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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HOME DEPOT U.S.A., INC., Petitioner,

v.

LYNK LABS, INC., Patent Owner.

IPR2021-01370 Patent 10,349,479 B2

Before JON B. TORNQUIST, MONICA S. ULLAGADDI, and SCOTT RAEVSKY, *Administrative Patent Judges*.

RAEVSKY, Administrative Patent Judge.

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

I. INTRODUCTION

Home Depot U.S.A., Inc. ("Petitioner") filed a Petition (Paper 1, "Pet.") requesting *inter partes* review of claims 9–17 of U.S. Patent No. 10,349,479 B2 (Ex. 1001, "the '479 patent"). Lynk Labs, Inc. ("Patent Owner") filed a Preliminary Response (Paper 5). Based on these and other submissions, we instituted an *inter partes* review of all challenged claims (Paper 8, "Institution Decision," "Decision" or "Dec."). Subsequent filings include a Patent Owner Response (Paper 23, "PO Resp."), a Petitioner Reply (Paper 29, "Reply"), and a Patent Owner Sur-reply (Paper 33, "Sur-reply"). An oral hearing was held on November 17, 2022, and a copy of the transcript was entered into the record. Paper 45 ("Tr.").

We have jurisdiction over this proceeding under 35 U.S.C. § 6(b). After considering the evidence and arguments of the parties, we determine that Petitioner has proven by a preponderance of the evidence that claims 9– 17 of the '479 patent are unpatentable. *See* 35 U.S.C. § 316(e).

II. BACKGROUND

A. The '479 patent

The '479 patent relates to circuits with light-emitting diodes (LEDs) driven by alternating current (AC) that are color temperature controllable and/or have an increased power factor and reduced total harmonic distortion. Ex. 1001, 1:23–27, 2:45–51, 7:40–42. The disclosed lighting devices may include "any device capable of emitting light no matter the intention." *Id.* at 7:42–44. Figure 8, reproduced below, depicts an example LED circuit:



See id. at 6:59–61. Figure 8 depicts an AC power source 44, a dimmer switch 42, and LED lighting devices 10. *Id.* at 14:4–15. The dimmer switch may control the voltage applied to the LED lighting devices 10. *Id.* at 14:19–34. As the dimmer switch is turned to provide more voltage to the LED lighting devices 10, amber colored LEDs may be turned on and increase in intensity. *Id.* at 14:19–22. Further voltage increases may turn on blue LEDs. *Id.* at 14:22–26. As the dimmer switch is turned up, the color temperature decreases. *Id.* at 14:26–29. Conversely, when the dimmer switch is turned down, the light has a warmer color temperature. *Id.* at 14:29–34.

B. Challenged Claims

Petitioner challenges claims 9–17 of the '479 patent. Claim 9 is illustrative:¹

9. An LED lighting system comprising:

[a] a first LED circuit having at least two LEDs;

[b] a first switch configured to be controlled by a user to control an amount of voltage or current that flows through the at least two LEDs; and

¹ For convenience, we use Petitioner's element labeling. See Pet. 17–22.

[c] a second switch that allows the first LED circuit to be disconnected from the AC voltage source and a second LED circuit to be connected to an AC voltage source;

[d] wherein the first LED circuit provides light of a different level of brightness in response to adjustment of the first switch; and

[e] wherein the LED lighting system is driven with the AC voltage source.

Ex. 1001, 20:14–26.

C. Asserted Grounds of Unpatentability

Claims Challenged	35 U.S.C. § ²	Reference(s)/Basis
9–11, 13, 15, 17	102	Dowling ³
9–15, 17	103(a)	Dowling, Mueller, ⁴ Okuno ⁵
9–11, 15, 16	102	Ter Weeme ⁶

Petitioner asserts the following grounds of unpatentability (Pet. 4):

² The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011), revised 35 U.S.C. §§ 102, 103 effective March 16, 2013. Because the challenged patent claims priority to an application filed before March 16, 2013 (Ex. 1001, code (60)), we refer to the pre-AIA versions of §§ 102, 103. *See also* Ex. 1003, 477 (Examiner relying on pre-AIA § 102(e)). Although the parties dispute whether the AIA or pre-AIA statutes apply (Reply 1, Sur-reply 4, n.2), the parties agreed during the hearing that we need not address these arguments because the outcome here does not turn on this issue. Tr. 60:10–61:6, 78:11–14.

³ U.S. Publication No. 2002/0048169 A1 to Dowling ("Dowling") (Ex. 1004).

⁴ U.S. Patent No. 6,016,038 to Mueller ("Mueller") (Ex. 1005).

⁵ U.S. Patent No. 4,298,869 to Okuno ("Okuno") (Ex. 1006).

⁶ WIPO Publication No. WO 2010/103480 A2 to Ter Weeme ("Ter Weeme") (Ex. 1007).

Petitioner relies on the declarations of Dr. Dean Neikirk (Exs. 1002, 1026), and Patent Owner relies on the declaration of Thomas L. Credelle (Ex. 2007).

III. ANALYSIS

A. Principles of Law

Petitioner bears the burden to demonstrate unpatentability. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

To show anticipation under 35 U.S.C. § 102, each and every claim element, arranged as in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359 (Fed. Cir. 2008). The prior art need not, however, use the same words as the claims. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009). The anticipation inquiry takes into account the literal teachings of the prior art reference, and inferences the ordinarily skilled person would draw from it. *Eli Lilly & Co. v. Los Angeles Biomedical Res. Inst. at Harbor-UCLA Med. Ctr.*, 849 F.3d 1073, 1074–75 (Fed. Cir. 2017).

A claim is unpatentable as obvious if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007) (quoting 35 U.S.C. § 103(a)). We resolve the question of obviousness based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the prior art and the claims; (3) the

level of skill in the art; and (4) when in evidence, objective indicia of

nonobviousness. See Graham v. John Deere Co., 383 U.S. 1, 17–18 (1966).

We apply these principles to the Petition's challenges.

B. Level of Ordinary Skill in the Art

We review the grounds of unpatentability in view of the understanding of a person of ordinary skill in the art at the time of the invention. *Graham*, 383 U.S. at 13, 17. Petitioner asserts that

[a] person of ordinary skill in the art ("POSITA")... would have had a bachelor's degree in electrical engineering, or similar technical field, with two years of relevant experience in the field of design and/or development of LEDs and circuits in the context of lighting control systems. An increase in experience could compensate for less education.

Pet. 14–15 (citing Ex. 1002 ¶ 29).

Patent Owner does not address the level of skill in the art. We are persuaded that Petitioner's proposal is consistent with the problems and solutions in the '479 patent and prior art of record. We adopt Petitioner's definition of the level of skill.

C. Claim Construction

In *inter partes* review, we construe claims using the same claim construction standard that would be used to construe the claim 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) (2021).

The Petition does not propose any constructions. Pet. 15. Patent Owner proposed a construction for the term "switch." PO Resp. 6. The

parties also address the meaning of the term "disconnected." POResp. 10, 18; Reply 2–8; Sur-reply 2–4.

1. "*switch*"

In our Institution Decision, in response to Patent Owner's arguments, we preliminarily construed "a second switch that allows the first LED circuit to be disconnected from the AC voltage source and a second LED circuit to be connected to an AC voltage source" to "encompass direct or indirect user control of the switch." Dec. 15. Patent Owner does not renew its preinstitution arguments because Patent Owner does not believe the arguments presented in its Response "depend on user control of the second switch." PO Resp. 6. However, Patent Owner asserts that the term "switch" should be construed as "a device for making, breaking, or changing the connections in an electrical circuit." Id. According to Patent Owner, "[t]his meaning is well known to those of ordinary skill in the art, is a common dictionary definition, and is consistent with the term 'switch' as used by the '479 Patent." Id. (citing Ex. 2007 ¶¶ 58-62; Ex. 2005). As claim 1 refers to "a first switch" and "a second switch," Patent Owner's "switch" construction presumably applies to both switches, although Patent Owner does not specify.

Petitioner initially appears to not dispute this construction, noting only that Patent Owner has waived any argument that "the term 'switch' itself is limited to directly controlled switches or excludes electrical switches." Reply 2. But later, Petitioner states that "[t]he claims are entitled to their ordinary meaning, which does not require a mechanical switch or an air gap." *Id.* at 9. In general, Petitioner focuses more on construing a related term, "disconnected." *Id.* at 2–8. The Sur-reply responds by asserting that

"Petitioner does not dispute Patent Owner's proposed construction" of switch. Sur-reply 1. Both the Reply and Sur-reply, however, intermingle their discussion of "disconnected" with references to the meaning of "switch." Reply 2–8; Sur-reply 2–4.

Accordingly, we address the meaning of "switch" in the context of our construction of "disconnected" below.

2. "disconnected"

Neither party explicitly construes the term "disconnected" in its opening brief, but Petitioner discusses this term in detail in the Reply because it believes that Patent Owner "argues that only mechanical switches can 'disconnect' a circuit as claimed." Reply 2–3 (citing PO Resp. 10 ("Since it is not a mechanical switch with contacts, switch 501 never disconnects the circuit"), 18 (arguing that "disconnected" requires an "air gap"). Petitioner also points to Patent Owner's expert, who opines that "disconnected" requires a mechanical switch with an air gap, to the exclusion of electronic switches." *Id.* at 3 (citing Ex. 1027, 82:20–88:4).

a. The parties' arguments

Petitioner proposes that we apply the ordinary meaning of "connect" and "disconnect," which "encompasses an electrical connection or disconnection sufficient to turn the LED circuit on or off, including an electronic switch like a transistor to perform the electrical connection or disconnection." Reply 3–4 (citing, e.g., Ex. 1026 ¶¶ 11–19; Exs. 1028, 1029, 1031, 1007). Said another way, Petitioner contends that the ordinary meaning of the claims "does not require a mechanical switch or an air gap." *Id.* at 9.

Petitioner initially refers to Patent Owner's expert, Mr. Credelle, who Petitioner argues "admits that electrical and mechanical switches can be 'equivalent' in function" and "acknowledges that an electronic switch (e.g., a transistor) 'open[s] and close[s] a circuit."" *Id.* at 4 (citing Ex. 1027, 56:11-57:4; Ex. 2007 ¶ 59). Petitioner's expert, Dr. Neikirk, also testifies that "[a] POSITA would have understood that creating an 'open' circuit between an AC voltage source and an LED circuit would 'disconnect' that LED circuit [from] the AC voltage source." *Id.* (citing Ex. 1026 ¶ 19). Thus, Petitioner contends, "a POSITA would have understood that an electronic switch can disconnect a circuit." *Id.* at 4–5 (citing Ex. 1026 ¶ 21).

