

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CREE, INC.

Petitioner

v.

OPTOLUM, INC.

Patent Owner

Case No. IPR2017-01260

Patent 6,831,303

PETITION FOR *INTER PARTES* REVIEW

Mail Stop "PATENT BOARD"

Patent Trial and Appeal Board

U.S. Patent and Trademark Office

P.O. Box 1450

Alexandria, VA 22313-1450

TABLE OF CONTENTS

	<u>Page</u>
LIST OF EXHIBITS	vi
I. INTRODUCTION	1
II. GROUNDS FOR STANDING PURSUANT TO 37 C.F.R. § 42.104(A).....	2
III. OVERVIEW OF THE ‘303 PATENT AND PRIOR ART	2
A. Overview of the ‘303 patent.....	2
B. Prosecution of the ‘303 patent and related applications	4
C. Overview of the ‘722 patent.....	5
D. Overview of the ‘211 patent.....	7
E. Overview of the ‘678 patent.....	9
F. Overview of the ‘819 patent.....	11
G. Overview of the ‘539 patent.....	12
H. Overview of the ‘347 patent.....	13
I. Person of Ordinary Skill in the Art	14
IV. IDENTIFICATION OF CHALLENGE PURSUANT TO 37 C.F.R. § 42.104(B)	14
A. 37 C.F.R. § 42.104(b)(1): Claims For Which <i>Inter Partes</i> Review Is Requested	14
B. 37 C.F.R. § 42.104(b)(2): The Prior Art And Specific Grounds On Which The Challenge To The Claims Is Based	15
C. 37 C.F.R. § 42.104(b)(3): Claim Construction	17
D. 37 C.F.R. § 42.104(b)(4): How The Construed Claims Are Unpatentable.....	18
E. 37 C.F.R. § 42.104(b)(5): Supporting Evidence	19

TABLE OF CONTENTS
(continued)

	<u>Page</u>
V. THERE IS A REASONABLE LIKELIHOOD THAT AT LEAST ONE CLAIM OF THE '303 PATENT IS UNPATENTABLE	19
A. Independent claims 1 and 19 are anticipated by the '722 patent (Ground 1)	20
B. Independent claims 1 and 19 are obvious in view of the '722 patent and the '211 patent (Ground 2)	29
C. Claim 2 is anticipated by the '722 patent (Ground 3) and obvious in view of the '722 and '211 patents (Ground 4)	36
D. Claims 3 and 4 are anticipated by the '722 patent (Ground 3) and obvious in view of the '722 and '211 patents (Ground 4)	37
E. Claims 6-8 are anticipated by the '722 patent (Ground 3).....	38
F. Claims 6-8 are obvious in view of the '722 patent and obvious in view of the '722 and '211 patents (Ground 4)	40
G. Claims 6-8 are obvious in view of the '722 and '678 patents (Ground 5) and obvious in view of the '722, '211 and '678 patents (Ground 6).....	41
H. Claims 9 and 14-16 are anticipated by the '722 patent (Ground 3) and obvious in view of the '722 and '211 patents (Ground 4)	46
I. Claims 10 and 11 are obvious in view of the '722, '819 and '539 patents (Ground 7) and obvious in view of the '722, '819, '539 and '211 patents (Ground 8).....	47
J. Claims 12 and 13 are obvious in view of the '722, '819 and '539 patents (Ground 9) and obvious in view of the '722, '819, '539 and '211 patents (Ground 10).....	49
K. Claims 12 and 13 are obvious in view of the '722, '819, '539 and '678 patents (Ground 11) and obvious in view of	

TABLE OF CONTENTS **(continued)**

	<u>Page</u>
the ‘722, ‘819, ‘539, ‘678 patents and ‘211 patents (Ground 12).....	50
L. Claims 17 and 18 are anticipated by the ‘722 patent (Ground 3) and obvious in view of the ‘722 patent and the ‘211 patent (Ground 4)	52
M. Claims 20 and 21 are anticipated by the ‘722 patent (Ground 13).....	53
N. Claim 22 is anticipated by the ‘722 patent (Ground 15).....	57
O. Claim 22 is obvious in view of the ‘722 patent and the ‘347 patent (Ground 15)	58
P. Claim 23 is obvious in view of the ‘722 patent and the ‘347 patent (Ground 16)	63
VI. MANDATORY NOTICES PURSUANT TO 37 C.F.R. § 42.8(A)(1).....	63
A. C.F.R. § 42.8(b)(1): Real Party-In-Interest.....	63
B. C.F.R. § 42.8(b)(2): Related Matters	63
C. C.F.R. § 42.8(b)(3) and (4): Lead and Back-up Counsel and Service Information.....	64
VII. CONCLUSION.....	65
CERTIFICATION OF COMPLIANCE	65

TABLE OF AUTHORITIES

	Page
 CASES	
<i>Graham v. John Deere Co.</i> 383 U.S. 1 (1966).....	19
<i>In re Am. Acad. Sci. Tech. Ctr.</i> , 367 F.3d 1359 (Fed. Cir., 2004).....	17
<i>KSR Int’l Co. v. Teleflex, Inc.</i> , 550 U.S. 398 (2007).....	19, 20, 31
<i>OptoLum, Inc. v. Cree, Inc.</i> , U.S. District Court for the District of Arizona, Civil Action No. 2:16-cv-3828	63
 STATUTES	
35 U.S.C. § 101.....	4, 5
35 U.S.C. § 102	passim
35 U.S.C. § 103.....	15, 16, 17, 29
 OTHER AUTHORITIES	
37 C.F.R. § 1.68	19
37 C.F.R. § 41.100(b)	17
37 C.F.R. § 42.8(A)(1).....	63
37 C.F.R. § 42.8(b)	63
37 C.F.R. § 42.10(b)	64
37 C.F.R. § 42.104(A)	2
37 C.F.R. § 42.104(B).....	14
37 C.F.R. § 42.104(b)(1).....	14

37 C.F.R. § 42.104(b)(2).....	15
37 C.F.R. § 42.104(b)(3).....	17
37 C.F.R. § 42.104(b)(4).....	18
37 C.F.R. § 42.104(b)(5).....	19

LIST OF EXHIBITS

Ex. 1001	U.S. Patent No. 6,831,303 (“the ‘303 patent”)
Ex. 1002	U.S. Patent No. 6, 220,722 (“the ‘722 patent” or “Begemann”)
Ex. 1003	U.S. Patent No. 6,682,211 (“the ‘211 patent” or “English”)
Ex. 1004	U.S. Patent No. 6,425,678 (“the ‘678 patent” or “Verdes”)
Ex. 1005	U.S. Patent No. 6,848,819 (“the ‘819 patent” or “Arndt”)
Ex. 1006	U.S. Patent No. 4,296,539 (“the ‘539 patent” or “Asami”)
Ex. 1007	U.S. Patent No. 5,949,347 (“the ‘347 patent” or “Wu”)
Ex. 1008	Declaration of Jianzhong Jiao (“the Jiao Decl.”)
Ex. 1009	Amended Complaint dated February 2, 2017 in <i>OptoLum v. Cree, Inc.</i> , 2:16-cv-3828 (D. Ariz.)
Ex. 1010	U.S. Patent No. 6,573,536 (“the ‘536 patent”)
Ex. 1011	Prosecution History of U.S. Patent Application No. 10/430,732
Ex. 1012	Prosecution History of U.S. Patent Application No. 10/156,810
Ex. 1013	U.S. Patent No. 6,462,669 (“the ‘669 patent”)
Ex. 1014	U.S. Patent Application Publication No. 20020005826 (“the ‘826 publication”)
Ex. 1015	U.S. Patent Application Publication No. 20010049893 (“the ‘893 publication”)
Ex. 1016	U.S. Patent Application Publication No. 20020191396 (“the ‘396 publication”)
Ex. 1017	Prosecution History of U.S. Patent Application No. 10/631,027
Ex. 1018	U.S. Patent No. 6,799,864 (“the ‘864 patent”)
Ex. 1019	Prosecution History of U.S. Patent Application No. 10/430,696 (“the ‘696 application”)

I. INTRODUCTION

The Petition demonstrates that claims 1-4 and 6-23 of U.S. Patent No. 6,831,303 (Ex. 1001, “the ‘303 patent”) are unpatentable in view of various prior art references: U.S. Patent No. 6,220,722 (Ex. 1002, “the ‘722 patent, or “Begemann”), U.S. Patent No. 6,682,211 (Ex. 1003, “the ‘211 patent,” or “English”), U.S. Patent No. 6,425,678 (Ex. 1004, “the ‘678 patent,” or “Verdes”), U.S. Patent No. 6,848,819 (Ex. 1005, “the ‘819 patent,” or “Arndt”), U.S. Patent No. 4,296,539 (Ex. 1006, “the ‘539 patent,” or “Asami”), and U.S. Patent No. 5,949,347 (Ex. 1007, “the ‘347 patent,” or “Wu”). Declaratory evidence from a distinguished expert, Dr. Jianzhong Jiao, who has been working in the technological fields of light-emitting diodes (“LEDs”) and lighting for over 25 years, corroborates why a person of ordinary skill in the art (“POSA”) would have understood that the various combinations of the above noted patents disclose the subject matter of claims 1-4 and 6-23 and why it would have been obvious to a POSA to combine those patents. *See* Ex. 1008, Declaration of Dr. Jianzhong Jiao.

The ‘303 patent is being asserted against Cree, Inc. (“Cree”) by the alleged assignee, OptoLum, Inc. (“OptoLum”), in a patent infringement lawsuit (*OptoLum v. Cree, Inc.*, 2:16-cv-3828 (D. Ariz.)) to recover alleged damages for certain LED devices. *See* Ex. 1009, Amended Complaint in 2:16-cv-03828.

As explained herein, there is a reasonable likelihood that at least one claim of the ‘303 patent is unpatentable under the identified grounds, and Petitioner requests that the Board institute an *inter partes* review proceeding.

II. GROUNDS FOR STANDING PURSUANT TO 37 C.F.R. § 42.104(A)

Petitioner Cree certifies that the ‘303 patent is available for *inter partes* review and that Petitioner is not barred or estopped from requesting *inter partes* review on the grounds identified herein.

