UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO. LTD., Petitioner,

v.

LYNK LABS, INC., Patent Owner.

IPR2021-01575 Patent 10,154,551 B2

Before JON B. TORNQUIST, STEPHEN E. BELISLE, and SCOTT RAEVSKY, *Administrative Patent Judges*.

TORNQUIST, Administrative Patent Judge.

JUDGMENT Final Written Decision Determining All Challenged Claims Unpatentable 35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background and Summary

Samsung Electronics Co., Ltd. ("Petitioner") filed a Petition (Paper 1, "Pet.") requesting an *inter partes* review of claims 1–9 and 37 of U.S. Patent No. 10,154,551 B2 (Ex. 1001, "the '551 patent"). Lynk Labs, Inc. ("Patent Owner") filed a Preliminary Response to the Petition. Paper 6. With authorization, Petitioner subsequently filed a Preliminary Reply (Paper 8) and Patent Owner filed a Preliminary Sur-Reply (Paper 11) addressing discretionary denial pursuant to 35 U.S.C. § 325(d).

Subsequent to the filing of the Petition, Patent Owner disclaimed claim 37 of the '551 patent. Ex. 2004; *see* 37 C.F.R. § 42.107(e) ("No *inter partes* review will be instituted based on disclaimed claims.").

Upon review of the parties' arguments and supporting evidence, we instituted review with respect to claims 1–9 of the '551 patent. Paper 20 ("Institution Decision" or "Dec.").

Patent Owner subsequently filed a Response (Paper 23, "PO Resp."), to which Petitioner filed a Reply (Paper 28, "Pet. Reply"), and Patent Owner filed a Sur-Reply (Paper 30, "Sur-Reply").

Petitioner relies, *inter alia*, upon the declaration of R. Jacob Baker, Ph.D. (Ex. 1002). Patent Owner submits a declaration from Thomas L. Credelle (Ex. 2007).

An oral hearing was held on March 10, 2023, and a transcript of the hearing is included in the record (Paper 37, "Tr.").

For the reasons that follow, we conclude that Petitioner has proven by a preponderance of the evidence that claims 1–9 of the '551 patent are unpatentable.

B. Real Parties-in-Interest

Petitioner identifies itself and Samsung Electronics America, Inc. as the real parties-in-interest. Pet. 1.

Patent Owner identifies itself as the real party-in-interest. Paper 27, 1.

C. Related Matters

The parties identify *Samsung Electronics Co. v. Lynk Labs, Inc.*, No. 1:21-cv-02665 (N.D. Ill.) (consolidated with *Lynk Labs, Inc. v. Samsung Electronics Co., Ltd.*, No. 1:21-cv-05126 (N.D. Ill.)) and *Lynk Labs, Inc. v. Samsung Electronics Co.*, No. 1:21-cv-05021-MHC (N.D. Ga.) as related matters. Pet. 1; Paper 9, 2; Paper 17, 1; Paper 27, 1.

The '551 patent is also at issue in IPR2021-01367. Pet. 2.

D. The '551 Patent

The '551 patent "relates to alternating current ('AC') driven LEDs, LED circuits, and AC drive circuits and methods." Ex. 1001, 2:24–26. The '551 patent explains that LEDs "are intrinsically DC devices that only pass current in one polarity and historically have been driven by DC voltage sources using resistors, current regulators, and voltage regulators to limit the voltage and current delivered to the LEDs." *Id.* at 2:31–35. With proper considerations, however, the '551 patent reports that "LEDs may be driven more efficiently with AC than with DC drive schemes." *Id.* at 2:38–39.

The '551 patent discloses various methods of driving LEDs, including the use of a single bridge rectifier to drive parallel LEDs, using a capacitor to smooth the AC waveform to reduce ripple and to protect the LEDs, and using various driver designs to provide a relatively constant or fixed voltage and frequency to LED circuits. *Id.* at 4:39–43, 4:49–51, 5:59–61.

E. Illustrative Claim

Petitioner challenges claims 1–9 of the '551 patent. Pet. 4. Claim 1, reproduced below, is illustrative of the challenged claims:

1. A lighting system comprising:

an LED circuit having at least one LED;

a bridge rectifier;

at least one capacitor;

a driver connected to the bridge rectifier;

- the driver, bridge rectifier, at least one capacitor and at least one LED circuit all mounted on a reflective substrate,
- the driver providing rectified AC voltage and current to the LED circuit,
- the driver having an input of a first rectified AC voltage and a first frequency from a mains power source.

Ex. 1001, 18:52–63.

F. Prior Art and Asserted Grounds

Petitioner asserts that claims 1–9 are unpatentable on the following grounds (Pet. 4)¹:

Claims Challenged	35 U.S.C. § ²	Reference(s)/Basis
1, 2, 4–6, 8, 9	103	Saito ³ , Catalano ⁴

¹ As discussed above, Patent Owner disclaimed claim 37. Ex. 2004. For context, however, we reproduce all of the grounds asserted in the Petition. ² The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103, effective March 16, 2013. Petitioner contends the pre-AIA versions of §§ 102 and 103 apply in this proceeding. Pet. 4, 6. Patent Owner does not dispute Petitioner's assertions. Accordingly, on this record, we apply the pre-AIA versions of §§ 102 and 103. *See* 35 U.S.C. § 100(i)(1)(B). ³ US Publication No. 2002/0158500 A1, publiched October 21, 2002

³ US Publication No. 2002/0158590 A1, published October 31, 2002. Ex. 1008 ("Saito").

⁴ US Publication No. 2005/0057187 A1, published March 17, 2005. Ex. 1006 ("Catalano").

Claims Challenged	35 U.S.C. § ²	Reference(s)/Basis
3, 7	103	Saito, Catalano, Johnson ⁵
1, 2, 4–6, 8, 9	103	Saito, Wojnarowski ⁶
3, 7	103	Saito, Wojnarowski, Johnson
37	103	Hamaguchi ⁷ , Wojnarowski

II. ANALYSIS

A. Legal Standards

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) if in the record, objective evidence of nonobviousness.⁸ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

In determining the level of skill in the art, we consider the type of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level of active workers in the field. *Custom*

⁵ US 5,463,280, issued October 31, 1995. Ex. 1022 ("Johnson").

⁶ US 6,412,971 B2, issued July 2, 2002. Ex. 1005 ("Wojnarowski").

⁷ JP 2004/111104 A, published April 8, 2004. Ex. 1010 ("Hamaguchi").

⁸ No objective evidence of nonobviousness has been presented in this proceeding.

Accessories, Inc. v. Jeffrey-Allan Indus., Inc., 807 F.2d 955, 962 (Fed. Cir. 1986).

Petitioner contends a person of ordinary skill in the art as of the priority date of the '551 patent "would have had at least a bachelor's degree in electrical engineering, computer engineering, computer science, physics, or the equivalent, and two or more years of experience with LED devices and/or related circuit design, or a related field." Pet. 9 (citing Ex. 1002 ¶¶ 19–20).

