diese Weise nämlich möglich, jede einzelne Solarzelle in ihrem optimalen Betriebszustand zu betreiben, während bei herkömmlichen Systemen häufig die schwächste Einheit, also die schwächste Solarzelle, den Betrieb des gesamten Solarzellenmoduls bestimmt hat. Entsprechendes gilt im übrigen auch bei dem Anschluß einer Mehrzahl von Solarzellenmodulen.

[0024] Die Tatsache, daß die Anschlußschaltung erfindungsgemäß eine gesteuerte elektronische Schaltanordnung zum individuellen Steuern bzw. Regeln einer jeweiligen Solarzelle einer Mehrzahl von Solarzellen des Solarzellenmoduls aufweist, ist auch insofern vorteilhaft, als daß nicht nur eine Anpassung der Steuerung bzw. Regelung an den jeweiligen Zustand der Solarzellen bei Inbetriebnahme der Solaranlage mit den entsprechenden Solarzellen möglich ist, sondern vielmehr auch ein Ausgleich von Alterungseffekten der Solarzellen ermöglicht wird, so daß durch den Einsatz einer "intelligenten" Schaltung über die gesamte Lebensdauer der Solarzellen bzw. der entsprechenden Solaranlage ein optimaler Wirkungsgrad erzielt werden kann.

[0025] Zur Lösung der zuletzt genannten Aufgabe ist zusätzlich oder alternativ zu dem zuvor ausgeführten vorgesehen, daß über die Anschlußkabel der Anschlußschaltung eine Bussteuerung erfolgt.

[0026] Insbesondere kann dabei vorgesehen sein, daß über die Bussteuerung eine Abfrage oder/und Einstellung von Betriebsparametern der Solarzellen oder/und des Solarzellenmoduls erfolgt. Dies ist insbesondere hilfreich, um den zuvor beschriebenen Betrieb der Solarzellen des Solarzellenmoduls mit jeweils optimalem Wirkungsgrad, insbesondere auch in Abhängigkeit von Alterungseffekten, zu erreichen. Gemäß einer bevorzugten Weiterbildung kann jedoch auch vorgesehen sein, daß die Bussteuerung Astro-Funktionen zur Sonnennachführung umfaßt. Das heißt, daß über die einfache Eingabe von geographischen Ortsdaten sowie Datum und Uhrzeit eine optimale Ausrichtung beweg- und nachführbarer Solarzellen erzielt werden kann. Damit stehen die Solarzellen immer im optimalen Winkel zum einfallenden Sonnenlicht, wodurch die Energieausbeute maximiert wird.

[0027] Schließlich ist bei allen zuvor genannten Ausgestaltungen von Anschlußschaltungen für Solarzellen eines Solarzellenmoduls gemäß einer bevorzugten Weiterbildung der Erfindung vorgesehen, daß ein Überspannungsschutzelement zum Schutz der Anschlußschaltung sowie der Solarzellen vor Überspannungen, z. B. durch einen benachbarten

Blitzeinschlag, verwendet wird.

[0028] Im einzelnen gibt es nun eine Vielzahl von Möglichkeiten, die erfindungsgemäßen Anschlußschaltungen auszugestalten und weiterzubilden. Dazu wird auf die den unabhängigen Patentansprüchen nachgeordneten Patentansprüche sowie auf die nachfolgende detaillierte Beschreibung eines bevorzugten Ausführungsbeispiels der Erfindung verwiesen. In der Zeichnung zeigt die einzige Figur schematisch eine Anschlußschaltung gemäß einem bevorzugten Ausführungsbeispiel der Erfindung.

[0029] Die Figur zeigt dabei eine Solarzelle 1, die eine Mehrzahl von in Reihe geschalteten Strings 2 aufweist, die ihrerseits aus mehreren, im einzelnen nicht mehr dargestellten, ebenfalls in Reihe geschalteten Solarzellen bestehen. Das Vorsehen von drei Strings 2 für das Solarzellenmodul 1 ist rein exemplarisch. Ebenso exemplarisch ist für lediglich einen String 2 die Absicherung über eine Anschlußschaltung gemäß einem bevorzugten Ausführungsbeispiel der Erfindung gezeigt. Eine entsprechende Absicherung kann natürlich für jeden String vorgesehen sein.

[0030] Wie zuvor schon ausgeführt, ist es das Ziel, eine derartige Anschlußschaltung anzugeben, die gewährleistet, daß im Falle einer Abschattung des damit abgesicherten Strings ein Strom-Bypass für diesen abgeschatteten String erzielt wird, so daß das Solarzellenmodul 1 einerseits weiterhin einsatzbereit bleibt, also einen Strom liefert, und andererseits eine Beschädigung des abgeschatteten Strings 2 verhindert wird. Dazu weist die Anschlußschaltung eine gesteuerte elektronische Schaltanordnung 3 auf, die über eine Ansteuerschaltung 4 sowie eine Schalteinrichtung 5 verfügt. Die Schalteinrichtung 5 wird von zwei Schaltelementen gebildet, nämlich von zwei gegeneinander gepolten MOSFETS 6, 7, die von der Ansteuerschaltung 4 ansteuerbar sind. Im übrigen ist für die Ansteuerschaltung 4 ein Speicherkondensator 8 vorgesehen, so daß im Falle einer Abschattung des durch die Anschlußschaltung abgesicherten Strings 2 folgender Ablauf ermöglicht wird:

Bei Abschattung des abgesicherten Strings 2 und weiterer Beleuchtung der verbleibenden Strings 2 des Solarzellenmoduls 1 baut sich über den unteren, sperrend wirkenden MOSFET 7 aufgrund der parasitären Diode des oberen MOSFETS 6 eine Spannung auf. Die Ansteuerschaltung 4 ist nun derart ausgelegt, daß sie diese Spannung durch teilweises Aufsteuern wenigstens des MOSFETS 7 auf ca. 20 V begrenzt, so daß eine Beschädigung des abgesicherten Strings 2 vermieden wird. In dieser Phase lädt sich der Speicherkondensator 8 strombegrenzt aus der Spannung über den MOSFET 7 auf. Sobald der Speicherkondensator 8 auf ca. 15 V aufgeladen ist, werden die MOSFETS 6, 7 vollständig aufgesteuert, wodurch die über den MOSFETS 6, 7 anliegende Spannung zusammenbricht. Vom Auftreten der anfängli-

chen Sperrspannung bis zu diesem Zeitpunkt des Zusammenbrechens der Spannung vergehen nur wenige Mikrosekunden.

[0031] Durch den Eigenstromverbrauch der Ansteuerschaltung 4 sinkt die Spannung über dem Speicherkondensator 8 und an den Gates der MOSFETS 6, 7 langsam ab. Sobald eine Spannung unterschritten wird, bei der ein vollständiges Aufsteuern der MOSFETS 6, 7 nicht mehr gewährleistet ist, schaltet die Ansteuerschaltung 4 wenigstens den MOSFET 7 ab. Über den MOSFET 7 baut sich dann eine Spannung auf, die wiederum, wie oben beschrieben, begrenzt wird. Die Leitendphase der MOSFETS 6, 7 dauert mehrere zehn Millisekunden. Aufgrund der verglichen zur Leitendphase sehr kurzen spannungsbegrenzten Sperrphase fallen die momentan hohen Verlustleistungen über den MOSFETS 6, 7 während der Sperrphasen damit gegenüber den Leitendverlusten kaum ins Gewicht, so daß insgesamt Verluste deutlich unter denen einer Schottky-Diode erreicht wird.

[0032] Die Ansteuerschaltung 4 ist weiterhin derart ausgelegt, daß sie bei Beleuchtung des damit abgesicherten Strings 2 nicht versorgt wird, so daß die MOSFETS 6, 7 sperren. Außer den geringen Sperrströmen der MOSFETS 6, 7 treten somit durch die gesteuerte elektronische Schaltanordnung 3 keinerlei Verluste auf, so daß die Gesamtverluste in der Praxis sogar unter denen von Schottky-Dioden liegen. Darüber hinaus ist bei der vorliegend beschriebenen Anschlußschaltung gemäß einem bevorzugten Ausführungsbeispiel der Erfindung wesentlich, daß sich die gesteuerte elektrische Schaltanordnung in der spannungsbegrenzten Sperrphase aus den verbleibenden, also noch beleuchteten Strings 2 versorgt, so daß keine Fremdversorgung erforderlich ist.

[0033] Im Ergebnis wird damit eine Anschlußschaltung für Solarzellen eines Solarzellenmoduls erzielt, die genauso unproblematisch einsetzbar ist wie eine Anschlußschaltung mit Bypass-Dioden, jedoch wesentlich geringere Verlustleistungen aufweist, so daß es zu deutlich geringeren Erwärmungen kommt.

Patentansprüche

1. Anschlußschaltung, zum elektrischen Anschluß von Solarzellen eines Solarzellenmoduls (1), mit einer Schutzeinrichtung, die im Fall einer abgeschatteten Solarzelle als Strom-Bypass für die abgeschattete Solarzelle wirkt, **dadurch gekennzeichnet**, daß die Anschlußschaltung als Schutzeinrichtung eine gesteuerte elektronische Schaltanordnung (3) aufweist.

2. Anschlußschaltung nach Anspruch 1, dadurch gekennzeichnet, daß die gesteuerte elektronische Schaltanordnung (3) eine Ansteuerschaltung (4) und

eine von der Ansteuerschaltung (4) ansteuerbare Schalteinrichtung (5) aufweist, wobei die Schalteinrichtung (5) parallel zu wenigstens einer Solarzelle geschaltet ist und im Falle einer Abschattung der Solarzelle von der Ansteuerschaltung (4) wenigstens zeitweise aufgesteuert wird, so daß ein Strom-Bypass für die abgeschattete Solarzelle erzielt wird.

3. Anschlußschaltung nach Anspruch 2, dadurch gekennzeichnet, daß die Schalteinrichtung (5) zwei in Reihe geschaltete und von der Ansteuerschaltung (4) angesteuerte elektrische oder elektronische Schaltelemente (6, 7) aufweist.

4. Anschlußschaltung nach Anspruch 3, dadurch gekennzeichnet, daß als Schaltelemente (6, 7) zwei gegeneinander gepolte Transistoren, vorzugsweise MOSFETS, vorgesehen sind.

5. Anschlußschaltung nach einem der Ansprüche 2 bis 4, dadurch gekennzeichnet, daß die Stromversorgung der Ansteuerschaltung (4) über den von den nicht abgeschatteten Solarzellen des Solarzellenmoduls (1) erzeugten Strom erfolgt.

6. Anschlußschaltung nach einem der Ansprüche 2 bis 5, dadurch gekennzeichnet, daß für die Ansteuerschaltung (4) ein Speicherkondensator (8) vorgesehen ist.

7. Anschlußschaltung nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß die Anschlußschaltung eine gesteuerte elektronische Schaltanordnung zum individuellen Steuern bzw. Regeln einer jeweiligen Solarzelle einer Mehrzahl von Solarzellen des Solarzellenmoduls aufweist.

8. Anschlußschaltung nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß über die Anschlußkabel der Anschlußschaltung eine Bussteuerung vorgesehen ist.

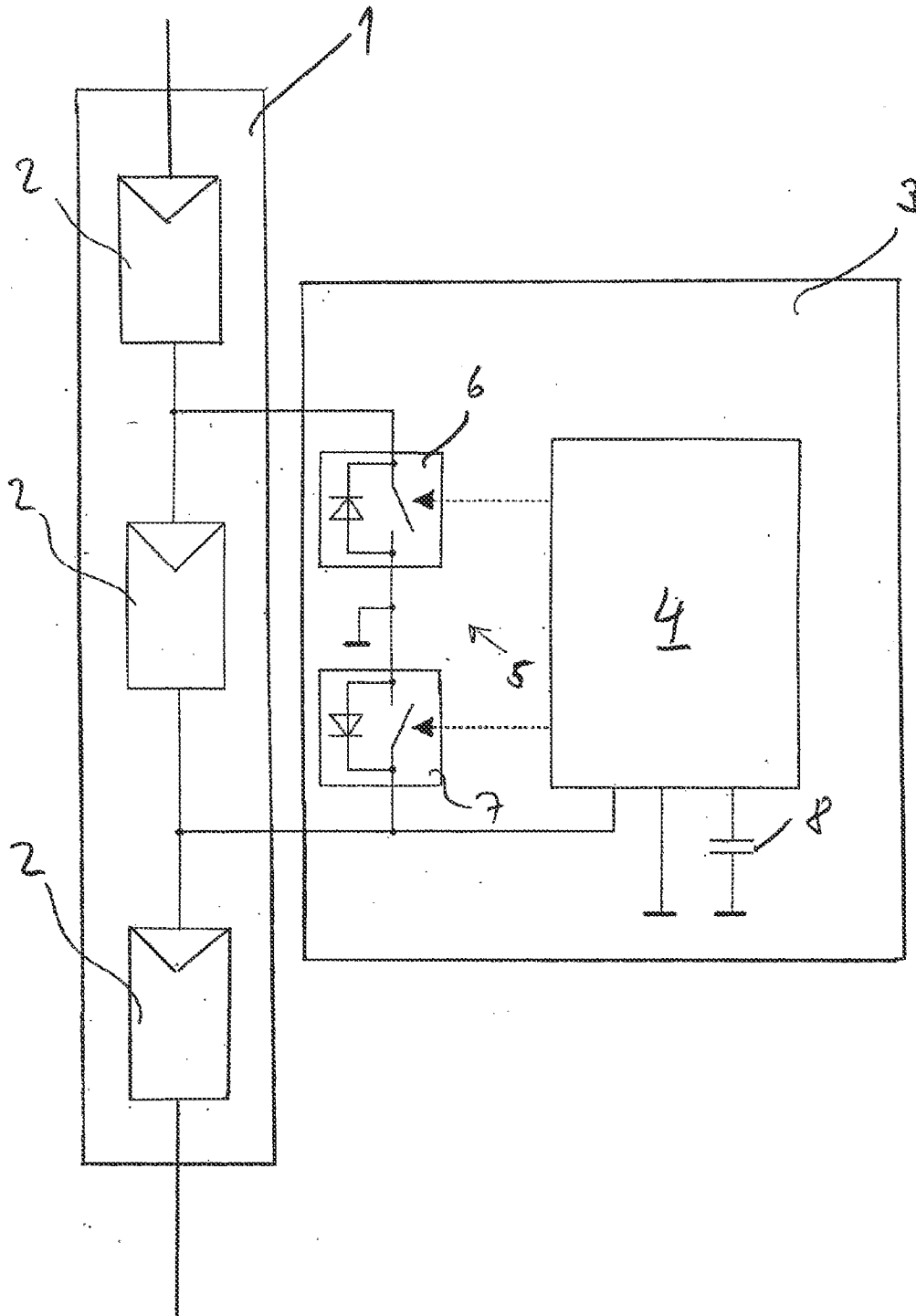
9. Anschlußschaltung nach Anspruch 8, dadurch gekennzeichnet, daß über die Bussteuerung eine Abfrage oder/und Einstellung von Betriebsparametern erfolgt.

10. Anschlußschaltung nach Anspruch 8 oder 9, dadurch gekennzeichnet, daß die Bussteuerung Astro-Funktionen, insbesondere zur Sonnennachführung, umfaßt.

11. Anschlußschaltung nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß ein Überspannungsschutzelement zum Schutz der Anschlußschaltung sowie der Solarzellen vor Überspannungen vorgesehen ist.

Es folgt ein Blatt Zeichnungen

Anhängende Zeichnungen



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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/628,977		Filing Date 12/01/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☒ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	minus 20 =	*	X \$	=		X \$	=		X \$	=
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$	=		X \$	=		X \$	=
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	10/12/2011	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	=	0		X \$	=	
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	=	0		X \$	=	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
TOTAL ADD'L FEE						0	OR	TOTAL ADD'L FEE		
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	Total (37 CFR 1.16(i))	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=			X \$	=	
	Independent (37 CFR 1.16(h))	*	Minus	***	=			X \$	=	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
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 number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/ANNIE SINGLETON/

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

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



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/628,977	12/01/2009	Ron HADAR	108144-202701/US (TGY027)	6958
64494 7590 07/12/2011 GREENBERG TRAURIG, LLP (SV) c/o: Greenberg Traurig LLP - Chicago Office 77 West Wacker Drive, Suite 3100 Intellectual Property Department Chicago, IL 60601			EXAMINER MARTIN, MATTHEW T	
			ART UNIT 1728	PAPER NUMBER
			NOTIFICATION DATE 07/12/2011	DELIVERY MODE 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):

LAIPMAIL@GTLAW.COM
clairt@gtlaw.com
cadanoc@gtlaw.com

Office Action Summary	Application No. 12/628,977	Applicant(s) HADAR ET AL.	
	Examiner MATTHEW T. MARTIN	Art Unit 1728	

-- 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 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, 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 01 March 2011.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ 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

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

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).
- a) ☐ All b) ☐ Some * c) ☐ None of:
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) | 4) ☐ Interview Summary (PTO-413) |
| 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) ☒ Information Disclosure Statement(s) (PTO/SB/08) | 5) ☐ Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>4/14/2011</u> . | 6) ☐ Other: _____ |

DETAILED ACTION

Status of Claims

1. Claims 1-20 are pending and are examined below.

Response to Arguments

Applicant's arguments with respect to claims 1-20 have been considered but are moot in view of the new ground(s) of rejection.

Additionally, the examiner notes that, in the recitations of Claims 1 and 12,

Claim Rejections - 35 USC § 103

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

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) 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.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

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were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1-13 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dorn et al., U.S. Publication No. 2008/0142071 in view of Wiles, "Photovoltaic Power Systems and the National Electrical Code: Suggested Practices" Sandia, 1999, and Liu et al., U.S. Publication No. 2010/0057267.

Regarding Claim 1, Dorn et al. teaches a photovoltaic system. The system taught by Dorn includes a solar module (see paragraph 21) that may be connected to an inverter (see paragraph 17) and a power bus connecting the system. The power bus is interpreted by the examiner in light of the present specification as a connection, as a conductive path connecting one or more solar modules, therefore, the reconfigurable interconnects taught by Dorn et al. (see abstract) are a power bus.

Dorn et al. further teaches that the device taught may be automatically be reconfigured through a switching system, which may be any switching device, and may be switched automatically by a controller (see paragraph 22). This system is interpreted understood by the examiner as a watchdog system. The limitation "watchdog system" is interpreted by the examiner in light of the present specification as a device or software configured to monitor communication from a central controller and disconnect. As, when configured automatically, the switching device will disconnect the plurality for cells for,

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among other things, safety reasons (see paragraph 17). The controller, according to this interpretation, is a local controller.

Therefore, Dorn et al. teaches a system comprising a watchdog unit (automatic switching system (see paragraph 17) coupled between a solar module (3) and a power bus (9A) that monitors communication from a central controller (see paragraph 22) including at least one switch (see paragraph 22) to disconnect the modules.

Although Dorn et al. does mention potential configurations for its switching system, such as diverting power, charging a battery, and disconnecting individual cells, Dorn et al. is silent on the exact configuration of the switching device/controller watchdog unit.

Wiles teaches that a photovoltaic power system must have a disconnect system. The Wiles circuit includes multiple power switching circuits, each controlling a load. The power switching circuits taught by Wiles monitor communication from a central controller and are required to disconnect the PV array under certain operating conditions, such as a disconnect of communication (see page 34).

Therefore, it would be obvious to one of ordinary skill in the art to modify the photovoltaic system taught by Dorn et al. by including a disconnect system, as taught by Wiles to be industry standard, because the PV system must respond to voltage interrupts for safety purposes (see Dorn et al. at paragraph 17 and Wiles at page 34).

However, neither Dorn et al. nor Wiles teach a remotely located central controller in communication with the watchdog system.

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Liu et al. teaches a solar photovoltaic system comprising a remotely located central controlled (44, see paragraph 34) to allow for communication with the various PV subsystems and to control a switching system, such as what is interpreted as the “watchdog” of Dorn et al. (see paragraph 34).

Therefore, it would be obvious to modify the PV system taught by modified Dorn et al. by integrating the remote central controller taught by Liu et al. because the central controller allows the monitoring and controlling of multiple PV subsystems simultaneously (see paragraph 34).

Regarding Claim 2, Dorn et al. teaches a switchable connection (see paragraph 22). Furthermore, Dorn et al. teaches that this connection may be used to disconnect the solar module or parts thereof from the power bus (see paragraphs 17 and 22) and that the components can be placed in a junction box (see paragraph 33).

Regarding Claim 3, Dorn et al. teaches that the switchable connection is configured by a controller (see paragraph 22). The examiner notes, that in engineering, a duty cycle of a system or device is the time it spends in operation over total time. Thus, by opening and closing the switch, the controller controls the duty cycle of the device, and thus the output voltage.

Regarding Claim 4, Wiles et al. teaches that PV output circuits are directly connected to the power controller and provide power thereto (see page 29, branch circuits section).

Regarding Claim 5, Dorn et al. teaches that the device may include a bypass circuit (see paragraph 24). Furthermore, this can occur when the switch disconnects the module from the power bus.

Regarding Claims 6, Wiles teaches that the disconnect needs to be effective when the system is subject to too much voltage (i.e. the threshold of irregularity has been surpassed; see page 35 at "Equipment Disconnects" section). Therefore, this irregularity can be considered irregularity of periodicity, and thus Wiles provides for amended Claim 6.

Regarding Claim 7, Wiles teaches that the disconnect needs to be effective when the system is subject to too much voltage (i.e. the threshold of irregularity has been surpassed; see page 35 at "Equipment Disconnects" section). It is the examiner's interpretation that the threshold of irregularity refers to the conventionally known "interrupt rating", the maximum amount of current a protective device can cut off safely.

Regarding Claim 8, Wiles et al. teaches that the communication is dependant on the signal of a central controller, because the signal can be interpreted as any electrical communication.

Regarding Claim 9, Wiles teaches that a junction box is often used in photovoltaic power systems because the junction box provides for weatherproofing of circuit components.

Therefore, it would be obvious to one of ordinary skill in the art to place the watchdog unit taught by Dorn et al. by placing it in the junction box taught by Wiles in order to weatherproof the watchdog components.

Regarding Claim 10, Dorn et al. teaches that the PV module is disconnected from the bus when the automatic switching system (watchdog unit) receives a signal from the controller (see paragraph 24).

Regarding Claim 11, Liu et al. teaches that the central controller may be in wireless communication (see paragraph 34).

Regarding Claim 12, Dorn et al. teaches a photovoltaic system. The system taught by Dorn includes a solar module (see paragraph 21) that may be connected to an inverter (see paragraph 17), a controller (see paragraph 21) that may reconfigure the configuration of the module, and a power bus connecting the system. The power bus is interpreted by the examiner in light of the present specification as a connection, as a conductive path connecting one or more solar modules, therefore, the reconfigurable interconnects taught by Dorn et al. (see abstract) are a power bus.

Dorn et al. further teaches that the device taught may be automatically be reconfigured through a switching system, which may be any switching device, and may be switched automatically by a controller (see paragraph 22). This system is interpreted understood by the examiner as a watchdog system. The limitation “watchdog system” is interpreted by the examiner in light of the present specification as a device or software configured to monitor communication from a central controller and disconnect, so it can be the switch taught by Dorn et al. because as, when configured automatically, the switching device will disconnect the plurality for cells for, among other things, safety reasons (see paragraph 17).