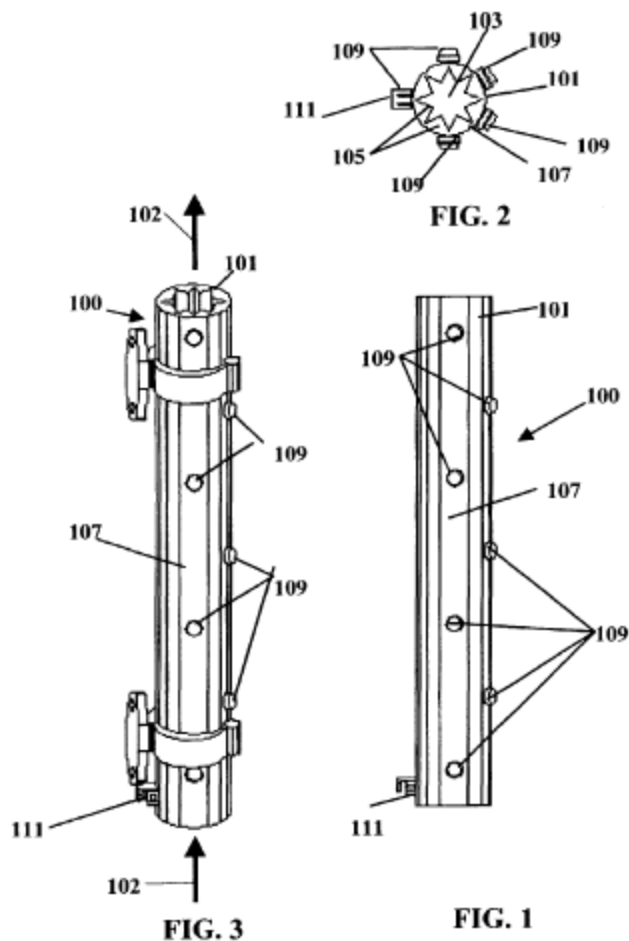
III. OVERVIEW OF THE ‘303 PATENT AND PRIOR ART

A. Overview of the ‘303 patent

The ‘303 patent (Ex. 1001), entitled “Light Emitting Diode Light Source,” discloses a “light source that utilizes light emitting diodes that emit white light” wherein “[t]he diodes are mounted on an elongate member having at least two surfaces upon which the light emitting diodes are mounted.” Ex. 1001, Abstract. “The elongate member is thermally conductive and is utilized to cool the light emitting diodes ... [and] is a tubular member through which a heat transfer medium flows.” *Id.* FIGS. 1-3 (below) illustrate light source 100, which includes an elongate thermally conductive heat sink 101 of excellent thermal conductivity. *Id.* at 2:59-62. Ex. 1008 at ¶ 39.

The tubular heat sink 101 is hollow (FIG. 2) and has an interior cavity 103 that includes heat dissipating fins 105. *Id.* at 2:67-3:2. Cooling of the heat sink is improved by movement of a medium 102, *e.g.*, air, through the heat sink. *Id.* at

3:5-9. The exterior surface 107 of the heat sink 101 has LEDs 109 mounted thereon. *Id.* at 3:11-12. Electrically conductive paths electrically connect the LEDs 109 to an electrical connector 111, the conductive paths being disposed on an electrically insulating layer(s) on surface 107 in the form of a flexible printed circuit(s) disposed on surface 107. *Id.* at 3:20-27. The flexible printed circuit 113 is adhered to the tube 101 with a heat conducting epoxy to enhance heat transmission from the LEDs 109 to the tube 101. *Id.* at 3:40-42. The light source may be mounted into a fixture by mounting clips. *Id.* at 3:57-58. Ex. 1008 at ¶ 40.



B. Prosecution of the ‘303 patent and related applications

The ‘303 patent was filed as U.S. Application No. 10/430,732 (“the ‘732 application”) on May 5, 2003, as a continuation of U.S. Application No. 10/156,810 (“the ‘810 application”) filed May 29, 2002, which matured into U.S. Patent No. 6,573,536 (“the ‘536 patent”). The ‘732 application was filed with 23 claims and encountered minimal prosecution, namely, an obviousness-type double patenting rejection in view of claims 1-23 of the ‘536 patent (the parent), and a provisional double patenting under 35 U.S.C. 101 as claiming the same invention

of claims 32-33 of U.S. Patent Application No. 10/430,696 (“the ‘696 application”). Ex. 1011, ‘732 Pros. Hist. at 1-18, 54-60. Following the filing of an Amendment and a Terminal Disclaimer for the ‘536 patent, a Notice of Allowance was issued. *Id.* at 64-75, 80-85. Ex. 1008 at ¶ 41.

The ‘810 application (parent of the ‘732 application) and U.S. Application No. 10/631,027 (“the ‘027 application,” a continuation of the ‘732 application), included substantially more prosecution pertinent to the claims of the ‘303 patent, and a summary of that prosecution is presented in the Jiao Declaration. Ex. 1008 at ¶¶ 42-49.

C. Overview of the ‘722 patent

The ‘722 patent (Ex. 1002, Begemann), entitled “LED Lamp,” relates to an LED lamp having a gear column connecting a lamp cap and a substrate. Ex. 1002, Abstract. The lamp (FIG. 1 below) comprises a tubular, hollow gear column 1, connected at one end to lamp cap 2 and at the other end to substrate 3, which is provided with a number of LEDs 4. *Id.* at 3:39-44. A space within the gear column 1 accommodates electronics for controlling the LEDs 4. *Id.* at 3:44-45. The lamp includes an envelope 5 of synthetic resin, which envelops gear column 1 and substrate 3. *Id.* at 3:47-50.

In FIG. 1, substrate 3 is a regular pyramid with four flat faces, whose vertex is connected to the gear column 1. *Id.* at 3:53-55. The outer surface of substrate 3

is made of metal or metal alloy, *e.g.*, copper alloy, which enables good heat conduction from LEDs 4 to column 1. *Id.* at 3:56-58. Each face of substrate 3 has multiple LEDs 4. *Id.* LEDs 4 are secured to substrate 3 faces with a heat-conducting adhesive. *Id.* at 3:59-62. Each LED 4 has two electrical connections by which the LEDs are soldered onto substrate 3, with the heat-conducting adhesive providing good heat dissipation from the LEDs to the substrate. *Id.* at 4:61-65.

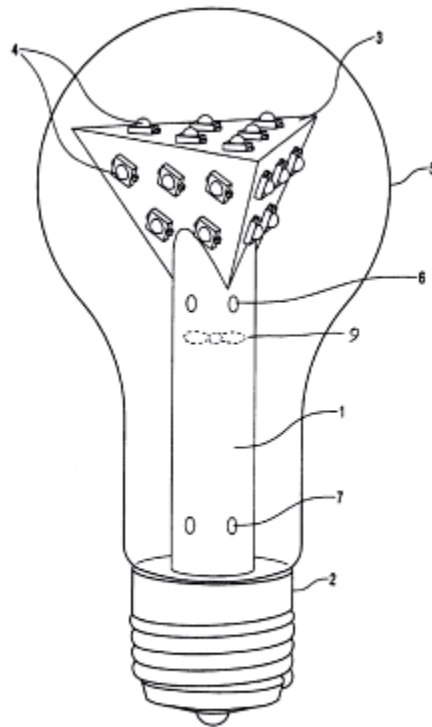


FIG. 1

The outer surface of gear column 1 is made of a metal or a metal alloy, *e.g.*, a copper alloy, enabling good heat conduction from substrate 3 to metal lamp cap 2. *Id.* at 3:66-4:2. Heat dissipation provided by the arrangement permits LEDs

with high luminous flux to be used without heat problems. *Id.* at 4:3-6. The LED lamp of FIG. 1 also includes a fan 9 disposed in gear column 1, which generates an air flow during operation, whereby air leaves gear column 1 via holes 6 therein and re-enters gear column 1 via holes 7 therein. *Id.* at 4:7-12. As a result, air flow is guided past a substantial number of LEDs 4 on substrate 3, and an improved heat dissipation from substrate 3 and LEDs 4 is achieved. *Id.* at 4:13-16. This arrangement permits good heat conduction from substrate 3 to metal lamp cap 2. *Id.* at 3:66-4:2. Accordingly, heat is conducted from LEDs 4 to metal substrate 3, from metal substrate 3 to metal gear column 1, and from metal gear column 1 to metal lamp cap 2. Moreover, as explained above, the hollow tubular structure of gear column 1 with fan 9 and holes 6, 7 provides circulation of air within the lamp and within gear column 1, such that heat transferred from LEDs 4 to substrate 3 to gear column 1 can further be transferred to air contained by the gear column 1. Ex. 1008 at ¶ 52.

Begemann issued on April 24, 2001, and is prior art under § 102(b).

D. Overview of the ‘211 patent

The ‘211 patent (Ex. 1003, English), entitled “Replaceable LED Lamp Capsule,” describes an LED lamp system that comprises a replaceable LED lamp capsule incorporating a support on which LEDs are directly placed, for automotive and other applications. Ex. 1003 at 1:5-8, 2:22-24, Abstract. The LED lamp

system (FIG. 1 below) comprises a replaceable LED lamp capsule 10 that fits in a reflector 12 and lens 14 housing, wherein LED lamp capsule 10 comprises a support 16 for one or more LED chips 22, the support 16 being formed from a material with high heat conductivity, such as a metal. *Id.* at 2:22-26, 36-37. The support 16 has a head 18 portion and a base 20 portion, where the head 18 and base 20 portions may be a single piece or may be separately formed and coupled to enable good heat conduction from LEDs 22, *e.g.*, head 18 and base 20 may each be formed from metal and screwed or otherwise joined together. *Id.* at 2:37-45.