For purposes of this proceeding, "Patent Owner does not dispute Petitioner's definition of a [person of ordinary skill in the art]." PO Resp. 9.

Upon review of the parties' arguments, the prior art of record, and the '551 patent, adopt Petitioner's undisputed level of ordinary skill in the art in this proceeding.

C. Claim Construction

In this proceeding, the claims of the '551 patent are construed "using the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b)." 37 C.F.R. § 42.100(b). Under that standard, the words of a claim are generally given their "ordinary and customary meaning," which is the meaning the term would have had to a person of ordinary skill at the time of the invention in the context of the entire patent including the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc).

In IPR2021-01367, which also is directed to the '551 patent, the Board construed the term "driver" to mean "a program, circuitry, or device used to power other programs, circuits, or devices." *Home Depot USA, Inc. v. Lynk Labs, Inc.*, IPR2021-01367, Paper 8 at 11–14 (PTAB Feb. 14, 2023) (Institution Decision); *see also* IPR2021-01367, Paper 46 at 7 (Final Written

Decision) (adopting the construction of "driver" set forth in the Institution Decision). Patent Owner believes that this construction is broader than that used by the '551 patent, "but will nevertheless refer to this construction because it is helpful in resolving the disputes over the teachings of the prior art, because none of the prior art teaches or suggests a driver even under this broader construction." PO Resp. 10–11. Patent Owner does not propose an alternative construction of the claim term. *Id.* Petitioner does not contest the adopted construction of "driver." Pet. Reply 1.

Upon review of the parties' arguments and evidence, and for the reasons expressly set forth in IPR2021-01367, we construe "driver" to mean "a program, circuitry, or device used to power other programs, circuits, or devices." No other claim terms require express construction. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) ("[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.")).

D. Priority Dispute

The '551 patent issued from an application filed October 30, 2017, and claims the benefit of the filing date of multiple continuation, continuation-in-part, and provisional applications. Ex. 1001, codes (22), (60). Relevant to this proceeding, the '551 patent claims the benefit of the April 6, 2004, filing date of U.S. Provisional Application No. 60/559,867 ("the '867 Provisional"). *Id.* at code (60).

Catalano was filed April 8, 2004, and claims the benefit of the September 12, 2003, filing date of U.S. Provisional Application No.

60/502,495 ("the '495 Provisional" or "Catalano's Provisional"). Ex. 1006, codes (22), (60).

The parties dispute whether the '551 patent is entitled to the benefit of the April 6, 2004, filing date of the '867 Provisional and whether Catalano is entitled to the benefit of the September 12, 2003, filing date of the '495 Provisional. Pet. 6–7, 11–14; PO Resp. 20–35. Given the respective filing dates, Catalano is prior art to the '551 patent if either it is entitled to the benefit of its provisional filing date, or if the '551 patent is not entitled to the benefit of the filing date of the '867 Provisional.

In order to gain the benefit of the filing date of an earlier application, "each application in the chain leading back to the earlier application must comply with the written description requirement of 35 U.S.C. § 112." *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571 (Fed. Cir. 1997). To satisfy this written description requirement, one must show that the inventors were in possession of the claimed invention. *Id.* at 1572. "One does that by such descriptive means as words, structures, figures, diagrams, formulas, etc. that fully set forth the claimed invention." *Id.* "A description which renders obvious the invention for which an earlier filing date is sought is not sufficient." *Id.*

For the reasons set forth below, we determine that Petitioner demonstrates that Catalano is entitled to the benefit of the September 12, 2003, filing date of the '495 Provisional. Accordingly, we apply Catalano as prior art without also addressing whether the '551 patent is entitled to the April 6, 2004, filing date of the '867 Provisional.

1. Overview of Catalano's '495 Provisional

Catalano's '495 Provisional is directed to "a light emitting diode and driving circuitry integrated into a component module that will retrofit

common incandescent lightbulb applications." Ex. 1007, 1:6–8.⁹ Figure 1 of the '495 Provisional is reproduced below:



FIGURE 1

Figure 1 "illustrates an embodiment of a universal LED illumination device that can be retrofit [in] an incandescent lightbulb application." *Id.* at 4:12– 13. As shown in Figure 1, universal LED illumination device 100 may be "made up of an LED lamp 102 that is connected to a printed circuit board 104 by an anode 126 wire at an LED anode connect 108 and a cathode 128 wire [at] an LED cathode connect 110 located on the printed circuit board 104." *Id.* at 5:9–13. "Electrical connections from the circuit board 104 to the bulb base 116 are made via a V_{in} positive 112 connector in connection with +V_{in} contact 120" and "a V_{in} negative 114 connector in connection with -V_{in} contact 122." *Id.* at 5:15–20.

⁹ Our citations to the '495 Provisional are to the native page numbers of the application, beginning at page 16 of Exhibit 1007.

According to the '495 Provisional, "printed circuit board 104 contains electronic circuitry placed in circuit area 106 and is of small size enabling the printed circuit board 104 to fit within the envelope of a standard bulb base 116." *Id.* at 5:13–15. The '495 Provisional also explains that the described configuration "allows the embodiment to be utilized as a replacement for conventional incandescent bulbs in a variety of applications" and "affords numerous operating advantages." *Id.* at 5:20–24.

Figure 6 of the '495 Provisional is reproduced below:



Figure 6 illustrates an embodiment of a universal LED illumination device that can be retrofit into an incandescent lightbulb application. *Id.* at 10:12– 13. As shown in Figure 6, LED 602 is mounted on wafer PC board 604 such that light will project outward and approximately perpendicular to the top surface of PC board 604. *Id.* at 10:13–15. Converter and logic circuit 606

may be mounted on either or both sides of PC board 604, and LED 602 and converter and logic circuit 606 are connected to 3-pin connector 612, which "facilitates an easy connection to a standard bulb base 616." *Id.* at 10:17–20.

2. Catalano's Claim to the Benefit of the '495 Provisional Filing Date

To obtain the benefit of the filing date of the '495 Provisional, Petitioner bears the burden to show that the provisional application provides written description support for at least one claim of the Catalano patent. *See Dynamic Drinkware, LLC v. National Graphics, Inc.*, 800 F.3d 1375, 1380 (Fed. Cir. 2015). To satisfy this burden, Petitioner provides a claim chart detailing where it contends every limitation of claim 23 of Catalano is disclosed in the '495 Provisional.¹⁰ Pet. 6–9.

There is no dispute that the '495 Provisional discloses the majority of the limitations of claim 23. The parties' dispute focuses on whether the '495 Provisional provides written description support for the claim 23 phrase "a standard bulb power connector equivalent to the power connector of a conventional incandescent bulb, which the improved device is capable of replacing." Ex. 1006, claim 23. Petitioner provides the following mapping of this claim term to the disclosures of the '495 Provisional (Pet. 7).

