

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CURRENT LIGHTING SOLUTIONS, LLC D/B/A GE CURRENT,
Petitioner,

v.

JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD.,
Patent Owner.

IPR2023-00269
Patent 10,560,989 B2

Before BRIAN J. McNAMARA, NEIL T. POWELL, and
JULIET MITCHELL DIRBA, *Administrative Patent Judges*.

POWELL, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. BACKGROUND

Current Lighting Solutions, LLC d/b/a GE Current (“Petitioner”) filed a Petition for *inter partes* review of claims 1, 2, 4–6, 12–14, 30, 31, 37, 47, 77, 84–86, 88, and 90 of U.S. Patent No. 10,560,989 B2 (Ex. 1001, “the ’989 patent”). Paper 1 (“Pet.”). Jiaxing Super Lighting Electric Appliance Co., Ltd. (“Patent Owner”) filed a Preliminary Response. Papers 10, 11¹ (“Prelim. Resp.”). With our authorization, Petitioner filed a Preliminary Reply to Patent Owner’s Preliminary Response. Papers 13, 15² (“Prelim. Reply” or “Preliminary Reply”). Also with our authorization, Patent Owner filed a Sur-reply to Petitioner’s Preliminary Reply to Patent Owner’s Preliminary Response. Papers 16, 17³ (“Prelim. Sur-reply” or “Preliminary Sur-reply”).

An *inter partes* review may not be instituted “unless . . . the information presented in the petition . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a). Having considered

¹ Paper 10 is an unredacted copy of the Preliminary Response filed under seal. Paper 11 is a redacted, public copy of the Preliminary Response. This Decision does not refer to any information that was redacted from the public document.

² Paper 13 is an unredacted copy of the Preliminary Reply filed under seal. Paper 15 is a redacted, public copy of the Preliminary Reply. This Decision does not refer to any information that was redacted from the public document.

³ Paper 16 is an unredacted copy of the Preliminary Sur-reply filed under seal. Paper 17 is a redacted, public copy of the Preliminary Sur-reply. This Decision does not refer to any information that was redacted from the public document.

the arguments and the associated evidence, we determine that Petitioner has not shown a reasonable likelihood that it will prevail in establishing the unpatentability of any of the challenged claims. Accordingly, we do not institute *inter partes* review.

B. RELATED PROCEEDINGS

The parties note that the '989 patent is (or was) involved in *Jiaxing Super Lighting Electric Appliance Co., Ltd. et al. v. Current Lighting Solutions, LLC d/b/a GE Current*, Civil Action No. 6:22-cv-00534-ADA (W.D. Tex. 2022), as well as *Jiaxing Super Lighting Electric Appliance Co., Ltd. et al. v. MaxLite, Inc.*, Case No. 2:19-cv-04047 (C.D. Cal.). Pet. 2; Paper 3, 1.

C. THE '989 PATENT

The '989 patent relates to LED tube lamps. Ex. 1001, 1:57–60. Citing certain advantages of LED tube lamps over fluorescent tube lamps, the '989 patent notes increasing desire for LED tube lamps. *Id.* at 1:65–2:9. The '989 patent also identifies certain drawbacks of LED tube lamps, however. *Id.* at 2:15–3:19. For example, LED tube lamps may experience rising internal temperature, which may cause improper operation of the lamps' electrical components. *Id.* at 2:16–19. The '989 patent elaborates that certain prior art did not provide sufficient heat dissipation for a power supply circuit inside end caps, risking damage. *Id.* at 2:47–53.

With this background, the '989 patent discloses LED tube lamp embodiments with an end cap housing a power supply that has “at least one inductor, capacitor, or resistor . . . closest . . . to [at least one opening in the end cap's end wall].” *Id.* at 4:19–40. “[T]he closest element will have better

heat dissipation effect and this makes the LED tube lamp operate normally,” the ’989 patent explains. *Id.* at 3:55–57.

The ’989 patent shows an embodiment of an LED tube lamp in Figure 67, which is reproduced below.

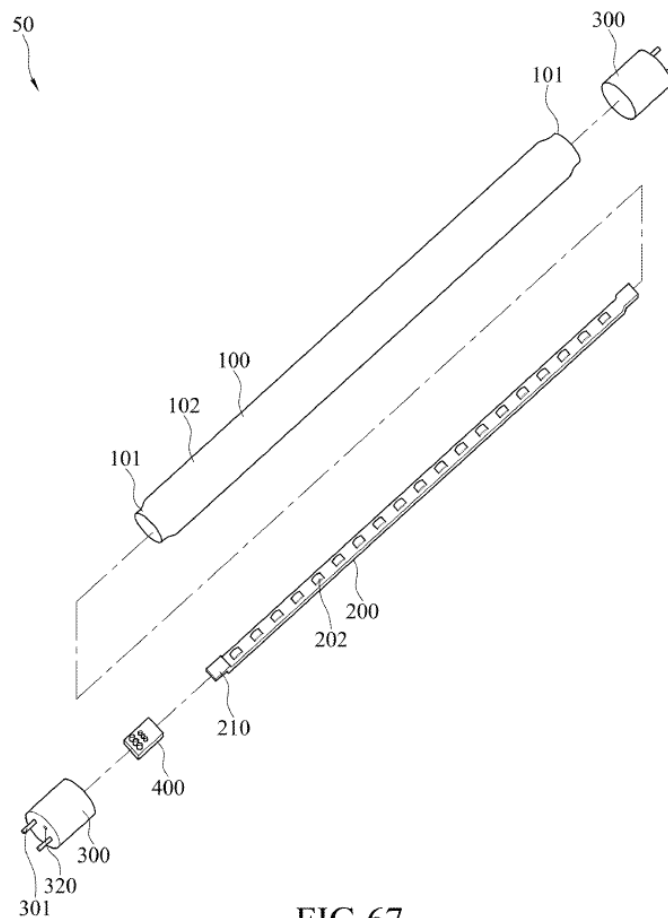


FIG.67

Figure 67 “illustrates an exploded view of an LED tube lamp.”

Id. at 12:41–42.

