

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

XU PEICHENG (HONG KONG) OPTOELECTRONIC
TECHNOLOGY CO., LIMITED,
Petitioner,

v.

SEMISILICON TECHNOLOGY CORP.,
Patent Owner.

IPR2024-00156
Patent 8,884,546 B2

Before CHARLES J. BOUDREAU, SHEILA F. McSHANE, and
RUSSELL E. CASS, *Administrative Patent Judges*.

McSHANE, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background

Xu Peicheng (Hong Kong) Optoelectronic Technology Co., Limited (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting *inter partes* review of claims 1–6 and 8 (the “challenged claims”) of U.S. Patent No. 8,884,546 B2 (Ex. 1001, “the ’546 patent”), along with a Declaration of Dr. E. Fred Schubert (Ex. 1003). Semisilicon Technology Corp. (“Patent Owner”) filed a Preliminary Response. Paper 10.

On May 20, 2024, the Board instituted an *inter partes* review of the challenged claims pursuant to 35 U.S.C. § 314. Paper 11 (“Dec.”).

After institution, Patent Owner filed a Patent Owner Response (Paper 14, “PO Resp.”), along with a Declaration of Dr. Michael Lebby (Ex. 2001). Petitioner filed a Reply (Paper 17, “Pet. Reply”), along with a Reply Declaration of Dr. Schubert (Ex. 1010), and Patent Owner filed a Sur-reply (Paper 20, “PO Sur-reply”). The parties presented oral arguments at a February 24, 2025 hearing, and a hearing transcript has been entered into the record (Paper 28, “Tr.”).

Pursuant to an Order (Paper 27), the parties were permitted to file post-hearing supplemental briefing, with Petitioner filing an Opening Post-Hearing Brief (Paper 30, “Pet. Supp. Br.”) and Responsive Post-Hearing Supplemental Brief (Paper 32, “Pet. Resp. Supp. Br.”), and with Patent Owner filing an Opening Post-Hearing Brief (Paper 29, “PO Supp. Br.”) and Responsive Post-Hearing Supplemental Brief (Paper 31, “PO Resp. Supp. Br.”).

For the reasons set forth in this Final Written Decision pursuant to 35 U.S.C. § 318(a), we determine that Petitioner has demonstrated, by a

preponderance of the evidence, that claims 1–3 and 8 of the ’546 patent are unpatentable but that Petitioner has not demonstrated, by a preponderance of the evidence, that claims 4–6 of the ’546 patent are unpatentable.

B. Real Party in Interest

Petitioner identifies itself and Shenzhen Yuyixin Lighting Technology Co., Ltd. as real parties in interest. Pet. 84; Paper 6, 1 (Petitioner’s Updated Mandatory Notices Pursuant to 37 C.F.R. § 42.8). Patent Owner identifies itself, Semisilicon Technology Corp., as the owner of the ’546 patent and real party in interest. Paper 4, 2 (Mandatory Notices by Patent Owner).

C. Related Matters

The parties do not identify any related matters involving the ’546 patent. See Pet. 84; Paper 4, 2.

D. The ’546 Patent (Ex. 1001)

The ’546 patent, titled “Driving Apparatus for Light-Emitting Diode Curtain Lamp,” issued November 11, 2014, from U.S. Patent Application No. 13/232,932. Ex. 1001, codes (54), (45), (21). The ’546 patent claims priority to TW099220340, filed October 21, 2010. *Id.* at code (30).

The ’546 patent discloses “a driving apparatus for curtain lamp, and especially relates to a driving apparatus for light-emitting diode curtain lamp.” Ex. 1001, 1:6–9. The ’546 patent describes two types of conventional driving apparatuses for light-emitting diode curtain lamps and states as objects of the invention to solve certain issues with those conventional apparatuses. *Id.* at 1:11–21, 25–36. First, the ’546 patent provides: “1. without microcontroller: this kind of driving apparatus would drive light-emitting diode curtain lamp as long as the driving apparatus receives power, but the light-emitting diode curtain lamp could not light

vividly. It is very dull.” *Id.* at 1:13–16. Second, the ’546 patent describes: “2. with microcontroller: this kind of driving apparatus usually includes three or four circuit loops to drive a plurality of light-emitting diode light strings. Because there are only three or four circuit loops, the light-emitting diode curtain lamp still could not light vividly. It still has the dull problem.” *Id.* at 1:17–21.

To solve these issues with conventional driving apparatuses for LED curtain lamps, the ’546 patent discloses exemplary embodiments related to driving apparatuses for LED curtain lamps that are applied to: 1) a direct current power source; or 2) an alternating current power source. Ex. 1001, 1:25–32, Figs. 1–3 (direct current), Figs. 4–6 (alternating current). The ’546 patent also discloses an embodiment providing a driving apparatus for an LED curtain lamp with a single LED in one LED string. *Id.* at 1:33–36, 2:34–46.

With respect to the embodiment directed to the direct current power source, the ’546 patent describes that the “driving apparatus for light-emitting diode curtain lamp . . . is applied to a direct current power source and at least a light-emitting diode light string,” and that “[t]he driving apparatus for light-emitting diode curtain lamp includes a master control unit, at least a slave control unit, and a transmission line.” Ex. 1001, 1:37–43. The master control unit electrically connects to the direct current power source, and the slave control unit electrically connects to the master control unit and the LED light string. *Id.* at 1:43–46. The master control unit controls the slave control unit to drive the LED light string. *Id.* at 1:48–50. Further, a “transmission line is electrically connected to the master control

unit and the slave control unit” and “is used to transit control signals and synchronous signals.” *Id.* at 1:46–48, 1:50–51.

Figure 1 of the '546 patent, reproduced below, shows a block diagram of the first exemplary embodiment of applying a driving apparatus for an LED curtain lamp to a direct current power source:

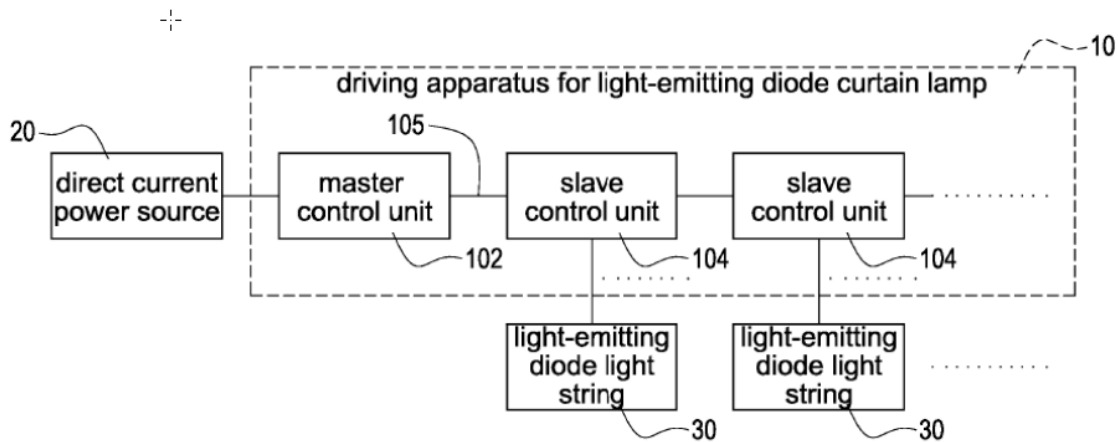


FIG.1

In Figure 1, above, driving apparatus for LED curtain lamp 10 is represented by a dashed-line box. Inside this box is a row of three boxes. From left to right in direction, the first box is labeled “master control unit” 102, followed by two boxes each labeled “slave control unit 104.” Below the two boxes labeled “slave control unit”, but outside of the dashed-line box, are two boxes that represent LED light strings 30. To the left of the box labeled “master control unit,” but outside of the dashed-line box, is a box that represents direct current power source 20. LED light strings 30 are shown as being electrically connected to slave control units 104 in driving apparatus 10. Slave control units 104 are in turn connected to master control unit 102, also in driving apparatus 10, through transmission line 105. Master control unit 102 is also connected to direct current power source 20. *See Ex. 1001, 2:50–64.*

The master control unit for the direct current power source exemplary embodiment is illustrated in Figure 2, reproduced below:

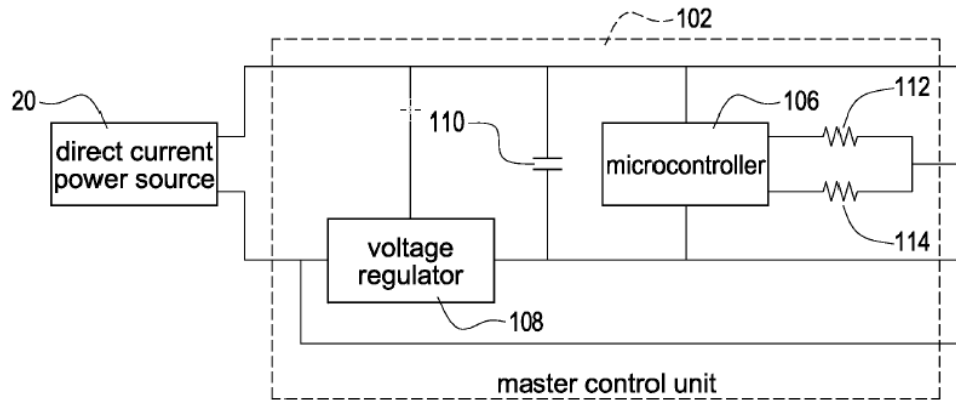


FIG.2

In Figure 2, above, master control unit 102 is represented by a dashed-line box. Inside this dashed-line box is a box labeled “voltage regulator 108,” and, to the left of voltage regulator 108, is a box labeled “microcontroller 106.” First resistor 112 and second resistor 114 extend from the right side of the box labeled “microcontroller.” To the left of, and outside of, the dashed-line box labeled “master control unit” is a box that represents direct current power source 20. First capacitor 110 is shown in parallel to microcontroller 106. Microcontroller 106 electrically connects to voltage regulator 108, first capacitor 110, first resistor 112, and second resistor 114. Voltage regulator 108 is also electrically connected to direct current power source 20, in which direct current power source 20 includes upper and lower terminal pins. *See* Ex. 1001, 3:1–9, 3:34–37.

In turn, the slave control unit for the direct current power source exemplary embodiment is illustrated in Figure 3, reproduced below:

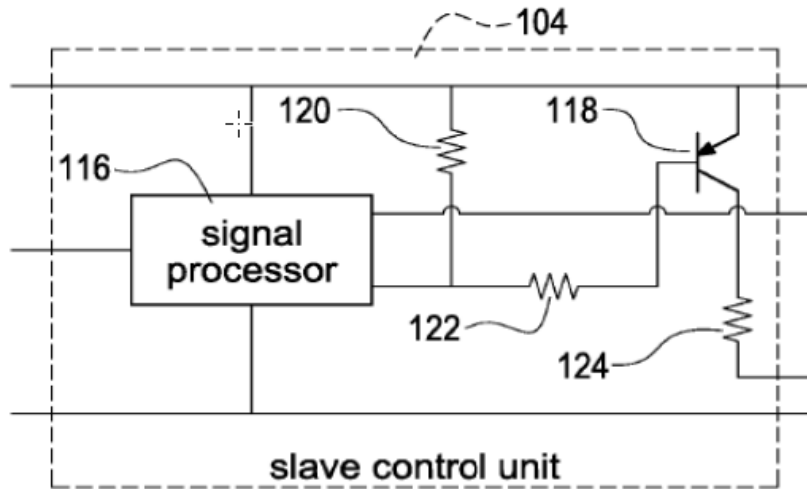


FIG.3

In Figure 3, above, slave control unit 104 is represented by a dashed-line box. Inside this dashed-line box is a box labeled “signal processor 116,” and transistor 118, third resistor 120, fourth resistor 122, and fifth resistor 124 are positioned to the right of the “signal processor” box. Transistor 118 is shown as being electrically connected to signal processor 116, third resistor 120, fourth resistor 122, and fifth resistor 124. Slave control unit 104 includes three terminal pins in the left side. Viewed from the top to the bottom of slave control unit 104, the first terminal pin receives a direct current voltage, the second terminal pin receives signals from master control unit 102 to drive LED light string 30 (not illustrated in Figure 3), and the third terminal pin receives a direct current voltage from voltage regulator 108 (not shown in Figure 3). *See* Ex. 1001, 3:10–17, 3:49–58.

For the exemplary embodiment directed to the alternating current power source, the '546 patent describes that the “driving apparatus for light-emitting diode curtain lamp . . . is applied to an alternating current power

source and at least a light-emitting diode light string” and that “[t]he driving apparatus for light-emitting diode curtain lamp includes a master control unit, and at least a slave control unit.” Ex. 1001, 1:52–56. The master control unit electrically connects to the alternating current power source and includes a power negative terminal pin and a signal output pin. *Id.*

at 1:58–61. The slave control unit electrically connects to the master control unit and the LED light string and includes a signal input pin, a signal output pin, a power positive terminal pin, and a power negative terminal pin. *Id.* at 1:62–67. The master control unit controls the slave control unit to drive the LED light string, in which the signal output pin of the master control unit electrically connects to the signal input pin of the slave control unit, and the power negative terminal pin of the master control unit electrically connects to the power positive terminal pin of the slave control unit. *Id.* at 1:67–2:6.

Figure 4, reproduced below, shows a block diagram of the second exemplary embodiment of applying a driving apparatus for an LED curtain lamp to an alternating current power source:

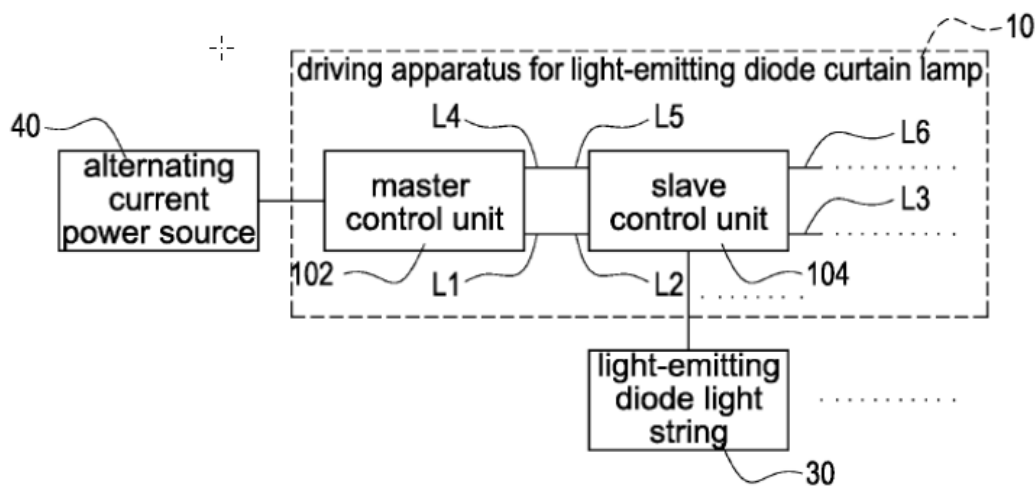


FIG.4

In Figure 4, above, driving apparatus for an LED curtain lamp 10 is represented by a dashed-line box. Inside this dashed-line box are two boxes with a top line and a bottom line extending between the boxes to each other. From left to right in direction, the first box is labeled “master control unit 102,” and the second box is labeled “slave control unit 104.” Below the box labeled “slave control unit 104,” but outside of the dashed-line box, is a box that represents LED light string 30. To the left of the box labeled “master control unit 102,” but outside of the dashed-line box, is a box that represents alternating current power source 40. LED light string 30 is shown as being electrically connected to slave control unit 104 in driving apparatus 10. In turn, slave control unit 104 electrically connects to master control unit 102, also in driving apparatus 10, and master control unit 102 is electrically connected to alternating current power source 40. Master control unit 102 includes power negative terminal pin of master control unit L1 and signal output pin of master control unit L4. In turn, slave control unit 104 includes signal input pin of slave control unit L5, signal output pin of slave control unit L6, power positive terminal pin of slave control unit L2, and power negative terminal pin of slave control unit L3. Signal input pin of slave control unit L5 electrically connects to signal output pin of master control unit L4. Power positive terminal pin of slave control unit L2 electrically connects to power negative terminal pin of master control unit L1. Further, signal output pin of slave control unit L6 of slave control unit 104 electrically connects to signal input pin of slave control unit L5 of the next slave control unit 104. Power negative terminal pin of slave control unit L3 of slave control unit 104 electrically connects to power positive terminal pin

of slave control unit L2 of the next slave control unit 104. *See* Ex. 1001, 4:11–37.