¹⁰ For each disclosure of Catalano relied upon in the Petition to establish obviousness, Petitioner provides parallel citations to the '495 Provisional. Pet. 6–7, 21–26. Patent Owner does not dispute that the subject matter of Catalano relied upon in the Petition is similarly disclosed in the '495 Provisional.

a standard bulb power	See, e.g., 1:6-8 (above), 10:12-25 ("Figure 6		
connector equivalent to the	illustratesa universal LED illumination device		
power connector of a	that can be retrofit [for] an incandescent		
conventional incandescent	lightbulb application" where LED 602 and		
bulb, which the improved	converter/logic circuit 606 "are connected to a 3-		
device is capable of replacing,	pin connector 612 [i.e., a power connector] that		
	facilitates an easy connection to a standard bulb		
	base 616."), FIG. 6		

In the Institution Decision, we noted Petitioner's reliance on the disclosure of LED 602 and converter/logic circuit 612 being "connected to a 3-pin connector 612 [*i.e.*, a power connector]," and questioned whether Petitioner was identifying 3-pin connector 612 as a "standard bulb power connector equivalent to the power connector of a conventional incandescent bulb," as recited in claim 23 of Catalano. Dec. 21–22. We also noted that there was no evidence that a 3-pin connector is "a standard bulb power connector." *Id.* at 22.

Patent Owner contends "the Institution Decision correctly determined that under *Dynamic Drinkware* . . . Petitioner did not meet its burden to show that the Catalano provision[al]" discloses the disputed limitations of claim 23 of Catalano. PO Resp. 35. Patent Owner does not otherwise analyze the disclosures of the '495 Provisional.

Petitioner contends that Patent Owner's reliance entirely on the Institution Decision is improper and Patent Owner therefore should be precluded from expanding on the "conclusory positions pursued in its Response." Pet. Reply 6–7. Addressing the questions raised in the Institution Decision, Petitioner contends the Board simply misunderstood Petitioner's position. *Id.* at 7. According to Petitioner, the reference to "*i.e.*,

a power connector" was to simply identify "the 3-pin connector as *a power connector*—*which it is* since it connects power to LED 602 with **the standard bulb base 616** that receives source power like conventional bulb bases." *Id.* at 8. Petitioner contends it is the "standard bulb base 616" that is the "standard bulb power connector" that is "equivalent to the power connector of a conventional incandescent bulb." *Id.* at 9.

Patent Owner argues in its Sur-Reply that "Catalano's 3-pin connector 612 is a non-standard power connector and not used to transfer power to a conventional incandescent bulb." Sur-Reply 9. Patent Owner further argues that Petitioner's Reply argument that standard bulb base 616 of Catalano is the "standard bulb power connector" of claim 23 is new, but nonetheless, "fails because nothing in Catalano suggests that bulb base 616 is 'equivalent to the power connector of a conventional incandescent bulb' as in claim 23." *Id*.

The terms "standard bulb power connector" and "equivalent to the base of a standard incandescent bulb" are not used in Catalano outside of the claims. We understand from the written description of Catalano, however, that "a standard bulb base" is "a standard bulb power connector that is equivalent to the base of a standard incandescent bulb" and "adapted to fit into standard bulb sockets." Ex. 1007, 2:16–18, 2:26–31; Ex. 1006 ¶ 5 ("The disclosed embodiments will perform with high efficiency at a wide operating voltage range with a very small size allowing for the incorporation within the envelope and form of existing lightbulb bases."), ¶ 7 ("A standard bulb base that is adapted to fit into standard bulb sockets").

Figure 6 in both Catalano and the Catalano Provisional label element 616 as a "standard bulb base," and there is no dispute that this element connects to power via standard bulb sockets, such as those used to connect

standard incandescent light bulbs. Ex. 1007, Fig. 6, 2:16 (noting that "a standard bulb base" is "adapted to fit into standard bulb sockets"), 10:12–13 (explaining that the device depicted in Figure 6 of Catalano is "a universal LED illumination device that can . . . retrofit an incandescent lightbulb application"); Ex. 1006, Fig. 6. Thus, we agree with Petitioner that "standard bulb base 616" of the '495 Provisional is "a standard bulb power connector" and that the claimed illumination device can replace an incandescent bulb, as recited in claim 23 of Catalano.

As noted in the Institution Decision, Petitioner's use of "*i.e.*, a power connector" to describe the 3-pin connector of Catalano was potentially ambiguous. Based on the full trial record, we are persuaded that the citations provided in the Petition provide sufficient evidence that the '495 Provisional provides written description support for claim 23 of Catalano.¹¹

In response to Patent Owner's argument that Catalano's 3-pin connector 612 is connected to bulb base 616, and there is no evidence that such a connector is used in "a conventional incandescent bulb" (Sur-Reply 9), we find that regardless of the internal components connecting the "standard bulb base" to the LED circuit, the "standard bulb base" is a connector that can fit within "standard bulb sockets" and allow the device to replace a conventional incandescent bulb. Ex. 1006 ¶¶ 5–7. Therefore, it is "a standard bulb power connector equivalent to the power connector of a

¹¹ As these arguments and supporting citations were presented in the Petition they are not new, as asserted by Patent Owner. Sur-Reply 9.

conventional incandescent bulb," as that term is used in claim 23 of Catalano.¹²

Petitioner's claim chart persuasively demonstrates where every limitation of claim 23 of Catalano is disclosed in the '495 Provisional, including "a standard bulb power connector equivalent to the power connector of a conventional incandescent bulb." Petitioner also demonstrates that the '495 Provisional discloses the same subject matter of Catalano that is relied upon in the Petition. Thus, we determine that Petitioner satisfies its burden to demonstrate that Catalano is entitled to the filing date of the '495 Provisional and is prior art to the '551 patent.

E. Claims 1, 2, 4–6, 8, and 9 over Saito and Catalano

Petitioner contends the subject matter of claims 1, 2, 4–6, 8, and 9 would have been obvious over the combined disclosures of Saito and Catalano. Pet. 14–39.

1. Saito

Saito discloses an LED device that can be "directly connected (directly coupled) to an alternating-current power supply." Ex. 1008 ¶ 1. Figure 7 of Saito is reproduced below:

¹² It appears that the 3-pin connector is not part of standard bulb base 616, as it is described in Catalano as facilitating "an easy connection to a standard bulb base 616." Ex. 1006 ¶ 29.

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Figure 7 is a circuit diagram showing a device of the fourth embodiment of Saito. *Id.* ¶ 42. As shown in Figure 7, the device includes various resistors, full-wave rectifying diode bridge 102, input/output voltage detection circuit 609, switching element 316, ON/OFF control circuit 712, capacitors 716 and 717, and LED lamp 106, which may comprise "two to several hundreds of serially connected LEDs." *Id.* ¶¶ 89, 95–98. In the circuit of Figure 7, ON/OFF control circuit 712 is supplied with a signal from input/output voltage detection circuit 609, and "performs ON/OFF control of the switching element 316" based on the set ON and OFF voltages. *Id.* ¶¶ 96–98 (noting that the ON/OFF voltage may be set to 30 V and 16 V).