Specifically, Figure 67 shows LED tube lamp 50, which includes LED light strip 200 housed in tube 100 capped by end caps 300. *Id.* at 98:1–6. In some embodiments, one end cap 300 may house power supply 400.

Id. at 98:11. LED light strip 200 may electrically connect power supply 400

to several LED light sources 202 on LED light strip 200. *Id.* at 98:9–10, 98:18–20.

The '989 patent shows additional aspects of tube lamp 50 in Figures 68 and 69, which are reproduced below.

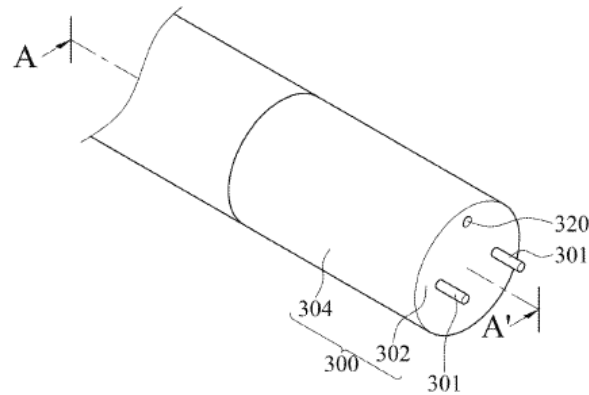


FIG. 68

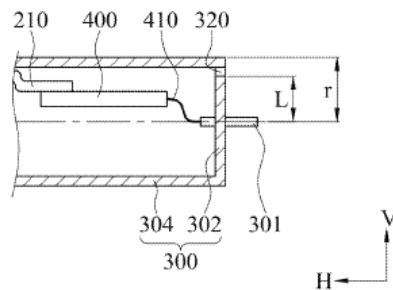


FIG. 69

“[Figure] 68 is a partial view of the LED tube lamp 50, and [Figure] 69 is a cross section of [Figure] 68 along the line A-A’.” *Id.* at 100:37–39.

End cap 300 includes tubular lateral wall 304 extending substantially coaxially from tube 100 and capped by end wall 302. *Id.* at 100:39–59, Figs 68, 69. Opening 320 extends through end wall 302. *Id.* at 100:62–63.

Power supply 400 is inside end cap 300. *Id.* at 100:61–62. In some embodiments, “the power supply comprises a printed circuit board [with substantially parallel first and second surfaces]” and “at least one inductor, transistor, capacitor, resistor, or integrated circuit on the first surface of the printed circuit board.” *Id.* at 4:7–11, 4:13–15. The printed circuit board’s first and second surfaces may extend “substantially parallel with the axial direction of the lateral wall.” *Id.* at 4:11–13.

End cap 300 may have hollow conductive pins 301 outside end wall 302. *Id.* at 101:19–20. Metal wires 401 may connect power supply 400 to hollow conductive pins 301, enabling connection of power supply 400 to an outer electrical power source. *Id.* at 101:12–19.

D. ILLUSTRATIVE CLAIMS

Of the challenged claims, claims 1 and 30 are independent. Each of claims 2, 4–6, 12–14, 31, 37, 47, 77, 84–86, 88, and 90 depends, directly or indirectly, from one of claims 1 and 30. Independent claims 1 and 30 are reproduced below with certain reformatting:⁴

1. [1[p]] An LED tube lamp, comprising:
 - [1[a]] a tube having two ends;
 - [1[b]] an LED light strip attached to an inner circumferential surface of the tube;
 - [1[c]] a plurality of LED light sources mounted on the LED light strip;
 - [1[d]] a power supply module electrically connecting to the LED light strip and configured to drive the plurality of LED light sources; and

⁴ We have added carriage returns and the same labels that Petitioner uses to identify particular portions of claims 1 and 30. *See, e.g.*, Pet. vii–x.

- [1[e]] a first end cap and second end cap respectively attached at the two ends of the tube, each of the first and second end caps comprising a lateral wall and an end wall, the lateral wall substantially being coaxial with the tube and connecting to the tube, the end wall substantially being perpendicular to an axial direction of the lateral wall and connecting to an end of the lateral wall away from the tube;
- [1[f]] wherein the power supply module comprises a printed circuit board and a plurality of electronic components mounted on the printed circuit board, the printed circuit board comprises a first surface and a second surface opposite to and substantially parallel to the first surface, and the first surface and the second surface of the printed circuit board are substantially parallel with the axial direction of the lateral wall;
- [1[g1]] wherein at least some of the plurality of electronic components comprise a rectifying circuit having at least two input terminals and configured to rectify signal receiving from the at least two input terminals,
- [1[g2]] at least one of the plurality of electronic components comprises a filtering circuit electrically connecting to the rectifying circuit,
- [1[h]] wherein the plurality of electronic components comprise a resistor which is positioned closest to the end wall of the first end cap and connecting to one of the input terminals of the rectifying circuit;
- [1[i]] wherein the end wall comprises a first portion made of an insulating material.

Ex. 1001, 120:5–42.

30. [30[p]] An LED tube lamp, comprising:

- [30[a]] a tube having two ends;
- [30[b]] an LED light strip attached to an inner circumferential surface of the tube;

- [30[c]] a plurality of LED light sources mounted on the LED light strip;
- [30[d]] a power supply module electrically connecting to the LED light strip and configured to drive the plurality of LED light sources; and
- [30[e]] a first end cap and second end cap respectively attached at the two ends of the tube, each of the first and second end caps comprising a lateral wall and an end wall, the lateral wall substantially being coaxial with the tube and connecting to the tube, the end wall substantially being perpendicular to an axial direction of the lateral wall and connecting to an end of the lateral wall away from the tube;
- [30[f]] wherein the power supply module comprises a printed circuit board and a plurality of electronic components mounted on the printed circuit board, the printed circuit board comprises a first surface and a second surface opposite to and substantially parallel to the first surface, and the first surface and the second surface of the printed circuit board are substantially parallel with the axial direction of the lateral wall;
- [30[g1]] wherein at least some of the electronic components comprise a rectifying circuit having at least two input terminals and configured to rectify signal receiving from the at least two input terminals,
- [30[g2]] at least one of the electronic components comprises a filtering circuit electrically connecting to the rectifying circuit,
- [30[h]] wherein the plurality of electronic components comprise a capacitor which is positioned closest to the end wall of the first end cap;
- [30[i]] wherein the end wall comprises a first portion made of an insulating material.