Petitioner next addresses Patent Owner's reliance on two dictionary definitions for "switch," arguing that these definitions in fact support Petitioner's position on "disconnected." *Id.* at 5. First, Petitioner points to Merriam-Webster's definition for "switch" as "a device for making, breaking, or changing the connections in an electrical circuit," arguing that Mr. Credelle testified that "breaking" a connection was the same as "electrically disconnecting." *Id.* (citing Ex. 2007 ¶¶ 37, 59; Ex. 1027, 53:7– 13). And second, Petitioner contends that "[t]he Illustrated Dictionary of Electronics literally includes electronic switches in its definition—'a circuit or device (electronic, electromechanical, or mechanical) for opening and closing a circuit or for connecting a line to one of several different lines."" *Id.* (citing Ex. 2007 ¶ 59; Ex. 2005).

Petitioner also relies on the intrinsic record, pointing us to Patent Owner's acknowledgement during prosecution that switches can "take the form of MOSFET switches, transistors, and other such types of switches that are controlled by the controller." *Id.* at 5–6 (quoting Ex. 1003, 454); *see*

also id. at 6 (citing Ex. 1003, 510 (prosecution statement that "transistors 'dynamically switch the LEDs in and out of an electrical connection to each other"")). As for the specification, Petitioner argues that Patent Owner's interpretation excludes the only disclosed example of a "dimmer switch," a "phase dimmer switch," which is an electronic switch. *Id.* (citing Ex. 1001, 14:15–17 (emphasis omitted); Ex. 1026¶23; Ex. 1027, 57:20–58:10 (Mr. Credelle admitting at deposition "that a phase dimmer switch is an electronic switch")). Not only that, Petitioner argues, but the disclosed dimmer switch may be "any . . . known in the art," which favors a broader interpretation of the claims than that urged by Patent Owner. *Id.* at 7; *see* Ex. 1001, 14:15–16. Relatedly, Petitioner asserts that Patent Owner's expert testimony should be discounted because he did not properly consider the intrinsic record. Reply 7 (citing, e.g., Ex. 1027, 44:6–45:1, 104:8–114:14, 115:9–21, 114:15–115:8).

The Sur-reply responds by arguing that "'disconnected' requires breaking or severing an electrical connection." Sur-reply 2. Patent Owner views the '479 patent specification as distinguishing the terms "connect" and "disconnect" from turning LED circuits "on" or "off." *Id.* For example, Patent Owner points to the specification's disclosure of turning LEDs off by reducing voltage without breaking a mechanical connection. *Id.* (citing Ex. 1001, 13:22–27) ("As the voltage continues to drop towards 7.5V, the amber LEDS will become dimmer and eventually turn off." (emphasis omitted)). Then Patent Owner contrasts this example with one where an LED device is disconnected from a failed driver by replacing the driver. *Id.* at 2–3 (citing Ex. 1001, 17:3–11 ("Likewise, if the driver or bypass or shunt active current limiting device fails, the LED lighting device may be

disconnected from the failed driver or bypass and be re-used with a new driver or bypass.")).

As for the specification's disclosure of a phase dimmer, Patent Owner views this as "<u>an example</u> of a dimmer switch" and asserts that "the claims need not encompass every disclosed embodiment." *Id.* at 3 (citing *TIP Systems, LLC v. Phillips & Brooks/Gladwin, Inc.*, 529 F.3d 1364, 1373 (Fed. Cir. 2008)).

b. Analysis

(1) Plain claim language

We begin by reviewing the plain claim language. Claim 9 recites "a second switch that allows the first LED circuit to be disconnected from the AC voltage source and a second LED circuit to be connected to an AC voltage source." Nothing in this language explicitly clarifies whether "disconnected" encompasses turning LEDs off mechanically, electronically, or both. This limitation also does not specify what type of switch is claimed, only broadly reciting "a second switch." But by broadly reciting "disconnected" and "switch" without any qualifiers, this language presumptively covers mechanical and electronic switch disconnection.

Claim 15, which depends from independent claim 9, further recites "wherein at least one of the first switch or the second switch is a dimmer switch." Ex. 1001, 20:40–41. Accordingly, under the doctrine of claim differentiation, the "second switch" of claim 9 presumptively encompasses more than a "dimmer switch." *Intamin Ltd. v. Magnetar Techs., Corp.*, 483 F.3d 1328, 1335 (Fed. Cir. 2007) ("An independent claim impliedly embraces more subject matter than its narrower dependent claim.").

In view of the foregoing, the plain claim language presumptively encompasses *any* type of switch that "allows the first LED circuit to be disconnected from the AC voltage source and a second LED circuit to be connected to an AC voltage source."

(2) Specification

The intrinsic record confirms that "switch" and "disconnected" are broad terms. The specification discloses generic switches, as well as dimmers: "LED device 10 may further include connection leads 24, 26 for connecting the device to an AC power source, like for example mains power or *a switch or dimmer* connected to mains power." Ex. 1001, 8:67–9:3 (emphasis added). The specification puts no limitations on what a switch may be, not even depicting a specific switch in any of the figures. *See, e.g.*, *id.* at Fig. 8 (depicting a black box "dimmer switch"—the only figure that depicts any switch). Even the disclosed "dimmer switch" is broadly described. "The dimmer switch *may be any known in the art*, like for example, a phase dimmer switch." *Id.* at 14:15–17 (emphasis added). We agree with Petitioner that a dimmer switch that "may be any known in the art" broadly encompasses both mechanical and electrical switches. *See* Reply 6–7.

Because the specification describes switches so generically, thereby encompassing both mechanical and electronic switches, "disconnected" implicitly also refers to disconnecting mechanical and electronic switches. Beyond this, the specification gives no specific guidance on what "disconnected" means. Although the specification refers to an "LED lighting device that may be disconnected," as Patent Owner points out, this passage has a different context than the claimed "disconnected." *See*

Ex. 1001, 17:8–11; Sur-reply 2–3. The passage Patent Owner relies on describes removing and installing replacement parts, not switching between two working LED circuits, as claimed. *See* Ex. 1001, 17:3–11 (describing an LED device that "may be disconnected from the failed driver or bypass and be re-used with a new driver or bypass"). Thus, this passage is inapposite to interpreting the meaning of "disconnected" in the claim.

(3) Prosecution history

The prosecution history also supports Petitioner's position that "disconnected" encompasses both mechanical and electronic disconnection. Reply 5–6. Petitioner notes that during prosecution, Patent Owner referred to electronic switches of a prior art reference as "dynamically switch[ing] the LEDs in and out of an electrical *connection to each other*." *Id.* (quoting Ex. 1003, 510) (emphasis added). Thus, Patent Owner implicitly acknowledged that electronic switches can be connected and disconnected. Patent Owner's prosecution acknowledgement belies its argument in this proceeding that "connect" and "disconnect" are not "synonymous with turning LED circuits 'on' or 'off."" Sur-reply 2. Although Patent Owner's prosecution statements interpreted a prior art reference, rather than the '479 patent, these prosecution statements support Petitioner's arguments because they show that Patent Owner had a broader view of connection and disconnection during prosecution.

Given the breadth of the claims and specification, as well as Patent Owner's implicit prosecution acknowledgement, we find the intrinsic evidence dispositive in this case of the meaning of "disconnected" as encompassing an electrical disconnection sufficient to turn the LED circuit

off, including an electronic switch like a transistor to perform the electrical disconnection.

(4) Extrinsic evidence

The extrinsic evidence is consistent with our determination based on the intrinsic evidence. First, we find persuasive the definition from the Illustrated Dictionary of Electronics submitted by Patent Owner, which defines a switch as "a circuit or device (electronic, electromechanical, or mechanical) for opening and closing a circuit or for connecting a line to one of several different lines." Ex. 2005, 6, *cited in* Ex. 2007 ¶ 59.⁷ As the specification does not describe switches restrictively, this definition is highly persuasive in establishing that the claimed switch encompasses electronic as well as mechanical switches. Second, Patent Owner's expert, Mr. Credelle, also testifies that an electronic switch is "equivalent . . . with a mechanical switch in terms of its function" and acknowledges that an electronic switch can open and close a circuit. Ex. 1027, 56:11-57:4; Ex. 2007 ¶ 59 (quoting Ex. 2005, 6). And third, Petitioner's expert, Dr. Neikirk, testifies that "[a] POSITA would have understood that creating an 'open' circuit between an AC voltage source and an LED circuit would 'disconnect' that LED circuit [from] the AC voltage source." Ex. 1026 ¶ 19. Thus, Dr. Neikirk persuasively testifies that "[d]isconnected' is not limited to the type of disconnection caused by a mechanical switch that creates an air gap between contacts in a circuit." Id. ¶9.

Accordingly, the extrinsic evidence confirms that disconnection is not purely a mechanical concept that refers to making an air gap between

⁷ Patent Owner does not rely on this definition in its briefing, but its expert, Mr. Credelle, does so in his declaration. PO Resp. 6; Ex. $2007 \P$ 59.

electrical components, but also refers to disconnecting an electronic switch by creating an electrically open circuit (for example, by turning an electronic switch off).

(5) Summary

In sum, we determine that the ordinary meaning of "disconnect" applies and encompasses an electrical disconnection sufficient to turn the LED circuit off, including an electronic switch like a transistor to perform the electrical disconnection. *See* Reply 3–4 (citing, e.g., Ex. 1026 ¶¶ 11–19).

We also determine that the ordinary meaning of "switch" applies, which encompasses both mechanical and electronic switches. Further, as Patent Owner does not dispute our Institution construction of "a second switch that allows the first LED circuit to be disconnected from the AC voltage source and a second LED circuit to be connected to an AC voltage source" as "encompass[ing] direct or indirect user control of the switch," we also adopt this construction for the reasons stated in our Institution Decision. *See* Dec. 11–15.

3. Remaining terms

Apart from our discussion of one additional term, "LED lighting system," in our merits analysis below, we determine that no other terms require construction. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy."" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng 'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

D. Asserted Anticipation by Dowling (Ground 1)

Petitioner contends that claims 9–11, 13, 15, and 17 are anticipated by Dowling. Pet. 15–24.

