

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HOYMILES USA, INC.,

Petitioner,

v.

CYBOENERGY, INC.,

Patent Owner.

CASE: IPR2024-01106

U.S. PATENT NO. 8,786,133

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 8,786,133**

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EXHIBIT LIST

The following Exhibit List is provided in accordance with 37 C.F.R. § 42.63(e):

Exhibit No.	Description
Ex. 1001	U.S. Patent No. 8,786,133
Ex. 1002	File History for U.S. Patent No. 8,786,133
Ex. 1003	Declaration of Mladen Kezunovic
Ex. 1004	U.S. Patent Publication No. 2009/0020151 A1 (“Fornage”)
Ex. 1005	U.S. Patent Publication No. 2008/0283118 (“Rotzoll ’118”)
Ex. 1006	U.S. Patent Publication No. 2005/0105224 A1 (“Nishi”)
Ex. 1007	U.S. Patent Publication No. 2002/0038667 A1 (“Kondo”)
Ex. 1008	A Review of Single-Phase Grid-Connected Inverters for Photovoltaic Modules, Kjaer, Pedersen and Blaabjerg, IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS, VOL. 41, NO. 5, SEPTEMBER/OCTOBER 2005 (“Kjaer”)
Ex. 1009	U.S. Patent Publication No. 2009/0000654 (“Rotzoll ’654”)
Ex. 1010	Patent Owner’s Response to Order Granting Request for <i>Ex Parte</i> Reexamination, App. No. 90/019,341

MANDATORY NOTICES

A. Real Party-In-Interest (37 C.F.R. § 42.8(b)(1)).

The real party-in-interest is Petitioner, Hoymiles USA, Inc., which is indirectly owned by Hoymiles Power Electronics, Inc.

B. Related Matters (37 C.F.R. § 42.8(b)(2)).

The '133 Patent is involved in two pending lawsuits, one of which involves Petitioner: *CyboEnergy, Inc. v. Hoymiles Power Elecs. USA, Inc.*, Case No. 2-23-cv-00311 (E.D. Tex.) and *CyboEnergy, Inc. v. Northern Elec. Power Tech., Inc.*, Case No. 5-23-cv-06121 (N.D. Cal.). These cases may be affected by the outcome of this Petition. In *CyboEnergy, Inc. v. Hoymiles Power Elecs. USA, Inc.*, CyboEnergy has asserted infringement of claims 15–16, 19–20 and 22–23, which are challenged in this Petition. Additionally, U.S. Patent No. 9,257,916 claims priority to the '133 Patent, and so the outcome in this proceeding may affect that patent.

The '133 Patent is currently under reexamination as application no. 90/019,341. The request for *ex parte* reexamination was filed by Northern Electric (which has no affiliation with Petitioner) on December 19, 2023. On March 18, 2024, the Office ordered reexamination, finding a substantial new question of patentability as to claims 15–24. The Patent Owner submitted a response on May 17, 2024. None of the prior art references relied upon in Grounds 1–4 of this Petition

are at issue in the reexamination proceedings.

Finally, the '133 Patent was previously the subject of two IPR petitions filed by Altenergy Power System USA, Inc. *See* IPR2024-00362 and IPR2024-00360.¹ Both Petitions were filed on December 26, 2023 and included the same Grounds 1–4 that are cited in this Petition. However, both of those petitions settled and were terminated by agreement of the parties before the Board could issue an institution decision. *See* IPR2024-00362, Paper 10 (PTAB May 9, 2024); IPR2024-00360, Paper 7 (Mar. 20, 2024).

C. Lead and Back-Up Counsel and Service Information (37 C.F.R. § 42.8(b)(3)–(4)).

Petitioner provides the following designation of counsel, to which all correspondence should be addressed. Petitioner consents to electronic service.

¹ It appears when Altenergy filed the '360 IPR petition, some of the figures were sized incorrectly and cut-off. Altenergy filed the '362 IPR petition as a corrected version, and it is substantially identical to the '360 IPR petition. *See* IPR2024-00360, Paper 8 (refund request by petitioner Altenergy).

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A power of attorney appointing the above lead and back-up counsel accompanies this Petition.

D. Payment of Fees.

The required fee has been paid from Deposit Account No. 02-1818, and the Office is authorized to deduct any additional fees due with this Petition.

I. INTRODUCTION

Under 35 U.S.C. §§ 311–319 and 37 C.F.R. § 42.100 et seq., Petitioner Hoymiles USA, Inc. requests *inter partes* review of claims 15– 24 of U.S. Patent No. 8,786,133 (Ex. 1001) (“the ’133 Patent”). This Petition establishes a reasonable likelihood that at least one of claims 15–24 of the ’133 Patent is unpatentable.

II. GROUND FOR STANDING

Petitioner certifies that the ’133 Patent is available for IPR having been filed on July 15, 2010 and issued on July 22, 2014, and that Petitioner is not barred or estopped from requesting review of claims 15–24 of the ’133 Patent on the grounds identified in this Petition.

III. RELIEF REQUESTED

Petitioner requests review of claims 15–24 of the ’133 Patent on the following grounds:

Ground	Proposed Statutory Rejections for the '133 Patent
1	Claims 15–16, 18–20 and 22–24 of the '133 Patent are obvious in view of Kondo and Nishi under 35 U.S.C. § 103.
2	Claims 15–16, 18–20 and 22–24 of the '133 Patent are obvious in view of Kondo and Fornage under 35 U.S.C. § 103.
3	Claims 15–16, 18–20 and 22–24 of the '133 Patent are obvious in view of Fornage and Kondo under 35 U.S.C. § 103.
4	Claims 17 and 21 are obvious in view of any of Kondo and Nishi, Kondo and Fornage, or Fornage and Kondo, and in further view of Rotzoll '654 under 35 U.S.C. § 103.

Each of the references listed in the preceding table are prior art under pre-AIA 35 U.S.C. §§ 102(b) or (e) because each reference is a patent or printed publication published or filed before the '133 Patent's claimed priority date of July 16, 2009. The references are analogous art to the '133 Patent because all references relate directly to inverter systems for use with DC electrical power sources such as photovoltaic modules.

IV. THE PURPORTED INVENTION OF THE CHALLENGED CLAIMS

The '133 Patent is directed to power inverters “that can intelligently invert DC power from single or multiple DC sources to single-phase or three-phase AC power to feed the power grid with both optimal efficiency and system scalability.” Ex. 1001, 1:13-17. Such inverters are used to convert DC power generated by a DC power source, such as a photovoltaic solar module, into AC power that can be

supplied to the AC power grid. Ex. 1001, Abstract, 1:7–12; Ex. 1003, ¶ 33.

A photovoltaic module (solar panel) converts light energy into electrical energy – namely direct current (“DC”) electricity. Ex. 1003, ¶ 36. The direction of power flow and current polarity of DC power are constant over time. *Id.*, ¶ 34. The electricity supplied by the power grid to the public is AC electricity, where the direction of power flow and polarity of current change over time, because of efficiencies in transport over long distances. *Id.*, ¶¶ 34–35. AC electricity supplied by the power grid is either single-phase AC for residential uses or three-phase AC circuit power for commercial uses. *Id.*, ¶ 87. To utilize the DC electrical power generated by a solar panel, that DC power must be changed into AC power. *Id.*, ¶ 36. This is done by one or more “inverters.” *See id.*

The ’133 Patent describes a design where inverters, each connected to one or more solar panels, can be linked together in a daisy chain to increase efficiency and scalability of power generation. *See* Ex. 1001, Abstract. The claimed design, shown in FIG. 5, includes a plurality of inverters (90), each with at least two DC input ports (94, 95) coupled to DC power sources, such as solar panels (100). Ex. 1001, Fig. 5, 4:22–39. Each power inverter has a single DC-AC inverter and can be “connected in a daisy-chain” through AC input and output ports (91, 92) to the power grid. *Id.*

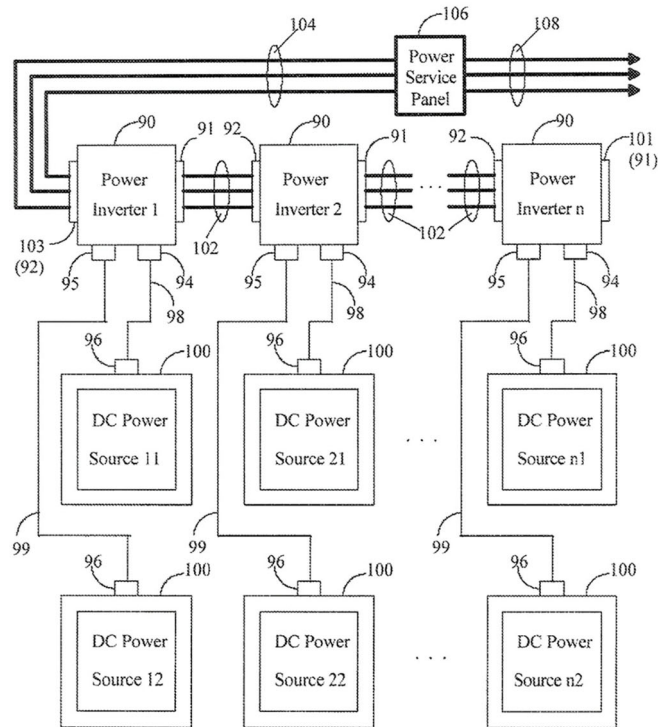


Fig. 5

Claim 15 is the only independent apparatus claim of those challenged in this Petition that claims, at a high level, the interconnected elements illustrated in FIG.

5. Claim 19 is a corresponding method claim.

Claim 15 provides:

15. A scalable DC to AC power inversion system for providing AC power to a power grid from a plurality of individual DC power sources each having a DC power output port, comprising:

a) a plurality of power inverters, each of said power inverters including a single DC-AC inverter, at least two

DC power input ports coupled to the single DC-AC inverter, an AC power input port, and an AC power output port coupled to the single DC-AC inverter, each of said DC power input ports having one DC power source connected thereto;

b) said AC power output port of each power inverter being connected in a daisy chain to the AC power input port of the next power inverter, except for the AC power input port of the first power inverter being left open, and the AC power output port of the last power inverter being connected to a power service panel of the power grid;

c) whereby said system is incrementally scalable by adding or subtracting DC power sources and daisy-chained inverters.

Claim 19 provides:

19. A method of making a DC to AC power conversion system incrementally scalable, comprising:

a) providing a plurality of DC power sources and a plurality of DC to AC power inverters, said DC to AC power inverters each having a single DC-AC inverter, an AC input port coupled to the single DC-AC inverter, an AC output port coupled to the single DC-AC inverter, and

at least two DC input ports coupled to the single DC-AC inverter;

b) connecting at least one of said DC power sources, respectively, to each of said DC input ports; and

c) providing AC power to the power grid.

A comparison of the elements of claims 15 and 19 is set forth in the chart below. The order of the elements of claim 19 has been altered to show correspondence with the claim 15 elements. Certain claims depending from claim 19 also correspond to elements in claim 15.

15[pre][1]: A scalable DC to AC power inversion system for providing AC power to a power grid	19[pre]: A method of making a DC to AC power conversion system incrementally scalable, comprising:
15[pre][2]: from a plurality of individual DC power sources each having a DC power output port, comprising:	19[a][1]: a) providing a plurality of DC power sources
15[a][1]: a) a plurality of power inverters, each of said power inverters including a single DC-AC inverter,	19[a][2]: and a plurality of DC to AC power inverters, said DC to AC power inverters each having a single DC-AC inverter,

15[a][2]: at least two DC power input ports coupled to the single DC-AC inverter,	19[a][4]: and at least two DC input ports coupled to the single DC-AC inverter;
15[a][3]: an AC power input port, and an AC power output port coupled to the single DC-AC inverter,	19[a][3]: an AC input port coupled to the single DC-AC inverter, an AC output port coupled to the single DC-AC inverter,
15[a][4]: each of said DC power input ports having one DC power source connected thereto;	19[b]: b) connecting at least one of said DC power sources, respectively, to each of said DC input ports; and
15[b][1]: b) said AC power output port of each power inverter being connected in a daisy-chain to the AC power input port of the next power inverter,	
15[b][2]: except for the AC power input port of the first power inverter being left open,	
15[b][3]: and the AC power output port of the last power inverter being connected to a power service panel of the power grid;	19[c]: c) providing AC power to the power grid.

15[c]: c) whereby said system is incrementally scalable by adding or subtracting DC power sources and daisy-chained inverters.	
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V. CLAIM CONSTRUCTION AND THE LEVEL OF SKILL IN THE ART

The purported invention of the '133 Patent is broadly claimed and described schematically without reference to individual circuits or circuit diagrams. Ex. 1003, ¶¶ 31-32. Accordingly, Petitioner submits that the claims do not require formal construction and all terms should be given their plain and ordinary meaning. Further, Petitioner submits that a person having ordinary skill in the art would have a bachelor's degree in electrical engineering and five years of experience designing grid connected photovoltaic systems. Ex. 1003, ¶¶ 30–32.

Petitioner does not waive any argument in any litigation that claim terms in the '133 Patent are indefinite or otherwise invalid, nor does Petitioner waive its right to raise additional issues of claim construction in any litigation. Construction of claim terms may be relevant to issues in district court litigation, *e.g.*, as part of resolving non-infringement disputes or to “clarify and when necessary to explain” terms for “determination of infringement” by the factfinder—typically non-technologist judges and/or jurors. *O2 Micro Int’l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1362 (Fed. Cir. 2008) (citation omitted).

VI. PROSECUTION HISTORY

The '133 application, initially filed with 28 claims, was subject to a restriction requirement and Applicant withdrew claims 13–20 in response thereto. Ex. 1002, at 94, 151, 157. Claims 1–12, 24, and 25 were allowed in a first Office Action and became claims 1–14 in the issued '133 patent. *Id.* at 97, 140-150. Independent claims 21 and 26 (which issued as 15 and 19) were rejected as indefinite under 35 U.S.C. §112 and obvious under 35 USC §103 over JP 09275637A (“*Aoki*”). *Id.* at 94-97.

In its original form, claim 15 (21) recited as follows:

21. (Original) A scalable DC to AC power inversion system for providing AC power to a power grid from a plurality of individual DC power sources each having a DC power output port, comprising:

- a) a plurality of power inverters, each of said power inverters having at least one DC power input port, an AC power input port, and an AC power output port, each of said DC power input ports having one DC power source connected thereto;
- b) said AC power output port of each inverter being connected in a daisy chain to the AC power input port of the next inverter, except for the AC power input port of the first inverter being left open, and the AC power output port of the last inverter being connected to a power service panel of the power grid;
- c) whereby said system is incrementally scalable by adding or subtracting DC power sources and daisy-chained inverters; and
- d) whereby an optimal amount of AC power is generated and supplied to said power grid regardless of the performance of any individual power source.