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Figure 8 of Saito is reproduced below:



Figure 8 shows the voltage waveforms appearing at nodes A (node 107) and B (node 715). *Id.* ¶ 100. As shown in Figure 8, "an AC input voltage of 100V is subjected to full-wave rectification by the diode bridge 102, and the ON/OFF circuit 712 causes the switching element 316 to turn ON during a time period in which the voltage . . . is equal to or lower than 30V" and the "output voltage (voltage at node B 715) is below 16 V." *Id.* ¶ 102. During this period of time, LED lamp 106 is "supplied with electric power from the capacitors 716 and 717 until the voltage of the rectified wave reaches 30V." *Id.* When 30 V is reached, the switch is turned OFF and "the LED lamp can be continuously lit with low electric power." *Id.* ¶¶ 100–101. After the switching element is turned OFF, "the voltage at the node B decreases from the specified value (about 30V as stated above) down to 16 V." *Id.* ¶ 101. When the voltage decreases below 16 V, the switching element is again

turned ON. *Id.* The ON/OFF control circuit 712 then repeats this operation. *Id.* According to Saito, "[w]ith this arrangement, the electric power efficiency can be increased (loss can be reduced), without entailing flickering of light." *Id.* ¶ 102.

Figures 15(a) and 15(d) of Saito are reproduced below:



Figure 15(a) is a front view of an exemplary structure of an LED lamp device of Saito and Figure 15(d) is a sectional view of the LED lamp device. Ex. 1008 ¶ 144. As shown in Figure 15(d), circuit board 1504d has mounted thereon rectifying diode bridge 1504a, IC chip 1504b, and inductor 1504c. *Id.* ¶ 147. LED lamp module 1503 includes eight LED chips 1503a (Figure 15(a)) which are powered by "commercial alternating-current power" via AC input lead wires 1504e and 1504f. *Id.* ¶ 149.

2. Catalano

Catalano discloses the same general information and Figures discussed above with respect to the '495 Provisional. *See* Ex. 1006, Figs. 1, 6. Figure 8 of Catalano is reproduced below:



FIGURE 8

Figure 8 is an embodiment designed to retrofit a halogen lightbulb application. *Id.* ¶ 17. As shown in Figure 8, halogen replacement bulb 800 includes LEDs 802 that are mounted on PC board 804 such that they will project light outward and perpendicular to the top surface of PC board 804. *Id.* ¶ 31. Catalano explains that converter and logic circuit 808 can be mounted on either side of wafer PC board 804, and the top surface of PC board 804 can be coated with a reflective surface 812 to both "increase light output intensity by reflecting light otherwise lost" and "enhance heat dissipation of the LEDs and circuitry." *Id.* Catalano further explains that "[t]he large area of PC board 804" is sufficient to allow "for additional circuitry 810 to be readily added to either side of the described embodiment." *Id.*

Catalano explains that the disclosed LED modules "can be driven by a circuit that is either a constant voltage output or a constant current output," with the "constant current design" being preferred. *Id.* ¶ 6. The constant current circuit is typically "a high frequency, low power dc/dc converter,"

which allows components of small size to be used. *Id.* If an AC source is used, however, Catalano explains that the constant current circuit may operate as "an AC/DC converter by adding a rectifier circuit." *Id.*

3. Analysis: Claim 1

Petitioner contends that Saito and Catalano teach or suggest every limitation of claim 1, including: (1) a lighting system (Pet. 14–15); (2) an LED circuit having at least one LED (the circuitry relating to LED lamp 106 in Saito) (*id.* at 15–16 (citing Ex. 1008 ¶¶ 62, 95, Fig. 7; Ex. 102 ¶ 91)); (3) a bridge rectifier ("full-wave rectifying diode bridge 102" of Saito) (*id.* at 16–17 (citing Ex. 1008 ¶ 62, Fig. 7; Ex. 1002 ¶ 92)); (4) at least one capacitor (capacitors 716 and 717 of Saito) (*id.* at 17 (citing Ex. 1008 ¶ 95, 102, Fig. 7; Ex. 1002 ¶ 93)); (5) a driver connected to the bridge rectifier (*id.* at 18); (6) the driver providing a rectified AC voltage and current to the LED circuit (*id.* at 26–27 (citing Ex. 1008 ¶ 102, Figs. 7, 8; Ex. 1002 ¶¶ 110–111)); and (7) the driver having an input of a first rectified AC voltage and a first frequency from a mains power source (*id.* at 27–30 (citing Ex. 1008 ¶ 102 (Saito) ("The AC input voltage is a commercial voltage of 100 V")).

With respect to the requirement of claim 1 that "the driver, bridge rectifier, at least one capacitor and at least one LED circuit" are "all mounted on a reflective substrate," Petitioner contends that Saito discloses mounting the rectifying diode bridge, IC chip, and inductor to a single circuit board and Catalano discloses mounting driver circuitry, control circuitry, and LEDs on a common reflective substrate. Pet. 19–22. Petitioner contends one of ordinary skill in the art would understand from these disclosures of Saito and Catalano that all of the circuitry used to drive

an LED circuit could be mounted on the same reflective substrate. *Id.* at 22–23.

Petitioner contends one of ordinary skill in the art would have understood that mounting the various components of Saito's fourth embodiment, as shown in Figure 7, on a single substrate would have been beneficial because this "would have reduced the number of parts (by eliminating a separate substrate), increased compactness, and expanded the versatility and application of the lighting system." *Id.* at 23. Petitioner further contends that such a combination of Saito and Catalano would, as suggested by Catalano, beneficially "increase light output intensity by reflecting light otherwise lost" and "enhance heat dissipation of the LEDs and circuitry." *Id.* at 24 (citing Ex. 1006, Figs. 6–8, ¶¶ 2, 5, 9, 29–31; Ex. 1007, Figs. 6–8, 2:11–13, 3:13–16, 10:12–11:21; Ex. 1008 ¶ 17 (disclosing a device that is high in efficiency and low in loss); Ex. 1011, code (57), FIG. 2.1, ¶ 18 ("coat a layer of high reflection material on the board" for an LED lighting device), ¶¶ 34, 81; Ex. 1005, 2:6–10, 7:49–8:46, 6:6–7:34, Figs. 1, 24–25; Ex. 1002 ¶¶ 105–108).

Patent Owner contends that claim 1 would not have been obvious over Saito and Catalano because (a) Saito does not teach or suggest the claimed "driver," and (b) Saito and Catalano do not collectively teach or suggest mounting a driver, bridge rectifier, one or more capacitors, and an LED circuit on the same reflective substrate. PO Resp. 12–20. We address these issues in turn.

a) Driver

Petitioner provides the following annotated version of Figure 7 of Saito:



Figure 7 of Saito is annotated above to show where Petitioner contends Saito discloses the claimed "driver." Pet. 18. As shown in the annotated figure, Petitioner contends that Saito's voltage detection circuit 609, ON/OFF control circuit 712, and switching element 316, as well as the associated conductors and ground connections, collectively constitute the claimed driver because this circuitry outputs "electric power for driving a load, namely LED lamp 106." *Id.* (citing Ex. 1008 ¶ 18, 32, 34, 85, 94–103; Ex. 1002 ¶¶ 93–95).

