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Paper 46
Date: March 29, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HOME DEPOT USA, INC.,
Petitioner,

v.

LYNK LABS, INC.,
Patent Owner.

IPR2021-01540
Patent 10,091,842 B2

Before JON B. TORNQUIST, KEVIN C. TROCK, and SCOTT RAEVSKY, *Administrative Patent Judges*.

RAEVSKY, *Administrative Patent Judge*.

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

I. INTRODUCTION

Home Depot USA, Inc. ("Petitioner") filed a Petition (Paper 1, "Pet.") requesting *inter partes* review of claims 33, 34, 38, 39, and 43 of U.S. Patent No. 10,091,842 B2 (Ex. 1001, "the '842 patent"). Lynk Labs, Inc. ("Patent Owner") filed a Preliminary Response (Paper 5). Based on these submissions, we instituted an *inter partes* review of claims 33, 34, 38, 39, and 43 (Paper 9, "Institution Decision" or "Dec."). Subsequent filings include a Patent Owner Response (Paper 19, "PO Resp."), a Petitioner Reply (Paper 32, "Reply"), and a Patent Owner Sur-reply (Paper 36, "Sur-reply"). We held an oral hearing on January 25, 2023, a transcript of which has been 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 33, 34, 38, 39, and 43 are unpatentable.

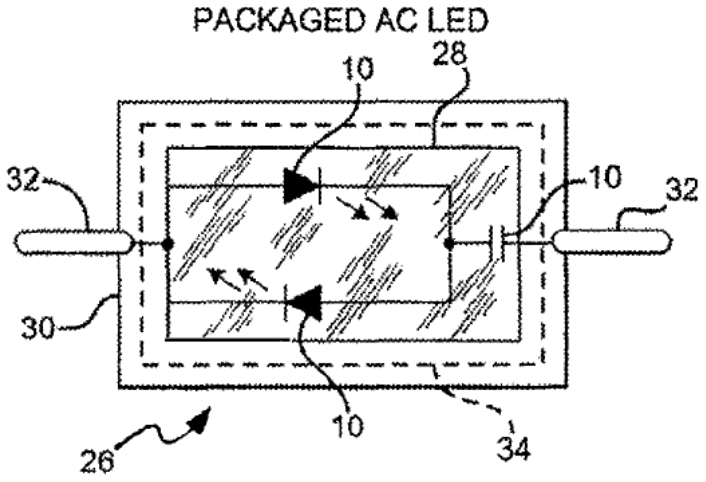
II. BACKGROUND

A. The '842 patent

The '842 patent describes light emitting diodes (LEDs) driven by alternating current (AC). Ex. 1001, code (57). For example, a lighting device as disclosed is capable of operating during both the positive and negative phase of an AC power supply. *Id.* at 11:24–26. In order to accomplish this, an LED circuit may be configured to allow current to pass during both AC phases, or the device may include a bridge rectifier to rectify AC power for use. *Id.* at 11:32–35.

Figure 2, reproduced below, depicts light emitting device 26:

FIG. 2



Id. at 11:58–59. Device 26 in Figure 2 includes light emitting devices 10 mounted on insulating substrate 28, which may be ceramic or sapphire, integrated into LED package 30. *Id.* at 11:60–65. Device 26 includes power connection leads 32 and lens 34, which may be made of a plastic, polymer, or other material used for light dispersion. *Id.* at 11:65–12:1. Lens 34 may be coated or doped with a phosphor or nano-particle that would produce a change in the color or quality of light emitted from device 10 through lens 34. *Id.* at 12:1–4.

B. Challenged Claims

Petitioner challenges claims 33, 34, 38, 39, and 43 of the '842 patent. Claim 33 is illustrative:[1]

> 33. An LED lighting system comprising:
>
> [a] an LED circuit array having a plurality of different LED circuits, each LED circuit having at least one LED;
>
> [b] an LED circuit driver, the LED circuit driver having an input of a first voltage and a first frequency, wherein the first voltage is an AC voltage;

[1] We use Petitioner's element labeling for convenience. *See* Pet. 15–25.

> [c] the LED circuit driver connected to at least one LED circuit of the plurality of different LED circuits and providing an output of a second voltage and a second frequency to the at least one LED circuit, wherein the second voltage is either a rectified DC voltage or a rectified AC voltage and wherein the second frequency of the output is a relatively higher frequency than the first frequency of the input;
>
> [d] at least one LED in the LED circuit array being a different color than other LEDs in the LED circuit array; and
>
> [e] the plurality of different LED circuits capable of being connected to the output of the LED circuit driver in parallel one LED circuit at a time.

Ex. 1001, 21:1–19.

C. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability (Pet. 5):

Claim(s) Challenged	**35 U.S.C. §**[2]	**Reference(s)/Basis**
33, 34, 43	103	Bruning[3]
38, 39	103	Bruning, Butterworth[4]
33	103	Teshima[5]
38	103	Teshima, Butterworth

[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. The '842 patent claims priority to applications reaching back to 2004. Ex. 1001, code (60). Petitioner applies the pre-AIA version of § 103 (Pet. 3). Patent Owner does not dispute that the pre-AIA statute applies. We therefore apply the pre-AIA versions of §§ 102 and 103.
[3] U.S. Publication No. 2002/0070914 A1 to Bruning, published June 13, 2002 (Ex. 1007).
[4] U.S. Patent No. 5,847,507 to Butterworth, issued Dec. 8, 1998 (Ex. 1008).
[5] U.S. Patent No. 4,271,408 to Teshima, issued June 2, 1981 (Ex. 1009).