1. Overview of Dowling

Dowling describes a system for using high-brightness, processorcontrolled LEDs in combination with diffuse materials to produce colorchanging effects. Ex. 1004, code (57). Figure 1, below, depicts an example device having LEDs:



Id. ¶ 38. The device includes user interface 1 and processor 2 for executing a program stored in memory 6 to generate control signals. *Id.* The control signals may be converted by controllers 3 into a form suitable for driving LEDs 4. *Id.*

Figure 8, below, depicts an example light bulb described in Dowling:



Id. ¶ 62. The lightbulb includes thumbwheel 185 and two-way switch 190. *Id.* Switch 190 permits selection of available modes, and thumbwheel 185 may control brightness. *Id.*

2. Independent Claim 9

a. An LED lighting system comprising:

Petitioner argues that Dowling discloses the preamble because "Dowling discloses an LED lighting system." Pet. 16 (citing, e.g., Ex. 1004 $\P\P$ 1–4, 38–55, 61–66; Ex. 1002 \P 31). Patent Owner does not dispute that Dowling discloses the preamble. We agree that Dowling discloses it.

b. [a] a first LED circuit having at least two LEDs

For this limitation, Petitioner relies on Dowling's disclosure of a lighting system that can "drive several LEDs 4 in series," which Petitioner argues "constitute an LED circuit 4 having at least two LEDs." Pet. 17 (citing Ex. 1004, Fig. 1, \P 40; Ex. 1002 \P 34). Patent Owner does not

dispute that Dowling discloses this limitation. We agree that Dowling discloses this limitation.

c. [b] a first switch configured to be controlled by a user to control an amount of voltage or current that flows through the at least two LEDs

Petitioner relies on Dowling's description of Figure 8 for this element. Pet. 18–20. Reproduced below is Figure 8, annotated by Petitioner, showing a light bulb:



Id. at 18. Figure 8 depicts thumbwheel 185, which Petitioner asserts is a dimmer switch. *Id.* (citing Ex. 1004 ¶ 62). Petitioner further contends that thumbwheel 185 is user interface 1 (from Fig. 1, reproduced above), which sends input to processor 2, which in turn directs controller 3, which "regulates the current, voltage and/or power through the LED, in response to signals received from the processor 2." *Id.* at 18–19 (citing Ex. 1004 ¶¶ 38–40, 54, 62). Thus, Petitioner contends, "Dowling discloses to a POSITA that the user can control an amount of voltage or current that flows through all of

the LEDs in light bulb 180, which includes the at least two red LEDs." *Id.* (citing Ex. $1002 \ \ensuremath{\P} 36$).

Patent Owner does not dispute this limitation. We agree that Dowling discloses it.

d. [c] a second switch that allows the first LED circuit to be disconnected from the AC voltage source and a second LED circuit to be connected to an AC voltage source

According to Petitioner, Dowling discloses this limitation by disclosing mode switch 190, which permits a user to select between four different lighting modes (in Figure 8, reproduced above). Pet. 20 (citing Ex. 1004, Fig. 8, \P 62; Ex. 1002 \P 38). In one mode (the third mode), Petitioner argues the LED lighting system can display static red light and then static blue light based on the mode switch. *Id.* at 21 (citing Ex. 1004 $\P\P$ 44–47). In another mode (the fourth mode), the LED lighting system can alternately strobe red and blue light. *Id.* (citing Ex. 1004 \P 47). Petitioner reproduces a portion of Figures 2A and 2B, shown below, which depict these third and fourth modes:



Id. As seen above in the reproduced portions of Figure 2A (left) and 2B (right), program or mode 3 includes changing a static color while the mode button is held down, while program or mode 4 includes strobing different colors. Ex. 1004 ¶¶ 44–47.

Petitioner further contends that "Dowling discloses that red light is generated by connecting red LED circuit 4 to the AC voltage source, and blue light is generated by connecting blue LED circuit 4 to the AC voltage source." Pet. 21 (citing Ex. 1004 ¶¶ 38–43, 63). Therefore, Petitioner contends, "the mode switch 190 allows the first LED circuit (*e.g.*, red LED circuit) to be disconnected from the AC voltage source and a second LED circuit (*e.g.*, blue LED circuit) to be connected to an AC voltage source." *Id.* (citing Ex. 1002 ¶ 39). Petitioner similarly relies on Dowling's three-way color control switch, which "disconnect[s] one color LED circuit and connect[s] another color LED circuit," to teach this limitation. *Id.* at 21–22 (citing Ex. 1004 ¶¶ 65–66; Ex. 1002 ¶ 40).

Patent Owner contends that neither Dowling's mode switch or threeway switch teaches the claimed second switch because they do not "disconnect a first LED circuit and connect a second LED circuit as claimed." PO Resp. 15 (citing Ex. 2007 ¶¶ 76–84). Dowling's "mode switch itself does not make or break a connection between a voltage source and the LED circuits," Patent Owner argues. *Id.* at 16. Rather, Patent Owner contends, "[i]t is the program or lookup table that adjusts the voltage based on the mode selected by the user using the mode switch." *Id.* (citing Ex. 1003 ¶ 64; Ex. 2007 ¶ 80). In other words, as Patent Owner's argument goes, Dowling's mode switch "is merely a means for providing user input to select a mode and does not make or break an electrical connection in the LED circuit from an AC voltage source." *Id.*

Further, in Patent Owner's view, Dowling's mode switch "does not make or break an electrical connection in the LED circuit from an AC voltage source" but rather causes a program or lookup table to "operate[] by

adjusting the input voltage to control the LED brightness." *Id.* at 16–17 (citing Ex. 1003 ¶ 64). And Patent Owner contends, "[a] POSITA would understand that making a connection or disconnection with a switch requires making or breaking an electrical connection such that current cannot flow through the circuit." *Id.* at 17 (citing Ex. 2007 ¶¶ 82–83). Dowling, Patent Owner argues, "merely adjusts the voltage applied to the LEDs (such as by making it low) so that the LED may not illuminate, but the electrical circuit itself remains unbroken." *Id.* at 18 (citing Ex. 1004 ¶ 64).

In Reply, Petitioner characterizes Patent Owner as arguing that Dowling's mode switch does not disclose this limitation for two reasons: "1) the mode switch does not (directly) change the connection and 2) it is not a mechanical switch that creates an air gap." Reply 8 (citing PO Resp 16–18). Petitioner contends that neither argument is commensurate with the scope of claim 9. *Id.* Regarding Patent Owner's first argument, that the mode switch does not directly change the connection, Petitioner asserts that it is premised on Patent Owner's "waived (and incorrect) claim construction that required 'direct' control," and we should reject it for reasons stated in our Institution Decision. *Id.* at 8–9. In Petitioner's view, "[t]here is no dispute that the mode switch in Dowling allows a user to 'indirectly' change the connections to, for example, cause the device to emit blue light or red light." *Id.* at 9 (citing Pet. 20–22, 24).

As for Patent Owner's second argument, that Dowling's mode switch is not a mechanical switch that disconnects by creating an air gap, Petitioner contends that no air gap is required by the claim. *Id.* at 9–10. Petitioner asserts that "[t]here is no dispute that Dowling's mode switch allows a user to electronically disconnect one LED circuit from the AC voltage source

sufficiently to turn it off, and electronically connect another LED circuit to the AC voltage source sufficiently to turn it on." *Id.* at 9 (citing Ex. 1004 ¶¶ 44–47). And Dowling discloses a controller that connects and disconnects LED circuits to the AC voltage source using pulse-width modulation (PWM) to turn those circuits on and off, Petitioner contends. *Id.* (citing Ex. 1004, Figs. 1, 8, ¶¶ 38–43, 63). "As Dr. Neikirk confirmed at his deposition," Petitioner explains, "when a PWM transistor is off, it is off." *Id.* (citing Ex. 2006, 33:17–25; Ex. 1026 ¶¶ 25–27).

Petitioner also addresses a remark made by Mr. Credelle during his deposition, that electrical switches do not sufficiently "disconnect" a circuit because they still have at least some leakage current when off. *Id.* at 3 (citing Ex. 1027, 82:20–84:21). Petitioner asserts that Patent Owner's expert "admits that even mechanical switches with air gaps have some leakage current, but in his opinion that leakage current would be small enough to be considered a 'disconnection.'" *Id.* (citing Ex. 1027, 67:5–69:20). In Petitioner's view, the experts agree that leakage current does not "affect the operation of the circuit." *Id.* (citing Ex. 1027, 67:5–69:20; Ex. 1026 ¶ 10).

In the Sur-reply, Patent Owner asserts that Petitioner mischaracterized its argument "as alleging that the mode switch merely allows a user to select a mode for a program or lookup table to change a connection." Sur-reply 5 (citing Reply 8–9). Patent Owner asserts that "<u>[n]either</u> the mode switch nor a program or lookup table makes or breaks a connection, directly or indirectly, as required by the claims." *Id.* For instance, Patent Owner argues, one mode of operation in Dowling "simply dims the brightness of the LEDs," whereas another "provide[s] a static, i.e., non-changing color." *Id.* (citing Ex. 2004¶46). Neither mode requires connection or

disconnection to a voltage source, Patent Owner argues. *Id.* And Patent Owner adds, "[t]here is no dispute that the circuit in Dowling is never 'broken' or 'open'—rather, the 'off' state merely involves minimal current (i.e., a leakage current) running through the circuit." *Id.* (citing PO Resp. 17–18; Ex. 2007 ¶¶ 82–83; Ex. 2006, 33:17–34:3).

Petitioner's arguments are more persuasive. Dowling discloses mode switch 190, which, among other modes, can "strobe, that is, flash on and off," LEDs in different colors. Ex. 1004 ¶¶ 47, 62. Dr. Neikirk testifies that this strobing action connects a red LED circuit to the AC voltage source, then disconnects it from the AC voltage source and connects a blue LED circuit to the AC voltage source. Ex. 1002 ¶ 39. Dr. Neikirk further testifies that Dowling discloses connecting and disconnecting the LED circuits to the AC voltage source via a controller that utilizes PWM to turn those circuits on and off. Ex. 1026 ¶ 27 (citing Ex. 1004, Figs. 1, 8, ¶¶ 38–43, 63). He further states, "[a]s I confirmed at my deposition, when a PWM transistor is off, it is off." *Id.* (citing Ex. 2006, 33:17–25). Under the correct construction of "disconnected" set forth above, we find this evidence persuasive to show that Dowling discloses this limitation. Significantly, Dowling discloses, and Patent Owner does not dispute,⁸ that LEDs of

⁸ For the first time in the hearing, Patent Owner raised a new argument that "Petitioner [does not] point to any disclosure in Dowling that actually says that a mode turns an LED on and turns another LED circuit off." *E.g.*, Tr. 79:3–9. Relatedly, Patent Owner argues that Dowling's "strobe mode" does not "cause[] some LED circuits to be connected and other LED circuits to be disconnected." *Id.* at 80:21–81:2; *see also id.* at 81:3–83:12 (colloquy with counsel regarding the absence of a "strobe mode" discussion in the PO Response). These arguments came too late, and we do not consider them. *See Dell Inc. v. Acceleron, LLC*, 884 F.3d 1364 (Fed. Cir. 2018) ("Unless it

different colors "flash on and off" in response to user selection of the mode switch, thereby teaching the claimed "second switch that allows the first LED circuit to be disconnected from the AC voltage source and a second LED circuit to be connected to an AC voltage source." Ex. 1004 ¶¶ 47, 62.