Ex. 1002, at 148. Only limitation (d) was rejected by the Examiner as indefinite under § 112. *Id.* at 94-95. The Examiner stated that the limitation contains “functional language without any associated physical structure” and that “the term

‘optimal’ is a relative term and indefinite.” *Id.*

The Examiner found the remaining limitations (with one exception), including the claimed “daisy-chain” AC connection between multiple inverters to be disclosed by *Aoki*. *Id.* at 95-97. Referring to FIG. 1 (below) the Examiner noted that *Aoki* disclosed:

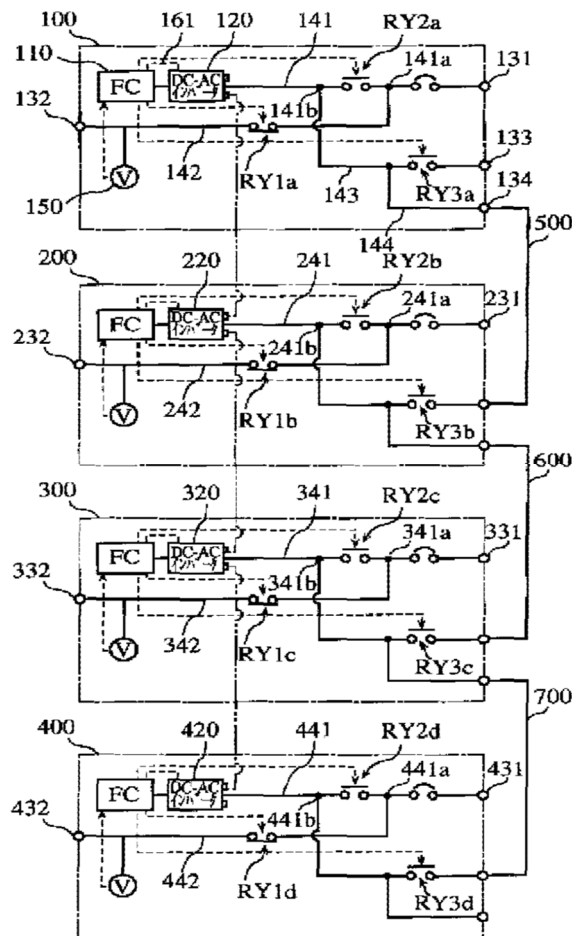
a plurality of power inverters, each of said power inverters having at least one DC power input port (i.e. input to FC, fig1), an AC power input port (i.e. respective input ports 333, fig1 [sic – 133]), and an AC power output port (i.e. respective output ports 134, fig 1), each of said DC power input ports having one DC power source connected thereto (read on by each respective FC); b) said AC power output port of each inverter being connected in a daisy chain to the AC power input port of the next inverter (read on by both the physical connection (i.e. “input to output”) and also the daisy chain master/slave configuration...) except for the AC power input port of the first inverter being left open (see open input of first/top inverter)...

Ex. 1002, at 95-96. Although the Examiner stated that *Aoki* did not disclose “the AC power output port of the last inverter being connected to a power service panel of the power grid” in limitation (b), he took Official Notice that the “service panel” and “power grid” limitations were well known in the art and rejected the claims. *Id.* at 96.

Applicant never disputed the Examiner’s correct observation that *Aoki* disclosed a daisy-chain of inverters connected through AC input/output ports. FIG.

1 of *Aoki*, below, shows just that, with an AC output port 134 of inverter 100, connected to an input of the next inverter in a daisy-chain, with the first input (133) being left open. See Ex. 1003, ¶¶ 81-83 (discussing *Aoki's* apparent AC input and output ports 133/134).

【図1】



Instead, Applicant amended claims 21 and 26 to require “each of said power inverters having at least two DC power input ports.” Ex. 1002 at 81, 82-83, 85 (“Thus the power inverters of claims 21 and 26 are capable of accepting DC power from

multiple sources.”). Later, Applicant further limited 21 and 26 to require that each inverter have a “single DC-AC inverter” and “at least two DC power input ports are coupled to the single DC-AC inverter,” and argued “Aoki fails to teach or suggest multiple DC input ports coupled to a single DC-AC inverter or the advantages thereof.” *Id.* at 52-54, 56.

In allowing the case, the Examiner did not rely on Applicant’s claim amendments regarding the inverter having a single DC-AC inverter with at least two DC input ports. Rather, the Examiner stated that “[t]he primary reason for allowance of the claims is the inclusion of the particular port configuration further comprising both an AC input port coupled to the single DC-AC inverter and the AC output port coupled to the single DC-AC inverter.” *Id.* at 19. The Examiner’s conclusion here was in error. Ex. 1003, ¶¶ 89–90.

The Examiner had *already located* an AC input port and an AC output port coupled to an inverter in *Aoki* (elements 133 and 134 in Aoki, FIG. 1, above). Applicant never disputed this conclusion. Moreover, *Rotzoll ’118* (Ex. 1005), a reference cited by the Examiner (Ex. 1002 at 19), but not substantively analyzed or relied on in a rejection, discloses AC input and output ports (*e.g.*, connectors) connected to a single inverter for arranging inverters in a daisy-chain. *See* Ex. 1003, ¶ 90, n. 5. *Rotzoll ’118* shows these features in FIG. 2 (annotated below) and provides, “[t]he AC grid voltage appears at connector the 208 and is passed to the

inverter 224 of the PV module 222 via another connector 225, which is mated with a receiving connector 208. Similarly, the same AC voltage is now available at a similar inverter 244 via the mating of a like connector 228 to another receiving connector 245. This sequence can continue until the maximum current rating of all cables 206, 207, 226, 227, 246, 247 and 266 has been exhausted.” Ex. 1005, [0008].

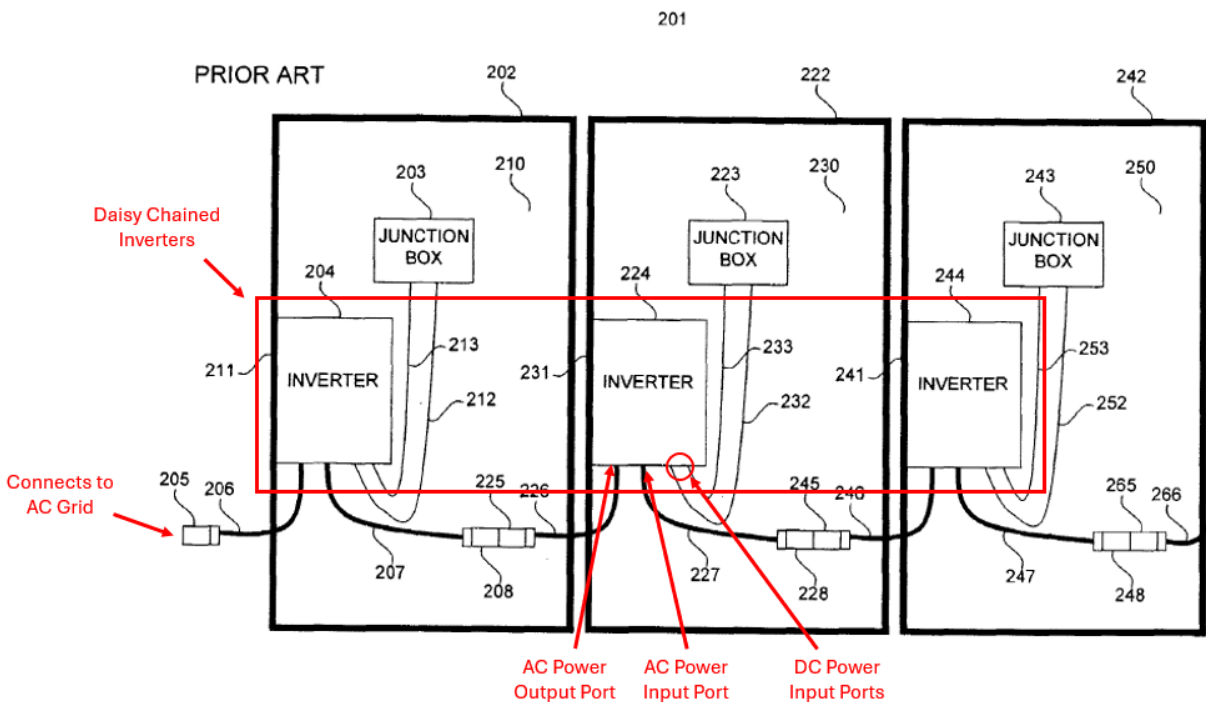


FIG. 2

Rotzoll '118 explicitly refers to this manner of connection through AC inputs and outputs as a “daisy chain.” *Id.* at [0015] (“There are, according to one embodiment, two inverter mounting bracket AC connections to support daisy-chain connections between multiple AC modules.”); *see also* Ex. 1003, ¶ 90, n. 5.

Thus, the idea of daisy-chained inverters connected through AC input/output ports was in the prior art, the Examiner acknowledged as much with *Aoki*, and the

Applicant did not contest that finding. As disclosed below, Applicant's asserted point of novelty, inverters with multiple DC inputs, was also in the prior art.

VII. SCOPE AND CONTENT OF THE PRIOR ART

Claims 15 and 19 of the '133 Patent claim an obvious combination of two prior art photovoltaic module inverter arrangements: multi-input, or multi-string inverters, and inverters connected in a daisy-chain manner.

Many different ways of connecting inverters with solar modules were known before the priority date of the '133 Patent. Ex. 1003, ¶ 50 citing *Kjaer* (Ex. 1008). Early solar generation systems would use a single centralized inverter. *Id.* Later, "string inverters" were introduced. *Id.* String inverters used one inverter for a string of multiple, series-connected solar panels. *Id.* Later, and directly relevant to the challenged claims, multi-string inverters were developed. *Id.* In a multi-string inverter, more than one solar panel or string of solar panels is connected to a single inverter, typically through one or more DC/DC converters. *Id.* Later still, "AC modules" were developed, where each solar panel has its own inverter. *Id.* These various topologies are schematically illustrated in FIG. 3 from *Kjaer*, a 2005 IEEE paper, which is excerpted below.

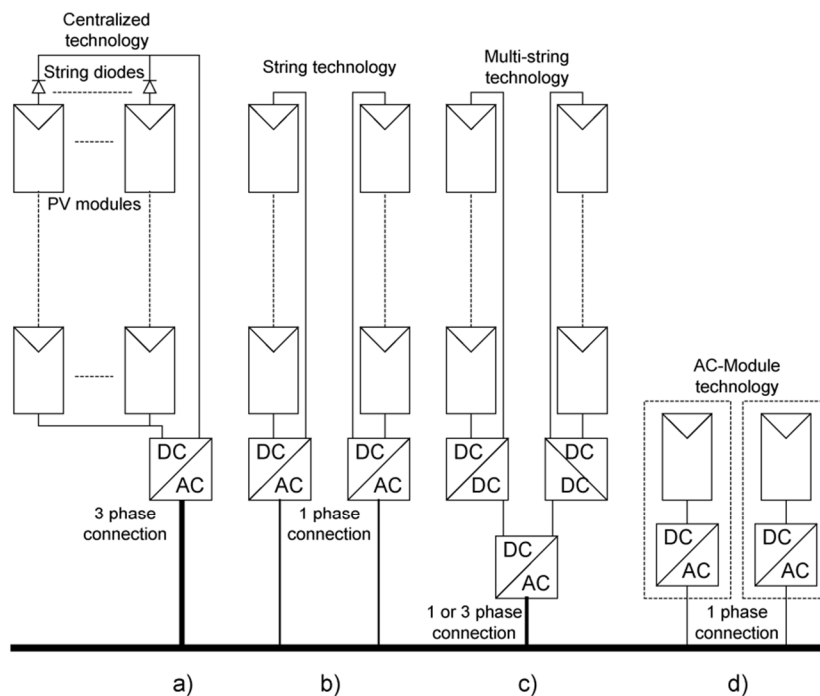


Fig. 3. Historical overview of PV inverters. (a) Past centralized technology. (b) Present string technology. (c) Present and future multi-string technology. (d) Present and future ac-module and ac cell technologies.

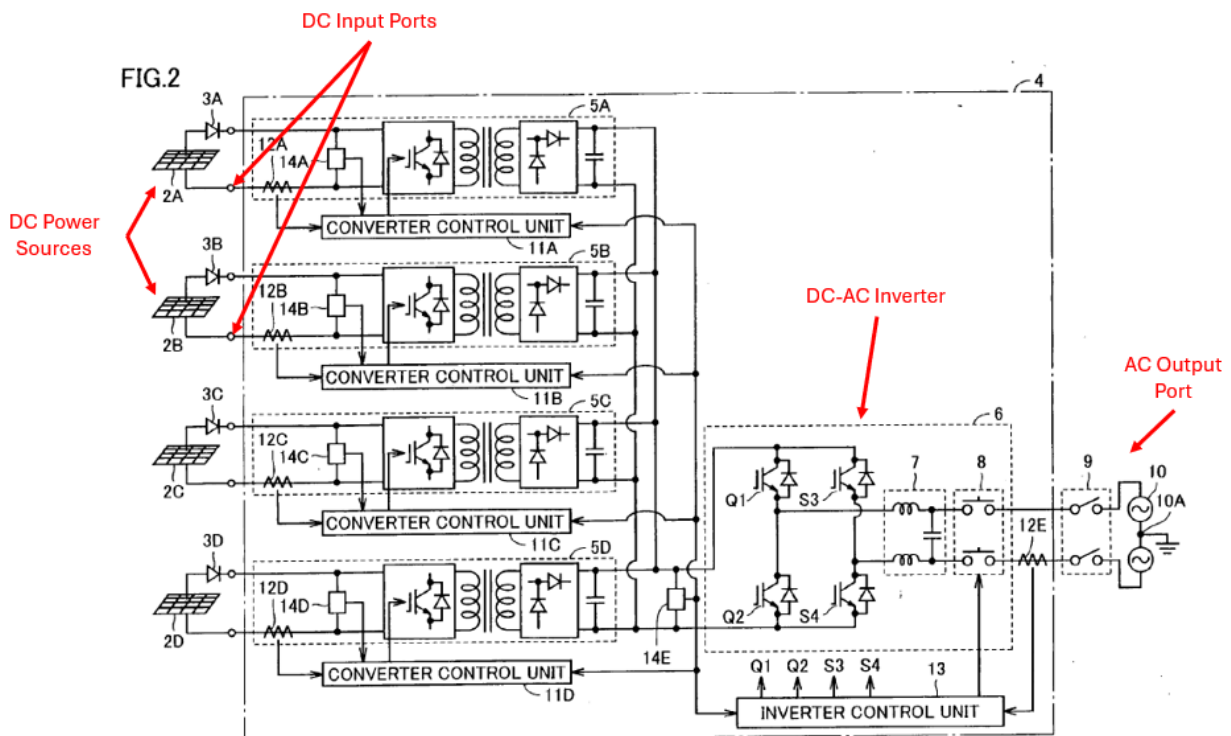
The multi-string inverter topology illustrated above had an advantage over prior inverter configurations. Solar cells, or series-connected strings of solar cells, will generate different amounts of power relative to other cells or strings of cells in the same installation for a number of reasons. Individual panels may have different responsivities, become dirty or damaged, be in the shade at different times, inclined with respect to the sun at different angles, or may degrade over time. Ex. 1003, ¶¶ 51-53, 41-47; *see also* ¶¶ 133-134 (citing *Fornage*). Additionally, the operating temperature of a solar panel will impact the amount of electrical power it produces, and temperature will vary from panel to panel depending on orientation and other operating conditions. Ex. 1003, ¶ 45.