Claim(s) Challenged	35 U.S.C. §[2]	Reference(s)/Basis
33, 34, 43	103	Teshima, *Signalized Intersection Safety in Europe* ("SISE")[6]
38, 39	103	Teshima, Butterworth, SISE

Petitioner relies on two declarations by Dr. Michael Lebby (Exs. 1002, 1039). Patent Owner relies on a declaration by Dr. Eric Bretschneider (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).

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

[6] U.S. Department of Transportation, Fed. Highway Admin., *Signalized Intersection Safety in Europe*, Report No. FHWA-PL-03-020, report date Dec. 2003 ("*Signalized Intersection Safety in Europe*" or "SISE") (Ex. 1010).

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 and networking systems. An increase in experience could compensate for less education.

Pet. 10–11 (citing Ex. 1002 ¶ 34).

Patent Owner states that it "adopts this definition of level of ordinary skill for purposes of this proceeding only." PO Resp. 5. We are persuaded that Petitioner's proposal is consistent with the problems and solutions in the '842 patent and prior art of record. We adopt Petitioner's definition of the level of skill.

Patent Owner asserts that during Dr. Lebby's deposition, Dr. Lebby took a broader interpretation of the level of ordinary skill because he opined, "I would say the field of invention is definitely electronic circuits and that include[s] optoelectronic devices." *Id.* at 5–7 (citing Ex. 2009, 10:1–5). We disagree because Dr. Lebby refers here to the "field of invention," not the level of ordinary skill in the art. Moreover, Patent Owner does not propose a different level of ordinary skill.

C. Claim Construction

In *inter partes* review, we construe a claim 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).

In our Institution Decision, we construed the term "driver" in claims 33, 38, and 43 to mean "a program, circuitry, or device used to power other programs, circuits, or devices." Dec. 12–15. Post-institution, the parties agree that the meaning of this term is no longer in dispute and need not be construed. PO Resp. 8–9 (Patent Owner applying the Board's construction); Reply 1 ("As the disputes between the parties are not implicated by this construction, the Board should maintain its preliminary construction."). Because the parties have agreed with our preliminary construction, we maintain our preliminary construction of "driver" here.

Patent Owner did not propose any explicit constructions in its Response. PO Resp. 8–9. Addressing what Petitioner asserts are implicit claim construction arguments in the Response, the Reply proposes constructions for "LED circuits capable of being connected," "in parallel one LED circuit at a time," and "at least one of the LEDs . . . being coated." Reply 1–9. The Sur-reply argues that these constructions constitute improper late Reply arguments and also disputes these constructions on the merits. Sur-reply 1–12. We need not decide the first two claim construction disputes because they pertain to the Bruning grounds, which we do not reach for reasons discussed below. We provide our discussion of the scope of "at

least one of the LEDs . . . being coated" below in our analysis of claim 38, the only challenged claim to include this term.

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 Obviousness over Teshima and SISE (Ground 5)

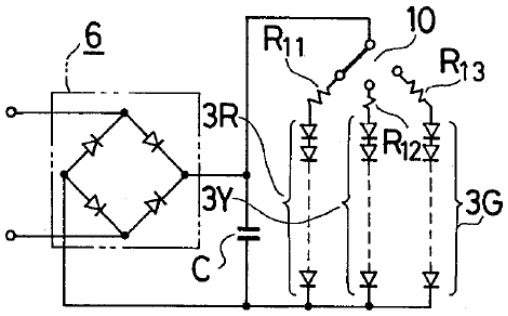
Petitioner contends that claims 33, 34, and 43 would have been obvious over the combination of Teshima and SISE. Pet. 54–59.

We address solely this ground and the next ground (Ground 6) because these two grounds are dispositive of all the challenged claims. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding a petitioner "is entitled to a final written decision addressing all of the claims it has challenged"); *Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. Apr. 30, 2020) (nonprecedential) (recognizing that the "Board need not address issues that are not necessary to the resolution of the proceeding" and, thus, agreeing that the Board has "discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims").

1. *Overview of Teshima*

Teshima describes a colored-light display device using LEDs. Ex. 1009, 1:6–8. Teshima uses red, green, and yellow LEDs that connect to a driver through a three-way switch that allows only one set of LEDs to be connected at a time. *Id.* at 8:39–9:4. Figure 10, reproduced below, shows a circuit diagram for actuating three groups of different color LEDs:

FIG. 10



Id. at 8:39–40. Figure 10 depicts full-wave rectifying circuit 6, selection switch means 10, and three groups of different color LEDs 3R (red), 3Y (yellow), and 3G (green). *Id.* at 8:41–50.

2. *Overview of SISE*

SISE describes recommendations for "improving signalized intersection safety." Ex. 1010, 13. Based on research in various European countries, the document makes five primary recommendations. *Id.* at 17–18. These recommendations include (1) developing a model photo enforcement program to reduce red-light running; (2) enhance dilemma-zone detection at high-speed rural intersections; (3) control vehicle speed through intersections; (4) promote roundabouts as alternatives to signalized intersections in some cases; and (5) develop guidelines for improving pedestrian safety at signalized intersections. *Id.* SISE refers to using LED technology for traffic signals. *Id.* at 28, 44, 52–53, 96.