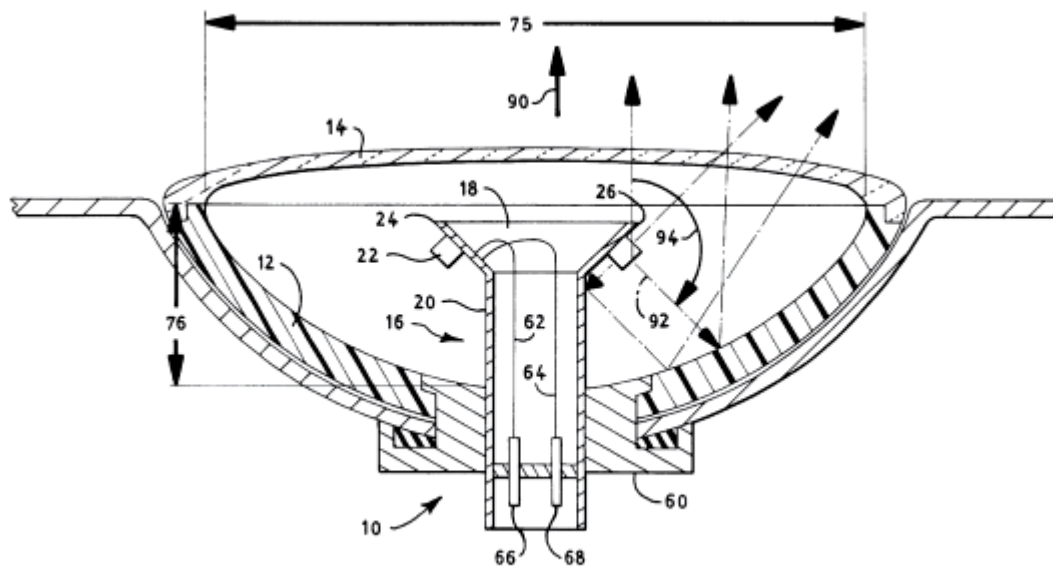


FIG. 1

The head 18 provides a surface on which to mount LED chips 22, which generally face away from the field to be illuminated and towards the base 20 or reflector 12. *Id.* at 2:46-48. Metal base portion 20 includes a coupling 60 providing direct metal to metal contact with a vehicle, enabling good thermal

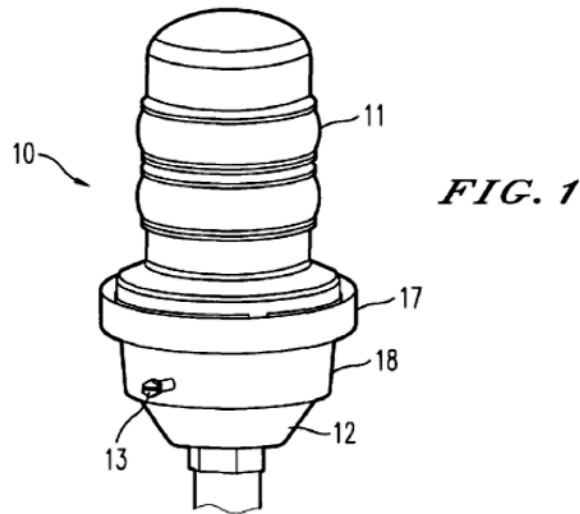
conduction away from LED chips 22 to the vehicle. *Id.* 3:56, 63-67. In a variation, “*the base 20 portion may include on an exterior side cooling fins or other heat dissipating structures exposed on the exterior of the base 20.*” *Id.* at 4:7-9.¹ By mounting LED chips directly on metal support 16, a substantial amount of heat is conducted away, thereby enhancing the lamp's life and reducing elevated junction temperatures that may otherwise lead to LED failures, achieving greater total light output than would be possible with SMT package mounting. *Id.* at 6:47-52; *see also* 5:20-31. Ex. 1008 at ¶¶ 53-54.

English was filed on September 28, 2001, and is prior art under § 102(e).

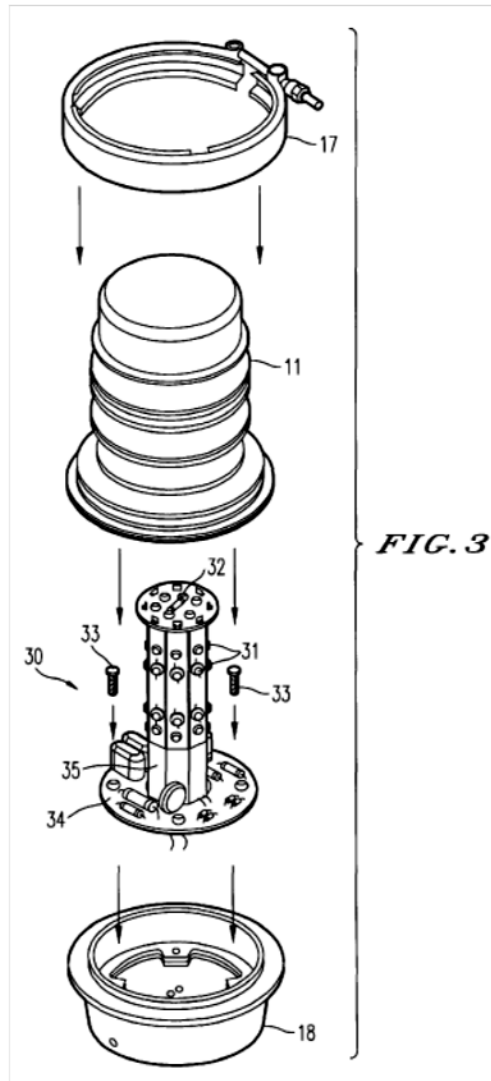
E. Overview of the ‘678 patent

The ‘678 patent (Ex. 1004, Verdes), entitled “LED Obstruction Lamp,” describes an obstruction lamp that replaces conventional incandescent obstruction lamps and which utilizes LEDs. Ex. 1004 at 1:61-64, Abstract. The lamp 10 (FIG. 1 below) includes an optical lens 11 mounted on a rugged metal base 18 with good heat dissipation properties. *Id.* at 3:16-19. The optical lens 11 houses LED elements, and a clamp 17 and gasket secures the lens 11 to the base 18, which are secured to a wire housing 12 by screws 13. *Id.* at 3:19-24.

¹ All emphasis herein is added unless otherwise indicated.



The internal illuminating unit 30 (FIG. 3 below) comprises a vertical metal cylinder 35 on which plural high-power LEDs 31 and driving circuitry are mounted and which provides heat sinking for the plural LEDs 31. *Id.* at 3:38-46, 3:51-55. By inspection, metal cylinder 35 has a polygon shape in cross section with multiple faces around its circumference on which the LEDs 31 are mounted. Ex. 1008 at ¶¶ 55-56.

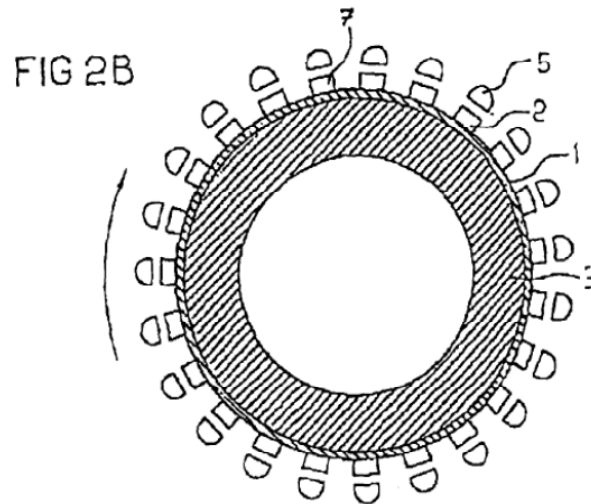


Verdes was filed on August 23, 1999, and is prior art under § 102(e).

F. Overview of the '819 patent

The '819 patent (Ex. 1005, Arndt), entitled "Light-Emitting Diode Arrangement," describes an array of LEDs 2 with lenses 5 surface mounted on a flexible printed circuit board (PCB 1) and laminated to a hollow cylindrical cooling member 3 through which a gas such as air, or a liquid coolant, may flow to improve heat elimination (FIG. 2B below). Ex. 1005 at Abstract, 4:23-32, 59-61.

The PCB 1 is laminated onto the cooling member 3 with a thermally conductive adhesive, paste or film 6, , the cooling member 3 being fabricated of metal, *e.g.*, copper or aluminum, exhibiting high thermal conductivity. *Id.* at 4:2-9. Ex. 1008 at ¶ 57.

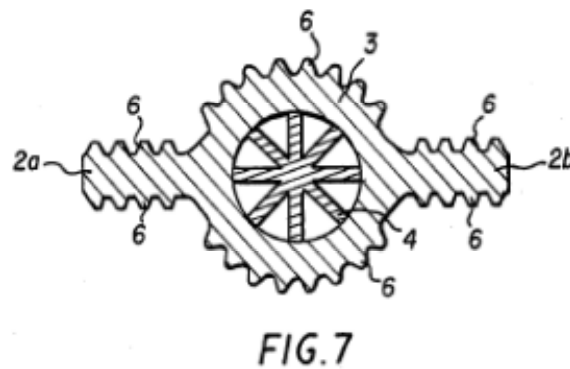
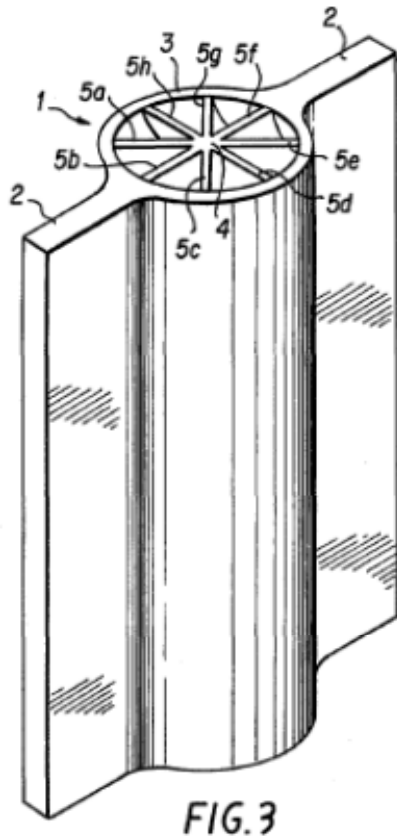


Arndt was filed as the National Stage under § 371 of PCT/DE00/01508, has a § 371(c)(1), (2), (4) date of March 26, 2002, and is prior art under § 102(e).