Furthermore, it is the examiner's interpretation that the disconnection of the solar cell from the power bus taught by Dorn et al. (see paragraph 17) is a shutdown, because when each module is disconnected, it is unoperational and thus shut down.

Wiles teaches that a photovoltaic power system must have a disconnect system. The Wiles circuit includes multiple power switching circuits, each controlling a load. The power switching circuits taught by Wiles monitor communication from a central controller and are required to disconnect the PV array under certain operating conditions, such as a disconnect of communication (see page 34).

Thus, Wiles teaches that the switching circuit verifies communication from a central controller and can respond to shut down the connection if communication has been interrupted.

Therefore, it would be obvious to one of ordinary skill in the art to modify the photovoltaic system taught by Dorn et al. by including a disconnect system, as taught by Wiles to be industry standard, because the PV system must respond to voltage interrupts for safety purposes (see Dorn et al. at paragraph 17 and Wiles at page 34).

However, neither Dorn et al. nor Wiles teach a remotely located central controller in communication with the watchdog system.

Liu et al. teaches a solar photovoltaic system comprising a remotely located central controlled (44, see paragraph 34) to allow for communication with the various PV subsystems and to control a switching system, such as what is interpreted as the "watchdog" of Dorn et al. (see paragraph 34).

Therefore, it would be obvious to modify the PV system taught by modified Dorn et al. by integrating the remote central controller taught by Liu et al. because the central controller allows the monitoring and controlling of multiple PV subsystems simultaneously (see paragraph 34).

Regarding Claim 13, Dorn and Wiles teach disconnecting the photovoltaic device in response to controller commands (see Dorn et al. at paragraph 22).

Regarding Claim 16, Dorn disconnects the solar module in response to controller signals. It is the examiner's position that the shutdown of the solar module corresponds to disconnecting the module.

Regarding Claim 17, Dorn et al. teaches that a controller or processor can be used to create connections via a software algorithm (see paragraph 24). This is interpreted by the Examiner to be a restart signal.

Regarding Claim 18, Wiles teaches incorporating a backup generator into a photovoltaic power system (see fig. 18). Additionally, Wiles teaches that the backup generator is connected to the charge controller, and therefore would provide power to the controller (see fig. 18).

9. Claims 14, 15, 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dorn et al. in view of Wiles et al. and Liu et al, as applied to Claims 1-13 and 16-18 above, and further in view of Takahara et al., U.S. Patent No. 6,101,073.

Regarding Claim 14, modified Dorn et al. teaches a solar power generation system as discussed above. Modified Dorn et al. does not teach that a challenge/response system is used.

Takahara et al. teaches a protection system for a solar power generation.

In one of the methods taught by Takahara, an output process (challenge) is sent to a controller to detect a ground fault (see claim 21). The controller is then sent another signal (response) based on the detection (see claim 21).

Therefore, it would be obvious to one of ordinary skill in the art to modify the control connection and disconnection steps in the method taught by Dorn et al. with the steps of Takahara because the Takahara system maintains safety in the system (see Dorn et al and paragraph 17).

Regarding Claim 15, Takahara et al. teaches the detection system that detects according to a set time (see abstract).

Regarding Claim 19, modified Dorn et al. teaches a solar power system as discussed above. Furthermore, Dorn et al. teaches that a computer may be used to reconfigure (i.e. connect and disconnect) the photovoltaic cells based on information (signal) provided by a detection circuit (see paragraph 21).

In particular, Dorn et al. teaches that the photovoltaic cells should be disconnected from the interconnection (power bus), if they become shaded, damaged, or if safety reasons have been implicated (see paragraph 24). Additionally, Dorn et al. teaches that this disconnection can be done through a controller (see paragraph 21) controlling a switching system. Finally, Dorn et al. teaches that the process can be monitored through an external computer, and thus is computer implemented, such as connecting the cells to the power bus through a computer. The central computer would be interpreted by the examiner as remote (see paragraph 24). The computer can be

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used to connect the modules to the power bus (see paragraph 24) by an optimized software algorithm (see paragraph 24). Thus, if the devices are reconnected by software, Dorn et al. must include a restart signal.

However, neither Dorn et al. nor Wiles teach a remotely located central controller in communication with the watchdog system.

Liu et al. teaches a solar photovoltaic system comprising a remotely located central controlled (44, see paragraph 34) to allow for communication with the various PV subsystems and to control a switching system, such as what is interpreted as the “watchdog” of Dorn et al. (see paragraph 34).

Therefore, it would be obvious to modify the PV system taught by modified Dorn et al. by integrating the remote central controller taught by Liu et al. because the central controller allows the monitoring and controlling of multiple PV subsystems simultaneously (see paragraph 34).

Modified Dorn et al. does not teach the specific method steps used to monitor the system.

Takahara teaches a protection system for a solar power generation.

Takahara teaches using a control unit (computing device) to monitor signal from a solar cell. If a ground fault is detected in the system (i.e. signal has been lost), which can occur when either no signal is sent of to the control unit, the system is disconnected, thus performing the claimed step of disconnecting one or more of the solar modules when incorporated with the computing device of Dorn et al. (see column,

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line). Furthermore, it can be interpreted that the occurrence of a ground fault can constitute the loss of signal.

Additionally, Takahara, an output process (challenge) is sent to a controller to detect a ground fault (see claim 21). The controller is then sent another signal (response) based on the detection (see claim 21). This ground fault detection can be considered to include a shutdown signal. Thus, Takahara additionally teaches the second part of the method.

Therefore, it would be obvious to one of ordinary skill in the art to modify the control connection and disconnection steps in the method taught by Dorn et al. with the steps of Takahara because the Takahara system maintains safety in the system (see Dorn et al and paragraph 17).

Regarding Claim 20, Dorn et al. teaches that the device may include a bypass circuit (see paragraph 24), which allows the power bus to be connected to other units (see paragraph 24).

Response to Arguments

Applicant's arguments with respect to claims 1-20 have been considered but are moot in view of the new ground(s) of rejection.

Additionally, the examiner would like to note that, to distinguish the claims from the prior art, Applicant should further specify how the local controller in the watchdog unit operates. At present, the only function the watchdog is required to perform in claim 1 is to connect the module with the power bus when the communication is not interrupted.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW T. MARTIN whose telephone number is (571)270-7871. The examiner can normally be reached on 8:30 to 5:00 EST Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Michener can be reached on (571)272-1424. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer K. Michener/
Supervisory Patent Examiner, Art Unit 1728

/MATTHEW T MARTIN/
Examiner, Art Unit 1728

Notice of References Cited	Application/Control No. 12/628,977		Applicant(s)/Patent Under Reexamination HADAR ET AL.	
	Examiner MATTHEW T. MARTIN		Art Unit 1728	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2010/0057267	03-2010	Liu et al.	700/297
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

<i>Index of Claims</i> 	Application/Control No. 12628977	Applicant(s)/Patent Under Reexamination HADAR ET AL.
	Examiner MATTHEW T MARTIN	Art Unit 1795

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant					☐ CPA					☐ T.D.					☐ R.1.47				
CLAIM		DATE																	
Final	Original	06/02/2010	11/17/2010	05/05/2011															
	1	✓	✓	✓															
	2	✓	✓	✓															
	3	✓	✓	✓															
	4	✓	✓	✓															
	5	✓	✓	✓															
	6	✓	✓	✓															
	7	✓	✓	✓															
	8	✓	✓	✓															
	9	✓	✓	✓															
	10	✓	✓	✓															
	11	✓	✓	✓															
	12	✓	✓	✓															
	13	✓	✓	✓															
	14	✓	✓	✓															
	15	✓	✓	✓															
	16	✓	✓	✓															
	17	✓	✓	✓															
	18	✓	✓	✓															
	19	✓	✓	✓															
	20	✓	✓	✓															

Search Notes 	Application/Control No. 12628977	Applicant(s)/Patent Under Reexamination HADAR ET AL.
	Examiner MATTHEW T MARTIN	Art Unit 1795

SEARCHED			
Class	Subclass	Date	Examiner
136	243, 244, 251	5/24/2010	mtm
307	19, 20, 64-66	5/24/2010	mtm

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	6/2/2010	mtm
NPL Search	5/24/2010, 6/2/2010	mtm
EAST Search	5/24/2010, 6/2/2010	mtm
Updated Search	11/17/2010, 5/5/2011	mtm

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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EAST Search History**EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	24	((RON) near2 (HADAR)).INV.	US-PGPUB; USPAT	OR	OFF	2011/05/05 10:31
L2	23	((SHMUEL) near2 (ARDITI)).INV.	US-PGPUB; USPAT	OR	OFF	2011/05/05 10:31
L3	333	solar near4 module same connect\$3 same inverter	US-PGPUB; USPAT	OR	ON	2011/05/05 10:51
L4	23	I3 and communication same controller	US-PGPUB; USPAT	OR	ON	2011/05/05 10:51
L5	16	I3 and communication same controller and (shutdown or disconnect)	US-PGPUB; USPAT	OR	ON	2011/05/05 10:57
L6	1	I3 and communication same controller and (shutdown or disconnect) same verif \$4	US-PGPUB; USPAT	OR	ON	2011/05/05 11:08
L7	2	solar near4 module same connect\$3 same inverter and remote near5 controller	US-PGPUB; USPAT	OR	ON	2011/05/05 11:19
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EAST Search History (I nterference)

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5/ 5/ 2011 12:28:02 PM**C:\ Documents and Settings\ mmartin\ My Documents\ EAST\ Workspaces\ 12628977. wsp**

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1728		
	Examiner Name	MARTIN, MATTHEW T		
	Attorney Docket Number	108144-202701/US (TGY027)		

U.S. PATENTS							Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	
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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	
MTM	1	20110061713		2011-03-17	Powell et al		

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	12628977
Filing Date	2009-12-01
First Named Inventor	Ron Hadar
Art Unit	1728
Examiner Name	MARTIN, MATTHEW T
Attorney Docket Number	108144-202701/US (TGY027)

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Examiner Signature	/MATTHEW T MARTIN/	Date Considered	5/5/2011
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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Ron Hadar	Examiner:	MATTHEW T. MARTIN
Serial No.:	12/628,977	Group Art Unit:	1728
Filed:	December 1, 2009	Confirmation:	6958
Title:	SYSTEMS AND METHODS FOR AN ENHANCED WATCHDOG IN SOLAR MODULE INSTALLATIONS		

NOTICE OF RELATED APPLICATIONS

Applicant is hereby providing notice that the subject patent application is related to the patent applications listed below. Applicant respectfully requests the Examiner to review the history of these related applications, including the current claims, and Office Actions and Notices of Allowance:

1. U.S. Patent Application Serial No. 12/254,780, filed October 10, 2008, entitled "Apparatuses and Methods to Reduce Safety Risks Associated with Photovoltaic Systems," now U.S. Patent No. 7,884,278.
2. U.S. Patent Application Serial No. 12/366,597, filed February 5, 2009, entitled "Apparatuses and Methods to Reduce Safety Risks Associated with Photovoltaic Systems," now U.S. Patent No. 7,807,919.
3. U.S. Patent Application Serial No. 12/948,614, filed November 17, 2010, entitled "Apparatuses and Methods to Reduce Safety Risks Associated with Photovoltaic Systems."
4. U.S. Patent Application Serial No. 13/073,915, filed March 28, 2011, entitled "Systems and Methods for Remote or Local Shut-Off of a Photovoltaic System."
5. U.S. Patent Application Serial No. 13/092,783, filed April 22, 2011, entitled "System and Method for an Enhanced Watch Dog in Solar Panel Installations."

A copy of the current transaction history retrieved from the USPTO Patent Application Information Retrieval (PAIR) system for the above-referenced patent applications and any granted patent are attached hereto.

Respectfully submitted,

Date: May 26, 2011

/John P. Ward/
John Ward
Reg. No. 40,216

GREENBERG TRAURIG, LLP
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Fax: (650) 328-8508

APPARATUSES AND METHODS TO REDUCE SAFETY
12/254,780 RISKS ASSOCIATED WITH PHOTOVOLTAIC
SYSTEMS

05-25-
2011::18:29:05

Transaction History

Date	Transaction Description
02-08-2011	Recordation of Patent Grant Mailed
01-20-2011	Email Notification
01-19-2011	Issue Notification Mailed
02-08-2011	Patent Issue Date Used in PTA Calculation
01-03-2011	Dispatch to FDC
01-03-2011	Application Is Considered Ready for Issue
12-30-2010	Response to Reasons for Allowance
12-30-2010	Issue Fee Payment Verified
12-30-2010	Issue Fee Payment Received
12-21-2010	Email Notification
12-16-2010	Mail PUB Notice of non-compliant IDS
12-14-2010	PUB Notice of non-compliant IDS
12-13-2010	Information Disclosure Statement considered
12-13-2010	Information Disclosure Statement (IDS) Filed
10-29-2010	Electronic Review
10-29-2010	Email Notification
10-29-2010	Email Notification
10-29-2010	Mail Examiner's Amendment
10-29-2010	Mail Notice of Allowance
10-25-2010	Notice of Allowance Data Verification Completed
10-25-2010	Case Docketed to Examiner in GAU
10-25-2010	Document Verification
10-25-2010	Examiner's Amendment Communication
08-10-2010	Information Disclosure Statement considered
10-06-2010	Case Docketed to Examiner in GAU
09-01-2010	Date Forwarded to Examiner
08-27-2010	Response after Non-Final Action
08-10-2010	Electronic Information Disclosure Statement
08-10-2010	Information Disclosure Statement (IDS) Filed
06-01-2010	Electronic Review
05-28-2010	Email Notification
05-28-2010	Mail Non-Final Rejection

05-24-2010	Non-Final Rejection
05-10-2010	Information Disclosure Statement considered
09-22-2009	Information Disclosure Statement considered
09-22-2009	Information Disclosure Statement considered
05-26-2009	Information Disclosure Statement considered
05-10-2010	Information Disclosure Statement (IDS) Filed
05-11-2010	Email Notification
05-11-2010	Filing Receipt - Corrected
04-28-2010	Preliminary Amendment
03-17-2010	Corrected filing receipt
03-17-2010	Rule 47 / 48 Correction of Inventorship Papers Filed
03-29-2010	Electronic Review
03-29-2010	Email Notification
03-29-2010	PG-Pub Request
01-20-2010	PGPubs early publication request
09-22-2009	Electronic Information Disclosure Statement
02-17-2010	Email Notification
02-04-2010	Mail-Record Petition Decision of Granted to Make Special
02-03-2010	Record Petition Decision of Granted to Make Special
01-20-2010	Petition Entered
07-13-2009	Preliminary Amendment
08-21-2009	Preliminary Amendment
09-22-2009	Information Disclosure Statement (IDS) Filed
09-22-2009	Information Disclosure Statement (IDS) Filed
08-11-2009	Case Docketed to Examiner in GAU
08-04-2009	Case Docketed to Examiner in GAU
05-26-2009	Miscellaneous Incoming Letter
05-26-2009	Electronic Information Disclosure Statement
05-26-2009	Information Disclosure Statement (IDS) Filed
05-13-2009	Case Docketed to Examiner in GAU
05-07-2009	PG-Pub Issue Notification
02-24-2009	IFW TSS Processing by Tech Center Complete
02-24-2009	Case Docketed to Examiner in GAU
01-08-2009	Oath or Declaration Filed (Including Supplemental)
11-25-2008	Application Dispatched from OIPE
11-05-2008	Sent to Classification Contractor

11-05-2008 Filing Receipt
10-23-2008 Cleared by OIPE CSR
10-22-2008 IFW Scan & PACR Auto Security Review
10-20-2008 Initial Exam Team nn

APPARATUSES AND METHODS TO REDUCE SAFETY
 12/366,597 RISKS ASSOCIATED WITH PHOTOVOLTAIC
 SYSTEMS

05-25-
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Transaction History

Date	Transaction Description
10-05-2010	Recordation of Patent Grant Mailed
09-16-2010	Email Notification
09-15-2010	Issue Notification Mailed
10-05-2010	Patent Issue Date Used in PTA Calculation
09-07-2010	Dispatch to FDC
08-30-2010	Application Is Considered Ready for Issue
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08-24-2010	Issue Fee Payment Received
08-24-2010	Email Notification
08-24-2010	Mail Notice of Allowance
08-18-2010	Document Verification
08-18-2010	Notice of Allowance Data Verification Completed
08-18-2010	Case Docketed to Examiner in GAU
07-30-2010	Examiner Interview Summary Record (PTOL - 413)
08-12-2010	Date Forwarded to Examiner
07-30-2010	Response after Non-Final Action
07-20-2010	Electronic Review
07-20-2010	Email Notification
07-20-2010	Mail Non-Final Rejection
07-06-2010	Non-Final Rejection
06-24-2010	Information Disclosure Statement considered
06-24-2010	Reference capture on IDS
06-24-2010	Electronic Information Disclosure Statement
06-26-2010	Date Forwarded to Examiner
06-24-2010	Request for Continued Examination (RCE)
06-26-2010	Disposal for a RCE / CPA / R129
06-24-2010	Information Disclosure Statement (IDS) Filed
06-24-2010	Workflow - Request for RCE - Begin
03-24-2010	Electronic Review
03-24-2010	Email Notification
03-24-2010	Mail Final Rejection (PTOL - 326)

03-20-2010	Final Rejection
01-04-2010	Miscellaneous Incoming Letter
01-24-2010	Date Forwarded to Examiner
12-18-2009	Supplemental Response
01-21-2010	Response after Non-Final Action
01-06-2010	Electronic Review
01-06-2010	Email Notification
01-06-2010	Mail Non-Final Rejection
01-03-2010	Non-Final Rejection
11-25-2009	Information Disclosure Statement considered
12-28-2009	Email Notification
12-28-2009	Mail Examiner Interview Summary (PTOL - 413)
12-18-2009	Examiner Interview Summary Record (PTOL - 413)
11-25-2009	Electronic Information Disclosure Statement
11-28-2009	Date Forwarded to Examiner
11-25-2009	Request for Continued Examination (RCE)
11-28-2009	Disposal for a RCE / CPA / R129
11-25-2009	Information Disclosure Statement (IDS) Filed
11-25-2009	Workflow - Request for RCE - Begin
08-28-2009	Electronic Review
08-28-2009	Email Notification
08-28-2009	Mail Final Rejection (PTOL - 326)
08-17-2009	Final Rejection
08-07-2009	Date Forwarded to Examiner
07-13-2009	Response after Non-Final Action
07-02-2009	Mail Examiner Interview Summary (PTOL - 413)
06-30-2009	Examiner Interview Summary Record (PTOL - 413)
05-22-2009	Miscellaneous Incoming Letter
05-22-2009	Electronic Information Disclosure Statement
06-16-2009	Mail Non-Final Rejection
06-08-2009	Non-Final Rejection
02-05-2009	Information Disclosure Statement considered
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05-22-2009	Information Disclosure Statement (IDS) Filed
05-13-2009	Mail-Record Petition Decision of Granted to Make Special

05-12-2009	Record Petition Decision of Granted to Make Special
04-21-2009	Petition Entered
04-06-2009	Mail-Petition Decision - Dismissed
04-06-2009	Petition Decision - Dismissed
02-05-2009	Petition Entered
03-31-2009	Case Docketed to Examiner in GAU
03-17-2009	IFW TSS Processing by Tech Center Complete
02-05-2009	Reference capture on IDS
02-05-2009	Electronic Information Disclosure Statement
02-13-2009	Application Dispatched from OIPE
02-13-2009	Filing Receipt
02-06-2009	Accelerated Examination Request
02-06-2009	Cleared by OIPE CSR
02-05-2009	Information Disclosure Statement (IDS) Filed
02-05-2009	Initial Exam Team nn

12/948,614 Apparatuses and Methods to Reduce Safety Risks Associated with Photovoltaic Systems 05-25-2011::18:42:36

Transaction History

Date	Transaction Description
04-14-2011	Electronic Information Disclosure Statement
04-14-2011	Information Disclosure Statement (IDS) Filed
03-18-2011	Email Notification
03-17-2011	PG-Pub Issue Notification
11-18-2010	Electronic Information Disclosure Statement
12-13-2010	Electronic Information Disclosure Statement
12-13-2010	Information Disclosure Statement (IDS) Filed
12-06-2010	Application Is Now Complete
12-06-2010	Email Notification
12-03-2010	Application Dispatched from OIPE
12-06-2010	Filing Receipt
11-22-2010	Cleared by OIPE CSR
11-18-2010	Information Disclosure Statement (IDS) Filed
11-17-2010	IFW Scan & PACR Auto Security Review
11-17-2010	Initial Exam Team nn

13/073,915 Systems and Methods for Remote or Local Shut-Off of a
Photovoltaic System

05-25-
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Transaction History

Date	Transaction Description
04-29-2011	Application Dispatched from OIPE
04-08-2011	Application Is Now Complete
04-08-2011	Email Notification
04-07-2011	Sent to Classification Contractor
04-08-2011	Filing Receipt
03-28-2011	Applicants have given acceptable permission for participating foreign
03-31-2011	Information Disclosure Statement (IDS) Filed
03-30-2011	Cleared by OIPE CSR
03-29-2011	IFW Scan & PACR Auto Security Review
03-28-2011	Initial Exam Team nn

13/092,783 System and Method for Enhanced Watch Dog in Solar Panel 05-25-
Installations 2011::18:59:26

Transaction History

Date	Transaction Description
05-06-2011	Electronic Review
05-06-2011	Email Notification
05-06-2011	Email Notification
05-06-2011	Notice Mailed--Application Incomplete--Filing Date Assigned
05-06-2011	Filing Receipt
04-26-2011	Cleared by OIPE CSR
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04-22-2011	Initial Exam Team nn



US007807919B2

(12) **United States Patent**
Powell et al.

(10) **Patent No.:** **US 7,807,919 B2**
(45) **Date of Patent:** **Oct. 5, 2010**

(54) **APPARATUSES AND METHODS TO REDUCE SAFETY RISKS ASSOCIATED WITH PHOTOVOLTAIC SYSTEMS**

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(75) Inventors: **Earl G. Powell**, Sunnyvale, CA (US); **Ron Hadar**, Cupertino, CA (US); **Dan Kikinis**, Saratoga, CA (US); **Shmuel Ardit**, Los Gatos, CA (US)

(Continued)

(73) Assignee: **Tigo Energy, Inc.**, Los Gatos, CA (US)

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

AU 2005262278 7/2005

(21) Appl. No.: **12/366,597**

(Continued)

(22) Filed: **Feb. 5, 2009**

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(65) **Prior Publication Data**

US 2009/0133736 A1 May 28, 2009

“Relays” website, <http://www.kpsec.freeuk/components/relay.htm> from Aug. 16, 2003, available from www.archive.org. (3 pages).*

Related U.S. Application Data

(Continued)

(63) Continuation of application No. 12/254,780, filed on Oct. 20, 2008.

Primary Examiner—Jeffrey T Barton

(60) Provisional application No. 61/001,587, filed on Nov. 2, 2007.