3. *Independent Claim 33*

Petitioner relies on Teshima for the preamble and limitations [a]–[d] of claim 33, which Patent Owner does not dispute. Pet. 40–46, 57 (citing Ex. 1002 ¶¶ 91–102, 133–137). Based on our review of the full record, we agree that Petitioner persuasively demonstrates that Teshima discloses the

preamble and limitations [a]–[d] of claim 33. *Cf. LG Elecs., Inc. v. Conversant Wireless Licensing S.A.R.L.*, 759 F. App'x 917, 925 (Fed. Cir. 2019) (nonprecedential) ("The Board is not required to address undisputed matters or arguments about limitations with which it was never presented.") (internal quotation omitted).

For limitation [e], "the plurality of different LED circuits capable of being connected to the output of the LED circuit driver in parallel one LED circuit at a time," Petitioner relies on the combination of Teshima and SISE.[7] *Id.* at 58. Petitioner contends,

> For the traffic light to function as required in the UK and Germany, the circuit must be able to sometimes provide power to the yellow (amber) and red lights at the same time (in parallel) and sometimes provide power to only one of them. It would have been obvious to implement Teshima's traffic light so that it will function as required in the UK and Germany.

Id. (citing Ex. 1002 ¶ 138); *see also id.* at 55 (citing Ex. 1010, 36 ("Germany and the United Kingdom use a 'start-up' yellow interval before the beginning of a green indication. This short interval displays the yellow and red indications at the same time to let the motorist know the green phase is coming.")).

Petitioner contends that a "POSITA would have been motivated to modify the switch in the traffic light of Teshima to allow the LED strings to operate in parallel and one-at-a-time, because a POSITA would have known that traffic lights with that functionality were required in the UK and Germany." *Id.* at 55 (citing, e.g., Ex. 1010, 36; Ex. 1002 ¶ 128). Petitioner

[7] Petitioner also relies on Teshima alone for this limitation, but we do not discuss this argument in light of the Teshima and SISE combination being dispositive. *See* Pet. 40–47, 58.

asserts that this modification would have been within the skill of a POSITA due to "Teshima's detailed disclosure and use of common components." *Id.* at 55–56. "Such common components include compound switches," Petitioner argues, which "are available in a number of designs—double pole, double throw, etc." *Id.* at 56 (citing Ex. 1002 ¶ 129). Petitioner further contends that there would have been a reasonable expectation of success in "implementing Teshima as required to function in the UK and Germany" because "a POSITA would have been familiar with the different standard switches available for use in circuits." *Id.* (citing Ex. 1002 ¶ 131). Finally, Petitioner notes that the '842 patent lacks disclosure on how to implement the claim limitation, which is evidence that "such techniques are within the knowledge and skill of a POSITA." *Id.* at 56–57 (citing Ex. 1002 ¶ 132).

Patent Owner raises several arguments. PO Resp. 40–46. We address each in turn.

a. Whether SISE discloses limitation 33[e]

First, Patent Owner contends that SISE does not disclose limitation 33[e]. PO Resp. 40–41. Patent Owner asserts that SISE does not disclose LED circuit design and at most discloses "that red and yellow lights may be turned on at the same time in traffic lights in Germany and the United Kingdom." *Id.* at 40. Along those lines, Patent Owner contends that SISE contains "nothing . . . about whether the red and yellow circuits are connected to the same driver or different drivers," or that the yellow and red lights are connected in parallel one LED circuit at a time. *Id.* Because "the red and yellow lights of SISE could be parts of different circuits, or arranged in series," Patent Owner contends, SISE does not disclose this limitation. *Id.* at 41.

The Reply asserts that Patent Owner misunderstands the combination. Reply 24. Petitioner explains that "SISE states that an LED traffic light is required to sometimes provide power to the yellow (amber) and red lights at the same time (in parallel) and sometimes provide power to only one of them." *Id.* (citing Pet. 54–58). Petitioner further explains, "[a] POSITA would have been motivated to modify the LED traffic light of Teshima such that it would function as required in those countries." *Id.* As for Patent Owner's assertion that SISE does not address LED circuit design, Petitioner responds that SISE is analogous art. *Id.* We discuss the parties' analogous art arguments in the next section below.

The Sur-reply reiterates that "nothing in SISE discloses whether the red and yellow lights are connected in parallel with one another." Sur-reply 23. Patent Owner further asserts that the Reply overlooks that "nothing in SISE discusses connecting LEDs in parallel or that two LEDs can both be on at the same time without being connected in parallel." *Id.* at 24.

Petitioner has the better argument because Patent Owner indeed misunderstands, or simply misstates, the combination. For instance, Patent Owner's assertion that SISE does not disclose LED circuits overlooks that Petitioner relies on Teshima for teachings of an LED circuit. *See* PO Resp. 40; Pet. 40–46, 57–58. Similarly, Patent Owner's assertion that SISE lacks a parallel connection overlooks that Petitioner relies on the combination of Teshima, SISE, and the knowledge of a skilled artisan for a parallel connection. PO Resp. 40; Pet. 40–46, 55–58. Petitioner explains that a POSITA would have modified Teshima's circuit to allow LED strings to operate in parallel and one-at-a-time (1) based on SISE's disclosure that

"in the UK and Germany, the circuit must be able to sometimes provide power to the yellow (amber) and red lights at the same time (in parallel) and sometimes provide power to only one of them" (Pet. 58); and (2) using a POSITA's knowledge of compound switches, such as double pole or double throw switches (Pet. 56), to modify Teshima to operate SISE's yellow and red lights. *See* Ex. 1002 ¶ 129. Patent Owner does not dispute that compound switches were well known in the art. *See* PO Resp. 40–41; *see also Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1337 (Fed. Cir. 2020) ("[T]he obviousness 'analysis *requires* an assessment of the . . . background knowledge possessed by a person having ordinary skill in the art.'" (quoting *KSR*, 550 U.S. at 401)) (internal quotations modified).