Id. at 122:58–123:27.

E. ASSERTED GROUNDS OF UNPATENTABILITY

Petitioner challenges the patentability of claims 1, 2, 4–6, 12–14, 30, 31, 37, 47, 77, 84–86, 88, and 90 of the '989 patent on the following grounds (Pet. 4):

Claims Challenged	35 U.S.C. §	References
1, 2, 4–6, 30, 31, 37, 88, 90	103 ⁵	Li ⁶ , Ono ⁷
12–14	103	Li, Ono, Xu ⁸
47, 77	103	Li, Ono, Guang ⁹
84–86	103	Li, Ono, Zhang ¹⁰
5, 6, 31	103	Li, Ono, Halliwell ¹¹

⁵ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), revised 35 U.S.C. § 103, effective March 16, 2013. Because the application from which the '989 patent issued was filed after that date, with no benefit claim prior to that date, the AIA version of § 103 applies.

⁶ Li et al., Chinese Patent Application Publication CN 103899939 A, published July 2, 2014 (Ex. 1005, “Ji”). Petitioner relies on a certified English translation of Li, which also appears in Exhibit 1005.

⁷ Ono et al., Japanese Patent Publication JP 2014-103000A, published June 5, 2014 (Ex. 1006, “Ono”). Petitioner relies on a certified English translation of Ono, which also appears in Exhibit 1006.

⁸ Xu, Chinese Patent Publication 2802892Y, published Aug. 2, 2006 (Ex. 1009, “Xu”). Petitioner relies on a certified English translation of Xu, which also appears in Exhibit 1009.

⁹ Guang, U.S. Patent No. 9,338,853 B2, issued May 10, 2016 (Ex. 1007, “Guang”).

¹⁰ Zhang, U.S. Patent No. 10,104,723 B2, issued Oct. 16, 2018 (Ex. 1014, “Zhang”).

¹¹ Halliwell et al., U.S. Patent No. 9,206,970 B2, issued Dec. 8, 2015 (Ex. 1015, “Halliwell”).

In support of its challenges, Petitioner also relies on the Declaration of Donald E. Ackley, Ph.D. Ex. 1003.

II. ANALYSIS

A. LEVEL OF ORDINARY SKILL IN THE ART

Petitioner asserts that the level of ordinary skill in the art corresponds to “a Bachelor’s degree in electrical engineering, or an equivalent field, as well as 1-2 years of academic or industry experience in LED lighting design.” Pet. 6 (citing Ex. 1003 ¶ 21). Petitioner also asserts that an ordinary artisan would have had “knowledge of LEDs and related technology for driving LEDs” and “would have been familiar with the field of technology” related to fluorescent lamps, their pre-heat process, increasing popularity of LED lamps, a need for heat dissipation and management in LED lamps, and end-cap openings used to lessen internal heat or pressure. *Id.* (citing *id.* at 6–11; Ex. 1002 ¶ 21).

At this stage, Patent Owner does not address the level of ordinary skill. *See generally* Prelim. Resp.

For purposes of this Decision, we adopt Petitioner’s proposed level of skill, as articulated above. We are satisfied that it comports with the level of skill necessary to understand and implement the teachings of the ’989 patent. *See also* Ex. 1003 ¶ 21.

B. CLAIM INTERPRETATION

We apply the same claim construction standard used in district courts, namely that articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b). In applying that standard, claim terms generally are given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the

time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13. “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).

Petitioner discusses constructions of certain claim language. Pet. 15–16. Patent Owner does not propose a construction of any claim language. *See generally* Prelim. Resp.

The parties’ arguments do not require an express construction of any claim language. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

C. GROUND 1 – ALLEGED OBVIOUSNESS OVER LI AND ONO

1. *Overview of Li*

Li discloses “an LED fluorescent lamp and an installation method of the fluorescent lamp.” Ex. 1005 ¶ 1.¹² Noting that “[l]ight emitting diodes (LEDs) . . . are solid-state semiconductor devices,” Li explains that “[c]ompared with traditional fluorescent lamps, LED fluorescent lamps have

¹² We cite to the English translation of Li on pages 1–29 of Exhibit 1005.

many advantages.” *Id.* ¶¶ 2–3. Li seeks an LED fluorescent lamp with “a compact structure and a simple manufacturing process.” *Id.* ¶ 6.

Li discusses an embodiment of a fluorescent LED lamp in connection with Figure 1, which is reproduced below.

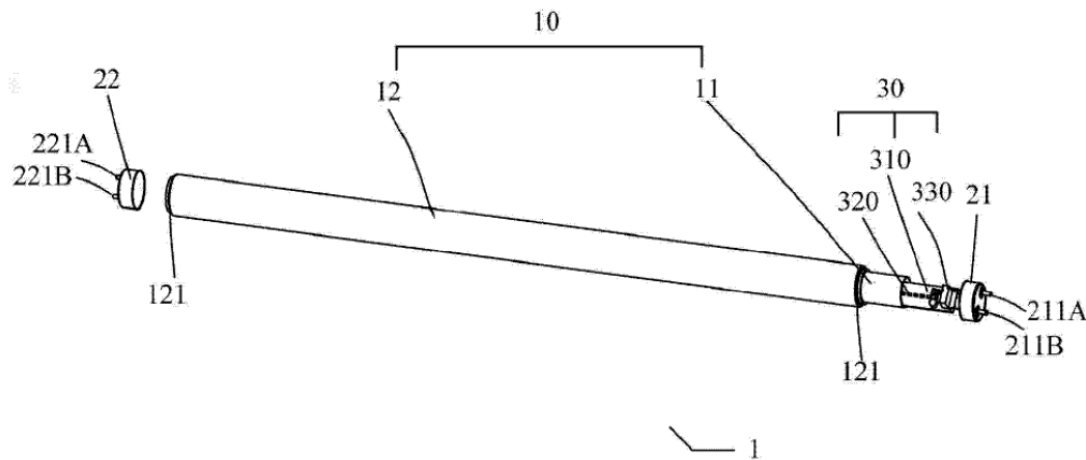
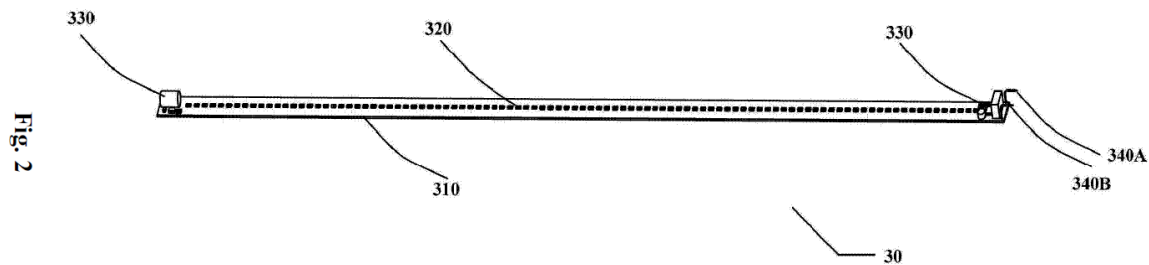


