

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SOLAREGE TECHNOLOGIES LTD.,
Petitioner,

v.

KOOLBRIDGE SOLAR, INC.,
Patent Owner.

IPR2022-00010
Patent 8,937,822 B2

Before THU A. DANG, BRIAN J. McNAMARA, and
PATRICK M. BOUCHER, *Administrative Patent Judges*.

DANG, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable

I. INTRODUCTION

Background

In response to a Petition (Paper 1, “Pet.”) filed by SolarEdge Technologies Ltd. (“Petitioner”), we instituted *inter partes* review of claims 14–19 (the “challenged claims”) of U.S. Patent No. 8,937,822 B2 (Ex. 1401, “the ’822 patent”). *See* Paper 10 (“Dec. Inst.”). During trial, Koolbridge Solar, Inc. (“Patent Owner”) filed a Response (Paper 14 (“PO Resp.”), to which Petitioner filed a Reply (Paper 17, “Pet. Reply.”). In turn, Patent Owner filed a Sur-Reply. Paper 19 (“PO Sur-Reply”). An oral hearing was held with the parties on January 19, 2023. A transcript of the hearing has been entered into the record. Paper 26 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of the claims on which we instituted trial. Based on the record before us, Petitioner has shown by a preponderance of the evidence that claims 14–19 of the ’822 patent are unpatentable.

Related Proceedings

Petitioner identifies the ’822 patent as the subject of IPR2022-00007 (“Petition 1”), IPR2022-00008 (“Petition 2”), IPR2022-00009 (“Petition 3”), IPR2022-00011 (“Petition 5”), and IPR2022-00012 (“Petition 6”). Paper 3, 1 (“Petitioner’s Petition Ranking” or “Ranking”).

The ’822 Patent

The ’822 patent, titled “Solar Energy Conversion and Utilization System,” issued on January 20, 2015, from Application No. 13/103,070, with a filing date of May 8, 2011. Ex. 1401, codes (54), (45), (21), (22).

The '822 patent discloses an electrical installation employing a load inverter implementation to provide a household with solar-generated alternating current (“AC”) power. *Id.* at 30:36–38.

An illustration of an embodiment of the '822 patent's electrical installation is depicted in Figure 18, reproduced below:

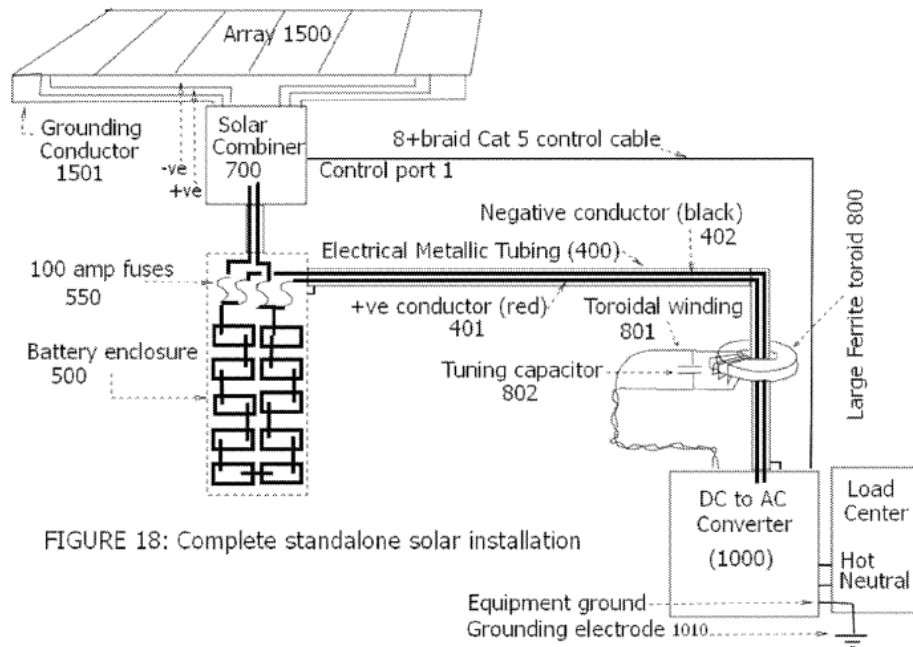


Figure 18 is a block diagram of an electrical installation with a solar array comprising one or more strings of solar panels installed on a south-facing roof, for example, wherein any exposed metallic parts other than its electrical terminals shall be returned to ground via a grounding conductor to give some degree of protection against thunderstorm transients. *Id.* at 30:38–43. In the electrical installation shown in Figure 18, solar combiner 700 selectively combines the currents from multiple strings of solar panels in array 1500 according to relay control signals presented to control port 1. *Id.* at 31:1–4. Standalone inverter (shown as “DC to AC converter”) 1000 is connected to control port 1 via 8-conductor-plus-braid Cat 5 cable, and

controls the string selection in order to maintain the voltage of battery 500 within desired limits. *Id.* at 31:4–8. The combined current from the selected strings is routed from solar combiner 700 to battery 500 to maintain a coaxial path. *Id.* at 31:39–41.

As shown in Figure 18, metallic conduit 400 is used to route wires from battery 500 through the ground leak detector comprised of ferrite toroid 800, toroidal winding 801, and tuning capacitor 802, to inverter 1000. *Id.* at 31:65–32:1. Metallic conduit 400 and its enclosed positive, negative and ground conductors pass in their entirety through ferrite toroid 800 which senses any unusual ground leak current, and outputs a corresponding voltage to inverter 1000. *Id.* at 32:1–27. An amplifier inside inverter 1000 amplifies this voltage and compares it to a threshold, wherein, if the voltage exceeds the threshold, inverter 1000 executes a shutdown, controlling solar combiner 700 to the direct current (“DC”) disconnect state and opening both the inverter AC output relays and the DC input power and start-up relays. *Id.* at 32:27–32. This completely isolates array 1500 from battery 500 and ground and battery 500 from inverter 1000 and ground, thus preventing any further ground leakage current. *Id.* at 32:32–35.

The Challenged Claims

Of the challenged claims (claims 14–19), claim 14 is independent, and is reproduced below:

14. In a solar energy installation comprising a photovoltaic solar array and a DC to AC converter having a DC input with positive and negative conductors routed in parallel with an array grounding conductor and an AC output having an output waveform with an output repetition frequency, a method of detecting a ground leak in the DC wiring to the solar array, comprising:

creating a common-mode AC probe signal waveform from said DC to AC converter at a characteristic repetition frequency that is in phase on both said DC positive and negative input conductors;

passing said positive and negative conductors from the array through a detector adapted to detect an unusual current with said common mode waveform at said characteristic repetition frequency and upon detection of said unusual current providing an indication of the presence of an unwanted ground leak.

Ex. 1401, 43:21–37.

Asserted Grounds of Unpatentability

We instituted *inter partes* review for all claims and all grounds in the Petition. Petitioner asserts that claims 14–19 of the '822 patent are unpatentable on the following grounds (Pet. 21):

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)/Basis
14, 15, 18	103	Suzui ² , Boniface ³ , Gilmore ⁴

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102, 103, effective March 16, 2013. Because the application from which the '822 patent issued was filed before this date, the pre-AIA versions of §§ 102, 103 apply.

² U.S. Patent No. 6,927,955 B2, issued August 9, 2005, filed September 24, 2002 (Ex. 1406, “Suzui”).

³ U.S. Patent Publication No. 2009/0297543 A1, published August 20, 2009, filed December 18, 2008 (Ex. 1424, “Boniface”).

⁴ U.S. Patent Publication No. 2009/0190275 A1, published July 30, 2009, filed January 29, 2008 (Ex. 1460, “Gilmore”).

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)/Basis
16	103	Suzui, Boniface, Gilmore, Dubovsky ⁵
17	103	Suzui, Boniface, Gilmore, Mori ⁶
19	103	Suzui, Boniface, Gilmore, Endo ⁷

Petitioner relies on the Declarations of Dr. R. Jacob Baker, Ph.D. (Exs. 1402, 1474) in support of its unpatentability contentions. Patent Owner provides the Declaration of Daniel Foty, Ph.D. (Ex. 2006), as well as the deposition of Dr. Baker (Exs. 2007–2008). Dr. Foty was cross-examined by Petitioner, and a transcript of his deposition was entered into the record. Ex. 1475. Petitioner then provides the Supplemental Declaration of Dr. Foty made at the request of Patent Owner. Ex. 1498.

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). Relying on the declaration of Dr. Baker, Petitioner contends that a person of ordinary skill in the art (POSITA) related to the '822 patent would

⁵ U.S. Patent No. 6,949,843 B2, issued September 27, 2005, filed September 22, 2003 (Ex. 1459, “Dubovsky”).