The master control unit and the slave control unit for the alternating current power source exemplary embodiment are illustrated in Figures 5 and 6, respectively, reproduced below:

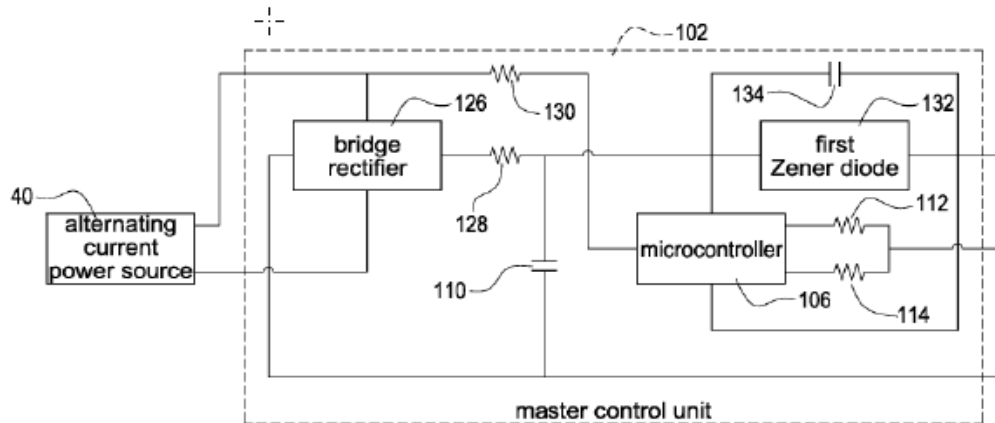


FIG.5

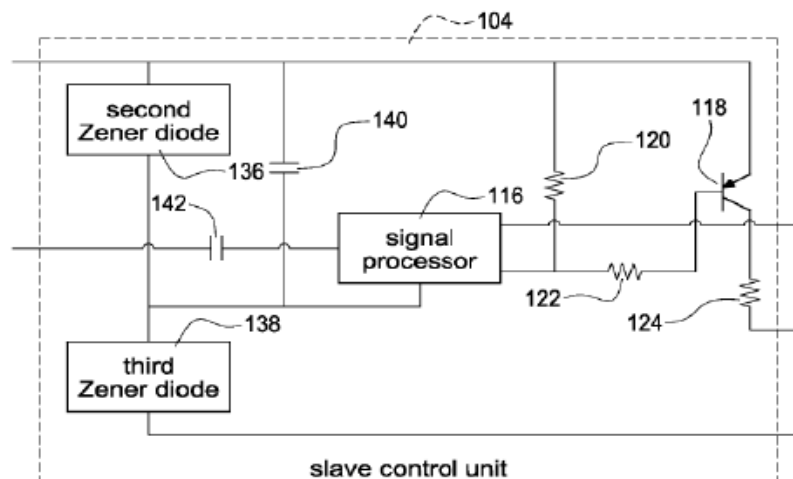


FIG.6

In Figures 5 and 6, above, the components of master control unit 102 and slave control unit 104, respectively, are illustrated. In Figure 5, above, master control unit 102 is represented by a dashed-line box. Inside this

dashed-line box are three boxes, labeled, from left to right in direction, as “bridge rectifier 126,” “microcontroller 106,” and “first Zener diode 132.” Microcontroller 106 of master control unit 102 is shown as being electrically connected to second capacitor 134, first Zener diode 132, first resistor 112, second resistor 114, and seventh resistor 130. Bridge rectifier 126 is electrically connected to first capacitor 110, sixth resistor 128, seventh resistor 130, and alternating current power source 40. The right side of master control unit 102 includes first and second terminal pins, in which the first terminal pin (viewed from the top to bottom direction) transmits power to first slave control unit 104 (not shown in Figure 5). *See* Ex. 1001, 4:46–52, 6:3–10.

In Figure 6, above, slave control unit 104 is represented by a dashed-line box. Inside this dashed-line box are three boxes labeled “second Zener diode 136,” “third Zener diode 138,” and “signal processor 116.” Also inside the dashed-line box of slave control unit 104 are various components, in which transistor 118 of slave control unit 104 electrically connects to third resistor 120, fourth resistor 122, fifth resistor 124, third capacitor 140, and second Zener diode 136. Signal processor 116 is electrically connected to third Zener diode 138, fourth capacitor 142, and fourth resistor 122. The left and right sides of slave control unit 104 include two terminal pins and three terminal pins, respectively. *See* Ex. 1001, 4:59–64, 5:17–25.

With respect to the embodiment directed to the driving apparatus for an LED curtain lamp with a single LED in one LED string, the ’546 patent describes that the driving apparatus includes a master control unit and at least a slave control unit. Ex. 1001, 2:7–14. The slave control unit electrically connects to the master control unit and the LED. *Id.* at 2:14–16.

Figure 7, reproduced below, shows a circuit diagram of an LED curtain lamp with at least a single LED in one LED string for an alternating current power source (Ex. 1001, 2:34–37):

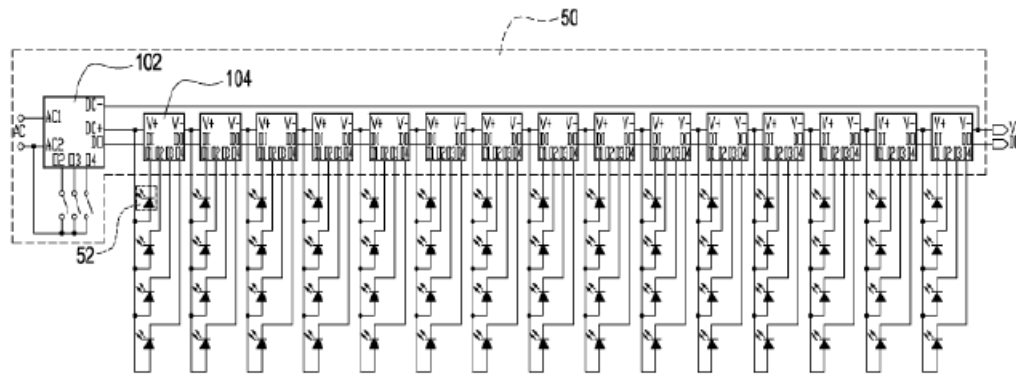


FIG. 7

In Figure 7, above, driving apparatus 50 is represented by a dashed-line that includes within it a box labeled 102 (master control unit 102) and boxes labeled 104 (slave control units 104). Master control unit 102 is shown as being electrically connected to multiple slave control units 104 in driving apparatus 50. Each slave control unit 104 is in turn connected to LEDs 52, in which driving apparatus 50 is applied to at least an LED 52. *See* Ex. 1001, 6:21–23, 6:32–40.

Figure 10, reproduced below, illustrates a circuit diagram of the secondary power supply of the LED curtain lamp with single LED in one LED string:

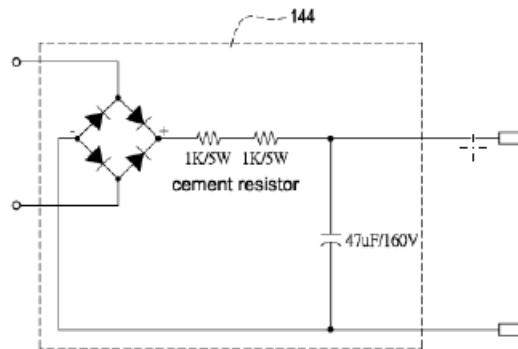


FIG.10

In the circuit diagram of the secondary power supply of the LED curtain lamp with single LED in one LED string of Figure 10, above, alternating current voltage transferring to direct current voltage 144 (represented by a dashed-line box) is illustrated as including a bridge rectifier, a cement resistor(s), and a capacitor. *See* Ex. 1001, 2:44–46, 6:41–49.

Referring to Figure 10, the '546 patent describes a “secondary power supply” of the LED curtain lamp with a single LED in one LED string, describing that “[t]he driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string 50 of the present invention only needs a master control unit 102, but an alternating current voltage transferring to direct current voltage circuit 144 (the secondary power supply) is required.” Ex. 1001, 6:41–49. The master control unit includes a microcontroller, and the slave control unit includes a signal processor. *Id.* at 6:51–53. The '546 patent describes that the “driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string 50 further includes an alternating current voltage transferring to direct current voltage circuit 144 and a second curtain lamp 146,” in which the “alternating current voltage transferring to

direct current voltage circuit 144 is electrically connected to the slave control unit 104,” and “[t]he second curtain lamp 146 is electrically connected to the alternating current voltage transferring to direct current voltage circuit 144.” *Id.* at 6:53–62.

E. Claims

Of the challenged claims, claims 1, 4, and 8 are independent claims and are reproduced below, with bracketed letters provided by Petitioner added to limitations for reference purposes:

1. [Pre] A driving apparatus for light-emitting diode curtain lamp applied to a direct current power source and at least a light-emitting diode light string, the driving apparatus for light-emitting diode curtain lamp including:

[A] a master control unit electrically connected to the direct current power source, including:
a microcontroller; and
a voltage regulator electrically connected to the microcontroller;

[B] at least a slave control unit electrically connected to the master control unit and the light-emitting diode light string;
and

[C] a transmission line electrically connected to the master control unit and the slave control unit,

[D] wherein the slave control unit is controlled by the master control unit to drive the light-emitting diode light string; the transmission line is used to transit control signals and synchronous signals.

4. [Pre] A driving apparatus for light-emitting diode curtain lamp applied to an alternating current power source and at least a light-emitting diode light string, the driving apparatus for light-emitting diode curtain lamp including:

[A] a master control unit including a power negative terminal pin of master control unit and a signal output pin of

master control unit, the master control unit being electrically connected to the alternating current power source; and

[B] at least a slave control unit including a signal input pin of slave control unit, a signal output pin of slave control unit, a power positive terminal pin of slave control unit, and a power negative terminal pin of slave control unit, the slave control unit being electrically connected to the master control unit and the light-emitting diode light string,

[C] wherein the slave control unit is controlled by the master control unit to drive the light-emitting diode light string; the signal output pin of master control unit is electrically connected to the signal input pin of slave control unit;

[D] the power negative terminal pin of master control unit is electrically connected to the power positive terminal pin of slave control unit.

8. [Pre] A driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string applied to at least a light-emitting diode, the driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string including:

[A] a master control unit; and
at least a slave control unit electrically connected to the master control unit and the light-emitting diode,

[B] wherein the master control unit includes a microcontroller; the slave control unit includes a signal processor;

[C] the driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string further including:

an alternating current voltage transferring to direct current voltage circuit electrically connected to the slave control unit; and

[D] a second curtain lamp electrically connected to the alternating current voltage transferring to direct current voltage circuit.

Ex. 1001, 7:7–24, 7:31–8:7, 8:25–44; Pet. 88–90.

F. Asserted Grounds of Unpatentability

Claims Challenged	35 U.S.C. §¹	Reference(s)
1, 2	103(a)	Kuang ²
3	103(a)	Kuang, Debevec ³
1, 2, 8	103(a)	Lys ⁴
3	103(a)	Lys, Debevec
4	103(a)	Hiroyuki ⁵
5, 6, 8	103(a)	Hiroyuki, Kuang

Pet. 3.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Relying on the Schubert Declaration, Petitioner proposes that a person of ordinary skill in the art “would have had a bachelor’s degree in electrical engineering, physics, materials science, or a related discipline, and 6 years of

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (Sept. 16, 2011), includes amendments to Section 103 that became effective on March 16, 2013. Because the challenged claims issued from an application filed before March 16, 2013, we apply pre-AIA law. *See* Pet. 2; Ex. 1001, codes (22), (30).

² US 2009/0021955 A1, published January 22, 2009 (Ex. 1004, codes (10), (43)) (“Kuang”). Petitioner contends that Kuang is prior art to the ’546 patent at least under pre-AIA 35 U.S.C. § 102(b). Pet. 2.

³ US 2012/0050606 A1, published March 1, 2012 (Ex. 1005, codes (10), (43)) (“Debevec”). Petitioner asserts that “[b]ecause Debevec was filed prior to the priority date of the ’546 patent, it qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(e).” Pet. 2.

⁴ US 6,774,584 B2, issued August 10, 2004 (Ex. 1008, codes (10), (45)) (“Lys”). Petitioner contends that Lys is prior art to the ’546 patent at least under pre-AIA 35 U.S.C. § 102(b). Pet. 2–3.

⁵ JP2006-228529, published August 31, 2006 (Ex. 1006, code (43)) (“Hiroyuki”). We refer herein to the certified English translation filed as Exhibit 1007. Petitioner contends that Hiroyuki is prior art to the ’546 patent at least under pre-AIA 35 U.S.C. § 102(b). Pet. 2.

practical experience in designing or fabricating LED lighting systems, including controlling and driving LEDs,” or “[a]lternatively . . . would have had a master’s degree and four years of experience, or a Ph.D. degree and two years of experience.” Pet. 5 (citing Ex. 1003 ¶ 31).

Patent Owner applies Petitioner’s asserted level of ordinary skill in the art. PO Resp. 7–8.

For the purposes of this Decision, we adopt the assessment offered by Petitioner as it is consistent with the ’546 patent and the prior art before us. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

B. Claim Construction

In this *inter partes* review, claims are construed using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2022). Under the principles set forth by our reviewing court, the “words of a claim ‘are generally given their ordinary and customary meaning,’” as would be understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005). “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Patent Owner asserts that the Petition improperly cites the same commands of the prior art to teach both “control signals” and “synchronous signals.” PO Resp. 8–9. Patent Owner contends that a person of skill would have understood that using synchronous timing would have been necessary

to effectively control curtain lamp LEDs individually and therefore would have also understood therefore that synchronous signals are distinct from control signals. *Id.* at 11 (citing Ex. 2001 ¶ 58). Dr. Lebby testifies that a person of ordinary skill in the art would have understood that “synchronous signals involve more than a command sent to turn off multiple devices.” Ex. 2001 ¶ 55. Patent Owner additionally argues that synchronous signals must be separate from control signals because where a claim lists elements separately “the clear implication” is that the elements are “distinct component[s].” PO Resp. 11 (quoting *Becton, Dickinson & Co. v. Tyco Healthcare Grp., LP*, 616 F.3d 1249, 1254 (Fed. Cir. 2010) (citing *Gaus v. Conair Corp.*, 363 F.3d 1284, 1288 (Fed. Cir. 2004))); *see also* PO Sur-reply 7–8. Patent Owner further asserts that there is nothing in the ’546 patent Specification that alters the presumption that control signals and synchronous signals should be separate elements. PO Sur-reply 8.

Petitioner, on the other hand, asserts “that a control signal *may* also be a synchronous signal,” such as when “a signal may contain control instructions (e.g. shut LEDs OFF) as well as synchronous instructions (e.g. execute the control instructions for multiple LEDs at the same time).” Pet. Reply 10 (citing Ex. 1010 ¶ 31). Petitioner contends that this is consistent with the claim language that recites “is used to transit control signals and synchronous signals” rather than “control signals *or* synchronous signals.” *Id.* Petitioner asserts the Specification also supports the understanding that control signals may also be synchronous because the Specification “only discloses control signals which may also be synchronous if controlling more than one slave unit at a time,” and nothing in the Specification “suggest[s] that a control signal can never be synchronous, or that a synchronous signal

cannot be a control signal.” *Id.* at 10–11. Indeed, Petitioner argues, “the only ‘signals’ explicitly described in the ’546 patent specification are control signals.” *Id.* at 11 (citing Ex. 1001, 3:38–4:3, 6:7–10; Ex. 1010 ¶ 32).