Fig. 1

“[Figure] 1 is a schematic exploded view of” LED fluorescent lamp 1. *Id.* ¶¶ 87–88.

LED fluorescent lamp 1 includes tube body 10, end covers 21 and 22, and LED driver power supply 30. *Id.* ¶ 88. Tube body 10 includes inner tube 11 and outer tube 12. *Id.* ¶ 89. Tube 10 houses LED driver power supply 30 between end covers 21 and 22. *Id.* ¶ 88; Fig. 1.

LED fluorescent lamp 1 has plugs 211A and 211B on end cover 21, as well as plugs 221A and 221B on end cover 22. *Id.* ¶ 92. Plugs 211A, 211B, 221A, and 221B allow attaching LED fluorescent lamp 1 to lamp holders, along with electrically connecting an external power supply to LED power supply 30. *Id.* Li elaborates on LED power supply 30 in connection with Figure 2, which is reproduced below.



“[Figure] 2 is a schematic diagram” showing LED power supply 30 and its components. *Id.* ¶¶ 94–95.

LED power supply 30 includes “substrate 310, a plurality of light emitting diode (LED) units 320 and a driver power supply module 330.” *Id.* ¶ 95. Substrate 310 may be strip-shaped and constructed of material(s) that provide “excellent thermal conductivity and infrared radiation performance, so that the heat from the LED units and the driver power supply module is dissipated by means of heat conduction and heat radiation at the same time.” *Id.* ¶ 96. Fixed inside inner tube 11, substrate 310 may have LED units 320 arranged longitudinally on substrate 310’s surface. *Id.* ¶¶ 97–98. Driver power supply module 330 electrically connects to and supplies current to LED units 320. *Id.* ¶ 99. At one end of substrate 310, pins 340A and 340B serve to electrically connect driver power supply module 330 to plugs 211A and 211B. *Id.* ¶ 100.

Li further discusses power supply module 30’s components in connection with Figure 3, which is reproduced below.

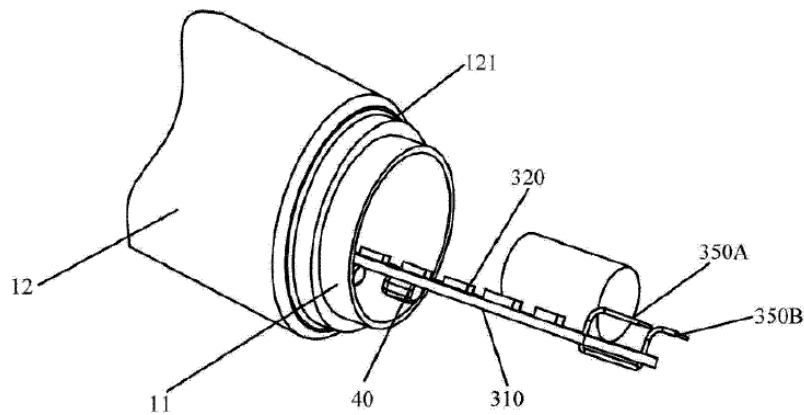
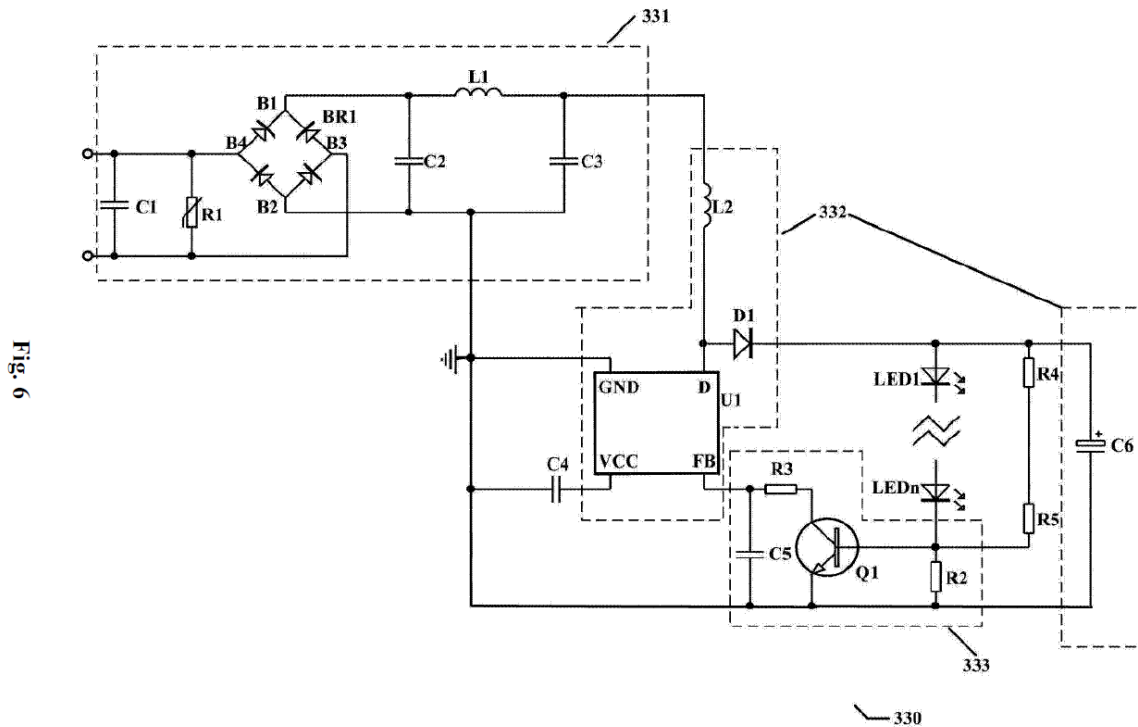


