

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HANWHA SOLUTIONS CORPORATION AND
HANWHA Q CELLS USA, INC.,
Petitioner,

v.

REC SOLAR PTE. LTD.,
Patent Owner.

IPR2021-00989
Patent 10,749,060 B2

Before GRACE KARAFFA OBERMANN, CHRISTOPHER M. KAISER,
and BRIAN D. RANGE, *Administrative Patent Judges*.

RANGE, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

This is a Final Written Decision addressing the *inter partes* review challenging claims 1–6, 11, and 13 of U.S. Patent No. 10,749,060 B2 (“the ’060 patent”). We have jurisdiction under 35 U.S.C. § 6. The evidentiary standard is a preponderance of the evidence. *See* 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d) (2019). We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Hanwha Solutions Corporation and Hanwha Q CELLS USA, Inc. (collectively “Petitioner”) do not demonstrate, by a preponderance of the evidence, that claims 1–6, 11, and 13 are unpatentable.

II. BACKGROUND

A. *Procedural History*

Petitioner filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of the ’060 patent. We instituted trial on two grounds.¹ After institution, REC Solar Pte. Ltd. (“Patent Owner” or “REC”) filed a Patent Owner Response. *See* Patent Owner’s Response (“PO Resp.”), Paper 22. Petitioner filed a Reply (Paper 26, “Pet. Reply”), and Patent Owner filed a Sur-Reply (Paper 30, “Sur-reply”). Additionally, Patent Owner filed a motion to exclude evidence (Paper 34, “Mot. Excl.”), Petitioner responded (Paper 35, “Opp. Mot. Excl.”), and Patent Owner provided a Reply brief (Paper 38, “Mot. Excl. Reply”).

We heard oral argument for this *inter partes* review (as well as for related *inter partes* review, IPR 2021-00988) on September 13, 2022, and a transcript of the hearing is part of the record of this proceeding. Paper 39 (“Tr.”).

¹ *See* Paper 12.

B. *Related Matters*

The parties identify the following as a related matter: *REC Solar Pte. Ltd. v. Hanwha Solutions Corp., et al.*, 1-20-cv-01622 (D. Del. Nov. 30, 2020). Pet. 2; Paper 7, 1.² Patent Owner also identifies the following as a related matter: *Hanwha Solutions Corporation and Hanwha Q Cells USA, Inc. v. REC Solar Pte Ltd.*, IPR2021-00988 (PTAB June 2, 2021). Paper 7, 1. Petitioner filed the petition for IPR2021-00988 on the same day as the instant Petition.

C. *The '060 Patent (Ex. 1101)*

The '060 patent is titled “Solar Cell Assembly.” Ex. 1101, (54). The challenged claims relate to a “solar cell assembly [that] includes one or more solar cell units coupled in series.” *Id.* at 2:40–41.

Below, we reproduce Figure 2a of the '060 patent.

² On October 29, 2021, the District Court granted without prejudice a motion to dismiss the complaint in *REC Solar Pte. Ltd. v. Hanwha Solutions Corp., et al.* Paper 11, 1. The District Court provided the plaintiff 21 days from October, 29, 2021, to refile the complaint. *Id.*

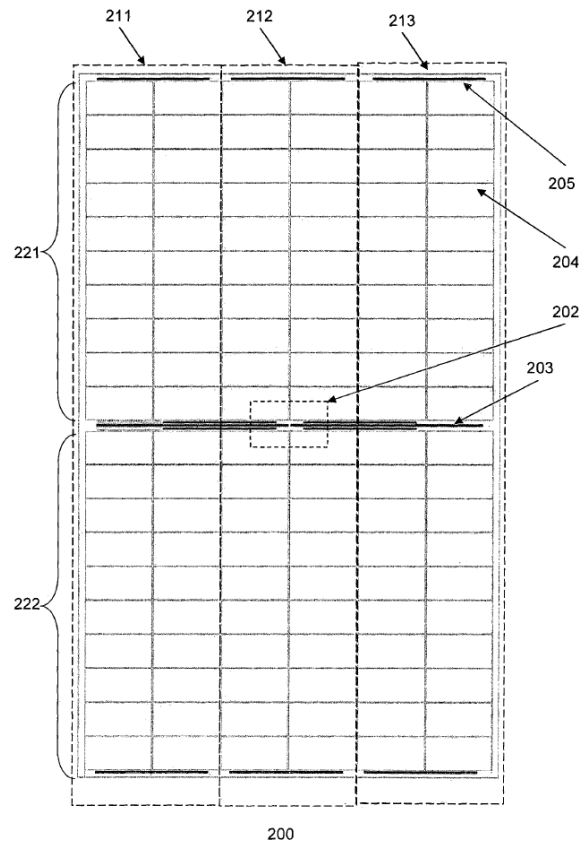


Fig. 2a

The '060 patent describes Figure 2a as “a solar cell assembly layout 200.” *Id.* at 3:22–23. The '060 patent describes that the solar cell assembly includes solar cells 204 which are arranged in one or more solar cell units. *Id.* at 3:26–28. As illustrated in Figure 2a, the solar cell assembly includes three solar cell units: a first solar cell unit 211, a second solar cell unit 212, and a third solar cell unit 213. *Id.* at 3:28–31. The '060 patent further describes that “a solar cell unit includes a first solar cell series and a second solar cell series.” *Id.* at 3:34–35. As illustrated in Figure 2a, “the first solar cell unit 211 ... includes a first solar cell series 221 and a second solar cell series 222.” *Id.* at 3:35–37. As also illustrated in Figure 2a, the solar cells are cut into half and connected in series with each other within each solar cell series. *Id.* at 3:46–48.

We reproduce Figure 2b of the '060 patent below.