G. Overview of the ‘539 patent

The ‘539 patent (Ex. 1006, Asami), entitled “Heat Transfer Tubing For Natural Gas Evaporator,” describes an easily fabricated heat transfer tube 1 comprising a tubular body 3, internal fins 4, and external fins (flutes) 6 formed by extrusion of an aluminum alloy (FIGs. 3 and 7 below) to provide effective, high-performance heat transfer. Ex. 1006 at 1:12-15, 4:8-13, 7:7-18. The tubular body

3 can be easily formed by extrusion of aluminum alloy as a single integral unit. *Id.* at 7:59-66. Ex. 1008 at ¶ 58.



Asami issued on October 27, 1981, and is prior art under § 102(b).

H. Overview of the '347 patent

The '347 patent (Ex. 1007, Wu), entitled "Light Emitting Diode Retrofitting Lamps for Illuminated Signs," describes LED illumination sources that fit with common incandescent lamp bases. Ex. 1007, Abstract. Wu describes various LED arrays, *e.g.*, illustrated in FIGS. 3C, 5C and 7C, wherein a surface of a frame (*e.g.*, PCB) on which the LEDs are mounted may be formed from, or coated with, a

reflective material to facilitate even illumination. *Id.* at 3:64-4:1, 4:17-21, 5:33-35, 5:63-67. Ex. 1008 at ¶ 59.

Wu issued on September 7, 1999, and is prior art under § 102(b).

I. Person of Ordinary Skill in the Art

A person of ordinary skill in the subject of the ‘303 patent, as of the effective filing date of the ‘303 patent, would have been a person having at least a bachelor’s degree in electrical or mechanical engineering or physics (or equivalent) and at least three years of training and practical experience in lighting or lighting related fields, including good working skills and knowledge related to LEDs and optical, electrical and mechanical designs for lighting applications. Alternatively, a POSA could have a Master’s Degree or a Ph.D. degree in electrical or mechanical engineering or physics (or equivalent) and at least one year of training and practical experience in lighting or lighting related fields, including good working skills and knowledge related to LEDs and optical, electrical and mechanical designs for lighting applications. Ex. 1008 at ¶ 37.

IV. IDENTIFICATION OF CHALLENGE PURSUANT TO 37 C.F.R. § 42.104(B)

A. 37 C.F.R. § 42.104(b)(1): Claims For Which *Inter Partes* Review Is Requested

Inter Partes review is requested for claims 1-4 and 6-23 of the ‘303 patent.

B. 37 C.F.R. § 42.104(b)(2): The Prior Art And Specific Grounds On Which The Challenge To The Claims Is Based

Inter Partes review is requested in view of the following prior art references:

- U.S. Patent No. 6,220,722 (Ex. 1002, “Begemann”);
- U.S. Patent No. 6,682,211 (Ex. 1003, “English”);
- U.S. Patent No. 6,425,678 (Ex. 1004, “Verdes”);
- U.S. Patent No. 6,848,819 (Ex. 1005, “Arndt”);
- U.S. Patent No. 4,296,539 (Ex. 1006, “Asami”);
- U.S. Patent No. 5,949,347 (Ex. 1007), “Wu”).

The specific statutory grounds under which 35 U.S.C. §§ 102 or 103 on which the challenge to the claims are based and the references relied upon for each ground are as follows:

Ground	Claims	Statutory Provision (pre-AIA)	Prior Art
1	1, 19	§ 102(b)	Begemann (Ex. 1002)
2	1, 19	§ 103(a)	Begemann (Ex. 1002), English (Ex. 1003)
3	2-4, 6-9, 14-18	§ 102(b)	Begemann (Ex. 1002)
4	2-4, 6-9, 14-18	§ 103(a)	Begemann (Ex. 1002), English (Ex. 1003)
5	6-8	§ 103(a)	Begemann (Ex. 1002), Verdes (Ex. 1004)
6	6-8	§ 103(a)	Begemann (Ex. 1002),

			Verdes (Ex. 1004), English (Ex. 1003)
7	10, 11	§ 103(a)	Begemann (Ex. 1002), Arndt (Ex. 1005), Asami (Ex. 1006)
8	10, 11	§ 103(a)	Begemann (Ex. 1002), Arndt (Ex. 1005), Asami (Ex. 1006), English (Ex. 1003)
9	12, 13	§ 103(a)	Begemann (Ex. 1002), Arndt (Ex. 1005), Asami (Ex. 1006)
10	12, 13	§ 103(a)	Begemann (Ex. 1002), Arndt (Ex. 1005), Asami (Ex. 1006), English (Ex. 1003)
11	12, 13	§ 103(a)	Begemann (Ex. 1002), Arndt (Ex. 1005), Asami (Ex. 1006), Verdes (Ex. 1004)
12	12, 13	§ 103(a)	Begemann (Ex. 1002), Arndt (Ex. 1005), Asami (Ex. 1006), English (Ex. 1003), Verdes (Ex. 1004)
13	20, 21	§ 102(b)	Begemann (Ex. 1002)

14	22	§ 102(b)	Begemann (Ex. 1002)
15	22	§ 103(a)	Begemann (Ex. 1002), Wu (Ex. 1007)
16	23	§ 103(a)	Begemann (Ex. 1002), Wu (Ex. 1007)

C. 37 C.F.R. § 42.104(b)(3): Claim Construction

Pursuant to 37 C.F.R. § 41.100(b), solely for the purposes of this review, Petitioner construes the claim language such that the claims are given their broadest reasonable interpretation (BRI) in light of the disclosure of the ‘303 patent. For the purposes of this review, each claim should be construed in accordance with its plain and ordinary meaning under the required BRI. Because the standard for claim construction at the Patent Office is different than that used during a litigation in a United States District Court (*see In re Am. Acad. Sci. Tech. Ctr.*, 367 F.3d 1359, 1364, 1369 (Fed. Cir., 2004); MPEP § 2111), Petitioner reserves the right to assert a different claim construction in litigation for any term of the ‘303 patent as appropriate in any such proceeding.

Term 1: “Elongate” means “having more length than width.” This interpretation represents the plain meaning of the term in the context of the specification (*e.g.*, such as illustrated by elongate heat sink 101 in FIGS. 1, 3 and 4 of the ‘303 patent). Moreover, the patentee asserted, and the Examiner adopted,

such a definition during prosecution of a related family member application. *See* Ex. 1017 at 48, 52-53. Ex. 1008 at ¶ 61.

Term 2: “Thermally conductive member” means a “structural unit that is thermally conductive.” This interpretation represents the plain meaning of the term in the context of the specification. The patentee asserted a similar definition (“structural unit that is a thermal conductor”) during prosecution of a related application. *See* Ex. 1017 at 48, 50-52. However, the patentee’s proposal is too narrow to the extent the language “is a thermal conductor” suggests that the thermally conductive member should be made of a single material, which is not required. Ex. 1008 at ¶ 62.

Term 3: “Heat dissipation protrusions” means “protrusions that dissipate heat.” This interpretation represents the plain meaning of the term in the context of the specification, which uses the term “fins” more narrowly than “protrusions,” indicating that “protrusions” is a broader term than “heat fins.” *See, e.g.*, Ex. 1001 at 1:65-67, 3:1-5. Ex. 1008 at ¶ 63.

D. 37 C.F.R. § 42.104(b)(4): How The Construed Claims Are Unpatentable

A detailed explanation of how claims 1-4 and 6-23 are unpatentable, including how each claim element is found in the prior art, is explained below at Section V.

E. 37 C.F.R. § 42.104(b)(5): Supporting Evidence

An Appendix of Exhibits supporting this petition is attached, including Ex. 1008, the Declaration of Jianzhong Jiao, under 37 C.F.R. § 1.68. In addition, the relevance of the evidence to the challenged claims, including an identification of the specific portions of the supporting evidence, is included in Section V.

V. THERE IS A REASONABLE LIKELIHOOD THAT AT LEAST ONE CLAIM OF THE ‘303 PATENT IS UNPATENTABLE

As explained below, claims 1-4 and 6-23 are unpatentable in view of the ‘722 patent alone or in combination with other references.

For each prior art ground based on obviousness, Petitioner states where each element is found in the prior art, *i.e.*, Petitioner has evaluated the scope and contents of the prior art, any differences between the art and the claims, and the knowledge of person of ordinary skill in the art in accordance with *Graham v. John Deere Co.* 383 U.S. 1 (1966) and *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007). For each ground under §103 a more than adequate written rationale is provided to support the combination. *See KSR*, 550 U.S. at 418. In general, “[A] ‘patent for a combination which only unites old elements with no change in their respective functions . . . obviously withdraws what already is known into the field of its monopoly and diminishes the resources available to skillful men.’ . . . The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *KSR*, 550 at 415-16

(citation omitted). “For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *Id.* at 417; MPEP § 2141. Additional details regarding rationales for the prior art combinations are provided in the detailed discussion below.

A. Independent claims 1 and 19 are anticipated by the ‘722 patent (Ground 1)

Independent claims 1 and 19 are anticipated by Begemann under pre-AIA 35 U.S.C. § 102(b) as explained below and in connection with the following claim chart with reference to each of the claim elements.

“A light source comprising”

Claims 1 and 19 each recite “A light source” in the preambles thereof. Begemann discloses this subject matter, *e.g.*: “These and other objects of the invention are achieved by a LED lamp....” Ex. 1002 at 1:40-41. *See* also FIGS. 1 and 2. Ex. 1008 at ¶ 67.