⁶ Japanese Patent Publication No. 2006-238630, published September 7, 2006, filed February 25, 2005 (Exs. 1404 (English translation), 1420, “Mori”).

⁷ Japanese Patent No. H11-136852, published May 21, 1999, filed October 27, 1997 (Exs. 1461, 1462 (English translation), “Endo”).

have had “a bachelor’s degree in electrical engineering or similar discipline,” and “three years of design experience with power electronics, including experience designing power converters.” Pet. 21–22 (citing Ex. 1402 ¶¶ 20–23). Patent Owner does not propose any definition for a POSITA, and Dr. Foty states that he “does not dispute the Petitioner’s proposed level of ordinary skill in the art.” *See generally* PO Resp.; Ex. 2006 ¶ 42.

We adopt and apply Petitioner’s definition of a POSITA at the time of the claimed invention because, based on the record, this proposal is consistent with the ’822 patent, the asserted prior art, and is supported by the testimony of Dr. Baker.

B. Claim Construction

We construe each claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b) (2020). Under this standard, claim terms are generally given their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art (POSITA) at the time of the invention and in the context of the entire patent disclosure. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

Petitioner proposes a construction for “DC to AC converter” and “detector.” Pet. 22–23. In its obviousness arguments, Petitioner further contends that the claim limitation “upon detection of said unusual current providing an indication of the presence of an unwanted ground leak” should be interpreted as “conditional language because it is contingent ‘upon detection of said unusual current,’ wherein “if the ‘unusual current’ is not

detected, then the claim does not require the limitation to be performed.” *Id.* at 42–43 (citing *Ex parte Schulhauser*, No. 2013-00787, slip op. at 10 (PTAB April 28, 2016)). Nevertheless, Petitioner contends that Suzui discloses this “conditional” limitation. *Id.*

Patent Owner does not propose any claim construction with respect to “DC to AC converter” and “detector.” *See generally* PO Resp. However, with respect to Petitioner’s “conditional” argument, Patent Owner contends that “the claim recites a ‘method of detecting a ground leak in the DC wiring to the solar array,’ wherein ‘if the ‘conditional’ language does not occur . . . -then the recited method is no longer a ‘method of detecting a ground leak.’” PO Resp. 4. Thus, Patent Owner contends that “this claim element cannot be ignored by the Board.” *Id.*

We determine that it is unnecessary to construe any claim term expressly to resolve the disputed issues before us. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those 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)). As Petitioner contends that Suzui discloses this limitation (Pet. 42–43), we do not ignore this limitation but address the limitation based on the parties’ explicit arguments with respect to Suzui.

C. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter 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) objective evidence of non-obviousness.⁸ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

D. Obviousness of Claims 14–19

Petitioner contends that claims 14, 15, and 18 of the ’822 patent would have obvious over by Suzui, Boniface, and Gilmore (Pet. 25–47); that claim 16 of the ’822 patent would have obvious over by Suzui, Boniface, and Gilmore in further view of Dubovsky (*id.* at 47–52); that claim 17 of the ’822 patent would have obvious over by Suzui, Boniface, and Gilmore in further view of Mori (*id.* at 52–61); and that claim 19 of the ’822 patent would have obvious over by Suzui, Boniface, and Gilmore in further view of Endo (*id.* at 61–65).

Patent Owner counters that the asserted combinations fail to disclose key elements of claim 14. PO Resp. 7–16; *see also* PO Sur-reply 3–15.

We summarize the asserted prior art below.

1. Suzui

Suzui, titled “Apparatus and Method of Detecting Ground Fault in Power Conversion System,” issued on August 9, 2005, with a filing date of September 24, 2002. Ex. 1406, codes (54), (45), (22). Suzui discloses a ground fault detection apparatus in a power conversion system, which can

⁸ Neither party presents evidence or arguments regarding objective evidence of non-obviousness in the instant proceeding.

detect a DC ground fault without stopping the operation of an inverter. *Id.* at 2:21–24. An illustration of Suzui’s solar power generation system using an inverter is depicted in Figure 2, reproduced below.

FIG. 2

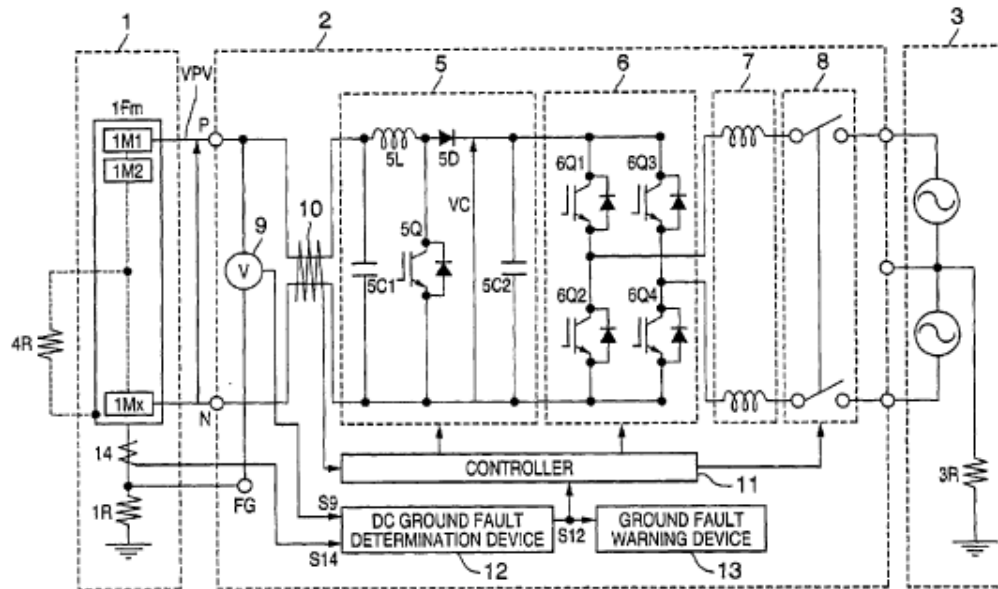


Figure 2 shows a schematic arrangement of a solar power generation system. *Id.* at 4:59–60. As shown in Figure 2, the circuit arrangement employs system interconnection inverter 2 which converts DC power output from solar battery 1 into AC power, and outputs the AC power to commercial power system 3. *Id.* at 4:61–65. Voltage detector 9 detects the voltage between the frame ground terminal of inverter 2 connected to the ground of solar battery 1 and the positive terminal of the DC input portion of inverter 2, and outputs voltage signal S9 to DC ground fault determination device 12. *Id.* at 5:41–46. Current detector 10 detects the zero-phase current of the DC circuit of inverter 2 and outputs ground fault signal S10 at a predetermined threshold value or more. *Id.* at 5:47–51.

2. Boniface

Boniface, titled “System and Method for Fault Detection and Hazard Prevention in Photovoltaic Source and Output Circuits,” published on August 20, 2009, with a filing date of December 18, 2008. Ex. 1424, codes (54), (43), (22). Boniface discloses a fault detect system that comprises a photovoltaic (PV) source responsive to incident sunlight to generate output power along output conductors. *Id.* at code (57). An illustration of Boniface’s PV system is depicted in Figure 1, reproduced below.

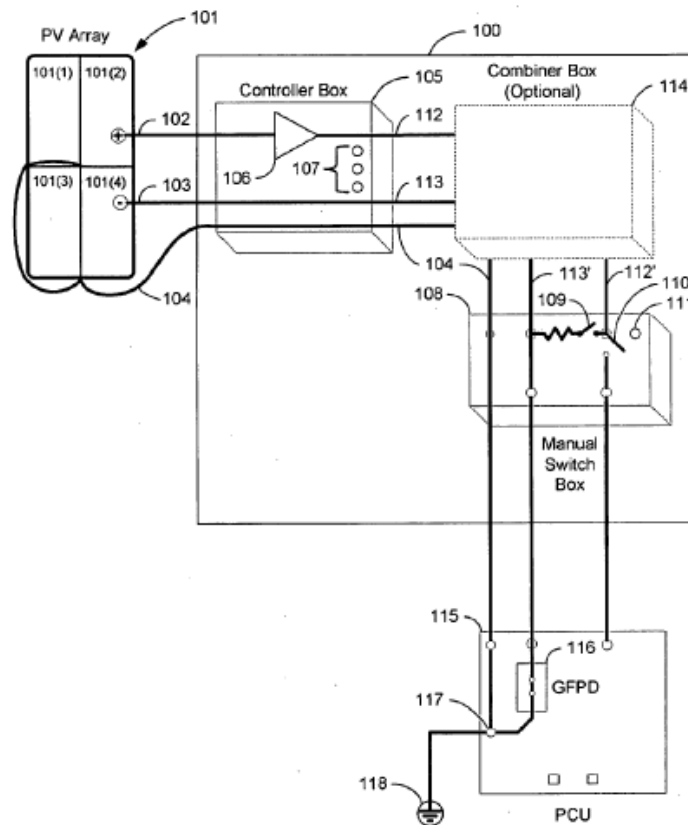


Fig. 1

Figure 1 is an illustration of an entire controlled PV system showing connections between a PV array, a controller, a manual switch, and a power

conditioning unit (PCU). *Id.* ¶ 12. As shown in Figure 1, complete PV control system 100 comprises controller 105, combiner 114, manual switch 108, and proper connective wiring. *Id.* ¶ 37. Combiner 114 connects multiple controllers in various series or parallel connection arrangements, the single combined output is then fed from combiner 114 to manual switch 108, and the output conductors of switch assembly 108 is then fed into PCU 115. *Id.* ¶ 38.