(74) Attorney, Agent, or Firm—Greenberg Traurig, LLP

(51) **Int. Cl.**
H01L 31/00 (2006.01)

(52) **U.S. Cl.** **136/244**

(58) **Field of Classification Search** 136/243–265;
200/506; 439/135–150, 152–160
See application file for complete search history.

(57) **ABSTRACT**

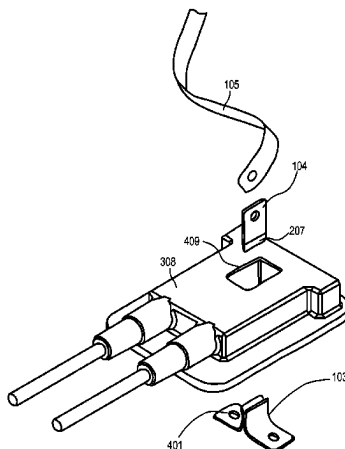
Apparatuses and methods to reduce safety risks associated with photovoltaic systems by providing a safety switch on a photovoltaic panel. In one embodiment, a photovoltaic panel includes: at least one photovoltaic cell; a connector to output energy from the photovoltaic panel; and a switch coupled between the at least one photovoltaic cell and the connector. The switch is configured to disconnect the at least one photovoltaic cell from the connector during installation of the photovoltaic panel, and to connect the at least one photovoltaic cell with the connector after installation of the photovoltaic panel.

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6 Claims, 6 Drawing Sheets



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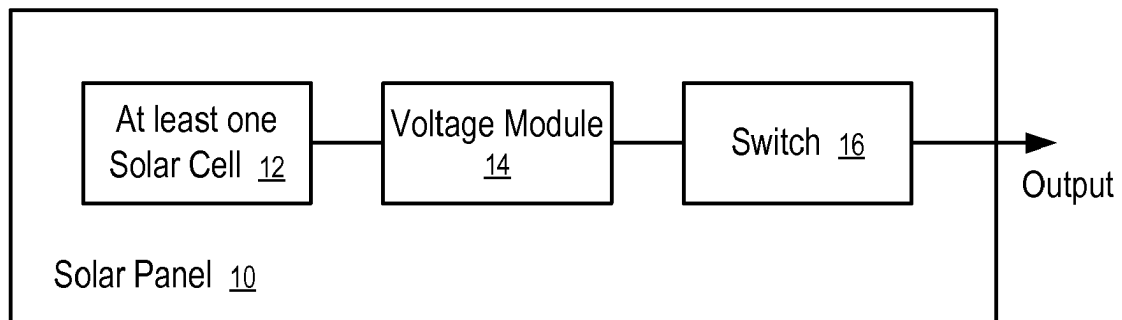


FIG. 1

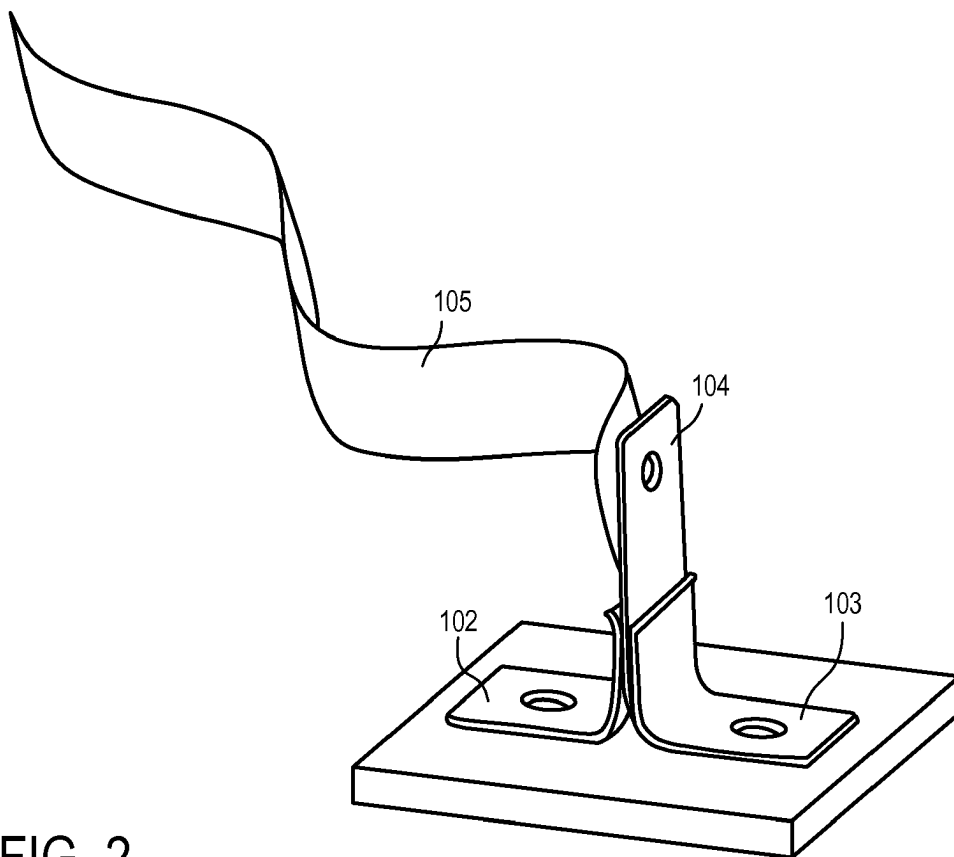


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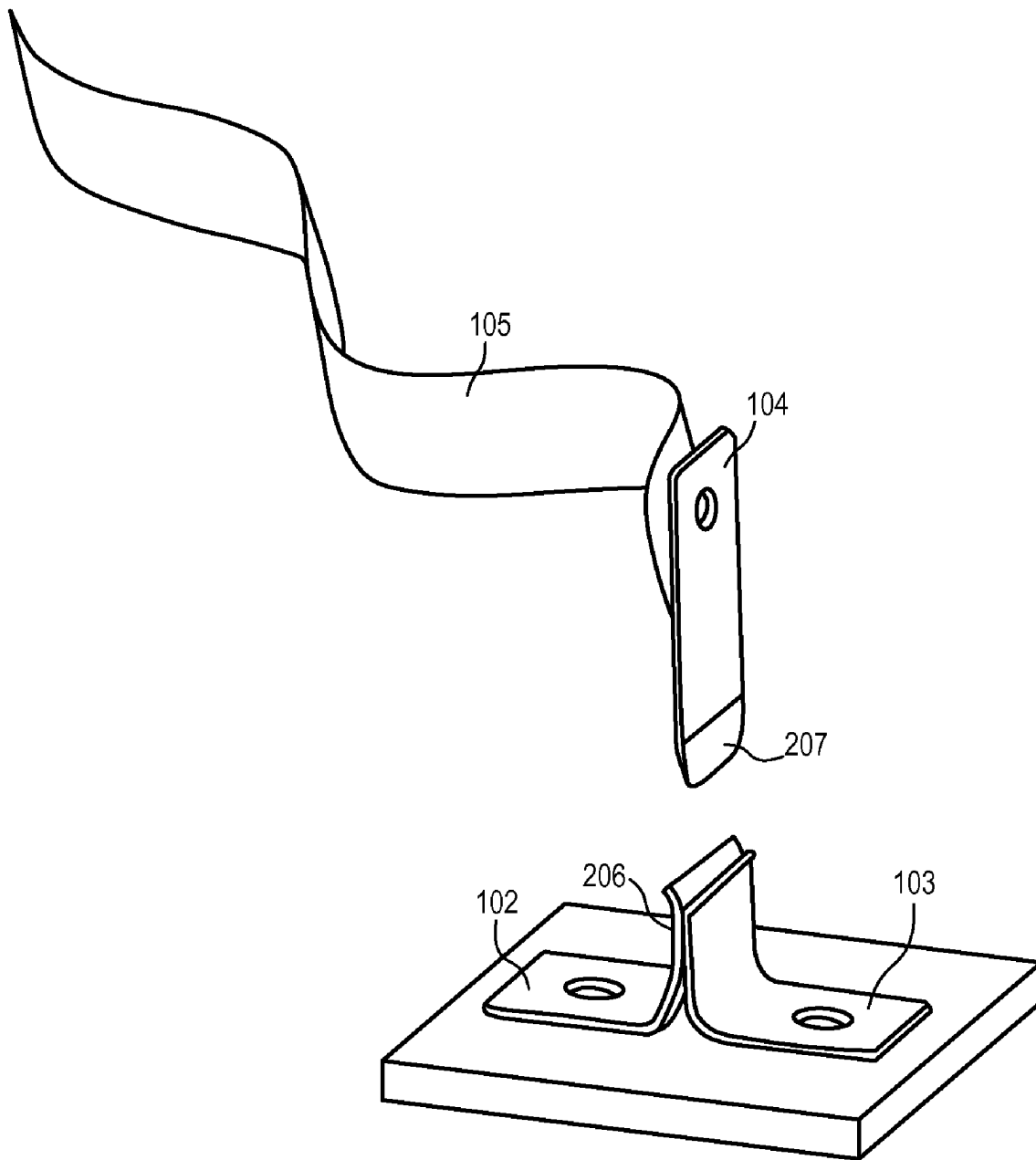


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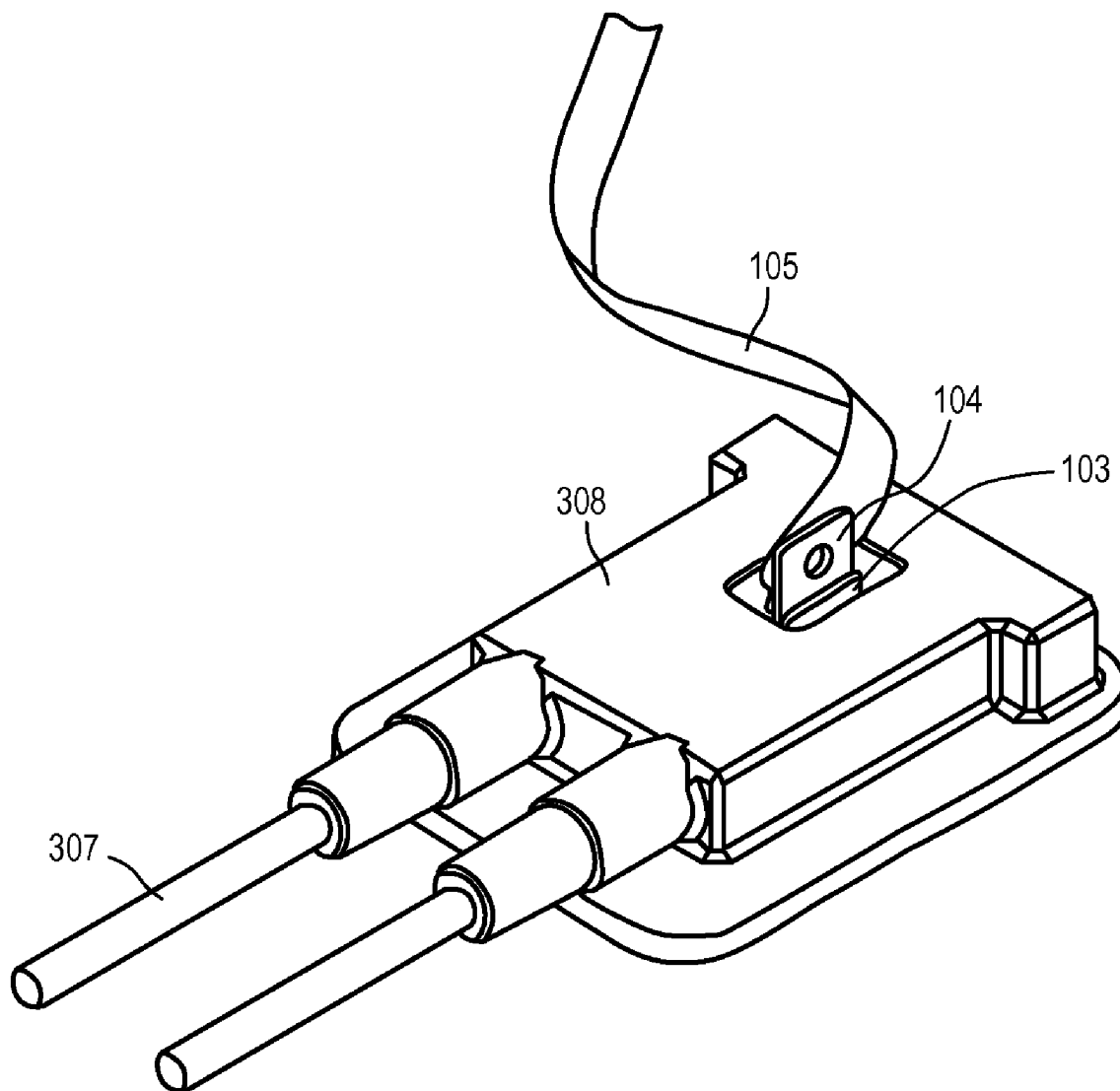


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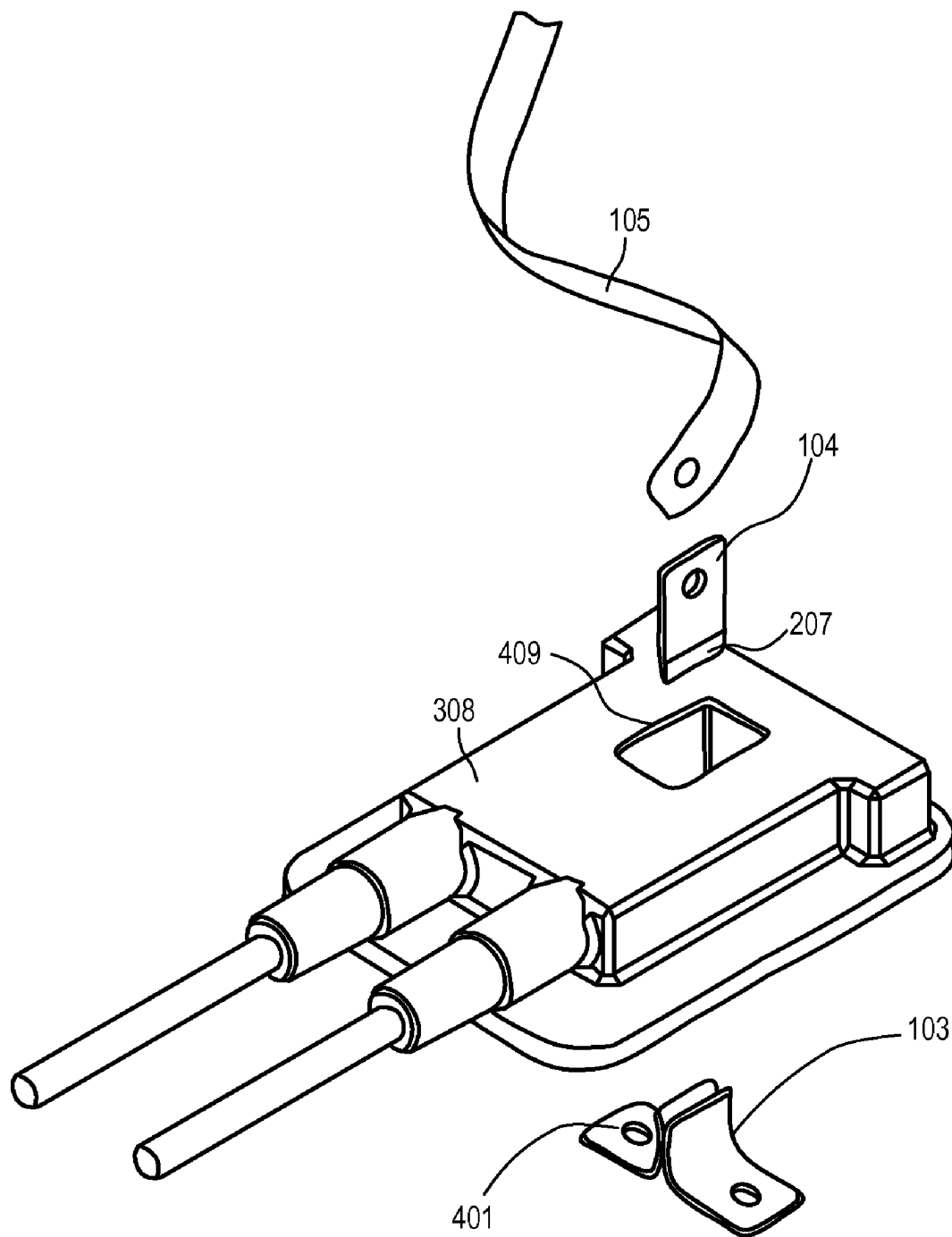


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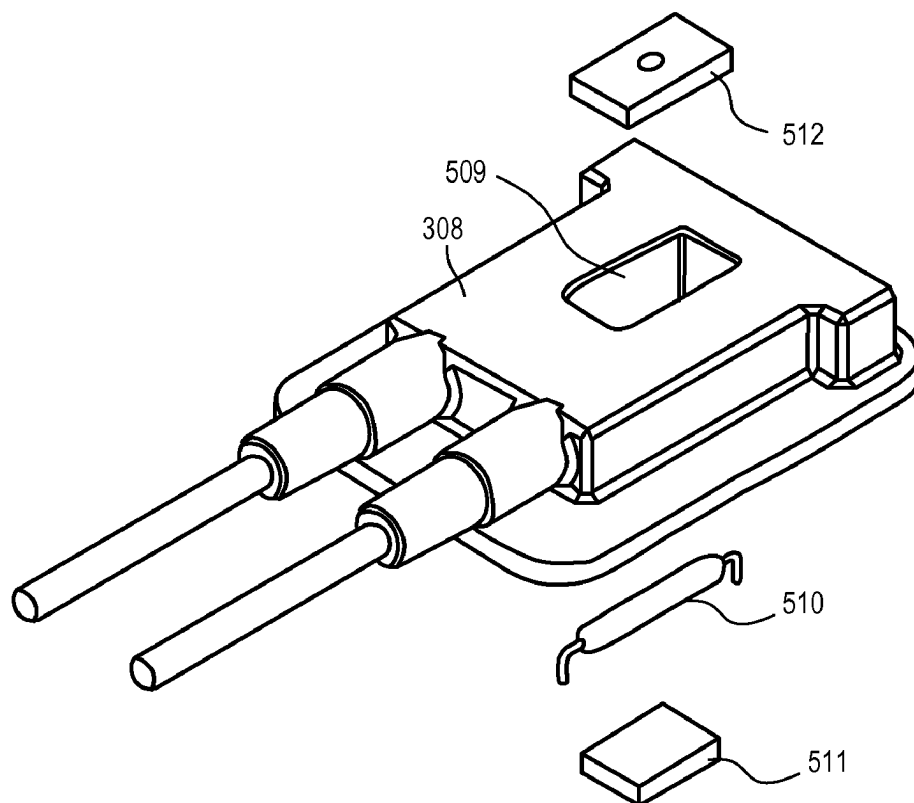


FIG. 6

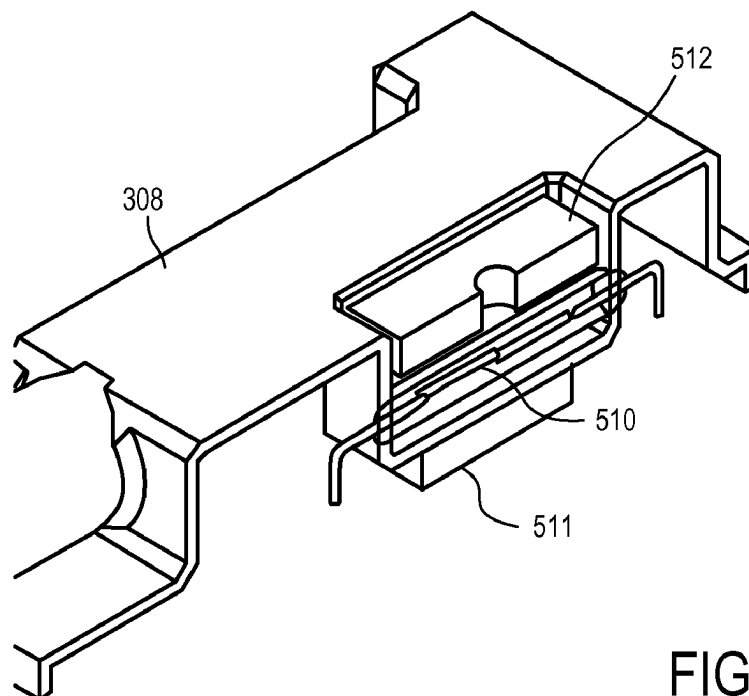


FIG. 7

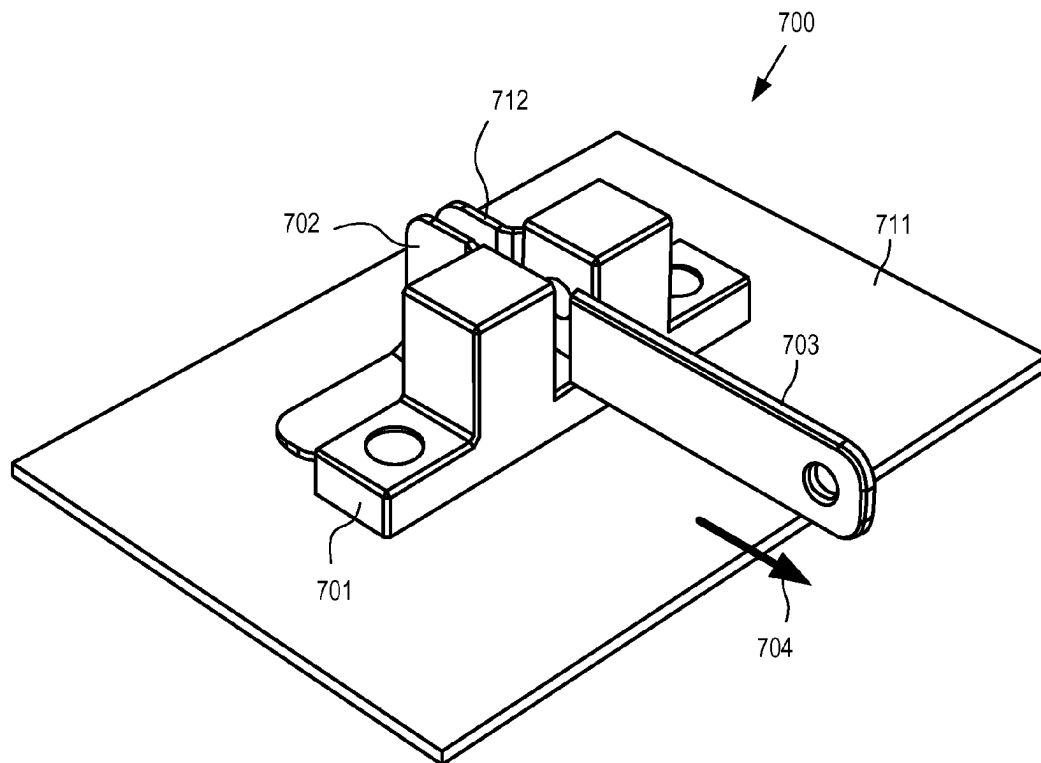


FIG. 8

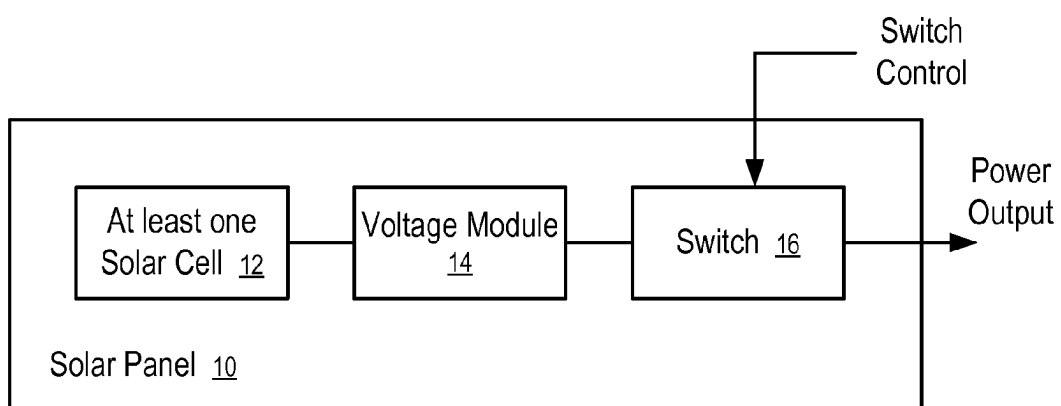


FIG. 9

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APPARATUSES AND METHODS TO REDUCE SAFETY RISKS ASSOCIATED WITH PHOTOVOLTAIC SYSTEMS

RELATED APPLICATIONS

The present application is a continuation application of a copending U.S. patent application Ser. No. 12/254,780, filed Oct. 20, 2008, which claims priority to provisional U.S. Patent Application Ser. No. 61/001,587, filed on Nov. 2, 2007 and entitled "Photovoltaic Safety Switch." The disclosures of the above referenced applications are hereby incorporated herein by reference.