Thus, Patent Owner's arguments lack merit because they attack the disclosures of the references individually. A finding of obviousness, however, cannot be overcome "by attacking references individually where the [ground] is based upon the teachings of a combination of references." *See Bradium Techs. LLC v. Iancu*, 923 F.3d 1032, 1050 (Fed. Cir. 2019) (quoting *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986)).

b. Whether SISE is analogous art to the '842 patent

Patent Owner contends that SISE is not analogous art to the '842 patent because it is neither in the same field of endeavor nor reasonably pertinent to the particular problem with which the inventor was involved. PO Resp. 42–44 (citing *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004)). According to Patent Owner, the field of endeavor is "LED lighting systems and specifically circuits for driving LED lighting systems," not "traffic intersection safety (as in SISE)." *Id.* SISE mentions LEDs but nothing about circuit design, Patent Owner contends. *Id.* And nothing in the '842

patent indicates a focus on traffic lights, according to Patent Owner. *Id.* at 42–43. Patent Owner also argues that SISE is not reasonably pertinent to the problem addressed by the '842 patent because it is directed to European intersection safety, not "more efficiently driving LED circuits" as in the '842 patent. *Id.* at 43 (citing Ex. 1001, 1:40–42).

Petitioner responds that SISE is both in the field of endeavor and reasonably pertinent to the problem the '842 patent attempts to solve. Reply 20–22. The field of endeavor is "LED lighting systems," Petitioner asserts, which SISE falls in because it "expressly discusses LED traffic lights" and because Patent Owner "points to nothing in the '842 patent that forecloses LED traffic lights from its field." *Id.* at 20 (citing Ex. 1038, 117:10–13; PO Resp. 39). SISE is also reasonably pertinent to the problem, Petitioner contends, because "it discusses an AC lighting system that **requires** two LED traffic lights to sometimes be on at the same time." *Id.* at 21–22 (citing Ex. 1039 ¶¶ 38–41). Petitioner also asserts that although Patent Owner claims that the problem is "more efficiently driving LED circuits," "none of the claims address any problems related to driving LEDs at any level of efficiency." *Id.* at 21 (citing PO Resp. 43).

In its Sur-reply, Patent Owner contends that SISE's field of endeavor is "signalized intersection safety," not "LED lighting system design." Sur-reply 24–25 (citing Ex. 1010, 1, 3, 75–94). Patent Owner argues that Petitioner's interpretation of the field of endeavor is so broad that "every document mentioning LEDs would qualify." *Id.* at 25. Patent Owner also takes issue with Petitioner's "reasonably pertinent to the problem" analysis, asserting that "Petitioner does not identify what it believes the problem being solved in the '842 patent is." *Id.*

We agree with Petitioner that SISE is analogous art to the '842 patent. The field of endeavor of the '842 patent is LED lighting systems. The '842 patent explains that "LED based lighting may be used for general lighting, specialty lighting, signs, and decoration such as for Christmas tree lighting." Ex. 1001, 1:66–2:2; *see also id.* at code (54) ("AC Light Emitting Diode and AC LED Drive Methods and Apparatus"). This is a broad field of endeavor, and we discern no relevant distinction between LED lighting systems that are used to illuminate an area or object and those used to signal information, such as traffic signals. Further, Patent Owner's arguments here are inconsistent with its arguments in a related proceeding, IPR2021-01369. There, Patent Owner argued that the field of endeavor in a continuation patent of the '842 patent was "LED lighting systems." *Home Depot USA, Inc. v. Lynk Labs, Inc.*, IPR2021-01369, Paper 45 at 17 (PTAB Feb. 14, 2023). Here, Patent Owner contends that the '842 patent's field of endeavor is "LED lighting systems and specifically circuits for driving LED lighting systems." PO Resp. 42. As both patents share a common specification and Patent Owner does not explain why it proposes a different field of endeavor, we determine that the field of endeavor here is also "LED lighting systems."

SISE also refers to LED lighting systems, including, for example (emphasis added):

> *LED signals* are used in the Netherlands, and a special code of practice addresses lamp monitoring and gradual failure. The Dutch have found that *LED lights* have a significant positive impact on signal visibility. Ex. 1010, 44.
>
> Stockholm recently converted all of its signals (more than 10,500 heads and 27,000 lenses) to *LED*. . . . The conversion to *LED*, driven by the need to conserve energy, cost the equivalent of U.S. $5.3 million (almost all paid by the

> national government) and is estimated to save about U.S. $870,000 a year in energy costs. *Id.* at 52–53.
>
> To minimize the likelihood of nonmotorized traffic crossing against the red phase, the Dutch have implemented several strategies: . . . *LED lights in the pavement*[.] *Id.* at 67.
>
> Several ongoing research projects involve the use of video detection to identify waiting pedestrians or bicyclists and *LED countdown sensors* in the pavement. *Id.* at 96.

Thus, we determine that SISE is in the same field of endeavor as the '842 patent. *See Wyers v. Master Lock Co.*, 616 F.3d 1231, 1238 (Fed. Cir. 2010) (explaining that the scope of analogous art must be construed "broadly"). As we determine that SISE is in the same field of endeavor as the '842 patent, we need not address whether SISE is reasonably pertinent to the problem facing the inventors of the '842 patent. *See Bigio*, 381 F.3d at 1325.