3. Gilmore

Gilmore, titled “System and Method for Ground Fault Detection and Interruption,” published on July 30, 2009, with a filing date of January 29, 2008. Ex. 1460, codes (54), (43), (22). Gilmore discloses a ground fault detector and interrupter for a PV energy conversion system. *Id.* at code (57). An illustration of Gilmore’s ground fault detector and interrupter is depicted in Figure 2, reproduced below.

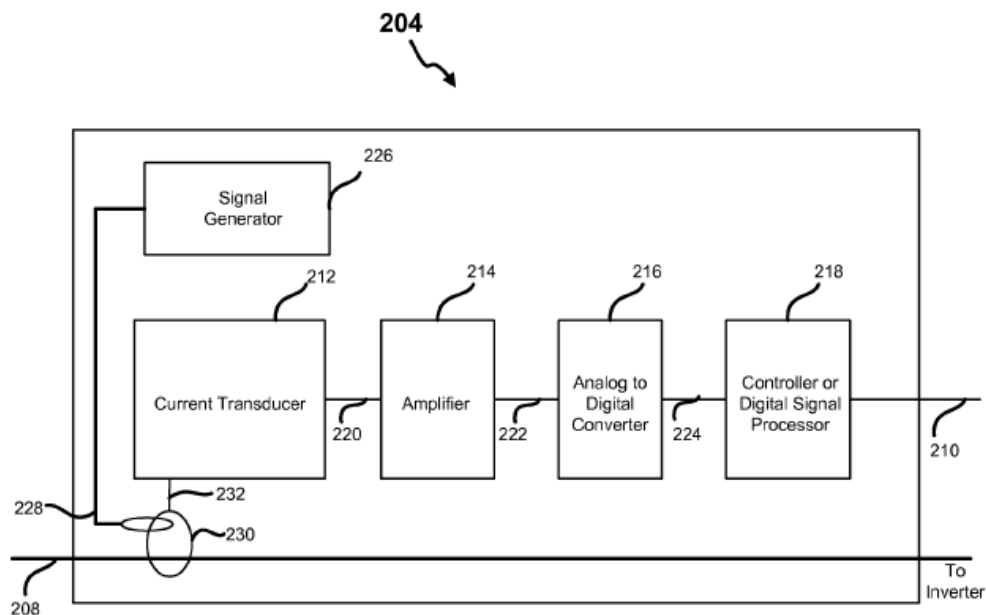
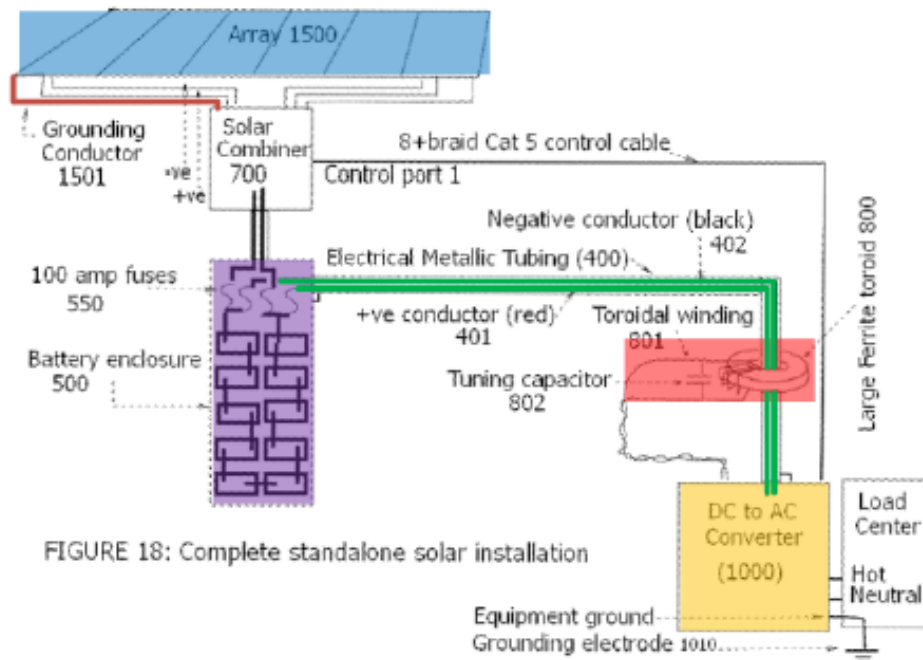


FIG. 2

Figure 2 is a block diagram of ground fault detector and interrupter 204, wherein input lines 208 from a PV array are coupled to DC current transducer 212, input lines 208 corresponding to the positive and neutral (tied to ground) connections to the PV array. *Id.* ¶ 22. As shown in Figure 2, ground fault detector and interrupter 204 comprises amplifier 214, analog-to-digital (A/D) converter 216, and controller or digital signal processor 218. *Id.* ¶ 23. DC current transducer 212 is coupled to amplifier 214 by connector lines 220, amplifier 214 is coupled to A/D converter 216 by connector lines 222, A/D converter 216 is coupled to controller or digital signal processor 218 by connector lines 224, and ground fault detector and interrupter 204 is coupled to a disconnect module of a PV energy conversion system by lines 210. *Id.* When a ground fault condition arises in the PV array, more current flow will flow on one of input lines 208 than the other input line, and a current will be induced in coil 230 of current transducer 212 so as to create a fault signal that is fed to input 232 of current transducer 212. *Id.* ¶ 24.

4. Analysis

Petitioner contends that the '822 patent is directed to a solar energy installation implemented with a ground leak detector. Pet. 2. Petitioner provides an annotated Figure 18 of the '822 patent, shown below, to illustrate its contentions.



Ex. 1401, Fig. 18 (annotated).

Annotated Figure 18 of the '822 patent in the Petition, according to Petitioner, illustrates a “solar energy installation,” which comprises “a solar array 1500 (blue) and a battery 500 (purple) connected to positive and negative DC input conductors (green) of a DC to AC converter 1000 (orange).” Pet. 2–3 (citing Ex. 1401, 5:4–6, 30:36–67, 31:35–47, 31:65–67, 35:43–36:9, 36:30–35, 36:49–51, 40:1–9, Fig. 18). Petitioner contends that, in the '822 patent, “[t]he positive and negative DC input conductors are routed from battery 500 and array 1500 (via solar combiner 700) through the ground leak detector (800, 801) (red) and to the inverter 1000.” *Id.* at 3 (citing Ex. 1402 ¶¶ 75–77). According to Petitioner, toroid 800 “senses an unusual ground leak current from the common-mode waveform on the positive and negative input conductors, and if the ground leak current exceeds a threshold, the inverter 1000 executes a shutdown,” thus,

“preventing any further ground leakage current.” *Id.* at 3–4 (citing Ex. 1401, 32:26–32, 35:65–36:3, 36:30–35, 40:29–35; Ex. 1402 ¶¶ 76–77).

Having reviewed Petitioner’s arguments and supporting evidence in the complete record, we determine Petitioner has demonstrated by a preponderance of the evidence that claim 14, and claims 15 and 18 depending therefrom, would have been obvious over Suzui in view of Boniface and Gilmore, notwithstanding Patent Owner’s arguments to the contrary. As the combination of Suzui, Boniface and Gilmore meets all the limitations of illustrative claim 14, the only independent challenged claim, we need not address Dubovsky, Mori, and Endo. *See Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, Nos. 2019-1594, 2019-1604, 2019-1605, 2020 WL 2071962, *4 (Fed. Cir. Apr. 30, 2020); *see also Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (holding that once a dispositive issue is decided, there is no need to decide other issues).