FIELD OF THE TECHNOLOGY

At least some embodiments disclosed herein relate to photovoltaic systems in general and, more particularly but not limited to, safety devices for the shipment, installation and/or maintenance of photovoltaic systems.

BACKGROUND

When a photovoltaic panel or laminate is exposed to direct or diffuse light, a lethal voltage potential may be present. In the United States the possible voltage could be as high as 600 volts, while in Europe and the rest of the world this voltage could approach a kilovolt.

Because of this potential danger from electrical shock, solar panel manufacturers and code and standards development organizations have made some recommendations to minimize or eliminate this danger.

One suggestion has been to cover the photovoltaic panel with an opaque material such as a tarpaulin. However, this approach proposes its own safety risk from having the wind catch the tarpaulin and pull installation personnel off the roof as they try to control the unstable sheet material against the wind.

Another recommendation is to install and/or service the photovoltaic panels at night when there is minimal risk of the panels being energized. This approach presents the potential safety risks associated from working in a poorly lighted environment.

In addition to the potential personnel safety issues there are also significant risks to equipment and hardware. Connecting or disconnecting energized plugs can cause arcing and damage to these connectors, junction boxes, and other electrical components.

SUMMARY OF THE DESCRIPTION

Apparatuses and methods to reduce safety risks associated with photovoltaic systems by providing a safety switch on a photovoltaic panel. Some embodiments are summarized in this section.

In one embodiment, a photovoltaic panel includes: at least one photovoltaic cell; a connector to output energy from the photovoltaic panel; and a switch coupled between the at least one photovoltaic cell and the connector. The switch is configured to disconnect the at least one photovoltaic cell from the connector during installation of the photovoltaic panel, and to connect the at least one photovoltaic cell with the connector after installation of the photovoltaic panel.

In one embodiment, the photovoltaic panel further includes a junction box to host the connector, wherein the switch is integrated in the junction box.

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In one embodiment, the switch includes a first conductive contactor, a second conductive contactor, and a removable portion which when removed connects the at least one photovoltaic cell with the connector. For example, the removable portion may include a dielectric separator; when the dielectric separator is inserted between the first and second contactor, the switch is not connected; and when the dielectric separator is removed, the switch is connected. In one embodiment, the first and second conductive contactors are spring loaded toward each other.

In one embodiment, the removable portion further includes a flag attached to the dielectric separator. The flag may have a visual indication of warning for electric shock.

In one embodiment, the switch includes a reed switch; and the removable portion includes a magnet. The reed switch may be a normally closed reed switch, or normally open reed switch.

In one embodiment, the switch includes an optical sensor to turn on or off the switch based on light detected by the optical sensor; and the removable portion includes a pull-tab configured to shield the optical sensor. The at least one photovoltaic cell may be used to power the optical sensor.

In one embodiment, the switch further includes a semiconductor switch device (e.g., a Field-Effect Transistor (FET)) or a relay.

In one embodiment, the switch includes a relay and a wiring connector to control the relay from a remote location.

In one embodiment, the photovoltaic panel further includes a circuit to detect a load from an inverter. The switch is to connect an output of the photovoltaic panel to the connector when the circuit detects a load from an inverter and to disconnect the output in absence of a load from an inverter.

In one embodiment, a photovoltaic panel module includes: a voltage module to adjust an output of a plurality of photovoltaic cells; and a switch coupled of the voltage module to selectively provide the output. In one embodiment, the voltage module outputs an alternating current (AC) output. The switch may include a semiconductor switch, a relay, a reed switch, a spring loaded switch, and/or an optical sensor to control a state of the switch.

In one embodiment, the photovoltaic panel module further includes connectors for wirings to control a state of the switch.

The disclosure includes methods and apparatuses which perform these methods, including data processing systems which perform these methods, and computer readable media containing instructions which when executed on data processing systems cause the systems to perform these methods.

Other features will be apparent from the accompanying drawings and from the detailed description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments are illustrated by way of example and not limitation in the figures of the accompanying drawings in which like references indicate similar elements.

FIG. 1 illustrates a solar panel having a safety switch according to one embodiment.

FIGS. 2-5 illustrate a spring loaded safety switch for a photovoltaic panel according to one embodiment.

FIGS. 6-7 illustrate a junction box with a reed switch for a photovoltaic panel according to one embodiment.

FIG. 8 illustrates an optical sensor to control a safety switch for a photovoltaic panel according to one embodiment.

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FIG. 9 illustrates a solar panel having a safety switch controlled via auxiliary wiring according to one embodiment.

DETAILED DESCRIPTION

The following description and drawings are illustrative and are not to be construed as limiting. Numerous specific details are described to provide a thorough understanding. However, in certain instances, well known or conventional details are not described in order to avoid obscuring the description. References to one or an embodiment in the present disclosure are not necessarily references to the same embodiment; and, such references mean at least one.

One embodiment of the disclosure provides a method and system to reduce the safety risks during the shipment, installation and/or maintenance of photovoltaic systems, without introducing the risks associated with other approaches, such as covering them with an opaque material or working on them at night.

In one embodiment, safety protection is provided via the inclusion of a normally closed switch integral to the panel junction box or integral to the panel module when alternating current (AC) or direct current (DC) modules are used.

FIG. 1 illustrates a solar panel having a safety switch according to one embodiment. In FIG. 1, a solar panel 10 (e.g., a photovoltaic panel) includes at least one solar cell 12 (e.g., a photovoltaic cell) to generate power when exposed to direct or diffuse light, in some cases a voltage module 14 to adjust or regulate the output voltage (or in some other cases a current module to regulate current), and a switch 16 to selectively isolate the solar cell 12 from the output connectors of the solar panel. In yet other cases, the switch may be incorporated into regulator modules, such as voltage module 14.

In one embodiment, the switch 16 is a normally closed switch. During the shipment, installation and/or maintenance, the switch 16 is placed in an open state to isolate the solar cell 12 from the output. After the installation or maintenance, the switch 16 is placed into a closed state to allow the solar cell 12 to energize the output connectors of the solar panel and to supply power through the output connectors of the solar panel.

The switch 16 and the voltage module can be integrated into the junction box of the solar panel. In some embodiment, the switch 16 is integrated with the voltage module 14 as a panel module.

FIGS. 2-5 illustrate a spring loaded safety switch for a photovoltaic panel according to one embodiment. In FIGS. 2-5, the switch includes two contactors 102 and 103 made of a conductive metal or plated hybrid. The contactors 102 and 103 are normally made of a spring alloy metal or have an integral spring plunger design (not shown). The contactors 102 and 103 are positioned or fixed in such a way that the two contacts 102 and 103 are spring loaded toward each other to maintain electrical continuity between the two contactors 102 and 103. Thus, the switch is normally closed (NC) and not in a safe mode for installation or maintenance.

In FIG. 2, a safe mode for installation or maintenance is achieved when the blade 104 is inserted between the two contactors 102 and 103. The blade 104 is manufactured from a dielectric material and when inserted between the two contactors 102 and 103 there is no electrical continuity between the contactors 102 and 103.

As illustrated in FIG. 2, the blade 104 may also have a flag 105 attached. The flag 105 could be red or some other highly visible color, to provide a visual indicator of the state of the panel.

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In one embodiment, the panels and/or panel with integral modules would come shipped from the factory with the blade 104 and the flag 105, where the blade 104 is inserted between the two contactors 102 and 103. The panels would be installed and integrated with the blade 104 present and flag 105 visible. The installer would mount, secure, and plug in all of the connections in the system, including the grounding.

As illustrated in FIG. 3, once the installation is completed the installer would remove the blades 104 at all those places indicated by the flags 105. Once the blade 104 is removed, the spring loaded contactors 102 and 103 contact each other to provide an electric path from the photovoltaic cells to the output connectors of the photovoltaic panel.

If additional work or troubleshooting were needed, the blade(s) 104 and flag(s) 105 could be reinserted, aided by the tapered section 207 of the blade 104, thereby breaking the electrical continuity between the contactors 102 and 103 at point 206.

In some embodiments, there is symmetry in contactors 102 and 103. In other embodiments, the contactors 102 and 103 are not identical or even similar. The contactors 102 and 103 are made of electrically conductive material and configured to be in physical contact with each other so that an electrically conductive path 206 is maintained, after the blade 104 is removed. In at least some embodiments, the electrical conductive path 206 is maintained without the blade 104 being inserted between the contactors 102 and 103, then disrupted by the blade 104 inserted between the contactors 102 and 103, and then reestablished by the reinsertions of a dielectric device such as the blade 104.

In addition to the visual indication of the modes of the panels provided by the flag(s) 105, the flags could also provide information in the form of text, such as, for example, "Remove before operation" or a warning of potentially lethal voltage.

FIG. 4 illustrates a configuration of a spring loaded switch integrated with a junction box 308 of a photovoltaic panel. The junction box 308 includes a connector to connect the solar power generated by the photovoltaic panel to a load (e.g., an inverter, a voltage bus, etc.) via a cable 307. Thus, when the blade 104 is inserted into the switch, with the flag 105 visible, the voltage generated by the solar cells is isolated from the connector for the cable 307; and thus it is safe to install the photovoltaic panel or to perform maintenance operations on the photovoltaic panel.

FIG. 5 shows the components of the spring loaded switch and the junction box of a photovoltaic panel. As illustrated in FIG. 5, the junction box 308 has an opening 409, which provides access to remove the blade 104 and/or to re-insert the blade 104. The contactors 103 of the switch can be attached to the junction box 308 via fastening the portion 401 to a supporting member of the junction box 308, such as a printed circuit board (PCB).

FIGS. 6-7 illustrate a junction box with a reed switch for a photovoltaic panel according to one embodiment. FIG. 6 shows an assembly of a reed switch 510 and magnets for integrated into the photovoltaic junction box 308. FIG. 7 shows a cut-away section illustrating the reed switch 510 and the magnets 511 and 512 installed within the portion 509 of the junction box 308.

In FIG. 7, a reed switch 510 is made normally closed by integrating a stationary biasing magnet 511 into the junction box 308 in close proximity to the normally open reed switch, so that the switch 510 is closed in absence of the magnet 512.

In one embodiment, the magnet 512 is inserted into the junction box well 509 so that the reversed polarity cancels the magnetic lines of force and the reed switch 510 opens.

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In one embodiment, the magnet **512** is installed in the junction box well **509** at the factory; and a flag **105** (not shown in FIGS. **6** and **7**) is attached to the magnet **512**. The magnet **512** is removable and/or re-insertable via the junction box well **509**.

In other embodiments, normally closed (NC) reed contacts can be used to replace the normally open (NO) reed contacts **510** and the magnet **511**, avoiding the need for the additional stationary magnet.

Once the installation and integrations are complete the magnet **512** is removed and may be discarded. The power leads of the junction box **308** can then be energized via the semiconductor switch or relay (not shown), when the reed switch **512** is in the closed state.

In some cases, a semiconductor switch (not shown in FIG. **7**) can be used to energize the power leads of the junction box **308**. The panel junction box **308** or inverter (not shown in FIG. **7**) may include a controller unit with a watchdog circuit configured to send a signal periodically (e.g., every time interval *t*) to maintain the connection of the panel outputs to the string. When this signal is timed-out or is absent, the panel outputs of the panel are disconnected via a semiconductor switch device (not shown).

FIG. **8** illustrates an optical sensor to control a safety switch for a photovoltaic panel according to one embodiment. In FIG. **8**, an optical sensor unit **700** with an optical sensor **701** is mounted on a printed circuit board (PCB) **711**. Additionally, springs **702** and **712** hold a separator **703** in place that can be removed in direction of arrow **704** using a pull-tab similar to the flag **105** discussed earlier. Not shown in FIG. **8** is the exterior enclosure that would contain the mechanical elements such as the cable connections and the guide elements for guiding separator **703** in and out of the unit.

In one embodiment, additional circuitry (not shown in FIG. **8**) will be on the side of the PCB **711**, such as a control circuit to affect an on/off switching either in some cases by FET (Field-Effect Transistor) transistors or using, in other cases, a relay, such as a bi-stable relay or another suitable circuit. The operational power may be drawn from the solar system itself, or it may be brought up by auxiliary wiring.

In yet some other embodiments, a relay can be simply remote controlled by an auxiliary wire to close or open the circuit. The advantage of this approach is that no pull-tabs (flags or blades) can be forgotten on the roof.

In one embodiment, a mechanism and/or circuitry is integrated in the panel to identify the load from the inverter and connect the panel to the panel outputs when the load is detected. When no load is present the panel outputs is disconnected. This functionality would also be implemented using a semiconductor switch device or other suitable device (such as a relay), and some sensor circuitry, allowing an automatic reconnect when the loop appears to be closed and a load connected.

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FIG. **9** illustrates a solar panel having a safety switch controlled via auxiliary wiring according to one embodiment. In FIG. **9**, a separate wire is connected to control the switch **16** from a remote location. For example, the switch may be controlled via a signal from a watchdog circuit, from a remote switch or controller, etc.

In the foregoing specification, the disclosure has been described with reference to specific exemplary embodiments thereof. It will be evident that various modifications may be made thereto without departing from the broader spirit and scope as set forth in the following claims. The specification and drawings are, accordingly, to be regarded in an illustrative sense rather than a restrictive sense.

What is claimed is:

1. A photovoltaic panel, comprising:
 - at least one photovoltaic cell disposed on the photovoltaic panel;
 - a connector to output energy from the at least one photovoltaic cell of the photovoltaic panel;
 - a junction box to host the connector of the photovoltaic panel; and
 - a safety switch integrated with the junction box of the photovoltaic panel and coupled between the at least one photovoltaic cell and the connector, the safety switch comprising a relay and a second switch having a removable portion, the safety switch configured to disconnect the at least one photovoltaic cell from the connector when the removable portion is with the safety switch, the safety switch configured to connect the at least one photovoltaic cell with the connector when the removable portion is removed from the safety switch;
 - wherein the removable portion of the safety switch is operable from outside of the junction box.
2. The photovoltaic panel of claim 1, wherein the safety switch comprises a wiring connector to control the relay.
3. The photovoltaic panel of claim 1, further comprising:
 - a circuit to detect a load from an inverter, wherein the safety switch is to connect an output of the photovoltaic panel to the connector when the circuit detects a load from an inverter and to disconnect the output in absence of a load from an inverter.
4. The photovoltaic panel of claim 1, further comprising:
 - a voltage module to adjust an output of the at least one photovoltaic cell;
 - wherein the safety switch is coupled to the voltage module.
5. The photovoltaic panel of claim 4, wherein the voltage module outputs an alternating current (AC) output.
6. The photovoltaic panel of claim 4, further comprising connectors for wirings to control a state of the safety switch.

* * * * *



US007884278B2

(12) **United States Patent**
Powell et al.

(10) **Patent No.:** **US 7,884,278 B2**
(45) **Date of Patent:** **Feb. 8, 2011**

(54) **APPARATUSES AND METHODS TO REDUCE SAFETY RISKS ASSOCIATED WITH PHOTOVOLTAIC SYSTEMS**

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Ron Hadar, Cupertino, CA (US); **Dan Kikinis**, Saratoga, CA (US); **Shmuel Arditi**, Los Gatos, CA (US)

(Continued)

(73) Assignee: **Tigo Energy, Inc.**, Los Gatos, CA (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 159 days.

AU 2005262278 7/2005

(21) Appl. No.: **12/254,780**

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(22) Filed: **Oct. 20, 2008**

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(60) Provisional application No. 61/001,587, filed on Nov. 2, 2007.

Primary Examiner—Jeffrey T Barton

(74) *Attorney, Agent, or Firm*—Greenberg Traurig, LLP

(51) **Int. Cl.**
H01L 31/00 (2006.01)

(57) **ABSTRACT**

(52) **U.S. Cl.** **136/244**

(58) **Field of Classification Search** 136/243–265
See application file for complete search history.

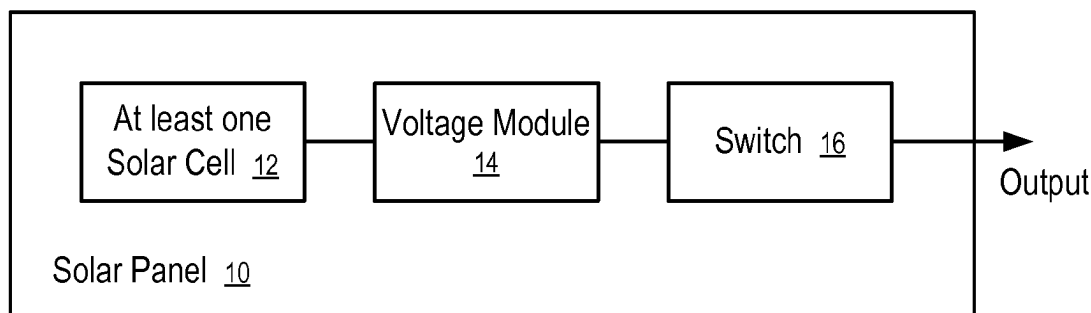
Apparatuses and methods to reduce safety risks associated with photovoltaic systems by providing a safety switch on a photovoltaic panel. In one embodiment, a photovoltaic panel includes: at least one photovoltaic cell; a connector to output energy from the photovoltaic panel; and a switch coupled between the at least one photovoltaic cell and the connector. The switch is configured to disconnect the at least one photovoltaic cell from the connector during installation of the photovoltaic panel, and to connect the at least one photovoltaic cell with the connector after installation of the photovoltaic panel.

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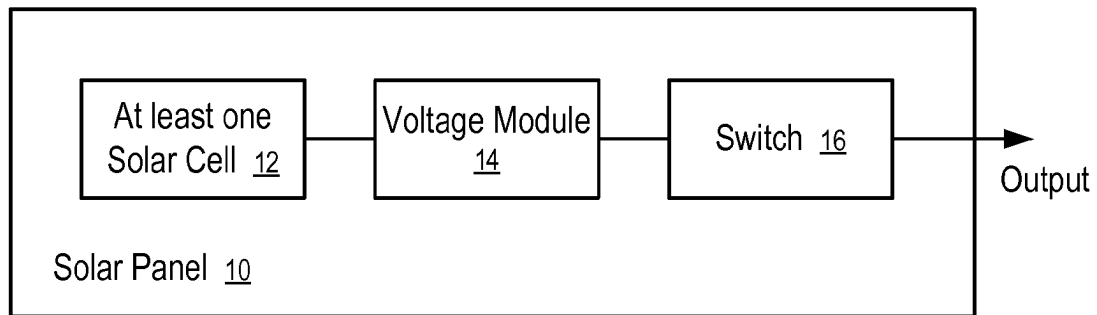