“An elongate thermally conductive member having an outer surface”

Claims 1 and 19 each recite “an elongate thermally conductive member having an outer surface.” Begemann discloses limitation, *e.g.*, via the combination of substrate 3, gear column 1, and lamp cap 2, that combination of which plainly has more length than width, as shown in annotated FIG. 1 below:

An elongate
thermally
conductive
member having
an outer surface
(1+2 +3)

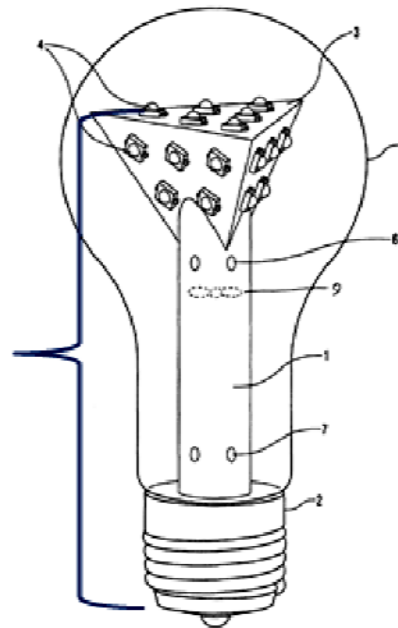


FIG. 1

Begemann discloses, *e.g.*: “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” Ex. 1002 at 3:39-44. “The outer surface of the gear column (1) of the LED lamp is made of a metal or a metal alloy. This enables a good heat conduction from the substrate (3) to the (metal) lamp cap (2) to be attained.” *Id.* at 3:66-4:2. “A further interesting embodiment of the LED lamp is characterized in that the heat-dissipating means comprise a metal connection between the substrate and the lamp cap.” *Id.* at 2:20-22. *See also* FIG. 2. Thus, Begemann discloses this limitation. Ex. 1008 at ¶¶ 68-69.

“A plurality of light emitting diodes [at least one light emitting diode] carried on said elongate member outer surface”

Claim 1 recites “a plurality of light emitting diodes carried on said elongate member outer surface,” and claim 19 recites, “at least one light emitting diode carried on said elongate member outer surface.” Begemann discloses these limitations by virtue of LEDs 4 carried on an outer surface of substrate 3 (which is part of the elongate member formed by features 1, 2, and 3), as shown in FIGs. 1 and 2. Begemann discloses, *e.g.*: “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” Ex. 1002 at 3:40-44. “The outer surface to the substrate (3) is made of metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4), to the column (1). . . . The outer surface of the gear column (1) of the LED lamp is made of a metal or metal alloy.” Ex. 1002 at 3:56-67. *See also* FIGs. 1 and 2. Thus, Begemann discloses this limitation. Ex. 1008 at ¶ 70.

“At least some of said light emitting diodes being disposed in a first plane and others of said light emitting diodes being disposed in a second plane not coextensive with said first plane”

Claim 1 recites, “at least some of said light emitting diodes being disposed in a first plane and others of said light emitting diodes being disposed in a second

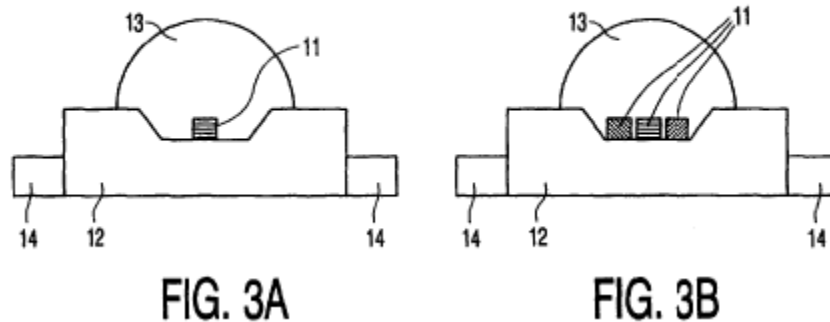
plane not coextensive with said first plane.”² Begemann discloses this limitation as shown in FIGs. 1 and 2, wherein LEDs 4 are disposed on differently oriented (not coextensive) surface planes of the polyhedron substrate 3. Begemann discloses, *e.g.*: “[T]he substrate (3) has the shape of a pyramid with four flat faces.... Each of the faces of the pyramid is provided with a number (five or six) LEDs (4), which are secured to the faces by means of a heat-conducting adhesive.” 1002 at 3:53-61. “[T]he substrate (3) is cube-shaped with six flat faces.... Each one of the faces ... is provided with a number (eight or nine) LEDs (4)....” *Id.* at 4:23-31. Thus, Begemann discloses this limitation. Ex. 1008 at ¶ 70.

“[One or more] electrical conductors carried by said elongate thermally conductive member and connected to said plurality of light emitting diodes [at least one light emitting diode] to supply electrical power thereto”

Claim 1 recites, “electrical conductors carried by said elongate thermally conductive member and connected to said plurality of light emitting diodes to supply electrical power thereto,” and claim 19 recites, “one or more electrical conductors carried by said elongate thermally conductive member and connected to said at least one light emitting diode to supply electrical power thereto.”

² Claim 19 does not require this limitation, but claim 19 is being treated with claim 1 because of other similarities.

Begemann discloses these limitations by virtue of electrical connections 14 to the LEDs 4, such as shown in FIGs. 3A and 3B, which supply power to the LEDs 4:



Ex. 1002 at FIG. 3A, 3B (*see also* FIGs. 3C and 3D). Begemann discloses, *e.g.*:

“The LED (4) is also provided with two electrical connections (14). Via these connections, the LED is soldered onto the substrate 3.” *Id.* at 4:61-63. “The space within the hollow gear column (1) accommodates the *electronic gear* necessary for *controlling the LEDs* (4).” *Id.* at 3:44-46. “A particular aspect of the invention resides in that the heat-dissipating means remove the heat, generated during operation of the lamp, from the substrate via the gear column to the lamp cap and the *mains supply connected thereto*.” *Id.* at 1:54-58. To provide for the described electronic control of the LEDs 4, the electrical connections 14 would necessarily supply power to the LEDs 4, which comes from the stated mains supply. Ex. 1008 at ¶ 72. Thus, Begemann discloses this limitation.

“Said elongate thermally conductive member being configured to conduct heat away from said light emitting diodes [at least one light

emitting diode] to fluid contained by said elongate thermally conductive member”

Claim 1 recites, “said elongate thermally conductive member being configured to conduct heat away from said light emitting diodes to fluid contained by said elongate thermally conductive member,” and claim 19 recites, “said elongate thermally conductive member being configured to conduct heat away from said at least one light emitting diode to fluid contained by said elongate thermally conductive member.” Begemann discloses these limitations, *e.g.*, via the assembly of the substrate 3, lamp cap 2, and gear column 3, which is provided with fan 9 and air holes 6, 7 to circulate fluid (air) for conducting heat away from the LEDs 4. Begemann teaches that the outer surfaces of the substrate 3, the gear column 1, and the lamp cap are metal, are connected as a unit, and that LEDs 4 are mounted on the metal outer surface of substrate 3 with heat-conducting adhesive. *See, e.g.*, Ex. 1002 at 3:40-44, 3:56-4:3. Ex. 1008 at ¶ 73-74. Thus, with substrate 3, gear column 1, and lamp cap 2 all being metal and joined together as a unit, heat is conducted from LEDs 4 to metal substrate 3 to metal gear column 1 and to metal lamp cap 2. *Id.*

Regarding heat conduction to contained fluid, Begemann discloses, *e.g.*: “The LED lamp shown in FIG, 1 also includes a fan (9) incorporated in the gear column (1), which fan generates an air flow during operation of the lamp. This air flow leaves the gear column (1) via holes (6) provided in the gear column, and re-

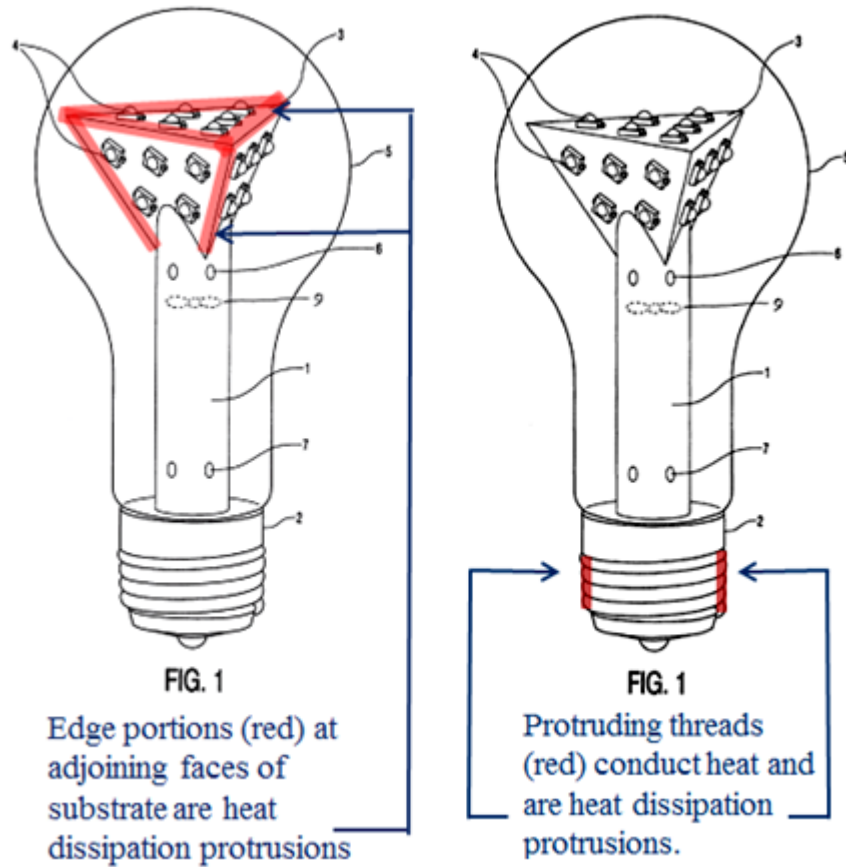
enters the gear column via the holes (7) provided in the gear column.... By virtue thereof, an improved heat dissipation from the substrate and the LEDs is obtained.”

Ex. 1002 at 4:7-16; *see also id.* at 2:33-39. Thus, in addition to conducting heat from LEDs 4 to metal substrate 3 to metal gear column 1 to metal lamp cap 2, the fan 9 and air holes 6, 7 in gear column 1 provide circulation of air within the lamp and within gear column 1, whereby heat transferred from LEDs 4 to substrate 3 and to gear column 1 can further be transferred to air contained by the gear column 1, which further facilitates heat dissipation from the LEDs 4. Ex. 1008 at ¶ 75-76.