We determine that dependent claim 16 is thus obvious over Suzui, Boniface, and Gilmore in further view of Dubovsky; that dependent claim 17 is thus obvious over Suzui, Boniface, and Gilmore in further view of Mori; and that dependent claim 19 is thus obvious over Suzui, Boniface, and Gilmore in further view of Endo. We address in detail Petitioner’s arguments and Patent Owner’s responses with respect to the limitations of illustrative claim 14.

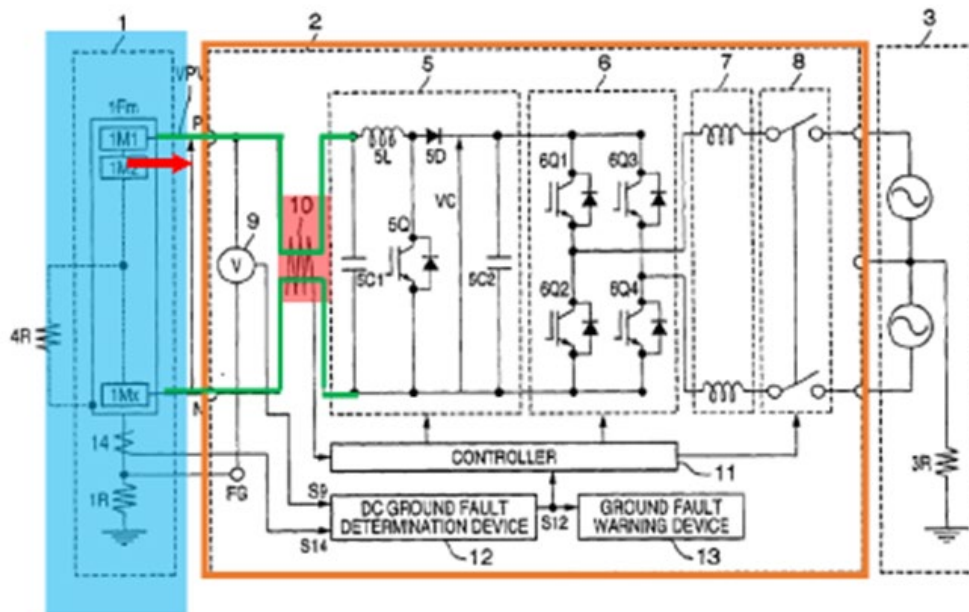
- i. *Preamble, “a solar energy installation comprising a photovoltaic solar array and a DC to AC converter having a DC input with positive and negative conductors routed in parallel with an array grounding conductor and an AC output having an output waveform with an output repetition frequency” (claim 14)*

Petitioner contends that, “[t]o the extent that the preamble is limiting, Suzui discloses it.” Pet. 25.⁹ In particular, Petitioner contends that “Suzui describes a solar power generation system (the claimed ‘solar energy installation’) including a solar battery formed as a string of series-connected solar battery modules,” the solar power generation system comprising “plurality of the solar battery strings connected in parallel (the claimed ‘photovoltaic solar array’).” *Id.* (citing Ex. 1406, 4:59–5:6, Figs. 2, 8; Ex. 1402 ¶¶ 184–187). According to Petitioner, Suzui’s solar power generation system “includes an inverter 2 that ‘converts a DC power output from a solar battery 1 into an AC power and outputs the AC power to a commercial power system 3’ (the claimed ‘DC to AC converter’).” *Id.* (citing Ex. 1406, 3:26–30, 4:60–65, 5:15–20, Fig. 2; Ex. 1402 ¶ 188).

Petitioner provides an annotated Figure 2 of Suzui, shown below, as illustration.

⁹ The issue of whether the preamble is limiting need not be resolved because, regardless of whether the preamble is limiting, as discuss below, Petitioner shows sufficiently that the combination of Suzui, Boniface and Gilmore teaches a “method of detecting a ground leak in the DC wiring to the solar array,” as recited in the preamble. *See Nidec*, 868 F.3d at 1017 (noting that “we need only construe terms ‘that are in controversy’” (quoting *Vivid*, 200 F.3d at 803)).

FIG. 2



Ex. 1406, Fig. 2 (annotated).

Annotated Figure 2 of Suzui in the Petition, according to Petitioner, illustrates “inverter 2 (orange) [that] receives, as input, a DC voltage (VPV) from solar battery 1 (blue) via positive and negative conductors (green) attached to respective input terminals [P, N] of the inverter,” i.e., “the claimed ‘DC to AC converter having a DC input with positive and negative conductors’.” Pet. 28 (citing Ex. 1402 ¶¶ 184–187, 191; Ex. 1406, 5:21–36, 6:58–64, Fig. 2). Petitioner contends that “Suzui’s inverter 2 meets the function of ‘[having] an AC output having an output waveform with an output repetition frequency’ because it outputs a single phase voltage at a commercial frequency.” *Id.* at 25–26 (citing Ex. 1406, 3:26–30, 4:60–65, 5:15–20, 7:46–60, Fig. 2; Ex. 1402 ¶¶ 189, 192).

Petitioner further contends that Boniface teaches a photovoltaic (PV) system “comparable to (and compatible with) Suzui’s system.” Pet. 32. Petitioner provides an annotated Figure 1 of Boniface, shown below.

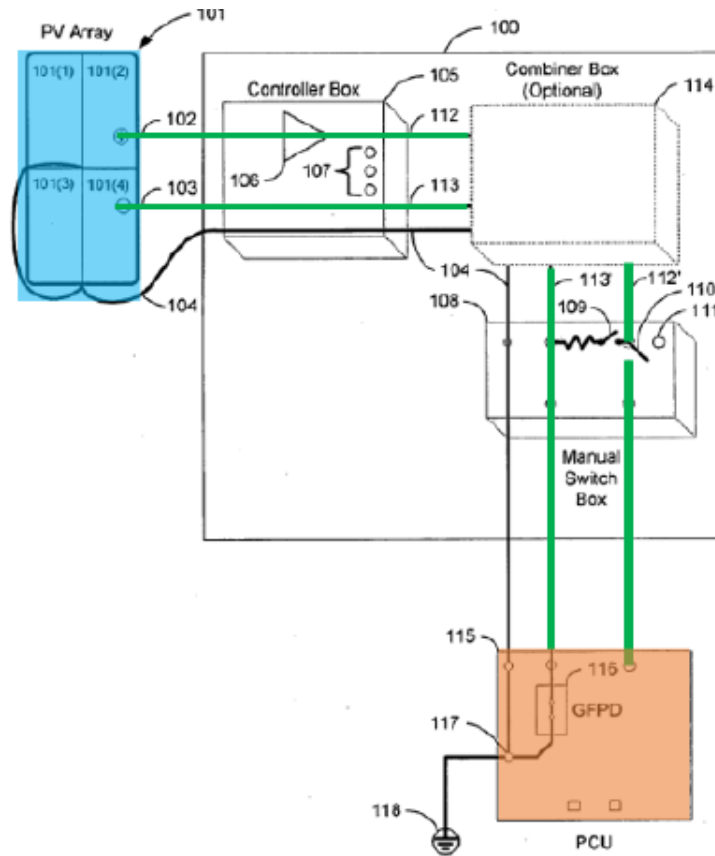


Fig. 1

Annotated Figure 1 of Boniface in the Petition, according to Petitioner, illustrates “a fault detection system comprising a photovoltaic solar array 101 (blue) connected to a power conditioning unit, e.g., inverter 115 (orange) via connective wiring,” wherein “a photovoltaic source positive conductor (102/112/112’) and a negative conductor (103/113/113’)(green) are routed in parallel with an equipment ground conductor 104 connected to earth ground system 118.” Pet. 29 (citing Ex. 1424 ¶¶ 37–39, 48, Figs. 1, 2, 6, 8; Ex. 1402 ¶ 194).

Patent Owner argues that “the Petition does not explain why the solar battery of Suzui is a ‘photovoltaic solar array,’” as recited in the claims. PO

Resp. 7. According to Patent Owner, Petitioner's expert, Dr. Baker, "merely says in passing that a POSITA would understand that the solar battery of Suzui is 'the equivalent of the claimed "photovoltaic solar array,"' wherein "Dr. Baker's statement is conclusory and deserves no weight." *Id.* at 8.