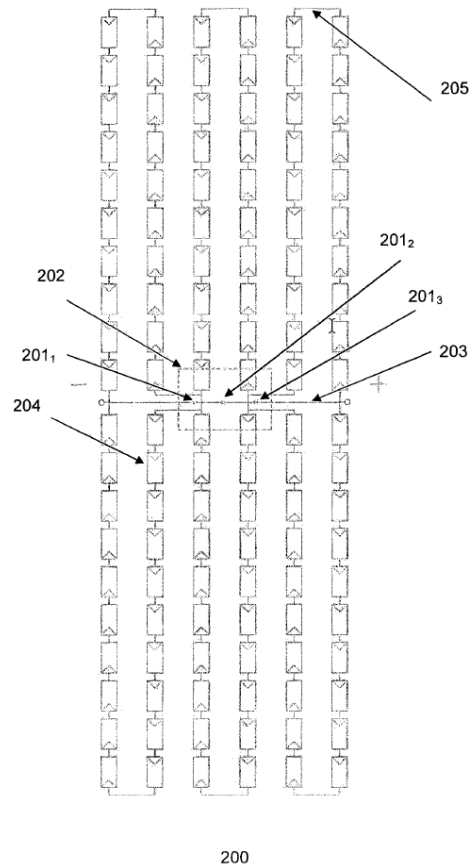


Fig. 2b

The '060 patent describes Figure 2b as “a corresponding electrical schematic diagram.” *Id.* at 3:23–24. The '060 patent further describes “the first and second solar cell series within the same solar cell unit share a same by-pass diode.” *Id.* at 3:53–54. As illustrated in Figure 2b, “the first and second solar cell series 221 and 222 within the first solar cell unit may share a first by-pass diode [201₁].” *Id.* at 4:1–3. “[T]he solar cell series are connected with the by-pass diodes via cross-connectors 203.” *Id.* at 4:21–22.

D. Challenged Claims

Petitioner challenges claims 1–6, 11, and 13 of the '060 patent. Pet. 3. Claim 1 is the only challenged independent claim. Claim 1 is illustrative of the claimed subject matter, and we reproduce claim 1 below, adding bracketed identifiers for claim elements.

1. [1pre] A solar cell assembly comprising:
 - [1a] a first solar cell unit, comprising:
 - [1b] a first solar cell series including a plurality of half-cut solar cells connected in series; a second solar cell series, coupled in parallel with the first solar cell series, including a plurality of half-cut solar cells connected in series;
 - [1c] a first bypass diode coupled in parallel with the first solar cell series and the second solar cell series; and
 - [1d] a first junction box containing the first bypass diode; and
 - [1e] a second solar cell unit, coupled in series with the first solar cell unit, comprising:
 - [1f] a third solar cell series including a plurality of half-cut solar cells connected in series;
 - a fourth solar cell series, coupled in parallel with the third solar cell series, including a plurality of half-cut solar cells connected in series;
 - [1g] a second bypass diode coupled in parallel with the third solar cell series and the fourth solar cell series; and
 - [1h] a second junction box containing the second bypass diode.

Ex. 1101, 8:2–22; *see* Pet. 36–48 (using same identifiers).³

E. Asserted Grounds of Unpatentability

Petitioner asserts that the challenged claims are unpatentable based on the following grounds:

³ We note that, at times, the parties or evidence refers to “by-pass diodes” (with a hyphen). We refer to “bypass diodes” (without a hyphen) except where providing a quote because this is the language claim 1 uses. In view of the record as a whole, we find there is no substantive distinction between “by-pass diodes” and “bypass diodes.”

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	1–6, 11, 13	103	Yagiura ⁴ , Shimasaki ⁵
2	1–6, 11, 13	103	Yagiura, Shimasaki, Yan ⁶

Pet. 19. The Petition and Reply are supported by the Declaration of Dr. Jonathan Kimball. Ex. 1103 (Petition declaration); Ex. 1154 (Reply declaration). The Response is supported by the Declaration of Dr. Stephen P. Shea. Ex. 2041.

III. PATENT OWNER’S MOTION TO EXCLUDE

Patent Owner’s Motion to Exclude seeks to exclude three areas of evidence. We address each in turn.

A. *Exclusion of JP 2010-165993 A as Unauthenticated Hearsay*

Patent Owner argues that Exhibits 1112 and 1137 each purport to be JP2010-165993 A and that Exhibits 1113 and 1138 each purport to be translations of that document. Mot. Excl. 1–2. Patent Owner argues that the four exhibits should be excluded as lacking authentication or as hearsay. *Id.* at 2–3. Patent Owner argues that authenticity and public availability is in question because Exhibit 1013 and 1038 are substantively different. *Id.* at 3–5.

Petitioner explains that Exhibit 1112, which was used to create the translation for Exhibit 1113, “was missing several paragraphs that are present in the published version of the reference.” Opp. Mot. Excl. 8–9; Ex. 1187, 1 (e-mail where Petitioner’s counsel explains issue to Patent Owner). Petitioner argues that the references are self-authenticating official

⁴ US 8,049,096 B2, issued Nov. 1, 2011 (Ex. 1110).

⁵ US 2013/0098423 A1, published Apr. 25, 2013 (Ex. 1118).

⁶ CN 102024865 A, published Apr. 20, 2011 (Ex. 1114). We refer to the English translation (Ex. 1115).

publications and are not hearsay because they are offered for what they describe rather than the truth. Opp. Mot. Excl. 9–10.

Petitioner’s position is persuasive. We agree that documents from the Japanese Patent Office are self-authenticating official government documents. The technical issues regarding missing pages in the originally filed version of the document do not cause us to question authenticity.

We also agree that Petitioner uses the documents to establish what the documents teach rather than establishing the truth of what the documents teach. In Reply, Patent Owner argues that Petitioner relies on the date printed on the document to prove up the truth of when the document was published. Mot. Excl. Reply 1–2. To the extent this is the case, an exception to hearsay applies because the document is a record of a public office. Fed. R. Evid. 803(8)(B) (a record of public office is an exception to the hearsay rule if the opponent does not show that the source of information or other circumstances “indicate a lack of trustworthiness”). Here, Patent Owner does not persuasively demonstrate a lack of trustworthiness; Patent Owner does not identify any substantively meaningful distinction in the missing pages of the originally filed document and does not identify any evidence to suggest that the missing pages were anything more than a harmless clerical error.

For the reasons above, Patent Owner’s motion to exclude is *denied* with respect to these documents.

B. *Exclusion of Dr. Kimball’s Declarations (Exhibits 1103 and 1154)*

Patent Owner argues that “[p]ortions” of Dr. Kimball’s declarations should be excluded to the extent they include Dr. Kimball’s “assessments of the art and ungrounded conclusions.” Mot. Excl. 5–9. In particular, Patent Owner argues that Dr. Kimball lacks expertise in the field of the ’060 patent. *Id.* Patent Owner’s argument dovetails with arguments in Patent Owner’s

Response where Patent Owner argues for a certain level of ordinary skill in the art for the '060 patent and argues that “Dr. Kimball was not a POSITA [person of ordinary skill in the art] in 2013.” PO Resp. 7–13; *see* Sur-reply 2–6.