Patent Owner's counter-arguments are not persuasive. Patent Owner contends that "nothing in the '842 Patent indicates a focus on traffic lights" yet also concedes that "traffic lights are one potential application of LEDs." PO Resp. 42–43. Patent Owner's argument overlooks that the '842 patent need not indicate a *focus* on traffic lights because it describes broad applicability to "general lighting" and "specialty lighting," which encompasses LED traffic lights. Ex. 1001, 1:66–2:2. Patent Owner further concedes that "SISE does mention LEDs in certain sections" but goes on to argue that "the[] type of bulb used in SISE is incidental to the primary issue of traffic safety." PO Resp. 42. Patent Owner cites to no authority that a reference must contain more than an "incidental" description to be part of the field of endeavor. *See Wyers*, 616 F.3d at 1238 (the scope of analogous art must be construed "broadly"). SISE describes LED traffic lights, which

again, are LED lighting systems. Further, it is of no import that SISE does not disclose "the design and/or development of LEDs and circuits in the context of lighting control and networking systems." *See* PO Resp. 42. The field is LED lighting systems, not "LED lighting systems and specifically circuits for driving LED lighting systems" as Patent Owner contends. *Id.*

Finally, we question Patent Owner's assertion that "[u]nder Petitioner's incredibly broad interpretation of the field of endeavor, every document mentioning LEDs would qualify as within the same field of endeavor as the '842 Patent." Sur-reply 25. The Federal Circuit has explained that "[t]he Supreme Court's decision in [*KSR*] directs us to construe the scope of analogous art *broadly*, stating that '*familiar items may have obvious uses beyond their primary purposes*, and a person of ordinary skill often will be able to fit the teachings of multiple patents together like pieces of a puzzle.'" *Wyers*, 616 F.3d at 1238 (citing *KSR*, 550 U.S. at 402) (emphasis changed). Following that instruction, we find that the field of endeavor of LED lighting systems broadly encompasses the LED traffic signal technology disclosed in SISE.

c. Whether a POSITA would have relied on SISE

Patent Owner contends that a POSITA would not have relied on SISE. PO Resp. 44–45. In particular, Patent Owner contends, "A POSITA with 'two years of relevant experience in the field of design and/or development of LEDs and circuits in the context of lighting control and networking systems' . . . does not necessarily have a background with traffic lights and would not have an understanding of the traffic signal requirements in the UK and Germany." *Id.* at 44 (citing Ex. 2007 ¶ 122; Ex. 2009, 39:6–13).

In its Reply, Petitioner asserts that Patent Owner mischaracterizes the combination in the Petition because "a POSITA would have been motivated to modify Teshima to function as required in the UK and Germany," and Petitioner relies on SISE "as evidence of a POSITA's knowledge regarding the required functionality from an analogous document." Reply 22. The Sur-reply asserts that SISE is "a document directed to traffic engineers, not POSITAs in the field of LED lighting design." Sur-reply 26.

Patent Owner's argument merely recasts its nonanalogous art argument. They are one and the same. "The person of ordinary skill is a hypothetical person who is presumed to be aware of all the pertinent prior art." *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986). Said another way, "[t]he scope of the prior art includes all analogous art." *Donner Tech., LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1359 (Fed. Cir. 2020). As we explain above, SISE is analogous art to the '842 patent. Thus, Petitioner permissibly relies on SISE "as evidence of a POSITA's knowledge regarding the required functionality from an analogous document." Reply 22.[8]

d. Whether SISE teaches away from implementing yellow and red indicators at the same time

Patent Owner also contends that "SISE teaches away from implementing the portion relied upon by Petitioner[]." PO Resp. 45. This is because, Patent Owner argues, "SISE specifically teaches that techniques such as displaying 'the yellow and red indicators at the same time' are 'a

[8] The parties also address the pertinence of Ex. 1011. Reply 22; Sur-reply 26. We do not rely on this reference, so we need not address the parties' arguments concerning it.

significant difference from U.S. practice' and 'cannot be directly transferred to the United States.'" *Id.* (citing Ex. 1010, 36).

Petitioner responds that Patent Owner's argument limiting a POSITA to "U.S. practice . . . is contrary to established patent law doctrine that a POSITA is presumed to know ***all*** the pertinent prior art, including U.S.-based printed publications about European devices." Reply 23 (citing *In re Carlson*, 983 F.2d 1032, 1038–39 (Fed. Cir. 1992)). In the Sur-reply, Patent Owner asserts that "SISE's purpose is to provide 'recommendations for U.S. implementation' of various traffic safety practices in Europe." Sur-reply 27. But SISE recommends against doing so, Patent Owner argues, and therefore teaches away. *Id.*

We agree with Petitioner that "a POSITA is presumed to know ***all*** the pertinent prior art." Reply 23; *Carlson*, 983 F.2d at 1038 ("To determine patentability, a hypothetical person is presumed to know all the pertinent prior art, whether or not the applicant is actually aware of its existence."); *Custom Accessories*, 807 F.2d at 962. Even if Patent Owner were correct that SISE explains that displaying yellow and red indicators at the same time "cannot be directly transferred to the United States," this is irrelevant to the question of whether SISE teaches away from combining with Teshima. *See* PO Resp. 45. There is no reason in the record why one of ordinary skill in the art could not have combined Teshima in Germany or the UK, using the teachings of SISE. And there is no requirement that prior art must be implemented on U.S. soil to render a claim obvious. To the contrary, the applicable statutes governing what constitutes prior art here explicitly refer to the applicability of prior art in foreign countries. *See, e.g.*, 35 U.S.C. § 102(a) ("in this or a foreign country"), § 102(b) ("in this or a foreign

country"); *see also* Pet. 4 (asserting Teshima is prior art under, e.g., §§ 102(a), (b) and SISE is prior art under § 102(a)).

e. Whether Petitioner relies on hindsight bias

Finally, Patent Owner argues that Dr. Lebby's testimony shows hindsight bias. PO Resp. 45–46. Dr. Lebby stated the following:

> I don't believe SISE talks about electronic circuits. But what we're talking about here is a person of ordinary skill in the art that ***was looking at invalidating Claim 33*** using Teshima would have at their fingertips enough electronics core competence to be familiar with simple switches and compound switches that could implement that circuit in Teshima in Figure 10 to be applicable for road safety in the UK and Germany.