To efficiently extract power from a solar panel into a load, the load should have the same electrical impedance (i.e., resistance) as the panel, and the impedance of the panel will vary with the amount of power it is producing. Ex. 1003, ¶¶ 46-47. Thus, more power can be extracted from a solar panel by impedance matching the panel to its load under various panel operating power levels—a practice referred to in the art as Maximum Power Point Tracking (“MPPT”). *Id.* MPPT tracking is typically done using a DC/DC converter, which converts a relatively low output voltage from the panel or string of panels to a higher, and variable, voltage. *Id.* DC/DC converters used for this purpose are disclosed in the multi-string inverter topology illustrated above, where each string is connected to a DC/DC converter. *See id.*, ¶¶ 50-53 (citing *Kjaer* and *Kjaer’s* FIG. 3, Ex. 1008 at 4–5, (above)).

The multi-string topology, where an inverter is shared between multiple strings of panels, is advantageous because it permits MPPT to be performed on each string individually. *Id.* This is useful since each string may include different types of solar panels, or solar panels operating under different conditions. *Id.* By performing MPPT on each string individually, and then feeding the DC output of each string to a shared inverter, the overall power output of the installation can be increased, while reducing the number of required inverters and controllers, saving costs. *Id.*, ¶¶ 53-55. Additionally, providing an inverter that is sharable between multiple strings of panels increases flexibility and scalability of the design, permitting a user to start

with a single string, and then plug more strings into the same inverter to expand the system over time. *Id.*, ¶¶ 51-52.

Inverters with multiple DC input ports are disclosed in references relied on herein, specifically, *Nishi* (Ex. 1006) and *Fornage* (Ex. 1004). See Ex. 1003, ¶¶ 57-63 (summarizing the references). *Nishi* was filed on November 5, 2004 and published on May 19, 2005. Ex. 1006 at 1. *Nishi* is prior art under pre-AIA 35 U.S.C. 102(b). *Fornage* was filed on July 16, 2007 and published on January 22, 2009. Ex. 1004 at 1. *Fornage* is prior art under pre-AIA 35 U.S.C. 102(e). Exemplary inverter arrangements from these references are illustrated in the annotated figures below.



Nishi, Fig. 2 (annotated).

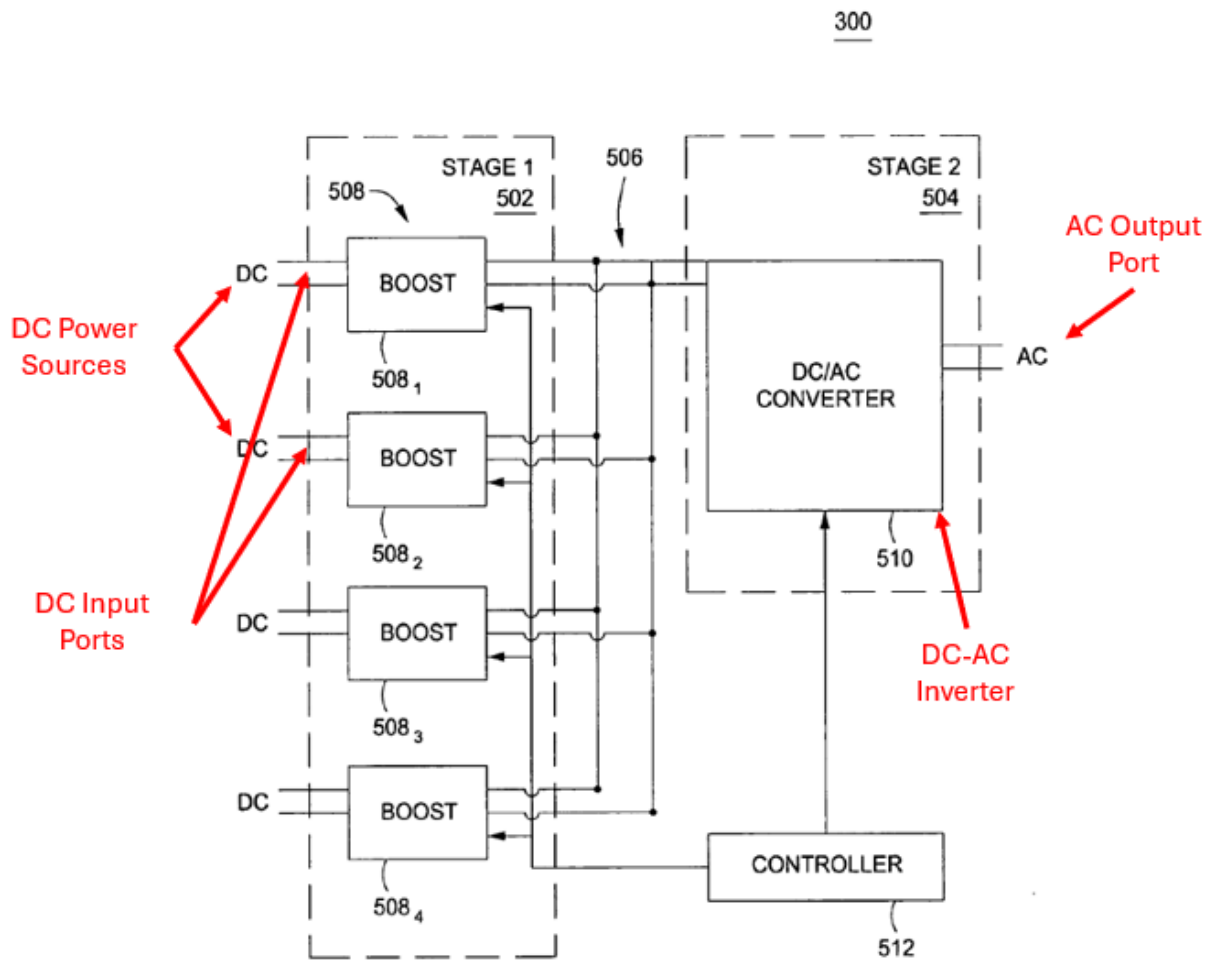
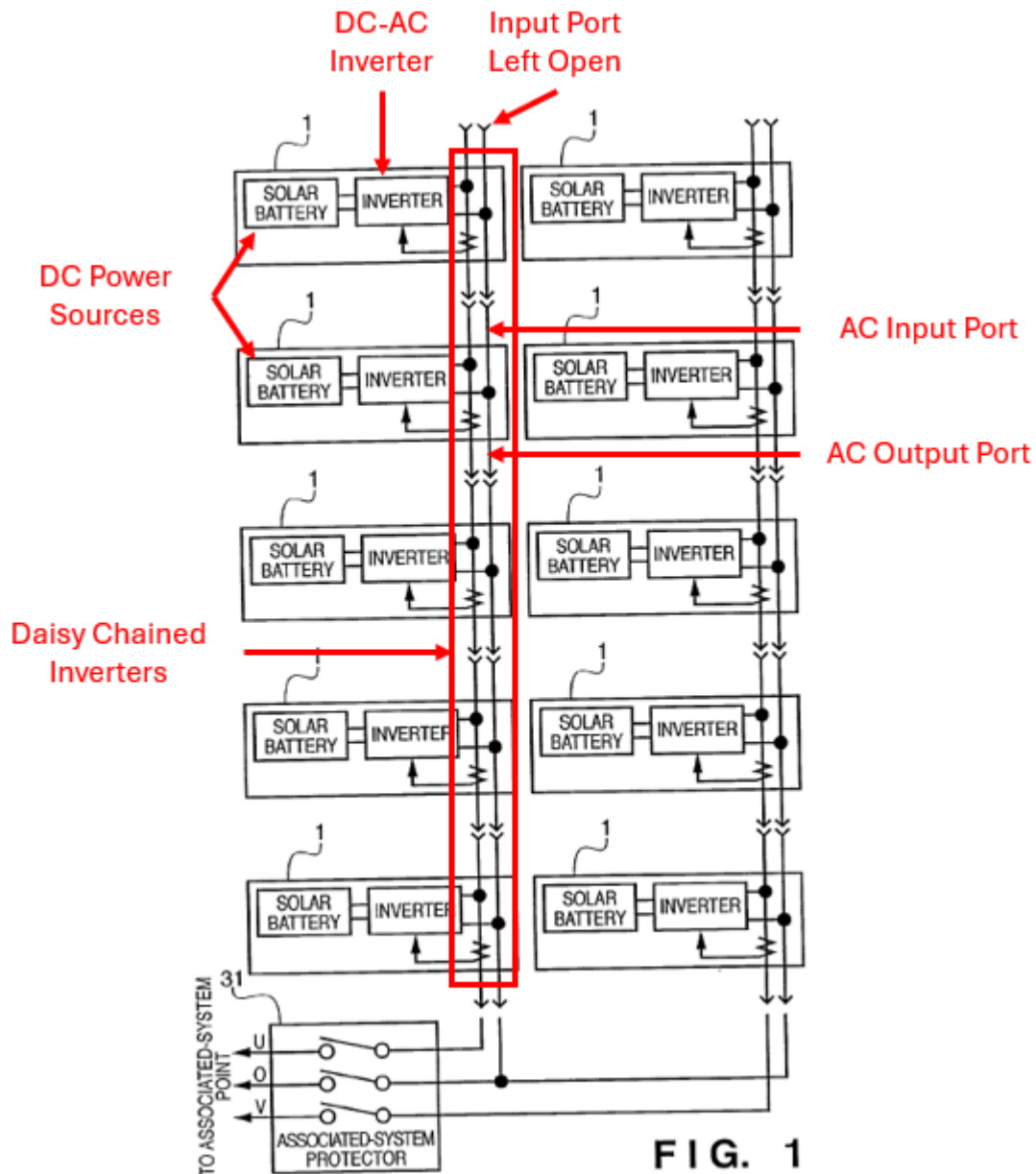


FIG. 5

Fornage, Fig. 5 (annotated).

Connecting multiple inverters in a daisy-chain to combine their AC output power was also known in the art before the priority date of the '133 Patent and was known to be advantageous as a means of scaling up a photovoltaic system power by adding additional inverters and solar panels. Ex. 1003, ¶¶ 64-76. Indeed, the Examiner noted this feature was disclosed, at least, in *Aoki*. Additionally, a daisy-chained inverter arrangement, where multiple inverters are joined between AC

Input/Output ports, and the advantages provided thereby, is disclosed in *Kondo* (Ex. 1007). *Kondo* was filed on September 24, 2001 and published on April 4, 2002. Ex. 1007 at 1. *Kondo* is prior art under pre-AIA 35 U.S.C. 102(b). Figure 1 of *Kondo*, annotated, is shown below.



It would have been obvious to the person of ordinary skill in the art (“POSA”)

to combine the teachings of *Kondo's* daisy-chained inverters with either *Nishi* or *Fornage* to gain the advantage of doing MPPT on more than one panel string, while sharing an inverter and an MPPT controller to reduce costs and enhance efficiency. Ex. 1003, ¶¶ 16-19. Grounds 1 and 2 show the obviousness of this combination, relying on *Kondo* as the primary reference, and *Nishi* and *Fornage* as the respective secondary references.

It would also have been obvious to take an inverter with multiple DC inputs and connect it to other inverters in a daisy-chain, through AC inputs and outputs. Ex. 1003, ¶ 19. The POSA would have recognized that this modification would allow a user to further expand a solar installation beyond a single inverter. *Id.* The POSA would also have understood that adding inverters in a daisy-chain was superior to other methods of parallel combination (like using an external AC bus), since daisy-chaining inverters allows each inverter in the chain to sense the total AC current flowing through the chain, so that it can disconnect and reduce current on the bus in the event of an over-current condition. Ex. 1003, ¶¶ 18-19, 70-74. Ground 3 demonstrates the obviousness of this combination and relies on *Fornage* as the primary reference and *Kondo* as the secondary reference.

VIII. CLAIMS 15–24 ARE UNPATENTABLE

A. Ground 1: Claims 15–16, 18–20 and 22–24 are obvious in view of **Kondo and Nishi**.

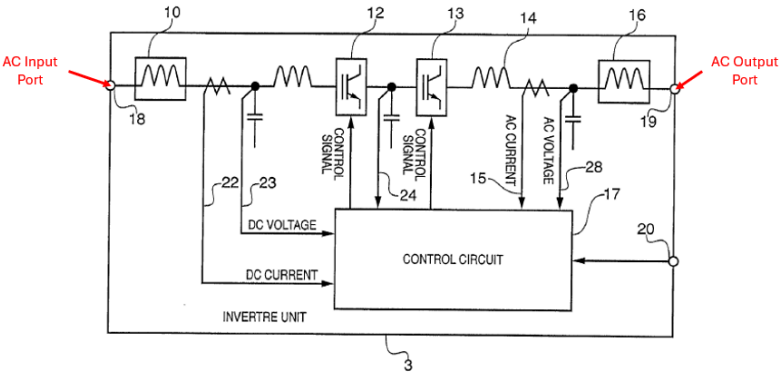
As is shown in the chart below, all elements of claims 15–16, 18–20 and 22–24 are disclosed in the obvious combination of **Kondo** and **Nishi**.