Patent Owner contends the circuit identified in the Petition is not a "driver" because "switching element 316, the voltage detection circuit 609, the on/off circuit 712, and the wires 306, 315, and 711" do not power the LEDs of Saito. PO Resp. 13–16. Rather, these components merely detect the AC input voltage (voltage detection circuit 609) and switch the voltage

source between the AC input and capacitors 716 and 717 (switching element 316). *Id.* at 15–16.

Petitioner argues in its Reply that there is no doubt that the identified components of Saito collectively constitute a "circuit" and that this circuit provides power to LEDs 106. Pet. Reply 11–12. Petitioner also argues that, to the extent Patent Owner contends that the "power" provided by the driver must originate in the driver, this understanding would be inconsistent with claim 1, which recites that the driver has an input of a first rectified AC voltage from a mains power source. *Id.* at 14.

In its Sur-Reply, Patent Owner again contends that Saito's circuit is merely a switching element that does not "power" an LED circuit, as required by the Board's construction of "driver." Sur-Reply 3. Patent Owner reasons that the Board's construction of "driver" requires that the driver circuit "power" an LED circuit, and a circuit that merely connects a power source to an LED circuit, such as the switching unit of Saito, does not power the LED circuit. *Id.* at 4. Patent Owner contends that under Petitioner's understanding of the term "driver," a person who simply flips a switch between two power sources would be considered a "driver" as this person determines which power source is used as an input. *Id.* at 5.

Upon review of the record and the parties' arguments as a whole, we agree with Petitioner that Saito discloses a driver, as that term is used in claim 1 of the '551 patent. First, our construction of "driver" is broad, constituting any "program, circuitry, or device used to power other programs, circuits, or devices." And, consistent with the structure of claim 1 of the '551 patent, this construction does not require that the identified circuit or device actually generate power, only provide power to another device or circuit.

Second, the circuit of Saito is much more complex than a simple switch that turns on or off a power source. Rather, the circuit of Saito monitors the voltage provided at both node A 107 and node B 715 and, depending on the reported voltages, switches between voltage sources to provide power to the LEDs. In this way, the voltage applied to the LED circuit is maintained within a range of roughly 16 and 30 Volts, and the LEDs are driven for a prolonged period of time by capacitors 106 and 107, which Saito explains "cut[s] down the consumption of electric current" and results in more efficient use of power. Ex. 1008 ¶¶ 98–103. We find persuasive Dr. Baker's testimony that one of ordinary skill in the art would have considered such a circuit to be a "driver," as recited in claims 1 and 5 of the '551 patent. Ex. 1002 ¶¶ 94–95, 110–111.

b) Mounted on a Reflective Substrate

Claim 1 requires that "the driver, bridge rectifier, at least one capacitor and at least one LED circuit" are "all mounted on a reflective substrate." Ex. 1001, 18:57–59. Petitioner contends that such a configuration would have been obvious in view of the collective disclosures of Saito and Catalano. Pet. 19–26.

Patent Owner contends Petitioner's arguments are not persuasive for at least two reasons. First, Patent Owner contends that neither Saito nor Catalano teach or suggest mounting all of the *claimed elements* on the same substrate as the LED circuit. PO Resp. 17. Patent Owner reasons that Saito expressly discloses that its LEDs are mounted on a different substrate than the bridge rectifier and IC chip, and Catalano does not disclose a driver and bridge rectifier mounted on the same reflective substrate. *Id.* at 18–19.

Second, Patent Owner contends that one of ordinary skill in the art would not combine Saito and Catalano because these references teach different form factors and methods of light output. *Id.* at 20.

(1) Disclosure of Saito and Catalano

Catalano discloses a single reflective circuit board (PC board 804) that has mounted thereon LEDs 802, AC/DC converter logic 808, and "additional circuitry" 810. Ex. 1006, Fig. 8. AC/DC converter logic 808 may be a driving circuit that operates in conjunction with a bridge rectifier. *Id.* ¶ 6, Fig. 8. Thus, we agree with Petitioner that one of ordinary skill in the art would have understood that the electronic components of Catalano, including the driver, bridge rectifier, and at least one LED circuit, are mounted on a single, reflective substrate. Pet. Reply 17–18; Pet. 21–22.

Even if Catalano did not expressly suggest mounting all of the LED circuitry and LEDs to the same reflective substrate, "[a] claim can be obvious even where all the claimed features are not found in specific prior art references, where 'there is a showing of a suggestion or motivation to modify the teachings of the prior art to the claimed invention." *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1307 (Fed. Cir. 2006) (quoting *SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.*, 225 F.3d 1349, 1356 (Fed. Cir. 2000)). Here, Catalano discloses mounting the LEDs, as well as AC/DC converter and logic 808 and "additional circuitry" 810, to the same reflective substrate. Ex. 1006 ¶¶ 6, 31 ("The large area of PC board 804 space additionally allows for additional circuitry 810 to be readily added to either side of the described embodiment."), Fig. 8. As such, Catalano teaches mounting multiple components of an LED lighting device on a single, reflective substrate, which Saito demonstrates may include a driver, bridge rectifier, at least one capacitor, and at least one LED circuit. *Id.* ¶ 31;

Ex. 1008, Figs. 7, 15. We agree with Petitioner that these *combined disclosures* teach or at least suggest mounting the driver, bridge rectifier, capacitor, and LED circuit of Saito on a single, reflective substrate. Pet. 24–25; Pet. Reply 18–19.

(2) Reason to Combine

Petitioner persuasively argues that one of ordinary skill in the art would have sought to combine the teachings of Saito and Catalano to mount LED circuitry on a single, reflective circuit board because this configuration would enhance heat dissipation of the LEDs and circuitry and ensure that light is not lost when it strikes the circuit board. Pet. 22 (citing Ex. 1006 ¶ 31). Petitioner also presents persuasive, uncontroverted testimony from Dr. Baker that one of ordinary skill in the art would have understood that mounting the LED circuitry of Saito on a single, reflective substrate would beneficially reduce the number of parts, increase compactness, and expand the versatility of the lighting system. *Id.* at 23 (citing Ex. 1002 ¶ 105).

Patent Owner contends one of ordinary skill in the art would not have combined Saito and Catalano in view of their different form factors and direction of light output. PO Resp. 20. Mr. Credelle testifies that Saito teaches an LED array of eight diodes arranged in a circular pattern and on a separate circuit board than that used to mount the other circuit components of the device. Ex. 2001 ¶ 93. In contrast, Catalano discloses LEDs mounted to a printed circuit board along with "converter and logic" and "additional circuitry," with the light output orthogonal to the printed circuit board. *Id.* Mr. Credelle testifies that "it would not be obvious" to one of ordinary skill in the art how to attach the eight LEDs of Saito to the printed circuit board containing the driver, bridge rectifier, and capacitors, and still "achieve the

desired output in the desired form factor." PO Resp. 20 (quoting Ex. 2007 ¶ 93).