Patent Owner's arguments do not undermine Petitioner's persuasive showing. Patent Owner's first argument, that Dowling's "mode switch itself does not make or break a connection between a voltage source and the LED circuits," is unpersuasive. PO Resp. 16 (emphasis added). We agree with Petitioner that this argument attempts to argue that the "second switch" limitation requires "direct" user control as Patent Owner argued preinstitution. Reply 8. But Patent Owner waived its pre-institution claim construction argument that "second switch" requires direct user control, as it did not renew this argument in the Response. See PO Resp. 5-6; Paper 9, 9 ("Patent Owner is cautioned that any arguments not raised in the response may be deemed waived."). For the reasons stated in our Institution Decision and adopted herein, the "second switch" limitation encompasses direct or indirect user control of the switch. See Dec. 11-15. Thus, Patent Owner's contention that the "mode switch *itself* does not make or break a connection between a voltage source and the LED circuits" is unpersuasive. PO Resp. 16.

Patent Owner's second argument, that Dowling's mode switch is not a mechanical switch that disconnects by creating an air gap, is based on a claim construction that we do not adopt. POResp. 16; Sur-reply 5. We

chose to exercise its waiver authority under 37 C.F.R. § 42.5(b), the Board was obligated to dismiss Dell's untimely argument given that the untimely argument in this case was raised for the first time during oral argument.").

determined above that the ordinary meaning of "disconnect" applies, which "encompasses an electrical disconnection sufficient to turn the LED circuit off, including an electronic switch like a transistor to perform the electrical disconnection." As we explained above, that is precisely what Dowling discloses, for example, with its strobe mode that causes LEDs of different colors to "flash on and off." *E.g.*, Ex. 1004, Figs. 1, 8, ¶¶ 38–43, 63. Further, Patent Owner misses the mark by focusing on certain modes of Dowling involving dimming and providing static colors while ignoring Dowling's strobe mode. *See* Sur-reply 5; Pet. 21; *see also supra* n.8 (discussing Patent Owner's new "strobe mode" argument at the oral hearing).⁹

We also find unpersuasive the Sur-reply's argument that "[t]here is no dispute that the circuit in Dowling is never 'broken' or 'open'—rather, the 'off' state merely involves minimal current (i.e., a leakage current) running through the circuit." Sur-reply 5 (citing PO Resp. 17–18; Ex. 2007 ¶¶ 82– 83; Ex. 2006, 33:17–34:3). This argument is an extension of Patent Owner's argument that disconnecting a switch requires creating an air gap, which is based on an incorrect claim construction that we have not adopted. In addition, Patent Owner does not address Petitioner's Reply arguments that Patent Owner's expert "admits that even mechanical switches with air gaps have some leakage current, but in his opinion that leakage current would be

⁹ Patent Owner's Sur-reply argument that Dowling does not disclose the disputed limitation because one mode of operation in Dowling "simply dims the brightness of the LEDs" and another "provide[s] a static, i.e., non-changing color," is also an improper new argument first raised in the Sur-reply. *See* Sur-reply 5 (citing Ex. 2004 ¶ 46). Accordingly, we do not consider these new arguments.

small enough to be considered a 'disconnection,'" and that the experts agree that leakage current does not "affect the operation of the circuit." Reply 3 (citing Ex. 1027, 67:5–69:20; Ex. 1026 ¶ 10). We find that any leakage current in Dowling's switch or LEDs is inapposite to the question of whether the LEDs are turned off, and hence disconnected, because Mr. Credelle conceded that "[t]o a person of skill in the art, . . . it may be that a picoamp of [leakage] current doesn't affect the operation of the circuit. So they would say, okay, it's – for the purposes of this circuit, it's disconnected." Ex. 1027, 67:10–68:7.

Thus, Petitioner persuades us that Dowling discloses this limitation.

e. [d] wherein the first LED circuit provides light of a different level of brightness in response to adjustment of the first switch

Petitioner contends that "Dowling discloses wherein the first LED circuit (e.g., red LED circuit) provides light of a different level of brightness in response to adjustment of the first switch (dimmer switch, either thumbwheel 185 or conventional dimmer)." Pet. 22 (citing Ex. $1002 \P 41$). Patent Owner does not dispute that this limitation is disclosed by Dowling. We agree that Dowling discloses it.

f. [e] wherein the LED lighting system is driven with the AC voltage source.

For this limitation, Petitioner argues that "Dowling discloses wherein the LED lighting system is driven with the AC voltage source (e.g., 110 VAC at 60Hz)." Pet. 22 (citing Ex. 1004, Figs. 1, 8, ¶¶ 34–43, 63–66; Ex. 1002 ¶ 42).

In the Response, Patent Owner argues that although "Dowling's LED lighting system" has a 110 VAC input voltage, "Dowling's LED system

actually uses DC power sources and thus cannot anticipate this limitation." PO Resp. 19 (citing Ex. 2007 ¶¶ 85–90). Patent Owner interprets the claim limitation to require that the '479 patent's LED system is AC-driven for two reasons. *Id.* First, according to Patent Owner, "a stated goal of the invention to replace prior art LED systems driven by DC power inputs with a less expensive LED lighting system that is driven by AC power inputs," and second, all of the LED circuit diagrams in the '479 patent show AC inputs to the LED lighting system. *Id.* (citing Ex. 2007 ¶¶ 55–57). And unlike the '479 patent, Patent Owner argues, "[a] POSITA would understand that, in all embodiments, Dowling's LED system uses as input a regulated pure DC voltage source." *Id.* at 19–21 (citing, e.g., Ex. 2007 ¶ 86–90; Ex. 1009 ¶¶ 58, 63, 70, 80).

Petitioner responds that we should reject Patent Owner's argument "because it conflates 'system' with 'circuit," and there is no requirement that the claimed LED "circuit" be driven by AC. Reply 10–11 (citing PO Resp. 19–21; Ex. 1026 ¶¶ 28–29). Petitioner contends that Patent Owner's argument contradicts the specification and claims, and that Patent Owner's expert even admits that the disclosed LED lighting "system" may be driven by AC while the LEDs within a circuit may be driven with DC:

[T]he '479 patent discloses LED systems driven by AC power sources. All of the LED circuit diagrams, in fact, illustrate AC input to the LED lighting system. In all cases, *the source voltage of the LED system is AC voltage*, although additional components such as bridge rectifiers and/or constant current regulators "CCRs" between the voltage source and the LEDs themselves may rectify and/or condition the AC signal *such that the LEDs may receive* AC, rectified AC, or *DC voltage as direct input*.

Id. at 11 (quoting Ex. 2007 ¶ 55). Petitioner further contends that "[t]he patent itself is replete with examples of systems that rectify AC and use constant current regulators (CCRs) before driving the LED circuits." *Id.* (citing Ex. 1001, 3:20–23, 3:29–35; 4:31–36, 5:33–6:19, 9:9–28, 15:42–51, 19:5–25, 19:48–51, 20:34–35).

Further, Petitioner points to claim 2's identical language, "wherein the LED lighting system is driven with an AC voltage source," and dependent claim 8's further language, "wherein the at least one LED circuit is driven with a constant current or constant voltage DC when connected to an AC power source." Id. at 11–12. In Petitioner's view, "[t]hese claims confirm that an LED lighting 'system' driven by an AC voltage source (as claimed in claims 2 and 9) can contain LED 'circuits' that are driven with DC (as claimed in claim 8)." Id. at 12. And that is precisely what is disclosed in Dowling, according to Petitioner. Id. (citing Ex. 1026 ¶¶ 30–31). Finally, Petitioner contends that Patent Owner's expert testified that he did not consider claims 2 and 8 in forming his opinions and refused to opine on them during his deposition. Id. (citing Ex. 1027, 36:7–17 ("I didn't analyze claim 2 at all because that wasn't part of the case "), 38:16–40:21 ("Q. Do you agree that claim 8 encompasses an LED lighting system driven by an AC voltage source and wherein the LED circuit is driven by DC? A.... I'm not willing to make an opinion and answer your question directly at this time other than what I just said.").

In the Sur-reply, Patent Owner concedes that "[t]here is no dispute that Dowling discloses an AC power source," but argues that Dowling converts that source to regulated pure DC power for driving its lighting system. Sur-reply 7. Patent Owner further argues that the '479 patent's

specification does not exclude the LEDs receiving DC voltage, but the instituted claims "require the lighting system to be driven by AC power such that some circuit elements may potentially receive AC as direct input." *Id.* And Patent Owner contends that "claim 8 merely requires the at least one LED circuit is driven with a constant current or constant voltage DC—claim 8 does not preclude other circuit elements of the lighting system receiv[ing] AC as direct input." *Id.*

Petitioner persuades us that Dowling discloses this limitation. The '479 patent specification discloses two different kinds of LED lighting systems, ones where the LED circuits within the system are powered by AC voltage, and others where the LED circuits are powered by rectified (e.g., DC) voltage. Ex. 1001, 8:50–9:42. Figure 3A, reproduced below, depicts an example of a LED lighting system where the LED circuits are AC powered:



Id. at 9:29–42. In Figure 3A above, lighting device 10' includes circuits 12', 14' that "use direct AC power without the requirement of rectification." *Id.* at 9:32–33. Leads 24', 26' are for connecting device 10' to an AC power

source. *Id.* at 9:1–2, 42–44. In contrast, Figure 2A, reproduced below, depicts LED lighting device 10 including LED circuits 12, 14 powered with rectified (e.g., DC) voltage:



Id. at 9:9–28. In Figure 2A, above, AC power for the device 10 is received on leads 24, 26, but bridge rectifier 28 provides rectified power to each circuit 12, 14. *Id.* at 9:1–2, 9–17.

Thus, Mr. Credelle's admission that "[i]n all cases, the source voltage *of the LED system* is AC voltage, although additional components such as *bridge rectifiers*... between the voltage source and the LEDs themselves may rectify and/or condition the AC signal such that *the LEDs* may receive AC, rectified AC, *or DC voltage* as direct input" is supported. Ex. 2007 ¶ 55 (emphasis added). Mr. Credelle thus distinguished "the LED system," which receives AC voltage, from "the LEDs," which may receive AC, rectified AC, or DC voltage. *Id.* This distinction is shown in Figures 2A and 3B above, where AC voltage is supplied to both systems—lighting device 10 (Figure 2A) and lighting device 10' (Figure 3A)—but rectified voltage is then provided to the internal LED circuits in Figure 2A.