Thus, Begemann discloses these limitations.

“Said elongate thermally conductive member comprises one or more heat dissipation protrusions”

Claims 1 and 19 recite, “said elongate thermally conductive member comprises one or more heat dissipation protrusions.” Begemann discloses this limitation by virtue of the edge portions of adjoining faces of substrate 3 and/or the protruding threads of the lamp cap 2 (*see, e.g.*, FIG. 1 below with added labeling and red highlighting):



Ex. 1002, FIG. 1 (annotated). The protruding threads (above right, highlighting added in red) are metal because the lamp cap 2 is metal, and these protruding threads would conduct heat to the socket in which the LED lamp is mounted. Ex. 1008 at ¶ 77. Begemann discloses, *e.g.*, “The outer surface of the substrate (3) is made of metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4) to the column (1).... The outer surface of the gear column (1) of the LED lamp is made of a metal or metal alloy. This enables a good heat conduction from the substrate (3) to the (metal) lamp cap (2) to be attained.” Ex. 1002 at 3:56-4:2. The threads are therefore protrusions that dissipate heat.

In addition, or alternatively, the edges of adjoining faces of the substrate 3 and the points where those edges intersect (above left, highlighting added in red) protrude from the remainder of the substrate 3, and those edges and intersecting points dissipate heat to the air circulating within the envelope, because the substrate 3 as whole dissipates heat to circulating air. *See, e.g.*, Ex. 1002 at 4:7-16, Ex. 1008 at ¶ 78. Begemann discloses, “The LED lamp shown in FIG. 1 also includes a fan (9) incorporated in the gear column (1), which fan generates an air flow during operation of the lamp.... By virtue thereof, an improved heat dissipation *from the substrate* and the LEDs *is obtained*.” Ex. 1002 at 4:7-16. Indeed, the edge portions of adjoining faces of Begemann’s substrate 3 are triangularly shaped like the heat dissipating protrusions disclosed in the ‘303 patent as shown below (annotated FIG. 1 Begemann left, annotated FIG. 2 ‘303 patent right), with one heat dissipating protrusion for each highlighted in red. Thus, the edges of adjoining faces of the substrate 3 are likewise protrusions that dissipate heat.

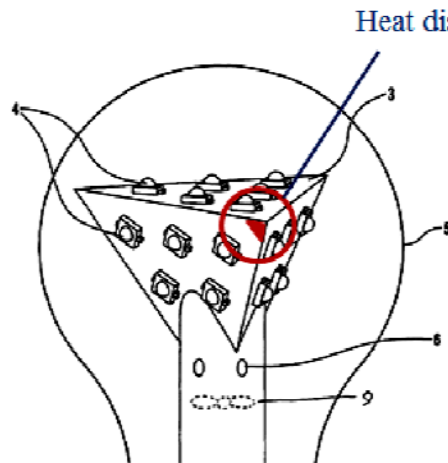


FIG. 1 '722 patent (annotated)

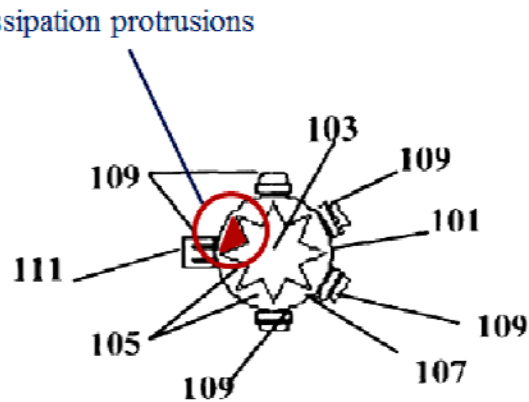


FIG. 2 '303 patent (annotated)

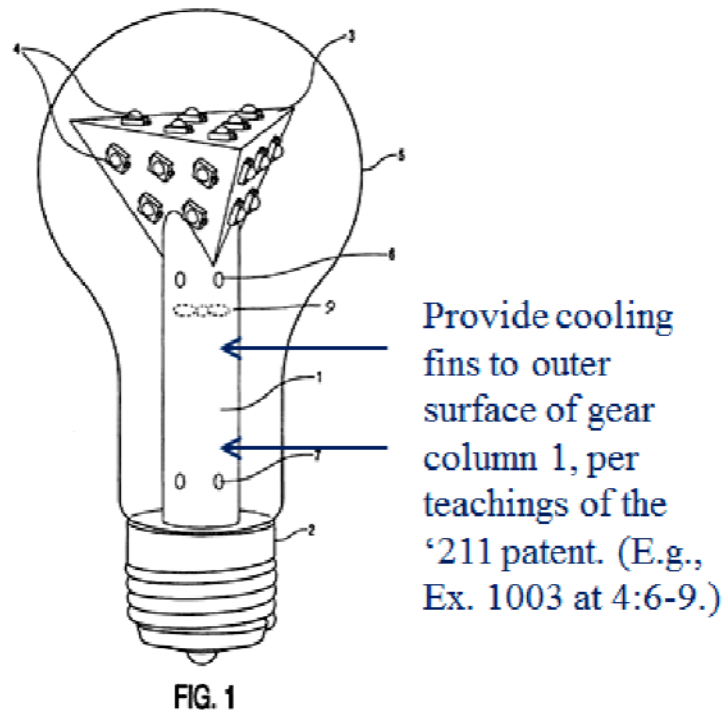
Thus, Begemann discloses this limitation. Ex. 1008 at ¶¶ 77-79. Accordingly, claims 1 and 19 are anticipated by Begemann.

B. Independent claims 1 and 19 are obvious in view of the '722 patent and the '211 patent (Ground 2)

Should it be determined that Begemann does not expressly disclose the claimed heat dissipation protrusions, then claims 1 and 19 are at least obvious in of Begemann in combination with English under pre-AIA 35 U.S.C. § 103(a). In this regard, English expressly discloses the placement of cooling fins on an exterior of a hollow, metal base portion 20 of an elongated, thermally conductive metal support 16 to further enhance heat dissipation for cooling LEDs mounted on the metal support 16. *See, e.g.*, Ex. 1003 at 4:6-9. A POSA would have been motivated at the time of the alleged invention to provide the cooling fins of the lamp of English to the outer surface of the elongate, thermally conductive member of the lamp of Begemann by placing such cooling fins on the outer surface of gear

column 1 of Begemann to enhance the performance and/or efficiency of cooling the LEDs 4 by enhancing heat dissipation away from the LEDs 4. Ex. 1008 at ¶ 80. The '722 and '211 patents address common technical issues of managing heat in high illumination LED-based light sources in which a thermally conductive member is formed in the shape of a hollow channel and wherein a fluid (notably air) is utilized to cool the LED light sources. Ex. 1008 at ¶ 80. Begemann expressly describes a fan 9 used to circulate air through holes 6, 7 in a hollow, metal gear column 1 so as to further enhance heat dissipation away from LEDs 4 mounted on a metal substrate 3 of an elongate, thermally conductive member. *See, e.g.,* Ex. 1002 at 4:7-16.

Thus, a POSA would have been motivated to apply the external cooling fins of English to the outer surface of the gear column 1 of Begemann because English expressly teaches the placement of exterior cooling fins on an outer surface of an elongate thermally conductive member to enhance heat dissipation away from LEDs, to enhance the lamp's life, reduce elevated junction temperatures that may otherwise lead to LED failures, and enhance a total light output that may be achieved. *See* Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at ¶ 81. A pictorial illustration of the modification with added labeling is shown below.



The devices described in the '722 and '211 patents relate to similar technical issues, and combining their features would have amounted to combining known prior art elements according to known methods, with no change in respective functions, to yield predictable results. Ex. 1008 at ¶ 81; see, *KSR*, 550 U.S. at 416; MPEP § 2141. English and Begemann teach a common goal of dissipating heat from LEDs in elongate thermally conductive members to enhance lamp performance as described above. See, e.g., Ex. 1002 at 3:56-62, 3:66-4:16, 4:7-16 ; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. A POSA would reasonably have expected the modification of Begemann's lamp to be successful at least because 1) the addition of cooling fins to the gear column 1 would have been a straightforward modification easily made to the lamp of Begemann, and 2) Begemann describes air

flow within the envelope 5 via fan 9 and holes 6, 7, which would have been able to effectuate enhanced cooling provided by such cooling fins placed on the outer surface of the gear column 1. Ex. 1008 at ¶ 82.

A claim chart is presented below showing where each limitation of claims 1 and 19 is found in the references, either as anticipated by Begemann or obvious in view of Begemann and English. Ex. 1008 at ¶ 83.