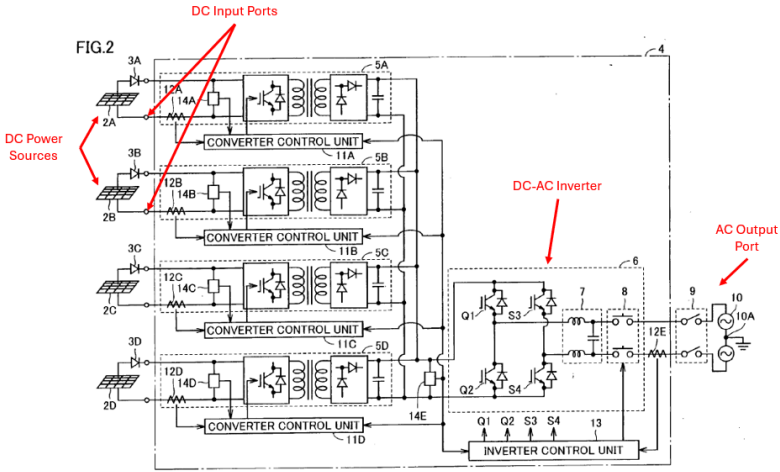
Claim Element	Kondo and Nishi
15[pre][1]: A scalable DC to AC power inversion system for providing AC power to a power grid	Kondo (Ex. 1007) discloses a DC to AC power inversion (i.e., conversion) system (the first embodiment shown and described in reference to FIGs. 1–6) for providing power to the grid. <i>See</i> Ex. 1003, ¶¶ 95-97. Kondo’s system includes inverters that convert DC to AC: “The power conversion unit 21 converts DC power supplied from the solar battery unit 2 to 50/60 Hz and 100V AC power.” Kondo , [0033].
19[pre]: A method of making a DC to AC power conversion System incrementally scalable, comprising:	Kondo’s system is incrementally scalable: “AC module, integrating a solar battery and an inverter, can easily be connected with other plural AC modules in parallel by way of cascade connections.” <i>Id.</i> , [Abstract]. Kondo’s system supplies AC power to the grid. <i>See</i> 15b3

Claim Element	<i>Kondo and Nishi</i>
	and FIG. 1, below (referencing the “ASSOCIATED SYSTEM POINT”); <i>Kondo</i> , [0026] and [0002].
15[pre][2]: from a plurality of individual DC power sources each having a DC power output port, comprising: 19[a][1]: a) providing a plurality of DC power sources	<i>Kondo</i> discloses a plurality of DC power sources, specifically, photovoltaic modules. “The present invention relates to a solar battery module and a power generation apparatus and, more particularly, to a solar battery module comprising a solar battery and an electronic power converter, and a power generation apparatus utilizing said solar battery module.” <i>Kondo</i>, [0001]. <i>Kondo</i>’s “solar batter[ies]” are photovoltaic modules, which produce DC power from an output port, e.g., an electrode. <i>See</i> FIGs. 1, 3 and 4, below. <i>Kondo</i> states that a “Solar Battery Unit” 2, shown in FIG. 4, is a “photoelectronic transducer” (e.g., a PV module), where “DC power is outputted from an electrode (not shown) of the solar battery unit 2.” <i>Id.</i>, [0031]. The non-illustrated “electrode” would be understood as a DC power output port. Ex. 1003, ¶ 99.

Claim Element	<i>Kondo and Nishi</i>
15[a][1]: a) a plurality of power inverters, each of said power inverters including a single DC-AC inverter, 19[a][2]: and a plurality of DC to AC power inverters, said DC to AC power inverters each having a single DC-AC inverter,	<i>Kondo</i> (Ex. 1007) discloses a plurality of power inverters, marked as “inverter” in FIG. 1 (below) and “power conversion units” 21 in FIG. 3 (below). Each power inverter has a single DC-AC inverter: “The power conversion unit 21 comprises an inverter unit 3, an over current detector 27, and current paths 7, 8 and 9. The power conversion unit 21 converts DC power supplied from the solar battery unit 2 to 50/60 Hz and 100V AC power.” <i>Kondo</i>, [0033]; <i>see also</i> Ex. 1003, ¶¶ 100-101. The DC-AC inverters output AC. <i>Kondo</i>, [0034]–[0040], Fig. 5.

Claim Element	<i>Kondo and Nishi</i>
	DC-AC Inverter Input Port Left Open DC Power Sources AC Input Port AC Output Port Daisy Chained Inverters TO ASSOCIATED SYSTEM POINT ASSOCIATED SYSTEM PROTECTOR FIG. 1

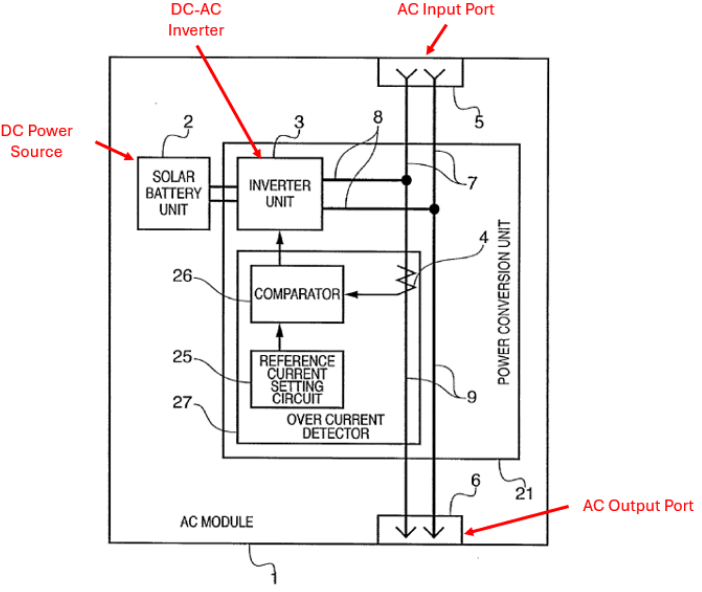
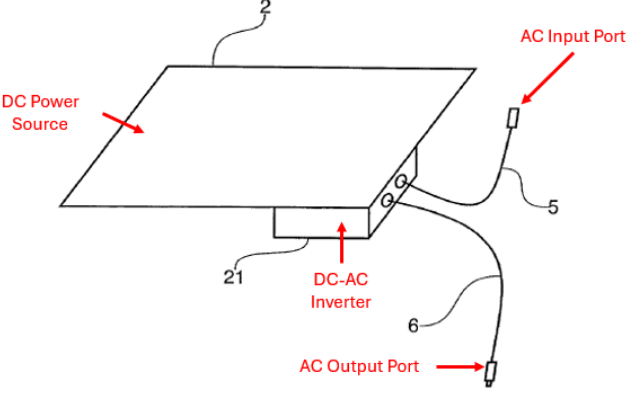
Claim Element	<i>Kondo and Nishi</i>
to the single DC-AC inverter;	FIG. 5  <i>Nishi</i> (Ex. 1006) discloses a power inverter - “inverter apparatus 4.” <i>Nishi</i>, [0068] and [0070]; FIGs. 1-2 (FIG. 2 annotated below). <i>Nishi</i>’s power inverter (4) has a plurality of DC inputs, shown by the terminals marked in FIG. 2, that take DC power from connected DC sources, solar cell arrays 2A–2D, through DC output ports. <i>See id.</i>, [0067]; Ex. 1003, ¶¶ 104-105. <i>Nishi</i>’s power inverter (4) includes a single DC-AC inverter 6 coupled to each of the DC inputs. <i>See Nishi</i>, [0070], [0067] and [0038] (“an inverter apparatus [is] provided between a plurality of DC power sources and a load for transforming a DC power received from each of the plurality of DC power sources into AC power”).

Claim Element	<i>Kondo and Nishi</i>
	 FIG. 2 It would have been obvious to incorporate <i>Nishi's</i> arrangement for providing multiple DC inputs to an inverter with <i>Kondo's</i> arrangement for daisy-chaining inverters through their AC outputs. The POSA would have been motivated to incorporate <i>Nishi's</i> shared inverter arrangement because it permits the inverter to optimize the DC power output of more than one connected string of PV modules, operating under different conditions, while sharing inverter, thereby saving cost. Ex. 1003, ¶¶ 106-107; ¶ 54 (citing <i>Kjaer</i> and <i>Rotzoll '118</i> to explain why sharing inverters is advantageous from a cost perspective). In reference to <i>Nishi's</i> embodiment of FIGs. 1 and 2: "Here, converter

Claim Element	<i>Kondo and Nishi</i>
	control units 11A–11D each calculate an output power of respective solar cell arrays 2A–2D based on corresponding input voltage detection value and input current detection value, and control respective converters 5A–5D so that the output of respective solar cell arrays 2A–2D becomes maximum.” <i>Nishi</i>, [0077]. One advantage of maximizing input power on each attached string is that overall power is maximized when each string has different illumination conditions, and therefore operates at a different voltage. <i>See id.</i>, [0061]–[0063] (different solar arrays receiving different amounts of sun will have different output voltage); [0065] (parallel DC/DC converters can adjust solar cell output voltage of all cells to maximized power); Ex. 1003, ¶¶ 106-107. Additionally, the POSA would have been motivated to add multiple DC inputs to <i>Kondo’s</i> inverters to provide the ability to accept DC power from different sources, while reducing component costs by sharing an inverter. Ex. 1003, ¶¶ 106-107. <i>Nishi’s</i> second

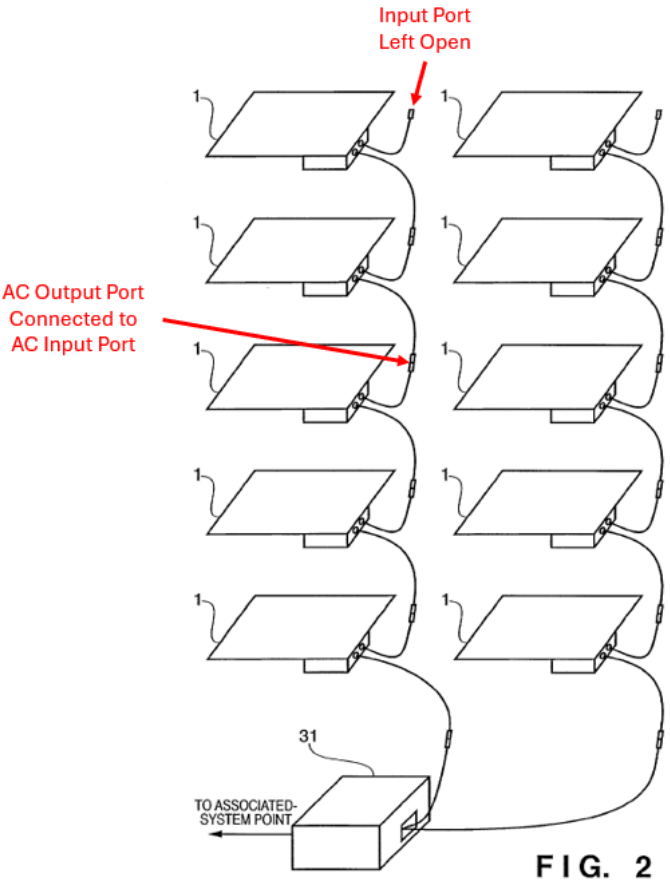
Claim Element	<i>Kondo and Nishi</i>
	embodiment, shown in FIG. 6, shows an inverter 4A, with a DC-AC inverter 6, receiving DC from solar panels 2A-DI, but also from fuel cell 16. <i>Nishi</i> emphasizes the advantages of this ability to generate AC from diverse sources: “Considering the diversification of the DC power sources of practical use, it is highly advantageous to structure a dispersed-power-source system of, a hybrid type that is higher in efficiency and lower in costs.” <i>Nishi</i>, [0035], [0047]. Using <i>Nishi</i>’s shared inverter arrangement in the inverter of <i>Kondo</i> would be a simple substitution of one known element for another, yielding predictable results. Ex. 1003, ¶ 109. <i>Kondo</i>, like <i>Nishi</i>, already discloses one DC input (18 in FIG. 5), a DC/DC boost converter (“boost circuit 12”), and a controller (“control circuit 17”) for performing MPPT. <i>See Kondo</i>, [0036] (“At this stage, the control circuit 17 performs the well-known optimum operation point tracking control based on DC current 22 and DC voltage 23”).

Claim Element	<i>Kondo and Nishi</i>
	Incorporating <i>Nishi</i>'s shared inverter arrangement into <i>Kondo</i> would simply involve adding DC inputs and boost circuits controlled by <i>Kondo</i>'s existing controller, and collecting the total DC output of the boost circuits on a DC bus, and providing it to <i>Kondo</i>'s inverter (13 in FIG. 5, <i>Kondo</i>, [0036]). This modification is well within the skill of the POSA. Ex. 1003, ¶¶ 109-110.
15[a][3]: an AC power input port, and an AC power output port coupled to the single DC-AC inverter, 19[a][3]: an AC input port coupled to the single DC-AC inverter, an AC output port	<i>Kondo</i> discloses these elements. Ex. 1003, ¶ 111. Each of power inverter (21) has an AC power input port (5) and an AC power output port (6), both of which are coupled directly to the DC/AC inverter (inverter unit 3) through "current paths" 8 and 9 in FIG. 3. FIGs. 3 and 4 (below); <i>see also Kondo</i>, [0006], [0033], and [0051]. The AC inputs and output may be either direct connections to the power inverter (21), as shown in FIG. 3, or the electrical connectors to those connections, as shown in FIG. 4.

Claim Element	Kondo and Nishi
coupled to the single DC-AC inverter,	FIG. 3  FIG. 4 

Claim Element	<i>Kondo and Nishi</i>
15[a][4]: each of said DC power input ports having one DC power source connected thereto; 19[b]: b) connecting at least one of said DC power sources, respectively, to each of said DC input ports; and	<i>Kondo</i> and <i>Nishi</i> disclose these elements. Ex. 1003, ¶¶ 102-105, 112. <i>Kondo</i>'s power inverters have DC input ports (18 in FIG. 5, above) that are connected to DC sources ("solar batteries" shown and described in the figures above). <i>Nishi</i> discloses an inverter with DC power input ports connected to DC sources, shown in the marked terminals in FIG. 2, above.
15[b][1]: b) said AC power output port of each power inverter being connected in a daisy-	<i>Kondo</i> discloses these elements. Ex. 1003, ¶¶ 64-76, 113 (explaining how <i>Kondo</i>'s connection arrangement is a "daisy chain" arrangement). In <i>Kondo</i>'s arrangement, the AC power output port (6 in FIG. 3) is connected in a daisy-chain to the AC power input port (5

Claim Element	<i>Kondo and Nishi</i>
chain to the AC power input port of the next power inverter, 22[a]: The method of claim 19 further comprising daisy-chaining at least two of said DC to AC power inverters, said AC power output port of each DC to AC power inverter being connected in a daisy-chain to the AC power input port	in FIG. 3) of the next inverter 21 in the chain and referred to as a “cascade.” See <i>Kondo</i>, [Abstract] and [0048]. This is illustrated in FIG. 1 (above) and FIG. 2 (below). This connection of one inverter to another, resulting in the AC outputs of the inverter being connected electrically, in parallel, is precisely the arrangement described in the ’133 Patent as a “daisy chain.” Ex. 1003, ¶¶ 37-38 (citing ’133 Patent); <i>see also</i> ’133 Patent (Ex. 1001) at 3:61–64 (“Although we say the power inverters daisy chain, where the output port of each power inverter is connected to the input port of the next power inverter, the actual connection of the inverters is pass-through. That means, the generated AC power from each power inverter is added in parallel onto the AC powerline.”).