Claim 9 recites "[a]n LED lighting system" which includes "a first LED circuit" and "a second LED circuit," and "wherein the LED lighting

system is driven with the AC voltage source." The plain language of claim 9 thus clarifies that only the recited *system* is required to be driven by AC voltage. The claim does not limit what type of voltage drives the LED circuits, whether AC or DC. Thus, the claim is worded broadly enough to cover LED circuits driven either by AC or DC voltage. This interpretation is confirmed by reviewing claim 2's identical language, "wherein the LED lighting system is driven with an AC voltage source," and dependent claim 8's further language, "wherein the at least one LED circuit is driven with a constant current or constant voltage DC when connected to an AC power source." Ex. 1001, 19:44–45, 20:10–12. Both independent claim 9 and independent claim 2 recite the same limitation requiring the LED lighting system to be driven with an AC voltage source. But claim 8, which depends from claim 2, clarifies that in the '479 patent, although the system may be driven with AC, an "LED circuit" in that system may be "driven with ... constant voltage DC." Id. Mr. Credelle's opinions on this disputed limitation are entitled to little weight because he did not include claims 2 and 8 in his analysis. Ex. 1027, 36:7–17 ("I didn't analyze claim 2 at all because that wasn't part of the case "), 38:16–40:21 ("Q. Do you agree that claim 8 encompasses an LED lighting system driven by an AC voltage source and wherein the LED circuit is driven by DC? A. ... I'm not willing to make an opinion and answer your question directly at this time other than what I just said.").

Petitioner persuasively contends, and Patent Owner does not dispute, that Dowling's LED lighting *system* receives AC voltage. Pet. 22 (citing Ex. 1004, Figs. 1, 8, ¶¶ 34–43, 63–66; Ex. 1002 ¶ 42); PO Resp. 19 ("Dowling states that power is received from an AC power source");

Sur-reply 7 ("There is no dispute that Dowling discloses an AC power source "). For example, Dowling describes a light bulb having "received power . . . in the form of a variable amplitude AC signal." Ex. 1004 ¶ 63. Although Dowling's light bulb also "maintain[s] a constant DC power supply for digital components," the light bulb as a whole—or in other words, Dowling's system—receives, and is therefore driven by, AC power. *Id.*; Ex. 1002 ¶ 42. That is all that is required to meet the disputed limitation, "wherein the LED lighting *system* is driven with the AC voltage source." Thus, Petitioner persuades us that Dowling discloses this limitation.

g. Summary as to Claim 9

Based on the full record, we determine that Petitioner has proven by a preponderance of the evidence that Dowling anticipates claim 9.

3. Dependent Claims 10, 11, 13, 15, and 17

Petitioner contends that dependent claims 10, 11, 13, 15, and 17 are anticipated by Dowling. Pet. 22–24. Petitioner provides a detailed analysis explaining where Dowling discloses the limitations in these dependent claims, which Patent Owner does not contest. *Id.* Based on our review of the entire record, we determine that Petitioner has proven by a preponderance of the evidence that Dowling anticipates claims 10, 11, 13, 15, and 17.

E. Asserted Obviousness over Dowling, Mueller, and Okuno (Ground 2)

Petitioner contends that claims 9–15 and 17 would have been obvious over Dowling, Mueller, and Okuno. Pet. 24–35.

1. Overview of Mueller

Mueller describes LED systems capable of generating light, such as for illumination or display purposes. Ex. 1005, code (57). The LEDs may be controlled by a processor to alter the brightness or color of the generated light by using pulse-width modulated signals. *Id*. The resulting illumination may be controlled by a computer program to provide complex, predesigned patterns of light. *Id*. The LED lighting system can include circuits containing multiple red LEDs, blue LEDs, and green LEDs. *Id*. at 3:15– 3:65.

2. Overview of Okuno

Okuno describes LEDs connected in series to elevate a working voltage, which can be used in a traffic signal or road sign. Ex. 1006, code (57), 3:35–37. A number of series-connected LEDs are also connected in parallel to maintain a display even upon a disconnection accident. *Id.* at code (57). Thus, the LEDs provide a failure-safe colored light display at a low power consumption. *Id.*

3. Independent Claim 9

Petitioner contends that the combination of Dowling, Mueller, and Okuno teaches or suggests the preamble and all limitations of claim 9. Pet. 31–32. For the preamble and each of the claim limitations, Petitioner states that Dowling discloses it for the same reasons stated in ground 1. *Id.* For limitations [a] and [b], Petitioner also contends in the alternative that it would have been obvious to implement each of the red and blue LEDs in Dowling using a plurality of LEDs as disclosed in Mueller and Okuno. *Id.* (citing Ex. 1002 ¶¶ 68, 70).

Petitioner contends that it would have been obvious to combine Dowling, Mueller, and Okuno because they are all analogous art to the '479 patent, directed to the field of LED lighting systems. *Id.* at 26. In addition, Petitioner notes that Dowling incorporates Mueller by reference, and Mueller incorporates Okuno by reference. *Id.* Dowling and Mueller also share two named inventors in common (Mueller and Lys), according to Petitioner. *Id.* Thus, Petitioner contends that "[a] POSITA would have been motivated to implement Dowling's LED circuits using at least two LEDs based on the express teachings in the references." *Id.* at 27. Petitioner further contends:

Implementing the LED circuits with at least two LEDs was a known technique that would have produced predictable results. The concepts taught at length by Okuno (filed in 1979) are fundamental electronic concepts in the field of LED lighting systems and would have been known to a POSITA by the date of invention. It would have been well within the knowledge and skill of a POSITA to implement the LED circuits in that manner, and a[] POSITA would have had a reasonable expectation of success in doing so.

Id. at 27–28 (citing Ex. 1002 ¶ 58).

Patent Owner solely contends that Mueller fails to render obvious LED lighting systems driven by AC power as required by claim 9. PO Resp. 25–26. But this argument is unavailing because, as Patent Owner admits, Petitioner relies on Dowling, not Mueller, for limitation 9(e), "wherein the LED lighting system is driven with the AC voltage source." Pet. 32; PO Resp. 25–26 ("The Petition does not rely on either Mueller or Okuno for this limitation."). We determined above that Dowling discloses this limitation.

Thus, we determine that Petitioner has proven by a preponderance of the evidence that the combination of Dowling, Mueller, and Okuno would have rendered claim 9 obvious.

4. Dependent Claims 10–15 and 17

Petitioner contends that dependent claims 10–15 and 17 are unpatentable as obvious over Dowling, Mueller, and Okuno. Pet. 32–35. Petitioner provides a detailed analysis explaining where Dowling discloses the limitations in these dependent claims, which Patent Owner does not contest, except for claim 14, which we address separately below. *Id.* Based on our review of the entire record, we determine that Petitioner has proven by a preponderance of the evidence that claims 10–13, 15, and 17 are unpatentable as obvious over Dowling, Mueller, and Okuno.

Claim 14 recites, "The lighting system of claim 9 further comprising at least one transformer." Ex. 1001, 20:38–39. Petitioner contends, "Mueller discloses an LED lighting system including at least one transformer with a further reference to Okuno." Pet. 34 (citing Ex. 1005, Fig. 2, 3:66–5:25, 9:23–32; Ex. 1002 ¶ 83). Petitioner further contends that "Okuno discloses an LED lighting system including at least one transformer to step a commercial ac power supply down to a desired voltage." *Id*. (citing Ex. 1006, 2B–2E, 7:1–8:27; Ex. 1002 ¶ 84).

It would have been obvious, Petitioner asserts, "to implement the power conversion circuitry disclosed by Dowling for light bulb 180 using at least one transformer as taught by Mueller and Okuno." *Id.* at 34–35 (citing Pet. §VII.D (Rationale for combining Dowling, Mueller, and Okuno); Ex. 1002 ¶ 85). For example, according to Petitioner, Dowling discloses power conversion circuitry for its light bulb, which converts a 120 volts AC

input to a DC voltage of 5 or 12 volts. *Id.* at 29–30 (citing Ex. 1004 ¶ 58; Ex. 1002 ¶ 62). For these and other reasons, Petitioner contends, "[a] POSITA would have been motivated to use a transformer and bridge rectifier as taught by Mueller and Okuno, and recognized the suitability of those components, for Dowling's power conversion circuity in an Edisonmount lightbulb." *Id.* at 30 (citing Ex. 1004, Fig. 8, ¶¶ 62–63).

Patent Owner contends that "Okuno does not disclose the claimed transformer because the transformer in Okuno is not a component of the LED circuit," and "[a] POSITA would understand that claim 14 requires the transformer to be a component of the lighting system." PO Resp. 23 (citing Ex. 2007 ¶¶ 95–99). Patent Owner reproduces Figure 2B of Okuno, shown below:



Id. at 24. Figure 2B above depicts Okuno's LED circuit. *Id.* Patent Owner asserts that Petitioner's expert conceded that this Figure does not include a transformer as part of the LED circuit. *Id.* (citing Ex. 2006, 56:8–10 ("No,

Figure 2 doesn't show a transformer."); Ex. 2007 ¶ 97). So, Patent Owner contends, Figure 2b "shows that the voltage source of the LED circuit is E_{ac} , which indicates that the transformer is outside of Okuno's LED circuit shown in Fig. 2." *Id.* (citing Ex. 2007 ¶ 97)

The Reply responds that Patent Owner "conflates the claimed 'system' with 'circuit." Reply 12 (citing PO Resp. 23–25). In Petitioner's view, claim 14 requires that the "system," not a "circuit," comprise a transformer. *Id.* Petitioner further explains that the only disclosure of a transformer in the '479 patent is to a "system" that may include "transformers" to drive "multiple devices." *Id.* at 12–13 (citing Ex. 1001, 7:51–55). Thus, Petitioner contends, "even if the transformer in the combination were external to the LED 'circuit' (or even external to the LED 'device' to drive multiple 'devices'), the transformer would still be part of the 'system' as claimed." *Id.* at 13 (citing Ex. 1026¶ 32).

Petitioner also contends that Patent Owner's argument about the placement of the transformer is unavailing "because it would have been obvious in the combination to use an internal transformer in Dowling's LED device." *Id.* That is because Dowling's light bulb receives 110 or 120 volts and internally drops the voltage to 5 or 12 volts. *Id.* (citing Ex. 1004 ¶¶ 58, 63–64; Pet. 28–31). "Thus, in the combination," Petitioner contends, "it would have been obvious for the internal voltage transformation in Dowling to have been performed by a transformer." *Id.* at 14 (citing Ex. 1026 ¶ 33).