FIG. 1

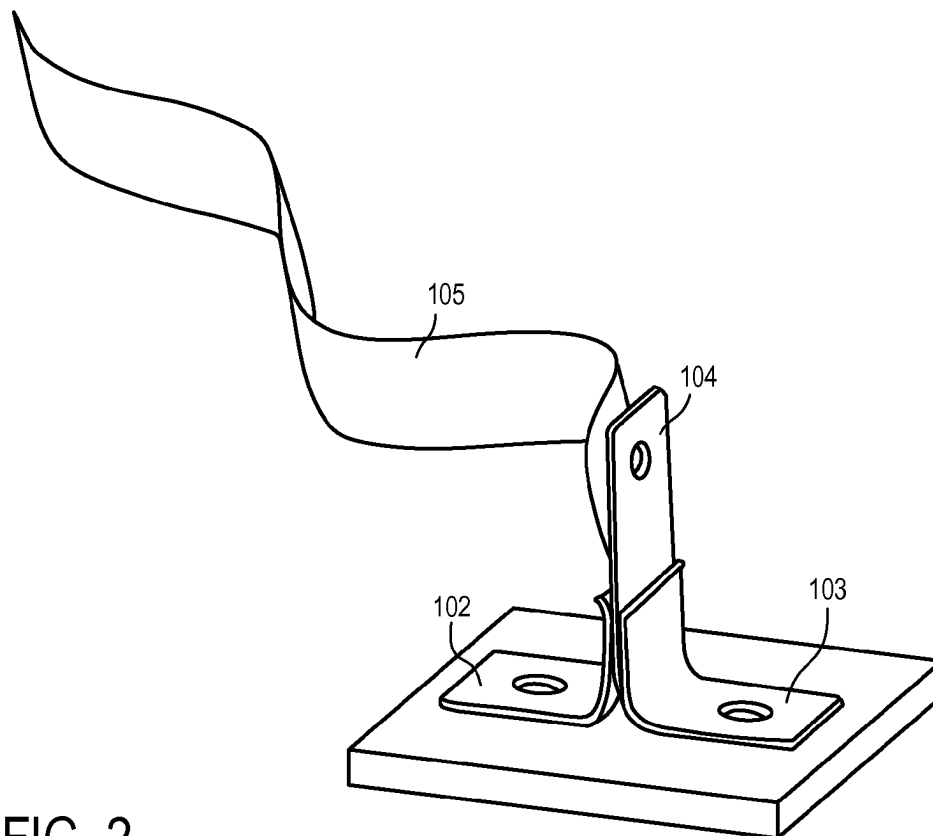


FIG. 2

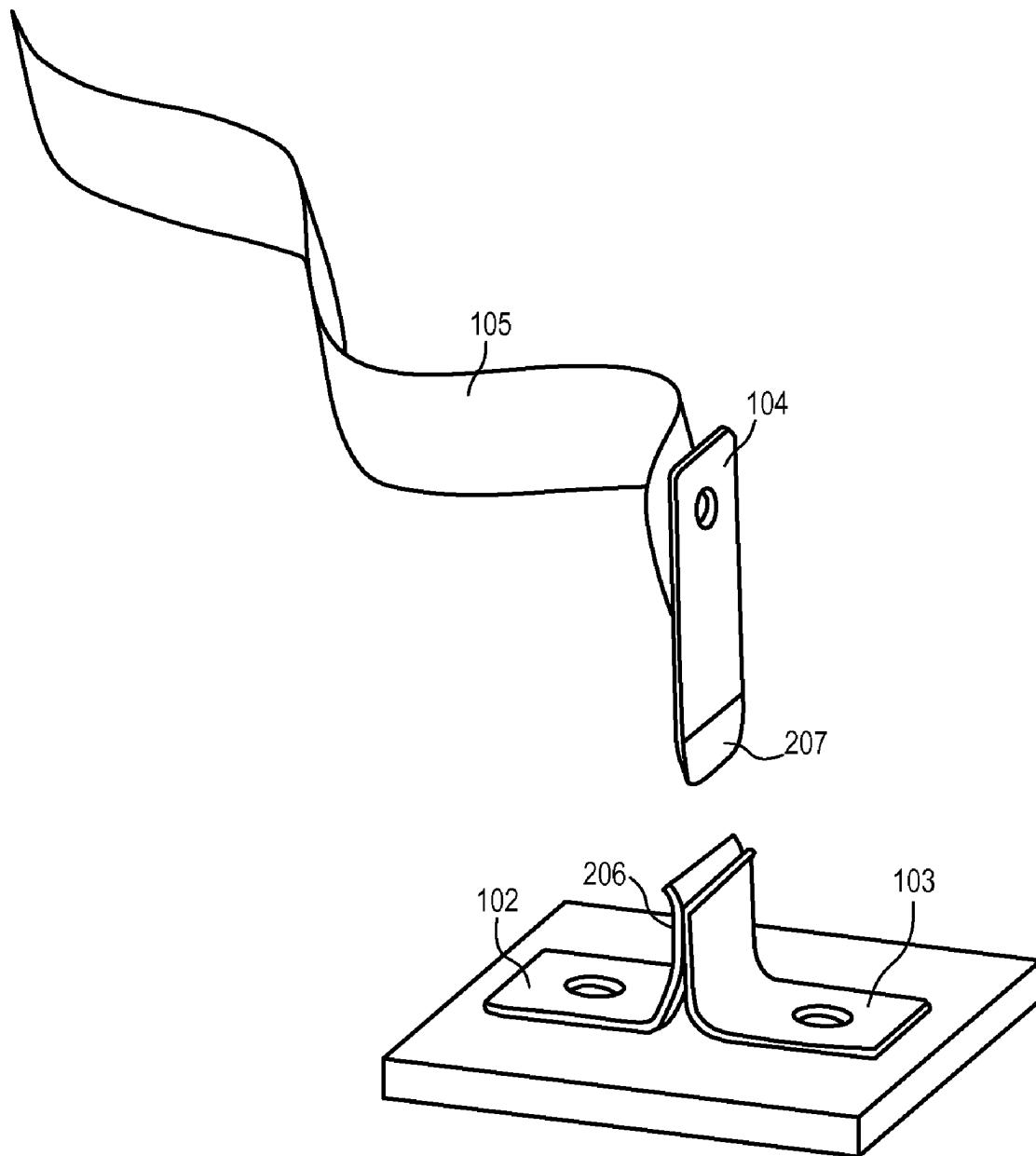


FIG. 3

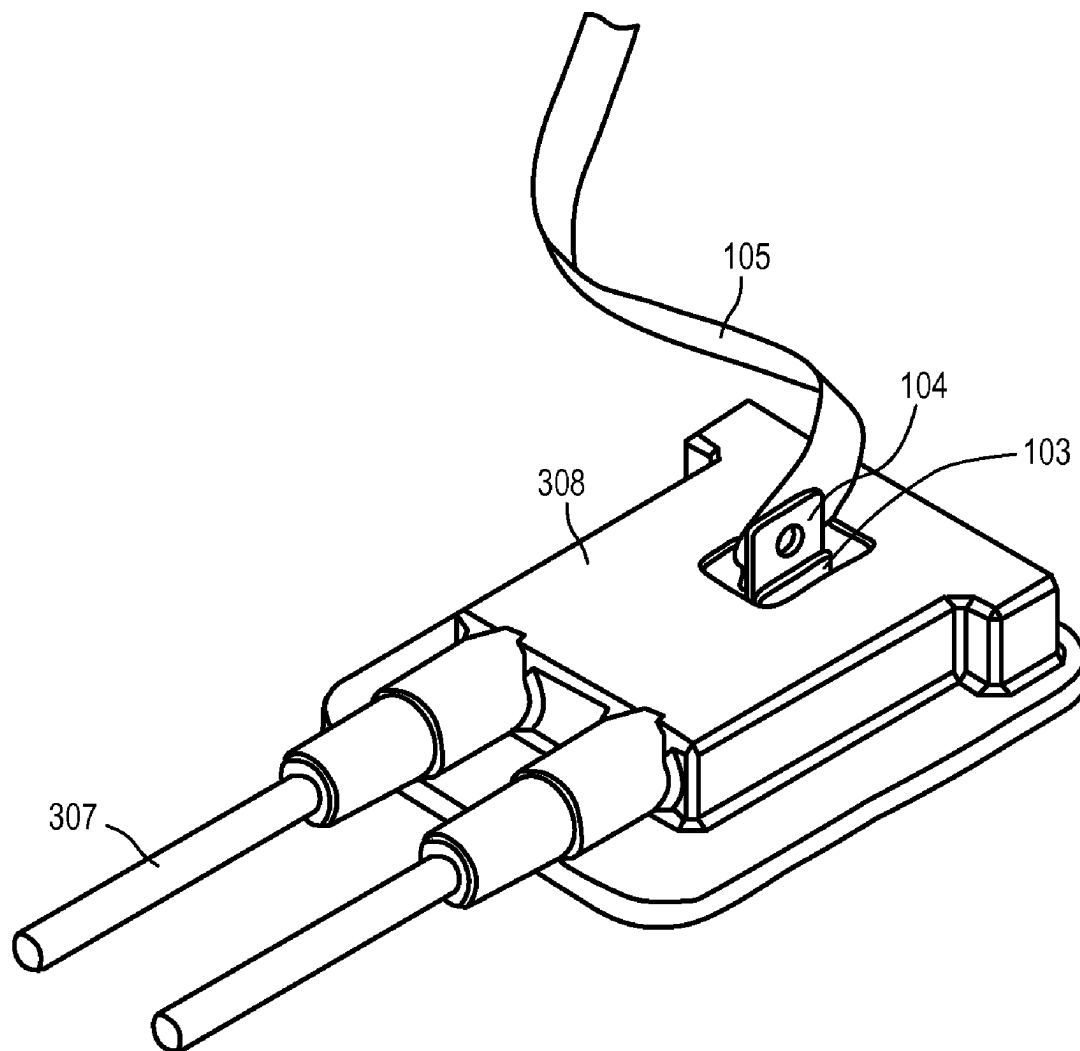


FIG. 4

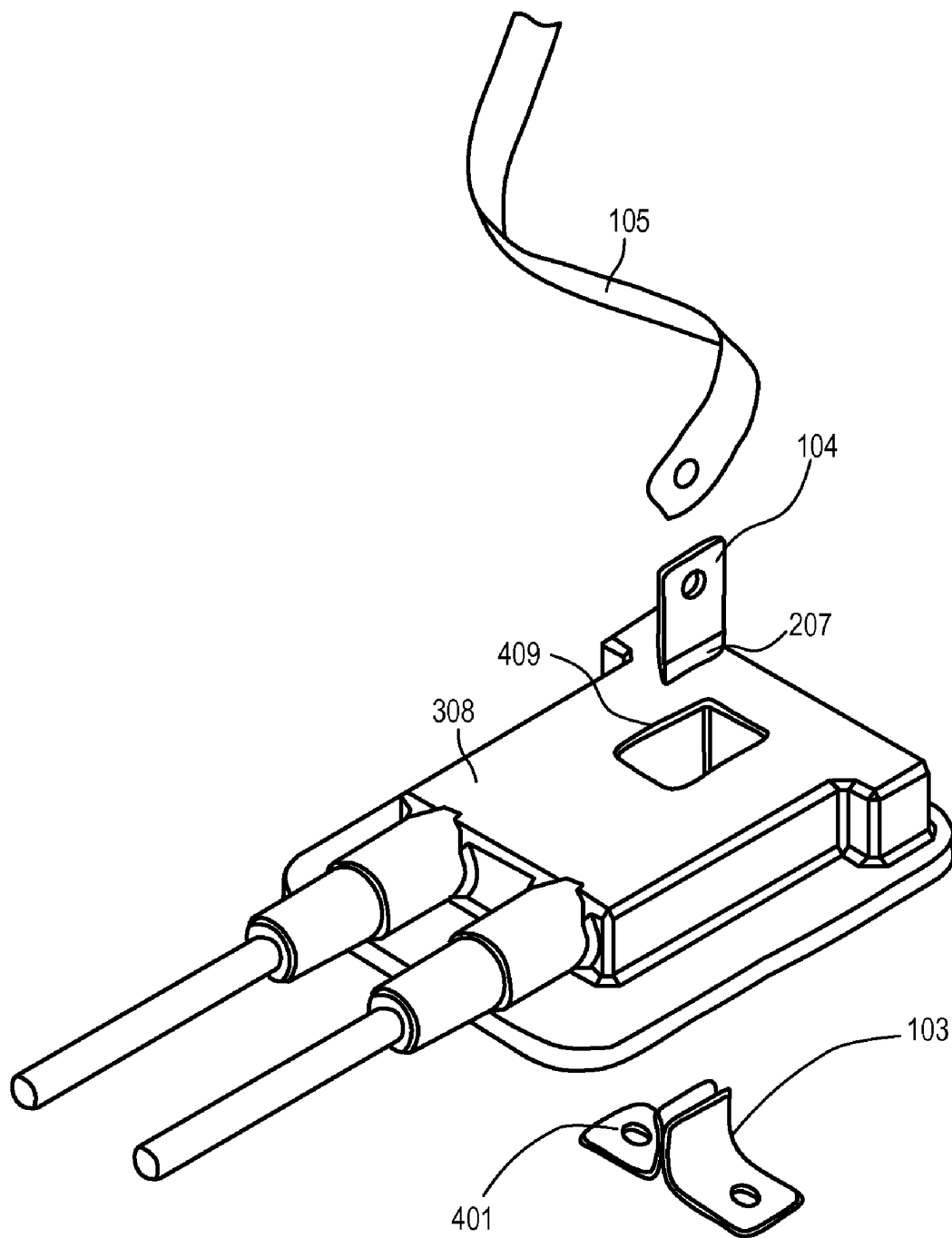


FIG. 5

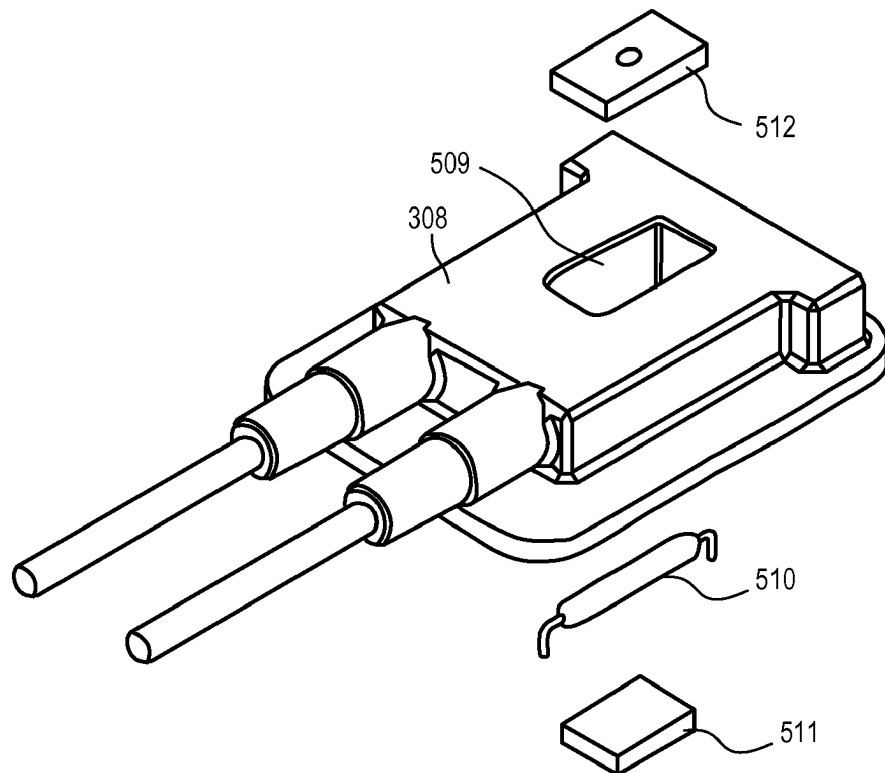


FIG. 6

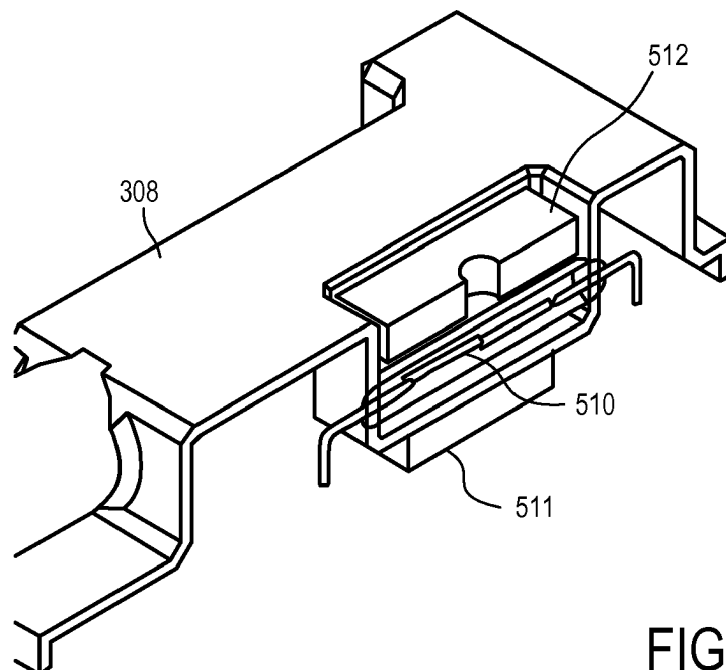


FIG. 7

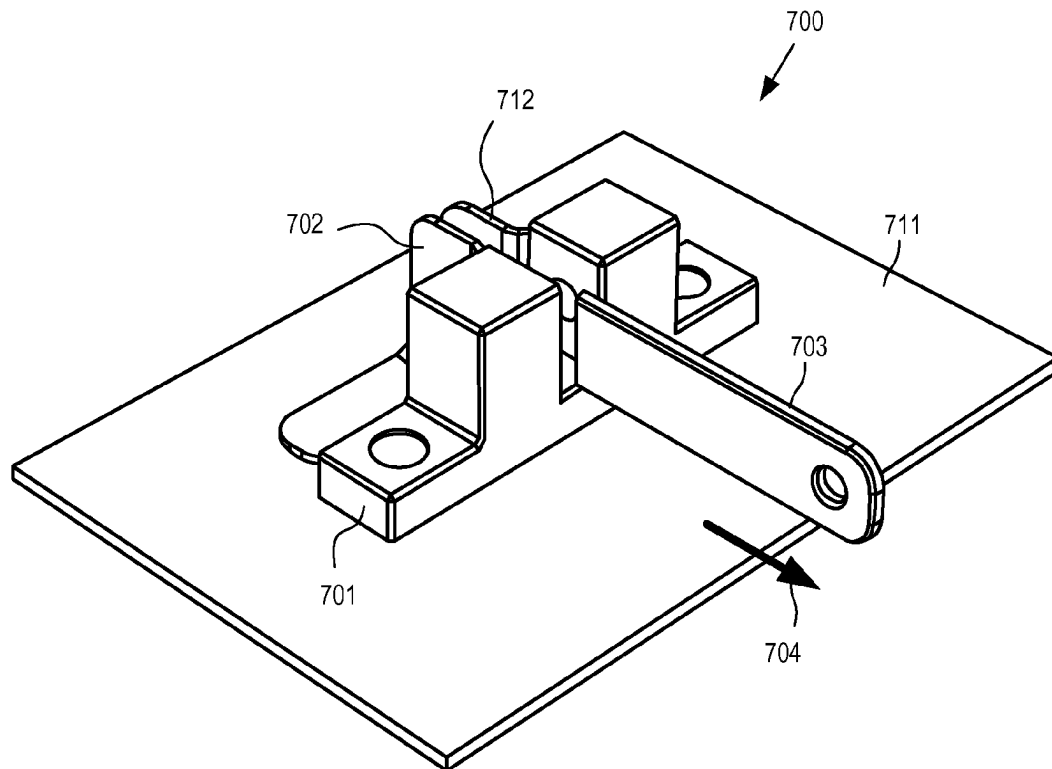


FIG. 8

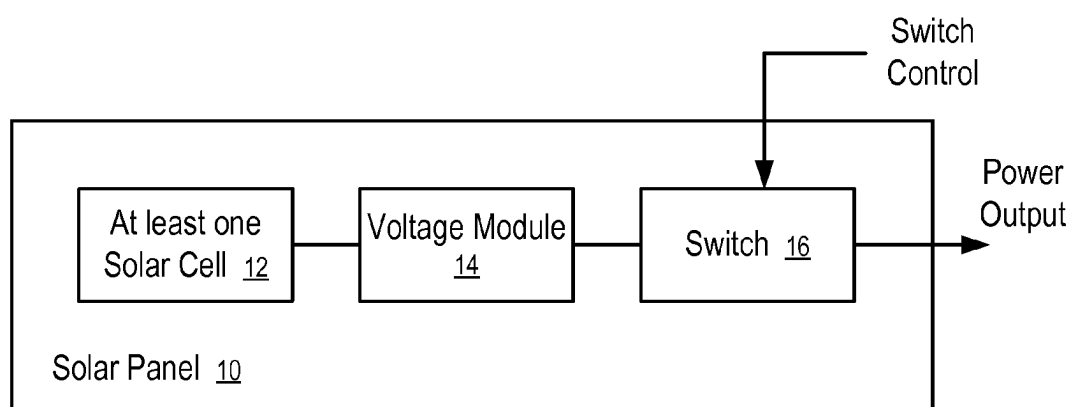


FIG. 9

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APPARATUSES AND METHODS TO REDUCE SAFETY RISKS ASSOCIATED WITH PHOTOVOLTAIC SYSTEMS

RELATED APPLICATIONS

The present application claims priority to provisional U.S. patent application Ser. No. 61/001,587, filed on Nov. 2, 2007 and entitled "Photovoltaic Safety Switch," the disclosure of which is hereby incorporated herein by reference.

FIELD OF THE TECHNOLOGY

At least some embodiments disclosed herein relate to photovoltaic systems in general and, more particularly but not limited to, safety devices for the shipment, installation and/or maintenance of photovoltaic systems.

BACKGROUND

When a photovoltaic panel or laminate is exposed to direct or diffuse light, a lethal voltage potential may be present. In the United States the possible voltage could be as high as 600 volts, while in Europe and the rest of the world this voltage could approach a kilovolt.

Because of this potential danger from electrical shock, solar panel manufacturers and code and standards development organizations have made some recommendations to minimize or eliminate this danger.

One suggestion has been to cover the photovoltaic panel with an opaque material such as a tarpaulin. However, this approach proposes its own safety risk from having the wind catch the tarpaulin and pull installation personnel off the roof as they try to control the unstable sheet material against the wind.

Another recommendation is to install and/or service the photovoltaic panels at night when there is minimal risk of the panels being energized. This approach presents the potential safety risks associated from working in a poorly lighted environment.

In addition to the potential personnel safety issues there are also significant risks to equipment and hardware. Connecting or disconnecting energized plugs can cause arcing and damage to these connectors, junction boxes, and other electrical components.

SUMMARY OF THE DESCRIPTION

Apparatuses and methods to reduce safety risks associated with photovoltaic systems by providing a safety switch on a photovoltaic panel. Some embodiments are summarized in this section.

In one embodiment, a photovoltaic panel includes: at least one photovoltaic cell; a connector to output energy from the photovoltaic panel; and a switch coupled between the at least one photovoltaic cell and the connector. The switch is configured to disconnect the at least one photovoltaic cell from the connector during installation of the photovoltaic panel, and to connect the at least one photovoltaic cell with the connector after installation of the photovoltaic panel.

In one embodiment, the photovoltaic panel further includes a junction box to host the connector, wherein the switch is integrated in the junction box.

In one embodiment, the switch includes a first conductive contactor, a second conductive contactor, and a removable portion which when removed connect the at least one photovoltaic cell with the connector. For example, the removable

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portion may include a dielectric separator; when the dielectric separator is inserted between the first and second contactor, the switch is not connected; and when the dielectric separator is removed, the switch is connected. In one embodiment, the first and second conductive contactors are spring loaded toward each other.

In one embodiment, the removable portion further includes a flag attached to the dielectric separator. The flag may have a visual indication of warning for electric shock.

In one embodiment, the switch includes a reed switch; and the removable portion includes a magnet. The reed switch may be a normally closed reed switch, or normally open reed switch.

In one embodiment, the switch includes an optical sensor to turn on or off the switch based on light detected by the optical sensor; and the removable portion includes a pull-tab configured to shield the optical sensor. The at least one photovoltaic cell may be used to power the optical sensor.

In one embodiment, the switch further includes a semiconductor switch device (e.g., a Field-Effect Transistor (FET)) or a relay.

In one embodiment, the switch includes a relay and a wiring connector to control the relay from a remote location.

In one embodiment, the photovoltaic panel further includes a circuit to detect a load from an inverter. The switch is to connect an output of the photovoltaic panel to the connector when the circuit detects a load from an inverter and to disconnect the output in absence of a load from an inverter.

In one embodiment, a photovoltaic panel module includes: a voltage module to adjust an output of a plurality of photovoltaic cells; and a switch coupled the voltage module to selectively provide the output. In one embodiment, the voltage module outputs an alternating current (AC) output. The switch may include a semiconductor switch, a relay, a reed switch, a spring loaded switch, and/or an optical sensor to control a state of the switch.

In one embodiment, the photovoltaic panel module further includes connectors for wirings to control a state of the switch.

The disclosure includes methods and apparatuses which perform these methods, including data processing systems which perform these methods, and computer readable media containing instructions which when executed on data processing systems cause the systems to perform these methods.

Other features will be apparent from the accompanying drawings and from the detailed description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments are illustrated by way of example and not limitation in the figures of the accompanying drawings in which like references indicate similar elements.