Fig. 3

“[Figure] 3 is a partial schematic view of the LED fluorescent lamp.” *Id.*

¶ 38. In connection with Figure 3, Li discloses that “[o]ptionally, . . . a pair of pins 350A and 350B electrically connected to the plugs 221A and 221B on the end cover 22, respectively, are arranged on the other end of the substrate 310.” *Id.* ¶ 101.

Li discusses a circuit configuration in connection with Figure 6, which is reproduced below.



“[Figure] 6 is a schematic circuit diagram of a drive circuit module contained in the LED driver power supply shown in [Figure] 2.” *Id.* ¶ 111.

Figure 6 shows drive circuit 330, which includes “a bridge rectifier filter unit 331, a DC-DC boost conversion unit 332 and a feedback unit 333.” *Id.* ¶ 112. “[B]ridge rectifier filter unit 331 comprises a full-bridge rectifier BR1, capacitors C1, C2, [and] C3, a varistor R1 and an inductor L1.” *Id.* ¶ 113. Full-bridge rectifier BR1 converts AC power to a pulsating voltage supplied to DC-DC boost conversion unit 332. *Id.* ¶¶ 113, 123.

DC-DC boost conversion unit 332 “is electrically connected to the bridge rectifier filter unit 331, the feedback unit 333 and the LED loads LED1-LEDn (i.e., the plurality of LED units 320 coupled in series in the LED driver power supply shown in Fig. 2).” *Id.* ¶ 116. DC-DC boost conversion unit 332 increases the voltage from full-bridge rectifier BR1,

supplying the increased voltage to the LED load. *Id.* Working in conjunction, DC-DC boost conversion unit 332 and feedback unit 333 provide power factor correction and supply constant current and voltage to the LED load. *Id.*

2. *Overview of Ono*

Ono “relate[s] to a straight tube lamp using light emitting elements as a light source and a lighting device using this straight tube lamp.” Ex. 1006 ¶ 1.¹³ According to Ono, existing straight tube lamp constructions have certain drawbacks:

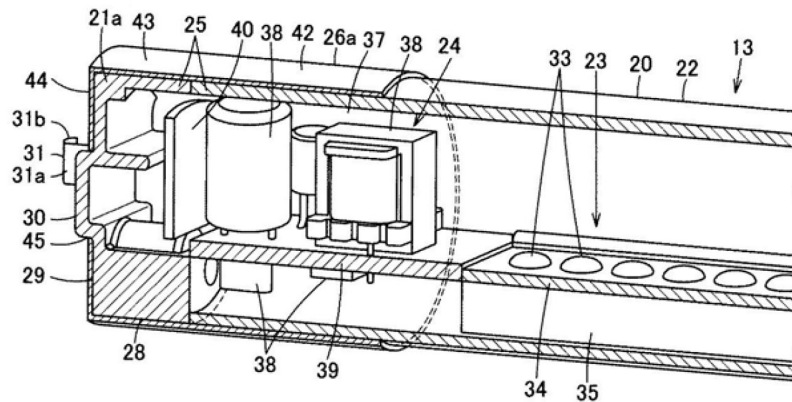
In a straight tube lamp with a built-in lighting circuit, when the electronic components in the lighting circuit experience abnormal heat generation due to age or misuse of the straight tube lamp, the resin components arranged around the electronic components may experience thermal damage, yet non-combustible structures have not been adopted.

Id. ¶ 5. Given this, Ono explains that “[t]he problem to be solved by the present invention is to provide a straight tube lamp with a built-in lighting circuit and a non-combustible structure, and to provide a lighting device using this straight tube lamp.” *Id.* ¶ 6.

Ono shows an embodiment in Figure 1, which is reproduced below.

¹³ We cite to the English translation of Ono on pages 1–17 of Exhibit 1006.

[Fig. 1]



“[Figure] 1 is a cross-sectional view” of one embodiment of a straight tube lamp. *Id.* ¶ 9.

As Figure 1 shows, straight tube lamp 13 includes lamp unit 22. *Id.* ¶ 13. Lamp unit 22 includes at least partially transparent straight tube 20 with cap 21a on one end and cap 21b (not shown in Figure 1) on another end. *Id.* With tube 20, cap 21a, and cap 21b constructed of insulative resin material, tube 20 and cap 21a compose insulator 25. *Id.* ¶¶ 14–15, 18. According to Ono, “by forming the insulator 25 from the end portion of the tube 20 and the cap 21a, a separate insulating member is not required, the number of parts can be reduced, and assembly is more efficient.” *Id.* ¶ 30.