The Sur-reply asserts that Petitioner's argument is not commensurate with the scope of claim 14 because the "operative claim element is 'lighting system'—not 'system' alone." Sur-reply 8. Patent Owner further asserts that Okuno discloses a "<u>commercial</u> power supply," and "[n]o reasonable

person of ordinary skill . . . would consider a power plant and a LED circuit to be parts of a single lighting system." *Id.* at 9 (citing Ex. 2007 ¶¶ 96–98). Finally, Patent Owner argues that "[n]othing in Mueller or Okuno suggests a transformer internal to the system," as "Mueller and Okuno instead disclose a transformer for dropping the AC voltage of a *commercial power supply*." *Id*.

We agree with Petitioner that the combination of Dowling, Mueller, and Okuno would have rendered claim 14 obvious. We find persuasive Petitioner's contention that it would have been obvious to implement the power conversion circuitry disclosed by Dowling for light bulb 180 using at least one transformer as taught by Mueller and Okuno. Pet. 34-35 (citing Ex. 1002 \P 85). We agree that Dowling already discloses power conversion circuitry for a light bulb, which converts a 120 volts AC input to a DC voltage of 5 or 12 volts. *Id.* at 29–30 (citing Ex. 1004 ¶ 58; Ex. 1002 ¶ 62). Specifically, Dowling describes a connection 70 for its light bulb that "may include a converter to convert received power to power that is useful," for example, "an AC to DC converter to convert one-hundred twenty Volts at sixty Hertz into a direct current at a voltage of, for example, five Volts or twelve Volts." Ex. 1004 ¶ 58; see also id. ¶ 63 ("A power converter can be used within the light bulb 180 to convert the received power . . . in the form of a variable amplitude AC signal . . . to the requisite power for the control circuitry and the LEDs ").

We also credit Dr. Neikirk's testimony that "a POSITA would have been motivated to investigate the known implementation details in the art regarding how to convert the AC power from a much higher voltage down to an appropriate direct current at a much lower voltage for driving LEDs, and

been led to the teachings of Mueller and Okuno." Ex. 1002 ¶ 62, quoted in Pet. 30. We further credit Dr. Neikirk's testimony that "[a] POSITA would have been motivated to use a transformer and bridge rectifier as taught by Mueller and Okuno, and recognized the suitability of those components, for Dowling's power conversion circuity in an Edison-mount lightbulb." *Id.* ¶ 64 (citing Ex. 1004, Fig. 8, ¶¶ 62–63), *quoted in* Pet. 30. In other words, based on Dowling's teachings of using power conversion circuitry in its light bulb, one of ordinary skill in the art would have looked to Okuno and recognized the suitability of a transformer for use as Dowling's power conversion circuitry. *See id.* ¶¶ 62–64.

We also agree with Petitioner that Patent Owner conflates the claimed "system" with "circuit." Reply 12. Claim 9 recites an "LED lighting system" that includes "a first LED circuit," and claim 14 recites "[t]he lighting system of claim 9 further comprising at least one transformer." Claim 14 does not specify that the transformer is part of any circuit recited in claim 9, but more generally, the transformer is just part of the "lighting system." Thus, Petitioner correctly explains that "even if the transformer in the combination were external to the LED 'circuit' (or even external to the LED 'device' to drive multiple 'devices'), the transformer would still be part of the "system" as claimed." *Id.* at 13 (citing Ex. 1026¶ 32); *see also* Ex. 1001, 7:51–55 ("A lighting system may include multiple such devices, ... including but not limited to ... transformers...."). Accordingly, the placement of the transformer in Okuno is unavailing because claim 14 generically recites a transformer and does not specify the transformer's relationship with the other components in claim 9.

Patent Owner's assertion that Okuno discloses a "commercial power supply," and "[n]o reasonable person of ordinary skill . . . would consider a power plant and a LED circuit to be parts of a single lighting system" again overlooks that claim 14 simply recites no details about the claimed transformer, so whether Okuno's transformer is part of a power plant or not is unpersuasive. Sur-reply 9 (citing Ex. 2007 ¶¶ 96–98). But Patent Owner's implication that the combination would include a power plant in Dowling's lighting system is unsupported, as Okuno simply teaches that "E_{ac} may be a commercial power supply source, or it may be a power supply source obtained by dropping the voltage of the commercial power supply source by a transformer." Ex. 1006, 7:5–7. Not only does Okuno not mention a power plant, but Okuno generically describes the transformer dropping the voltage of a commercial power supply without explaining where the transformer is, how large it is, or anything else about the transformer. Patent Owner's assumption that the transformer is part of a power plant is unsupported-not even Mr. Credelle testifies as such-and is not credible. *Compare* Sur-reply 9, *with* Ex. 2007 ¶¶ 96–98.

Patent Owner's argument regarding the placement of the transformer in Okuno is also unavailing because in the combination, it would have been obvious to use an internal transformer in Dowling's LED device. Ex. 1004 $\P\P$ 58, 63–64; Pet. 28–31; Reply 13. Petitioner persuasively explains that Dowling discloses power conversion circuitry for its light bulb, which converts a 120 volts AC input to a DC voltage of 5 or 12 volts. Pet. 29–30 (citing Ex. 1004 \P 58; Ex. 1002 \P 62). And Petitioner further persuasively explains that "[a] POSITA would have been motivated to use a transformer and bridge rectifier as taught by Mueller and Okuno, and recognized the

suitability of those components, for Dowling's power conversion circuity in an Edison-mount lightbulb." *Id.* at 30 (citing Ex. 1004, Fig. 8, ¶¶ 62–63). We find unpersuasive Patent Owner's assertion that "[n]othing in Mueller or Okuno suggests a transformer internal to the system," as "Mueller and Okuno instead disclose a transformer for dropping the AC voltage of a *commercial power supply*." Sur-reply 9. Patent Owner's assertion that Okuno (and Mueller) does not suggest a transformer internal to the system argues the references individually by overlooking that Petitioner relies on Dowling, not Okuno, for teaching power conversion circuitry internal to a light bulb. Pet. 29–30; *see In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (One cannot show non-obviousness by attacking references individually, where the rejections are based on combinations of references.). Petitioner merely relies on Okuno for the teaching of a transformer. Pet. 29– 30, 34–35. Thus, Patent Owner's argument does not undermine Petitioner's persuasive showing.

Accordingly, Petitioner has shown by a preponderance of the evidence that the combination of Dowling, Mueller, and Okuno would have rendered claim 14 obvious.

F. Asserted Anticipation by Ter Weeme (Ground 3)

Petitioner contends that claims 9–11 and 15–16 are anticipated by Ter Weeme. Pet. 35–44.

1. Overview of Ter Weeme

Ter Weeme discloses using sets of LEDs to resemble incandescent lamp behavior when dimmed. Ex. 1007, code (57). Two different sets of LEDs produce light at different color temperatures. *Id.* The two sets are

connected in series or parallel. *Id.* Figure 1A of Ter Weeme, below, depicts example lighting device 10:



Id. at 5:31. Lighting device 10 has a power cord 11 and plug 12 connected to a wall socket 8, which receives dimmed mains voltage from a dimmer 9 connected to mains. *Id.* at 5:31–33.

2. Independent Claim 9

a. An LED lighting system comprising:

Petitioner argues that Ter Weeme discloses an LED lighting system, and hence, the preamble. Pet. 36 (citing, e.g., Ex. 1007, Title, Abstract, 1:9– 7:10, 10:10–27; Ex. 1002 ¶ 90). Patent Owner does not dispute that Ter Weeme discloses the preamble. We agree that Ter Weeme discloses the preamble.

b. [a] a first LED circuit having at least two LEDs

For this limitation, Petitioner argues that Ter Weeme discloses a first LED circuit (e.g., white LED string 113) having at least two LEDs (e.g., at least two white LEDs). Pet. 37 (citing, e.g., Ex. 1007, 5:30–8:25, 10:10–27; Ex. 1002 ¶ 92). Patent Owner does not dispute that Ter Weeme discloses this limitation. We agree with Petitioner that Ter Weeme discloses it.

c. [b] a first switch configured to be controlled by a user to control an amount of voltage or current that flows through the at least two LEDs

For this limitation, Petitioner points to Ter Weeme's dimmer 9 as the first switch. Pet. 37 (citing, e.g., Ex. 1007, 5:30–8:25, 10:10–27, 16:29–17:12; Ex. 1002 ¶ 93). Petitioner argues that dimmer 9 is connected to mains power, such that power plug and driver 101 of lighting device 10 receives a dimmed mains voltage. *Id.* (citing Ex. 1007, Fig. 1A, 5:31–34). According to Petitioner, driver 101 converts the dimmed mains voltage into a dimmed LED output current with a reduced average current level. *Id.* at 38 (citing Ex. 1007, Fig. 1B, 6:3–14). Thus, Petitioner concludes, the dimmer switch controls the current that flows through the LEDs. *Id.* at 38 (citing Ex. 1002 ¶ 95).

Patent Owner contends that Ter Weeme's "switch 9 does not satisfy the claim requirement for the first switch to be part of the LED lighting system." PO Resp. 27. Patent Owner reproduces an annotated version of Ter Weeme's Figure 1A, shown below:



Id. at 28. Figure 1A above schematically shows lighting device 10 having power cord 11 and power plug 12 connected to wall socket 8, which receives dimed mains voltage from dimmer (switch) 9 connected to mains power. Ex. 1007, 5:31–33. Patent Owner has highlighted switch 9 in red, wall socket 8 in purple, and lighting device 10, power cord 11, and plug 12 in

green. PO Resp. 28. Patent Owner asserts that a "POSITA would not understand switch 9 to be part of Ter Weeme's LED device because switch 9 is connected to wall socket 8, whereas the lighting device is unplugged from the wall socket via power plug 12." *Id.* at 29 (citing Ex. 2007 ¶¶ 102–105).