As the Institution Decision pointed out, and Dr. Schubert concurs, the ’546 patent Specification and prosecution history does not expressly define “synchronous signals,” and the term is only included in repeated recitations of the phrase “[t]he transmission line is used to transit control signals and synchronous signals.” Dec. 43–44 (citing Ex. 1001, code (57), 1:50–51, 2:66–67; Ex. 1010 ¶ 10). Accordingly, there is nothing in the intrinsic record that states or suggests that the terms “control signals” and “synchronous signals” are mutually exclusive and cannot overlap.

Patent Owner argues that “‘synchronous signals’ are distinct from the ‘control signals’” because one of skill “would have understood that using synchronized timing would have been necessary for the master and slave control units to effectively *control* the curtain lamp LEDs individually.” PO Resp. 11 (emphasis added). Consistent with Patent Owner’s argument, there appears to be no dispute between the parties that “synchronous signals” are sent to control activities under the parties’ proposed construction of the term identified below.⁶ And in the absence of the intrinsic record suggesting otherwise, we discern no reason that a “synchronous signal” that is sent to control activities should not also be considered to be a “control signal” under an ordinary meaning of the term, that is, a signal used to control activities. Thus, we determine that a “synchronous signal” may also be a “control signal.”

⁶ Nonetheless, under the parties’ proposed constructions, “synchronous signals” are sent to control activities in a specific way, as is discussed below.

The parties also dispute the interpretation of the term “synchronous signals” recited in claim 1, with the parties proposing these respective constructions:

Petitioner’s Proposed Construction	Patent Owner’s Proposed Construction
“signals that are sent to the slave nodes to control their corresponding LED strings at the same time.” Pet. 17	“signals related to activities governed by synchronized timing” PO Resp. 8

As discussed *infra* Section II.D.2.b.v, because we determine that Kuang teaches a synchronous signal under either proposed construction, we need not construe the term “synchronous signals.” *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (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)).

We determine that we need not construe any other claim terms. *See Realtime Data*, 912 F.3d at 1375.

C. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art;

(2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective indicia of nonobviousness.⁷ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

D. Obviousness of Claims 1 and 2 over Kuang

Petitioner contends that claims 1 and 2 would have been obvious over Kuang in the view of one of ordinary skill in the art. Pet. 6–20. Petitioner also relies upon the Schubert Declaration (Ex. 1003) and the Schubert Reply Declaration (Ex. 1010) to support its positions.

Patent Owner contends that Kuang fails to teach certain limitations of the claims. PO Resp. 12–17, 19–25; PO Sur-reply 5–9, 12–17. Patent Owner also relies upon the Lebby Declaration (Ex. 2001) to support its positions.

We begin our discussion with a brief summary of Kuang and then address the evidence and arguments presented.

1. Kuang (Ex. 1004)

Kuang is a United States patent application publication titled “Control Network for LED-Based Lighting System in a Transit Vehicle.” Ex. 1004, code (54). Kuang discloses that the invention “relates to lighting systems and, more particularly, to control networks for lighting systems used in transit vehicles or conveyances such as buses, lightrail cars, and the like.” *Id.* ¶ 3; *see id.* at code (57).

Kuang discloses that the transit vehicle lighting system includes “a plurality of LED-based lighting fixtures for providing interior illumination,”

⁷ No evidence of objective indicia of nonobviousness has been presented in the record. *See generally* Pet.; PO Resp.

in which “[a] control network comprises a plurality of slave nodes for controlling the LED-based lighting fixtures, and a master node for controlling the slave nodes.” Ex. 1004, code (57). The master node and slave nodes are connected by a combined power/communication bus in a daisy chain fashion. *Id.* The slave node may include “a power regulator and a controller for providing a target current command to the power regulator.” *Id.*

Figure 1 of Kuang, reproduced below, illustrates an example lighting control system, including a master node and slave nodes:

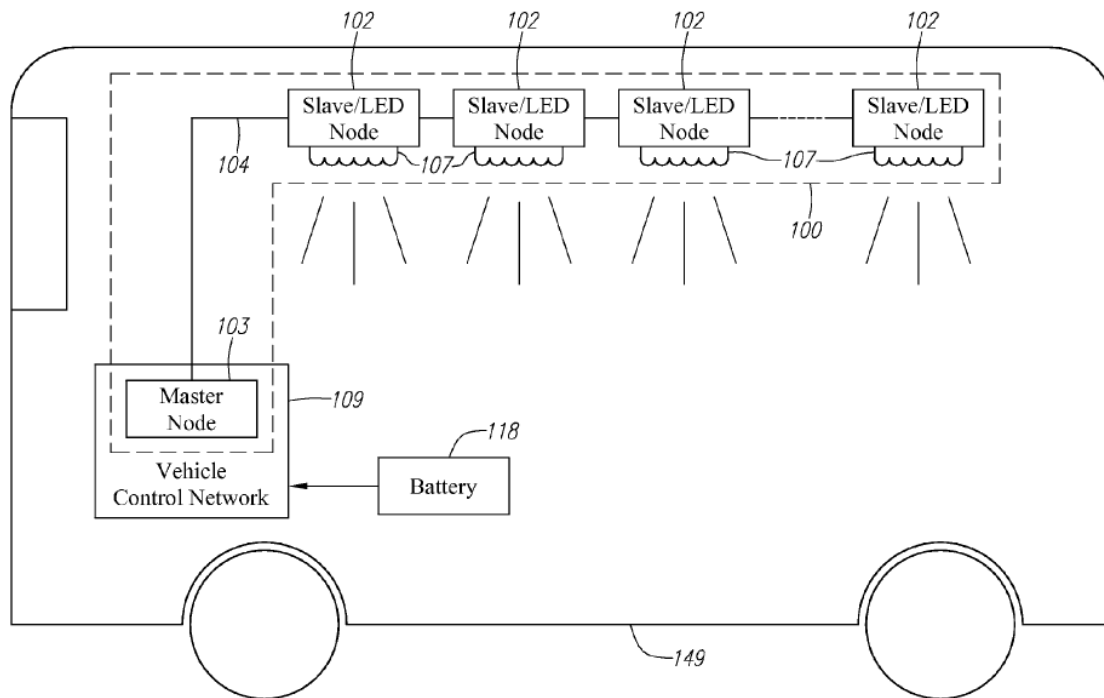


FIG. 1

As shown in the conceptual diagram of Figure 1, above, “lighting control network 100 . . . comprises a plurality of network nodes including a master node 103 and a series of slave/LED nodes 102, each of which constitutes or is associated with an LED-based lighting fixture having local electronic control but responsive to the master node 103.” Ex. 1004 ¶¶ 14, 32. The

“power/data bus 104 preferably interconnects the series of slave/LED nodes 102 in a daisy-chain fashion,” and “[e]ach of the slave/LED nodes 102 may include a plurality of LEDs 107.” *Id.*

Figure 2A of Kuang, reproduced below, provides a “high level architectural diagram” of a lighting control system embodiment. Ex. 1004 ¶ 15.

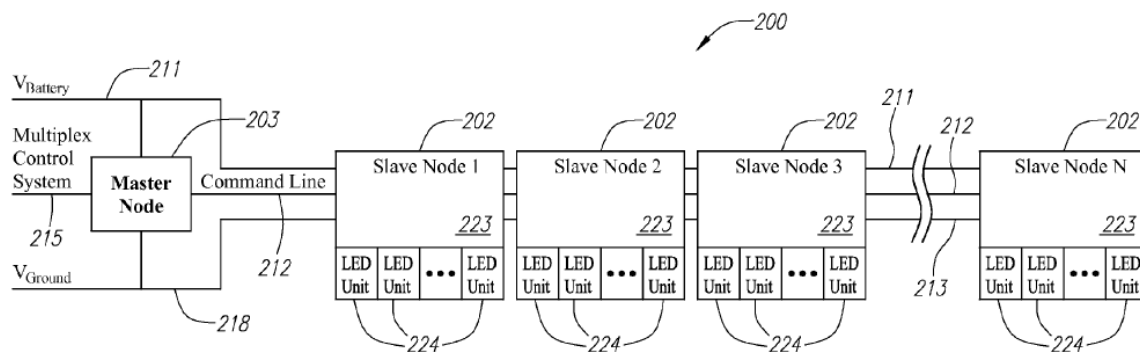
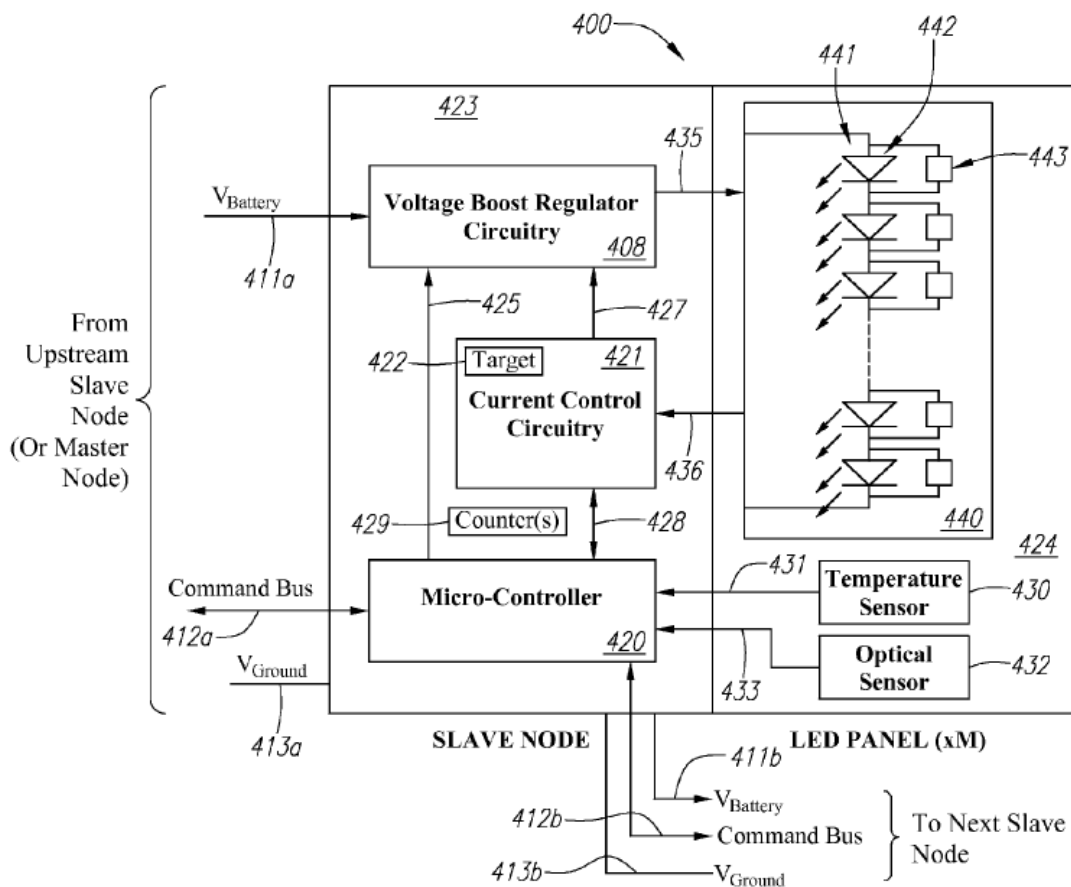


FIG. 2A

As illustrated in Figure 2A, above, a “power bus comprising a power supply line 211 from the vehicle battery and a ground line 213 is preferably connected from the master node 203 to each LED-based lighting fixture 202 and slave node 223 thereof, in series,” and “[l]ikewise, a command/data bus 212 may be connected from the master node 203 to each LED-based lighting fixture 202 and slave node 223 thereof, in series.” Ex. 1004 ¶ 33. Kuang describes that “the master node 203 may communicate with the main vehicle control network . . . and may respond to commands or queries therefrom, and/or may send alarm signals, interrupts, or status information to the main vehicle control network,” and that “[t]he master node 203 may also control the various LED-based lighting fixtures 202, and slave nodes 223 thereof, through commands or queries transmitted over the command/data bus 212.”

Id. ¶ 34. Kuang also describes that “[c]ommands or inquiries may be transmitted from the master node 203 over the command/data bus 212 to the first slave node 223 (Slave Node 1),” in which first slave node 223 (Slave Node 1) “then propagates the commands or inquiries over the command/data bus 212 to the next slave node 223 (Slave Node 2) in the chain, and so on in sequence until the command or inquiry reaches the last slave node 223 (Slave Node N) if necessary.” *Id.*

Figure 4 of Kuang, reproduced below, provides a block diagram of an LED-based lighting fixture and slave node that may be used in the lighting control system of Figure 2A. Ex. 1004 ¶ 18.



As illustrated in Figure 4, above, the “LED-based lighting fixture 400 is conceptually divided into a slave node 423, which forms a network node of

the lighting control network, and one or more LED units or modules 424.”
Ex. 1004 ¶ 42. Preferably, LED-based lighting fixture 400 includes “a voltage boost regulator 408 which receives a power signal from the power supply line 411a,” and voltage boost regulator 408 “converts the input power signal to both a stable low voltage power output signal for digital electronics and other components within the slave node 423, and a regulated boosted voltage level for the LEDs on the various LED units 424.” *Id.* Further, voltage regulator 408 “outputs appropriate internal power supply signals (not shown) to other components of the slave node 223, such as microcontroller 420 and any other components requiring a low voltage source.” *Id.*
In Kuang, micro-controller 420 has a range of capabilities related to LED-based lighting fixture 400. Ex. 1004 ¶ 54. For example, a “master light shutoff command may also be sent from the master node 203 instructing all LED/slave nodes to turn off,” and “[t]he micro-controller 420 may also respond to commands from the master node 203 to dim the LEDs 442 on all or selected ones of the LED units 424.” *Id.*

2. Discussion

a. Patent Owner’s General Assertions

Patent Owner argues that Petitioner asserts that in several grounds obviousness is based on the prior art references “in view of the general knowledge of a POSITA [person of ordinary skill in the art]” and this makes the grounds “problematic on their face” to “supply missing claim limitations.” PO Resp. 52. Patent Owner contends that Petitioner does not explain how or why the knowledge of a person of skill is used in the obviousness combinations. *Id.* Patent Owner argues that Petitioner makes unsupported assertions about what “a POSITA would have understood” to

bridge gaps between the references and the claim language. *Id.* at 53 (citing Pet. 7, 8, 14, 16–18, 25–29, 32, 33, 36, 38, 40, 42, 46, 47, 51, 54, 55, 57–60, 62, 63, 66–68, 72, 77, 80). Patent Owner further contends that “[t]he Petition fails to explain what modifications are being proposed to the primary reference, or what the resulting combination/modification would be,” or explain a motivation for modifying the primary references or a reasonable expectation of success. *Id.* at 54, 57–61. Patent Owner also asserts that the Schubert Declaration adds nothing to the Petition’s analysis, simply repeats attorney argument, and lacks requisite analysis and evidence of obviousness so it should not be afforded weight. *Id.* at 61–62.

We do not agree with Patent Owner’s contentions that the Petition improperly relies on the general knowledge of a person of ordinary skill. *See* PO Resp. 52–61. As discussed below, we determine that the prior art itself discloses and teaches the limitations of the claims, and to the extent references are combined, rationale to combine has been provided with “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418.

Regarding the sections of the Petition that are similar to Dr. Schubert’s Declaration, Petitioner argues, and we agree, that repeating Dr. Schubert’s testimony in the Petition may be done to avoid any arguments of impermissible incorporation by reference. *See* Pet. Reply 26–27. Further, we agree with Petitioner that Dr. Schubert declares that the opinions in his declarations are his own. *Id.* at 27; Ex. 1003 ¶ 137, Section XIV. Accordingly, we do not discern that we should afford less weight to Dr. Schubert’s declarations because of overlap with the Petition.