"It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements," or a demonstration that "the features of a secondary reference may be bodily incorporated into the structure of the primary reference." *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012); *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). Rather, the question is "what the combined teachings of the references would have suggested to those of ordinary skill in the art." *Keller*, 642 F.2d at 425.

Given this framework for demonstrating obviousness, Petitioner need not show that one of ordinary skill in the art could modify Saito and still retain the specific "form factor" or light output orientation used in, for example, the embodiment depicted in Figure 15 of Saito. Instead, Petitioner must demonstrate that one of ordinary skill in the art would have been motivated to combine Saito and Catalano and have had a reasonable expectation of success in doing so to arrive at the subject matter of claim 1—which does not require a specific form factor or light output direction. See In re Warsaw Orthopedic, Inc., 832 F.3d 1327, 1333 (Fed. Cir. 2016) (noting that the obviousness inquiry requires consideration of "whether a [person of ordinary skill in the art] would have been motivated to combine the prior art to achieve the claimed invention and whether there would have been a reasonable expectation of success in doing so") (quoting DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co., 464 F.3d 1356, 1360 (Fed. Cir. 2006)). Petitioner persuasively demonstrates that one of ordinary skill in the art would have sought to combine Saito and Catalano to arrive at the subject matter of claim 1 with a reasonable

expectation of success. See Ex. $1002 \ \P \ 106$ (Dr. Baker testifying that one of ordinary skill in the art would have had a reasonable expectation of success in mounting multiple components on a common substrate).

c) Conclusion: Claim 1

For the reasons set forth above, and for the reasons explained in the Petition, with which we agree, we determine that Petitioner demonstrates that Saito and Catalano teach or suggest every limitation of claim 1. Petitioner also provides a persuasive explanation as to why one of ordinary skill in the art would have combined these references to arrive at the subject matter of claim 1 with a reasonable expectation of success. Accordingly, Petitioner demonstrates by a preponderance of the evidence that claim 1 of the '551 patent would have been obvious over the combined teachings of Saito and Catalano.

4. Claims 2, 4–6, 8, and 9 over Saito and Catalano

Claims 2 and 4 depend from independent claim 1. Ex. 1001, 18:64– 65, 19:1–2. Petitioner identifies where Saito and Catalano teach or suggest every limitation of these claims, including: (1) a voltage regulator with feedback voltage regulator circuitry (input/output voltage detection circuit 609) (claim 2) (Pet. 30–31); and (2) a substrate that is a heat sinking material (e.g., a metal core PC board or heat sinking material on a circuit board) (claim 4) (*id.* at 32–33 (citing Ex. 1006 ¶ 35; Ex. 1007, 12:25–29; Ex. 1002 ¶¶ 118–120)).

With respect to independent claim 5, Petitioner contends every limitation of this claim is disclosed in Saito and Catalano, including at least one capacitor (capacitors 716 and 717) that is connected to the at least one LED and serves to smooth the rectified AC voltage waveform. Pet. 35–36 (citing Ex. 1008 ¶¶ 95, 100–102, Figs. 7–8; Ex. 1002 ¶¶ 131–132).

Petitioner also identifies where Saito and Catalano teach or suggest every limitation of claims 6, 8, and 9, which depend from independent claim 5, including: (1) "a voltage regulator with feedback voltage regulator circuitry (claim 6) (*id.* at 36); (2) a substrate that is a heat sinking material (claim 8) (*id.*); and (3) a lighting system "having a dimmer coupled to the driver" (claim 9) (*id.* at 36–38) (citing Ex. 1006 \P 6 (Catalano noting that additional features may be added to the lighting device, including "dimming"); Ex. 1007, 6:12–20; Ex. 1002 \P 136).

Patent Owner does not address Petitioner's arguments with respect to claims 2, 4–6, 8, and 9, apart from its arguments discussed above that Saito and Catalano do not disclose the driver and mounting limitation of claims 1 and 5. PO Resp. 12, 20.

Upon review of the parties' arguments and submitted evidence, we determine that Petitioner demonstrates by a preponderance of the evidence that claims 2, 4–6, 8, and 9 would have been obvious over the combined disclosures of Saito and Catalano.

F. Claims 3 and 7 over Saito, Catalano, and Johnson

Claim 3 depends from claim 1, and claim 7 depends from claim 5, and both require that "the driver further includes power factor correction circuitry." Ex. 1001, 18:66–67, 19:19–20. Petitioner contends the subject matter of claims 3 and 7 would have been obvious over the combined disclosures of Saito, Catalano, and Johnson. Pet. 39–42.

1. Johnson

Johnson discloses "retrofittable lamps configured as standard incandescent lamps but with LED illumination sources." Ex. 1022, 1:6–8. Figure 8 of Johnson is reproduced below:

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Figure 8 is a side elevational view of one embodiment of the retrofittable lamp of Johnson. *Id.* at 3:48–50. In the embodiment of Figure 8, lamp 98 includes lamp tube 100, base 102, and circuit 104. *Id.* at 6:67–7:2. Circuit 104 includes light emitting diodes 110, diode bridge 108, and switching power supply 106, disposed between bridge 108 and diodes 110. *Id.* at 7:2–5. According to Johnson, switching power supply 106 "can take the form of a power factor controller which would cause this embodiment of the invention to have a desirably high power factor." *Id.* at 7:5–10 (noting that power factor controllers are commercially available and suitable for use in the disclosed circuitry).

2. Analysis: Claims 3 and 7

Petitioner contends that Johnson expressly discloses the use of power factor correction circuitry in LED lighting devices and asserts that one of ordinary skill in the art would have sought to add such circuitry in the combined Saito-Catalano device in order to provide the "predictable benefit" of a "desirably high power factor" in the lighting device. Pet. 39–41.

Patent Owner contends that Petitioner's ground based on Saito, Catalano, and Johnson fails for the same reasons set forth above with respect to independent claims 1 and 5. PO Resp. 36.

Upon review of the parties' arguments and supporting evidence, we determine that Petitioner persuasively explains where Saito, Catalano, and Johnson teach or suggest every limitation of claims 3 and 7. Petitioner also provides a persuasive, uncontested explanation, with which we agree, as to why one of ordinary skill in the art would have sought to use power factor correction circuitry, as disclosed in Johnson, in the device of Saito and Catalano. Thus, Petitioner demonstrates by a preponderance of the evidence that claims 3 and 7 would have been obvious over the combined disclosures of Saito, Catalano, and Johnson.

Patent Owner's counter-arguments are not persuasive for the same reasons discussed above with respect to independent claim 1.