Patent Owner acknowledges that Dr. Baker also testified that "the term 'solar battery' refers to a solar panel," but contends that "a POSITA would understand that solar panels provide a variable DC output." PO Resp. 9 (citing Ex. 2006 ¶ 60, Ex. 2007, 57:1–58:2, 134:15–135:12, 136:18–137:1). Patent Owner then contends that "Suzui is directed to a system with a DC power supply that has 'an almost fixed DC voltage to ground.'" *Id.* at 10 (citing Ex. 1406, preamble, 2:32–36. 2:49–53. 2:65–3:1, 12:5–9). That is, "[a]most fixed' is not 'variable,' meaning the critical claim limitation is simply not met by the proposed combination of references." PO Sur-reply 3 (citing Ex. 1406, Abstract, 2:35. 2:52, 2:67, 10:24, 12:6, 12:12, claims 1, 8, 13, 14). Thus, according to Patent Owner, "[a] POSITA would therefore understand that the 'solar battery' disclosed in Suzui cannot be a solar panel," but rather, Suzui's solar battery "appears to refer to a type of storage battery." PO Resp. 10–11 (citing Ex. 2006 ¶ 61; Ex. 2011, 2:32–59).

We are not persuaded by Patent Owner's contention that Suzui's system comprises a DC power supply that has an almost fixed DC voltage, wherein "[a]most fixed' is not 'variable,' meaning the critical claim limitation is simply not met by the proposed combination of references." PO Sur-reply 3. In particular, there is no "critical claim limitation" that requires a "variable" DC power supply. *See* Ex. 1401, 43:21–37.

We also are not persuaded by Patent Owner's argument that Suzui's solar battery cannot be the photovoltaic solar array as claimed. PO Resp. 9–

10. Instead, we are persuaded by Dr. Baker’s testimony that Suzui’s solar battery 1 “is formed as a solar battery string by connecting a plurality of solar battery modules 1M1 to 1Mx in series such that an appropriate voltage can be output as the input voltage to the system interconnection inverter 2.” Ex. 1402 ¶ 186 (citing Ex. 1406, 4:66–5:2). We find persuasive Dr. Baker’s testimony that Suzui’s solar battery modules 1M1 to 1Mx are “arranged in an array,” wherein a POSITA “would understand that they are composed of photovoltaic cells.” *Id.* at ¶ 187 (citing Ex. 1406, 4:59–5:6, Figs. 2, 8).

We are unpersuaded by Patent Owner’s contention that Suzui’s solar battery is a “storage” battery, and thus, “cannot be a solar panel.” PO Resp. 10. Although Patent Owner argued during oral argument that “a solar battery and storage battery does not have to include a solar array or a solar panel” (Tr. 24:21–24), Patent Owner does not dispute that components of Suzui’s solar battery include “solar battery modules.” *Id.* at 24: 1–8 (“JUDGE BOUCHER: . . . Suzui says, and the Petitioner pointed to this, that a solar battery can be made up of a plurality of solar battery modules – a string of solar battery modules. What is that if that’s not a photovoltaic solar array? MR. BOERMAN: . . . I mean, you can string batteries together”). In fact, Patent Owner acknowledges that Suzui’s solar battery is a solar array. *See id.* at 18: 19–21 (“JUDGE BOUCHER: Okay, so, you agree it’s an array, but it’s not a photovoltaic array? MR. BOERMAN: I don’t think we disagree with that language.”); *see also* PO Sur-reply 7 (““solar battery’ *can* refer to a solar array . . . Patent Owner has never disputed the point.”)

Here, Petitioner contends that, “[t]he parties appear to agree that the claimed photovoltaic solar array generates DC power from sunlight.” Pet. Reply 3 (citing Ex. 2006 ¶¶ 59–61; Pet. 1–3, 25; Ex. 1402 ¶¶ 89, 185–187;

Ex. 1474 ¶ 8). We are persuaded by Petitioner’s contention that Suzui’s solar battery performs this function. *Id.* at 3–4 (citing Ex. 1406, 1:20–33). In particular, Suzui discloses a system using a solar battery such as “a solar power generation system” “converts (DC/AC-converts) a DC power generated by a solar battery into an AC power by an inverter or the like and supplies the AC power to a commercial power system.” *See* Ex. 1406, 1:26–34.

Although Patent Owner contends that “‘solar battery’ disclosed in Suzui cannot be a solar panel,” because a solar panel does not provide a constant level of voltage, but rather, “appears to refer to a type of storage battery” (PO Resp. 10; *see also* PO Sur-reply 3–4), nothing in the challenged claim requires a solar panel that provides a constant level of voltage or precludes “storage battery” comprising a solar array. *See* Ex. 1401, 43:21–37. We are persuaded by Petitioner’s contention, as supported by Dr. Baker, that a POSITA “would have understood [Suzui’s] solar battery modules to be composed of solar or photovoltaic cells because these generate DC power from sunlight,” wherein “a plurality of solar battery modules (i.e., solar cells), connected in series and in parallel, form an array.” Pet. Reply 4 (citing Ex. 1402 ¶¶ 165, 185–187, Ex. 1474 ¶ 9).

Furthermore, as Petitioner points out, “Petitioner cited both Gilmore and Boniface as alternatively teaching the ‘positive and negative conductors from the array through a detector,’ in which the claimed ‘array’ is described in these references as a solar array.” Pet. Reply 3. We are persuaded by Petitioner’s reliance on Boniface for disclosing “a fault detection system comprising a photovoltaic solar array 101 . . . connected to a power conditioning unit, e.g., inverter 115 . . . via connective wiring.” Pet. 29

(citing Ex. 1424 ¶¶ 37–39, 48, Figs. 1, 2, 6, 8; Ex. 1402 ¶ 194). According to Petitioner, “Suzui and Boniface are similar photovoltaic systems sharing similar components and features.” *Id.* at 33 (citing Ex. 1424, Fig. 1; Ex. 1406, Fig. 2; Ex. 1402 ¶ 197). Similarly, we are also persuaded by Petitioner’s reliance on Gilmore for disclosing “a ground fault detector—like Suzui’s current detector 10—that detects unsafe ground fault conditions based on levels of current flowing between a [photovoltaic] array and ground.” *Id.* at 38 (citing Ex. 1460 ¶¶ 20, 24, 26; Ex. 1402 ¶ 206). According to Petitioner, “Gilmore’s detector and transducer coil would have been compatible with the photovoltaic system of Suzui.” *Id.* at 42 (citing Ex. 1402 ¶ 210).

Patent Owner does not present arguments in its Response or its Sur-reply addressing the specific merits of Petitioner’s contentions with respect to Gilmore and Boniface regarding the preamble. *See generally* PO Resp.; PO Sur-reply. Although Patent Owner acknowledges that Petitioner argues in its Reply that “both Gilmore and Boniface disclose the claimed solar array” but argues that “this argument was not made in the Petition” (PO Sur-reply 9), Patent Owner overlooks Petitioner’s specific contention that Boniface and Gilmore teach a “photovoltaic array” in the Petition. *See* Pet. 29, 33, 38, 42.

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that the combination of Suzui, Boniface and Gilmore teaches “a solar energy installation comprising a photovoltaic solar array” and “a DC to AC converter having a DC input with positive and negative conductors routed in parallel with an array grounding conductor and an AC output having an output waveform with an output repetition

frequency,” as recited in claim 14, regardless of whether or not the preamble is limiting.

- ii. *Preamble continued, “a method of detecting a ground leak in the DC wiring to the solar array” (claim 14)*

Petitioner then contends that “Suzui also discloses ‘a method of detecting a ground leak in the DC wiring to the solar array.’” Pet. 27 (citing Ex. 1402 ¶ 189). In particular, Petitioner contends that “Suzui’s inverter converts the DC voltage output from the solar battery to a 60 Hz, sine-shaped alternating current,” i.e., “the claimed ‘AC output having an output waveform with an output repetition frequency’” that is “received by Suzui’s single-phase three-wire commercial power system 3.” *Id.* at 28. Referring to its annotated Figure 2 of Suzui in the Petition, Petitioner contends that “[t]he positive and negative conductors (annotated in green), connecting Suzui’s inverter to the solar battery, run parallel alongside a frame ground conductor connecting the inverter’s frame ground terminal [FG] to a ground of the solar battery.” *Id.* (citing Ex. 1406, 5:41–44, Fig. 2; Ex. 1402 ¶ 193).

Petitioner further contends that “routing wires in parallel (for instance in the same conduit) was a well-known wiring technique,” wherein Boniface teaches “routing the positive and negative conductors ‘in parallel with an array grounding conductor.’” Pet. 29 (citing Ex. 1402 ¶¶ 193–196).