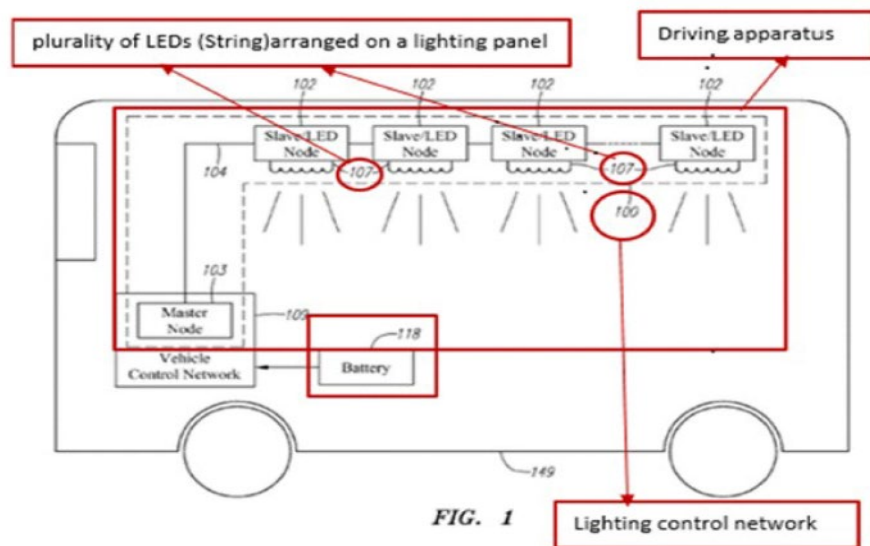
b. Claim 1

Below we address the claim 1 limitations in turn.

i. Preamble 1[Pre]

The preamble of claim 1 (1[Pre]) recites “[a] driving apparatus for light-emitting diode curtain lamp applied to a direct current power source and at least a light-emitting diode light string.” Ex. 1001, 7:7–10.

Petitioner contends that Kuang teaches claim 1’s preamble because it discloses “a ‘driving apparatus’ for a plurality of LEDs arranged on a lighting panel or other fixture, which are powered by a direct current power source.” Pet. 6–7. Petitioner provides an annotated version of Kuang’s Figure 1 as reproduced below:



In describing annotated Figure 1, Petitioner points to the following teaching in Kuang: “power may be provided to the vehicle control network 109 and/or lighting control network 100 via an on-board battery 118.” Pet. 7 (quoting Ex. 1004 ¶ 32). Relying on the Schubert Declaration, Petitioner contends that a person of ordinary skill in the art would have understood that “battery 118 as disclosed in Kuang functions as a ‘direct current power source’ as claimed because a battery is commonly known as a DC voltage source consisting of two or more cells that convert one form of energy (such as chemical energy) into electrical energy.” *Id.* (quoting Ex. 1003 ¶ 35).

Citing further to Kuang and the Schubert Declaration, Petitioner asserts that Kuang discloses master node 103 and slave nodes 102. Pet. 7–8 (citing Ex. 1004 ¶ 32; Ex. 1003 ¶ 36). Petitioner contends that “battery 118 in Kuang provides power to a series of LEDs,” which a person of ordinary skill in the art “would have understood constitutes a ‘light-emitting diode light string’ as claimed.” *Id.* at 8 (quoting Ex. 1003 ¶ 36). Petitioner further asserts that a person of ordinary skill “would have understood Kuang to disclose a ‘curtain lamp,’ which is commonly understood to be one or more light strings.” *Id.* (quoting Ex. 1003 ¶ 37; citing Ex. 1004 ¶ 45). Petitioner cites to Figures 7 and 8 and their descriptions, which are alleged to “illustrat[e] circuit diagrams for curtain lamps with a single LED string and a plurality of LED strings, respectively.” *Id.* (citing Ex. 1001, 2:34–40, Figs. 7, 8).

Patent Owner argues the preamble of claim 1 is limiting. PO Resp. 13–15. More particularly, Patent Owner argues, “[w]hen the body of the claim expressly refers to several features recited in the preamble and uses those referenced features to define the claimed invention, as is the case

here,” then the preamble should be afforded patentable weight. *Id.* at 13 (citing *Catalina Mktg. Int’l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002) (“[D]ependence on a particular [] preamble phrase for antecedent basis may limit claim scope because it indicates a reliance on both the preamble and claim body to define the claimed invention.”)).

Patent Owner contends that there are multiple terms in the body of the claim, such as “the light-emitting diode string” and “the direct current power source,” that rely upon the preamble for antecedent support. *Id.* at 14 (citing Ex. 1001, 7:7–24, 8:25–44). Patent Owner also asserts that the preamble recites structure that is essential to give life to the body of the claim. *Id.* Specifically, Patent Owner argues, the ’546 patent addresses certain drawbacks of conventional driving apparatuses, and the preamble phrase “driving apparatus for light-emitting diode curtain lamp” describes a structure that is essential to provide meaning to the limitations in the body of the claim. *Id.* at 14–15 (citing Ex. 2001 ¶ 65).

Petitioner does not dispute that the preamble of claim 1 is limiting. *See* Pet. 6–9; Pet. Reply 2–6. We have considered the preamble and, in light of its recitation of the “driving apparatus” and in view of other preamble terms serving as antecedent bases, we agree with Patent Owner that the preamble is limiting.

Patent Owner argues that Kuang fails to teach the “light emitting curtain lamp” recited in the preamble. PO Resp. 15–17; PO Sur-reply 12–17; PO Supp. Br. 4–8; PO Resp. Supp. Br. 4–5. Specifically, Patent Owner argues that Petitioner has not demonstrated “how Kuang discloses ‘one or more light strings’ under Petitioner’s own definition of ‘curtain lamp.’” PO Resp. 15 (citing Pet. 8, 25, 38; Ex. 2001 ¶ 67). Patent Owner asserts that the

disclosures that Petitioner relies upon, particularly Kuang’s disclosures of ceiling panels with rigid light units that have LEDs arranged on a metal printed circuit board, do not teach or suggest “light strings” to meet the definition of “curtain lamp.” *Id.* at 15–17 (citing Pet. 6–9; Ex. 1004 ¶¶ 32, 45, 61, 67, 68, 122, Figs. 1, 11C, 11D; Ex. 2001 ¶ 68).

In Reply, Petitioner refers to the ’546 patent’s disclosure that “the light-emitting diode string could include single light-emitting diode.” Pet. Reply 3 (quoting Ex. 1001, 6:15–20). Petitioner asserts that Patent Owner and Dr. Lebby did not contest Dr. Schubert’s opinion that a “curtain lamp” “is commonly understood to be one or more light strings.” *Id.* at 2 (citing Ex. 1003 ¶ 37). Petitioner contends that the “minimum configuration for a ‘curtain lamp’ according to the ’546 specification is one LED,” and “[t]herefore, the reverse must be true as well: one LED constitutes the claimed LED ‘curtain lamp.’” *Id.* at 3 (citing Ex. 1010 ¶ 13). Accordingly, Petitioner argues, Dr. Lebby’s argument that Kuang’s ceiling light panels are not curtain lamps should be rejected. Petitioner also points to Figure 2B of Kuang as satisfying the teaching of “curtain lamp.” *Id.* at 3–4 (citing Ex. 1003 ¶ 44; Ex. 1010 ¶¶ 14–15). Petitioner additionally asserts that Figures 4 and 7 of the ’546 patent support that there is nothing to suggest that an LED “string” is limited to a certain physical configuration. *Id.* at 4–5 (citing Ex. 1010 ¶ 16). In supplemental briefing, Petitioner reiterates that the ’546 patent discloses that a light string may be one LED, as discussed for Figure 9. Pet. Supp. Br. 8 (citing Ex. 1001, 6:27–40).

In Sur-reply, Patent Owner contends that Petitioner’s claim interpretation that a “light string” “may consist only one LED” was never cited before. PO Sur-reply 12 (citing Ex. 1010 ¶¶ 13, 18, 19; Pet. Reply 3).

Patent Owner argues that Dr. Schubert’s original declaration asserted that a “curtain lamp” is “commonly understood to be one or more light strings,” but he did not broaden his interpretation of “curtain lamp” to be a single LED until the “eleventh hour.” *Id.* Patent Owner contends that “[t]his nonsensical argument is unsupported by a proper reading of the ’546 patent, and should be disregarded as procedurally improper and factually incorrect.” *Id.* Patent Owner asserts that the “single-LED” assertion is wrong, with the ’546 patent never describing, illustrating, or suggesting that a curtain lamp could be a single LED. *Id.* at 13. Patent Owner cites to the ’546 patent Specification at column 6, lines 15 to 20, and contends that it “mentions that one light string 30 could ‘include single light-emitting diode,’ but “[t]he next sentence gives this embodiment a special name: ‘[i]t is called the driving apparatus for light-emitting diode.’” *Id.* (citing Ex. 1001, 16:15–20); *see also* Tr. 44:15–18. Patent Owner argues that “the single-LED theory is illogical because the ’546 patent defines it with a special name, rather than a curtain lamp as understood by a person of ordinary skill in the art.” PO Supp. Br. 10. Patent Owner argues that neither in this passage, nor elsewhere, does the ’546 patent state that the entire curtain lamp could constitute a single LED. PO Sur-reply 14. Patent Owner contends that every circuit diagram of a curtain lamp in the ’546 patent, including Figures 7 and 8, shows multiple LEDs arranged in strings. *Id.* (citing Fig. 7, 2:34–36, 6:21–23). Patent Owner further asserts that, as shown in Figures 7 and 8, “you could have a string that has one light, but the entire curtain lamp is not just that one light. There are other strings with lights on them as well.” Tr. 46:10–12. In supplemental briefing, Patent Owner argues that the ’546 patent discusses Figure 9 with Figures 7 and 8, which are circuit diagrams

which show multiple strings of LEDs and “light emitting diode 52” is one of dozens of LEDs shown in Figure 7, so Figure 9 does not support interpreting a single LED as a “curtain lamp.” PO Resp. Supp. Br. 5 (Ex. 1001 at 6:21–40, Figs. 7–9). Patent Owner also argues that “[t]here would be *no reason* to have both a master control unit and a slave control unit to operate just a single LED.” *Id.*

Patent Owner also argues that the Petition identified a “light string” in Kuang’s bus lighting panel, which has a plurality of lights as shown in Figure 1, but the Reply abandoned that application of Kuang and now asserts that various LED units 274 constitute a “string of LEDs.” PO Sur-reply 15 (citing Pet. Reply, 3–4). Patent Owner contends, contrary to Petitioner’s assertions, that element 50 of Figure 7 in the ’546 patent is a driving apparatus and is not a light-emitting diode string. *Id.* at 16–17.

Although Patent Owner argues that Petitioner’s arguments in the Reply on “light strings” and “curtain lamp” as they relate to a single LED are improper, we do not agree. As Patent Owner acknowledges, the Petition and Dr. Schubert’s original declaration stated that a “curtain lamp” is “commonly understood to be one or more light strings.” *See* PO Sur-reply 12; *see also* Pet. 8; Ex. 1003 ¶ 37. Patent Owner did not contest Petitioner’s interpretation in its Response. *See* PO Resp. 15. Patent Owner did, however, argue that Kuang did not teach or suggest “light strings” in any form and therefore did not teach a “curtain lamp” under Petitioner’s definition of the same. PO Resp. 15–17. A petitioner reply may respond to arguments raised in a patent owner’s response under 35 U.S.C. § 42.23(b), and here Petitioner’s argument that a light string may have a single LED is properly presented in its Reply in response to Patent Owner’s arguments.

Further, Patent Owner was not only aware that Petitioner had taken the position that a “curtain lamp” could be a single “light string,” but Patent Owner also did not dispute Petitioner’s interpretation.⁸ Our view, therefore, is that Petitioner’s argument that a curtain lamp may be a single LED is proper because it is corollary to Petitioner’s reply arguments on light strings. That is, Petitioner’s assertion follows from the reply arguments on light strings and the unopposed interpretation of curtain lamp as a single light string. Additionally, to the extent there could be any prejudice to Patent Owner by these light string and curtain lamp arguments, Patent Owner has had opportunities to address them by supplemental briefing.

We now turn to the issues as to whether a “light string” can be interpreted to be a single LED and whether a “curtain lamp” can be interpreted to be a single “light string” and a single LED. For the assertion that a “light string” and a “curtain lamp” can be a single LED, Petitioner, in part, relies upon the following portions of the ’546 patent Specification (Pet. Reply 3; Pet. Supp. Br. 8):

The light-emitting diode light string 30 mentioned above includes a plurality of light-emitting diodes. However, *the light-emitting diode light string 30 could include single light emitting diode. It is called the driving apparatus for light emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string of the present invention.*

Ex. 1001, 6:15–20 (emphasis added).

FIG. 9 shows a circuit diagram of the slave control unit of the light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string. The principles are same as before. Therefore, it would be omitted here.

⁸ Patent Owner had been “cautioned that any arguments not raised in the response may be deemed waived.” Paper 12, 9.

The driving apparatus for *light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string 50* is applied to at least a light-emitting diode 52. The driving apparatus for *light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string 50* includes a master control unit 102 and at least a slave control unit 104. The slave control unit 104 is electrically connected to the master control unit 104 and the light-emitting diode 52.

Ex. 1001, 6:27–40 (emphasis added). Petitioner also relies on the descriptions of Figures 7 and 8 of the '546 patent for its assertion that a curtain lamp may have one or more light strings, with the Specification stating, in part, that Figure 7 “shows a circuit diagram of the light-emitting diode curtain lamp with single light-emitting diode in one light emitting diode string.” See Pet. 8; Ex. 1001, 2:34–40. We agree with Patent Owner that Figures 7 and 8 of the '546 patent show that the circuit diagram of the curtain lamp has multiple LEDs (PO Sur-reply 14); however, as noted in part above, there are several instances where the '546 patent discloses similar descriptions of the driving apparatus for a curtain lamp having a single light-emitting diode in one light-emitting diode string, including claim 8 (see Ex. 1001, 1:33–36, 6:15–20, 6:27–40, 8:25–45). The '546 patent Specification also provides support that driving apparatus for a light-emitting diode curtain lamp with a “single light-emitting diode in one light-emitting diode string 50” includes both master control unit 102 and slave control unit 104. Ex. 1001, 6:34–38; see also *id.* at 8:25–45 (also indicating that a driving apparatus for curtain lamp includes a first curtain lamp with one LED in one light string, which has a master control unit and a slave control unit, as well as second curtain lamp (claim 8)). Although Patent Owner argues that there would be no reason to have both a master control unit and slave control unit to operate a single LED, and the '546 does not

appear to provide any explanation for this, the patent nonetheless discloses that the driving apparatus for a curtain lamp with one LED in a single string has both the master and slave control units. *See id.* Patent Owner further argues that “the ’546 patent mentions that one light string 30 could ‘include single light-emitting diode’” and “[t]he next sentence gives this embodiment a special name” and does not say that the entire curtain lamp could constitute a single LED. PO Sur-reply 13–14 (citing Ex. 1001, 6:15–20). This disclosure, however, explicitly discloses that a curtain lamp could have a “single light-emitting diode in one light-emitting diode string,” and as discussed above, it is consistent with other disclosures in the patent. *See* Ex. 1001, 6:15–20.

We recognize that, as Petitioner advocates, interpreting a “curtain lamp” to include “one or more light strings” where a light string may include only one LED results in a curtain lamp being a single light string with one LED, and this implicates the issue of whether the recited elements have to be distinct components. *Becton*, 616 F.3d at 1254 (“[W]here a claim lists elements separately, ‘the clear implication of the claim language’ is that those elements are ‘distinct component[s]’ of the patented invention.” (quoting *Gaus v. Conair Corp.*, 363 F.3d 1284, 1288 (Fed. Cir. 2004))). “[T]o overcome *Becton*, there must be evidence that shows that the impliedly distinct components, instead, can be satisfied by a single component.” *Regeneron Pharms., Inc. v. Mylan Pharms. Inc.*, 130 F.4th 1372, 1380 (Fed. Cir. 2025). *Google LLC v. EcoFactor, Inc.*, 92 F.4th 1049, 1058 (Fed. Cir. 2024) stated:

[Our] cases do not create a *per se* rule that separately listed claim elements are distinct components, regardless of the intrinsic record . . . Rather, we have explained that there is a ‘presumption’

that separately listed claim limitations may indicate separate and distinct physical structure, but that presumption may always be rebutted in the context of a particular patent.