Cap 21a includes cylindrical peripheral surface portion 28 closed by end surface portion 29. *Id.* ¶ 15. Protruding portion 30 extends from the outer surface of end surface portion 29. *Id.* “[T]erminals 31 protrude from the protruding portion 30 with the axis of the tube at the center.” *Id.*

Lamp unit 22 houses light source 23. Light source unit 23 has multiple light emitting elements 33 attached to a mounting surface of board 34. *Id.* ¶ 16. Light emitting elements 33 may be LED elements. *Id.*

Heat dissipator 35 is bonded to a side of board 34 opposite the mounting surface for light emitting elements 33. *Id.*

Tube lamp 13 also includes lighting circuit 24, which has a number of components housed between light source unit 23 and cap 21a inside lighting circuit housing portion 37:

The lighting circuit 24 has a circuit board 39 on which a plurality of electronic components 38 have been mounted. Lead components such as capacitors and inductors are mounted on the mounting surface of the circuit board 39, and surface mounted components such as resistors and switching elements are mounted on the wiring pattern surface. The mounting surface of the circuit board 39 is arranged so as to be substantially flush with the mounting surface of the board 34 on which the light emitting elements 33 have been mounted. Here, 40 denotes an auxiliary board erected vertically with respect to the circuit board 39 on which some of the electronic components 38 have been mounted.

Id. ¶ 17. Lighting circuit 24 converts alternating current power received from cap 21a into direct current power for illuminating light emitting elements 33. *Id.*

Tube lamp 13 also includes non-combustible covers 26a and 26b, which “are made of a metal material such as aluminum or a steel plate . . . and cover both ends of the tube 20 and the outer surfaces of the caps 21a, 21b on both ends.”¹⁴ *Id.* ¶ 19. According to Ono, non-combustible cover 26a provides certain benefits:

[B]ecause the non-combustible cover 26a has a lighting circuit covering portion 42 that covers the periphery of the lighting circuit 24, a cap peripheral surface covering portion 43 that covers the peripheral surface of the cap 21a, and a cap end surface covering portion 44 that covers the end surface of the

¹⁴ Figure 1 does not show non-combustible cover 26b.

cap 21a, covering the periphery of the lighting circuit 24, which is susceptible to heat damage, with the non-combustible cover 26a creates a reliable non-combustible structure.

Id. ¶ 31.

3. Discussion

Petitioner asserts that “Li-Ono renders obvious” or that “Li-Ono describes” each limitation of claims 1, 2, 4–6, 30, 31, 37, 88, and 90. Pet. 25–34, 36–38, 40, 42, 44–45, 47–48. Petitioner cites Li as teaching a tube lamp with many aspects of the challenged claims’ limitations. *E.g.*, Pet. 26–29, 36–39, 44, 47–48 (focusing on Li’s disclosure for certain claim limitations). For example, addressing limitation 1[a], Petitioner argues that Li discloses an “LED lamp tube body ‘compris[ing] an . . . inner tube 11 and an . . . outer tube 12 sleeved outside the inner tube 11.’” *Id.* at 26.

Asserting that Li does not disclose some details of its tube lamp’s construction, Petitioner argues that it would have been obvious to use Ono’s disclosure to supply some of Li’s allegedly missing details. *Id.* at 20–21. For example, Petitioner contends that it would have been obvious to combine Li’s lamp with certain aspects of Ono’s “lighting circuit PCB and insulated end caps.” *Id.* at 25. Petitioner cites these aspects of Ono’s disclosure when addressing requirements of limitations 1[e], 1[f], 1[h], 1[i], 30[e], 30[f], 30[h], and 30[i] related to end cap and power supply module configuration and arrangement. Pet. 30–32, 35–36, 44, 46–47.

Petitioner advances various rationales in support of its view that it would have been obvious to combine the references’ disclosures. *Id.* at 21–24. Petitioner argues that “[a person of ordinary skill in the art] would have been motivated to configure the ends of Li’s lamp—including the physical format of its circuit on a PCB—with the insulator end caps

within a non-combustible cover like Ono's for each of several independent reasons." *Id.* at 21. For example, a person of ordinary skill in the art allegedly would have combined the disclosures to "configure [Li's] drive circuit," "achieve the improved safety characteristics disclosed by Ono," "reduce the number of parts and improve the efficiency of assembly," "improve safety due to the inclusion of a reliable non-combustible structure surrounding the power circuit," "simplify manufacturing of Li's lamp with insulative end caps," and "reduce the number of parts and improve the efficiency of assembly with a reasonable expectation of success." *Id.* at 21–22.

Petitioner also argues that it would have been "obvious to try implementing Ono's PCB structure with Li's drive circuit." *Id.* at 22. In support of this, Petitioner avers that "there were a finite number of identified, predictable solutions a [person of ordinary skill in the art] would have pursued." *Id.*

Petitioner additionally argues that "a [person of ordinary skill in the art] would have understood that the simple substitution of Ono's PCB structure and end caps for Li's drive circuit and end covers would have predictable results." *Id.* at 24. For example, Petitioner contends that "a [person of ordinary skill in the art] would have understood that Ono's teachings of arranging components on a double-sided PCB could be used to implement Li's drive circuit." *Id.* at 23–24.

Petitioner also contends that "a [person of ordinary skill in the art] would have reasonably expected success in implementing Ono's lamp-end configuration in the ends of Li's LED lamp." *Id.* at 24. According to Petitioner, "[t]he technology for installing electronic components on a PCB

was well developed, and such an installation would have been a straight-forward implementation of known technology.” *Id.*

Patent Owner argues, among other things, that Petitioner does not show that it would have been obvious to combine Li and Ono in a way that meets either limitation 1[h] or limitation 30[h]. Prelim. Resp. 30–36. In particular, Patent Owner contends that Petitioner has not addressed persuasively limitation 1[h]’s requirement for “a resistor which is positioned closest to the end wall” or limitation 30[h]’s requirement for “a capacitor which is positioned closest to the end wall.” *Id.*

We turn now to the parties’ dispute regarding limitations 1[h] and 30[h].

a) Limitations 1[h] and 30[h]

Limitation 1[h] recites “wherein the plurality of electronic components comprise a resistor which is positioned closest to the end wall of the first end cap and connecting to one of the input terminals of the rectifying circuit.” Ex. 1001, 120:37–40. Limitation 30[h] recites “wherein the plurality of electronic components comprise a capacitor which is positioned closest to the end wall of the first end cap.” *Id.* at 123:23–25.