Petitioner argues for a level of ordinary skill in the art that differs from Patent Owner’s proposal. Pet. 5–6 (identifying level of ordinary skill in the art). Petitioner also argues that Dr. Kimball is qualified to provide expert opinion in the field. Pet. Reply 26–27 (arguing that Kimball is a person of ordinary skill in the art); Mot. Excl. Opp. 2–8 (arguing that Dr. Kimball should not be excluded as an expert). We begin our assessment of Patent Owner and Petitioner’s respective arguments by determining the field of the '060 patent and determining the level of ordinary skill in the art.

We first assess field. Patent Owner argues that the relevant field is “solar module design.” PO Resp. 7 (citing Ex. 1101, 1:5–6). Petitioner argues that the field is “solar cell assemblies and [] solar cell modules including such solar cell assemblies.” Pet. Reply 26 (also citing Ex. 1101, 1:5–6). We determine that the '060 Patent itself adequately states the field of the invention by stating that “[t]he present invention relates to solar cell assemblies and to solar cell modules including such solar cell assemblies.” Ex. 1101, 1:3–6. This matches Petitioner’s proposed field, and Patent Owner does not appear to genuinely dispute this point. Sur-reply 3 (stating that Petitioner’s definition of field is “co-extensive” with Patent Owner’s definition).

We next determine level of ordinary skill in the art. The level of ordinary skill in the art at the time of the invention is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *Al-Site Corp. v. VSI Int’l Inc.*, 174 F.3d 1308, 1324 (Fed. Cir. 1999) (citing

Graham v. John Deere Co., 383 U.S. 1, 17–18 (1966); *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991)). Factors pertinent to determining the appropriate level of skill in the art include:

- (1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field. . . . The patent’s purpose can also be informative.

Best Medical Int’l, Inc. v. Elekta Inc., 46 F.4th 1346, 1353 (Fed. Cir. 2022) (citations omitted). Below, we put the parties’ proposed definitions side-by-side in a table for comparison:

Petitioner’s POSITA definition	Patent Owner’s POSITA definition
A person of ordinary skill in the art (“POSITA”) at the time of the alleged invention would have had at least a bachelor’s degree in mechanical engineering or electrical engineering and 2–3 years of professional experience in solar energy, or a master’s or doctorate with experience specific to solar energy. A POSITA would have been familiar with solar module design and/or manufacturing.	A person of ordinary skill in the art (“POSITA”) at the time of filing, i.e., July 2013, “would have been someone with a bachelor’s degree in electrical engineering, applied physics, or the like, and at least three years of professional experience designing, developing, and/or researching in the field. Alternatively, that person would have had an advanced degree in electrical engineering, applied physics, or the like and at least one year of professional experience designing, developing, and/or researching in the field.

Pet. 5–6 (citing Ex. 1103 ¶ 31); PO Resp. 7–8 (citing Ex. 2041 ¶¶ 26–28).

Based upon the record as a whole,⁷ we agree with Patent Owner that Petitioner’s proposal is too broad. PO Resp. 8. For example, a person who merely installs solar panels for three years (satisfying “professional experience in solar energy”) while having some familiarity with module manufacturing would not be of ordinary skill in the design aspects of the ’060 patent as, for example, reflected by the claims at issue and the ’060 patent’s text and figures. *See, e.g.*, Ex. 1101, Figs. 2a, 2b, 3a, 3b, 4a, 4b, 3:22–7:44.

On the other hand, we also determine that Patent Owner’s proposal is too narrow. A person could, for example, have ordinary skill in the art of the ’060 patent by virtue of non-professional experience (for example, academic experience). When assessing relevant experience, research work done for a university (beyond mere classroom study) would have been just as valuable as research work done for a corporation. Also, ordinary skill in the art could be demonstrated by work that requires understanding of the ’060 patent’s field even if not “designing, developing, and/or researching” in the field itself

We, thus, determine that a person of ordinary skill in the art of the ’060 patent would have been someone with a bachelor’s degree in electrical engineering, applied physics, or the like, and at least two years of

- (a) experience designing, developing, and/or researching in the field or
- (b) experience in solar energy that required an understanding of the ’060 patent’s field. Alternatively, that person would have had an advanced degree in electrical engineering, applied physics, or the like and at least one year of

⁷ Our analysis is constrained to the extent neither party addresses the *Best Medical* factors with particularity. For example, the briefing does not address the educational level of the inventor.

- (a) experience designing, developing, and/or researching in the field or
- (b) experience in solar energy that required an understanding of the '060 patent's field.

We next assess whether or not Dr. Kimball's testimony properly qualifies as evidence in this matter. The Federal Circuit has held that expert testimony about the perspective of person of ordinary skill in the art (as Dr. Kimball provides here) must come from a person having at least ordinary skill in the art. *Kyocera Senco Indus. Tools, Inc. v. ITC*, 22 F.4th 1369, 1376–78 (Fed. Cir. 2022) (quoting *Sundance, Inc. v. DeMonte Fabricating Ltd.*, 550 F.3d 1356, 1362, 1364–65 (Fed. Cir. 2008)) (holding that ITC Administrative Law Judge abused discretion by admitting expert testimony of witness who lacked the experience of a person having ordinary skill in the art); see Mot. Excl. 6–7 (arguing this point). Patent Owner, however, cites no authority that expert testimony on such matters come from a person having ordinary skill in the art *at the time of the invention*. Cf. *Scentair Tech., LLC v. Prolitiec Inc.*, IPR2021-00012, Paper 22 at 61 (PTAB Apr. 22, 2022) (similarly noting a party's lack of authority on this point). Beyond needing to come from a person of ordinary skill in the art, expert testimony is admissible if the expert has the “scientific, technical, or other specialized knowledge [that] will help the trier of fact to understand the evidence or to determine a fact in issue.” Fed. R. Evid. 702. Furthermore, “[t]here is ... no requirement of a perfect match between the expert's experience and the relevant field.” USPTO, Patent Trial and Appeal Board Consolidated Trial Practice Guide, 34 (Nov. 2019).