FIG. 1 illustrates a solar panel having a safety switch according to one embodiment.

FIGS. 2-5 illustrate a spring loaded safety switch for a photovoltaic panel according to one embodiment.

FIGS. 6-7 illustrate a junction box with a reed switch for a photovoltaic panel according to one embodiment.

FIG. 8 illustrates an optical sensor to control a safety switch for a photovoltaic panel according to one embodiment.

FIG. 9 illustrates a solar panel having a safety switch controlled via auxiliary wiring according to one embodiment.

DETAILED DESCRIPTION

The following description and drawings are illustrative and are not to be construed as limiting. Numerous specific details

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are described to provide a thorough understanding. However, in certain instances, well known or conventional details are not described in order to avoid obscuring the description. References to one or an embodiment in the present disclosure are not necessarily references to the same embodiment; and, such references mean at least one.

One embodiment of the disclosure provides a method and system to reduce the safety risks during the shipment, installation and/or maintenance of photovoltaic systems, without introducing the risks associated with other approaches, such as covering them with an opaque material or working on them at night.

In one embodiment, safety protection is provided via the inclusion of a normally closed switch integral to the panel junction box or integral to the panel module when alternating current (AC) or direct current (DC) modules are used.

FIG. 1 illustrates a solar panel having a safety switch according to one embodiment. In FIG. 1, a solar panel 10 (e.g., a photovoltaic panel) includes at least one solar cell 12 (e.g., a photovoltaic cell) to generate power when exposed to direct or diffuse light, in some cases a voltage module 14 to adjust or regulate the output voltage (or in some other cases a current module to regulate current), and a switch 16 to selectively isolate the solar cell 12 from the output connectors of the solar panel. In yet other cases, the switch may be incorporated into regulator modules, such as voltage module 14.

In one embodiment, the switch 16 is a normally closed switch. During the shipment, installation and/or maintenance, the switch 16 is placed in an open state to isolate the solar cell 12 from the output. After the installation or maintenance, the switch 16 is placed into a closed state to allow the solar cell 12 to energize the output connectors of the solar panel and to supply power through the output connectors of the solar panel.

The switch 16 and the voltage module can be integrated into the junction box of the solar panel. In some embodiment, the switch 16 is integrated with the voltage module 14 as a panel module.

FIGS. 2-5 illustrate a spring loaded safety switch for a photovoltaic panel according to one embodiment. In FIGS. 2-5, the switch includes two contactors 102 and 103 made of a conductive metal or plated hybrid. The contactors 102 and 103 are normally made of a spring alloy metal or have an integral spring plunger design (not shown). The contactors 102 and 103 are positioned or fixed in such a way that the two contacts 102 and 103 are spring loaded toward each other to maintain electrical continuity between the two contactors 102 and 103. Thus, the switch is normally closed (NC) and not in a safe mode for installation or maintenance.

In FIG. 2, a safe mode for installation or maintenance is achieved when the blade 104 is inserted between the two contactors 102 and 103. The blade 104 is manufactured from a dielectric material and when inserted between the two contactors 102 and 103 there is no electrical continuity between the contactors 102 and 103.

As illustrated in FIG. 2, the blade 104 may also have a flag 105 attached. The flag 105 could be red or some other highly visible color, to provide a visual indicator of the state of the panel.

In one embodiment, the panels and/or panel with integral modules would come shipped from the factory with the blade 104 and the flag 105, where the blade 104 is inserted between the two contactors 102 and 103. The panels would be installed and integrated with the blade 104 present and flag 105 visible. The installer would mount, secure, and plug in all of the connections in the system, including the grounding.

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As illustrated in FIG. 3, once the installation is completed the installer would remove the blades 104 at all those places indicated by the flags 105. Once the blade 104 is removed, the spring loaded contactors 102 and 103 contact each other to provide an electric path from the photovoltaic cells to the output connectors of the photovoltaic panel.

If additional work or troubleshooting were needed, the blade(s) 104 and flag(s) 105 could be reinserted, aided by the tapered section 207 of the blade 104, thereby breaking the electrical continuity between the contactors 102 and 103 at point 206.

In some embodiments, there is symmetry in contactors 102 and 103. In other embodiments, the contactors 102 and 103 are not identical or even similar. The contactors 102 and 103 are made of electrically conductive material and configured to be in physical contact with each so that an electrically conductive path 206 is maintained, after the blade 104 is removed. In at least some embodiments, the electrical conductive path 206 is maintained without the blade 104 being inserted between the contactors 102 and 103, then disrupted by the blade 104 inserted between the contactors 102 and 103, and then reestablished by the reinsertions of a dielectric device such as the blade 104.

In addition to the visual indication of the modes of the panels provided by the flag(s) 105, the flags could also provide information in the form of text, such as, for example, "Remove before operation" or a warning of potentially lethal voltage.

FIG. 4 illustrates a configuration of a spring loaded switch integrated with a junction box 308 of a photovoltaic panel. The junction box 308 includes a connector to connect the solar power generated by the photovoltaic panel to a load (e.g., an inverter, a voltage bus, etc.) via a cable 307. Thus, when the blade 104 is inserted into the switch, with the flag 105 visible, the voltage generated by the solar cells is isolated from the connector for the cable 307; and thus it is safe to install the photovoltaic panel or to perform maintenance operations on the photovoltaic panel.

FIG. 5 shows the components of the spring loaded switch and the junction box of a photovoltaic panel. As illustrated in FIG. 5, the junction box 308 has an opening 409, which provides access to remove the blade 104 and/or to re-insert the blade 104. The contactors 103 of the switch can be attached to the junction box 308 via fastening the portion 401 to a supporting member of the junction box 308, such as a printed circuit board (PCB).

FIGS. 6-7 illustrate a junction box with a reed switch for a photovoltaic panel according to one embodiment. FIG. 6 shows an assembly of a reed switch 510 and magnets for integrated into the photovoltaic junction box 308. FIG. 7 shows a cut-away section illustrating the reed switch 510 and the magnets 511 and 512 installed within the portion 509 of the junction box 308.

In FIG. 7, a reed switch 510 is made normally closed by integrating a stationary biasing magnet 511 into the junction box 308 in close proximity to the normally open reed switch, so that the switch 510 is closed in absence of the magnet 512.

In one embodiment, the magnet 512 is inserted into the junction box well 509 so that the reversed polarity cancels the magnetic lines of force and the reed switch 510 opens.

In one embodiment, the magnet 512 is installed in the junction box well 509 at the factory; and a flag 105 (not shown in FIGS. 6 and 7) is attached to the magnet 512. The magnet 512 is removable and/or re-insertable via the junction box well 509.

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In other embodiments, normally closed (NC) reed contacts can be used to replace the normally open (NO) reed contacts **510** and the magnet **511**, avoiding the need for the additional stationary magnet.

Once the installation and integrations are complete the magnet **512** is removed and may be discarded. The power leads of the junction box **308** can then be energized via the semiconductor switch or relay (not shown), when the reed switch **512** is in the closed state.

In some cases, a semiconductor switch (not shown in FIG. **7**) can be used to energize the power leads of the junction box **308**. The panel junction box **308** or inverter (not shown in FIG. **7**) may include a controller unit with a watchdog circuit configured to send a signal periodically (e.g., every time interval *t*) to maintain the connection of the panel outputs to the string. When this signal is timed-out or is absent, the panel outputs of the panel are disconnected via a semiconductor switch device (not shown).

FIG. **8** illustrates an optical sensor to control a safety switch for a photovoltaic panel according to one embodiment. In FIG. **8**, an optical sensor unit **700** with an optical sensor **701** is mounted on a printed circuit board (PCB) **711**. Additionally, springs **702** and **712** hold a separator **703** in place that can be removed in direction of arrow **704** using a pull-tab similar to the flag **105** discussed earlier. Not shown in FIG. **8** is the exterior enclosure that would contain the mechanical elements such as the cable connections and the guide elements for guiding separator **703** in and out of the unit.

In one embodiment, additional circuitry (not shown in FIG. **8**) will be on the side of the PCB **711**, such as a control circuit to affect an on/off switching either in some cases by FET (Field-Effect Transistor) transistors or using, in other cases, a relay, such as a bi-stable relay or another suitable circuit. The operational power may be drawn from the solar system itself, or it may be brought up by auxiliary wiring.

In yet some other embodiments, a relay can be simply remote controlled by an auxiliary wire to close or open the circuit. The advantage of this approach is that no pull-tabs (flags or blades) can be forgotten on the roof.

In one embodiment, a mechanism and/or circuitry is integrated in the panel to identify the load from the inverter and connect the panel to the panel outputs when the load is detected. When no load is present the panel outputs is disconnected. This functionality would also be implemented using a semiconductor switch device or other suitable device (such as a relay), and some sensor circuitry, allowing an automatic reconnect when the loop appears to be closed and a load connected.

FIG. **9** illustrates a solar panel having a safety switch controlled via auxiliary wiring according to one embodiment. In FIG. **9**, a separate wire is connected to control the switch **16** from a remote location. For example, the switch may be controlled via a signal from a watchdog circuit, from a remote switch or controller, etc.

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In the foregoing specification, the disclosure has been described with reference to specific exemplary embodiments thereof. It will be evident that various modifications may be made thereto without departing from the broader spirit and scope as set forth in the following claims. The specification and drawings are, accordingly, to be regarded in an illustrative sense rather than a restrictive sense.

What is claimed is:

1. A photovoltaic panel, comprising:
 - a plurality of photovoltaic cells;
 - at least one connection terminal configured on the photovoltaic panel to output electricity from the photovoltaic panel;
 - a voltage module to adjust an output of the plurality of photovoltaic cells;
 - a circuit configured to detect a load from an inverter; and
 - a switch coupled between the voltage module and the connection terminal to selectively provide the output through the switch to the connection terminal, the switch configured to disconnect the output in absence of the load detected by the circuit.
2. The photovoltaic panel of claim 1, wherein the voltage module outputs an alternating current (AC) output.
3. The photovoltaic panel of claim 1, wherein the switch comprises one of a semiconductor switch, a relay, a reed switch, and a spring loaded switch.
4. The photovoltaic panel of claim 1, wherein the switch comprises an optical sensor to control a state of the switch.
5. A photovoltaic panel, comprising:
 - a plurality of photovoltaic cells;
 - a connector to output energy generated by the plurality of photovoltaic cells of the photovoltaic panel;
 - a voltage module to adjust an output of at least one photovoltaic cell;
 - a circuit to detect a load from an inverter; and
 - a switch coupled between the voltage module and the connector and, the switch coupled with the circuit to connect the plurality of photovoltaic cells through the switch to the connector when the circuit detects a load from an inverter and to disconnect the plurality of photovoltaic cells from the connector via the switch when the circuit detects no load from an inverter.
6. The photovoltaic panel of claim 5, further comprising:
 - a junction box to host the connector, wherein the switch is integrated in the junction box.
7. The photovoltaic panel of claim 5, wherein the switch comprises a semiconductor switch device or a relay.
8. The photovoltaic panel of claim 7, wherein the semiconductor switch device comprises a Field-Effect Transistor (FET).

* * * * *

Electronic Acknowledgement Receipt

EFS ID:	10175517
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	John Patrick Ward/Patricia Caldwell
Filer Authorized By:	John Patrick Ward
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	26-MAY-2011
Filing Date:	01-DEC-2009
Time Stamp:	14:36:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	108144-202701_Notice_related_apps.pdf	496590 385a24a900500eede41bf8c549db19e9e83ff3a4	no	33

Warnings:

Information: EXHIBIT 1016 (Pt. 1 of 2)

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

New Applications Under 35 U.S.C. 111

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

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

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1728		
	Examiner Name	MARTIN, MATTHEW T		
	Attorney Docket Number	108144-202701/US (TGY027)		

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	1	20110061713		2011-03-17	Powell et al		

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	12628977
Filing Date	2009-12-01
First Named Inventor	Ron Hadar
Art Unit	1728
Examiner Name	MARTIN, MATTHEW T
Attorney Docket Number	108144-202701/US (TGY027)

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	
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*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	12628977
Filing Date	2009-12-01
First Named Inventor	Ron Hadar
Art Unit	1728
Examiner Name	MARTIN, MATTHEW T
Attorney Docket Number	108144-202701/US (TGY027)

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	/John P. Ward/	Date (YYYY-MM-DD)	2011-04-14
Name/Print	John P. Ward	Registration Number	40216

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.**

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

Electronic Acknowledgement Receipt

EFS ID:	9884953
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	John Patrick Ward/Patricia Caldwell
Filer Authorized By:	John Patrick Ward
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	14-APR-2011
Filing Date:	01-DEC-2009
Time Stamp:	18:45:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Filed (SB/08)	108144-202701_IDS.pdf	612449 848fc755de618669c7710bd4cb4faf3a67e87854	no	4

Warnings:

Information: Exhibit 1016 (Pt. 1 of 2)

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New Applications Under 35 U.S.C. 111

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

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

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Ron Hadar et al.	Examiner:	Matthew Martin
Serial No.:	12/628,977	Group Art Unit:	1728
Filed:	December 1, 2009	Confirmation:	6958
Title:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations		

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

RESPONSE TO NON-FINAL OFFICE ACTION

Sir:

In response to the Non-Final Office Action mailed December 1, 2010, please kindly enter the following amendments and consider the following remarks/arguments:

Amendments to the Claims are reflected in the list of claims that begins on page 2 of this paper;

Remarks/Arguments begin on page 5 of this paper.

CLAIMS

1. (Currently Amended) A system comprising:
a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog unit having:
a local controller to monitor a communication from a central controller remote from the solar module and determine whether the communication is interrupted; and
at least one switch to disconnect the solar module from the power bus when the communication is interrupted;
wherein the watchdog unit is configured to connect the solar module to the power bus when the communication is not interrupted.
2. (Previously Presented) The system of claim 1, further comprising a junction box housing the watchdog unit, the junction box to provide connectivity between the solar module and the power bus.
3. (Previously Presented) The system of claim 2, wherein the local controller is configured to control a duty cycle of the switch to control an output voltage from the junction box.
4. (Previously Presented) The system of claim 3, wherein the local controller is configured to operate using power from the solar module.
5. (Previously Presented) The system of claim 1, further comprising a bypass circuit configured to enable current in the power bus to bypass the solar module when the switch disconnects the solar module from the power bus.
6. (Previously Presented) The system of claim 1, wherein the watchdog unit is configured to determine irregularity in periodicity of the communication to determine whether the communication is interrupted.

7. (Original) The system of claim 1, wherein the communication is interrupted when a threshold of irregularity is surpassed.
8. (Original) The system of claim 1, wherein the communication is interrupted when the central controller fails to send a communication.
9. (Previously Presented) The system of claim 1, further comprising the solar module; and a junction box coupled with the solar module to provide connectivity to the power bus, wherein the watchdog unit resides in the junction box.
10. (Original) The system of claim 1, further configured to disconnect the solar module from the power bus when the watchdog unit receives a shutdown signal.
11. (Original) The system of claim 1, wherein the watchdog unit wirelessly communicates with the central controller.
12. (Currently Amended) A system comprising:
a watchdog device coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog device configured to:
verify communication with a central controller remote from the solar module; and
shutdown the solar module from the power bus if communication with the central controller cannot be verified.
13. (Original) The system of claim 12, wherein to shutdown the solar module entails disconnecting the solar module from the power bus.
14. (Original) The system of claim 12, wherein to verify communication:
a challenge is sent to the central controller; and
a response to the challenge is received.

15. (Original) The system of claim 12, wherein to verify communication, a communication is received within a set time from when a last communication was received.
16. (Original) The system of claim 12, further configured to shutdown the solar module if a shutdown signal is received.
17. (Original) The system of claim 12, further configured to wait for a restart signal.
18. (Original) The system of claim 12, further configured to draw energy from a backup energy source when a primary energy source is not available.
19. (Currently Amended) A computer-implemented method comprising:
monitoring, via a computing device, a signal from a central controller remote from the computing device;
determining, via the computing device, if the signal has been lost;
disconnecting, via the computing device, one or more solar modules from a power bus if the signal has been lost, the power bus configured to connect a plurality of solar modules to an inverter;
~~determining, via the computing device, if the signal includes a shutdown command;~~
~~disconnecting, via the computing device, the one or more solar modules from the power bus if the signal includes a shutdown command;~~
waiting, via the computing device, for a restart signal; and
connecting, via the computing device, the one or more solar modules to the power bus when the restart signal is received.
20. (Original) The method of claim 19, further comprising:
enabling, via the computing device, a bypass circuit when the one or more solar modules are disconnected from the power bus, so that current continues to flow in the power bus.

REMARKS

The foregoing amendment and the following arguments are provided generally to impart precision to the claims, by more particularly pointing out the invention, rather than to avoid prior art.

Rejections Under 35 U.S.C. §112

Claim 1 is amended to more particularly point out the invention. It is believed that the amendment overcomes the rejection under 35 U.S.C. §112.

Rejections Under 35 U.S.C. §103

Claims 12, 13 and 16-18 were rejected under 35 U.S.C. §103(a) over U.S. Pat. App. Pub. No. 2008/0142071(Dorn) in view of Wiles (“Photovoltaic Power Systems and the National Electrical Code: Suggested Practices”, Sandia, 1999) and U.S. Pat. App. Pub. No. 2008/0236648(Klein). The rejection is respectfully traversed.

It is respectfully submitted that the interpretation of Dorn as presented in the Office Action mailed Dec. 1, 2010 is incorrect. As a result the elements of Dorn do not correspond to the features recited in the pending claims. Furthermore, Dorn and Wiles teach way.

Specifically, it appears that the Office Action mailed Dec. 1, 2010 *mistakenly* considered the solar cells of Dorn as solar modules. As described in Par. [0002] of Dorn, a photovoltaic (PV) module (also commonly known as a solar cell module, or a solar panel) are configured with an arrangement of PV cells (also commonly known as solar cells). Within a solar module, the solar cells are conventionally interconnected via copper strips, etc. (Par. [0002], Dorn). In the invention of Dorn, reconfigurable interconnects are used to interconnect the solar cells (Par. [0004], Dorn).

More specifically, Par. [0004] of Dorn shows that the invention of Dorn is about the connectivity inside a *single* PV module that has a plurality of PV cells and a plurality of reconfigurable interconnects. Fig. 1B of Dorn shows that the *entire* structure 1 is merely a single solar module (PV module, or solar panel). Par. [0023] of Dorn shows that the entire set of

solar cells (e.g., 3A, 3B, 3C, 3D and 3E) and the traces 5 and bus lines 7 are contained within a single module 1. Par. [0023] shows that the junction box 11 and the integrated circuit 13 are all inside the single solar module 1.

Thus, Dorn does not disclose a “power bus configured to connect a plurality of solar modules to an inverter” that is recited in claim 12. The reconfigurable interconnects of Dorn are merely connections disposed within a single solar module 1 to connect solar cells. The reconfigurable interconnects of Dorn do not correspond to the power bus “configured to connect a plurality of solar *modules*”.

Furthermore, Dorn does not disclose a “central controller remote from the solar module”. The entire structure disclosed in Figs. 1A – 1F are within a single solar module. Claim 7 of Dorn indicates that the control device to control reconfiguration of the interconnection is part of the solar module.

Furthermore, Dorn *teaches away* from what is claimed in claim 12. Specifically, the explicitly state purpose of the reconfigurable interconnects of Dorn is to serve as “a means of collection of current from PV cells and as the electrical interconnection of two or more PV cells for the purpose of transferring the current generated in one PV cell to adjacent cells and/or out of the PV module to the output connectors” (Par. [0015], Dorn). For example, Par. [0017] of Dorn enumerates various ways to “optimize” or “maximize” the output of the PV module (also known as solar module or solar panel). Thus, the reconfigurable interconnects of Dorn is provided to facilitate current output. Since the stated purpose of Dorn to optimize or maximize the output of the PV module (also known as solar module or solar panel) is the opposite of the operation to shutdown the PV module (also known as solar module or solar panel), Dorn teaches away from the feature of “shutdown the solar module from the power bus if communication with the central controller cannot be verified” recited in claim 12.

Furthermore, Wiles teaches away from the combination suggested by the examiner. Specifically, Wiles states

“local inspectors will *not* require disconnects on totally enclosed, self-contained PV systems like a PV-powered, solar, hot-water circulating system.

This would be particularly true if the entire assembly were listed as a unit and there were no external contacts or user serviceable parts.” (Wiles, page 34, lines 3-6 in the third paragraph under the heading “Disconnecting Means”) [Emphasis Added].

As discussed above, the reconfigurable interconnects and the solar cells of Dorn are disposed within a single PV module (also known as solar module or solar panel). Such a single PV module (also known as solar module or solar panel) is a “totally enclosed, self-contained PV systems” discussed in Wiles in page 34, lines 3-6 in the third paragraph under the heading “Disconnecting Means”. Thus, according to this discussion of Wiles, disconnects is not required in the PV module of Dorn.

The examiner asserted that “Wiles teaches that a photovoltaic power system must have a disconnect system.” However, in view of the explicit discussion of Wiles (page 34, lines 3-6 in the third paragraph under the heading “Disconnecting Means”) that contradicts the way the examiner applied the teaching of Wiles, Applicant respectfully submits that the examiner misinterpreted/misapplied the teaching of Wiles.

Thus, the rejection for claim 12 is erroneous, because both Dorn and Wiles teach away from the invention as claimed in claim 12, and because examiner misinterpreted the disclosure of Dorn (e.g., mistakenly considering the solar cells disposed within a single solar module as solar modules) and the disclosure of Wiles (e.g., failing to consider the explicit teaching on page 34, lines 3-6 in the third paragraph under the heading “Disconnecting Means”). Therefore, the withdrawal of the rejection for claim 12 and its dependent claims is respectfully requested.

The rejection of claim 19 and its dependent claim 20 is based on a combination of Dorn and Wiles. As discussed above, the combination of Dorn and Wiles is improper and does not correspond to the features recited in the pending claims. Thus, at least for the above discussed reasons, the withdrawal of the rejection for claim 19 and its dependent claim is respectfully requested.

At least some of the discussions are also applicable to the rejection of claim 1 and its dependent claims. Thus, at least for the above discussed reasons, the withdrawal of the rejection for claim 1 and its dependent claim is respectfully requested.

CONCLUSION

It is respectfully submitted that all of the Examiner's objections have been successfully traversed and that the application is now in order for allowance. Accordingly, reconsideration of the application and allowance thereof is courteously solicited.