Referring to its annotated Figure 1 of Boniface in the Petition, Petitioner further contends that Boniface discloses that “a photovoltaic source positive conductor (102/112/112’) and a negative conductor (103/113/113’) (green) are routed in parallel with an equipment ground conductor 104 connected to earth ground system 118.” *Id.* (citing Ex. 1424, ¶¶ 37–39, 48, Figs. 1, 2, 6, 8; Ex. 1402 ¶ 194). According to Petitioner, a

POSITA would have been motivated to implement Suzui's system, in view of Boniface's teaching, "to route Suzui's positive and negative conductors in parallel with Suzui's frame grounding conductors . . . to prevent shock hazards and improve safety," and additionally "because routing the wires in parallel (e.g., in the same conduit) would also be easier and more convenient." *Id.* at 31 (citing Ex. 1424 ¶ 2; Ex. 1402 ¶ 195).

Patent Owner contends that "Petitioner offers no evidence that the cited art discloses a system to detect a 'ground leak,'" but rather, "Suzui discloses a 'DC ground fault detector' that outputs a 'ground fault signal,'" wherein "[g]round leaks and ground faults are not the same thing." PO Resp. 12 (citing Ex. 1406, 5:47–51; Ex. 2006 ¶ 64). In particular, according to Patent Owner, a "ground fault" is "a failure (often destructive) of the system (induced by corrosion, direct water, etc.) that causes a catastrophic shunting for the current in the system to ground," whereas, in contrast, a "ground leak" is "a condition that can occur during the normal operation of a solar-electric system that does not represent a catastrophic system failure and from which the system can recover by simply being reset." *Id.* (citing 2006 ¶¶ 64, 66). According to Patent Owner, Petitioner improperly conflates "ground faults" with "ground leaks" (PO Sur-reply), yet Dr. Baker "recognized the difference between ground leaks and ground faults." PO Resp. 13 (citing Ex. 2007, 132:12–19).

We are not persuaded by Patent Owner's argument that Petitioner "offers no evidence that the cited art discloses a system to detect a 'ground leak,'" because Suzui "discloses a 'DC ground fault detector' that outputs a 'ground fault signal.'" PO Resp. 12. As Petitioner points out, the '822 patent itself "describes its ground leak detector as detecting ground faults."

Pet. Reply 11 (citing Ex. 1401, Abstract). The '822 provides that “the ‘occurrence of a ground fault,’ may be ‘very small leakage currents; or ‘heavier ground leaks from the DC conductors to the conduit or equipment ground.’” *Id.* at 12 (citing Ex. 1401, 36:30–55).

Although Patent Owner argues that ground leaks and ground faults “are not the same thing” (PO Resp. 12), the preamble of claim 14 does not just recite a “ground leak,” but rather recites “a method of ***detecting*** a ground leak in the DC wiring to the solar array.” Ex. 1401, 43:21–37 (emphasis added). Here, we are persuaded by Petitioner’s contention that “the '822 Patent simply does not meaningfully differentiate between ***detecting*** a ground leak and a ground fault.” Pet. Reply 12 (emphasis added). As Petitioner points out, the '822 patent teaches that “its leak detectors detect a ‘ground leakage fault’ by the presence of ‘any leakage path on the DC side [that] will result in a 60 Hz imbalance current between neutral and hot on the AC side.’” *Id.* (citing Ex. 1401, 25:42–47).

We find persuasive Dr. Baker’s testimony that Suzui’s system provides a “ground fault detection apparatus” which “can detect a DC ground fault” wherein “Suzui, through its ground fault detection apparatus, discloses the claimed ‘method of detecting a ground leak in the DC wiring to the solar array.’” *See* Ex. 1402 ¶ 190 (citing Ex. 1406, 2:20–26). As Petitioner explained during oral argument, “all faults are a leak of some sort,” wherein “a fault is something set above a certain threshold,” such as 6mA set by the National Electric Code, and thus “ground fault detectors necessarily have to detect a leak.” Tr. 7:23–24, 9:3–14.

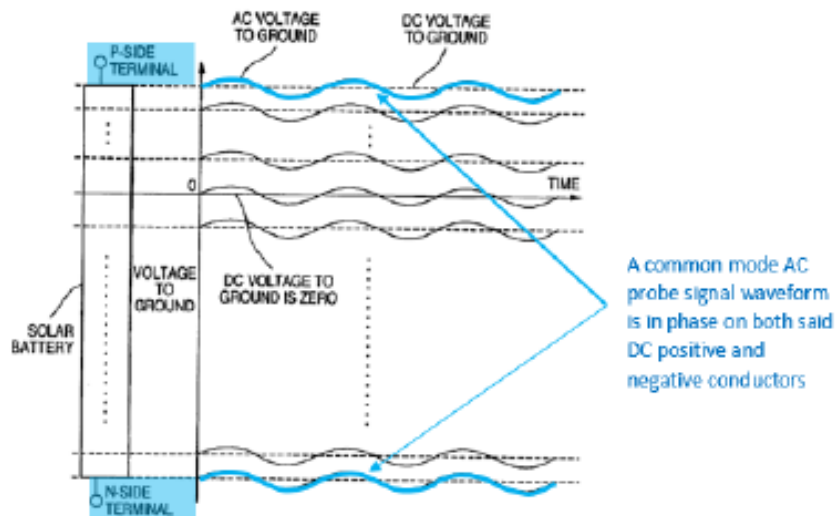
Based on the complete record presented, we are persuaded that Petitioner has demonstrated that the combination of Suzui, Boniface and

Gilmore teaches “a method of detecting a ground leak in the DC wiring to the solar array,” as recited in claim 14, regardless of whether the preamble is limiting.

- iii. *“creating a common mode AC probe signal waveform from said DC to AC converter at a characteristic repetition frequency that is in phase on both said DC positive and negative input conductors,” and “passing said positive and negative conductors from the array through a detector adapted to detect an unusual current with said common mode waveform at said characteristic repetition frequency” (claim 14)*

Petitioner contends that “Suzui’s inverter 2 creates an AC voltage to ground on the DC inputs,” which a POSITA “would have understood to be the ‘creating a common mode AC probe signal waveform from said DC to AC converter.’” Pet. 34 (citing Ex. Ex. 1406, 4:28–47, 5:41–51, Figs. 2, 10; Ex. 1402 ¶¶ 198–199). According to Petitioner, Suzui depicts “the AC voltage to ground—which is generated on the positive and negative conductors leading from the DC power supply (the claimed ‘DC positive and negative input conductors’),” by “the switching arrangement of Suzui’s inverter—operating with symmetrical, time-synchronized behavior . . . (the claimed ‘at a characteristic repetition frequency that is in phase on both said DC positive and negative input conductors’).” *Id.* at 35 (citing Ex. 1406, 4:28–40, 5:32–46, 5:61–67, 7:46–60, Figs. 2, 10; Ex. 1402 ¶¶ 200–201). Petitioner provides an annotated Figure 10 of Suzui, shown below, to illustrate its contentions.

FIG. 10



Ex. 1406, Fig. 10 (annotated).

Annotated Figure 10 of Suzui in the Petition, according to Petitioner, illustrates “a common-mode AC probe signal waveform.” Pet. 35 (citing Ex. 1406, Fig. 10; Ex. 1402 ¶¶ 201–202). According to Petitioner, “this waveform generated by Suzui would be understood by a POSITA to be a common-mode voltage, which is defined as ‘[t]he voltage that, at a given location, appears equally and in phase from each signal conductor to ground.’” *Id.* (citing Ex. 1443, 4; Ex. 1442, 4; Ex. 1436, 4; Ex. 1402 ¶ 201).

Petitioner then refers to Suzui’s annotated Figure 2 in the Petition described above, and contends that “the positive and negative conductors (green) from Suzui’s solar battery 1 are passed through current detector 10 (red),” which is “the claimed ‘passing said positive and negative conductors from the array through a detector.’” Pet. 36 (citing Ex. 1402 ¶ 204; Ex. 1406, 1:56–61, 5:47–51, Figs. 2, 9B). Petitioner contends that “Suzui’s current detector 10 detects an imbalance between the currents flowing in the positive and negative DC conductors (zero-phase current) of the inverter (the

claimed ‘a detector adapted to detect an unusual current’),” which “is generated by the 120 Hz AC voltage to ground (the claimed ‘with said common mode waveform at said characteristic repetition frequency’).” *Id.* at 37 (citing Ex. 1406, 5:47–51, 7:46–61, Fig. 2; Ex. 1402 ¶ 205).

Petitioner further contends that “Gilmore discloses a ground fault detector—like Suzui’s current detector 10—that detects unsafe ground fault conditions based on levels of current flowing between a PV array and ground.” Pet. 38 (citing Ex. 1460 ¶¶ 20, 24, 26; Ex. 1402 ¶ 206). Petitioner provides an annotated Figure 2 of Gilmore, shown below, to illustrate its contentions.