Here, Petitioner adequately establishes that Dr. Kimball qualifies as a person of ordinary skill in the art of the '060 patent. In particular, we find the following:

1. Dr. Kimball received a doctorate in electrical and computer engineering in 2007 from the University of Illinois at Urbana-Champaign. Ex. 1103, App. A, 1.
2. From 1994 to 1995, Dr. Kimball designed solar modules for a solar powered vehicle using half cut cells. Ex. 1154 ¶ 16.
3. Dr. Kimball founded SmartSpark Energy Systems, Inc. (later named SolarBridge Technologies) and was involved in all aspects of the company including designing and constructing a custom solar panel. *Id.* ¶ 17. Dr. Kimball developed micro-inverters and that work required understanding the module and challenges of module design. *Id.* ¶ 18. Dr. Kimball's work resulted in various related publications and patents. *Id.*
4. Dr. Kimball designed custom solar modules as part of a system marketed as ForeverPower. *Id.* ¶ 19. That work resulted in several patents and publications.
5. Dr. Kimball is a tenured professor of electrical and computer engineering at Missouri University of Science and Technology where he has researched and taught since 2008 in solar assemblies and solar module design. Ex. 1154 ¶¶ 20–26; Ex. 1103, App. A, 1.
6. Dr. Kimball was lead author on a 2009 paper entitled “System Design Approach for Unattended Solar Energy Harvesting Supply” which discusses Dr. Kimball's solar module design research. Ex. 1154 ¶ 23.
7. Dr. Kimball has twice taught the Photovoltaic Systems course which focuses on PV system design. Ex. 1154 ¶ 25; Ex. 1103, App. A, 17.
8. Since 2015, Dr. Kimball has worked closely with students to design and fabricate solar modules. Ex. 1154 ¶ 26.

Based on Dr. Kimball's cumulative experience, we determine that Dr. Kimball is a person having ordinary skill in the art of the '060 patent and

further determine that Dr. Kimball was a person of ordinary skill in the art of the '060 patent as of the '060 patent's priority date. We also determine that Dr. Kimball's testimony is helpful to understand the evidence or determine facts in issue. For example, Dr. Kimball provides helpful explanations of the prior art's teachings. *See* Ex. 1103; Ex. 1154. We, thus, *deny* Patent Owner's motion to exclude Dr. Kimball's testimony. When considering Dr. Kimball's testimony, we weigh the testimony based, in part, on considering the totality of Dr. Kimball's relevant experience.

C. *Exclusion of Exhibits 1160, 1165–1168, 1170, 1171, and 1173*

Patent Owner argues that Exhibits 1160, 1165–1168, 1170, 1171, and 1173 should be excluded because, for example, the exhibits are not cited by Petitioner directly and, for many of the exhibits, the exhibits are addressed by Dr. Kimball in only a cursory fashion. Mot. Excl. 10–13. Patent Owner also argues that Exhibits 1160, 1165–1168, 1170, 1171, and 1173 are inadmissible hearsay. *Id.* at 12–13. Petitioner argues that each of the exhibits are relevant to issues Patent Owner raised in opposition or were submitted to provide the full scope of documents Dr. Kimball considered. Opp. Mot. Excl. 10–13. For the reasons well explained by Petitioner, we agree that Exhibits 1160, 1165–1168, 1170, 1171, and 1173 are relevant, and we decline to exclude these exhibits. We note, however, that we do not consider Petitioner arguments not made in the Petition or not properly presented in Petitioner's Reply.

With respect to Exhibits 1160, 1165–1168, 1170, 1171, and 1173, we consider those documents to the extent to which they are evidence of Dr. Kimball's diligence in forming his opinions. We do not consider the substance of those documents to the extent Petitioner does not address the substance of these documents in its Petition and Reply.

For the reasons above, we *deny* Patent Owner’s motion to exclude.

IV. OTHER PRELIMINARY MATTERS

A. *Level of Ordinary Skill in the Art*

We address the level of ordinary skill in the art in the context of Patent Owner’s motion to exclude testimony of Dr. Kimball. *See* Section III(B), *supra*.

B. *Claim Interpretation*

We interpret claims using the same standard applied in a civil action under 35 U.S.C. § 282(b), “including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b) (2020). Under that standard, we interpret the claim language as it would be understood by one of ordinary skill in the art in light of the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (“The ordinary and customary meaning ‘is the meaning that the term would have to a person of ordinary skill in the art in question.’”). We construe only terms in controversy and then only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

The Petition argues that all claim terms should be given their plain and ordinary meaning. Pet. 18. Patent Owner does not dispute this. PO Resp. 13.

We determine that no claim term requires express construction for purposes of this Final Written Decision. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms that are in controversy, and only to the

extent necessary to resolve the controversy.” (internal quotes and citation omitted)).

C. Overview of the Principal Prior Art References

The challenges rest on three principal prior art references—Yagiura, Shimasaki, and Yan. Patent Owner does not challenge the prior art status of these references but addresses the merits of Petitioner’s challenges as if they qualify as prior art. *See generally* PO Resp. We provide an overview of each of the three references below.

1. Overview of Yagiura (Ex. 1110)

Yagiura is a US patent publication that relates to a solar battery cell. Ex. 1110, (10) (57). The solar battery cell has a hexagonal shape and is divided into four parts at a straight line connecting between opposed apexes and a straight line connecting between middle points of opposed sides. *Id.* at (57).

Below, we reproduce Yagiura Figure 1.