Claim Element	<i>Kondo and Nishi</i>
of the next DC to AC power inverter,	 FIG. 2
15[b][2]: except for the AC power input port of the first power inverter being left open, 22[b]:	<i>Kondo</i> discloses this element. Ex. 1003, ¶¶ 69, 114. As is illustrated in FIGs. 1 and 2, the first AC power input port of the daisy-chain is left open. “As shown in FIG. 1, the input connector 5 of the AC module 1, which is connected at the end of the cascade connection, is unconnected. Therefore, a receptacle that does not allow easy contact with the electrically activated portion is used

Claim Element	<i>Kondo and Nishi</i>
except for the AC power input port of the first DC to AC power inverter being left open,	for the input connector 5, and a plug is used for the output connector 6.” <i>Kondo</i> , [0048].
15[b][3]: and the AC power output port of the last power inverter being connected to a power service panel of the power grid; 19[c]: c) providing AC power to the power grid. 22[c]:	In <i>Kondo</i>, the last power inverter is connected to an associated system point” through an “associated system protector” 31 (i.e., a breaker panel illustrated as including breaker switches) shown above in FIGs. 1 and 2. <i>See also</i> Ex. 1003, ¶ 115. The associated system can be a power grid, which <i>Kondo</i> calls a “commercial-use power system.” <i>Kondo</i>, [0026]. <i>Kondo</i> also states, generally, that photovoltaic installations are used to supply power to the power grid: “Recently widely available photovoltaic power generation systems include a system-association type, which supplies a commercial-use power system with AC power obtained by an inverter performing DC/AC conversion of power generated by a solar battery,

Claim Element	<i>Kondo and Nishi</i>
and the AC power output port of the last DC to AC power inverter being connected to a power service panel of the power grid.	and an independent type which supplies power to a load.” <i>Id.</i>, [0006]. To the extent that Kondo does not disclose providing AC power to the grid through a service panel, these elements are disclosed by Nishi. Ex. 1003, ¶ 117. In FIG. 2, reproduced above, the inverter 4 is connected to a breaker 9, and then to “commercial power system 10”, <i>i.e.</i>, the grid. <i>See Nishi</i> at [0097]; <i>see also id.</i> at [0003], [0005], and [0016]. The POSA would understand Kondo’s “associated system protector” and Nishi’s “breaker” to be service panels. Ex. 1003, ¶¶ 115-117. To the extent that neither Kondo nor Nishi discloses a grid connected service panel, such an arrangement was known in the art and would have been obvious to incorporate so that a user of solar-generated AC could feed loads connected to the service panel, and also receive power from and sell power to the grid. Ex. 1003, ¶¶ 84-85, 116, 118. These elements are disclosed in Fornage, as is set forth below in Ground 2. Fornage (Ex.

Claim Element	<i>Kondo and Nishi</i>
	1004) at [0005], [0027]. Additionally, the Examiner took official notice of the obviousness of this arrangement: “Official Notice is taken that both the concept and advantages of providing a power service panel connection from a supplemental utility grid co-generation system and providing power to the utility grid are well known and expected in the art.” Ex. 1002 at 96.
15[c]: c) whereby said system is incrementally scalable by adding or subtracting DC power sources and daisy-chained inverters.	<i>Kondo’s</i> system may be scaled by adding or subtracting daisy-chained inverters. <i>Kondo’s</i> system allows for an increase in “the number of parallel-connected AC modules by sequentially repeating cascade connection.” <i>Kondo</i>, [0003]; <i>see also id.</i> at [Abstract], [0004]; <i>see also</i> Ex. 1003, ¶ 119. <i>Nishi’s</i> system is incrementally scalable by adding or subtracting DC power sources to the shared inverter. “Thus, inverter apparatus 4 in the dispersed-power-source system includes a plurality of converters having different input voltage ranges, and therefore it can transform a DC power outputted from each of a plurality of DC power

Claim Element	<i>Kondo and Nishi</i>
	sources having different output voltage ranges into a commercial AC power, without providing a booster circuit at a front stage or imposing limit on a number of solar cell modules to be connected for constituting an solar cell array.” <i>Nishi</i>, [0068]; <i>see also id.</i> at [0003] (referring to a “plurality of DC sources”), [0043] (referring to a “plurality of converters” each connected to a DC source). Additionally, <i>Nishi</i> contemplates that its system may include “at least one first DC power source” and “at least one second DC power source” in the plurality of sources, which suggests that the system may include any number of sources, more than two. <i>Id.</i>, [0038]. For the reasons set forth above, it would have been obvious to enhance <i>Kondo’s</i> scalability with the additional ability to add or subtract strings of panels to a single inverter, so that the system could perform MPPT tracking on more than one panel string while sharing an inverter. Ex. 1003 at ¶¶ 119-121.

Claim Element	<i>Kondo and Nishi</i>
16. The system of claim 15, in which the output of each of the said power inverters is single phase AC. 20. The method of claim 19, in which the output of each of said power inverters is single phase AC.	<i>Kondo</i> discloses single phase AC. In the first embodiment of <i>Kondo</i>, relied on above, the inverters output single phase AC. <i>See Kondo</i>, [0025] (“each AC module 1 has a 100V singlephase output.”); Ex. 1003, ¶ 122.
18. The system of claim 15 further comprising a first DC power source connected to one of said DC power input ports of one of said	<i>Nishi</i> discloses this limitation. Ex. 1003, ¶¶ 123-126. <i>Nishi</i> provides that different strings of solar panels generating different voltages may be connected to the input ports of the same inverter. <i>See Nishi</i>, ¶¶ [0061]–[0063] (“Specifically, under a certain solar radiation condition, solar cell arrays 2A, 2B each output a DC voltage of about 230V, while solar cell arrays 2C, 2D

Claim Element	<i>Kondo and Nishi</i>
power inverters and a second DC power source different in kind from said first DC power source connected to another of said DC power input ports of said one power inverter. 24. The method of claim 19 further comprising: a) connecting a first DC power source to one of said DC power input ports of one of said power inverters; and	each output a DC voltage of about 70V.”), [0068], and FIG. 1. Additionally, <i>Nishi</i> discloses providing DC outputs from non-solar DC sources to the DC inputs of its shared inverter. <i>Id.</i>, [0047]. In its second embodiment of FIG. 6 (below), <i>Nishi</i> discloses a shared inverter arrangement with a non-solar DC source. <i>Id.</i>, [0108] (“In a second embodiment, a dispersed-power-source system of the hybrid type in which solar cell arrays and fuel cells are used as DC power sources is shown”). In the FIG. 6 embodiment, DC power from solar cells (2A–D) as well as a fuel cell 16, is provided through an array of DC inputs to “inverter apparatus 4A in place of inverter apparatus 4” (described above). As is seen in FIG. 6, inverter apparatus 4A (a power inverter) includes a single DC/AC inverter 6 (like the one described above in reference to FIG. 2). <i>See id.</i>, [0114].

Claim Element	<i>Kondo and Nishi</i>
b) connecting a second DC power source, different in kind from said first DC power source, to another of said DC power input ports of said one power inverter.	FIG.6 As discussed above for claim 15, the POSA would have been motivated to incorporate <i>Nishi's</i> multi-input inverter topology into the combination to optimize power output of a collection of solar panels operating under unlike conditions. Ex. 1003, ¶¶ 123-126. The POSA would have recognized the efficiency benefit of being able to share an inverter between solar cell and non-solar DC sources such as the fuel cell shown in FIG. 6 of <i>Nishi. Id.</i> <i>Nishi</i> teaches the advantages of this type of “hybrid” system, stating “a dispersed-power-source

Claim Element	<i>Kondo and Nishi</i>
	system of a hybrid type can easily be structured with low costs and without reduction of efficiency.” <i>Nishi</i>, [0115]. <i>Nishi</i> further teaches that this sort of system can be easily implemented simply by providing a DC/DC converter having different input ranges (5E) in the input path of the fuel cell. <i>Id.</i>, [0112].
23. The method of claim 19 where the providing of AC power includes producing a total AC power that is the summation of the AC power supplied by each said DC to AC power inverter.	<i>Kondo</i> discloses summing the AC power generated by each of its inverters through its daisy chain connection. Ex. 1003, ¶¶ 127-128. “The DC power generated by the solar battery unit 2 is converted to AC power by the inverter unit 3, sent through the current path 8, collected together with the power, which is generated by other AC modules 1 and inputted from the input connector 5, then sent through the current path 9, and outputted to the output connector 6.” <i>Kondo</i>, [0051]. FIG. 6 shows the summation of AC current contributed by all the modules in the daisy-chain over time as “insolation” (solar irradiation on the solar panels) increases. <i>See id.</i>, [0053] (referring to the “collected current values of the

Claim Element	<i>Kondo and Nishi</i>
	AC modules 1 connected in common phase”), [0056] (showing currents being added, with each AC module contributing 0.9A).

B. Ground 2: Claims 15–16, 18–20 and 22–24 are obvious in view of Kondo and Fornage.

The combination of Kondo and Fornage discloses all elements of claims 15–16, 18–20 and 22–24. The claim chart below incorporates by reference the disclosures of Kondo and analysis set forth above in Ground 1.

Claim Element	<i>Kondo and Fornage</i>
15[pre][1]: A scalable DC to AC power inversion system for providing AC power to a power grid 19[pre]:	As discussed in Ground 1, 15[pre][1] and 15[c], above, <i>Kondo</i> discloses these elements. These elements are also disclosed in <i>Fornage</i>. See 15[c], below.

Claim Element	<i>Kondo and Fornage</i>
A method of making a DC to AC power conversion System incrementally scalable, comprising:	
15[pre][2]: from a plurality of individual DC power sources each having a DC power output port, comprising: 19[a][1]: a) providing a plurality of DC power sources	As discussed in Ground 1, 15[pre][2], above, <i>Kondo</i> discloses these elements.

Claim Element	<i>Kondo and Fornage</i>
15[a][1]: a) a plurality of power inverters, each of said power inverters including a single DC-AC inverter, 19[a][2]: and a plurality of DC to AC power inverters, said DC to AC power inverters each having a single DC-AC inverter,	As discussed in Ground 1, 15[a][1], above, <i>Kondo</i> discloses these elements.
15[a][2]: at least two DC power input ports	As discussed in Ground 1, <i>Kondo</i> discloses an arrangement of daisy-chained inverters, each with an input port connected to a single “solar battery” or DC source.

Claim Element	<i>Kondo and Fornage</i>
coupled to the single DC-AC inverter, 19[a][4]: and at least two DC input ports coupled to the single DC-AC inverter;	<i>Fornage</i> (Ex. 1004) discloses, in FIG. 3, a plurality of power inverters (300₁₋₄) connected in parallel along an AC bus 314: “Each power generator (for example generator 320₁) comprises a plurality of inverters 300₁ (see FIG. 4) and a photovoltaic panel 102₁.” <i>Fornage</i>, [0022]. Each inverter 300 can be a shared inverter that receives DC power from a plurality of DC sources, which is the arrangement shown in FIG. 5. Ex. 1003, ¶¶ 131-132. “FIG. 5 is a block diagram...of a dual stage inverter 500 that may be used as an inverter 300....” <i>Fornage</i>, [0032]. The inverter 500 of FIG. 5 has a single DC-AC inverter 504, and at least two DC power input ports connected to the DC/AC converter. <i>Id.</i>, [0033]. These are the DC input lines that are upstream or downstream of the BOOST circuits 508_i shown in FIG. 5 (below). These lines are connected to PV panels (i.e., DC power sources). <i>Id.</i>, [0034]. An exemplary pair of DC power input ports is marked in red in FIG. 5, below.

Claim Element	Kondo and Fornage
	Diagram of a photovoltaic system (Fig. 3) showing multiple photovoltaic panels (102) connected to inverters (300). A DC Power Source and Inverter are highlighted with red arrows. The system includes a Junction Box (304), Electric Panel (306), Meter (310), and connections to the Power Grid (312) and Appliances (316). Fornage, Fig. 3 (annotated). Diagram of a multi-stage DC/AC converter (Fig. 5) showing multiple DC input ports (508) connected to boost converters (506) in Stage 1 (502). The outputs of Stage 1 are connected to a DC/AC Converter (510) in Stage 2 (504), which produces an AC Output Port. A Controller (512) is connected to the system. FIG. 5 Fornage Fig. 5 (annotated). It would have been obvious to incorporate <i>Fornage's</i> arrangement for providing multiple DC inputs

Claim Element	<i>Kondo and Fornage</i>
	to an inverter with <i>Kondo</i>'s arrangement for daisy-chaining inverters through their AC outputs/inputs. Ex. 1003, ¶¶ 133-136. The POSA would have been motivated to incorporate <i>Fornage</i>'s shared inverter arrangement to optimize the DC power output of more than one connected string of PV modules, while using the same shared inverter (510) and controller (512), thereby reducing component count and cost. Ex. 1003, ¶ 133. "In this embodiment, the boost circuits 508₁, 508₂...508_n share a single DC/AC converter 510." <i>Fornage</i>, [0034]. <i>Fornage</i> further states: "A controller 512 provides an individual control signal to each boost circuit 508 to ensure that the rows of cells coupled thereto operates [sic] at the row's MPP." <i>Id.</i>, [0033]. <i>Fornage</i> generally recognizes the importance of being able to operate PV modules that are experiencing different levels of illumination, or have different characteristics, at their optimum peak power point. <i>See id.</i>, [0006]–[0007], [0018]–[0019], and [0033]–[0034].