Petitioner suggests that it was known to locate a resistor or capacitor closest to an end wall, citing certain portions of Li, such as Li’s disclosures regarding varistor R1 and capacitor C1, in combination with Ono. Pet. 34–36, 45–47. For example, according to Petitioner, “[t]he location of [Li’s] varistor R1 closest to the end wall of the end cap is confirmed by Ono.” *Id.* at 35. Similarly, Petitioner contends that “[t]he location of [Li’s] capacitor C1 closest to the end wall of the end cap is confirmed by Ono.” *Id.* at 46.

Petitioner relies on Li's Figure 6 and related discussion as disclosing proximity of a resistor and a capacitor to an end wall, citing Dr. Ackley's testimony. Pet. 34, 45 (citing Ex. 1003 ¶¶ 98, 120). Dr. Ackley testifies that Li's "varistor R1 is close to the end wall" and Li's "capacitor C1 is closest to the end wall." Ex. 1003 ¶¶ 98, 120.

Patent Owner disagrees, asserting that "Li does not disclose or suggest that Li's circuit diagram reflects the physical layout of the components on substrate 310." Prelim. Resp. 30–31. Patent Owner adds that "there is no clear correspondence between the circuit diagram shown in Li's [Figure] 6 and the depiction of substrate 310 in [Figure] 3." *Id.* at 30.

We agree with Patent Owner that Petitioner has not supported sufficiently its arguments about the locations of Li's varistor R1 and capacitor C1 relative to an end wall. Petitioner and Dr. Ackley assume certain spatial relationships based on Li's Figure 6 and related disclosures. Pet. 34–35, 45–46; Ex. 1003 ¶¶ 98, 120. But, consistent with Patent Owner's argument, Li's Figure 6 is a "schematic circuit diagram," not a representation of lamp components' spatial arrangement. Ex. 1005 ¶ 41; Prelim. Resp. 30–31. In addition to Figure 6, Petitioner and Dr. Ackley cite Li's disclosure that "the filter capacitor C1 and the varistor R1 are connected in parallel between the AC input terminals B3 and B4 of the full-bridge rectifier BR1, wherein the varistor R1 holds the input voltage of the full-bridge rectifier BR1 at a predetermined level by suppressing abnormal overvoltage in the circuit." Ex. 1005 ¶ 115; Pet. 34–35, 45; Ex. 1003 ¶¶ 98, 120. Like Figure 6, this discloses the components' electrical relationships. Li's disclosure of certain electrical relationships does not specify any particular spatial relationships of varistor R1 and capacitor C1 to an end

wall. And neither Petitioner nor Dr. Ackley explains why a person of ordinary skill in art would have read the disclosed electrical relationships as teaching component locations to arrive at the particular spatial arrangement required by the claim.

Petitioner also fails to provide sufficiently persuasive support for its assertions that “[t]he location of the varistor R1 closest to the end wall of the end cap is confirmed by Ono” and “[t]he location of the capacitor C1 closest to the end wall of the end cap is confirmed by Ono.” Pet. 35, 46. Petitioner does not allege that Ono teaches or suggests placing a resistor or a capacitor closest to an end wall. *See generally* Pet. Rather, Petitioner argues that Ono teaches placing a capacitor and a resistor on opposite surfaces of a printed circuit board. *Id.* at 35, 46. According to Petitioner, applying this to Li’s circuit would result in both varistor R1 and capacitor C1 being closest to the end wall:

when Li’s drive circuit is implemented in a PCB as described by Ono, the capacitor C1 is mounted on the top of the PCB and varistor R1 is mounted on the bottom and a [person of ordinary skill in the art] would have understood that both the capacitor C1 and the varistor R1 are located closest to the end wall of the end cap.

Id. at 35–36, 46–47.

We find this to be conclusory and, thus, do not find it persuasive. As discussed above, Petitioner does not provide sufficiently persuasive support for its contention that Li’s varistor R1 is close to an end wall or for its contention that Li’s capacitor C1 is closest to an end wall. Given this, it does not follow that simply placing varistor R1 and capacitor C1 on opposite surfaces of a printed circuit board would result in either varistor R1 or capacitor C1 being closest to an end wall.

Petitioner does not otherwise provide a sufficiently persuasive reason that Ono would have made it obvious to place a resistor or capacitor closest to an end wall. Indeed, as Patent Owner notes, Ono appears to disclose placing auxiliary board 40 closer to the end wall of cap 21a than any resistor or capacitor on circuit board 39. Ex. 1006 ¶ 17; Fig. 1; Prelim. Resp. 34–36. Accordingly, simply applying Ono’s configuration to Li’s seemingly would result in auxiliary board 40 closer to an end wall than any resistor or capacitor. And Petitioner does not address auxiliary board 40, much less its position closer to the end wall than any resistor or capacitor on circuit board 39. *See generally* Pet.

Nor does Petitioner provide any other sufficiently persuasive basis for asserting that it would have been obvious in view of Li and Ono to locate varistor R1 or capacitor C1 closest to an end wall. Petitioner argues that a person of ordinary skill in the art would have understood heat-dissipation benefits of locating a resistor or capacitor closest to an end wall. Pet. 36, 47. In support of this, Petitioner relies on Dr. Ackley, who testifies as follows:

a [person of ordinary skill in the art] would have understood that resistors are heat generating circuit elements. Therefore, it would have been obvious for a [person of ordinary skill in the art] to place the resistor closest to the end cap such that heat would be efficiently dissipated through heat dissipating functions in the end caps, such as ventilating holes. This placement would cool the resistor as well as minimize the effects of the resistor heating up other components on the PCB and improve the lifespan of the LED lamp. As an alternative to, or in addition to ventilation holes, the PCB could be placed in direct contact with the end cap. A [person of ordinary skill in the art] would have understood that heat is transferred to the end cap through this direct connection and would have been conducted out of the LED lamp to the outside environment directly through the end wall or through the conducting pins. Thus, it would have been obvious

to a [person of ordinary skill in the art] to locate the (heat generating) resistor closest to the end cap.

Ex. 1003 ¶ 100; *see also id.* ¶ 122 (similar testimony addressing placing capacitor closest to end wall). Patent Owner suggests that this testimony stems from improper hindsight based on the '989 patent's disclosure of heat-dissipation benefits of the claimed component locations. Prelim. Resp. 33–34.