FIG. 1

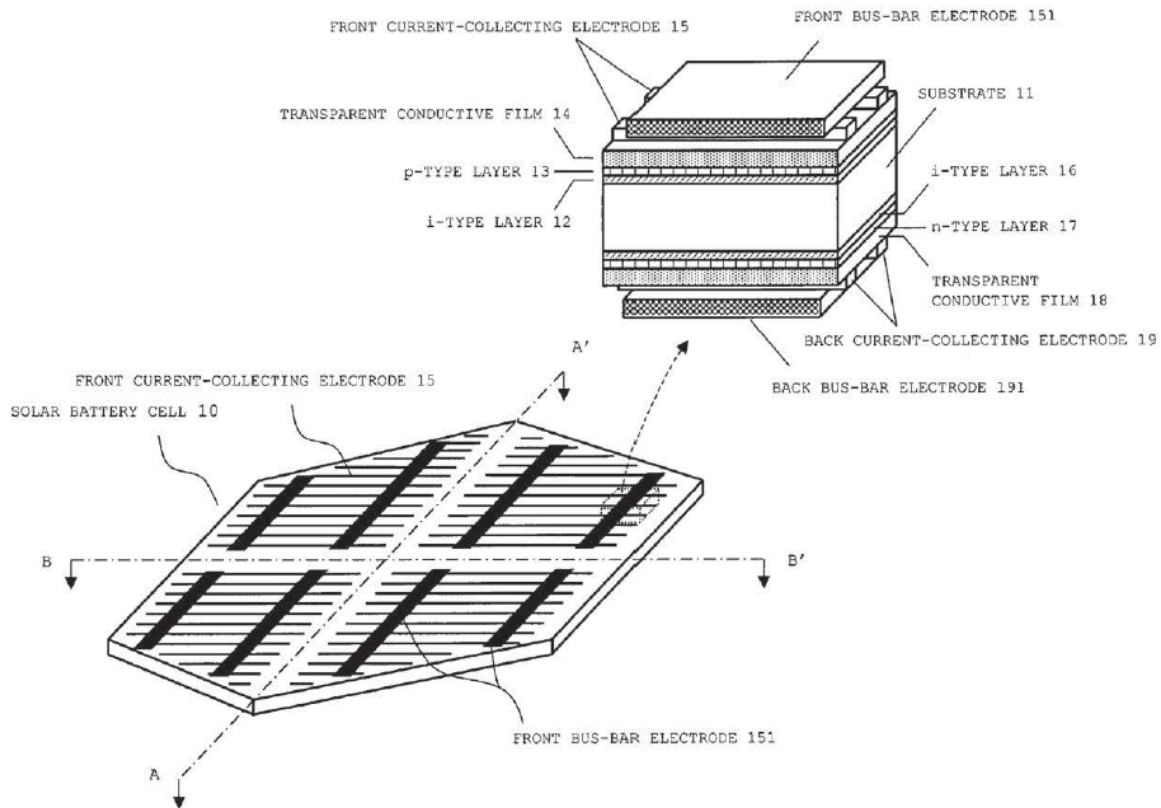
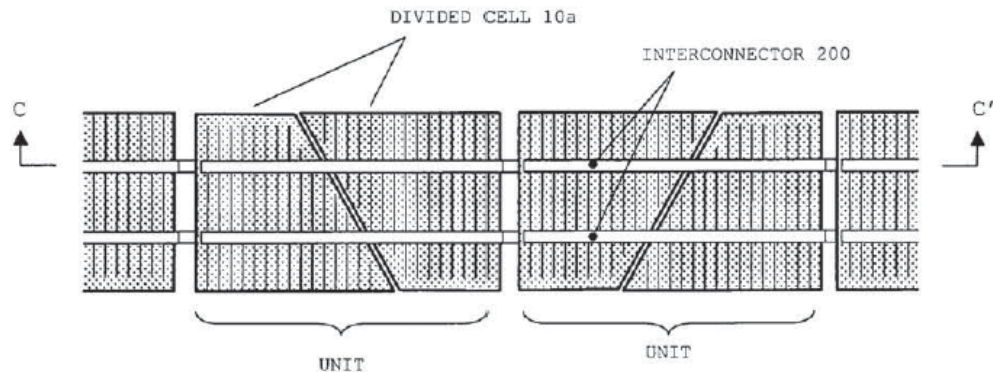


Figure 1 illustrates a configuration of a solar battery cell. *Id.* at 4:49–50. The lower left side of Figure 1 illustrates a solar battery cell 10 with a hexagonal shape seen from a plan view. *Id.* at 5:15–17. The upper right side of Figure 1 illustrates front current-collecting electrodes 15 and front bus-bar electrodes 151 are on a front surface, and back current-collecting electrodes 19 and back bus-bar electrodes 191 are formed on a back surface. *Id.* at 5:17–21. It illustrates that solar battery cell 10 includes a substrate 11, an i-type layer 12, a p-type layer 13, a transparent electrode film 14, the front current-collecting electrodes 15, an i-type layer 16, an n-type layer 17, a transparent conductive film 18, and the back current-collecting electrodes 19. *Id.* at 5:25–30.

Below, we reproduce Yagiura Figure 3A.

FIG. 3A



EXAMPLE OF CONNECTION BETWEEN UNITS

Figure 3A illustrates a “connection form[ed] between divided cells and a connection form[ed] between units.” *Id.* at 4:53–55. For the electrical connection between two divided cells 10a, the divided cells 10a are arranged without being turned upside down such that oblique sides thereof oppose each other without deviation. *Id.* at 6:32–35. Two interconnectors 200 are placed on front bus-bar electrodes 151 on front surfaces of the divided cells 10a, and are electrically connected to the front bus-bar electrodes 151. *Id.* at 6:35–38. Thus, Yagiura describes divided cells 10a as “connected in parallel.” *Id.* at 6:38–39.

Below, we reproduce Yagiura Figure 5.