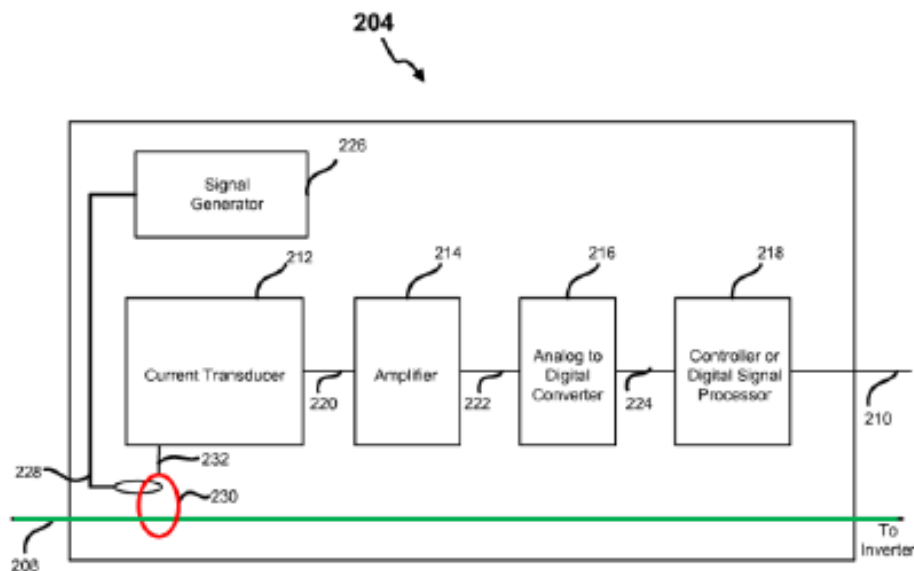


FIG. 2

Ex. 1460, Fig. 2 (annotated).

Annotated Figure 2 of Gilmore, as discussed in the Petition, shows “the positive and negative conductors (green)—shown as input lines 208 from Gilmore’s PV array 102—pass through current transducer coil 230 (red), which is coupled to a DC current transducer 212.” Pet. 38 (citing Ex. 1402 ¶ 206; Ex. 1460 ¶¶ 22, 24, Fig. 2). According to Petitioner, POSITA

would have implemented the system of Suzui and Boniface in view of Gilmore’s teaching “to pass the positive and negative conductors—from the output of the Suzui-Boniface solar battery 1—through a current transducer coil that determines ground faults by detecting differences in current on the conductors.” *Id.* at 40 (citing Ex. 1402 ¶ 208).

Patent Owner contends that although Petitioner asserts that it would have been obvious to replace the current detector of Suzui with the current detector of Gilmore, “neither Suzui nor Gilmore discloses a detector ‘adapted to detect an unusual current with said common mode waveform at said characteristic repetition frequency.’” PO Resp. 14. Instead, according to Patent Owner, “both Suzui and Gilmore simply detect a differential current between two lines.” *Id.* Thus, according to Patent Owner, a POSITA would understand that “the claimed detector does not look for just an unusual current, but rather a specific unusual current with specific characteristics, i.e., ‘with said common mode waveform at said characteristic frequency.’” *Id.* at 15 (citing Ex. 2006 ¶ 75).

We are not persuaded by Patent Owner’s argument that the claimed detector must look for “a specific unusual current with specific characteristics, i.e., ‘with said common mode waveform at said characteristic frequency.’” PO Resp. 15. In particular, claim 14 recites “creating” a common-mode AC probe signal waveform “from said DC to AC converter at a characteristic repetition frequency that is in phase on both said DC positive and negative input conductors,” and the claimed detector is adapted to “detect *with said*” common mode waveform at said characteristic repetition frequency. *See* Ex. 1401, 43:21–37 (emphasis added). That is, contrary to Patent Owner’s contention that the claimed detector “must look

for” the unusual current with the common mode waveform, claim 14 recites that the common mode wave form is *created* from the DC to AC converter at the characteristic frequency, and the detector then *detects* the unusual current *with said created* common mode waveform at the characteristic frequency. *Id.*

As pointed out by Petitioner during oral argument, “the existence of a common [mode] waveform in Suzui is not in dispute.” Tr. 9:23–24. We find persuasive Petitioner’s reliance on Suzui to disclose “creating a common mode AC probe signal waveform from a DC to AC converter at a characteristic repetition frequency” as recited in claim 14. Pet. 37. As Dr. Baker testified, “[f]rom the DC input voltage output by solar battery 1, Suzui’s inverter generates an output AC waveform—specifically a 60 Hz, sine-shaped alternating current” which “corresponds to the claimed ‘AC output having an output waveform with an output repetition frequency,’” which is then “received by Suzui’s single-phase three-wire commercial power system 3.” See Ex. 1402 ¶ 192 (citing Ex. 1406, 3:26–30, 4:60–65, 5:15–24, 5:32–40, 5:51–67, 7:43–52, Fig. 2).

Further, we are also persuaded by Petitioner’s contention that Suzui and Gilmore teach “detecting an imbalance current generated by the common-mode voltage.” Pet. Reply 17 (citing Pet. 37–42; Ex. 1474 45–46). In particular, we are persuaded by Petitioner’s contention, supported by Dr. Baker’s declaration, that Suzui’s current detector 10 “detects an imbalance between the currents flowing in the positive and negative DC conductors (zero-phase current) of the inverter (the claimed ‘a detector adapted to detect an unusual current’),” which “is generated by the 120 Hz AC voltage to ground (the claimed ‘with said common mode waveform at said

characteristic repetition frequency’).” Pet. 37; *see also* Ex. 1402 ¶ 205. That is, we are persuaded by Dr. Baker’s testimony that, “because Suzui’s current detector 10 detects an imbalance in the zero-phase current of the DC circuit of the inverter,” a POSITA would understand Suzui to disclose “a detector adapted to detect an unusual current,” wherein “because this ‘unusual current’ is generated by the AC voltage to ground that has a frequency of 120 Hz,” the POSITA would also understand Suzui to disclose the claimed “with said common mode waveform at said characteristic repetition frequency.” Ex. 1402 ¶ 205 (citing Ex. 1406, 5:47–51, 7:46–61, Fig. 2).

As Petitioner explained during oral argument, “as long as the inverter is operating, Suzui is going to have a common-mode waveform on the DC inputs that passes through the fault detectors.” Tr. 10:6–8. We agree with Petitioner that a POSITA would recognize that “the detected unusual current will have that same frequency as the common-mode waveform that generated it.” Pet. Reply 18. As Petitioner explains, “the ‘unusual current’ has this characteristic frequency from being ‘generated by the 120 Hz AC voltage to ground (claimed ‘with said common mode waveform at said characteristic repetition frequency’). *Id.* (citing Pet. 36–37; Ex. 1402 204–205, 215–216, 219).

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that the combination of Suzui, Boniface and Gilmore teaches “creating a common mode AC probe signal waveform from said DC to AC converter at a characteristic repetition frequency that is in phase on both said DC positive and negative input conductors” and “passing said positive and negative conductors from the array through a detector

adapted to detect an unusual current with said common mode waveform at said characteristic repetition frequency,” as recited in claim 14.

- iv. *“upon detection of said unusual current providing an indication of the presence of an unwanted ground leak”*

According to Petitioner, Suzui describes that, “after detecting a current exceeding a predetermined threshold value, current detector 10 outputs a ground fault signal [S10] to controller 11 indicating the presence of a DC ground fault,” thereby “causing the inverter to disconnect from commercial system 3.” Pet. 43 (citing Ex. 1406, 5:47–62, 1:8–14, 1:34–38, 1:56–61, Fig. 2; Ex. 1402 ¶¶ 211–213). Patent Owner does not present arguments in its Response addressing the specific merits of Petitioner’s contentions with respect to this claim limitation. *See generally* PO Resp.

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that the combination of Suzui, Boniface and Gilmore teaches “upon detection of said unusual current providing an indication of the presence of an unwanted ground leak,” as recited in claim 14.

v. *Claims 15 and 18*

Petitioner also challenges claims 15 and 18 as unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface and Gilmore. Pet. 43–47. In particular, as to claim 15, Petitioner relies on Suzui for teaching “inverter 2” that “creates a common-mode AC probe signal waveform at a frequency of

120 Hz (the claimed ‘characteristic repetition frequency’).” *Id.* at 43 (citing Ex. 1406, 4:28–40, 5:32–46, 5:61–67, 7:46–60, Figs. 2, 10; Ex. 1402 ¶¶ 200, 215). Furthermore, according to Petitioner, “Suzui’s inverter 2 outputs its AC output signal at a frequency of 60 Hz (the claimed ‘AC output repetition frequency’).” *Id.* at 43–44 (citing Ex. 1406, 1:8–14, 4:60–65, 5:21–24, 5:32–40, 5:51–67, 7:43–61, Fig. 2; Ex. 1402 ¶¶ 200, 215).