The “context” is typically evaluated by reviewing the intrinsic record. *See e.g., Regeneron*, 130 F.4th at 1380–84. Here, as discussed above, the ’546 patent has multiple disclosures where a curtain lamp has a single light-emitting diode in one light-emitting diode string. *See* Ex. 1001, 1:33–36, 6:15–20, 6:27–40, 8:25–45. In particular, the ’546 patent similarly discloses a first curtain lamp with one LED in one light string, as well as a second curtain lamp, which provides further support for Petitioner’s proposed interpretation. *Id.* at 8:25–45. Although Patent Owner argues that Figures 7 and 8 disclose multiple LEDs and light strings in curtain lamps, other embodiments and claims explicitly indicate single components in a “curtain lamp.” “[T]here is a strong presumption against a claim construction that excludes a disclosed embodiment.” *See In re Katz Interactive Call Processing Patent Litig.*, 639 F.3d 1303, 1324 (Fed. Cir. 2011). Given that certain embodiments and claim 8 disclose a curtain lamp with one light string with one LED, we decline to interpret the claim to prohibit Petitioner’s interpretation.

Additionally, we do not find that Petitioner’s claim interpretation renders the claim terms nonsensical or illogical. *See Becton*, 616 F.3d at 1255. Patent Owner asserts otherwise, arguing that Petitioner’s interpretation is based upon a “nonsensical” or “absurd[]” argument, there is no reason to have both a master and slave control unit to operate a single LED, and the interpretation renders most of the components superfluous. *See* PO Sur-reply 12; PO Resp. Supp. Br. 5. As discussed above, however, although the ’546 patent does not appear to provide any explanation for why

there are master and slave control units to operate a single LED, the patent nevertheless discloses that in embodiments. This situation is also distinguishable from *Becton*, where “unequivocal language” of the claim recited “spring means ‘connected to’ the hinged arm,” such that interpreting the spring means and the hinged arm as the same structure would have rendered the claim nonsensical. *Becton*, 616 F.3d at 1254–55. *Becton* further found that interpreting the spring means and hinged arm as the same structure would be inconsistent with descriptions of the elements in the specification. *Id.* Here, in contrast, the ’546 patent Specification is replete with disclosures of a curtain lamp having one light string with one LED, and claim 8 is directed to the same. Accordingly, we adopt Petitioner’s interpretation of these claim elements.

Patent Owner’s arguments on the teaching of the preamble solely relate to the interpretation of “light string” and “curtain lamp,” and we agree with Petitioner’s positions on this for the reasons discussed above. PO Resp. 15–17; PO Sur-reply 12–17; PO Supp. Br. 4–8; PO Resp. Supp. Br. 4–5.

We have reviewed Petitioner’s arguments and evidence on the teaching of the preamble. On this complete record, we agree with Petitioner that Kuang teaches the preamble of claim 1.

ii. Limitation 1[A]

Limitation 1[A] recites “a master control unit electrically connected to the direct current power source, including a microcontroller and a voltage regulator electrically connected to the microcontroller.” Ex. 1001, 7:11–15.

Petitioner asserts that Kuang’s master node 103 coupled to battery 118 in Figure 1 teaches “a master control unit electrically connected to the direct current power source.” Pet. 9 (citing Ex. 1004, Fig. 1; Ex. 1003 ¶ 39).

Petitioner relies on the annotated version of Kuang's Figure 3 reproduced below:

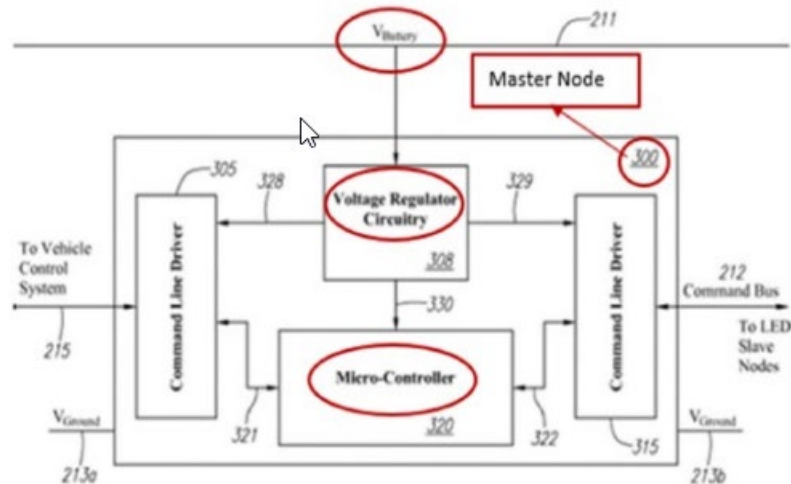


FIG. 3

Pet. 10 (annotated version of Ex. 1004, Fig. 3). Annotated Figure 3 of Kuang, above, shows master node 300 (identified by Petitioner by a red box labeled “Master Node”), which includes voltage regulator circuitry 308, micro-controller 320, and power from a battery, all of which are circled in red by Petitioner. *See id.* Voltage regulator circuitry 308 receives a power signal from power supply line 211, and micro-controller 320 performs supervisory control and logic functioning of the lighting control system. *See* Ex. 1004 ¶¶ 39–40.

In referring to Figure 3 of Kuang, Petitioner states that Kuang’s master node 300 includes voltage regulator 308 and microcontroller 320. Pet. 9–10 (citing Ex. 1004 ¶¶ 39–40; Ex. 1003 ¶ 40). Petitioner asserts that Figure 3 of Kuang shows that voltage regulator 308 is “electrically connected” to microcontroller 320. *Id.* at 10–11 (citing Ex. 1004, Fig. 3, ¶ 39; Ex. 1003 ¶ 41).

Patent Owner presents no arguments specifically related to limitation 1[A]. *See generally* Prelim. Resp.; PO Sur-reply.

We have reviewed Petitioner’s arguments and evidence on the teaching of limitation 1[A]. On this complete record, we agree with Petitioner that Kuang teaches limitation 1[A].

iii. Limitation 1[B]

Limitation 1[B] recites “at least a slave control unit electrically connected to the master control unit and the light-emitting diode light string.” Ex. 1001, 7:16–18.

Petitioner cites to Figure 1 of Kuang for disclosing a slave/LED node 102 that is electrically connected to master node 103 and LEDs 107. Pet. 11 (citing Ex. 1004, Fig. 1; Ex. 1003 ¶ 42). Further, Petitioner cites to Kuang for teaching “[t]he lighting control network 100 . . . comprises a plurality of network nodes including a **master node 103** and a **series of slave/LED nodes 102**, each of which constitutes or is associated with an LED-based lighting fixture having local electronic control but **responsive to the master node 103**.” Pet. 12 (quoting Ex. 1004 ¶ 32 (emphasis added)) (citing Ex. 1003 ¶ 43). Petitioner also cites to Kuang for teaching that “lighting control system 200 comprises a master node 203 and a series of LED-based lighting fixtures 202, each of which constitutes or is associated with **a slave/LED network node having local control electronics responsive to the master node 203**.” *Id.* (quoting Ex. 1004 ¶ 33 (emphasis added)) (citing Ex. 1003 ¶ 43).

Petitioner asserts that Kuang’s slave/LED nodes “must be ‘electrically connected’ to the LEDs . . . because the slave/LED nodes ‘control[] the LED-based lighting fixtures.’” Pet. 12 (citing Ex. 1004 ¶ 11). Petitioner

further points to Figure 2B and paragraph 37 of Kuang to show the electrical connections between slave nodes 273 and LED units 274. *Id.* at 12–13.

Petitioner relies on the annotated version of Kuang’s Figure 2B reproduced below:

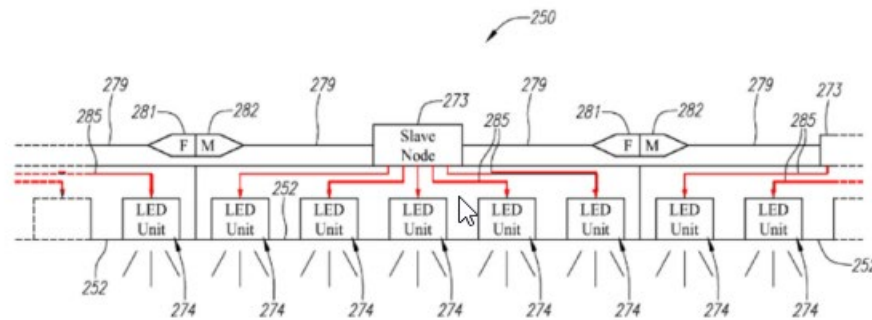


FIG. 2B

Id. at 13 (annotated version of Ex. 1004, Fig. 2B) (citing Ex. 1003 ¶ 44).

Annotated Figure 2B of Kuang, above, shows lighting control system 250 including LED-based lighting fixtures 252 connected in series, in which each LED-based lighting fixture 252 includes one or more LED units 274 comprising a plurality of LEDs for illumination. Each LED-based lighting fixture 252 includes slave node 273, and each slave node 273 is coupled to LED units 274 through one or more control and/or power signals 285 (shown in red by Petitioner). *See* Ex. 1004 ¶¶ 36–37.

Patent Owner presents no arguments specifically related to limitation 1[B]. *See generally* PO Resp.; PO Sur-reply.

We have reviewed Petitioner’s arguments and evidence on the teaching of limitation 1[B]. On this complete record, we agree with Petitioner that Kuang teaches this limitation.

iv. Limitation 1[C]

Limitation 1[C] recites “a transmission line electrically connected to the master control unit and the slave control unit.” Ex. 1001, 7:19–20.

Petitioner cites to Figure 1 and paragraph 32 of Kuang and asserts that a person of ordinary skill in the art “would have understood Kuang’s power/data bus 104 as meeting the ‘transmission line’ limitation,” with respect to which Petitioner states that “[f]or example, a POSITA would have understood that a data bus is commonly defined as a wire or group of wires used to transmit data to or from a number of different locations.” Pet. 14 (citing Ex. 1004, Fig. 1, ¶ 32) (quoting Ex. 1003 ¶ 46). Petitioner contends that Figure 1 illustrates that “power/data bus 104 electrically connects the master node to the series of slave/LED nodes.” *See id.* (citing Ex. 1004, Fig. 1) (quoting Ex. 1003 ¶ 46). Petitioner relies on the annotated version of Kuang’s Figure 1, *id.* at 13–14, reproduced below:

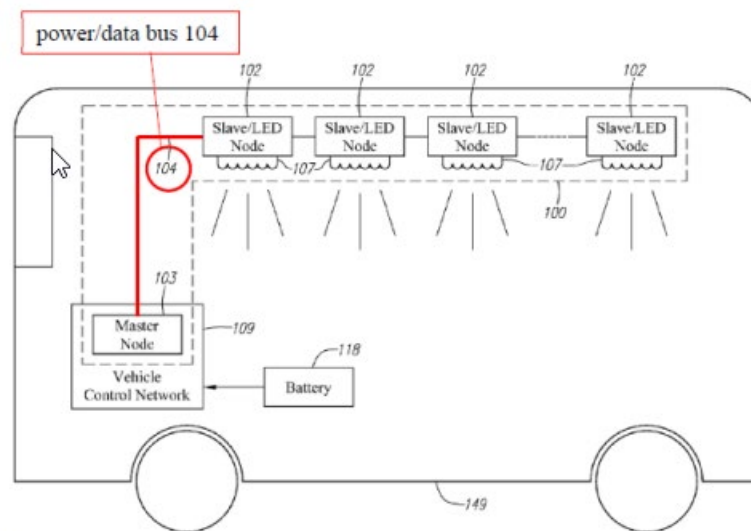


FIG. 1

Pet. 13–14 (annotated version of Ex. 1004, Fig. 1; Ex. 1003 ¶ 45).

Annotated Figure 1 of Kuang, above, shows transit vehicle 149 with power/data bus 104 interconnecting the series of slave/LED nodes 102. *See*

Ex. 1004 ¶ 32. Petitioner has circled the reference numeral “104” in red color; added a red box labeled “power/data bus 104”; and identified power/data bus 104 in red color. *See* Pet. 14.

In addition, Petitioner cites to Figure 2A and paragraph 33 of Kuang as illustrating a “transmission line” as “power supply line 211 or a command line 212, either of which are electrically connected to master node . . . and slave nodes 202.” Pet. 15 (citing Ex. 1004, Fig. 2A, ¶ 33) (quoting Ex. 1003 ¶ 47). Petitioner relies on the annotated version of Kuang’s Figure 2A, *id.* at 15, reproduced below:

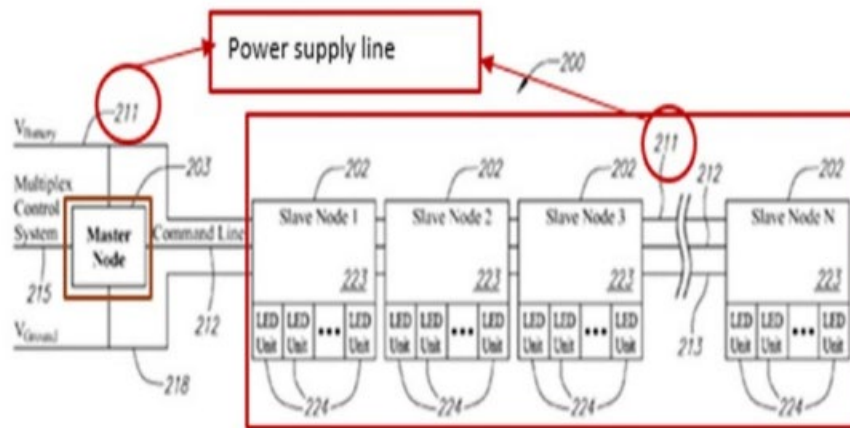


FIG. 2A

Pet. 15 (annotated version of Ex. 1004, Fig. 2A). Annotated Figure 2A of Kuang, above, shows lighting control system 200, which includes master node 203 and a series of LED-based lighting fixtures 202. Each LED-based lighting fixture 202 comprises slave node 223 and one or more LED units 224, where each LED unit 224 comprises one or more LEDs for providing illumination. A power bus that comprises power supply line 211 from the vehicle battery and a ground line 218/213 is connected from master node 203 to each LED-based lighting fixture 202 and slave node 223 in series.

See Ex. 1004 ¶ 33. Petitioner has circled in red reference numerals “211” and has added a brown box and a red box. The brown box surrounds “Master Node 203,” and the red box encloses Slave Nodes 1, 2, 3, and N, including lines 211, 212, and 213, and LED units 224. Petitioner has also added a red box, labeled “Power supply line,” with arrows extending from lines 211 to this box. *See* Pet. 15.

Patent Owner presents no arguments specifically related to this limitation. *See generally* PO Resp.; PO Sur-reply.

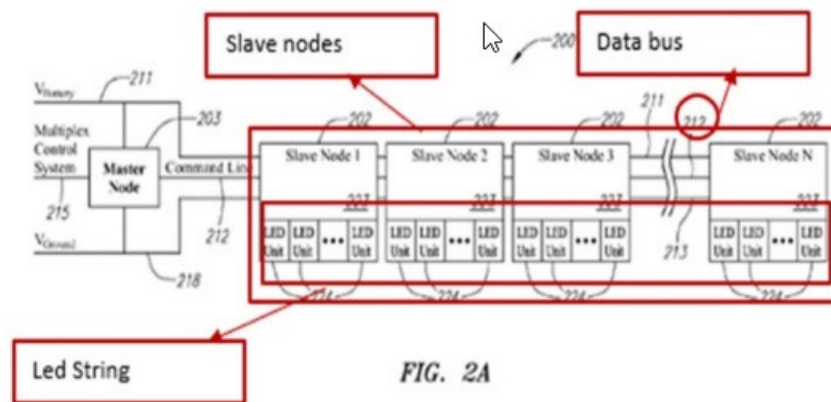
We have reviewed Petitioner’s arguments and evidence on the teaching of limitation 1[C]. On this complete record, we agree with Petitioner that Kuang teaches this limitation.

v. Limitation 1[D]

Limitation 1[D] recites “wherein the slave control unit is controlled by the master control unit to drive the light-emitting diode light string; the transmission line is used to transit control signals and synchronous signals.” Ex. 1001, 7:21–24.