FIG. 5

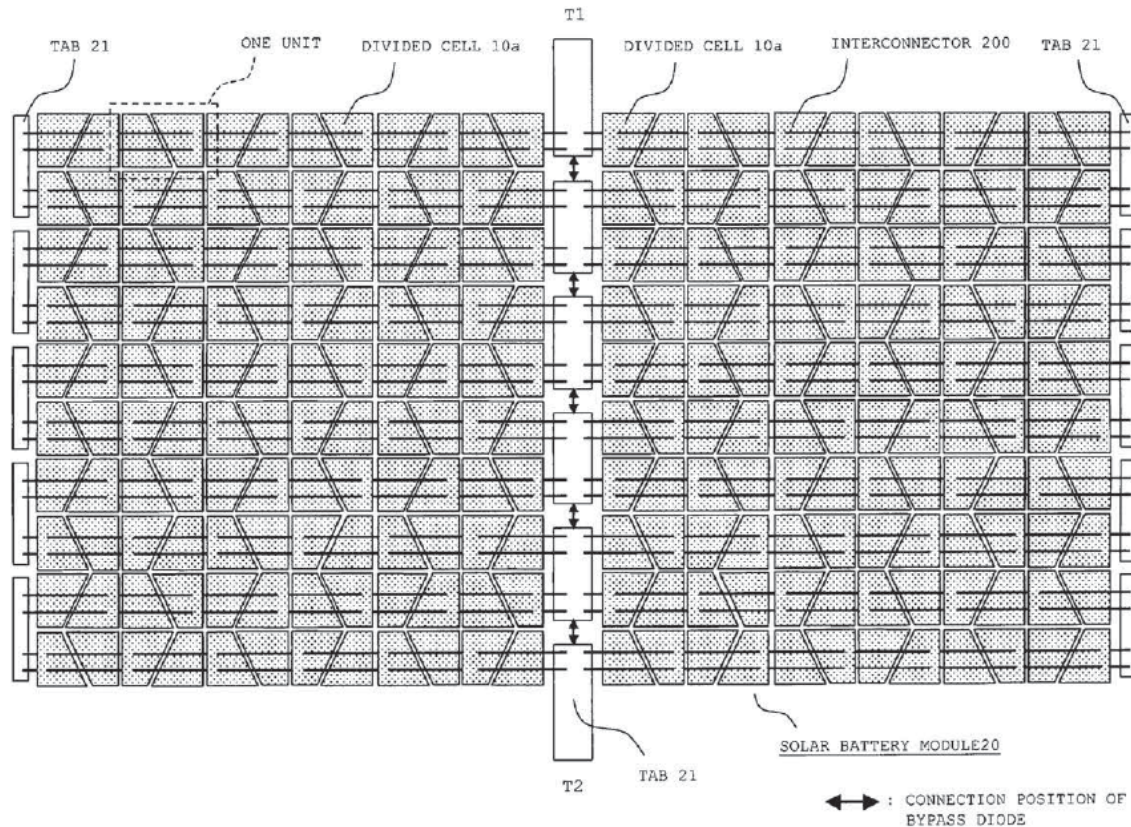


Figure 5 illustrates a unit connection pattern. *Id.* at 4:58–59. In the electrical connection pattern, units in each left row are sequentially connected leftward in series through inter-connectors from a center of a solar battery module 20, and units in each right row are sequentially connected rightward in series through interconnectors from the center of the solar battery module 20. *Id.* at 7:11–16. In unit groups of odd-numbered rows counted from above (*i.e.*, unit groups of first, third, fifth, seventh, and ninth rows), back surfaces of units located at a center are electrically connected to tabs 21 located at the center of the solar battery module 20, respectively, and front surfaces of rightmost and leftmost units are electrically connected to tabs 21 located at both ends of the solar battery module 20, respectively. *Id.* at 7:16–23. Further, in unit groups of even-numbered rows counted from above (*i.e.*, unit groups of

second, fourth, sixth, eighth, and tenth rows), front surfaces of units located at a center are electrically connected to the tabs 21 located at the center of the solar battery 20, respectively, and back surfaces of rightmost and leftmost units are electrically connected to the tabs 21 located at both ends of the solar battery module 20, respectively. *Id.* at 7:23–30.

In the tabs 21 located at the center of the solar battery module 20, the uppermost tab 21 serves as an output terminal T1 of the solar battery module 20 and the lowermost tab 21 serves as an output terminal T2 of the solar battery module 20. *Id.* at 7:31–34. In this electrical connection pattern, a bypass diode connects between adjoining tabs 21 located at the center of the solar battery module 20 in order to prevent application of reverse voltage, as shown by an arrow in Figure 5. *Id.* at 7:35–38. Here, adjoining tabs 21 are close to each other at the position shown by an arrow in Figure 5; therefore, a bypass diode can be readily inserted between the tabs 21. *Id.* at 7:38–41.

2. Overview of *Shimasaki* (Ex. 1118)

Shimasaki is a United States patent application publication that relates to a solar battery module. Ex. 1118, (10), (57). The solar battery module includes a plurality of solar battery cells, each being substantially a rectangle, and a ratio of a short side length and a long side length of the substantial rectangle being 1/n:1 (where n is an integer equal to or larger than 2). *Id.* at (57). The solar battery module also includes a plurality of light-receiving-surface bus electrodes parallel to the short side of the substantial rectangle on a light receiving surface. *Id.* The solar battery module further includes rear-surface bus electrodes each at a position on a non-light-receiving surface corresponding to each of the light-receiving surface bus electrodes and includes a light-receiving-surface lead (*i.e.*, an interconnector) that electrically connects the light-receiving-surface bus

electrodes of one of the solar battery cells to the rear-surface bus electrodes of an adjacent one of the solar battery cells. *Id.*

Below, we reproduce Shimasaki Figure 13.

FIG.13

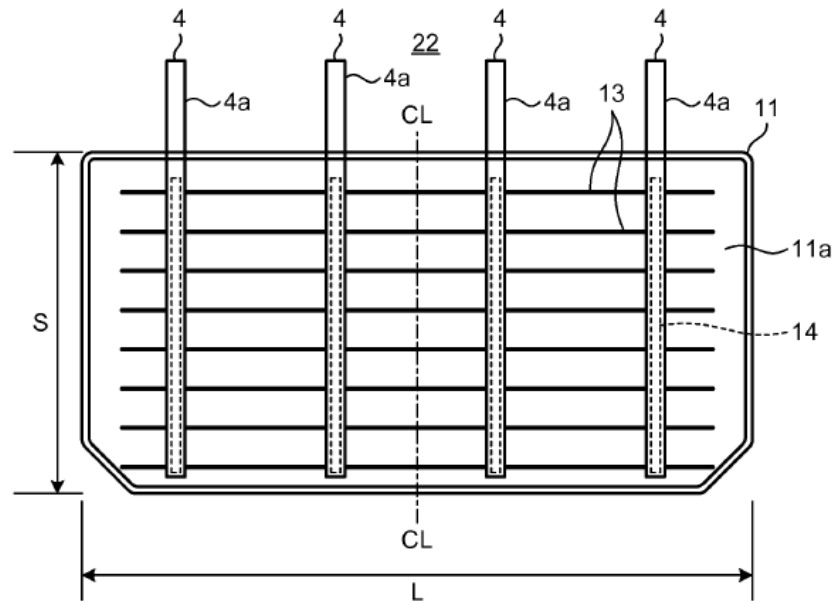


Figure 13 is a top view illustrating a light-receiving-surface bus electrode joined to a solar battery cell used for a solar battery module. *Id.* ¶ 25. A solar battery cell 22 is produced by dividing a square solar battery cell into two in the direction that the light-receiving-surface bus electrode 14 extends and the ratio of the short side length S to the long side length L is 1/2:1. *Id.* ¶ 57. The solar battery cell 22 is formed in such a pattern that the light-receiving-surface bus electrode 14 and the rear-surface bus electrode 15B are line-symmetrical with respect to an imaginary central line CL passing through a middle point of the long side and parallel to the short side. *Id.* ¶ 58. When the light-receiving-surface bus electrode 14 of a certain cell and the rear-surface-bus electrode 15B of an adjacent cell are in the same straight line, these cells can be connected to each other at the shortest distance by leads 4 and 7. *Id.* ¶ 59.

3. Overview of Yan (Ex. 1115)

Yan is a Chinese patent publication that relates to a connection method for cells of a solar photovoltaic module involving multiple junction boxes. Ex. 1115, (10), (57). A group of cells on the solar photovoltaic module closest to a negative terminal is connected with a negative terminal junction box, where a distance between the negative terminal junction box and the negative terminal is less than one half of the width of the solar cell module. *Id.* at (57). A group of cells on the solar photovoltaic module closest to a positive terminal is connected with a positive terminal junction box, where a distance between the positive terminal junction box and the positive terminal is less than one half of the width of the solar cell module. *Id.* Further, one or more middle junction boxes are also arranged. *Id.*

Below, we reproduce Yan Figure 3.