We are persuaded by Petitioner’s contention that Suzui teaches a “‘characteristic repetition frequency of said probe signal’ of 120 Hz” which “is 2 times Suzui’s ‘AC output repetition frequency’ of 60 Hz.” Pet. 44. Having considered the evidence and arguments of record, we conclude that Petitioner shows, by a preponderance of the evidence, that claim 15 is unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface and Gilmore.

As to claim 18, Petitioner relies on Suzui for disclosing “current detector 10” that “detects an imbalance between the currents in the positive and negative DC conductors (zero-phase current) of the DC circuit of the inverter (the claimed ‘a detector adapted to detect an unusual current’).” Pet. 44 (citing Ex. 1406, 5:47–51, 7:46–61, Fig. 2; Ex. 1402 ¶ 205). Furthermore, Petitioner relies on Gilmore for disclosing “one or more current transformers encircling either said positive and negative conductors.” *Id.* at 45 (citing Ex. 1402 ¶¶ 218–222).

We are persuaded by Petitioner’s contention, as supported by Dr. Baker’s testimony, that a POSITA “would have readily modified, within the Suzui-Boniface system, a ground fault detector 10 to use Gilmore’s transducer coil 230 through which the positive and negative conductors pass (the claimed ‘one or more current transformers encircling . . . said positive

and negative conductors’) to facilitate detection of a ground fault.” Pet. 46 (citing Ex. 1402 ¶¶ 209, 222).

Having considered the evidence and arguments of record, we conclude that Petitioner also shows, by a preponderance of the evidence, that claim 18 is unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface and Gilmore.

vi. Claim 16

Petitioner challenge claims 16 as unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface, and Gilmore in further view of Dubovsky. Pet. 47–52. In particular, Petitioner relies on Suzui’s “solar batteries” for “the claimed ‘storage battery charged by said solar array.’” *Id.* at 47 (citing Ex. 1406, 1:16–2:18, 4:59–5:6–46, Figs. 2, 8; Ex. 1402 ¶¶ 224–225). Furthermore, Petitioner contends that “Dubovsky describes a grid-connected photovoltaic power system 10 that is similar to the PV system disclosed in Suzui.” *Id.* at 48 (citing Ex. 1459, 10:45–64, Fig. 1; Ex. 1402 ¶¶ 223–229). According to Petitioner, “Dubovsky teaches that back-up power source 14 preferably comprises a rechargeable DC battery that can be charged from primary PV power source 12 (the claimed ‘storage battery charged by said solar array’).” *Id.* at 49 (citing Ex. 1459, 2:12–16, 10:57–60, 13:8–20; Ex. 1402 ¶ 227).

We are persuaded by Petitioner’s contention, as supported by Dr. Baker’s testimony, that it would have been obvious “to modify Suzui-Boniface-Gilmore’s solar power generation system to include a storage battery, as taught by Dubovsky.” Pet. 49 (citing Ex. 1402 ¶¶ 227–228). That is, “[s]ince the Suzui-Boniface-Gilmore system already measures the zero-phase (common mode) current at the input of the inverter to detect

unwanted ground leaks,” in view of Dubovsky’s teachings, the system “would advantageously provide a back-up power source for powering a commercial power system (or a portion thereof) in the event of utility service interruptions or whenever sufficient power was not available from a photovoltaic array.” *Id.* at 49–50 (citing Ex. 1402 ¶¶ 228–229).

Having considered the evidence and arguments of record, we conclude that Petitioner shows, by a preponderance of the evidence, that claim 16 is unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface, Gilmore and Dubovsky.

vii. Claim 17

Petitioner challenges claim 17 as unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface, and Gilmore in further view of Mori. Pet. 52–60. In particular, Petitioner relies on Mori for teaching a “full-bridge inverter” that is connected “in series with other full-bridge inverters to form a multiplex inverter.” *Id.* at 53 (citing Ex. 1404; Ex. 1402 ¶ 232).

We are persuaded by Petitioner’s contention, supported by Dr. Baker’s testimony, that “it would have been obvious to modify Suzui’s inverter to include series connected H-bridges” as disclosed in Mori, “which would produce ‘said common-mode AC probe signal waveform corresponds to the changing value of a selected digit within a multi-digit number sequence representing said AC output waveform,’” as recited in claim 17. Pet. 53. That is, a POSITA would have been motivated “to modify Suzui’s system . . . by incorporating Mori’s multiplex inverter and it[s] corresponding control system into Suzui’s PV system, with each H-bridge being connected to a respective DC power source and leakage detector of Suzui. *Id.* at 58 (citing Ex. 1402 ¶ 240). As Petitioner points out, “Mori

explains that use of its multilevel inverter is desirable in order to ‘suppress an increase in switching loss and output a highly accurate voltage,’” and thus, “the capacitance of the smoothing output filter can be reduced, and the power conversion device can be simplified and made smaller.” *Id.* at 58–59 (citing Ex. 1404 ¶¶ 13–14, 22; Ex. 1402 ¶ 240).

Having considered the evidence and arguments of record, we conclude that Petitioner shows, by a preponderance of the evidence, that claim 17 is unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface, Gilmore and Mori.

viii. Claims 19

Petitioner challenges claim 19 as unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface, and Gilmore in further view of Endo. Pet. 61–65. In particular, Petitioner relies on Gilmore for expressly disclosing “one or more current transformers encircling . . . said positive and negative conductors.” *Id.* at 62 (citing Ex. 1402 ¶¶ 206–210, 220–222, 245, 249). Furthermore, Petitioner points out that Suzui describes the method in Endo “to detect ground faults ‘on the basis of a zero-phase current in the DC circuit or AC circuit,’” and further relies on Endo which “expounds on the method of detecting ground faults using a current detector, as taught by Suzui.” *Id.* at 63 (citing Ex. 1462 ¶ 8; Ex. 1402 ¶ 246).

We are persuaded by Petitioner’s contention, as supported by Dr. Baker’s testimony, that a POSITA would have been motivated to implement a ground fault detector, as taught by Endo, in the Suzui-Boniface-Gilmore system. *Id.* at 64–65 (citing Ex. 1402 ¶ 248). In particular, we are persuaded by Dr. Baker’s testimony that this implementation “would have amounted to little more than the use of a known technique (ground fault

detection techniques using a current detector, band-pass filter and comparator, as taught by Endo) to improve similar devices (the ground fault detection system disclosed by Suzui),” in “the same way (using ground fault detection techniques employing a current sensor, band-pass filter and comparator, as taught by Endo, to detect the occurrence of a ground fault).”
See Ex. 1402 ¶ 248.

Having considered the evidence and arguments of record, we conclude that Petitioner shows, by a preponderance of the evidence, that claim 19 is unpatentable under 35 U.S.C. § 103(a) over Suzui, Boniface, Gilmore and Endo.

III. CONCLUSION

For the foregoing reasons, we are persuaded on the record at hand that Petitioner has demonstrated by a preponderance of the evidence that the challenged claims of the ’822 patent are unpatentable.¹⁰

¹⁰ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

In summary:

<u>Claims</u>	<u>35 U.S.C. §</u>	<u>Reference(s)/Basis</u>	<u>Claims Shown Unpatentable</u>	<u>Claims Not Shown Unpatentable</u>
14, 15, 18	103	Suzui, Boniface, Gilmore	14, 15, 18	
16	103	Suzui, Boniface, Gilmore, Dubovsky	16	
17	103	Suzui, Boniface, Gilmore, Mori	17	
19	103	Suzui, Boniface, Gilmore, Endo	19	
<u>Overall Outcome</u>			14–19	

IV. ORDER

For the reasons given, it is

ORDERED that, based on the preponderance of the evidence, claims 14–19 of the '822 patent have been shown to be unpatentable; and

FURTHER ORDERED that, because this is a final written decision. Parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2022-00010
Patent 8,937,822 B2

For PETITIONER:

Frederic M. Meeker
Michael S. Cuvillo
John R. Hutchins
John Harris Curry
Azuka C. Dike
BANNER & WITCOFF, LTD.
fmeeker@bannerwitcoff.com
mcuvillo@bannerwitcoff.com
jhutchins@bannerwitcoff.com
jcurry@bannerwitcoff.com
adike@bannerwitcoff.com

For PATENT OWNER:

Robert R. Brunelli
Brian S. Boerman
SHERIDAN ROSS P.C.
rbrunelli@sheridanross.com
bboerman@sheridanross.com