Claim Element	<i>Kondo and Fornage</i>
	Additionally, the POSA would have recognized that adding <i>Fornage’s</i> multi-input capability would provide for a more flexible and scalable system, where the user could add panels without the need to add inverters. Ex. 1003, ¶ 135. <i>Fornage</i> recognizes this advantage when it describes the system of FIG. 3, including the multi-input inverters of FIG. 5 as “scalable and flexible to fit any user’s needs.” <i>Fornage</i>, [0025]. <i>Kondo</i> also recognizes the importance of flexibility and scalability when it touts the advantage of its system that “enables to increase the number of parallel-connected AC modules by sequentially repeating cascade connection.” <i>Kondo</i>, [0003]; <i>see also id.</i>, [0004] (“enables easy parallel connection of plural AC modules by way of cascade connection”). The POSA would recognize the advantage of scalability and that additional scalability could be provided in <i>Kondo’s</i> system with the addition of <i>Fornage’s</i> multi-input inverter.

Claim Element	<i>Kondo and Fornage</i>
	Using <i>Fornage</i>'s shared inverter in the inverter system of <i>Kondo</i> would be a simple substitution of one known element for another, yielding predictable results. Ex. 1003, ¶ 136. <i>Kondo</i>, like <i>Fornage</i>, already provides for one DC input (18 in FIG. 5, Ground 1, above), a DC/DC boost converter ("boost circuit 12"), and a controller ("control circuit 17") for performing MPPT. <i>See Kondo</i>, [0036] ("At this stage, the control circuit 17 performs the well-known optimum operation point tracking control based on DC current 22 and DC voltage 23."). Incorporating <i>Fornage</i>'s shared inverter arrangement into <i>Kondo</i> would simply involve providing additional DC inputs and additional boost circuits controlled by <i>Kondo</i>'s existing controller, and then collecting the total DC output of the boost circuits on a DC bus (<i>Fornage</i>, FIG. 5, 506 described at [0032]–[0033]), and providing it to <i>Kondo</i>'s inverter (<i>Kondo</i> FIG. 5 at 13, described at [0035]–[0036]). This modification is well within the skill of the POSA. Ex.1003, ¶ 136.

Claim Element	<i>Kondo and Fornage</i>
15[a][3]: an AC power input port, and an AC power output port coupled to the single DC-AC inverter, 19[a][3]: an AC input port coupled to the single DC-AC inverter, an AC output port coupled to the single DC-AC inverter,	As discussed in Ground 1, 15[a][3], <i>Kondo</i> discloses these elements.
15[a][4]: each of said DC power input ports	As discussed in Ground 1, 15[a][4], <i>Kondo's</i> power inverters have DC input ports (18 in FIG. 5, above) that are connected to DC sources (“solar batteries” 2 shown and

Claim Element	<i>Kondo and Fornage</i>
having one DC power source connected thereto; 19[b]: b) connecting at least one of said DC power sources, respectively, to each of said DC input ports; and	described in the figures above). <i>Fornage</i> discloses an inverter with multiple DC power input ports, shown in the marked terminals in FIG. 5, above. These input ports are connected to DC sources, the “Photovoltaic Panels” 102 marked in FIG. 3, above. <i>See also Fornage</i>, [0023] (“The photovoltaic panels...are well known in the art and are used for generating DC power from solar energy.”); Ex.1003, ¶ 137.
15[b][1]: b) said AC power output port of each power inverter being connected in a daisy-chain to the AC power input port of the next	As discussed in Ground 1, 15[b][1], <i>Kondo</i> discloses this element.

Claim Element	<i>Kondo and Fornage</i>
power inverter, 22[a]: The method of claim 19 further comprising daisy- chaining at least two of said DC to AC power inverters, said AC power output port of each DC to AC power inverter being connected in a daisy-chain to the AC power input port of the next DC to AC power inverter,	

Claim Element	<i>Kondo and Fornage</i>
15[b][2]: except for the AC power input port of the first power inverter being left open, 22[b]: except for the AC power input port of the first DC to AC power inverter being left open,	As discussed in Ground 1, 15[b][2], Kondo discloses this element.
15[b][3]: and the AC power output port of the last power inverter being connected to a power service	As discussed in Ground 1, 15[b][3], Kondo discloses this element. Providing AC power to the grid through a service panel is also disclosed by Fornage. Ex. 1003, ¶¶ 118, 138-139. Fornage's FIG. 3, above, shows an inverter arrangement for generating AC power that is supplied to an Electric Panel 306, and then to the Power Grid 312. <i>See</i>

Claim Element	<i>Kondo and Fornage</i>
panel of the power grid; 19[c]: c) providing AC power to the power grid. 22[c]: and the AC power output port of the last DC to AC power inverter being connected to a power service panel of the power grid.	<i>Fornage</i>, [0027]. To the extent that <i>Kondo’s</i> “associated system protector” 31 and “commercial use power system” discussed in <i>Kondo</i> [0026] do not disclose the claimed power service panel and grid, it would have obvious to incorporate these elements from <i>Fornage</i>. Ex. 1003, ¶¶ 118, 138-139; <i>see also</i> 84-85, 116 (citing the Examiner’s Official Notice of these elements). Doing so would enable <i>Kondo’s</i> system to supply power through a home distribution hub (the Electric Panel) to various home circuits and to sell power to the grid. <i>See Fornage</i>, [0027].
15[c]:c) whereby said system is	As discussed in Ground 1, 15[c], <i>Kondo’s</i> system may be scaled by adding or subtracting daisy-chained

Claim Element	<i>Kondo and Fornage</i>
incrementally scalable by adding or subtracting DC power sources and daisychained inverters.	inverters. Ex. 1003, ¶ 140. Kondo’s system permits an increase in “the number of parallel connected AC modules by sequentially repeating cascade connection.” Kondo, [0003]; <i>see also id.</i>, [0004] and [Abstract]. Fornage’s system is also incrementally scalable. Ex. 1003, ¶¶ 141-142. Fornage states that the system of FIG. 3, including the multi-input inverters of FIG. 5 is “scalable and flexible to fit any user’s needs.” Fornage, [0025]. Fornage further provides that its system “may include any number of the photovoltaic panels.” <i>Id.</i>, [0023]. In connection with FIGs. 3 and 5, Fornage discloses a system that contemplates an arbitrary number n of inverters 300, and arbitrary number n of DC sources that can be connected to an arbitrary number n of boost circuits 508. <i>See Fornage</i> FIGs. 3 and 5, [0025], and [0032]–[0034]; <i>see also</i> Ex. 1003, ¶¶ 141-142. Fornage also provides “the system 100 may include any number of the photovoltaic panels 102.” Fornage, [0023]. It would have been obvious to enhance Kondo’s existing scalability (daisy chaining inverters) with the

Claim Element	<i>Kondo and Fornage</i>
	additional ability to add or subtract strings of panels to a single inverter. Ex. 1003, ¶ 143. Such a system would allow a user to add panels as needed, without having to add an additional inverter. Ex. 1003, ¶ 143. If more generation capacity was required, additional inverters could be added, as shown in both <i>Fornage</i> (FIG. 3) and <i>Kondo</i>. Ex. 1003, ¶ 143. The ability to incrementally expand power generating capacity was known to be advantageous in the art, and was recognized, for example, in <i>Kjaer</i>. <i>Kjaer</i> (Ex. 1008) at 5; Ex. 1003, ¶¶ 50-55. Additionally, this enhancement of scalability is inherent after modifying <i>Kondo's</i> inverters to receive multiple DC inputs. As is set forth above, the POSA would already have been motivated to make this modification in order to gain the ability to do MPPT on individual solar panels while sharing an inverter. Once multiple DC inputs are provided, scaling the system is simply a matter of adding or subtracting sources from the DC inputs already provided by <i>Fornage</i>. See Ex. 1003, ¶ 143.

Claim Element	<i>Kondo and Fornage</i>
16. The system of claim 15, in which the output of each of the said power inverters is single phase AC. 20. The method of claim 19, in which the output of each of said power inverters is single phase AC.	As discussed in Ground 1 above, <i>Kondo</i> discloses this element. <i>Fornage</i> also teaches that inverters may produce power that is “in-phase with the AC grid current.” <i>Fornage</i>, [0024]. As noted by the Examiner during prosecution, it would have been obvious to supply power in whatever phase is usable by the grid and connected home loads. <i>See</i> Ex. 1003, ¶¶ 86-87, 167-170 (noting that it is obvious to have inverters supply power in whatever phase is appropriate as recognized by <i>Rotzoll ’654</i>, <i>Kjaer</i>, and the Examiner).
18. The system of claim 15 further comprising a first DC power source connected to one of said DC power	<i>Fornage</i> discloses connecting different in-kind DC sources to its inverter arrangements. <i>Fornage</i> notes that “[d]ue to manufacturing tolerances, all solar cells have different characteristics” and observes that in certain installations some solar cells will be in full sun, and other may be shaded. <i>Fornage</i>, [0007]; <i>see also</i> [0018]–[0019],

Claim Element	<i>Kondo and Fornage</i>
input ports of one of said power inverters and a second DC power source different in kind from said first DC power source connected to another of said DC power input ports of said one power inverter.	and FIG. 1 (describing and illustrating a condition where some cells in a panel are in full sun and others are partially shaded). <i>Fornage</i> notes further that the panels described in the embodiment of FIG. 3 may be “of any size or shape.” <i>Id.</i>, [0023]; see also Ex. 1003, ¶¶ 144-146. As is set forth above with respect to claim 15, the POSA would have been motivated to incorporate <i>Fornage’s</i> multi-input inverter topology into the combination precisely to gain the advantage of being able to optimize power output of a collection of solar panels operating under unlike conditions.
24. The method of claim 19 further comprising: a) connecting a first DC power source to one of	

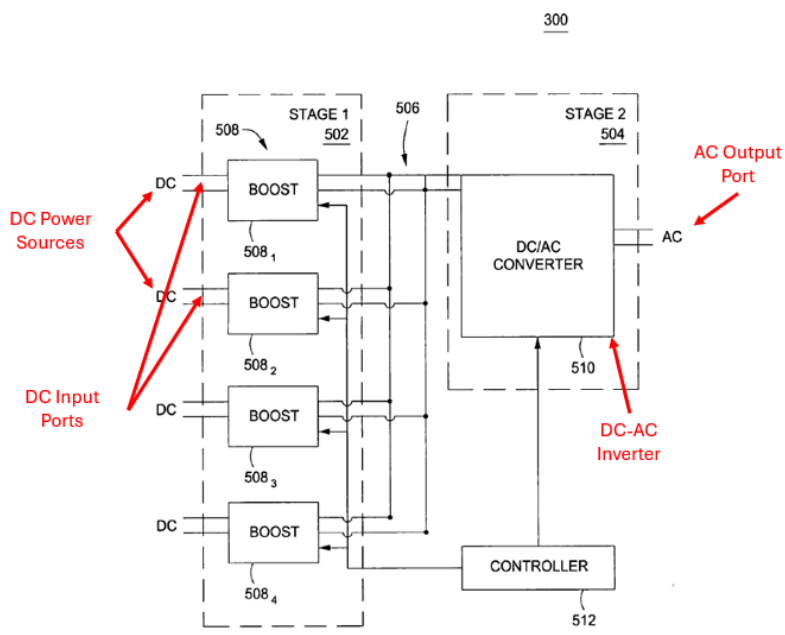
Claim Element	<i>Kondo and Fornage</i>
said DC power input ports of one of said power inverters; and b) connecting a second DC power source, different in kind from said first DC power source, to another of said DC power input ports of said one power inverter.	
23. The method of claim 19 where the providing of AC power includes producing a total AC power that is	As discussed in Ground 1 above, 23, <i>Kondo</i> discloses this element.

Claim Element	<i>Kondo</i> and <i>Fornage</i>
the summation of the AC power supplied by each said DC to AC power inverter.	

C. Ground 3: Claims 15–16, 18–20 and 22–24 are obvious in view of *Fornage* and *Kondo*.

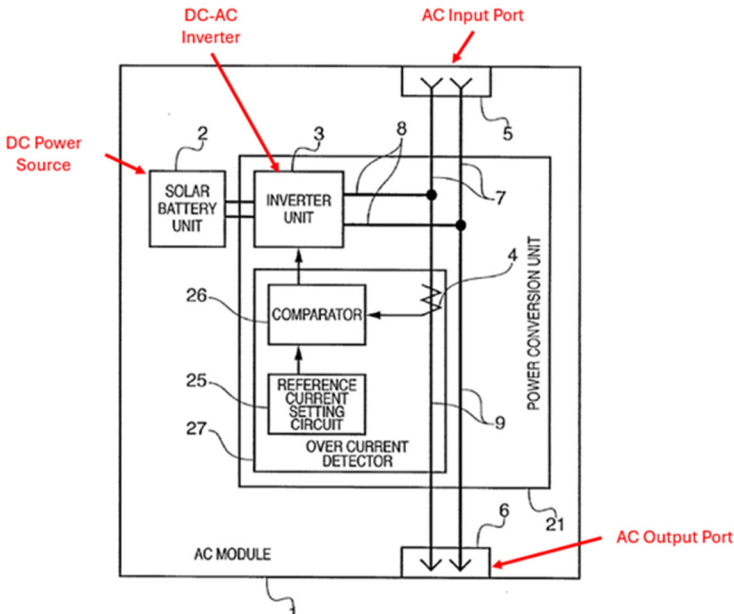
As is shown in the chart below, all elements of claims 15–16, 18–20 and 22–24 are disclosed in the combination of *Fornage* and *Kondo*. For Ground 3, *Fornage*, with its disclosure of multi-input inverters connected together along an AC bus, is the primary reference. It would have been obvious to modify *Fornage*'s arrangement with *Kondo*'s teaching of daisy chaining inverters together through AC input and output ports, essentially, bringing *Fornage*'s AC bus through each inverter. The POSA would have been motivated to make this modification to allow each inverter sense total current on the bus and take corrective action. *See* Ex. 1003, ¶¶ 70-75, 147. The chart below incorporates the disclosure and analysis set forth in Grounds 1 and 2 with respect to *Kondo* and *Fornage*.

Claim Element	<i>Fornage and Kondo</i>
power sources each having a DC power output port, comprising: 19[a][1]: a) providing a plurality of DC power sources	the art and are used for generating DC power from solar energy.” <i>Fornage</i>, [0023]. Each photovoltaic panel must necessarily have a DC power output port to connect to <i>Fornage’s</i> inverter. <i>See Fornage</i> FIGs. 3 and 5, below. To the extent that <i>Fornage</i> does not explicitly disclose an “output port,” it would have been obvious to incorporate <i>Kondo’s</i> “electrode” for the purpose of getting power out of the solar panels. <i>See</i> Ex. 1003, ¶¶ 149-150. The diagram illustrates a solar power system architecture. At the top, a series of photovoltaic panels (102₁, 102₂, 102₃, ..., 102_N) are shown, each associated with a DC power source (320₁, 320₂, 320₃, ..., 320_N). Each panel is connected to its own inverter (300₁, 300₂, 300₃, ..., 300_N). A red arrow labeled 'DC Power Source' points to the first panel, and another red arrow labeled 'Inverter' points to the first inverter. The outputs of all inverters are connected to a common bus (314). This bus leads to a junction box (304). From the junction box, the power is distributed to a meter (310) and an electric panel (306). The meter is connected to a power grid (312), and the electric panel is connected to appliances (316). The entire system is labeled 100. Fornage, Fig. 3 (annotated).