G. Claims 1, 2, 4–6, 8, and 9 over Saito and Wojnarowski

Petitioner contends that the subject matter of claims 1, 2, 4–6, 8, and 9 would have been obvious over the combined disclosures of Saito and Wojnarowski. Pet. 42–48.

1. Wojnarowski

Wojnarowski discloses a light source that includes a substrate, an array of un-packaged light emitting semiconductor devices (LESDs), and a plurality of electrical connections for providing electrical power to a respective LESD. Ex. 1005, code (57).

Figure 1 of Wojnarowski is reproduced below:



FIG. 1

Figure 1 is a side view of one embodiment of the light source of Wojnarowski. *Id.* at 1:44–45. As shown in Figure 1, light source 10 includes substrate 16 and array 12 of unpackaged LESDs 14. *Id.* at 2:3–7. Each LESD has at least one light emitting surface 13 and/or 17 and a substrate surface 15 attached to substrate 16. *Id.* at 2:7–9. Wojnarowski explains that substrate 16 may be any suitable structural material, such as a ceramic, molded plastic material, or a printed circuit board, and may be flat, curved, conformal, or flexible. *Id.* at 2:15–21. Control device 20 is situated in substrate 16 and is coupled to the LESD array by any appropriate connection technique. *Id.* at 3:11–14. Heat transfer device 76 is coupled to surface 19 of substrate 16 to optimize thermal management of the array. *Id.* at 3:16–19. Figure 27 of Wojnarowski is reproduced below:



FIG. 27

Figure 27 is a side view of a reflector component for use in the invention of Wojnarowski. *Id.* at 1:66–67. In the embodiment depicted in Figure 27, substrate 716 includes reflector component assembly 770, either as an integral or pre-attached assembly. *Id.* at 7:11–14. Each reflector is situated to reflect light from each LESD, and is "shaped to re-direct the maximum light emitted at odd angles from the LESDs so that such light is not lost and can be effectively used." *Id.* at 6:6–12, 7:15–18. After reflector portions 766 are formed, "LESDs 14 are then attached to the substrate/reflector component assembly combination." *Id.* at 7:15–18.

2. Analysis: Claim 1

For the reasons discussed above with respect to the combination of Saito and Catalano, Petitioner contends Saito discloses every limitation of claim 1, except for mounting the driver, bridge rectifier, at least one capacitor, and the LED circuit on a reflective substrate. Pet. 42–48. Petitioner contends, however, that such a configuration would have been obvious in view of Wojnarowski. *Id.*

Petitioner contends that Wojnarowski discloses that its driver circuitry (e.g., control device 20) and LEDs are mounted on a common substrate and that this substrate may include an "integral reflective coating (*e.g.*,

aluminum or gold), thus making it a reflective substrate." *Id.* at 45. Petitioner argues that Wojnarowski discloses that its reflective coating ensures that "light is not lost and can be effectively used," and asserts that one of ordinary skill in the art would have sought to use a similar coating for the lighting system of Saito in view of these benefits. *Id.* at 45–46. Petitioner further contends that mounting all of the circuit elements of Saito on a single, reflective substrate would result in the added benefits of reducing the number of parts, increasing compactness, and expanding the versatility in retrofit designs and applications of the lighting system. *Id.*

Patent Owner contends that Petitioner's arguments based on Wojnarowski and Saito are not persuasive because (a) Wojnarowski does not teach or suggest a driver and bridge rectifier that are mounted on the same substrate; and (b) Wojnarowski's substrate is not a reflective substrate "because the reflector portions are not part of the substrate but rather attachment points for individual LESDs." *Id.* at 38–39 ("At most, Wojnarowski discloses that LEDs are mounted to reflectors and the reflectors are mounted on a substrate."). PO Resp. 37–40. We address these arguments in turn.

a) Driver and Bridge Rectifier

Petitioner contends that Saito discloses a driver, bridge rectifier, LED circuit, and capacitors, and that control device 20 of Wojnarowski has a "rectifier, filter, and power conditioner" that may be used to control the operation of the LESDs. Pet. 43–44 (citing Ex. 1005, 2:6–10, 3:11–15, 7:49–8:46, Figs. 1, 24–26; Ex. 1008 ¶¶ 50, 144–147, Figs. 7, 15; Ex. 1002 ¶ 157).

Patent Owner contends that Wojnarowski does not teach or suggest that control device 20 is the claimed driver or bridge rectifier and, therefore,

"control device 20 cannot teach mounting a driver or a bridge rectifier on the same substrate." PO Resp. 38 (citing Ex. 2007 \P 99). We disagree.

Wojnarowski teaches or suggests mounting numerous circuits that are used to drive and control the LEDs on the same substrate as the LEDs. Ex. 1005, 3:11–15, 7:49–8:39 (noting that the control system within control device 20 may include a rectifier, filter, and power conditioner), Fig. 1 (depicting control device 20 within the substrate). We credit Dr. Baker's testimony that Wojnarowski's disclosures, in combination with the knowledge of one of ordinary skill in the art, would have at least suggested mounting the circuitry necessary to control and drive the LEDs of a device, such as the driver, bridge rectifier, at least one capacitor, and the LED circuit of Saito, on the same substrate.¹³ Ex. 1002 ¶¶ 160–161; Pet. 43–44.

Moreover, Wojnarowski discloses that control device 20 can be coupled to the LESD array by any appropriate connection technique, and used "for controlling the operation of the LESDs." Ex. 1005, 3:11–15. Wojnarowski further discloses that various control systems may be included within control device 20 and may include a rectifier and filter to provide dc voltage. *Id.* at 7:53–62. This controller may also condition the power provided to the LESDs. *Id.* at 7:66–8:1. Given these express disclosures, which are cited in the Petition, we agree with Petitioner that Wojnarowski teaches a driver and bridge rectifier that are mounted to the same substrate. Pet. 43; Pet. Reply 23 n.22.

¹³ Controller 20 of Wojnarowski is mounted in the substrate, as opposed to on its top surface. Patent Owner does not contest that controller 20 is mounted "on" the substrate of Wojnarowski. Tr. 46:16–24.

b) Reflective Substrate

Petitioner contends that Wojnarowski discloses that its "substrate may include an optional integral reflective coating (*e.g.*, aluminum or gold)" that renders the substrate reflective. Pet. 45 (citing Ex. 1005, 6:6–7:34; Ex. 1002 ¶ 158).

Patent Owner contends that Wojnarowski discloses only mounting LEDs to reflectors, which are then mounted on a substrate, and Wojnarowski teaches that the reflector portions should be prevented from "extending to the substrate." PO Resp. 39 (citing Ex. 2007 ¶ 101), 45 (quoting Ex. 1005, 6:59-7:9). Patent Owner further argues that the reflector component is fabricated by injection molding a plastic material and then coating this material with a reflective material, and such a plastic material could not act as a substrate because it lacks the ability to accommodate electrical traces, etc. *Id.* (citing Ex. 1005, 6:59-7:9; Ex. 2007 ¶ 101).