First, we address the limitation “wherein the slave control unit is controlled by the master control unit to drive the light-emitting diode light string,” and then we turn to the limitation “the transmission line is used to transit control signals and synchronous signals.” Ex. 1001, 7:21–24.

Petitioner contends that Kuang’s Figure 2A illustrates “a master node (the claimed ‘master control unit’) driving slave nodes (the claimed ‘slave control units’) to drive the LEDs, including by transmitting control signals and synchronous signals.” Pet. 16 (citing Ex. 1004, Fig. 2A) (quoting Ex. 1003 ¶ 48). Petitioner relies on the annotated version of Kuang’s Figure 2A, *see id.*, reproduced below:



Pet. 16 (annotated version of Ex. 1004, Fig. 2A). Annotated Figure 2A of Kuang, above, depicts a high-level architectural diagram of lighting control system 200, showing master node 203, a series of LED-based lighting fixtures 202, and slave nodes 223, and multiple LED units 224 electrically connected to slave nodes 223. Petitioner identifies command/data bus 212, which is shown as connecting master node 203 to each LED-based lighting fixture 202 and slave node 223. *See* Ex. 1004 ¶ 33. Petitioner has circled in red the reference numeral “212”; added a red box labeled “Slave nodes” (with a red arrow extending from Slave Node 2 to this box); added a red box labeled “Data bus” (with a red arrow extending from reference numeral 212 to this box); added a red box labeled “Led String” (with a red arrow extending from the left-most reference numeral “224” to this box); and added a red box surrounding Slave Nodes 1, 2, 3, and N, including lines 211, 212, and 213 and LED units 224. *See* Pet. 16.

Patent Owner presents no arguments specifically related to this limitation “wherein the slave control unit is controlled by the master control unit to drive the light-emitting diode light string.” *See generally* PO Resp.; PO Sur-reply. We have reviewed Petitioner’s arguments and evidence on

the teaching of this portion of limitation 1[D] and find it sufficiently demonstrates that Kuang teaches it.

We next turn to the recitation that “the transmission line is used to transit control signals and synchronous signals.” Ex. 1001, 7:23–24. As discussed *supra* with respect to limitation 1[C], Petitioner relies on the following from Kuang as meeting the claimed “transmission line”: power/data bus 104 from Figure 1; power supply line 211 from Figure 2A; and/or command line 212 from Figure 2A.

With respect to the claimed “control signals,” Petitioner asserts that “Kuang explains that the master node sends ‘commands or queries’ to the slave nodes” and quotes Kuang: “[t]he master node 203 may . . . control the various LED-based lighting fixtures 202, and slave nodes 223 thereof, through commands or queries transmitted over the command/data bus 212.” Pet. 16 (quoting Ex. 1004 ¶ 34 (emphasis added)) (citing Ex. 1003 ¶ 49).

In addition, with respect to the claimed “synchronous signals,” Petitioner states that “Kuang also discloses a master node that sends synchronous signals to all slave nodes, and in turn, all LEDs,” and asserts that “[i]n this context, a POSITA would have understood the term ‘synchronous signals’ to mean signals that are sent to the slave nodes to control their corresponding LED strings at the same time.” Pet. 16–17. Petitioner also cites to Kuang at paragraph 54 for teaching “synchronous signals”: “[a]s explained in Kuang, ‘[a] master light shutoff command may also be sent from the master node 203 instructing *all* LED/slave nodes to turn off.’” *Id.* at 17 (quoting Ex. 1004 ¶ 54 (emphasis added)) (citing Ex. 1003 ¶ 50). Petitioner further cites to Kuang, as follows: “The microcontroller 420 may also respond to commands from the master node

203 to dim the LEDs 442 *on all or selected ones of the LED units 424.*” *Id.* (quoting Ex. 1004 ¶ 54 (emphasis added)) (citing Ex. 1003 ¶ 50).

Petitioner additionally asserts that, even under Patent Owner’s proposed construction of the term “synchronous signals,” consistent with the “in rhythm” disclosure (*see* Ex. 1001, 3:30–32) in the ’546 patent, Kuang teaches this limitation. Pet. Supp. Br. 3–5. In support, Petitioner refers to Kuang’s disclosure that “[t]he master node 203 may, for example, command certain LED units 224 to turn on, turn off, dim by a specified amount, intensify by a specified amount, flash (e.g., in emergency situations), *or activate according to a predetermined pattern.*” *Id.* at 4 (quoting Ex. 1004 ¶ 35 (emphasis added); citing Ex. 1010 ¶ 34). Petitioner argues that “[b]ecause a ‘predetermined pattern’ can be repeated, it follows that Kuang discloses signals that are ‘in rhythm’ because they ‘are occurring relative to one another on some kind of time scale’ as characterized by Patent Owner.” *Id.*

As discussed *supra* Section II.B, Patent Owner proposes a construction of the term “synchronous signals,” and also contends that synchronous signals must be separate from control signals. *See* PO Resp. 11. We have determined that control and synchronous signals need not be separate for the reasons discussed above. *See supra* Section II.B. We also determine that Kuang teaches “synchronous signals” under Patent Owner’s proposed construction as: “signals related to activities governed by synchronized timing.” PO Resp. 8. We agree with Petitioner that Kuang’s disclosure that the master node commanding certain LED units to activate in a predetermined pattern is equivalent to signaling “in rhythm,” wherein the signals occur relative to one another on a time scale. Patent Owner argues

that the disclosure in Kuang does not explain “a predetermined pattern” or disclose that it is governed by synchronized timing. PO Resp. Supp. Br. 3. We do not find this argument persuasive because the signaling in a predetermined pattern in Kuang would be control by synchronized timing, as Patent Owner admits:

The use of synchronous signals in claim 1 enables activities governed by synchronized timing, such as *controlling LEDs in patterns*, and providing moving/animated lights, consistent with the '546 patent's disclosure of driving light strings “in turn, or in rhythm, or together.”

PO Supp. Br. 2.

Patent Owner also asserts that Kuang fails to teach synchronous signals because its slave nodes do not operate according to synchronized timing under Patent Owner's proposed construction of the term “synchronized signals.” PO Resp. 21–24. Patent Owner contends that Kuang discloses sending a command that is propagated from one slave node to the next, until the command reaches the last slave node. *Id.* (citing Ex. 1004 ¶ 34). Patent Owner argues that a person of ordinary skill in the art would expect that each slave node would execute the command as it is received, and “[a]s a result, the slave/LED nodes would shut off their lights in a sequential manner” which “says nothing about shutoff being governed by synchronized timing.” *Id.* (citing Ex. 2001 ¶¶ 76, 80). Dr. Lebby testifies that, with the propagation, “[t]he time that a given node receives the command would depend on how many slave nodes there are to receive the commands, physical distance between the nodes, and other delays that may occur due to signal propagation issues and transmission errors.” Ex. 2001 ¶ 76. Dr. Lebby also testifies that “it is my opinion that a POSITA would expect that each of Kuang's slave nodes executes the command as it is

received – and in a manner that is not at the same time, simultaneous, or in governed by synchronized timing.” *Id.*

We do not find that Patent Owner’s arguments undermine Petitioner’s showing on the issue of the teaching of “synchronous signals” in Kuang. In Reply, Petitioner relies upon the testimony of Dr. Schubert concerning the propagation of the electrical signal as an electromagnetic guided wave over the transmission line in Kuang. Pet. Reply 7–8 (citing Ex. 1010 ¶¶ 25–26). Dr. Schubert testifies that because the propagation velocities are high, the delays are short and are not noticeable to a human observer.⁹ Ex. 1010 ¶ 26. Petitioner also asserts that, based on Dr. Schubert’s testimony, the embodiments of the ’546 patent would “disclose the same propagation delays that Dr. Lebby alleges would distinguish Kuang from meeting this limitation.” Pet. Reply 8–9 (citing Ex. 1010 ¶ 27).

Dr. Lebby testifies that in Figure 7 of the ’546 patent each serial string of LEDs 52 receives power via a common power line, and each LED 52 can be individually controlled via connections to a slave control unit 104, so a person of skill “would have understood that because the ’546 patent discloses the use of synchronous signals, the ’546 patent curtain lamp is designed for controlling LED lights individually and in a time-coordinated manner.” Ex. 2001 ¶ 57. Patent Owner argues that this testimony is un rebutted—but while Patent Owner argues the benefits of synchronous timing, Patent Owner does not rebut the issue of whether there would be delays in the transmissions in the signals to the slave control units under the

⁹ Dr. Schubert testifies that it only takes 20 ns (nanoseconds) to propagate 10 feet, and this is very small and far below the 1 ms (milliseconds) time for a human observer to notice, so it would not be noticeable. Ex. 1010 ¶ 26.

'546 patent. PO Sur-reply 7. Instead, Patent Owner concedes that delays would occur: “synchronized timing provided by the synchronous signals in the '546 patent would ensure that activities would be synchronized across different devices *despite any transmission propagation delays.*” *Id.* (emphasis added); *see also* PO Supp. Br. 3. By this, Patent Owner appears to be arguing that it is the time of the delay that is at issue but not that there are delays in the signal transmissions to the slave control units in the '546 patent.

On the transmission time delays in the '546 patent, Dr. Schubert testifies that in Figure 7 of the '546 patent, the “slave control units 104 are connected by wirings that have a physical length” and “[i]t is simply impossible for the propagation delay to be zero,” so there would be propagation delays between the slave control units 104. Ex. 1010 ¶ 27. Dr. Schubert testifies that, even if the wirings between slave control units 104 are short, there would still be a propagation delay of 20 ns. We credit this testimony because it is based on known scientific principles (*id.* ¶¶ 25–28), and, accordingly, we agree that in the '546 patent the signals between slave control units would necessarily have some, although “exceedingly small,” delays, which is similar to the teachings of Kuang in that its delays have the same order of magnitude of nanoseconds, which is far below the magnitude of delays that are noticeable to a human observer. *See id.* ¶¶ 27–28. Accordingly, we are not persuaded by Patent Owner’s arguments with regard to differentiation with the '546 patent teachings; Patent Owner asks too much of the prior art teachings by effectively requiring no delays, even negligible delays, in the signal transmissions. Furthermore, we credit Dr. Schubert’s testimony that any delays in Kuang would be negligible, that

is, not noticeable to a human observer,¹⁰ and would be similar to those that occur in '546 patent.

Accordingly, on this complete record, we agree with Petitioner that Kuang teaches limitation 1[D].

vi. Conclusion

Weighing the record as a whole in view of the findings and analysis above, we conclude that Petitioner has met its burden to show, by a preponderance of the evidence, that claim 1 would have been obvious over Kuang.

c. Claim 2

Claim 2 recites “[t]he driving apparatus for light-emitting diode curtain lamp in claim 1, wherein the slave control unit includes a signal processor.” Ex. 1001, 7:25–27.

Petitioner provides evidence and argument that claim 2 would have been obvious over Kuang. Pet. 17–20. Petitioner asserts, in part, that Kuang’s slave node 423 of Figure 4 “includes a micro-controller 420 which can serve as the claimed ‘signal processor.’” *Id.* at 19. Petitioner cites to Kuang, which states that in Figure 4: “[t]he micro-controller 420 performs the local control and logic functions required by the lighting control system for causing the LEDs of the LED units 424 to turn on and off, dim, flash if necessary,” and “the micro-controller 420 would be understood to include appropriate memory . . . , interfaces, and drivers, as well as logic circuitry

¹⁰ In Patent Owner’s Response, Sur-reply, and supplemental briefing, we discern no evidence that rebuts Dr. Schubert’s testimony that any delays in Kuang’s signal transmissions would not be noticeable to a human observer. *See* PO Resp. 20–24; Ex. 2001 ¶¶ 57–58, 75–80; PO Sur-Reply 5–7; PO Supp. Br. 2–4.

including, for example, a microprocessor, FPGA [Field-Programmable Gate Array], or other programmable logic.” *Id.* at 19–20 (quoting Ex. 1004 ¶ 43).

Patent Owner presents no arguments specifically related to claim 2. *See generally* Prelim. Resp.; PO Sur-reply.

We have reviewed Petitioner’s arguments and evidence on the teaching of the limitations of claim 2. On this complete record, we agree with Petitioner that Kuang teaches the limitations of claim 2.

Weighing the record as a whole in view of the findings and analysis above, we conclude that Petitioner has met its burden to show, by a preponderance of the evidence, that claim 2 would have been obvious over Kuang.

E. Obviousness of Claim 3 over Kuang and Debevec

Petitioner contends that claim 3 would have been obvious over the combination of Kuang and Debevec. Pet. 20–22. Petitioner also relies upon the Schubert Declaration (Ex. 1003) and the Reply Schubert Declaration (Ex. 1010) to support its positions.

Patent Owner contends that a person of ordinary skill in the art would not have combined Kuang and Debevec and Petitioner’s obviousness analysis is flawed. PO Resp. 34–40; PO Sur-reply 21–22. Patent Owner also relies upon the Lebby Declaration (Ex. 2001) to support its positions.

We begin our discussion with brief summary of Debevec, and then address the evidence and arguments presented.

1. Debevec (Ex. 1005)

Debevec is directed to: “[a] controllable lighting system [that] may include a plurality of light source groups, a group controller for each light source group, a master controller, and a network communication system.”

Ex. 1005, code (57). Debevec discloses that each group controller “may be configured to control the light sources in its light source group based on a group control command.” *Id.* Further, Debevec discloses that the network communication system “may be configured to communicate the group control commands from the master controller to the group controllers.” *Id.*

2. Discussion

Claim 3 recites: “[t]he driving apparatus for light-emitting diode curtain lamp in claim 2, wherein the slave control unit includes a transistor electrically connected to the signal processor.” Ex. 1001, 7:28–30.

Petitioner asserts that “[a]lthough Kuang does not explicitly disclose a ‘slave control unit’ that includes ‘a transistor electrically connected to the signal processor,’ Debevec does.” Pet. 20 (citing Ex. 1003 ¶ 55). Petitioner argues that Debevec discloses that it is a “controllable lighting system” that has a similar master/slave controller system as Kuang. *Id.* Petitioner asserts that the “‘network communication system’ communicates master controller commands to the group controllers” so the “group controllers” in Debevec are the claimed “slave control unit.” *Id.* at 20–21 (citing Ex. 1005 ¶ 8; Ex. 1003 ¶ 56). Petitioner refers to Debevec’s brightness feedback control circuit used by its group controller which calibrates the brightness of each LED, and which is “controlled by an electronic switch or valve, such as by a transistor 703.” *Id.* at 21 (citing Ex. 1005 ¶ 78, Fig. 7; Ex. 1003 ¶ 57).

Petitioner argues that a person of ordinary skill in the art would have been motivated to combine Kuang with Debevec because both systems are directed to “[c]ontrollable lighting systems that can be adjusted in terms of their brightness, color, and temporal dynamics.” Pet. 21. Dr. Schubert testifies that:

In order to adjust the brightness of LEDs, or to switch them ON or OFF, an electric switch or valve is needed. A transistor is a common electrical switch or valve used in electrical circuits. A POSITA would be aware of the suitability of a transistor as an electronic switch or valve. Furthermore, Debevec discloses the use of a transistor as an electronic switch or valve for the purpose of switching the current to an LED light source or driving an LED light source with a certain calibrated current. Electric circuits are known to be predictable. That is, transistor circuits are common in the field and their functioning is not subject to unexpected results.

Ex. 1003 ¶ 58. Dr. Schubert further testifies that one of skill in the art would have been motivated to use Debevec's transistor as an electronic switch or valve in Kuang's lighting system and this combination would have been obvious and predictable. *Id.*

We determine that Petitioner has sufficiently demonstrated that Debevec discloses the use of a transistor in a slave control unit, there is rationale to combine Debevec and Kuang, and such a combination would have had a reasonable expectation of success. More specifically, we credit Dr. Schubert's testimony that in lighting control systems, electrical switching is required and transistor circuits are commonly used for this switching, which serves as rationale for the combination of Kuang and Debevec, and, further, that the functioning of transistor circuits is predictable.