Id. (citing Ex. 2009, 119:9–17). Patent Owner asserts hindsight bias because "[a] POSITA here is interested in solving the problem of more efficiently driving LED circuits, not in invalidating claim 33 or improving road safety in the UK and Germany." *Id.* at 46.

The Reply responds that it and its expert "applied the proper obviousness tests in combining Teshima and SISE." Reply 24. In response, Patent Owner asserts that "Dr. Lebby's admission is a textbook example of hindsight bias using the claims of the '842 Patent as a guide." Sur-reply 28.

We agree with Petitioner that it and its expert applied the proper obviousness tests in combining Teshima and SISE. Although the above testimony by Dr. Lebby is inartfully worded, we weigh this quotation against his testimony as a whole and the other evidence of record, including the teachings of the references. We also recognize that Dr. Lebby is not a lawyer. Taken all together, the evidence of record does not support a finding that Petitioner or its expert improperly relied on hindsight bias.

f. Summary as to claim 33

We therefore determine that Petitioner has shown that the combination of Teshima and SISE teaches or suggests every limitation of claim 33 and that Petitioner articulates a rational basis, supported by evidence, as to why Teshima and SISE would have been combined, in light of the knowledge of one of ordinary skill in the art, to arrive at the subject matter of claim 33, with a reasonable expectation of success.

4. *Dependent Claim 34*

Petitioner contends that dependent claim 34 would have been obvious over the combination of Teshima and SISE. Pet. 58–59. Petitioner's arguments are supported by reasoned analysis and evidence, which Patent Owner does not dispute. We determine that Petitioner has shown by a preponderance of the evidence that claim 34 would have been obvious over the combination of Teshima and SISE.

5. *Independent Claim 43*

Petitioner contends that the combination of Teshima and SISE would have rendered obvious independent claim 43 for similar reasons as for claim 33. Pet. 59. Patent Owner relies on the same arguments for this claim as claim 33, with which we disagree for reasons stated above. PO Resp. 41. We determine that Petitioner has proven by a preponderance of the evidence that claim 43 would have been obvious over the combination of Teshima and SISE for similar reasons as with claim 33.

E. Asserted Obviousness over Teshima, Butterworth, and SISE (Ground 6)

Petitioner contends that the combination of Teshima, Butterworth, and SISE would have rendered obvious independent claim 38 and dependent claim 39. Pet. 59–62; *see also id.* at 30–39 (Ground 2 over Butterworth).

1. *Overview of Butterworth*

Butterworth is titled "Fluorescent Dye Added to Epoxy of Light Emitting Diode Lens" and discloses methods of tailoring the color of light emitted from an LED "through selection of the number and types of fluorescent dyes added to the lens, and through their relative concentrations." Ex. 1008, codes (54), (57).

Butterworth notes that it was known in the art that LEDs could be doped to shift the color of emitted light. *Id.* at 4:34–37. For example, "[a] red LED can be shifted to green by doping the die." *Id.* at 4:36–37. Butterworth explains, however, that the efficiency and consistency of the light emitted from the LED can be improved by using epoxy lenses containing a fluorescent dye to shift the color of emitted light. *Id.* at 2:60–61, 4:40–43.

In one embodiment of Butterworth, a "lens containing a fluorescent dye is over molded to a short wavelength (e.g., blue) light emitting die placed within a reflector cup. The fluorescent dye absorbs at least a portion of the light emitted by the diode and re-emits light of a second, longer wavelength." *Id.* at 2:8–12. Butterworth explains that by selecting the number and types of fluorescent dyes, the color of the light emitted from the lens may be readily and consistently tailored. *Id.* at 2:17–20.

2. *Independent Claim 38*

Petitioner relies on Teshima for the preamble and limitations [a]–[c] of claim 38 for similar reasons as the corresponding recitations of claim 33, which Patent Owner does not dispute. Pet. 60–61 (citing Ex. 1002 ¶¶ 149–152). Based on our review of the full record, we agree that Petitioner persuasively demonstrates that Teshima discloses the preamble and limitations [a]–[c] of claim 38. Petitioner relies on Teshima and SISE for limitation 38[f] for similar reasons as the corresponding limitation of claim 33. *Id.* at 61 (citing Ex. 1002 ¶ 156). Patent Owner also relies on its arguments for claim 33 for these limitations, with which we disagree for the reasons stated above. PO Resp. 46.

For limitations 38[d] and [e], Petitioner relies on Teshima in view of Butterworth, citing to its earlier discussion of Butterworth in Ground 2. Pet. 61, 30–39. We did not address Ground 2 above, so we address the parties' arguments over Butterworth here now. Limitation 38[d] recites, "at least one of the LEDs in the LED circuit array being coated or doped with at least one of a phosphor, nano-crystals, or a light changing or enhancing substance." Ex. 1001, 22:6–9. Limitation 38[e] recites, "at least one of the coated or doped LEDs in the LED circuit array producing a different color of light than another coated or doped LED in the LED circuit array." *Id.* at 22:10–12.