Petitioner argues in its Reply that the Petition did not advocate for use of reflector "dishes," much less adding a driver or rectifier on such a reflector dish. Pet. Reply 27. Rather, the argument presented in the Petition is that one of ordinary skill in the art, considering Saito and Wojnarowski as a whole, would have sought to mount Saito's driver, bridge rectifier, at least one capacitor, and at least one LED circuit on a single, reflective substrate. *Id.* (citing Pet. 45). Petitioner further argues that, even if it had relied on the reflector portions of Wojnarowski, it is evident that the substrate of Wojnarowski may include reflector components that are all part of an integral assembly. *Id.* at 24.

In its Sur-Reply, Patent Owner argues that the only portions of the substrate of Wojnarowski that are reflective are the reflector dishes. Sur-Reply 13 ("Wojnarowski does not disclose any other portions of

substrate 716 as reflective."). Thus, according to Patent Owner, "the manner Wojnarowski mounts LED circuits to a reflector requires mounting circuitry to the reflector dishes, which as the Reply concedes, 'makes no sense." *Id.* at 13–14 (quoting Pet. Reply 28).

Upon review of the record and the parties' arguments and evidence as a whole, we agree with Petitioner that Wojnarowski teaches or suggests mounting LED lighting circuitry on a reflective substrate. First, there is no requirement in claim 1 that the entire substrate be reflective; nor do we discern such a requirement in the written description of the '551 patent. As such, the reflective components of Wojnarowski, which may be an integral component of the substrate, render the substrate reflective.

Second, obviousness does not require a physical combination of disclosed components, such that the driver, bridge rectifier, at least one capacitor, and LEDs of Saito would need to be installed in or on one or more of Wojnarowski's reflector dishes. *Mouttet*, 686 F.3d at 1332 ("It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements."). Rather, Petitioner must demonstrate that one of ordinary skill in the art, considering the combined disclosures of Saito and Wojnarowski, would have found it obvious to arrive at the subject matter of claim 1 of the '551 patent. On this point, Dr. Baker persuasively testifies that Wojnarowski's disclosure of mounting LED circuit elements on a single, reflective substrate would have motivated one of ordinary skill in the art to mount all of Saito's LED circuit elements on a single, reflective substrate. Ex. 1005, 6:10–12; Ex. 1002 ¶ 159. Dr. Baker also persuasively testifies that one of ordinary skill in the art would have recognized several benefits to this combination, including improved lighting efficiency, improved heat

dissipation of the LEDs, and allowance for more compact designs, which would improve the versatility of the lighting system. Ex. 1002 ¶¶ 160–161.

Patent Owner's and Mr. Credelle's counter-arguments are not persuasive. The Petition never advocates for using the specific reflector dish structures of Wojnarowski, as Mr. Credelle and Patent Owner appear to presume. Pet. 45; PO Resp. 38–39; Ex. 2007 ¶ 101. But even if this were Petitioner's argument, Mr. Credelle ignores the discussion in the Petition that the reflectors of Wojnarowski may be integrally formed in the substrate, as opposed to being mounted as a separate component on top of the substrate. Ex. 2007 ¶ 101; Pet. 45; *see also* Pet. Reply 24 (noting that the reflective elements may be an integral portion of the substrate). In addition, we discern no requirement in claim 1 that the driver, bridge rectifier, at least one capacitor, and the at least one LED circuit all be mounted above the reflective portion of the substrate, as opposed to being within the substrate. Finally, contrary to Patent Owner's arguments, substrate 16 of Wojnarowski is expressly capable of containing electrical contacts connecting control device 20 to the LESDs. Ex. 1005, 4:38–60, Fig. 6.

c) Conclusion

For the reasons set forth above, and for the reasons set forth in the Petition, Petitioner demonstrates that Saito and Wojnarowski teach or suggest every limitation of claim 1. Petitioner also provides a persuasive explanation as to why one of ordinary skill in the art would have combined these references to arrive at the subject matter of claim 1 with a reasonable expectation of success. Accordingly, Petitioner has proven by a preponderance of the evidence that claim 1 would have been obvious over Saito and Wojnarowski.

3. Analysis: Claims 2, 4–6, 8, and 9

Petitioner contends Saito and Wojnarowski, when considered in combination with the knowledge and skill of the ordinarily skilled artisan, teach or suggest every limitation of claims 2, 4–6, 8, and 9 of the '551 patent. Pet. 49–55. In support of this argument, Petitioner provides detailed explanations as to where the subject matter of these claims, when considered in light of the knowledge and experience of an ordinarily skilled artisan, is taught or suggested in Saito and Wojnarowski. *Id*.

Patent Owner does not address Petitioner's arguments with respect to claims 2, 4–6, 8, and 9, beyond noting that its arguments with respect to claim 1 apply to these claims as well. PO Resp. 36.

Upon review of the parties' arguments and supporting evidence, we determine that Petitioner demonstrates by a preponderance of the evidence that the subject matter of claims 2, 4–6, 8 and 9 would have been obvious in view of Saito and Wojnarowski, when considered in light of the knowledge of one of ordinary skill in the art.

H. Claim 3 and 7 over Saito, Wojnarowski, and Johnson

Petitioner contends the subject matter of claims 3 and 7 would have been obvious over the combined disclosures of Saito, Wojnarowski, and Johnson. Pet. 55–57. In particular, Petitioner contends one of ordinary skill in the art would have found it obvious to implement power factor correction circuitry in the combined Saito-Wojnarowski device in view of Johnson's disclosure of the benefits of such technology in improving the power factor of an LED lighting device. *Id*.

Patent Owner does not address Petitioner's arguments with respect to this ground, apart from alleging that Johnson does not cure the deficiencies

asserted by Patent Owner with respect to independent claims 1 and 5. PO Resp. 40.

Upon review of the parties' arguments and the evidence of record, we determine that Petitioner sufficiently demonstrates that the Saito-Wojnarowski-Johnson combination teaches all the limitations of claims 3 and 7, and persuasively explains why a person of ordinary skill in the art would have combined the teachings of Johnson with the teachings of the Saito-Wojnarowski to arrive at the subject matter of claims 3 and 7 with a reasonable expectation of success. Accordingly, Petitioner demonstrates by a preponderance of the evidence that claims 3 and 7 would have been obvious over Saito, Wojnarowski, and Johnson.

III. CONCLUSION¹⁴

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 4–6, 8, 9	103	Saito, Catalano	1, 2, 4–6, 8, 9	
3,7	103	Saito, Catalano, Johnson	3, 7	
1, 2, 4–6, 8, 9	103	Saito, Wojnarowski	1, 2, 4–6, 8, 9	
3, 7	103	Saito,	3, 7	

In summary:

¹⁴ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
		Wojnarowski,		
		Johnson		
Overall			1.0	
Outcome			1-9	

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1-9 of the '551 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision,

parties to the proceeding seeking judicial review of the decision must

comply with the notice and service requirements of 37 C.F.R. § 90.2.

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