The Reply asserts that we should reject Patent Owner's argument as "based on an improperly narrow interpretation of LED lighting 'system." Reply 15. Petitioner views the "LED lighting system" in Ter Weeme as including "lighting device 10, its internal circuitry, programming and LED circuits, switch 501, dimmer switch 9, and AC voltage source." *Id.* (citing Pet. 36; Ex. $1002 \P 91$). Petitioner reproduces the following annotated Figure 1 of Ter Weeme:



LED lighting system

Id. Figure 1A above is annotated to show all of the components of Figure 1A (described above) in a single LED lighting system. *Id.*

Petitioner asserts that "LED lighting system" is not limited to a single integrated device because the plain and ordinary meaning of "system" encompasses the combination of multiple physical devices. *Id.* at 16 (citing Ex. 1026 ¶¶ 36–38). The '479 patent specification supports this interpretation, Petitioner argues, because it repeatedly discloses an LED device as one portion of a system, and Patent Owner's argument that a system must be an integrated device would exclude these embodiments. *Id.*

at 16–17 (citing Ex. 1001, 3:62–66 ("[T]he LED lighting device may be integrated into a lighting system, the lighting system having a dimmer switch"), 5:33–34, 15:31–32; 14:7–17). For example, Petitioner explains that Figure 8 discloses an LED lighting system 40 including LED lighting device 10 and a separate and distinct switch 42. *Id.* at 16. Figure 8 is reproduced again below:



Id. Figure 8 above depicts LED lighting device 10, which "may be integrated into a lighting system or fixture 40 having a dimmer switch [D]immer switch 42 may be connected to AC power source 44, which may be, for example, mains power." Ex. 1001, 14:9–13.

Finally, Petitioner also points to the prosecution history of the child patent, U.S. Patent No. 10,757,783 ("the '783 patent"), as confirming that "system" is broader than "device." Reply 17. There, Petitioner argues, "system" claims with a switch were narrowed to instead recite a "device" with a switch, and then were further narrowed to recite that the switch be "integrated into the LED lighting device." *Id.* (citing Ex. 1021, 158–61, 222–23, 288; Ex. 1026¶ 39). According to Petitioner, this amendment was made to overcome "prior art that disclosed an LED lighting device and a wall mounted switch." *Id.* (citing Ex. 1021, 158–61). Thus, Petitioner

argues, the prosecution history shows that "system" claims do not require a switch integrated into an LED lighting device. *Id.* at 17-18.¹⁰

The Sur-reply contends that the claim requires a "lighting system," not "system" alone, and that a "lighting system" must be a discrete system for lighting. Sur-reply 11. "Under Petitioner's erroneous understanding of the claim language," Patent Owner argues, "a switch located in a circuit breaker that supplies power to a user's home would be part of the user's home LED lighting system." *Id.* In Patent Owner's view, "[n]o reasonable person of ordinary skill, however, would consider a circuit breaker panel and a LED circuit to be part of a single lighting system." *Id.* (citing Ex. 2007 ¶ 104). Similarly, Patent Owner contends, "no reasonable person of ordinary skill would consider a building's electrical wiring separated from an LED system by a wall socket to be part of that LED system." *Id.* (citing Ex. 2007 ¶ 104).

The Sur-reply next contends that the '479 patent specification supports Patent Owner's view of the claims. *Id.* at 11–12. For example, Patent Owner argues, while the specification shows dimmer switch 42 and LED lighting device 10 "as separate components," it "still explicitly teaches that the dimmer switch 42 and the lighting device 10 comprise the same lighting system." *Id.* (citing Ex. 1001, 14:7–17). In Patent Owner's view,

¹⁰ Petitioner also raises a new argument that Ter Weeme discloses that the dimmer switch and lighting device 10 may be hardwired together, which we do not consider because it is an improper new Reply argument. Reply 18 (citing Ex. 1007, 4:23–27; Ex. 1026 ¶¶ 40–41); Sur-reply 12–13 (pointing out new Reply argument). The Petition does not rely on Ter Weeme's alleged hardwiring disclosure to teach this limitation but instead relies on Figure 1A's switch 9, which is in the wall socket and not in Ter Weeme's lighting device 10. Pet. 37–39.

the specification provides no suggestion that a building's wiring is also part of that lighting system. *Id.* at 12. Patent Owner also disputes the relevance of the prosecution history in the '783 patent, as the amendments there "clarified that the switch is integrated into the LED lighting device," which is "a different issue than whether the LED lighting system comprises the switch as here." *Id.* In the end, Patent Owner asserts, "Petitioner cannot escape that Ter Weeme shows that its switch is part of the electrical wiring of the building from which the lighting system draws power and not part of the lighting system itself." *Id.*

Turning to our analysis, we start by addressing the interpretation of claim 9's preamble, "[a]n LED lighting system." Both parties brief the meaning of this preamble, but neither party addresses the threshold issue of whether the preamble is limiting. We note that "[g]enerally, a preamble is not limiting." *Summit 6, LLC v. Samsung Elecs. Co.*, 802 F.3d 1283, 1292 (Fed. Cir. 2015). However, among other exceptions to this general rule, our reviewing court has "repeatedly held a preamble limiting when it serves as antecedent basis for a term appearing in the body of a claim." *In re Fought*, 941 F.3d 1175, 1178 (Fed. Cir. 2019) (citations omitted). The body of claim 9 refers back to the preamble by reciting, "wherein the LED lighting system is driven with the AC voltage source." Ex. 1001, 20:25–26. As such, the body of the claim relies on the preamble for antecedent basis support, and we determine that the preamble of claim 9 is limiting.

As for what the preamble encompasses, we agree with Petitioner that an "LED lighting system" is not limited to a single integrated device because the plain and ordinary meaning of "system" encompasses the combination of multiple physical devices. *See* Reply 16 (citing Ex. 1026 ¶¶ 36–38). The

plain language of claim 9 refers broadly to an "LED lighting system" having components such as a first LED circuit, a first switch, and a second switch, without any limitation on where these components are located in relation to each other. For instance, there is no recited circuit board or enclosure that must contain the first LED circuit together with the first switch and second switch. Thus, the plain claim language is not limited to a single integrated device. The first switch simply must "be controlled by a user to control an amount of voltage or current that flows through the at least two LEDs" in the "first LED circuit." Ex. 1001, 20:15–18. By its plain terms, then, the claimed LED lighting system may include a switch placed on a wall and an LED circuit in a separate light fixture, so long as a user can use the wall switch to control an amount of voltage or current flowing through the LEDs in the light fixture.

Nothing in the specification defines "system" restrictively or disavows this broad interpretation. To the contrary, the specification describes LED devices and systems expansively. One passage refers to "[e]xamples of lighting devices" as those including various LED chips, packages, board assemblies, or modules, which "may also include any required power connections or leads or contacts, or drivers, required to provide power to the circuits and allow the circuits within the device to emit light." *Id.* at 7:44–51. The passage goes on to explain that "[a] lighting system may include multiple such devices, and some or all of the required parts to drive such a device or multiple devices, including but not limited to, power supplies, transformers, inverters, rectifiers, sensors or light emitting circuitry discussed herein." *Id.* at 7:51–55. In other words, the disclosed lighting system may include multiple devices, as well as required power supplies and

any required power connections. *Id.* at 7:44–55. These disclosures cut against Patent Owner's assertion that "no reasonable person of ordinary skill would consider a building's electrical wiring separated from an LED system by a wall socket to be part of that LED system." *See* Sur-reply 11 (citing Ex. 2007 ¶ 104).¹¹ The disclosed "*any* required power connections or leads or contacts" and "power supplies" do not exclude electrical wiring from a lighting system. *See* Ex. 1001, 7:44–55.

We now address the parties' dispute about whether an example in the specification limits "LED lighting system." Referring to Figure 8's disclosure of a dimmer switch and LED lighting device, Petitioner argues that these devices are separate and distinct, yet part of an LED lighting system. Reply 16–17 (citing, e.g., Ex. 1001, 14:7–17). For its part, Patent Owner argues that while the specification shows dimmer switch 42 and LED lighting device 10 "as separate components," it "still explicitly teaches that the dimmer switch 42 and the lighting device 10 comprise the same lighting system." Sur-reply 11–12. Petitioner's view is more correct because Figure 8, reproduced again below, schematically depicts the dimmer switch and the lighting device as separate components—which Patent Owner concedes—and not as part of a single enclosure:

¹¹ They also cut against Patent Owner's assertion that "[n]o reasonable person of ordinary skill . . . would consider a circuit breaker panel and a LED circuit to be part of a single lighting system." Sur-reply 11 (citing Ex. 2007 ¶ 104). However, we note that Petitioner is not asserting that Ter Weeme describes a circuit breaker panel. *See* Pet. 37–39.



See id. And although the text accompanying Figure 8 states that LED lighting device 10 "may be integrated into a lighting system or fixture 40 having a dimmer switch," it merely states this "may" be the case and does not *require* the depicted components to be integrated into a single fixture. Ex. 1001, 14:8–10. Thus, this specification example does not limit the claims.

The prosecution history of the child patent, the '783 patent, further supports Petitioner's interpretation. Claim 1 in the '783 patent was amended from reciting "An LED lighting system" to recite, "An LED lighting device ... wherein the at least one LED circuit and the switch are integrated into the LED lighting device." Ex. 1021, 222, 288. In an Office Action Response, Patent Owner distinguished a prior art reference because it "does not disclose a switch integrated with an LED lighting device, but instead discloses a wall mounted dimmer switch." *Id.* at 292. The claims here are broader, generically reciting an LED lighting system and a first switch but not requiring that the first switch is "integrated" with an LED lighting device. Patent Owner's argument here that the amendments "clarified that the switch is integrated into the LED lighting device—a different issue than whether the LED lighting system comprise the switch as here," overlooks the implication of those amendments. Sur-reply 12. The "integrated" amendment language in the child patent to overcome prior art disclosing a

wall-mounted dimmer switch, coupled with a lack of such a limitation here, further suggests that claim 9 encompasses such prior art. *See id.*

As the intrinsic record is clear in this case that "LED lighting system" is not limited in the way Patent Owner proposes, we address the experts' related testimony only briefly. Dr. Neikirk testifies that "[a] POSITA would have understood that the plain and ordinary meaning of a lighting 'system' is broader than 'device,' and encompasses multiple physical devices." Ex. 1026 ¶ 37. Dr. Neikirk supports this testimony with citations to the specification and prosecution history. *Id.* ¶ 38–39. This testimony is credible because it comports with the specification and prosecution history passages we discussed above. Mr. Credelle, on the other hand, does not appear to directly interpret "LED lighting system," but in the context of distinguishing Ter Weeme, testifies that "[a] POSITA would understand that Ter Weeme's entire LED device comprises power plug 12, power cord 11, and lighting device 10 and does not include wall socket 8 or the elements beyond wall socket 8, such as switch 9." Ex. 2007 ¶ 104. "In other words," he continues, "the POSITA would not understand switch 9 to be part of Ter Weeme's LED device because it is attached to wall socket 8, whereas the lighting device is unplugged from the wall socket via power plug 12." Id. ¶ 105. Mr. Credelle's testimony is not credible because it does not address the contrary statements in the specification and prosecution history described above.