Patent Owner argues that Kuang already has the capabilities of an electronic switch or valve, so there is no motivation to add Debevec's transistor. PO Resp. 34–35 (citing Ex. 2001 ¶¶ 100–102). Patent Owner asserts that Petitioner does not explain how a person of skill would have integrated Debevec's transistor into Kuang's circuitry or explain what the modified circuit would have looked like, which is alleged to be critical

because Kuang discloses controllers that adjust LED brightness and output without adding Debevec's transistor. *Id.* at 38 (citing Ex. 2001 ¶ 109). Patent Owner also argues that Petitioner does not explain why a person of skill would have had a reasonable likelihood of success in modifying Kuang's circuit to add Debevec's transistor because the respective circuits are different. *Id.* at 38–39 (citing Ex. 2001 ¶ 109). Patent Owner further asserts that Debevec and Kuang are non-analogous to each other because Debevec discloses a lighting system, for instance, for lighting systems in the shape of a geodesic sphere and Kuang is directed to vehicle lighting, so a person of ordinary skill in the art would not have looked to Debevec's geodesic sphere lighting for making improvements to Kuang. *Id.* at 35–36 (citing Ex. 2001 ¶103).

We do not find that Patent Owner's arguments undermine Petitioner's showing on the teachings of the combination of Kuang and Debevec, the rationale to combine, and the reasonable likelihood of success. As an initial matter, Petitioner's showing that Debevec and Kuang are analogous prior art is sufficient. A reference is considered analogous prior art: (1) if the reference is from the same field of endeavor as the claimed subjected matter, regardless of the problem addressed; or (2) if "the reference still is reasonably pertinent to the particular problem with which the inventor is involved," even though the reference is not within the field of the inventor's endeavor. *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004). The "field of endeavor" test asks if the structure and function of the prior art is such that it would be considered by a person of ordinary skill in the art because of the similarity to the structure and function of the claimed invention as disclosed in the application. *Id.* at 1325–27. Here, Debevec and Kuang are both in the

same field of endeavor—they both are directed to controlling lighting systems by the use of master and slave control units. *See* Ex. 1004, code (57); Ex. 1005, code (57). Both references are also pertinent to addressing similar problems in the controlling lighting systems. *See* Ex. 1004 ¶ 9; Ex. 1005 ¶ 7. According, we are not persuaded by Patent Owner’s arguments that one of ordinary skill in the art would not have looked to Debevec’s geodesic sphere lighting system for making improvements to Kuang.

We also do not find persuasive Patent Owner’s argument that Kuang already has the capabilities of an electronic switch or valve, so there is no motivation to add Debevec’s transistor. *See* PO Resp. 34–35 (citing Ex. 2001 ¶¶ 100–102). Here, Dr. Lebby acknowledges, as Petitioner asserts, that in Debevec a transistor is used as part of a “brightness feedback circuit” in a group controller, to calibrate the brightness of light sources. *See* Ex. 2001 ¶ 101, Pet. 21; Ex. 1005 ¶ 78. Dr. Lebby also acknowledges that Kuang discloses the same functionality as that achieved by the addition of Debevec’s transistor. Ex. 2001 ¶ 101. Accordingly, Patent Owner does not dispute Dr. Schubert’s testimony that it was known that a transistor was used in driving an LED light and a person of skill would have found the use of a transistor to be a suitable substitution in Kuang. *See* Ex. 1003 ¶ 58. Patent Owner argues that because Kuang already discloses the requisite functionality there is no need to add Debevec’s transistor, but Petitioner demonstrates obviousness with its assertion that there was a known substitute that yields predictable results. *KSR* explains that “[o]ne of the ways in which a patent's subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there

was an obvious solution encompassed by the patent's claims." *KSR*, 550 U.S. at 419–420. "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Id.* at 416. Similarly, "the simple substitution of one known element for another" often results in obvious subject matter, absent unexpected results. *Id.*; *see also id.* at 416 ("[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result."), 417 ("[A] court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions."). Again, Dr. Lebby's testimony corroborates Dr. Schubert's testimony that transistors were known for the use in controlling LED lights and the substitution of Debevec's transistor in Kuang would result in the same functionality for light control, which is sufficient to demonstrate rationale for the combination. *See* Ex. 1003 ¶ 58; Ex. 2001 ¶ 101.

Patent Owner also argues Petitioner does not explain how a person of skill would have integrated Debevec's transistor into Kuang's circuitry or explain what the modified circuit would have looked like, which is alleged to be critical. PO Resp. 38. More specifically, Patent Owner contends that Petitioner does not explain how the existing voltage boost regulator circuitry 408, current control circuitry 421, and micro-controller 420 in Kuang would be affected by the addition of Debevec's transistor 420. *Id.* at 38 (citing Ex. 1004, Fig. 4; Ex. 1005, Fig. 7). We credit Dr. Schubert's testimony on this issue because he identifies Debevec's transistor switch in the brightness feedback circuit used by a group controller, which is mapped as the slave

control unit, and asserts that this switch can be used to control current flow in Kuang. Ex. 1003 ¶¶ 57–58. We find that this level of detail is sufficient to indicate that Debevec’s transistor switch would be included in Kuang’s slave node current control circuitry in the proposed combination. *See id.*; Ex. 1001, Fig. 4. The details of the integration of the transistor switch in this circuitry appears to be within the capabilities of one of skill consistent with Dr. Lebby’s testimony that the addition of Debevec’s transistor results in the same functionality of Kuang for this current control circuit. Ex. 2001 ¶ 101.

Accordingly, on this complete record, we agree with Petitioner that the combination of Kuang and Debevec teaches the limitations of claim 3, there is rationale to combine the references, and there is a reasonable likelihood of success of the combination.

Weighing the record as a whole in view of the findings and analysis above, we conclude that Petitioner has met its burden to show, by a preponderance of the evidence, that claim 3 would have been obvious over the combination of Kuang and Debevec.

F. Obviousness of Claims 1, 2, and 8 over Lys

Petitioner contends that claims 1, 2, and 8 would have been obvious over Lys. Pet. 23–47. Petitioner also relies upon the Schubert Declaration (Ex. 1003) and the Reply Schubert Declaration (Ex. 1010) to support its positions.

For the reasons discussed above, Petitioner demonstrates by a preponderance of the evidence that claims 1 and 2 would have been unpatentable over Kuang. Accordingly, we need not address whether Lys renders claims 1 and 2 unpatentable. *See In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009).

As to claim 8, Patent Owner contends that Lys does not teach some of the claim limitations. PO Resp. 32–33; PO Sur-reply 17–18. Patent Owner also relies upon the Lebby Declaration (Ex. 2001) to support its positions.

We begin our discussion with brief summary of Lys, and then address the evidence and arguments presented.

1. Lys (Ex. 1008)

Lys is directed to a method of illuminating liquids in, for instance, a pool or spa, that employs independent or coupled controllable devices to form a networked lighting system to provide programmable and/or coordinated color illumination effects. Ex. 1008, code (57). Lys discloses a controller that may receive mode and options signals that may be controlled using a remote user interface having selectors. *Id.* at 13:40–43. A mode signal generated by the remote user interface may be used to select one of the stored illumination programs. *Id.* at 13:55–58. An options signal generated by the remote user interface may be used to adjust one or more variable parameters of a selected illumination program. *Id.* at 13:59–63.

2. Discussion

i. Preamble 8[Pre]

The preamble of claim 8 (8[Pre]) recites: “[a] driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string applied to at least a light-emitting diode, the driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string including.” Ex. 1001, 8:25–44.

Petitioner contends that Lys discloses a plurality of LED light sources powered by a “driving apparatus” as shown in annotated Figure 4 reproduced below.

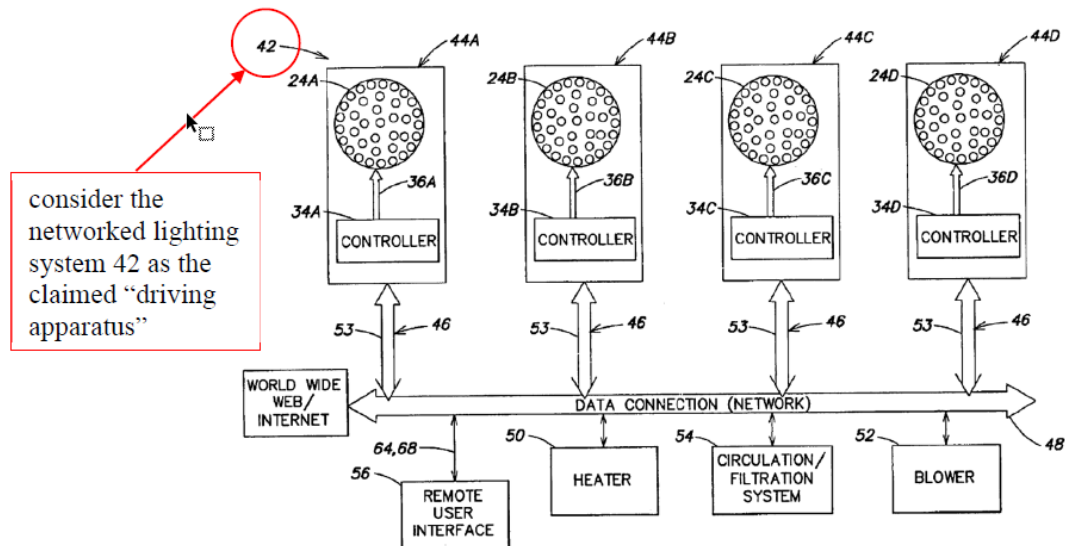


FIG. 4

Annotated Figure 4, above, depicts light sources 24A–24D that are “coupled together to form the networked lighting system 42” where the light sources “may include one or more LEDs 32.” Pet. 37; Ex. 1008, 15:46–56, 10:61–11:20. Networked lighting system 42 is composed of light sources coupled together with devices. Ex. 1008, 15:37–39.

Petitioner asserts that in Lys networked lighting system 42 is the claimed “driving apparatus.” Pet. 37. Petitioner contends that the light sources are coupled together to form a networked lighting system, which includes one or more LEDs. *Id.* (citing Ex. 1003 ¶ 78). Petitioner argues that a person of ordinary skill in the art would have understood that “a light emitting curtain lamp” may be understood to be one or more light strings. In Reply, Petitioner contends that the minimum configuration for a curtain lamp is one LED. Pet. Reply 5. Petitioner also asserts that Lys also

discloses a string of LEDS (24A–24D) that satisfy the curtain lamp limitation. *Id.* at 6.

We determine that Petitioner has demonstrated that Lys teaches a driving apparatus for a curtain lamp with a single light-emitting diode in one light-emitting diode string applied to at least a light-emitting diode.

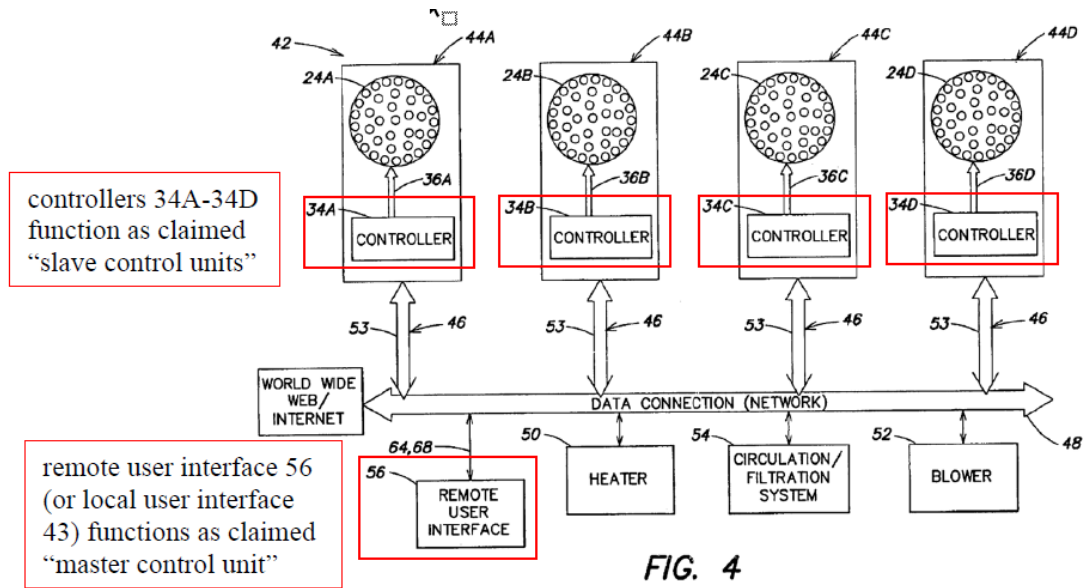
Patent Owner argues, similar to the argument presented for claim 1 under *Kuang*, that Lys does not disclose light strings, a curtain lamp, or a second curtain lamp. PO Resp. 32–33; PO Sur-reply 12–14, 17–18. As discussed *supra* Section II.D.2.b.v, under the intrinsic evidence of the ’546 patent, a curtain lamp may include one light string with one LED, and Petitioner has demonstrated this teaching in Lys.

On this complete record, we agree with Petitioner that Lys teaches the preamble of claim 8.

ii. Limitation 8[A]

Limitation 8[A] recites: “a master control unit; and at least a slave control unit electrically connected to the master control unit and the light-emitting diode.” Ex. 1001, 8:31–33.

Petitioner asserts that Lys teaches a remote or local user interface, which is the claimed “master control unit,” and at least one controller, the claimed “slave control unit,” electrically connected to the local user interface and the LEDs, as shown in annotated Figure 4 of Lys, reproduced below. Pet. 38–39.



Annotated Figure 4 of Lys, above, depicts Petitioner’s identification of the claimed “slave control units” as controllers 34 and the claimed “master control unit” as remote user interface 56. Pet. 39. Petitioner asserts that Lys discloses “a local user interface 43 may be associated with the controller 34 shown in FIG. 2 to facilitate user selection of one or more operating modes of the controller 34 and the light source 24.” *Id.* (citing Ex. 1008, 14:17–29; Ex. 1003 ¶ 81). Petitioner also asserts that “Lys discloses a remote user interface 56 that also meets the ‘master control unit’ limitation” that can be combined with the local user interface 43. *Id.* (citing 1003 ¶ 82).

Patent Owner presents no arguments specifically related to this limitation. *See generally* PO Resp.; PO Sur-reply.

We have reviewed Petitioner’s arguments and evidence on the teaching of limitation 8[B]. On this complete record, we agree with Petitioner that Lys teaches this limitation.

iii. Limitation 8[C]

Limitation 8[c] recites: “the driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string further including: an alternating current voltage transferring to direct current voltage circuit electrically connected to the slave control unit; and” Ex. 1001, 8:38–42.

Petitioner contends that Lys discloses an AC to DC converter electrically connected to the controllers, the claimed “slave control units,” where each controller 34 “receives a power signal 47 to provide power to the light source 24.” In various aspects of this embodiment, the power signal 47 may be provided directly by either an A.C. or D.C. power source.” Pet. 43–44 (citing Ex. 1008, 12:32–46; Ex. 1003 ¶ 88).

Patent Owner presents no arguments specifically related to this limitation. *See generally* PO Resp.; PO Sur-reply.

We have reviewed Petitioner’s arguments and evidence on the teaching of limitation 8[C]. On this complete record, we agree with Petitioner that Lys teaches this limitation.

iv. Limitation 8[D]

Limitation 8[D] recites: “a second curtain lamp electrically connected to the alternating current voltage transferring to direct current voltage circuit.” Ex. 1001, 8:43–45.

Petitioner asserts that Lys discloses a plurality of light sources driven by the same power signal as shown in Figure 4 of Lys. Pet. 44–45 (citing Ex. 1008, Fig. 4 (showing light sources 24A to 24D)). Petitioner asserts that “[a]lthough FIG. 4 shows four light sources 24A–24D coupled together to form the networked lighting system 42, it should be appreciated that the

invention is not limited in this respect, as any two or more of the light sources shown in FIG. 1 may be coupled together to form the networked lighting system 42.” *Id.* at 54 (citing Ex. 1008, 15:46–56; Ex. 1003 ¶ 89). In Reply, Petitioner states that the minimum configuration for a curtain lamp is one LED. Pet. Reply 17. Petitioner argues that light sources 24A to 24D meet the second curtain lamp limitation. *Id.* at 18.