Respectfully submitted,

Date: March 1, 2011

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Electronic Acknowledgement Receipt

EFS ID:	9565109
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	Lehua Wang/Anne Collette
Filer Authorized By:	Lehua Wang
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	01-MAR-2011
Filing Date:	01-DEC-2009
Time Stamp:	21:08:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		108144-202701US_Response.pdf	116496 4ec6fdd82fb11214359bec372ba1a5c177d9badb	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	4
	Applicant Arguments/Remarks Made in an Amendment	5	8
Warnings:			
Information:			
Total Files Size (in bytes):		116496	
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/628,977		Filing Date 12/01/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☒ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	minus 20 =	*	X \$	=	OR	X \$	=			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$	=		X \$	=			
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
			TOTAL			TOTAL				
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	03/01/2011	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X \$26 =	0	OR	X \$	=
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0	X \$110 =	0	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	0	OR	TOTAL ADD'L FEE	
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)
	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 number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/SHARAIN MORELAND/

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/628,977	12/01/2009	Ron HADAR	108144-202701/US (TGY027)	6958
64494 7590 12/01/2010 GREENBERG TRAURIG, LLP (SV) IP DOCKETING 2450 COLORADO AVENUE SUITE 400E SANTA MONICA, CA 90404			EXAMINER MARTIN, MATTHEW T	
			ART UNIT	PAPER NUMBER
			1728	
			NOTIFICATION DATE	DELIVERY MODE
			12/01/2010	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):

LAIPMAIL@GTLAW.COM
santosv@gtlaw.com
clairt@gtlaw.com

Office Action Summary	Application No. 12/628,977	Applicant(s) HADAR ET AL.	
	Examiner MATTHEW T. MARTIN	Art Unit 1728	

-- 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 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, 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 18 September 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ 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

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

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).
- a) ☐ All b) ☐ Some * c) ☐ None of:
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) | 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) ☐ Notice of Informal Patent Application |
| 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>8/10/2010, 11/18/2010</u> . | 6) ☐ Other: _____ |

DETAILED ACTION

Status of Claims

1. Claims 1-20 are pending and are examined below.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding Claim 1, Amended Claim 1 requires "a local controller to monitor communication from a central" and applicant cancelled the limitation requiring a controller. This limitation is unclear because it does not provide what is the central. For the purposes of examination, the Examiner reads this as a central controller, but correction is required.

Claims 2-11 are rejected as being dependant on a rejected base claim.

Claim Rejections - 35 USC § 103

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

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) 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.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 12, 13 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dorn et al., U.S. Publication No. 2008/0142071 in view of Wiles, "Photovoltaic Power Systems and the National Electrical Code: Suggested Practices" Sandia, 1999 and Klein et al., U.S. Publication No. 2008/0236648.

Regarding Claim 12, Dorn et al. teaches a photovoltaic system. The system taught by Dorn includes a solar module (see paragraph 21), a controller (see paragraph 21) that may reconfigure the configuration of the module, and a power bus connecting the system. The power bus is interpreted by the examiner in light of the present

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specification as a connection, as a conductive path connecting one or more solar modules, therefore, the reconfigurable interconnects taught by Dorn et al. (see abstract) are a power bus.

Dorn et al. further teaches that the device taught may be automatically be reconfigured through a switching system, which may be any switching device, and may be switched automatically by a controller (see paragraph 22). This system is interpreted understood by the examiner as a watchdog system. The limitation “watchdog system” is interpreted by the examiner in light of the present specification as a device or software configured to monitor communication from a central controller and disconnect, so it can be the switch taught by Dorn et al. because as, when configured automatically, the switching device will disconnect the plurality for cells for, among other things, safety reasons (see paragraph 17).

Furthermore, it is the examiner's interpretation that the disconnection of the solar cell from the power bus taught by Dorn et al. (see paragraph 17) is a shutdown, because when each module is disconnected, it is unoperational and thus shut down. Wiles teaches that a photovoltaic power system must have a disconnect system. The Wiles circuit includes multiple power switching circuits, each controlling a load. The power switching circuits taught by Wiles monitor communication from a central controller and are required to disconnect the PV array under certain operating conditions, such as a disconnect of communication (see page 34).

Thus, Wiles teaches that the switching circuit verifies communication from a central controller and can respond to shut down the connection

Therefore, it would be obvious to one of ordinary skill in the art to modify the photovoltaic system taught by Dorn et al. by including a disconnect system, as taught by Wiles to be industry standard, because the PV system must respond to voltage interrupts for safety purposes (see Dorn et al. at paragraph 17 and Wiles at page 34).

Regarding Claim 13, Dorn and Wiles teach disconnecting the photovoltaic device in response to controller commands (see Dorn et al. at paragraph 22).

Regarding Claim 16, Dorn disconnects the solar module in response to controller signals. It is the examiner's position that the shutdown of the solar module corresponds to disconnecting the module.

Regarding Claim 17, Dorn et al. teaches that a controller or processor can be used to create connections via a software algorithm (see paragraph 24). This is interpreted by the Examiner to be a restart signal.

Regarding Claim 18, Wiles teaches incorporating a backup generator into a photovoltaic power system (see fig. 18). Additionally, Wiles teaches that the backup generator is connected to the charge controller, and therefore would provide power to the controller (see fig. 18).

8. Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dorn et al. in view of Wiles et al., as applied to Claims 12, 13 and 15-18 above, and further in view of Klein et al., U.S. Publication No. 2008/0236648.

Regarding Claim 1, Dorn et al. teaches a photovoltaic system. The system taught by Dorn includes a solar module (see paragraph 21), a controller (see paragraph 21) that may reconfigure the configuration of the module, and a power bus connecting

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the system. The power bus is interpreted by the examiner in light of the present specification as a connection, as a conductive path connecting one or more solar modules, therefore, the reconfigurable interconnects taught by Dorn et al. (see abstract) are a power bus.

Dorn et al. further teaches that the device taught may be automatically be reconfigured through a switching system, which may be any switching device, and may be switched automatically by a controller (see paragraph 22). This system is interpreted understood by the examiner as a watchdog system. The limitation "watchdog system" is interpreted by the examiner in light of the present specification as a device or software configured to monitor communication from a central controller and disconnect. As, when configured automatically, the switching device will disconnect the plurality for cells for, among other things, safety reasons (see paragraph 17).

Therefore, Dorn et al. teaches a system comprising a watchdog unit (automatic switching system (see paragraph 17) coupled between a solar module (3) and a power bus (9A) that monitors communication from a central controller (see paragraph 22) including at least one switch (see paragraph 22) to disconnect the modules.

Although Dorn et al. does mention potential configurations for its switching system, such as diverting power, charging a battery, and disconnecting individual cells, Dorn et al. is silent on the exact configuration of the switching device/controller watchdog unit.

Wiles teaches that a photovoltaic power system must have a disconnect system. The Wiles circuit includes multiple power switching circuits, each controlling a load. The

Art Unit: 1728

power switching circuits taught by Wiles monitor communication from a central controller and are required to disconnect the PV array under certain operating conditions, such as a disconnect of communication (see page 34).

Therefore, it would be obvious to one of ordinary skill in the art to modify the photovoltaic system taught by Dorn et al. by including a disconnect system, as taught by Wiles to be industry standard, because the PV system must respond to voltage interrupts for safety purposes (see Dorn et al. at paragraph 17 and Wiles at page 34).

However, neither Dorn et al. nor Wiles teach a local controller used in the individual solar cells.

Klein et al. teaches a local controller (501) incorporated into each unit module of a photovoltaic system and used to control various inputs, including "communication" thereto (see paragraph 29).

Therefore, it would be obvious to one of ordinary skill in the art to modify the system taught by Dorn et al. and Wiles et al. by incorporating a local controller for each individual module because the individual controllers can more effectively control the inputs for each individual photovoltaic cell.

Regarding Claim 2, Dorn et al. teaches a switchable connection (see paragraph 22). Furthermore, Dorn et al. teaches that this connection may be used to disconnect the solar module or parts thereof from the power bus (see paragraphs 17 and 22).

Regarding Claim 3, Dorn et al. teaches that the switchable connection is configured by a controller (see paragraph 22), and Klein et al. teaches that the controller

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(501, "local controller") is configured to control a duty cycle to control a switch (see paragraph 29).

Regarding Claim 4, Wiles et al. teaches that PV output circuits are directly connected to the power controller and provide power thereto (see page 29, branch circuits section).

Regarding Claim 5, Dorn et al. teaches that the device may include a bypass circuit (see paragraph 24). Furthermore, this can occur when the switch disconnects the module from the power bus.

Regarding Claims 6, Wiles teaches that the disconnect needs to be effective when the system is subject to too much voltage (i.e. the threshold of irregularity has been surpassed; see page 35 at "Equipment Disconnects" section). Therefore, this irregularity can be considered irregularity of periodicity, and thus Wiles provides for amended Claim 6.

Regarding Claim 7, Wiles teaches that the disconnect needs to be effective when the system is subject to too much voltage (i.e. the threshold of irregularity has been surpassed; see page 35 at "Equipment Disconnects" section). It is the examiner's interpretation that the threshold of irregularity refers to the conventionally known "interrupt rating", the maximum amount of current a protective device can cut off safely.

Regarding Claim 8, Dorn et al. and Wiles et al. teach that the communication is dependant on the signal of a central controller, because the signal can be interpreted as any electrical communication.

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Regarding Claim 9, Wiles teaches that a junction box is often used in photovoltaic power systems because the junction box provides for weatherproofing of circuit components.

Therefore, it would be obvious to one of ordinary skill in the art to place the watchdog unit taught by Dorn et al. by placing it in the junction box taught by Wiles in order to weatherproof the watchdog components.

Regarding Claim 10, Dorn et al. teaches that the PV module is disconnected from the bus when the automatic switching system (watchdog unit) receives a signal from the controller.

9. Claims 14, 15, 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dorn et al. in view of Wiles et al., as applied to Claims 12, 13 and 16-18 above, and further in view of Takahara et al., U.S. Patent No. 6,101,073.

Regarding Claim 14, modified Dorn et al. teaches a solar power generation system as discussed above. Modified Dorn et al. does not teach that a challenge/response system is used.

Takahara et al. teaches a protection system for a solar power generation.

In one of the methods taught by Takahara, an output process (challenge) is sent to a controller to detect a ground fault (see claim 21). The controller is then sent another signal (response) based on the detection (see claim 21).

Therefore, it would be obvious to one of ordinary skill in the art to modify the control connection and disconnection steps in the method taught by Dorn et al. with the

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steps of Takahara because the Takahara system maintains safety in the system (see Dorn et al and paragraph 17).

Regarding Claim 15, Takahara et al. teaches the detection system that detects according to a set time (see abstract).

Regarding Claim 19, modified Dorn et al. teaches a solar power system as discussed above. Furthermore, Dorn et al. teaches that a computer may be used to reconfigure (i.e. connect and disconnect) the photovoltaic cells based on information (signal) provided by a detection circuit (see paragraph 21).

In particular, Dorn et al. teaches that the photovoltaic cells should be disconnected from the interconnection (power bus), if they become shaded, damaged, or if safety reasons have been implicated (see paragraph 24). Additionally, Dorn et al. teaches that this disconnection can be done through a controller (see paragraph 21) controlling a switching system. Finally, Dorn et al. teaches that the process can be monitored through an external computer, and thus is computer implemented, such as connecting the cells to the power bus through a computer. The computer can be used to connect the modules to the power bus (see paragraph 24) by an optimized software algorithm (see paragraph 24). Thus, if the devices are reconnected by software, Dorn et al. must include a restart signal.

Modified Dorn et al. does not teach the specific method steps used to monitor the system.

Takahara teaches a protection system for a solar power generation.

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Takahara teaches using a control unit (computing device) to monitor signal from a solar cell. If a ground fault is detected in the system (i.e. signal has been lost), which can occur when either no signal is sent of to the control unit, the system is disconnected, thus performing the claimed step of disconnecting one or more of the solar modules when incorporated with the computing device of Dorn et al. (see column, line). Furthermore, it can be interpreted that the occurrence of a ground fault can constitute the loss of signal.

Additionally, Takahara, an output process (challenge) is sent to a controller to detect a ground fault (see claim 21). The controller is then sent another signal (response) based on the detection (see claim 21). This ground fault detection can be considered to include a shutdown signal. Thus, Takahara additionally teaches the second part of the method.

Therefore, it would be obvious to one of ordinary skill in the art to modify the control connection and disconnection steps in the method taught by Dorn et al. with the steps of Takahara because the Takahara system maintains safety in the system (see Dorn et al and paragraph 17).

Regarding Claim 20, Dorn et al. teaches that the device may include a bypass circuit (see paragraph 24), which allows the power bus to be connected to other units (see paragraph 24).

10. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dorn et al. in view of Wiles et al. and Klein et al., as applied to Claims 1-10 and 13-18 above, and further in view of Choe, U.S. Publication No. 2005/0051209.

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Regarding Claim 11, modified Dorn et al. teaches a photovoltaic power system as discussed above.

Modified Dorn et al. does not teach a controller in wireless communication.

Choe et al. teaches a power regulation system for a solar cell using a controller in wireless communication (see abstract).

Therefore, it would be obvious to one of ordinary skill in the art to modify the controller taught by Dorn et al. by including the wireless controller taught by Choe because the wireless controller allows for remote data detection in the system (see abstract).

Response to Arguments

Applicant's arguments with respect to claims 1-20 have been considered but are moot in view of the new ground(s) of rejection.

Furthermore, the examiner notes that the disclosure of Takahara is applicable to the present specification because the individual components can be applied for motivation for configuring the individual components of the circuit, already taught by Dorn et al. for the purpose of operating the photovoltaic system.

Finally, the examiner notes that limitations such as “verify(ing) communication” are very broad, and can be interpreted as met in the operation of a controller to disconnect any device.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW T. MARTIN whose telephone number is

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(571)270-7871. The examiner can normally be reached on 8:30 to 5:00 EST Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Michener can be reached on (571)272-1424. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer K. Michener/
Supervisory Patent Examiner, Art Unit 1728

/MATTHEW T MARTIN/
Examiner, Art Unit 1728

Notice of References Cited	Application/Control No. 12/628,977		Applicant(s)/Patent Under Reexamination HADAR ET AL.	
	Examiner MATTHEW T. MARTIN		Art Unit 1728	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2008/0236648	10-2008	Klein et al.	136/244
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

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

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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	1	"136".clas. and irregular adj periodicity	US-PGPUB; USPAT	OR	OFF	2010/11/17 17:22
L3	16	"136".clas. and periodicity same (voltage or current or communication or signal)	US-PGPUB; USPAT	OR	OFF	2010/11/17 17:23
L5	1	"6,101,073".pn.	US-PGPUB; USPAT	OR	OFF	2010/11/17 18:03
S1	6	"136".clas. and watchdog	US-PGPUB; USPAT	OR	OFF	2010/03/12 11:12
S2	1	"136".clas. and power near4 bus same disconnect	US-PGPUB; USPAT	OR	OFF	2010/05/18 13:43
S3	1	"3740636".pn.	US-PGPUB; USPAT	OR	OFF	2010/05/24 10:43
S4	33	("5143556" "5280133" "5604430" "6093885" "6275016" "6396239" "6515215" "6545211" "6593520" "6650031" "6653549" "6837739" "6984970" "7061214" "7150938" "7276886" "7518346" "7595616" "20050057214" "20050057215" "20060001406" "20060174939" "20060232232" "20070273351" "20080121272" "20080122449" "20080122518" "20080142071" "20080179949" "20080191560" "20080191675" "20080303503" "20090114263").pn.	US-PGPUB; USPAT	OR	OFF	2010/05/24 10:50
S5	8378	"136".clas. and (solar adj (cell or module) or photovoltaic)	US-PGPUB; USPAT	OR	OFF	2010/05/24 10:59

S6	44	"136".clas. and (solar adj (cell or module) or photovoltaic) and power adj bus	US-PGPUB; USPAT	OR	OFF	2010/05/24 10:59
S7	0	S6 and monitor same disconnect	US-PGPUB; USPAT	OR	OFF	2010/05/24 10:59
S8	12	tigo near4 energy.as.	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:10
S9	5944	(307/19.ccls. 307/20.ccls. 307/64-66.ccls. 136/244.ccls. 136/243.ccls. 136/251.ccls. 136/206.ccls.)	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:12
S10	0	"136".clas. and monitor same controller and disconnect same interrupt	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:17
S11	73	"136".clas. and monitor same controller	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:17
S12	9	"136".clas. and monitor same controller and disconnect	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:18
S13	102	monitor same communication and communication same interrupt\$4 same disconnect	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:32
S14	12335	monitor same controller and controller same interrupt\$4	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:34
S15	129	monitor same controller and controller same interrupt\$4 same disconnect	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:34
S16	0	"136.cla.s" and disconnect\$4 same interrupt\$4 same signal	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:46
S17	5	"136".clas. and disconnect\$4 same interrupt\$4 same signal	US-PGPUB; USPAT	OR	OFF	2010/05/24 11:47
S18	5	"136".clas. and controller same interrupt \$4 same signal	US-PGPUB; USPAT	OR	OFF	2010/05/24 14:28
S19	0	"136".clas. and threshold same irrgeularity	US-PGPUB; USPAT	OR	OFF	2010/05/24 14:45
S20	0	"136".clas. and threshold same irrgeularity	US-PGPUB; USPAT	OR	OFF	2010/05/24 14:45

S21	2	"136".clas. and threshold same irregularity	US-PGPUB; USPAT	OR	OFF	2010/05/24 14:45
S22	22	"136".clas. and wireless near10 controller	US-PGPUB; USPAT	OR	OFF	2010/05/24 14:53
S23	0	"136".clas. and challenge same controller	US-PGPUB; USPAT	OR	OFF	2010/05/24 15:00
S24	447	challenge same response same controller	US-PGPUB; USPAT	OR	OFF	2010/06/02 14:02
S25	49	S24 and (power near2 system or photovoltaic or solar adj cell)	US-PGPUB; USPAT	OR	OFF	2010/06/02 14:04
S26	1	"6101073".pn.	US-PGPUB; USPAT	OR	OFF	2010/06/02 14:11
S27	14387	"136".clas. and restart or reconnect	US-PGPUB; USPAT	OR	OFF	2010/06/02 14:19
S28	41	"136".clas. and (restart or reconnect)	US-PGPUB; USPAT	OR	OFF	2010/06/02 14:19
S29	1	"20080142071".pn.	US-PGPUB; USPAT	OR	OFF	2010/06/02 14:23
S30	15	((RON) near2 (HADAR)).INV.	US-PGPUB; USPAT	OR	OFF	2010/06/02 14:40
S31	15	((SHMUEL) near2 (ARDITI)).INV.	US-PGPUB; USPAT	OR	OFF	2010/06/02 14:40
S32	68	watchdog adj unit	US-PGPUB; USPAT	OR	OFF	2010/11/16 18:23
S33	6	local adj controller same central adj controller same interrupt\$4	US-PGPUB; USPAT	OR	OFF	2010/11/16 18:23
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S35	1	"20100139734".pn.	US-PGPUB; USPAT	OR	OFF	2010/11/16 18:28
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S38	1	"20080142071".pn.	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:16
S39	1	"136".clas. and disconnect same local near4 controller	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:23
S40	1	"136".clas. and disconnect\$3 same local near4 controller	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:23

S41	45	"136".clas. and disconnect\$3 same controller	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:23
S42	49	"136".clas. and (disconnect\$3 or shutdown) same controller	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:32
S43	7	"136".clas. and tigo.as.	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:34
S44	47	("20050057214" "20050057215" "20060001406" "20060174939" "20060185727" "20060231132" "20070273351" "20080121272" "20080122449" "20080122518" "20080142071" "20080179949" "20080191560" "20080191675" "20080303503" "20090114263" "20100139734" "5143556" "5235266" "5268832" "5280133" "5604430" "5923158" "6031736" "6093885" "6101073" "6275016" "6396239" "6448489" "6515215" "6545211" "6593520" "6650031" "6653549" "6837739" "6844739" "6894911" "6897370" "6984970" "7061214" "7248946" "7256566" "7276886" "7518346" "7595616" "7605498" "7719140").PN. OR ("7807919").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/11/17 12:35
S45	510	"136".clas. and (junction adj box or terminal adj box)	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:42

S46	72843	S45 nad (watchdog or shutdown or disconnect) same (controller or signal or communication)	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:44
S47	10	S45 and (watchdog or shutdown or disconnect) same (controller or signal or communication)	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:44
S48	29169	(disconnect\$3 or shutdown) same controller	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:47
S49	8066	(disconnect\$3 or shutdown) same controller same switch	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:47
S50	1315072	(disconnect\$3 or shutdown) same controller same switch and (junction or terminal) adx box	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:47
S51	110	(disconnect\$3 or shutdown) same controller same switch and (junction or terminal) adj box	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:48
S52	16115	136/243-265.ccls. 200/506.ccls. 439/135-150,152-160.ccls.	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:55
S53	93	S52 and disconnect same (cell or module)	US-PGPUB; USPAT	OR	OFF	2010/11/17 12:59
S54	28	S53 and controller	US-PGPUB; USPAT	OR	OFF	2010/11/17 13:00
S55	20	S54 and switch	US-PGPUB; USPAT	OR	OFF	2010/11/17 13:00
S56	1	"6799282".pn.	US-PGPUB; USPAT	OR	OFF	2010/11/17 13:46
S57	1	"136".clas. and verify near10 (signal or communication)	US-PGPUB; USPAT	OR	OFF	2010/11/17 15:39
S58	2769	"136".clas. and (signal or communication)	US-PGPUB; USPAT	OR	OFF	2010/11/17 15:39
S59	552	"136".clas. and (signal or communication) same time	US-PGPUB; USPAT	OR	OFF	2010/11/17 15:40

S60	28	"136".clas. and (signal or communication) same time same (shutdown or shut-down or shut adj down or disconnect\$4)	US-PGPUB; USPAT	OR	OFF	2010/11/17 15:40
S61	1	"6,101,073".pn.	US-PGPUB; USPAT	OR	OFF	2010/11/17 15:51

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Pt. 1 of 2 (04-10)

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	Filing Date		2009-12-01
	First Named Inventor	Ron Hadar	
	Art Unit	1795	
	Examiner Name	Matthew Martin	
	Attorney Docket Number	108144-202701/US	

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/M.M./	1	5235266		1993-08-10	Schaffrin	
/M.M./	2	5268832		1993-12-07	Kandatsu	
/M.M./	3	5923158		1999-07-13	Kurokami et al.	
/M.M./	4	6031736		2000-02-29	Takehara et al.	
/M.M./	5	6448489		2002-09-10	Kimura et al.	
/M.M./	6	6844739		2005-01-18	Kasai et al.	
/M.M./	7	6894911		2005-05-17	Telefus et al.	
/M.M./	8	6897370		2005-05-24	Kondo et al.	

Receipt date: 08/10/2010 INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	12628977 - GAU: 1728
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1795		
	Examiner Name	Matthew Martin		
	Attorney Docket Number	108144-202701/US		

/M.M./	9	7248946		2007-07-24	Bashaw et al.	
/M.M./	10	7256566		2007-08-14	Bhavaraju et al.	
/M.M./	11	7605498		2009-10-20	Ledenev et al.	
/M.M./	12	7719140		2010-05-18	Ledenev et al.	