We therefore determine that the claimed "LED lighting system" is not limited to a single integrated device but rather encompasses the combination of multiple physical devices.

As to the merits of Petitioner's arguments of anticipation by Ter Weeme, we agree that Ter Weeme discloses this limitation. Petitioner persuasively argues, as supported by the testimony of Dr. Neikirk, that the "LED lighting system" in Ter Weeme includes "lighting device 10, its internal circuitry, programming and LED circuits, switch 501, dimmer switch 9, and AC voltage source." Reply 15 (citing Pet. 36; Ex. 1002 ¶ 91). The following annotated Figure 1 of Ter Weeme depicts these components:



Id. Figure 1A above is annotated by Petitioner to show each of the components of Figure 1A (described above) in a single LED lighting system. *Id.* In other words, Ter Weeme discloses an LED lighting system having all the components of claim 9, including the disputed "first switch" (dimmer 9, which provides a dimmed voltage to lighting device 10). Ex. 1002 ¶¶ 93–96; Ex. 1026 ¶¶ 36–42; Ex. 1007, 5:31–34. In fact, Ter Weeme's system is similar to the prior art system that Patent Owner amended around in the child '783 patent, which Patent Owner characterized as "disclos[ing] a wall mounted dimmer switch." Ex. 1021, 292. As noted above, claim 9 is broader than claim 1 in the '783 patent, as it does not include the "switch integrated with an LED lighting device" limitation presented there to overcome the wall-mounted dimmer prior art. *See id.* Finally, Patent Owner's contrary (and conclusory) assertion that a "POSITA would not

understand switch 9 to be part of Ter Weeme's LED device because switch 9 is connected to wall socket 8, whereas the lighting device is unplugged from the wall socket via power plug 12," is unconvincing because it implicitly relies on a claim construction that we have not adopted. *See* PO Resp. 29 (citing Ex. 2007 ¶¶ 102–105).

We therefore determine that Ter Weeme discloses this limitation.

d. [c] a second switch that allows the first LED circuit to be disconnected from the AC voltage source and a second LED circuit to be connected to an AC voltage source

Petitioner argues that "Ter Weeme discloses a second switch (division circuit 515 with switch 501) that allows a first LED circuit (white LED string 113) to be disconnected from an AC voltage source" and which also allows "a second LED circuit (amber LED string 114) to connect to the AC voltage source." Pet. 39 (citing, e.g., Ex. 1007, 6:15–8:25, 10:10–27; Ex. 1002 ¶ 97). Petitioner relies primarily on annotated Figure 4A, below, which depicts a division circuit 515:



FIG. 4A

Id. at 40 (citing Ex. 1007, 5:10–11). The division circuit 515 is outlined in red by Petitioner and includes switch 501. *Id.* Blocks 113 and 114 each represent an LED string (white 113, amber 114). *Id.* (citing, e.g., Ex. 1007, 10:10–27). Petitioner asserts, "[d]uring time period t1, the white LED string 113 is connected and the amber LED string 114 is disconnected, and during time period t2 the white LED string 113 is disconnected and the amber LED string 114 is disconnected." *Id.*

Patent Owner contends that Ter Weeme's switch 501 does not satisfy the "second switch" limitation because the switch 501 is a "controllable electronic switch" that "is always connected to the power source regardless of whether the switch is turned on or off." PO Resp. 32-33 (citing Ex. 1007, 12; Ex. 2007 ¶¶ 109–110). Patent Owner also asserts that when the switch is in the "off state," it has a "high impedance that minimizes the current flow through the switch but does not break the connection." *Id.* at 33. Thus, in Patent Owner's view, "some current always flows through an electronic switch like controllable switch 501," so it "does not make or break an electr[ical] connection as required under the common understanding of the terms 'switch,' 'connected,' and 'disconnected."" *Id.*

The Reply contends that Patent Owner's argument rests on incorrect interpretations of "switch," "connected," and "disconnected" as excluding electronic switches. Reply 18–19. Petitioner further contends that "[a] POSITA would have understood a switch with a high impedance to be 'off,' and thus the LED circuits to be disconnected from the voltage source." *Id.* at 20 (citing Ex. 1026 ¶¶ 43–45). The Sur-reply responds that "Ter Weeme teaches at most that, in some cases, high impedance in the switch minimizes current flow through the switch, but this does not 'disconnect' the LED

circuit from the AC voltage source as claimed." Sur-reply 14 (citing Ex. 2007, 107–110).

Petitioner persuades us that Ter Weeme discloses this limitation. We agree with Petitioner and Dr. Neikirk that "Ter Weeme discloses a second switch (division circuit 515 with switch 501) that allows a first LED circuit (white LED string 113) to be disconnected from an AC voltage source" and which also allows "a second LED circuit (amber LED string 114) to connect to the AC voltage source." Pet. 39 (citing, e.g., Ex. 1007, 6:15-8:25, 10:10-27; Ex. 1002 ¶ 97). We further agree with Petitioner and Dr. Neikirk that "[a] POSITA would have understood a switch with a high impedance to be 'off,' and thus the LED circuits to be disconnected from the voltage source." Reply 20 (citing Ex. 1026 ¶¶ 43–45). Patent Owner does not dispute that Ter Weeme's switch 501 switches power connections between two LED circuits; rather, Patent Owner disputes that Ter Weeme's switch is ever disconnected. PO Resp. 32–33. But Patent Owner's arguments rely on its proposed constructions of "switch" and "disconnected," which we have not adopted.¹² Under the correct construction of "disconnected," which as we explained above, encompasses an electrical disconnection sufficient to turn the LED circuit off, including an electronic switch like a transistor to perform the electrical disconnection, we agree with Petitioner that Ter Weeme discloses this limitation.

¹² Patent Owner concedes that there is no dispute about whether Ter Weeme's LED string is "connected" to the voltage source. Sur-reply 14.

e. [d] wherein the first LED circuit provides light of a different level of brightness in response to adjustment of the first switch

As noted above for limitation 9[b], Petitioner argues that Ter Weeme includes a dimmer switch, which adjusts the amount of current flowing through Ter Weeme's LED string. Pet. 41. Petitioner contends, "Ter Weeme discloses to a POSITA that the reduction in current causes the LED circuit to provide light of a lower level of brightness by disclosing it results in dimming, a reduced luminous flux, and a reduced 'average light output.'" *Id.* (citing Ex. 1007, 2:5–18, 3:9–4:22, 10:23–27). And Petitioner contends that one of ordinary skill would have understood that dimming means providing a different level of brightness. *Id.* (citing Ex. 1002 ¶ 99).

Patent Owner does not dispute that Ter Weeme discloses this limitation. We agree with Petitioner that Ter Weeme discloses it.

f. [e] wherein the LED lighting system is driven with the AC voltage source.

For this limitation, Petitioner contends that "Ter Weeme discloses wherein the LED lighting system is driven with the AC voltage source (mains M, *e.g.*, 230 VAC at 50 Hz)." Pet. 42 (citing Ex. 1007, 5:30–6:2; Ex. 1002 ¶ 100).

Patent Owner concedes that "Ter Weeme does disclose an AC voltage source as the mains voltage source" but asserts that "Ter Weeme, like Dowling, is also abundantly clear that its LED system is driven by regulated DC power." PO Resp. 29–30 (citing Ex. 2007 ¶¶ 111–14; Ex. 1007, 17:11). "Because Ter Weeme's system uses regulated pure DC voltage," Patent Owner contends, "it does not disclose the limitation of 'the LED lighting

system is driven with the AC voltage source' as recited in claim 9." *Id.* at 31.

In the Reply, Petitioner argues that Patent Owner "repeats the same meritless argument it made against Dowling, by arguing that because Ter Weeme converts AC to DC prior to driving its circuits, its system is not driven by AC as claimed." Reply 18. Petitioner adds, "Ter Weeme's LED lighting 'system' is driven with an AC voltage source as claimed, and Ter Weeme's system converts the AC to DC before driving Ter Weeme's LED 'circuits.'" *Id.* In the Sur-reply, Patent Owner notes that "Petitioner concedes that 'Ter Weeme's system converts the AC to DC *before* driving Ter Weeme's LED circuits.'" Sur-reply 13 (citing Reply 18) (internal quotations omitted). Patent Owner concludes, "[b]ecause Ter Weeme explicitly uses regulated pure DC voltage to drive its lighting system," it does not disclose the disputed limitation. *Id.*

We agree with Petitioner. As Patent Owner concedes, "Ter Weeme does disclose an AC voltage source as the mains voltage source." PO Resp. 29. We also agree with Petitioner that Patent Owner "repeats the same meritless argument it made against Dowling, by arguing that because Ter Weeme converts AC to DC prior to driving its circuits, its system is not driven by AC as claimed." Reply 18. As with Dowling, Ter Weeme's LED lighting system receives AC voltage from an AC mains voltage source. Ex. 1007, 5:30–6:2; Ex. 1002 ¶ 100; *cf.* Ex. 1004 ¶ 63; Ex. 1002 ¶ 42. Although Ter Weeme's LED lighting system converts the AC mains voltage into DC power, the LED lighting system receives, and is therefore driven by, AC power. Ex. 1007, 5:30–6:2; Ex. 1002 ¶ 100. Thus, Petitioner persuades us that Ter Weeme discloses this limitation.

g. Summary as to Claim 9

Based on the full record, we find that Petitioner has shown by a preponderance of the evidence that Ter Weeme anticipates claim 9.

3. Dependent Claims 10, 11, 15, and 16

Petitioner contends that dependent claims 10, 11, 15, and 16 are anticipated by Ter Weeme, and Petitioner provides a detailed explanation of how each of these claims is disclosed by Ter Weeme. Pet. 32–35. Patent Owner does not dispute Petitioner's arguments for these dependent claims. Based on our review of the full record, Petitioner has shown by a preponderance of the evidence that Ter Weeme anticipates claims 10, 11, 15, and 16.

IV. CONCLUSION¹³

Claims	35	Reference(s)/ Basis	Claims	Claims
	U.S.C.		Shown	Not shown
	§		Unpatentable	Unpatentable
9–11, 13, 15, 17	102	Dowling	9–11, 13, 15, 17	
9–15, 17	103(a)	Dowling, Mueller, Okuno	9–15, 17	

In summary:

¹³ 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).

9–11, 15, 16	102	Ter Weeme	9–11, 15, 16	
Overall Outcome			9–17	

V. ORDER

It is, therefore,

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 9–17 of the '479 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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