Petitioner argues that Butterworth discloses these limitations by teaching an LED having a dyed epoxy lens that changes blue LED light to a different color (red or green) and focuses it. Pet. 36–38 (citing Ex. 1008, Fig. 2, 2:6–4:2; Ex. 1002 ¶¶ 83–87). Petitioner relies on Figure 2 of Butterworth, reproduced below:

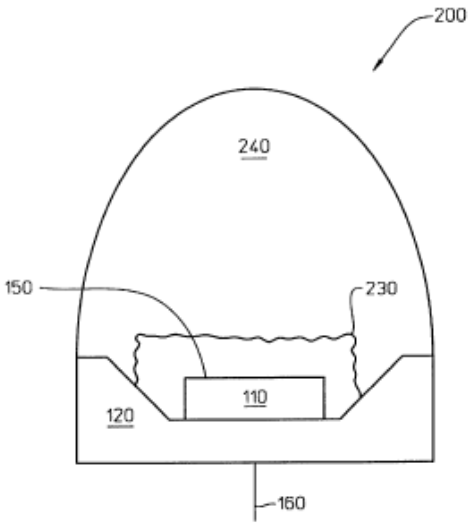


Figure 2

Id. at 37. According to Petitioner, Figure 2 above depicts a blue LED 110 that is over-molded (i.e., coated) with epoxy lens 240 containing a fluorescent dye. *Id.* (citing Ex. 1008, Fig. 2, 2:6–16, 2:55–65). Petitioner sets forth a detailed rationale for combining Teshima, Butterworth, and SISE, which Patent Owner does not dispute (apart from disputing the combination of Teshima and SISE, which we have already addressed above). *Id.* at 48–51, 60.

Patent Owner contends that Butterworth fails to disclose limitations 38[d] and [e] "because Butterworth does not teach coating or doping LEDs 'with at least one of a phosphor, nano-crystals, or a light changing or enhancing substance.'" PO Resp. 27–29. Patent Owner argues that Butterworth dyes a lens on an LED, which is not a coating. *Id.* at 27 (citing Ex. 2007 ¶ 79). Patent Owner further argues that the over-molding process of Butterworth is "different than coating an LED, which is applying a *thin*

layer of material such as phosphor or nano-crystals over the LED." *Id.* (citing Ex. 2007 ¶ 80) (emphasis added).[9]

In its Reply, Petitioner asserts that it did not argue that "dyeing is coating," but rather that "Butterworth discloses that a blue (Gallium Nitride) LED is ***overmolded,* i.e., *coated, with an epoxy lens 240*** containing fluorescent dye." Reply 14 (citing Pet. 37). Petitioner further argues that the only support provided for Patent Owner's position that a coating must be a "thin layer" is the testimony of Dr. Bretschneider, but he could not explain during cross-examination what he meant by a "thin layer" or explain how one of ordinary skill in the art would determine whether a coating was thin. *Id.* at 7 (citing Ex. 1038, 129:16–131:13, 131:15–134:13, 135:20–138:5). Petitioner also views "thin layer" as being indefinite. *Id.*

Petitioner further argues that examination of the prior art demonstrates that a "coated LED" encompasses coatings of various thicknesses, including the epoxy molded lenses disclosed in Butterworth. *Id.* at 8. In support of this argument, Petitioner notes that Okuno (Ex. 1029) explicitly discloses that LEDs may be "coated" with an epoxy resin, and that Leung (Ex. 1037) discloses "conventional" ways to coat an LED with epoxy molded lenses. *Id.* (citing Ex. 1029, Fig. 6D, 17:21–30, 19:5–7; Ex. 1037, Figs. 1, 2, 5, 7, ¶¶ 8–11, 42–115, 124–126).

In its Sur-Reply, Patent Owner argues that its expert relied on a common dictionary definition of the term "coating." Sur-reply 7–8 (citing

[9] Patent Owner also disputes that Butterworth teaches doping an LED. PO Resp. 28–29. We need not address this argument because claim 38 requires at least one of the LEDs to be "coated *or* doped," and for reasons stated below, we agree with Petitioner that Butterworth teaches coating at least one LED.

Ex. 2007 ¶ 79 ("Coating an LED is adding a thin layer or covering to something." (citing Ex. 2018 [Lexico]). Patent Owner further contends that "thin" is not inherently indefinite and that its expert explained that Butterworth's "lens must necessarily be thick." *Id.* at 8 (citing Ex. 2007 ¶¶ 81–82). Patent Owner further argues that neither Okuno nor Leung is used in any ground in the Petition. *Id.* at 9. Patent Owner concedes that Okuno uses the term "coating . . . to indicate that epoxy resin can be used to coat an LED" but disputes that it uses overmolding to refer to coating. *Id.* at 11 (citing Ex. 1029, 19:5–7). As for Leung, Patent Owner asserts that "much of the material in Leung is cut away to result in LEDs with a relatively thin coating." *Id.* at 11–12 (citing, e.g., Ex. 1037 ¶ 126).