Claim Element	<i>Fornage and Kondo</i>
	 FIG. 5 Fornage Fig. 5 (annotated).
15[a][1]: a) a plurality of power inverters, each of said power inverters including a single DC-AC inverter, 19[a][2]:	In FIG. 3, <i>Fornage</i> shows a plurality of power inverters (300₁₋₄): “Each power generator (for example generator 320₁) comprises a plurality of inverters 300₁ (see FIG. 4) and a photovoltaic panel 102₁.” <i>Fornage</i>, [0022]. Each inverter 300 can be a shared inverter that receives DC power from a plurality of DC sources, as shown in FIG. 5. “FIG. 5 is a block diagram...of a dual stage inverter 500 that may be used as an inverter 300...” <i>Id.</i>, [0032]. The inverter 500 of FIG. 5 has a single DC-AC inverter 504,

Claim Element	<i>Fornage and Kondo</i>
and a plurality of DC to AC power inverters, said DC to AC power inverters each having a single DC-AC inverter,	which contains a DC/AC Converter 510. <i>Id.</i> , [0033]. The POSA would understand either the second inverter stage 504 or its DC/AC converter to be a DC-AC inverter, since these components convert DC to AC. <i>See</i> Ex. 1003, ¶¶ 151-152; and <i>Fornage</i> [0032]–[0034].
15[a][2]: at least two DC power input ports coupled to the single DC-AC inverter, 19[a][4]: and at least two DC input ports coupled to the single DC-AC inverter;	<i>Fornage’s</i> inverter 500 of FIG. 5 has at least two DC power input ports connected to the DC/AC converter. Ex. 1003, ¶ 153. These are the DC input lines that are upstream or downstream of the BOOST circuits 508i shown in FIG. 5 (above). These lines are connected to PV panels (i.e., DC power sources). <i>Fornage</i>, [0034]. These input ports are connected to the boost circuits, then to DC bus 506 and then to the single DC-AC inverter 504 or DC/AC Converter 510. <i>See id.</i>, [0033]. An exemplary pair of DC power input ports is marked in red in FIG. 5, above.

Claim Element	<i>Fornage and Kondo</i>
15[a][3]: an AC power input port, and an AC power output port coupled to the single DC-AC inverter, 19[a][3]: an AC input port coupled to the single DC-AC inverter, an AC output port coupled to the single DC-AC inverter,	<i>Fornage</i> discloses each of its power inverters (300) having at least an AC output port coupled to the inverter. <i>Fornage's</i> AC output ports are coupled to an AC bus 314 shown in FIG. 3 (below). <i>Fornage</i>, [0025]; <i>see also id.</i> [0022] and [0024] (explaining that the inverters 300 convert DC to AC). Where the inverter 300 is a two-stage inverter, as shown in FIG. 5, the AC output port comes from the single DC-AC inverter, Converter 510 (or second stage 504). The AC output port is marked “AC” in FIG. 5. Thus, <i>Fornage</i> discloses inverters connected in parallel via an external AC bus, as shown in FIG. 3. Ex. 1003, ¶ 154. To the extent that <i>Fornage's</i> disclosure of inverters having an AC output port coupled to an AC bus does not disclose an AC input port and an AC output port, it would have been obvious to add these features from <i>Kondo</i>. <i>See</i> Ex. 1003, ¶¶ 155-161. As discussed in 15[a][3] for Grounds 1 and 2, above, <i>Kondo</i> discloses a daisy-chained inverter arrangement where inverters are connected

Claim Element	<i>Fornage and Kondo</i>
	through AC input/output ports. FIG. 3  It would have been obvious to modify <i>Fornage’s</i> arrangement of a chain of inverters connected along an external AC bus (shown in <i>Fornage</i> FIG. 3, above) with <i>Kondo’s</i> teaching of providing AC input/output ports to route the AC bus through each inverter, <i>i.e.</i>, along “conduction path[s]” 7 and 9 shown in <i>Kondo</i> FIG. 3, above. <i>Kondo</i> notes that interconnection of multiple inverters (e.g., in the manner of <i>Fornage</i> FIG. 3) can result

Claim Element	<i>Fornage and Kondo</i>
	in too much AC current on the bus if too many are connected or if the connected panels receive too much light.” <i>Kondo</i> at [Abstract]; <i>see also</i> [0004]. <i>Kondo</i> notes that in the prior art, when the current provided by the connected inverters exceeded a rating, the solution was to disconnect the entire system from the grid. <i>Kondo</i> describes high current conditions “where the associated-system protector 31 [i.e., a breaker] detects an over current and disconnects the switch therein.” <i>Kondo</i>, [0057]; <i>see also</i> Ex. 1003, ¶¶ 157-158 (explaining why <i>Kondo</i>’s concern about too much current during periods of high sunlight would also apply to <i>Fornage</i>’s arrangement of FIG. 3, which also accumulates current generated by all the inverters.). The POSA considering <i>Fornage</i>’s external AC bus and <i>Kondo</i>’s concerns with overcurrent would have been motivated to adopt <i>Kondo</i>’s solution to this problem, which is to route the AC bus <i>through</i> each inverter (as shown in <i>Kondo</i> FIGs. 1–3, above). Ex. 1003, ¶¶ 157-159,

Claim Element	<i>Fornage and Kondo</i>
	70-75. This allows each inverter to monitor the current on the bus and take corrective action if needed: “In view of this, the current detector detects a current in the collective-power current path of the AC module, and when the detected current value exceeds a value set in the reference current setting circuit, the current detector stops the inverter.” <i>Kondo</i> at [Abstract]; <i>see also</i> Ex. 1003, ¶¶ 72-73, 158 (explaining how <i>Kondo</i> FIG. 6 shows shutdown of an inverter that detects too much current). <i>Kondo’s</i> inverters are provided with an overcurrent detector (FIGs. 3, 27) which measures current running through the inverter, between the AC input and AC output, and directs the DC-AC inverter 3 to stop producing additional current if the current on the conductive path is too high. <i>See Kondo</i>, [0046]; Ex. 1003, ¶¶ 72-73, 158. In <i>Kondo’s</i> system, inverters on the chain that are close to the end and that sense accumulated current above some threshold are shut down, and the overall system continues to generate power at near maximum current. <i>See Kondo</i>, [0057]; Ex. 1003, ¶

Claim Element	<i>Fornage and Kondo</i>
	159. This is an advantage over prior art systems which sense overcurrent at the grid connection and disconnect all connected inverters in the event of overcurrent. <i>See Kondo</i>, [0057]; Ex. 1003, ¶ 159. The POSA would understand that <i>Fornage’s</i> parallel connection of inverters along an AC bus, shown in FIG. 3, could be improved by <i>Kondo’s</i> teaching of providing AC inputs and outputs such that the AC bus runs through daisy-chained inverters, where it can be monitored by overcurrent monitors. Ex. 1003, ¶¶ 154-161. <i>Kondo’s</i> arrangement enables inverters in the chain close to the grid (“associated-system point”) to detect overcurrent and shut down, allowing the remaining inverters to continue producing during high irradiation (“insolation”) conditions. Ex. 1003, ¶ 158. The POSA would recognize that this improvement is made simply by running the current through the inverters, as in <i>Kondo</i>, so that each inverter can measure the current on the bus, and determine whether it can add more. Ex. 1003, ¶¶ 158, 160-161. <i>Fornage’s</i>

Claim Element	<i>Fornage and Kondo</i>
	external bus of FIG. 3 was ready for this improvement, because in that configuration, it is not as simple to sense current on the bus. Ex. 1003, ¶ 157. Modifying <i>Fornage’s</i> arrangement with <i>Kondo</i> in this manner would enable inverters to be added easily and without concern that the system will be shut down entirely in the event of overcurrent produced by high light conditions. Ex. 1003, ¶ 160. For the same reasons, <i>Kondo’s</i> improvement also maximizes power and efficiency. <i>See Fornage</i> [0020]; Ex. 1003, ¶ 160. <i>Kondo</i> also suggests to the POSA that its improvement allows for “easily” connecting inverters together, through AC input and output ports, as shown in Kondo’s FIG. 2. <i>Kondo</i>, Abstract; Ex. 1003, ¶ 156. Additionally, the POSA would understand that the modification would be simple, predictable, and well within the skill of the art. Ex. 1003, ¶ 161. <i>Fornage’s</i> parallel bus connection would simply be modified such that the bus ran through each inverter in the chain, as shown in FIGs. 1–3

Claim Element	<i>Fornage and Kondo</i>
	of <i>Kondo</i>. This could be accomplished by adding <i>Kondo's</i> AC input and output ports and current paths to the second stage (504). Ex. 1003, ¶ 161. The POSA would also add <i>Kondo's</i> overcurrent detector 27, such that <i>Fornage's</i> controller 512 was directed to stop producing power in the event of an overcurrent condition. <i>Id.</i>
15[a][4]: each of said DC power input ports having one DC power source connected thereto; 19[b]: b) connecting at least one of said DC power sources, respectively, to each of said DC	<i>Fornage</i> discloses DC power input ports (marked in FIG. 5, above) connected to DC power sources. <i>See Fornage</i>, [0034] (referring to FIG. 5) (“The boost circuit 508 receives DC from a DC source, such as rows 404, columns 406, solar cell 402, portions thereof and the like.”); Ex. 1003, ¶ 162.

Claim Element	<i>Fornage and Kondo</i>
input ports; and	
15[b][1]: b) said AC power output port of each power inverter being connected in a daisy-chain to the AC power input port of the next power inverter, 22[a]: The method of claim 19 further comprising daisy-chaining at least two of said DC to AC power inverters, said AC	<i>Fornage</i> discloses inverters connected in parallel via an external AC bus. <i>Fornage</i>, FIG. 3, above (showing inverters 300 connected in a chain to bus 314); Ex. 1003, ¶ 154. For the reasons set forth in 15a3 above, it would also have been obvious to modify <i>Fornage’s</i> parallel arrangement on an external bus with <i>Kondo’s</i> teaching of daisy-chaining inverters together through AC input/output ports so that each inverter in the chain could detect an overcurrent condition. Ex. 1003, ¶ 163. Note again that <i>Kondo’s</i> connection of one inverter to another, resulting in the AC outputs of the inverter being connected together electrically in parallel, is precisely the arrangement described in the ’133 Patent as a “daisy chain.” Ex. 1003, ¶ 75 (citing the ’133 Patent (Ex. 1001) at 3:61–64).

Claim Element	<i>Fornage and Kondo</i>
power output port of each DC to AC power inverter being connected in a daisy-chain to the AC power input port of the next DC to AC power inverter,	
15[b][2]: except for the AC power input port of the first power inverter being left open, 22[b]: except for the AC power input port of	As discussed in Grounds 1 and 2, 15[b][2] above, Kondo discloses the AC input port of the first inverter in the chain being left open. Kondo FIG. 2 and [0047]–[0048] (describing the first AC input port as “unconnected”). An unconnected first AC input would necessarily result from adding AC inputs and AC outputs to Fornage’s inverters to route the AC bus through each inverter, and the POSA would not have been motivated to make the upstream most inverter different to avoid this result. Ex. 1003, ¶ 164.

Claim Element	<i>Fornage and Kondo</i>
the first DC to AC power inverter being left open,	
15[b][3]: and the AC power output port of the last power inverter being connected to a power service panel of the power grid; 19[c]: c) providing AC power to the power grid. 22[c]: and the AC power	As discussed in Ground 2, 15[b][3] above, both references disclose this limitation or alternatively, it would have been obvious to add for the purpose of supplying power to household loads and for selling power to the grid utility. <i>See</i> Ex. 1003, ¶ 165 (citing Office Notice of these elements taken by the Examiner); <i>Fornage</i>, [0022], [0027], and FIG. 3 (showing “grid” 312 and “electric panel” 306).

Claim Element	<i>Fornage and Kondo</i>
output port of the last DC to AC power inverter being connected to a power service panel of the power grid.	
15[c]: c) whereby said system is incrementally scalable by adding or subtracting DC power sources and daisy chained inverters.	As set forth above, <i>Fornage</i> discloses scalability, both in terms of the number of DC sources shared by an inverter, and in terms of the number of parallel connected inverters. Ex. 1003, ¶ 166. “Using such an AC bus 314 and discrete power generators 320_n, the system 100 is scalable and flexible to fit any user’s needs.” <i>Fornage</i>, [0025]. <i>Fornage</i> also provides that “system 100 may include any number of inverters 300...” and that “Although three panels are shown, the photovoltaic panel system 100 may include any number of panels 102.” <i>Id.</i>, [0032], [0017]. <i>Kondo</i> is also scalable and improves the scalability of <i>Fornage</i> because it detects and deals with overcurrent

Claim Element	<i>Fornage and Kondo</i>
	conditions. Kondo states that its connection scheme “enables to increase the number of parallel-connected AC modules by sequentially repeating cascade connection.” Kondo, [0003]; <i>see also id.</i>, [0004] and [Abstract].
16. The system of claim 15, in which the output of each of the said power inverters is single phase AC. 20. The method of claim 19, in which the output of each of said power inverters is single phase AC.	Fornage provides, “The inverters 300 of the present invention may produce current that is in-phase with the AC grid current and generate such current with low distortion.” Fornage, [0024]. It would have been obvious to configure Fornage’s inverters to output single phase AC if that was required by the connected grid 312 or loads fed by Fornage’s service panel 306. Ex. 1003, ¶ 167. It was well-known in the art for a solar inverter system to output single or three phase AC depending on the type of load or grid connection to which the solar system was interfacing. <i>See Kjaer</i> (Ex. 1008) at 4–5 and FIG. 3; Rotzoll ’654 (Ex. 1009) at [0007]; Ex. 1003, ¶¶ 168-170. Kondo explicitly discloses that its inverters have a single-phase AC output. Kondo, [0025]. Thus, it would have been obvious to incorporate Kondo’s single-phase inverter

Claim Element	<i>Fornage and Kondo</i>
	output where required to drive connected loads or to sync to the grid. Ex. 1003, ¶¶ 167-170.
18. The system of claim 15 further comprising a first DC power source connected to one of said DC power input ports of one of said power inverters and a second DC power source different in kind from said first DC power source connected to another of said DC power input ports	<i>Fornage</i> discloses the use of its system with DC sources that are different in-kind, namely, photovoltaic cells in different states of illumination that produce different levels of power, as well as cells that have different characteristics due to “temperature”, “aging” and “manufacturing tolerances” and panels that are “any size or shape” See <i>Fornage</i>, [0007], [0017]–[0018], [0023]; Ex. 1003, ¶¶ 171-172.