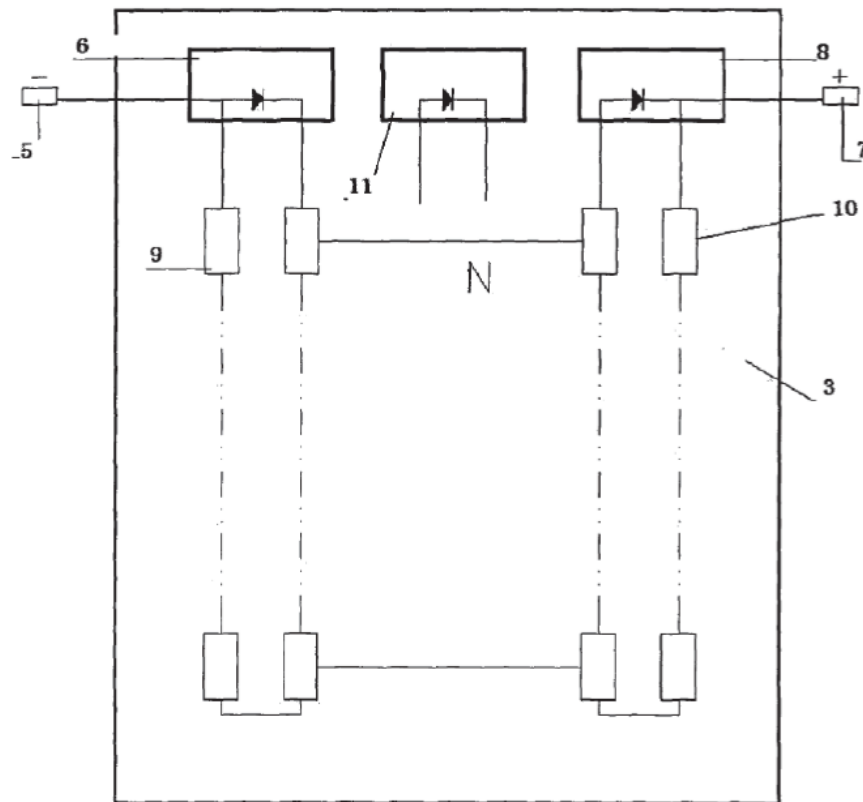


FIG. 3

Figure 3 illustrates a schematic diagram of a connection method that uses a plurality of junction boxes for a solar photovoltaic module. *Id.* ¶ 24. A group of cells 9 on the solar photovoltaic module 3 closest to a negative terminal 5 is connected with a negative terminal junction box 6, where a distance between the negative terminal junction box 6 and the negative terminal 5 is less than one half of the width of the solar cell module 3. *Id.* ¶ 25. A group of cells 10 on the solar photovoltaic module 3 closest to a positive terminal 7 is connected with a positive terminal junction box 8, where a distance between the positive terminal junction box 8 and the positive terminal 7 is less than one half of the width of the solar cell module 3. *Id.* Further, a middle junction box 11 is provided between the positive terminal junction box 8 and the negative terminal junction box 6. *Id.* ¶ 26.

V. ANALYSIS OF THE CHALLENGES

Below, we address each of Petitioner's three grounds in the order the Petition presents them.

A. *Ground One: Obviousness Based on Yagiura and Shimasaki*

Petitioner asserts that claims 1–6, 11, and 13 would have been obvious over Yagiura in view of Shimasaki. Pet. 19–53. Because Petitioner's ground requires combining the teachings of Yagiura and Shimasaki, we first address motivation to combine. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion as to obviousness”)).

Petitioner argues that a person of ordinary skill in the art would have had several reasons to modify Yagiura's configuration in view of Shimasaki to arrive at the configuration Petitioner depicts at page 29 of the Petition. Pet. 28–29. Petitioner argues that both Yagiura and Shimasaki belong to the

field of solar battery modules and seek to improve designs by reducing complexity between cells. *Id.* at 29–30. Petitioner argues that a person having ordinary skill in the art would recognize that Shimasaki’s halved cells have similar characteristics to the cells of Yagiura. *Id.* at 30–31. Petitioner further argues that a person of ordinary skill in the art would have recognized that the halved cells of Shimasaki could be formed with fewer, less complicated steps than the cells of Yagiura and that Shimasaki’s substantially square cells would allow use of less expensive and more readily available base materials. *Id.* at 31–33. Petitioner further argues that the combination of Yagiura and Shimasaki’s teachings, as Petitioner proposes, would use fewer bypass diodes, tabs, and interconnectors thus resulting in lower cost, better reliability, lower resistance, and improved efficiency. *Id.* at 33–35.

Patent Owner argues that a person of ordinary skill in the art would not have discarded Yagiura’s inventive divided quarter cells for Shimasaki’s halved cells and would not have made the other structural changes Petitioner suggests. PO Resp. 14. Patent Owner argues that cut hexagonal cells are essential to Yagiura’s invention. *Id.* at 15–20. Patent Owner further argues that Yagiura’s divided cells are coupled in parallel to form rectangular units and that units are coupled in series, not cells. *Id.* at 20–25. Patent Owner argues that, to reach a plurality of half-cut solar cells in series, a person of ordinary skill in the art would need reason to (1) discard Yagiura’s divided 10a cells in favor of Shimasaki’s half cells, (2) change Yagiura’s electrical landscape orientation to a portrait orientation, and (3) change the series/parallel connections of Yagiura. *Id.* at 20–21. Patent Owner further argues that Petitioner’s “follow-on fixes” after substituting Shimasaki’s halved cells for Yagiura’s cells are not justified. *Id.* at 25–29.

On balance, the preponderance of the evidence supports Patent Owner's position. We find persuasive and credible Dr. Shea's testimony that a person of ordinary skill in the art would not have been motivated to combine the teachings of Yagiura and Shimasaki to arrive at Petitioner's proposed modified Yagiura. Ex. 2041 ¶¶ 44–65. Dr. Shea testifies that Yagiura's invention flows from a geometry problem: the manufacturing process for monocrystalline silicon generates cylindrical ingots, but solar battery cells fill rectangular solar battery modules. *Id.* ¶ 45 (citing Ex. 1110, 1:22–42).