We find Petitioner's arguments more persuasive. As a threshold matter, we disagree with Patent Owner that "coated" requires a "thin layer." We note that Patent Owner did not construe "coated" in its Patent Owner Response, relying only on a single citation to its expert declaration for the proposition that "coated" refers to a "thin layer." PO Resp. 27 (citing Ex. 2007 ¶ 80). There, Dr. Bretschneider merely cites a dictionary definition without analysis or discussion in support of his testimony that "[c]oating an LED is adding a thin layer or covering to something." Ex. 2007 ¶ 79. When questioned about this, he testified, "I didn't equate that [statement in the declaration] to an opinion equivalent to claim construction." Ex. 1038, 132:2–14. Patent Owner also does not discuss the intrinsic record in support of its implicit claim construction position. Based on our review of the intrinsic record, we can find no special definition or disavowal associated with the term "coated." We also find Patent Owner's dictionary definition unhelpful, as the meaning of "thin" layer is unclear. *See* Ex. 2007 ¶ 79.

Moreover, Leung refers to "coating an LED with a phosphor layer" and that "it is often difficult to control the phosphor layer's geometry and thickness," which undercuts Patent Owner's position that a coated layer must be thin. *See* Ex. 1037 ¶ 8.

Petitioner presents persuasive evidence that coating of LEDs with epoxy resin was known in the art, as was using this epoxy resin to both protect the LEDs as a coating and serve as a lens. For example, Okuno describes LEDs that are "coated" with an epoxy resin, and discloses molding a transparent epoxy resin over LEDs and projecting the front surface of this mold to serve as a lens. Ex. 1029, 17:21–30, 19:5–7. Likewise, Leung discloses "coating" an LED with a phosphor-containing epoxy layer. Ex. 1037 ¶ 8 ("One conventional method for coating an LED with a phosphor layer utilizes a syringe or nozzle for injecting a phosphor containing epoxy over the LED.").

Patent Owner's assertion that neither Okuno nor Leung is used in any ground in the Petition is irrelevant, as we must consider evidence of the general knowledge of a skilled artisan. *See Philips*, 948 F.3d at 1338. Petitioner's presentation of Okuno and Leung is also responsive to Patent Owner's coated argument in the Patent Owner Response. *See* 37 C.F.R. § 42.23(b). Patent Owner overlooks that "the petitioner in an inter partes review proceeding may introduce new evidence after the petition stage if the evidence is a legitimate reply to evidence introduced by the patent owner, or if it is used 'to document the knowledge that skilled artisans would bring to bear in reading the prior art identified as producing obviousness.'" *Anacor Pharm., Inc. v. Iancu*, 889 F.3d 1372, 1380–81 (Fed. Cir. 2018) (quoting *Genzyme Therapeutic Prods. Ltd. Partnership v. Biomarin Pharm. Inc.*, 825

F.3d 1360, 1369 (Fed. Cir. 2016)). Okuno and Leung legitimately reply to evidence introduced by Patent Owner in the form of its expert testimony (e.g., Ex. 2007 ¶¶ 79–80) and persuasively document the knowledge that skilled artisans would bring to bear in reading Butterworth.

We also disagree with Patent Owner that Okuno's overmolding does not refer to a coating because Okuno (1) refers to LEDs that "are coated with, for example, an epoxy resin" and (2) also refers to "[a] mold 23 of transparent epoxy resin surrounding light-emitting diodes . . . to serve as a lens." Ex. 1029, 17:21–30, 19:5–7. Further, Patent Owner's assertion that Leung cuts away material to result in a thin coating overlooks Leung's teaching that "coating an LED with a phosphor layer . . . containing epoxy" can also result in it being "difficult to control the phosphor layer's geometry and thickness," teaching that varying geometries and thicknesses still constitute a coating. Sur-reply 11–12; Ex. 1037 ¶ 8.

Given the disclosures identified by Petitioner, we credit the testimony of Dr. Lebby that the phosphor-containing epoxy layer of Butterworth, which is formed in the shape of a lens, would be considered by one of ordinary skill in the art to be a coating, such that the resulting LED is coated with "a light changing or enhancing substance." Ex. 1002 ¶ 84 (describing Butterworth's "coated" LED with an epoxy lens); Ex. 1039 ¶ 19 (Dr. Lebby testifying that the term "coated," as used in the relevant field, includes coating of various levels of thickness such as epoxy coatings that are in the shape of a lens).

Upon review of the parties' arguments and evidence as a whole, we determine that Petitioner persuasively demonstrates that Teshima, Butterworth, and SISE teach or suggest every limitation of claim 38.

Petitioner also provides a reasoned explanation as to why one of ordinary skill in the art would have combined these references to arrive at the subject matter of claim 38 with a reasonable expectation of success. Accordingly, Petitioner has shown by a preponderance of the evidence that claim 38 would have been obvious over Teshima, Butterworth, and SISE.

3. *Dependent Claim 39*

Petitioner contends that dependent claim 39 would have been obvious over the combination of Teshima, SISE, and Butterworth. Pet. 62. Petitioner's arguments are supported by reasoned analysis and evidence, which Patent Owner does not dispute. We determine that Petitioner has shown by a preponderance of the evidence that claim 39 would have been obvious over the combination of Teshima, SISE, and Butterworth.

IV. CONCLUSION[10]

In summary:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
33, 34, 43	103	Bruning[11]		

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

[11] We do not address the first four asserted grounds for the reasons explained above.

38, 39	103	Bruning, Butterworth		
33	103	Teshima		
38	103	Teshima, Butterworth		
33, 34, 43	103	Teshima, SISE	33, 34, 43	
38, 39	103	Teshima, SISE, Butterworth	38, 39	
Overall Outcome			33, 34, 38, 39, 43	

V. ORDER

It is, therefore,

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 33, 34, 38, 39, and 43 of the '842 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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