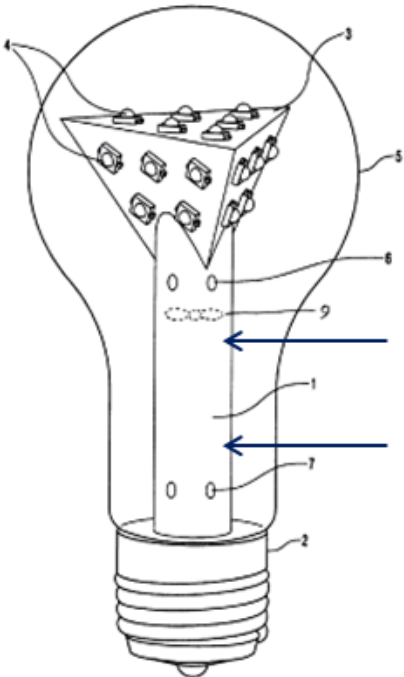
CLAIMS 1 and 19 – anticipation and obviousness

Claim Element	Prior Art Teaching
<u>Claims 1 and 19</u> A light source comprising:	Ex. 1002 (Begemann) at 1:40-41. “These and other objects of the invention are achieved by a LED lamp...”
<u>Claims 1 and 19</u> an elongate thermally conductive member having an outer surface;	Ex. 1002 at 3:39-44. “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” Ex. 1002 at 2:20-22. “A further interesting embodiment of the LED lamp is characterized in that the heat-dissipating means comprise a metal connection between the substrate and the lamp cap.” Ex. 1002 at 3:56-4:2. “The outer surface to the substrate (3) is made of metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4) to the column (1).... The outer surface of the gear column (1) of the LED lamp is made of a metal or metal alloy. This enables a good heat conduction from the substrate (3) to the (metal) lamp cap (2) to be attained.”
<u>Claim 1</u>	Ex. 1002 at 3:40-44. “This lamp comprises a tubular,

Claim Element	Prior Art Teaching
a plurality of light emitting diodes carried on said elongate member outer surface <u>Claim 19</u> at least one light emitting diode carried on said elongate member outer surface;	hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” <i>See</i> FIG. 1 and FIG. 2
<u>Claim 1</u> at least some of said light emitting diodes being disposed in a first plane and others of said light emitting diodes being disposed in a second plane not coextensive with said first plane;	Ex. 1002 at 3:53-61. “In the example described herein, the substrate (3) has the shape of a regular pyramid with four flat faces.... Each of the faces of the pyramid is provided with a number (five or six) LEDs (4), which are secured to the faces by means of a heat-conducting adhesive.” Ex. 1002 at 4:23-31. “In the example described with respect to FIG. 2, the substrate (3) is cube-shaped with six flat faces.... Each one of the faces ... is provided with a number (eight or nine) LEDs (4)....”
<u>Claim 1</u> electrical conductors carried by said elongate thermally conductive member and connected to said plurality of light emitting diodes to supply electrical power thereto; and <u>Claim 19</u> one or more electrical conductors carried by said elongate thermally conductive member and connected to said at least one light emitting diode	Ex. 1002 at 4:61-63. “The LED (4) is also provided with two electrical connections (14). Via these connections, the LED is soldered onto the substrate (3).” Ex. 1002 at 3:44-46. “The space within the hollow gear column (1) accommodates the electronic gear necessary for controlling the LEDs (4).” <i>See also</i> Ex. 1002 at 1:54-58 (describing “mains supply connected” to lamp cap).

Claim Element	Prior Art Teaching
to supply electrical power thereto;	
<u>Claim 1</u> said elongate thermally conductive member being configured to conduct heat away from said light emitting diodes to fluid contained by said elongate thermally conductive member; <u>Claim 19</u> said elongate thermally conductive member being configured to conduct heat away from said at least one light emitting diode to fluid contained by said elongate thermally conductive member; and	Ex. 1002 at 3:40-44. “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” Ex. 1002 at 3:56-4:2. “The outer surface of the substrate (3) is made of a metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4) to the column (1).... The outer surface of the gear column (1) of the LED lamp is made of a metal or a metal alloy. This enables a good heat conduction from the substrate (3) to the (metal) lamp cap (2) to be attained.” Ex. 1002 at 4:7-12. “The LED lamp shown in FIG, 1 also includes a fan (9) incorporated in the gear column (1), which fan generates an air flow during operation of the lamp. This air flow leaves the gear column (1) via holes (6) provided in the gear column, and re-enters the gear column via the holes (7) provided in the gear column.... By virtue thereof, an improved heat dissipation from the substrate and the LEDs is obtained.” <i>See also</i> Ex. 1002 at 2:33-39.
<u>Claims 1 and 19</u> said elongate thermally conductive member comprises one or more heat dissipation protrusions.	<u>Anticipation by Ex. 1002 (Begemann):</u> Ex. 1002 at 3:56-4:2. “The outer surface to the substrate (3) is made of metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4) to the column (1).... The outer surface of the gear column (1) of the LED lamp is made of a metal or metal alloy. This enables a good heat conduction from the substrate (3) to the (metal) lamp cap (2) to be

Claim Element	Prior Art Teaching
	attained.” FIG. 1 Edge portions (red) at adjoining faces of substrate are heat dissipation protrusions FIG. 1 Protruding threads (red) conduct heat and are heat dissipation protrusions. Heat dissipation protrusions FIG. 1 '722 patent (annotated) FIG. 2 '303 patent (annotated) <u>Obviousness in view of Ex. 1002 (Begemann) and Ex. 1003 (English):</u> Ex. 1003 (English) 4:6-8: “In another variation, the base 20 portion may include on an exterior side cooling fins or other heat dissipating structures

Claim Element	Prior Art Teaching
	exposed on the exterior of the base 20.”  FIG. 1

C. Claim 2 is anticipated by the ‘722 patent (Ground 3) and obvious in view of the ‘722 and ‘211 patents (Ground 4)

Claim 2 depends from claim 1 and recites, “at least one of said heat dissipation protrusions being carried on said elongate member outer surface.” This claim is anticipated by Begemann (Ground 3) considering that (1) the heat dissipating, protruding edges of adjoining faces of the substrate 3, and the points where those edges intersection, shown in FIGs. 1 and 2 are part of the elongate thermally conductive member, and/or (2) the lamp cap 2 of the lamp shown in FIGs. 1 and 2 forms part of the elongate thermally conductive member and

includes protruding metal threads that dissipate heat as explained above for claims 1 and 19. *See, e.g.*, Ex. 1002 at 3:56-4:6 and FIGS. 1 and 2. Ex. 1008 at ¶ 84.

Should the protruding edges of adjoining faces of the substrate 3 or the protruding metal threads on lamp cap 2 of Begemann be determined not to be heat dissipating protrusions as claimed in claims 1 and 2, then claim 2 is obvious (Ground 4) under the combination of Begemann and English because, as explained above for claims 1 and 19, it would have been obvious to add the cooling fins of English to the outer surface of the gear column 1 of the lamp of the ‘722 patent. *See, e.g.*, Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at ¶ 85.

D. Claims 3 and 4 are anticipated by the ‘722 patent (Ground 3) and obvious in view of the ‘722 and ‘211 patents (Ground 4)

Claim 3 depends from claim 2 and recites, “said elongate thermally conductive member is configured to conduct heat away from said light emitting diodes to fluid proximate said elongate member outer surface.” Claim 4 depends from claim 3 and recites, “said fluid proximate said elongate member outer surface comprises air. Begemann discloses these limitations of claims 3 and 4 (Ground 3), *e.g.*, via the assembly of the substrate 3, lamp cap 2 and gear column 1 being provided with fan 9 and air holes 6, 7, so as to circulate fluid (air) for conducting heat away from the LEDs 4. Begemann discloses, “The LED lamp shown in FIG, 1 also includes a fan (9) incorporated in the gear column (1), which fan generates

an air flow during operation of the lamp. This air flow leaves the gear column (1) via holes (6) provided in the gear column, and re-enters the gear column via the holes (7) provided in the gear column.... By virtue thereof, an improved heat dissipation from the substrate and the LEDs is obtained.” *Id.* at 4:7-16, *see also id.* at 2:33-39. Thus, Begemann discloses these limitations. Ex. 1008 at ¶ 86.

However, should it be determined that Begemann does not expressly disclose heat dissipating protrusions as claimed in claims 1 and 2, then claims 3 and 4 are obvious (Ground 4) under the combination of Begemann and English with the addition of English’s cooling fins to gear column 1 as explained for claims 1 and 2. *See, e.g.*, Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at ¶ 87.

E. Claims 6-8 are anticipated by the ‘722 patent (Ground 3)

Claim 6 depends from claim 3 and recites, “said elongate thermally conductive member comprises a tube.” Begemann discloses this limitation at least by virtue of tubular hollow gear column 1 shown in FIGS. 1 and 2. Begemann discloses, *e.g.*, “FIG. 1 shows a first embodiment of the invented light emitting [d]iode lamp (LED lamp). This lamp comprises a **tubular, hollow gear column (1)**, which is connected with one end to a lamp cap (2).” Ex. 1002 at 3:38-42. A POSA would also reasonably consider the substrate 3 to be an extension of the gear column 1 to which it is attached, such that the gear column 1 and substrate 3

of FIGS. 1 and 3 together may be considered the claimed tube. The polyhedron substrate 3 is referred to as a “substrate,” which indicates a thin planar structure in the electrical arts, and a POSA would understand the substrate 3 to be hollow and not a solid block of metal. Ex. 1008 at ¶ 88. A POSA therefore would consider the hollow substrate 3 structure to be a tubular extension of the gear column 1. *Id.* Thus, Begemann anticipates claim 6.

Claim 7 depends from claim 6 and recites, “said tube has a cross-section in the shape of a polygon.” Claim 8 depends from claim 6 and recites, “said tube has a cross-section having flat portions.” Begemann discloses these limitations at least because the hollow polygon shaped substrate 3 forms part of the claimed tube as explained above. Begemann discloses, *e.g.*: “In the example described herein, the substrate (3) has the shape of a pyramid with four flat faces.... Each of the faces of the pyramid is provided with a number (five or six) LEDs (4), which are secured to the faces by means of a heat-conducting adhesive.” 1002 at 3:53-62. “In the example described with respect to FIG. 2, the substrate (3) is cube-shaped with six flat faces.... Each one of the faces ... is provided with a number (eight or nine) LEDs (4)....” *Id.* at 4:23-31. Thus, a cross section of the substrate 3 would have a shape of a polygon (claim 7), and such a cross section would likewise have flat portions (claim 8). Ex. 1008 at ¶ 89. Thus, Begemann anticipates claims 6 and 7 (Ground 3). *Id.*