Yagiura supports Dr. Shea's testimony. Yagiura's specification begins by describing the field of invention as being concerned with placing battery cells in a module as efficiently as possible. Ex. 1110, 1:10–14. Yagiura then explains the related art by emphasizing that solar battery modules are typically rectangularly shaped whereas single crystal silicon ingots are a cylindrical shape. *Id.* at 1:22–42. Yagiura Figures 11(a-1) and 11(a-2) illustrate that if circular cells are placed in a module, there is inefficiency in the distance between cells. *Id.* at 1:36–42, Fig. 11(a-1), Fig. 11(a-2). Yagiura Figures 11(b-1) and 11(b-2) illustrate that square shaped cells allow efficient placement within a module but create wasted space on the ingot. *Id.* at 1:43–50, Fig. 11(b-1), Fig. 11(b-2). Yagiura Figures 11(c-1) and 11(c-2) illustrate that a hexagonal shape can efficiently fill a module and efficiently use the ingot, but the hexagon shape leaves a clearance area where the module cannot be filled. *Id.* at 1:31–42, Fig. 11(c-1), Fig. 11(c-2). Yagiura then discusses other approaches to this problem of geometry and problems related to those approaches. *Id.* at 1:62–2:52.

Yagiura solves these problems by utilizing “tetragonal-shaped solar battery cells forming a substantially rectangular contour in pairs.” *Id.* at

2:65–3:6; *see id.* at Fig. 4; 6:63–7:9. The design for connecting cells flows from this geometric arrangement. *Id.* at Figs. 4–9; 3:2–6; 7:10–10:12. All of Yagiura’s depictions of complete modules utilize this geometry. Although, as Petitioner argues (Pet. Reply 26), Yagiura does not explicitly state that its layout is limited to hexagonal cells or would not work with other shaped cells, Yagiura as a whole indicates that the hexagonal cells are at the core of its disclosure. Given that Yagiura focuses on solving this geometry problem, a person of ordinary skill in the art would not have modified this geometry absent a sufficient reason to do so.

Petitioner proposes reasons why a person of ordinary skill in the art would modify Yagiura, but Petitioner’s proposals are not supported by the preponderance evidence when weighed against Yagiura’s teachings regarding cell geometry and when weighed against Dr. Shea’s persuasive testimony. We address Petitioner’s reasons to combine below.

First, as Petitioner argues, Yagiura and Shimasaki are from the same field and both seek to improve efficiency and reduce complexity. Pet. 29–30; Pet. Reply 7–8. But Yagiura’s emphasis on improving geometric efficiency illustrates that cell shape is of primary concern. In view of this concern, Petitioner’s proposal to modify Yagiura to reach rectangular cells is not supported by the preponderance of the evidence. Pet. 29 (illustrating Petitioner’s proposed modification).

Petitioner also argues that a person of ordinary skill in the art would have modified Yagiura to implement Shimasaki’s halved cells because Shimasaki’s cells “exhibit many similar characteristics” to those of Yagiura and because such cells could be formed with fewer, less complicated steps and with more available base materials. Pet. 30–33. Yagiura, however, criticizes rectangular half-cells as wasteful. PO Resp. 22; Ex. 1110, 1:43–50

(explaining how rectangular cells do not allow an ingot to be used efficiently); *see* Ex. 1110, Fig. 11 (illustrating inefficiency of rectangular cells). We find persuasive and credible Dr. Shea’s testimony that Yagiura’s criticism of cells similar to Shimasaki weighs against Petitioner’s proposed combination. Ex. 2041 ¶¶ 54–56. The testimony is credible because Dr. Shea’s position aligns with the text of Yagiura itself.

Petitioner further argues that the proposed modified system of Yagiura would use fewer bypass diodes, fewer tabs, and fewer interconnectors thus improving reliability while improving efficiency. Pet. 33–35; *see* Pet. Reply 8. Although improved efficiency would be desirable, the preponderance of the evidence does not support that a person of ordinary skill in the art would have started with Yagiura’s solution to a geometric ingot and panel layout efficiency problem and then discarded that solution in favor of different considerations. PO Resp. 24. Dr. Shea’s testimony regarding this point is credible and persuasive. Ex. 2041 ¶ 57.

Petitioner also argues that a person of ordinary skill in the art would have had an expectation of success in reaching the proposed combination. Pet. 35. There is a distinction, however, between expectation of success and motivation to combine the references’ teachings. *Intelligent Bio-Sytems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016) (emphasizing that “reasonable expectation of success and motivation to combine” are “two different legal concepts”). Here, for the reasons explained above, the preponderance of the evidence supports that motivation to combine is lacking.

Because Petitioner does not persuasively establish by a preponderance of the evidence that a person of ordinary skill in the art would have had reason to modify Yagiura in view of Shimasaki, Petitioner does not meet its

burden to show the unpatentability of claims 1–6, 11, and 13 over Yagiura in view of Shimasaki.

B. *Ground Two: Obviousness Based on Yagiura, Shimasaki, and Yan*

Petitioner’s second ground adds the Yan reference to further address multiple junction boxes. Pet. 54. This ground relies on the combination of Yagiura and Shimasaki that we address above, and Petitioner’s use of Yanoes does not enhance Petitioner’s argument as to why a person of skill in the art would have modified Yan in view of Shimasaki. *Id.* at 57–69. As such, for the reasons we explain above with regard to Petitioner’s first ground, Petitioner does not meet its burden to show the unpatentability of claims 1–6, 11, and 13 over Yagiura in view of Shimasaki and Yan.

C. *Secondary Considerations*

Patent Owner argues that secondary considerations must be considered with respect to Petitioner’s obviousness grounds. PO Resp. 45–53. Above, we determined that Petitioner has not shown sufficient reasoning to combine the teaching of Yagiura and Shimasaki. Thus, Petitioner is unable to show how the prior art, as a whole, teaches all the limitations of the challenged claims. Because this alone is a sufficient reason to deny Petitioner’s obviousness challenge, we need not consider what impact, if any, Patent Owner’s evidence of secondary considerations would have had on our obviousness determination.

VI. CONCLUSION

For the above reasons, we determine that Petitioner does *not* establish by a preponderance of the evidence that

(a) claims 1–6, 11, and 13 are obvious over Yagiura in view of Shimasaki; or that

(b) claims 1–6, 11, and 13 are obvious over Yagiura in view of Shimasaki and Yan.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1–6, 11, 13	103	Yagiura, Shimasaki		1–6, 11, 13
1–6, 11, 13	103	Yagiura, Shimasaki, Yan		1–6, 11, 13
Overall Outcome				1–6, 11, 13

VII. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner does not establish by a preponderance of the evidence that claims 1–6, 11, and 13 of U.S. Patent No. 10,749,060 B2 are unpatentable;

FURTHER ORDERED that Patent Owner’s Motion to Exclude is *denied*; and

FURTHER ORDERED that, because this is a Final Written Decision, the parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.

IPR2021-00989
Patent 10,749,060 B2

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