Patent Owner does not provide any other arguments besides those directed to curtain lamps (PO Resp. 32–33; PO Sur-reply 12–14, 17–18), which we do not find persuasive for the reasons discussed *supra* Section II.D.2.b.v.

On this complete record, we agree with Petitioner that Lys teaches limitation 8[D].

v. Conclusion

Weighing the record as a whole in view of the findings and analysis above, we conclude that Petitioner has met its burden to show, by a preponderance of the evidence, that claim 8 would have been obvious over Lys.

G. Obviousness of Claim 3 over Lys and Debevec

For the reasons discussed above, Petitioner demonstrates by a preponderance of the evidence that claim 3 would have been unpatentable over Kuang and Debevec. Accordingly, we need not address whether the combination of Lys and Debevec renders claim 3 unpatentable. *See In re Gleave*, 560 F.3d at 1338.

H. Obviousness of Claim 4 over Hiroyuki

Petitioner contends that claim 4 would have been obvious over Hiroyuki. Pet. 49–66. Petitioner also relies upon the Schubert Declaration

(Ex. 1003) and the Reply Schubert Declaration (Ex. 1010) to support its positions.

Patent Owner contends that Hiroyuki does not teach all the limitations of claim 4. PO Resp. 40–44; PO Sur-reply 22–23. Patent Owner also relies upon the Lebby Declaration (Ex. 2001) to support its positions.

We begin our discussion with brief summary of Hiroyuki and then address the evidence and arguments presented.

1. Hiroyuki (Ex. 1007)

Hiroyuki is a Japanese patent application publication titled “Illumination Apparatus” and discloses that its invention “relates to an illumination apparatus comprising a plurality of lighting units connecting a plurality of LEDs in series.” Ex. 1007 ¶ 3, code (57).

Hiroyuki discloses an illumination apparatus that can achieve “miniaturization, thinness, and low cost.” Ex. 1007 ¶ 9. In an exemplary embodiment, an illumination apparatus performs line lighting, in which the apparatus comprises a master unit 1 and a plurality of slave units 2 connected in sequence. *Id.* ¶ 15. Figure 1 of Hiroyuki is reproduced below:

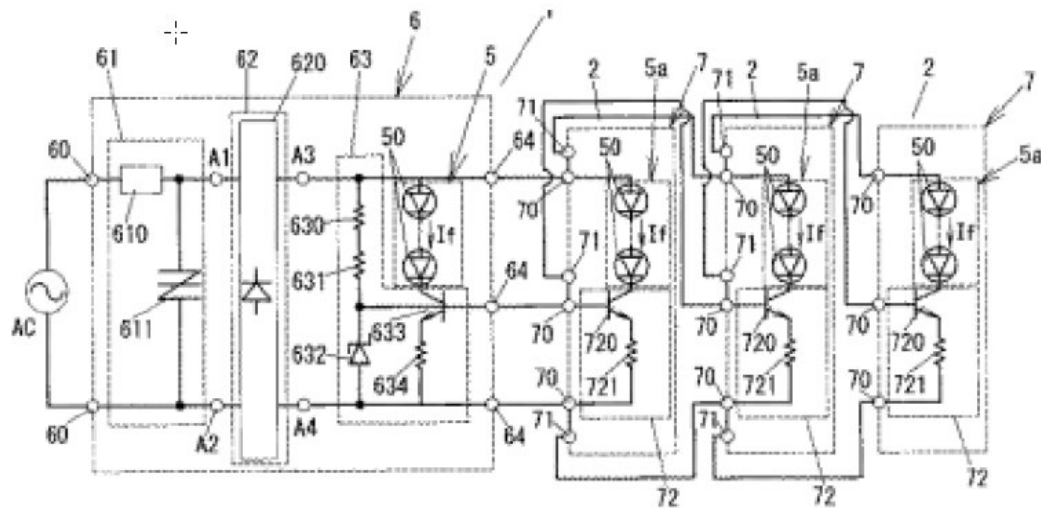


Fig. 1

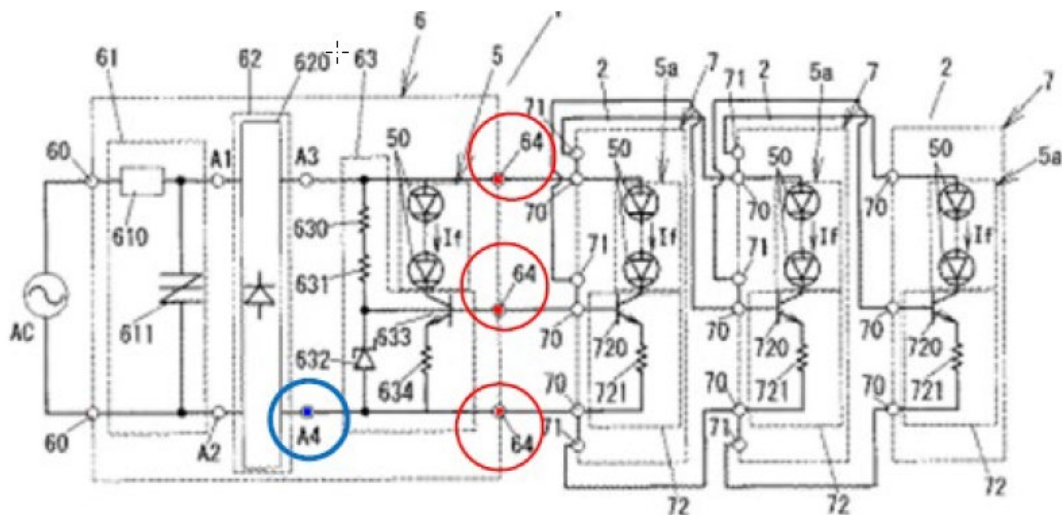
As shown in Figure 1 of Hiroyuki, above, master unit 1 includes housing 3, panel 4, LED group 5, and master drive unit 6. Ex. 1007 ¶ 15. Slave unit 2 is electrically connected to master unit 1 and includes housing 3a, panel 4, LED group 5a, and slave drive unit 7. *Id.* An AC power source supplies AC power. *Id.* ¶ 16. “[M]aster drive unit 6 includes the terminal units 60, 60 [sic], a protective circuit unit 61, a conversion circuit unit 62, a constant current circuit unit (lighting circuit unit) 63, and terminal units 64, 64, 64 [sic],” which are shown “in order from the AC power supply side on a circuit board (not shown) different from the LED board (not shown).” *Id.* ¶ 22. Further, Figure 1 illustrates that “terminals 60, 60 are electrically connected to the AC power supply via a cable 32 and an AC outlet 33 (see FIG. 2)” and that “terminal units 64, 64, 64 are electrically connected to the slave unit 2.” *Id.*

2. Discussion

The operative issue is whether Hiroyuki teaches “pins” that are recited in claim 4. Limitation 4[A] recites “a master control unit including a power negative terminal pin of master control unit and a signal output pin of master

control unit, the master control unit being electrically connected to the alternating current power source.” Ex. 1001, 7:35–39.

Petitioner cites to Figure 1 and paragraph 22 of Hiroyuki for the disclosure of master drive unit 6 that is electrically connected to the AC power source. Pet. 52–53 (citing Ex. 1007 ¶ 22, Fig. 1; Ex. 1003 ¶ 97). Petitioner cites to Figures 1 and 2 and paragraphs 22, 24, and 33 of Hiroyuki for the disclosure of the claimed “signal output pin” and “power negative terminal pin.” Pet. 52–55. Petitioner contends that a person of ordinary skill in the art “would have understood the terminal units 64 at the master drive unit 6 to represent ‘signal output pins’ and the negative terminal unit A4 at the master drive unit 6 to represent a ‘power negative terminal pin’ as claimed,” and provides an annotated version of Hiroyuki’s Figure 1 as reproduced below:



Pet. 54 (annotated version of Ex. 1007, Fig. 1). Annotated Figure 1 of Hiroyuki, above, shows master drive unit 6 (represented by a dashed-line box housing multiple components) electrically connected to three slave drive units 7 (represented by three dashed-line boxes, each housing multiple

components). Master drive unit 6 includes terminal units 64, 64, 64, which are circled in red by Petitioner and are located on the right side of the dashed-line box representing master drive unit 6. Terminal units 64, 64, 64 electrically connect to slave drive units 7 depicted in Figure 1. *See* Ex. 1007 ¶ 22. Petitioner also circles element “A4” in annotated Figure 1 in blue.

Petitioner further asserts that a person of ordinary skill in the art “would have understood Hiroyuki’s ‘terminal’ notation to correspond to ‘terminal pin’ or ‘output pin’ as claimed,” and states that “[f]or example, a POSITA would have understood a ‘pin’ to be ‘[a] terminal on a connector, plug, or tube base.’” Pet. 55 (quoting Ex. 1003 ¶ 100; *see* Ex. 1009,¹¹ 566). Petitioner contends that “[t]he words ‘terminal’ and ‘pin’ typically imply an electrical end point at which an electrical connection is made to another unit” and that “[a] ‘pin’ can be understood as a pointed terminal, indicating that ‘terminal’ encompasses a ‘pin.’” *Id.* (quoting Ex. 1003 ¶ 100).

Patent Owner asserts that Hiroyuki’s Figure 1 does not disclose the pins of limitation 4[A].¹² PO Resp. 41. Patent Owner argues that Hiroyuki’s “terminals” and “terminal units” are not disclosed as being pins. *Id.* Patent Owner contends that the Petition tries to fill in gaps and cites to a dictionary, as well as the testimony of Dr. Schubert, that a “[a] ‘pin’ can be understood as a pointed terminal.” *Id.* at 42 (citing Pet. 55, citing Ex. 1003 ¶ 100). Patent Owner also refers to IPR2024-00157, where, with the support of Dr. Schubert, the same petitioner asserted that a “‘pin’ means ‘[a] slender,

¹¹ MODERN DICTIONARY OF ELECTRONICS, 7th Ed., Rudolf F. Graf, 1999 (Ex. 1009).

¹² Patent Owner also asserts that Hiroyuki does not disclose the pins recited in limitation 4[B]. PO Resp. 41–44. Although the issues are the same, we need not reach limitation 4[B].

straight, stiff prong used as a terminal.” *Id.* (citing IPR2024-00157, Paper 1, 10–12; *id.* at Ex. 1013). Patent Owner contends that the Petition does not establish that Hiroyuki meets the claim terms under Petitioner’s own definitions. *Id.* at 42 (citing Ex. 2001 ¶ 114). Patent Owner further argues that Petitioner does not explain how Hiroyuki’s terminals are “on a connector, plug, or tube base” or establish that Hiroyuki’s terminals are pointed. *Id.* at 43 (citing Pet. 55, 60; Ex. 1009, 556). Patent Owner refers to the Microsoft Computer Dictionary,¹³ which defines “pin,” in part, as “[a] slender prong.” *Id.* at 43 (citing Ex. 2002). Patent Owner also asserts that the presence of “terminal” and “pin” in claim 4 requires that the words be afforded different meanings. PO Sur-reply 22.

Petitioner replies that the Modern Dictionary of Electronics¹⁴ defines “terminal,” in part, as “[a] point of connection for two or more conductors in an electrical circuit,” and the McGraw-Hill Dictionary of Scientific and Technical Terms¹⁵ defines “pin” as “[a] terminal on an electron tube, semiconductor, integrated circuit, plug, or connector.” Pet. Reply 21 (citing Ex. 1016, 768; Ex. 1017, 1600). Petitioner argues that a person of ordinary skill in the art would understand the “terminal” disclosures in Hiroyuki to reference a connection point in an electric circuit. *Id.* (citing Ex. 1010 ¶ 58). Petitioner argues that the ’546 patent does not describe the physical structure of any claimed “pins.” *Id.* at 22. Petitioner asserts that a person of ordinary skill in the art “would understand Hiroyuki to disclose the claimed ‘pins’

¹³ MICROSOFT COMPUTER DICTIONARY, 5th Ed., 2002 (Ex. 2002).

¹⁴ MODERN DICTIONARY OF ELECTRONICS, R.F. Graf, 7th Ed., 1999 (Ex. 1016).

¹⁵ MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, 6th Ed., 2003 (Ex. 1017).

because both ‘terminals’ and ‘pins’ imply an electrical end point at which an electrical connection is made to another unit,” and “not all definitions of ‘pin’ are tied to a physical structure.” *Id.* (citing Ex. 1010 ¶ 59).

Although Petitioner points out that the ’546 patent does not describe the physical structure of “pins,” and some dictionary definitions do not tie “pins” to physical structures, the Petition, with supporting testimony from Dr. Schubert, states that “a ‘pin’ can be understood as a pointed terminal.” *See* Pet. 55; Ex. 1003 ¶ 100. Patent Owner also refers to Petitioner’s reference to a dictionary definition of “pin” that is similar as: “[a] slender prong.” *See* IPR2024-00157, Ex. 1013; PO Resp. 42. Accordingly, by its own admissions, Petitioner and its expert have indicated that a “pin” is a “pointed terminal,” which is supported by extrinsic evidence. Also, contrary to Petitioner’s argument that “terminals” and “pins” both imply electrical endpoints, we find persuasive Patent Owner’s argument that with claim 4’s recitation of a “terminal pin,” the words “terminal” and “pin” indicate that a “terminal pin” is different from a “terminal” alone. PO Sur-reply 22. Here, Hiroyuki’s disclosures on “terminals” and “terminal units” do not disclose any specific structures and, in particular, does not disclose that “terminals” or “terminal units” are pointed terminals.

Accordingly, on this complete record, we do not find Petitioner has demonstrated that Hiroyuki teaches all the limitations of claim 4.

Weighing the record as a whole in view of the findings and analysis above, we conclude that Petitioner has not met its burden to show, by a preponderance of the evidence, that claim 4 would have been obvious over Hiroyuki.

I. Obviousness of Claims 5, 6, and 8 over Hiroyuki and Kuang

Petitioner contends that claims 5, 6, and 8 would have been obvious over Hiroyuki and Kuang. Pet. 66–82. Claims 5 and 6 depend directly or indirectly from claim 4. Petitioner relies upon Kuang for the teaching of limitations 5 and 6, but the evidence and arguments relied upon do not cure the deficiency of the showing as to claim 4. *Id.* at 66–71. Accordingly, the challenges to claim 5 and 6 fail due to dependency from claim 4.

As to claim 8, for the reasons discussed above, Petitioner demonstrates by a preponderance of the evidence that claim 8 would have been unpatentable over Lys. Accordingly, we need not address whether the combination of Hiroyuki and Kuang renders claim 8 unpatentable. *See In re Gleave*, 560 F.3d at 1338.

III. CONCLUSION¹⁶

The outcome for the challenged claims of this Final Written Decision follows. In summary:

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

Claim(s)	35 U.S.C. §	Reference(s) /Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1, 2	103(a)	Kuang	1, 2	
3	103(a)	Kuang, Debevec	3	
1, 2, 8 ¹⁷	103(a)	Lys	8	
3 ¹⁸	103(a)	Lys, Debevec		
4	103(a)	Hiroyuki		4
5, 6, 8 ¹⁹	103(a)	Hiroyuki, Kuang		5, 6
Overall Outcome			1–3, 8	4–6

IV. ORDER

It is hereby:

ORDERED that Petitioner has demonstrated, by a preponderance of the evidence, that claims 1–3 and 8 of the '546 patent are unpatentable and Petitioner has not demonstrated, by a preponderance of the evidence, that claims 4–6 of the '546 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.

¹⁷ As explained above, it was not necessary to reach the unpatentability of claims 1 and 2 in this ground.

¹⁸ As explained above, it was not necessary to reach the unpatentability of claim 3 in this ground.

¹⁹ As explained above, it was not necessary to reach the unpatentability of claim 8 in this ground.

IPR2024-00156
Patent 8,884,546 B2

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