Claim Element	<i>Fornage and Kondo</i>
of said one power inverter. 24. The method of claim 19 further comprising: a) connecting a first DC power source to one of said DC power input ports of one of said power inverters; and b) connecting a second DC power source, different in kind from said first DC power source, to another of said	

Claim Element	<i>Fornage and Kondo</i>
DC power input ports of said one power inverter.	
23. The method of claim 19 where the providing of AC power includes producing a total AC power that is the summation of the AC power supplied by each said DC to AC power inverter.	<i>Fornage</i> provides, in connection with FIG. 3 (above): “The junction box 304 generally connects together the outputs from all the inverters 300₁, 300₂...300_n to form a single AC feed to the electric panel 106.” <i>Fornage</i>, [0026]. Similarly, as is set forth in Ground 1, 23 above, <i>Kondo</i> also discloses this element (<i>see Kondo</i> FIG. 6, showing summation of currents), and in fact, its overcurrent protection feature is designed to accommodate large summations of current caused by a daisy-chain arrangement. <i>See</i> Ex. 1003, ¶ 173.

D. Ground 4: Claims 17 and 21 are obvious in view of any of the combinations of Grounds 1–3 and in further view of Rotzoll ’654.

Claim 17 recites “[t]he system of claim 15, in which the output of each of said power inverters is three-phase AC,” and claim 21 recites “The method of claim 19,

in which the output of each of said power inverters is three-phase AC.” Ex. 1001, 15:27-28, 16:14-15. The Examiner noted during prosecution that it would have been obvious to configure an inverter system with whatever phase was appropriate for the connected load: “Official Notice is taken that both the concept and advantages of providing for single or three phases power in power inversion systems are well known and expected in the art.” Ex. 1002, 97; Ex. 1003, ¶¶ 86-87, 175 (also citing *Kjaer’s* FIG. 3, which shows 1 or 3 phase power).

An inverter arrangement for a solar power system where the inverter generates three-phase power is also disclosed in *Rotzoll ’654* (Ex. 1009), and it would have been obvious to modify the inverters of any of inverter arrangements of Grounds 1–3 to output three-phase power. *Rotzoll ’654* discloses an inverter arrangement in which multiple strings of solar modules are connected to DC inputs of an inverter, the AC output of which is connected in parallel to other inverters by AC wiring. Ex. 1003, ¶¶ 176-177.

FIG. 6, below, shows a first “PV module string 601” and a “second PV module string 611” each of which has a pair of “output DC wire[s]” 605, 606 and 615, 616. *Rotzoll ’654*, [0064]. Those DC outputs are provided as input to a power inverter (marked as 620 on FIG. 6), which includes a DC combiner. The DC combiner provides DC input to “DC inputs of an inverter 624”, i.e., a DC/AC inverter. *See id.*, [0065]. “The AC outputs of the inverter 624 are connected in parallel to other

inverters via AC wiring 625...” *Id.*

Rotzoll ’654 also provides that its inverters can be single-phase or multi-phase: “Without loss of generality, the output of the microinverters can be single-phase AC, split-phase AC or multi-phase AC.” *Id.*, [0071]; *see also* [0045] (“The power inversion unit converts DC power from the associated PV module to AC power. The AC power may be generated in single-phase or multi-phase form.”). Additionally, **Rotzoll ’654** explains the advantages of inverters being capable of generating either single-phase or multi-phase power when it states, “Residential systems commonly utilize single phase AC, while commercial systems most often use three phase AC.” *Id.*, [0007]. The reference further states: “A multiphase microinverter has the additional advantage of delivering substantially balanced multiphase AC power.” *Id.*, [0011]. It would have been obvious to configure the single-phase inverters of **Kondo** or **Fornage**, as set forth in Grounds 1–3, above, to provide three-phase power, for example, by making the inverter of those combinations a multiphase inverter, as taught in **Rotzoll ’654**. The modification would have been motivated by the advantage stated in **Rotzoll ’654**, namely being usable for a commercial installation. Ex. 1003, ¶¶ 178-179.

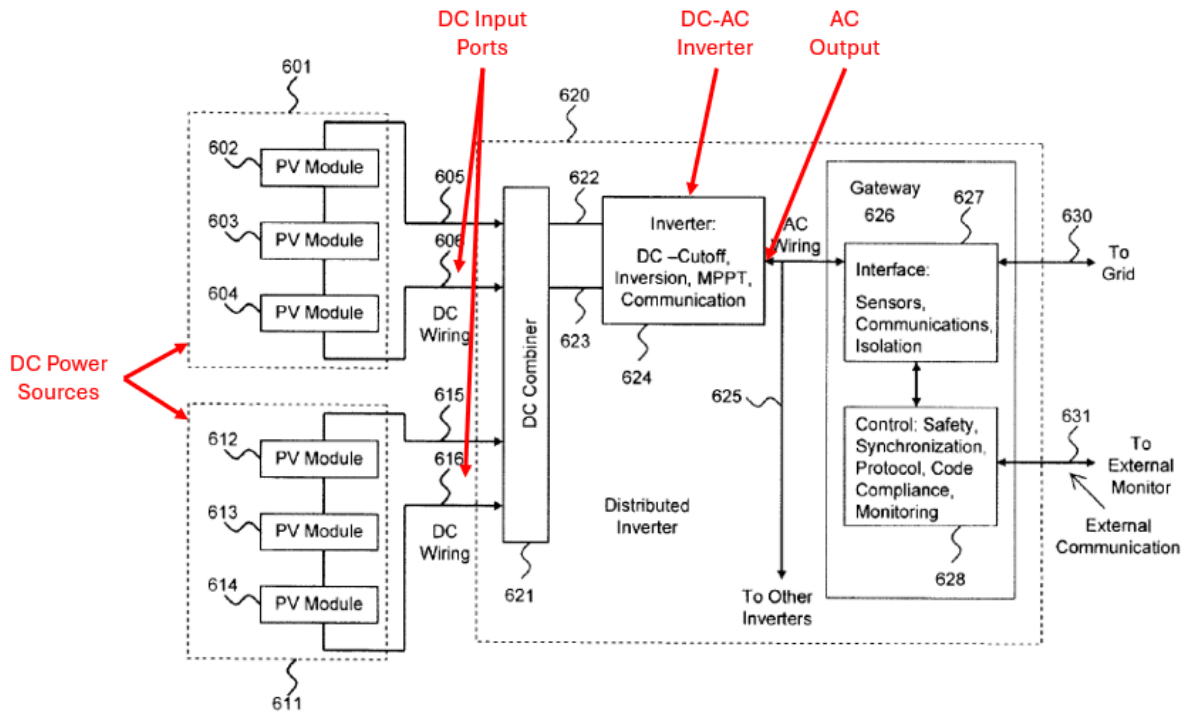


FIG. 6

E. Secondary Considerations of Nonobviousness.

In the Patent Owner’s response to the *ex parte* reexamination, Patent Owner raised arguments relating to secondary considerations of nonobviousness. *See* Ex. 1010, 6–11. However, for the reasons below, none of Patent Owner’s arguments weigh in favor of a finding of nonobviousness.

Long Felt Need: As evidence of long felt need in the art, Patent Owner cites language in the ’133 Patent describing “numerous problems attributed to centralized inverters.” *Id.*, 6. As an initial matter, Patent Owner does not actually cite to any prior art references that demonstrate long felt need, only the patent itself. Moreover, the patent does not indicate how long this supposed need existed. *See id.*, 6–7.

Secondly, alternatives to centralized power inverters were already known in the art, for example as taught by *Kjaer*. See Ex. 1003, ¶ 50. Likewise, it was known how to perform MPPT at each individual DC input to a multi-input inverter, as taught by *Nishi* and *Fornage*. See Ex. 1003, ¶¶ 107, 134. Therefore, Patent Owner has not shown long felt need in the art.

Industry Praise: As evidence of industry praise, Patent Owner points to the fact that Frost & Sullivan awarded the CyboInverter a “Global Product Differentiation” award. See Ex. 1010, 7–9. However, Frost & Sullivan is not part of the solar generation industry; they are a consulting firm that provides general market research and analytics across a wide range of industries including finance, healthcare, and entertainment. See <https://www.frost.com/about/>. For industry praise to show a secondary consideration, it must be from an industry participant because “[i]ndustry participants, especially competitors, are not likely to praise an obvious advance over the art.” *Apple Inc. v. Samsung Elecs. Co., Ltd.*, 839 F.3d 1034, 1053 (Fed. Cir. 2016); see also *Power-One, Inc. v. Artesyn Techs., Inc.*, 599 F.3d 1343, 1352 (Fed. Cir. 2010). Accordingly, an award by a generalist consulting firm does not carry any weight. Furthermore, the specific praise of the award directed toward the multiple DC inputs, was already known in the art as taught by *Nishi* and *Fornage*. See Ex. 1003, ¶¶ 17, 57-63.

Copying: As evidence of copying, Patent Owner points to competitor

products that allegedly infringe the '133 Patent. However, there is no evidence that these competitors *copied* the '133 Patent or CyboEnergy's products. *See* Ex. 1010, 9–11. “Not every competing product that arguably falls within the scope of a patent is evidence of copying; otherwise, ‘every infringement suit would automatically confirm the nonobviousness of the patent.’” *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010). “[C]opying requires evidence of efforts to replicate a specific product” as evidenced by internal company documents, documentation of disassembling a patented prototype and using it as a blueprint to build a replica, etc. *Id.* Therefore, Patent Owner has not shown evidence of copying.

IX. THE PETITION SHOULD NOT BE DISCRETIONARILY DENIED

This Petition should not be discretionarily denied under 35 U.S.C. § 325(d). *Kondo*, *Nishi*, and *Fornage* were not cited during prosecution of the '133 Patent, nor in the pending *ex parte* reexamination of the '133 Patent. These references were cited in the two petitions for IPR filed by Altenergy Power System USA, Inc. *See* IPR2024-00362; IPR2024-00360. However, both of those petitions settled prior to an institution decision.

Rotzoll '654 was cited in an IDS submitted by the Applicant. *See* Ex. 1002, 121. However, when a reference is not the basis of a rejection, and is merely cited in an IDS, it weighs “strongly against” exercising discretionary denial. *See e.g., CODE200, UAB v. Bright Data Ltd.*, IPR2022-00353, Paper 8 at 10 (PTAB July 1,

2022); *Samsung Elecs., Co. v. G+ Commc'ns, LLC*, IPR2022-01598, Paper 10 at 13 (PTAB Apr. 4, 2023).

Rotzoll '118 was cited in the Examiner's reasons for allowance, with the Examiner noting that "Claims 26-32 in the application are deemed to be directed to a nonobvious improvement over the prior art of record, particularly... *Rotzoll et al. US 2008/0283118*." Ex. 1002, 19. However, ***Rotzoll '118*** was not cited as a reason for rejecting any claims, and in this Petition ***Rotzoll '118*** is used only as background on the state of the art.

Finally, in the pending reexamination of the '133 Patent (Application No. 90/019,341), ***Kjaer*** was cited as one of the references raising a substantial new question of patentability in the Office's Order Granting Request for *Ex Parte* Reexamination. See Ex. 1002, 12-13. Similar to ***Rotzoll '118***, however, ***Kjaer*** is used herein only as background on the state of the art. Accordingly, the present Petition should not be discretionarily denied under 35 U.S.C. § 325(d). See generally *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020) (precedential).

Nor should the Board deny this Petition in view of 35 U.S.C. § 314(a). *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) sets forth factors to consider in a discretionary denial under 35 U.S.C. § 314(a). When assessed holistically, these six factors do not warrant discretionary denial.

Petitioner and Patent Owner are currently engaged in district court litigation, *CyboEnergy, Inc. v. Hoymiles Power Electronics USA, Inc.*, No. 2:23-cv-00311-JRG, in the Eastern District of Texas. Trial is currently scheduled for April 7, 2025. However, the parties have only just begun claim construction, *i.e.* by exchanging proposed terms for construction. The parties have not yet briefed claim construction or even exchanged proposed constructions, nor has any expert discovery taken place. Therefore, at least the third factor weighs in favor of institution.

As to the fourth factor, this Petition challenges more claims than have been asserted in the parallel proceeding, and it raises different grounds of invalidity than the ones at issue in the pending reexamination, meaning there are issues in this proceeding that would not be addressed by the District Court or in the reexamination.²

As to the fifth factor, Petitioner had no involvement in the request for *ex parte* reexamination. And although Petitioner is named as a defendant in the district court litigation, there has been very little overlap of the issues because expert discovery (*e.g.*, invalidity reports) have yet to occur.

² Petitioner reserves the right to file a *Sotera* stipulation at a later date. *See BMW of North America, LLC v. NorthStar Systems LLC*, No. IPR2023-00890, 2023 WL 7449411, at *3 (PTAB Nov. 9, 2023).

Finally, regarding the sixth factor, the merits of the arguments presented to the Board here present a compelling challenge to patentability, also weighing in favor of institution. Balancing these factors holistically, the Board should not exercise its discretion to deny institution of this Petition.

X. CONCLUSION

Petitioner requests that the Board grant this Petition and cancel claims 15–24 of the '133 Patent.

Date: June 27, 2024

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

I hereby certify that the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 8,786,133 includes the following number of words (as calculated by Microsoft Word), excluding those in the table of contents, table of authorities, mandatory notices, certificate of service, certificate of word count, and appendix of exhibits: 13,668.

Date: June 27, 2024

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CERTIFICATE OF SERVICE

I hereby certify that on June 27, 2024, a true and correct copy of this Petition for *Inter Partes* Review of U.S. Patent No. 8,786,133 was served in its entirety via FedEx Priority Overnight® to the Patent Owner by serving the correspondence address of record for the '133 Patent:

DLA PIPER LLP US – Reston
Attn: Patent Group
11911 Freedom Drive, Suite 300
Reston, VA 20190

Additionally, a true and correct copy of the Petition was served in its entirety via e-mail to Patent Owner's litigation counsel:

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