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	First Named Inventor	Ron Hadar		
	Art Unit	1795		
	Examiner Name	Matthew Martin		
	Attorney Docket Number	108144-202701/US		

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Examiner Signature	/Matthew Martin/	Date Considered	11/16/2010
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<i>Index of Claims</i> 	Application/Control No. 12628977	Applicant(s)/Patent Under Reexamination HADAR ET AL.
	Examiner MATTHEW T MARTIN	Art Unit 1795

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant				☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE							
Final	Original	06/02/2010	11/17/2010						
	1	✓	✓						
	2	✓	✓						
	3	✓	✓						
	4	✓	✓						
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	17	✓	✓						
	18	✓	✓						
	19	✓	✓						
	20	✓	✓						

Search Notes 	Application/Control No. 12628977	Applicant(s)/Patent Under Reexamination HADAR ET AL.
	Examiner MATTHEW T MARTIN	Art Unit 1795

SEARCHED			
Class	Subclass	Date	Examiner
136	243, 244, 251	5/24/2010	mtm
307	19, 20, 64-66	5/24/2010	mtm

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	6/2/2010	mtm
NPL Search	5/24/2010, 6/2/2010	mtm
EAST Search	5/24/2010, 6/2/2010	mtm
Updated Search	11/17/2010	mtm

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977	
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1728		
	Examiner Name			
	Attorney Docket Number	108144-202701 (TGY027)		

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
/M.M./	1	7807919		2919-10-05	Powell et al.	

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If you wish to add additional U.S. Published Application citation information please click the Add button.

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

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NON-PATENT LITERATURE DOCUMENTS			Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	12628977
Filing Date	2009-12-01
First Named Inventor	Ron Hadar
Art Unit	1728
Examiner Name	
Attorney Docket Number	108144-202701 (TGY027)

1		☐
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If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature	/Matthew Martin/	Date Considered	11/22/2010
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*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		12628977	
	Filing Date		2009-12-01	
	First Named Inventor	Ron Hadar		
	Art Unit	1728		
	Examiner Name			
	Attorney Docket Number	108144-202701 (TGY027)		

U.S. PATENTS							Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	
	1	7807919		2919-10-05	Powell et al.		

If you wish to add additional U.S. Patent citation information please click the Add button.

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U.S. PATENT APPLICATION PUBLICATIONS							Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	
	1						

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

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NON-PATENT LITERATURE DOCUMENTS				Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12628977
	Filing Date		2009-12-01
	First Named Inventor	Ron Hadar	
	Art Unit	1728	
	Examiner Name		
	Attorney Docket Number	108144-202701 (TGY027)	

	1		☐
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If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
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*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	12628977
Filing Date	2009-12-01
First Named Inventor	Ron Hadar
Art Unit	1728
Examiner Name	
Attorney Docket Number	108144-202701 (TGY027)

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	/John P. Ward/	Date (YYYY-MM-DD)	2010-11-18
Name/Print	John P. Ward	Registration Number	40216

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.**

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

Electronic Acknowledgement Receipt

EFS ID:	8870473
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	John Patrick Ward/Patricia Caldwell
Filer Authorized By:	John Patrick Ward
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	18-NOV-2010
Filing Date:	01-DEC-2009
Time Stamp:	17:38:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	108144-202701_Notice_related_apps.pdf	211489 840715bab77698f87c72a9a0de35b47c561c3922	no	8

Warnings:

Information:

Exhibit 1016 (Pt. 1 of 2)

2	Information Disclosure Statement (IDS) Filed (SB/08)	108144-202701_IDS.pdf	612376 8c2f2667b963c9adf863691aa544a49be569d2f2	no	4
Warnings:					
Information:					
Total Files Size (in bytes):				823865	
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. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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

Inventor(s):	Ron Hadar	Examiner:	
Serial No.:	12/628,977	Group Art Unit:	1728
Filed:	December 1, 2009	Confirmation:	6958
Title:	SYSTEMS AND METHODS FOR AN ENHANCED WATCHDOG IN SOLAR MODULE INSTALLATIONS		

NOTICE OF RELATED APPLICATIONS

Applicant is hereby providing notice that the subject patent application is related to the patent applications listed below. Applicant respectfully requests the Examiner to review the history of these related applications, including the current claims, and Office Actions and Notices of Allowance:

1. U.S. Patent Application Serial No. 12/254,780, filed October 20, 2008, entitled “Apparatuses and Methods to Reduce Safety Risks Associated with Photovoltaic Systems.”
2. U.S. Patent Application Serial No. 12/366,597, filed February 5, 2009, entitled “Apparatuses and Methods to Reduce Safety Risks Associated with Photovoltaic Systems,” now U.S. Patent No 7,807,919.
3. U.S. Patent Application Serial No. 12/948, 614, filed November 17, 2010, entitled “Apparatuses and Methods to Reduce Safety Risks Associated with Photovoltaic Systems.”

A copy of the current transaction history retrieved from the USPTO Patent Application Information Retrieval (PAIR) system for the above-referenced patent applications are attached hereto.

Respectfully submitted,

Date: November 18, 2010

/John P. Ward/
John Ward
Reg. No. 40,216

GREENBERG TRAURIG, LLP
CUSTOMER NUMBER **64494**
1900 University Avenue, Fifth Floor
East Palo Alto, CA 94303
Phone: (650) 328-8500; Fax: (650) 328-8508

APPARATUSES AND METHODS TO REDUCE SAFETY
12/254,780 RISKS ASSOCIATED WITH PHOTOVOLTAIC
SYSTEMS

11-18-
2010::16:04:57

Transaction History	
Date	Transaction Description
10-29-2010	Electronic Review
10-29-2010	Email Notification
10-29-2010	Email Notification
10-29-2010	Mail Examiner's Amendment
10-29-2010	Mail Notice of Allowance
10-25-2010	Notice of Allowance Data Verification Completed
10-25-2010	Case Docketed to Examiner in GAU
10-25-2010	Document Verification
10-25-2010	Examiner's Amendment Communication
08-10-2010	Information Disclosure Statement considered
10-06-2010	Case Docketed to Examiner in GAU
09-01-2010	Date Forwarded to Examiner
08-27-2010	Response after Non-Final Action
08-10-2010	Electronic Information Disclosure Statement
08-10-2010	Information Disclosure Statement (IDS) Filed
06-01-2010	Electronic Review
05-28-2010	Email Notification
05-28-2010	Mail Non-Final Rejection
05-24-2010	Non-Final Rejection
05-10-2010	Information Disclosure Statement considered
09-22-2009	Information Disclosure Statement considered
09-22-2009	Information Disclosure Statement considered
05-26-2009	Information Disclosure Statement considered
05-10-2010	Information Disclosure Statement (IDS) Filed
05-11-2010	Email Notification
05-11-2010	Filing Receipt - Corrected
04-28-2010	Preliminary Amendment
03-17-2010	Corrected filing receipt
03-17-2010	Rule 47 / 48 Correction of Inventorship Papers Filed
03-29-2010	Electronic Review
03-29-2010	Email Notification
03-29-2010	PG-Pub Request

01-20-2010	PGPubs early publication request
09-22-2009	Electronic Information Disclosure Statement
02-17-2010	Email Notification
02-04-2010	Mail-Record Petition Decision of Granted to Make Special
02-03-2010	Record Petition Decision of Granted to Make Special
01-20-2010	Petition Entered
07-13-2009	Preliminary Amendment
08-21-2009	Preliminary Amendment
09-22-2009	Information Disclosure Statement (IDS) Filed
09-22-2009	Information Disclosure Statement (IDS) Filed
08-11-2009	Case Docketed to Examiner in GAU
08-04-2009	Case Docketed to Examiner in GAU
05-26-2009	Miscellaneous Incoming Letter
05-26-2009	Electronic Information Disclosure Statement
05-26-2009	Information Disclosure Statement (IDS) Filed
05-13-2009	Case Docketed to Examiner in GAU
05-07-2009	PG-Pub Issue Notification
02-24-2009	IFW TSS Processing by Tech Center Complete
02-24-2009	Case Docketed to Examiner in GAU
01-08-2009	Oath or Declaration Filed (Including Supplemental)
11-25-2008	Application Dispatched from OIPE
11-05-2008	Sent to Classification Contractor
11-05-2008	Filing Receipt
10-23-2008	Cleared by OIPE CSR
10-22-2008	IFW Scan & PACR Auto Security Review
10-20-2008	Initial Exam Team nn

APPARATUSES AND METHODS TO REDUCE SAFETY
 12/366,597 RISKS ASSOCIATED WITH PHOTOVOLTAIC
 SYSTEMS

11-18-
 2010::16:06:59

Transaction History	
Date	Transaction Description
10-05-2010	Recordation of Patent Grant Mailed
09-16-2010	Email Notification
09-15-2010	Issue Notification Mailed
10-05-2010	Patent Issue Date Used in PTA Calculation
09-07-2010	Dispatch to FDC
08-30-2010	Application Is Considered Ready for Issue
08-24-2010	Issue Fee Payment Verified
08-24-2010	Electronic Review
08-24-2010	Issue Fee Payment Received
08-24-2010	Email Notification
08-24-2010	Mail Notice of Allowance
08-18-2010	Document Verification
08-18-2010	Notice of Allowance Data Verification Completed
08-18-2010	Case Docketed to Examiner in GAU
07-30-2010	Examiner Interview Summary Record (PTOL - 413)
08-12-2010	Date Forwarded to Examiner
07-30-2010	Response after Non-Final Action
07-20-2010	Electronic Review
07-20-2010	Email Notification
07-20-2010	Mail Non-Final Rejection
07-06-2010	Non-Final Rejection
06-24-2010	Information Disclosure Statement considered
06-24-2010	Reference capture on IDS
06-24-2010	Electronic Information Disclosure Statement
06-26-2010	Date Forwarded to Examiner
06-24-2010	Request for Continued Examination (RCE)
06-26-2010	Disposal for a RCE / CPA / R129
06-24-2010	Information Disclosure Statement (IDS) Filed
06-24-2010	Workflow - Request for RCE - Begin
03-24-2010	Electronic Review
03-24-2010	Email Notification
03-24-2010	Mail Final Rejection (PTOL - 326)

03-20-2010	Final Rejection
01-04-2010	Miscellaneous Incoming Letter
01-24-2010	Date Forwarded to Examiner
12-18-2009	Supplemental Response
01-21-2010	Response after Non-Final Action
01-06-2010	Electronic Review
01-06-2010	Email Notification
01-06-2010	Mail Non-Final Rejection
01-03-2010	Non-Final Rejection
11-25-2009	Information Disclosure Statement considered
12-28-2009	Email Notification
12-28-2009	Mail Examiner Interview Summary (PTOL - 413)
12-18-2009	Examiner Interview Summary Record (PTOL - 413)
11-25-2009	Electronic Information Disclosure Statement
11-28-2009	Date Forwarded to Examiner
11-25-2009	Request for Continued Examination (RCE)
11-28-2009	Disposal for a RCE / CPA / R129
11-25-2009	Information Disclosure Statement (IDS) Filed
11-25-2009	Workflow - Request for RCE - Begin
08-28-2009	Electronic Review
08-28-2009	Email Notification
08-28-2009	Mail Final Rejection (PTOL - 326)
08-17-2009	Final Rejection
08-07-2009	Date Forwarded to Examiner
07-13-2009	Response after Non-Final Action
07-02-2009	Mail Examiner Interview Summary (PTOL - 413)
06-30-2009	Examiner Interview Summary Record (PTOL - 413)
05-22-2009	Miscellaneous Incoming Letter
05-22-2009	Electronic Information Disclosure Statement
06-16-2009	Mail Non-Final Rejection
06-08-2009	Non-Final Rejection
02-05-2009	Information Disclosure Statement considered
05-22-2009	Information Disclosure Statement considered
05-28-2009	PG-Pub Issue Notification
05-22-2009	Information Disclosure Statement (IDS) Filed
05-13-2009	Mail-Record Petition Decision of Granted to Make Special

05-12-2009	Record Petition Decision of Granted to Make Special
04-21-2009	Petition Entered
04-06-2009	Mail-Petition Decision - Dismissed
04-06-2009	Petition Decision - Dismissed
02-05-2009	Petition Entered
03-31-2009	Case Docketed to Examiner in GAU
03-17-2009	IFW TSS Processing by Tech Center Complete
02-05-2009	Reference capture on IDS
02-05-2009	Electronic Information Disclosure Statement
02-13-2009	Application Dispatched from OIPE
02-13-2009	Filing Receipt
02-06-2009	Accelerated Examination Request
02-06-2009	Cleared by OIPE CSR
02-05-2009	Information Disclosure Statement (IDS) Filed
02-05-2009	Initial Exam Team nn

12/948,614 Apparatuses and Methods to Reduce Safety Risks Associated with Photovoltaic Systems 11-18-2010::16:08:16

Transaction History

Date	Transaction Description
11-17-2010	IFW Scan & PACR Auto Security Review
11-17-2010	Initial Exam Team nn

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Ron Hadar et al.	Examiner:	Matthew Martin
Serial No.:	12/628,977	Group Art Unit:	1795
Filed:	December 1, 2009	Confirmation:	6958
Title:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations		

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

RESPONSE TO NON-FINAL OFFICE ACTION

Sir:

In response to the Non-Final Office Action mailed June 14, 2010, please kindly enter the following amendments and consider the following remarks/arguments:

Amendments to the Claims are reflected in the list of claims that begins on page 2 of this paper; and

Remarks/Arguments begin on page 6 of this paper.

CLAIMS

1. (Currently Amended) A system comprising:
a watchdog unit coupled between a solar module and a power bus, the watchdog unit having-and configured to:
a local controller to monitor a communication from a central controller; determine that-and determine whether the communication is interrupted; and
at least one switch to disconnect the solar module from the power bus when the communication is interrupted;
wherein the watchdog unit is configured to connect the solar module to the power bus when the communication is not interrupted.
2. (Currently Amended) The system of claim 1, further comprising ~~a switchable connection configured to disconnect~~ a junction box housing the watchdog unit, the junction box to provide connectivity between the solar module [[from]] and the power bus.
3. (Currently Amended) The system of claim 2, wherein the local controller is configured to control a duty cycle of the switch to control an output voltage from the junction box ~~switchable connection is controlled by a controller.~~
4. (Currently Amended) The system of claim 3, ~~further comprising a feed line from the solar module to the controller, and configured to provide~~ wherein the local controller is configured to operate using [[with]] power from the solar module when a primary power source is unavailable.
5. (Currently Amended) The system of claim 1, further comprising a bypass circuit configured to enable current in the power bus to bypass the solar module when the switch disconnects the solar module from the power bus.

6. (Currently Amended) The system of claim 1, ~~wherein further comprising a backup power source configured to provide~~ the watchdog unit is configured to determine irregularity in periodicity of the communication to determine whether the communication is interrupted with power when a primary power source is unavailable.
7. (Original) The system of claim 1, wherein the communication is interrupted when a threshold of irregularity is surpassed.
8. (Original) The system of claim 1, wherein the communication is interrupted when the central controller fails to send a communication.
9. (Currently Amended) The system of claim 1, further comprising the solar module; and a junction box coupled with the solar module to provide connectivity to the power bus, wherein the watchdog unit resides in ~~[[a]]~~ the junction box.
10. (Original) The system of claim 1, further configured to disconnect the solar module from the power bus when the watchdog unit receives a shutdown signal.
11. (Original) The system of claim 1, wherein the watchdog unit wirelessly communicates with the central controller.
12. (Currently Amended) A system comprising:
a watchdog device coupled between a solar module and a power bus, the watchdog device configured to:
verify communication with a central controller; and
shutdown the solar module from the power bus if communication with the central controller cannot be verified.

13. (Original) The system of claim 12, wherein to shutdown the solar module entails disconnecting the solar module from the power bus.
14. (Original) The system of claim 12, wherein to verify communication:
a challenge is sent to the central controller; and
a response to the challenge is received.
15. (Original) The system of claim 12, wherein to verify communication, a communication is received within a set time from when a last communication was received.
16. (Original) The system of claim 12, further configured to shutdown the solar module if a shutdown signal is received.
17. (Original) The system of claim 12, further configured to wait for a restart signal.
18. (Original) The system of claim 12, further configured to draw energy from a backup energy source when a primary energy source is not available.
19. (Original) A computer-implemented method comprising:
monitoring, via a computing device, a signal from a central controller;
determining, via the computing device, if the signal has been lost;
disconnecting, via the computing device, one or more solar modules from a power bus if
the signal has been lost;
determining, via the computing device, if the signal includes a shutdown command;
disconnecting, via the computing device, the one or more solar modules from the power
bus if the signal includes a shutdown command;
waiting, via the computing device, for a restart signal; and
connecting, via the computing device, the one or more solar modules to the power bus
when the restart signal is received.

20. (Original) The method of claim 19, further comprising:
enabling, via the computing device, a bypass circuit when the one or more solar modules
are disconnected from the power bus, so that current continues to flow in the
power bus.

REMARKS

The foregoing amendment and the following arguments are provided generally to impart precision to the claims, by more particularly pointing out the invention, rather than to avoid prior art.

Rejections Under 35 U.S.C. §102(a)

Claims 1-10 and 13-18 were rejected under Dorn (U.S. Pat. App. Pub. No. 2008/0142071) and Wiles (“Photovoltaic Power Systems and the National Electrical Code: Suggested Practices”). Applicant respectfully disagrees.

Applicant respectfully submits that claims 1-10 are patentable over Dorn and Wiles. Neither Dorn nor Wiles discloses Applicant’s claimed feature of “at least one switch to **disconnect the solar module from the power bus** *when the communication is interrupted*; wherein the watchdog unit is configured to **connect** the solar module to the power bus *when the communication is not interrupted*” recited in claim 1.

Dorn merely discloses the idea of “cell connectivity could also be modified to disconnect all cells as a safety feature” (the last sentence of Par. [0017] of Dorn). The cell connectivity is limited within a model (see, e.g., the first sentence of Par. [0017] of Dorn). However, Dorn failed to suggest the specific way of disconnecting “the solar module from the power bus *when the communication is interrupted*” recited in claim 1.

The disclosure of Dorn (e.g., Par. [0017]) is limited to connecting the PV cells within a module. For example, the first sentence of Par. [0017] of Dorn states “[t]he interconnection between the cells *in the* module ...” (emphasis added); and the first sentence of Par. [0023] of Dorn states “FIG. 1A illustrates a circuit schematic of *a module* ...” (emphasis added). As a result, Dorn does not disclose “a watchdog unit coupled *between a solar module and a power bus*” as recited in claim 1.

Wiles is not sufficient to cure the above discussed deficiency of Dorn. Thus, claim 1 and its dependent claims are patentable.

Furthermore, Wiles teaches away by suggesting that

“local inspectors will **not** require disconnects on totally enclosed, self-contained PV systems like a PV-powered, solar, hot-water circulating system. This would be particularly true if the entire assembly were listed as a unit and there were no external contacts or user serviceable parts.” (Wiles, page 34, lines 3-6 in the third paragraph under the heading “Disconnecting Means”) [Emphasis Added].

Since what is disclosed in Dorn is the structure inside a module (which corresponds to “totally enclosed, self-contained PV systems” discussed in Wiles), Wiles teaches away from using the disconnecting means of Wiles in the module of Dorn.

The examiner failed to provide the detailed reasons for the rejection of claims 14, 15, and 17. Thus, the rejections for claims 14, 15 and 17 are improper.

Further, claims 13-18 depend from claim 12 to incorporate the limitations of claim 12. Since the examiner failed to provide reasons to reject claim 12 based on Dorn and Wiles, the rejections for claims 13-18 based on Dorn and Wiles are improper.

Claims 12, 19 and 20 were rejected under Dorn and Wiles and further in view of Takahara (U.S. Pat. No. 6,101,073). Applicant respectfully disagrees.

In Takahara, the stopping of “the operation of an inverter connected between the solar cell array and a load” is based on the detection of **ground fault** (see, e.g., Abstract, lines 1-7, Takahara). Takahara does not disclose “verify **communication with a central controller**” and “shutdown the solar module from the power bus if **communication with the central controller** cannot be verified.” Specifically, “a ground fault for a period longer than a time **T1**” as in Takahara does not correspond to the condition of “**communication with the central controller** cannot be verified” recited in claim 12. Thus, Takahara is not sufficient to cure the deficiency in Dorn and Wiles.

Furthermore, the Takahara system is designed to stop “an inverter” under a specific condition (i.e., ground fault) (see, e.g., Abstract, lines 1-7, Takahara). However, the switches in

the Dorn system are designed to modify cell connectivity with a module (see, e.g., the first and the last sentences of Par. [0017] of Dorn). Thus, the disclosure of Takahara is not applicable to the module disclosed in Dorn.

Thus, at least for the above reasons, claim 12 and its dependent claims are patentable.

None of Dorn, Wiles and Takahara discloses the Applicant's claimed feature of "disconnecting, via the computing device, one or more solar modules from a power bus *if the signal has been lost*" recited in claim 19. Thus, claim 19 and its dependent claims are patentable.

The dependent claims further recite patentable features not found in Dorn, Wiles and Takahara.

For example, claim 3 recites "the local controller is configured to control a duty cycle of the switch to control an output voltage from the junction box," which feature is not found in Dorn, Wiles and Takahara.

For example, claim 5 recites "a bypass circuit configured to enable current in the power bus to bypass the solar module when the switch disconnects the solar module from the power bus," which feature is not found in Dorn, Wiles and Takahara. Dorn merely discloses that "a shaded cell could act as a bypass diode." However, Dorn does not disclose enabling "current in the power bus to *bypass the solar module* when the switch disconnects the solar module from the power bus", in a way as recited in claim 5.

For example, claim 6 recites "the watchdog unit is configured to determine irregularity in periodicity of the communication to determine whether the communication is interrupted," which feature is not found in Dorn, Wiles and Takahara.

For example, claim 8 recites "the communication is interrupted when the central controller *fails to* send a communication," which feature is not found in Dorn, Wiles and Takahara.

Thus, at least for the above reasons, the pending claims are patentable.

CONCLUSION

It is respectfully submitted that all of the Examiner's objections have been successfully traversed and that the application is now in order for allowance. Accordingly, reconsideration of the application and allowance thereof is courteously solicited.

Respectfully submitted,

Date: September 14, 2010

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Electronic Acknowledgement Receipt

EFS ID:	8417763
Application Number:	12628977
International Application Number:	
Confirmation Number:	6958
Title of Invention:	Systems and Methods for an Enhanced Watchdog in Solar Module Installations
First Named Inventor/Applicant Name:	Ron HADAR
Customer Number:	64494
Filer:	John Patrick Ward/Anne Collette
Filer Authorized By:	John Patrick Ward
Attorney Docket Number:	108144-202701/US (TGY027)
Receipt Date:	14-SEP-2010
Filing Date:	01-DEC-2009
Time Stamp:	17:55:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		108144-202701US_Response.pdf	121210 a254f1d0849394226a31b5a4c671e245823556fd	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	9
Warnings:			
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/628,977		Filing Date 12/01/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)		SMALL ENTITY ☒		OR		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A		N/A		N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A		N/A		N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A		N/A		N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$	=	OR	X \$	=	X \$	=	X \$
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$	=	OR	X \$	=	X \$	=	X \$
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL		TOTAL		TOTAL		TOTAL	
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT	09/14/2010	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)
Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X \$26 =	0	OR	X \$ =	X \$ =	X \$ =
Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0	X \$110 =	0	OR	X \$ =	X \$ =	X \$ =
☐ Application Size Fee (37 CFR 1.16(s))							OR			
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR			
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE		
(Column 1)			(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)
Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =		OR	X \$ =	X \$ =	X \$ =
Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		OR	X \$ =	X \$ =	X \$ =
☐ Application Size Fee (37 CFR 1.16(s))							OR			
☐ 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 number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/Theresa Dawkins/

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