We determine that Petitioner's rationale is insufficiently supported. Dr. Ackley provides no supporting evidence to corroborate his opinion. *See* Ex. 1003 ¶¶ 100, 122. And, as noted above, the '989 patent describes LED tube lamp embodiments with a capacitor or resistor closest to an opening in the end wall, explaining that “the closest element will have better heat dissipation effect and this makes the LED tube lamp operate normally.” *Id.* at 3:55–57, 4:19–40. As a result, we are concerned that Petitioner's rationale suffers from improper hindsight bias. *See KSR*, 550 U.S. at 421 (“A factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning.”); *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1068 (Fed. Cir. 2018) (“We have observed that the prejudice of hindsight bias often overlooks that the genius of invention is often a combination of known elements which in hindsight seems preordained.” (internal quotation marks omitted)). Accordingly, we do not find Dr. Ackley's testimony to be sufficient to support Petitioner's contention that a person of ordinary skill in the art would have recognized the heat-dissipation advantages of Patent Owner's claimed arrangement.

As noted above, Petitioner advances other general reasons that it allegedly would have been obvious to modify Li based on Ono. *E.g.*,

Pet. 20–25. But none of those other reasons provides a sufficiently persuasive, logical reason that it would have been obvious to modify the prior art to have a resistor or capacitor closest to an end wall. For example, Petitioner argues that “a [person of ordinary skill in the art] would have been motivated to look . . . for the details Li omits.” *Id.* at 20. Petitioner similarly argues the obviousness of Patent Owner’s claimed invention based on “simple substitution” of Ono’s disclosures for Li’s disclosures. *Id.* at 23–24. Petitioner has not demonstrated that simple substitution of Ono’s disclosures for Li’s would have resulted in the claimed invention. As discussed above, Petitioner does not show that either Ono or Li teaches a resistor or capacitor closest to an end wall.

Petitioner’s arguments about certain advantages discussed in Ono also fail to provide a sufficiently persuasive, logical basis for locating a resistor or capacitor near an end wall. *E.g.*, Pet. 21–22. For example, in support of its assertion that it would have been obvious to modify Li based on Ono, Petitioner cites Ono’s disclosure that “because the non-combustible cover 26a has a lighting circuit covering portion 42 that covers the periphery of the lighting circuit 24, . . . covering the periphery of the lighting circuit 24, which is susceptible to heat damage, with the non-combustible cover 26a creates a reliable non-combustible structure.” Ex. 1006 ¶ 31; Pet. 21. To the extent this disclosed advantage would have motivated a person of ordinary skill in the art to add a non-combustible cover to Li’s configuration, it does not provide a persuasive reason that a person of ordinary skill in the art would have modified Li to have a resistor or capacitor closest to an end wall.

We also find unavailing Petitioner’s argument that “a [person of ordinary skill in the art] would have found it obvious to try implementing Ono’s PCB structure with Li’s drive circuit because there were a finite number of identified, predictable solutions a [person of ordinary skill in the art] would have pursued.” Pet. 22. As Patent Owner argues, Petitioner does not provide persuasive support for its conclusory assertion of a finite number of identified, predictable solutions. Prelim. Resp. 29; Pet. 22–23.

In sum, weighing the parties’ arguments and evidence, we find Petitioner has not persuasively addressed limitation 1[h]’s requirement for a “resistor which is positioned closest to the end wall” or limitation 30[h]’s requirement for a “capacitor which is positioned closest to the end wall.”

b) Conclusion for Ground 1

Because Petitioner does not provide sufficiently persuasive arguments and evidence addressing limitations 1[h] and 30[h], we find Petitioner has not demonstrated a reasonable likelihood of establishing obviousness of independent claims 1 and 30. Additionally, Petitioner’s arguments and evidence addressing dependent claims 2, 4–6, 31, 37, 88, and 90 do not cure the deficiencies in Petitioner’s challenge to independent claims 1 and 30. Pet. 36–43, 47–48. Accordingly, Petitioner also fails to demonstrate a reasonable likelihood of prevailing on its challenge of dependent claims 2, 4–6, 31, 37, 88, and 90.

D. GROUNDS 2–5 – ALLEGED OBVIOUSNESS OVER LI AND ONO IN COMBINATION WITH XU, GUANG, ZHANG, OR HALLIWELL

Grounds 2–5 build from Petitioner’s Ground 1 challenge of independent claims 1 and 30 as allegedly obvious over Li and Ono. *See, e.g.*, Pet. 50 (“As explained in Sections IX.A.3-IX.A.5 for Ground 1, Li-Ono renders obvious claim 1. A [person of ordinary skill in the art] would have

also been motivated to further modify Li-Ono in view of Xu for each of several reasons.”). The deficiencies in Ground 1 are not cured by Petitioner’s arguments and evidence in Grounds 2–5 that each of claims 5, 6, 12–14, 31, 47, 77, and 84–86 would have been obvious based on a combination of Li and Ono with Xu, Guang, Zhang, or Halliwell. Pet. 48–82. Accordingly, like Ground 1, Grounds 2–5 do not demonstrate a reasonable likelihood of establishing unpatentability of any challenged claim.

III. CONCLUSION

Because we determine that the information presented in the record does not establish there is a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim of the patent ’989 patent, we do not institute an *inter partes* review.

IV. ORDER

For the reasons given, it is:

ORDERED that the Petition is *denied* as to all challenged claims of the ’989 patent and no trial is instituted.

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FOR PETITIONER:

Eagle Robinson
Valerie Barker
Catherine Garza
NORTON ROSE FULBRIGHT US LLP
Eagle.robinson@nortonrosefulbright.com
Valerie.barker@nortonrosefulbright.com
Cat.garza@nortonrosefulbright.com

FOR PATENT OWNER:

Patrick McKeever
Miguel Bombach
Evan Day
An-Wei Chen
PERKINS COIE LLP
Mckeever-ptab@perkinscoie.com
Bombach-ptab@perkinscoie.com
Day-ptab@perkinscoie.com
Chen-ptab@perkinscoie.com