F. Claims 6-8 are obvious in view of the ‘722 patent and obvious in view of the ‘722 and ‘211 patents (Ground 4)

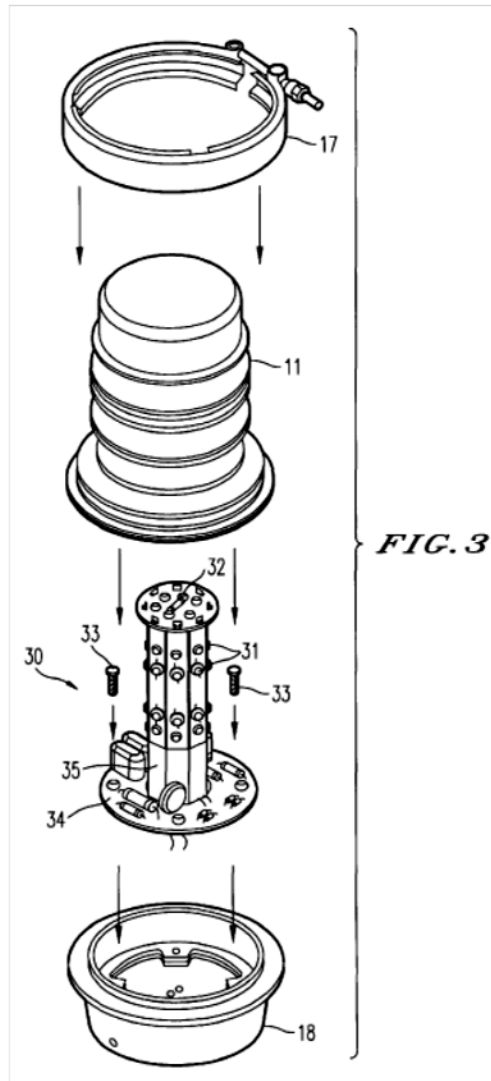
Should it be determined that Begemann does not disclose that the polyhedron substrate 3 is hollow, a POSA would have found it obvious at the time of the alleged invention to make polyhedron substrate 3 to be hollow. With the polyhedron substrate 3 being hollow, the limitations of claims 6-8 are accounted for as explained for claims 6-8 in Section E (Ground 3) immediately above. It would have been obvious to make the polyhedron substrate 3 hollow at least because it is referred to as a “substrate” (which indicates a thin planar structure in the electrical arts) and also to reduce the weight and materials cost of the lamp, since fabricating such lamps with a hollow copper substrate 3 instead of solid blocks of copper metal or copper alloy for the substrate 3 would reduce the manufacturing and shipping costs. Ex. 1008 at ¶ 90. In addition, it would have been obvious to make the substrate 3 hollow to provide convenient means for making electrical connections to LEDs from beneath, *i.e.*, from inside, the substrate 3 and to further enhance air circulation for heat dissipation from the LEDs 4. *Id.* With a hollow polyhedron substrate 3, the limitations of claims 6-8 are accounted for as explained for claims 6-8 in Section E immediately above. *Id.*

Also, should it be determined that Begemann does not expressly disclose heat dissipating protrusions of claims 1 and 2, then claims 6-8 are obvious under the combination of Begemann and English with the addition of English’s cooling

fins to gear column 1 as explained for claims 1 and 2. *See, e.g.*, Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at ¶ 91.

G. Claims 6-8 are obvious in view of the ‘722 and ‘678 patents (Ground 5) and obvious in view of the ‘722, ‘211 and ‘678 patents (Ground 6)

Should the substrate 3 of Begemann not be considered part of the claimed tubular member, then claims 6-8 are at least obvious in view of Begemann in combination with Verdes. Verdes discloses an LED obstruction lamp that can replace incandescent lamps, wherein an internal illuminating unit 30 comprises a vertical metal cylinder 35 on which a plurality of high-power LEDs 31 and driving circuitry are mounted and which provides heat sinking for the plural LEDs 31. Ex. 1004 at 3:38-46, 51-55, FIG. 3. Ex. 1008 at ¶ 92.



The metal cylinder 35 has a shape of a polygon in cross section with multiple side faces around its circumference on which LEDs 31 are mounted and a top plate on which LEDs 32 are mounted. A POSA would have recognized the desirability of Verdes's teaching of a simple and uniformly polygon shaped, vertical cylinder 35 which would be easy to manufacture and on which it would be easy to mount LEDs for uniform side and top illumination given the distribution of multiple convenient flat faces encompassing 360 degrees laterally and a flat

mounting face at the top of the cylinder 35. Ex. 1008 at ¶ 93. A POSA would have been motivated at the time of the alleged invention to replace the hollow gear column 1 and polygon substrate 3 of Begemann with a simple vertical metal tube (consistent with Begemann's teaching of a hollow tube 1) having the uniform polygon cross-sectional shape of the metal cylinder 35 of Verdes and top plate of Verdes, with Begemann's LEDs 4 being mounted on the side polygon surfaces and top plate of such vertical metal tube, such as illustrated for LEDs 31 and 32 mounted on the vertical metal cylinder 35 of Verdes, while retaining the fan 9 and air holes 6, 7 of Begemann inside the resulting vertical, polygon metal tube to provide the desired heat dissipation provided by those components. Ex. 1008 at ¶¶ 93-94. A POSA would have been motivated to make such modifications Begemann's lamp to provide a simpler supporting structure on which to mount LEDs 4, which avoids the complexity of the polygon shape substrate 3 and complexity of its attachment to the gear column 1, thereby simplifying the manufacturing process and reducing the cost of manufacturing the lamp of Begemann, while still retaining the fan 9 and air holes 6, 7 disclosed in Begemann for maintaining the enhanced heat dissipation provided by those features. *Id.* There would have been a reasonable expectation of success at least because replacement of the gear column 1 and substrate 3 of Begemann with a modified vertical metal tube and top plate having the outer shape of Verdes's vertical metal

cylinder 35 would have been a straightforward reconfiguration of easily manipulated components. *Id.* at ¶ 94. Moreover, the resulting vertical metal tube with cross-sectional polygon shape and top plate would have provided desirable and convenient flat surfaces on which to mount Begemann's LEDs 4 as well as a desirable structure for directing light both vertically and horizontally, consistent with the omnidirectional illumination of the Begemann's lamp. *Id.*

With the gear column 1 and substrate 3 of Begemann thus replaced with a simpler, vertical metal tube with polygon-cross sectional shape and top plate, such as illustrated by the vertical metal cylinder 35 of Verdes, the resulting lamp would have accounted for all the limitations of claims 6-8. In particular, claim 6 depends from claim 3 and recites, "said elongate thermally conductive member comprises a tube." The modified lamp of Begemann as described above would possess an elongate thermally conductive member in the form the modified vertical metal tube in combination with Begemann's lamp cap 2, which would have possessed the same heat dissipating properties as the combined substrate 3 and gear column 1 for reasons already explained for claim 1 above. That structure would also meet all the other limitations of claim 1 (for reasons already explained for claim 1). That structure would also meet the limitations of claim 2 (at least because the threads on lamp cap 2 are heat dissipating protrusions on an outer surface of the elongate member as previously explained for claims 1 and 2) and claim 3 (for the same

reasons already explained above for claim 3). Claim 7 depends from claim 6 and recites, “said tube has a cross-section in the shape of a polygon.” The resulting modified lamp with the vertical metal tube meets the limitation of claim 7, because the modified vertical metal tube is purposefully configured to have the polygon cross-sectional shape with multiple flat surfaces like Verdes vertical metal cylinder 35. Claim 8 depends from claim 6 and recites, “said tube has a cross-section having flat portions.” Again, the resulting modified lamp with a vertical metal tube purposefully modified to have the polygon cross-sectional shape with multiple flat surfaces like Verdes vertical metal cylinder 35 meets the limitation of claim 8. Ex. 1008 at ¶¶ 94-95.

Thus, claims 6-8 would have been obvious in view of Begemann and Verdes (Ground 5). Ex. 1008 at ¶¶ 94-95.

Should it be determined that the protruding threads of Begemann’s lamp cap 2 are not heat dissipating protrusions as claimed (in the modified lamp of Begemann as described above), then claims 6-8 are obvious under the combination of Begemann, Verdes, and English with the addition of English’s cooling fins to the outer surface of the modified vertical tube having the polygon cross-sectional shape as described above (which would still contain fan 9 and air holes 6,7, as explained above). *See, e.g.*, Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at 95.

H. Claims 9 and 14-16 are anticipated by the ‘722 patent (Ground 3) and obvious in view of the ‘722 and ‘211 patents (Ground 4)

Claims 9 and 14-16 recite:

9. A light source in accordance with claim 1, wherein:
said elongate thermally conductive member comprises a
channel.

14. A light source in accordance with claim 1, wherein:
said fluid is moved in said elongate thermally conductive
member.

15. A light source in accordance with claim 1, wherein:
said elongate thermally conductive member comprises a
thermal transfer media disposed therein.

16. A light source in accordance with claim 15, wherein:
said elongate thermally conductive member comprises a
flow channel for said thermal transfer media.

Begemann discloses the limitations of claims 9 and 14-16 (Ground 3) at least because Begemann’s tubular hollow gear column 1 is hollow and therefore comprises a channel, *e.g.*, the open interior of gear column 1 (claim 9), wherein fluid (namely, air) is moved therein (claim 14), comprises a thermal transfer media (namely, air) disposed therein (claim 15), and comprises a flow channel (open interior of gear column 1) for the thermal transfer media (namely, air) (claim 16). Begemann discloses, “The LED lamp shown in FIG, 1 also includes a fan (9) incorporated in the gear column (1, which fan generates an air flow during operation of the lamp. This air flow leaves the gear column (1) via holes (6)

provided in the gear column, and re-enters the gear column via the holes (7) provided in the gear column.... By virtue thereof, an improved heat dissipation from the substrate and the LEDs is obtained.” *Id.* at 4:7-16, *see also id.* at 2:33-39. Thus, Begemann anticipates claims 9 and 14-16 (Ground 3). Ex. 1008 at ¶ 97.

Should it be determined that Begemann does not expressly disclose heat dissipating protrusions as claimed, then claims 9 and 14-16 are obvious under the combination of Begemann and English (Ground 4) with the addition of English’s cooling fins to gear column 1 as explained for claims 1 and 2. *See, e.g.*, Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at ¶ 98.

I. Claims 10 and 11 are obvious in view of the ‘722, ‘819 and ‘539 patents (Ground 7) and obvious in view of the ‘722, ‘819, ‘539 and ‘211 patents (Ground 8)

Claim 10 depends from 3 and recites, “said elongate thermally conductive member comprises an extrusion.” Claim depends from claim 10 and recites, “said extrusion is an aluminum extrusion.”

Begemann does not expressly disclose that any of the substrate 3, gear column 1, and lamp cap 2 comprises an extrusion (claim 10), *i.e.*, a part formed by an extruding process, and that such extrusion is an aluminum extrusion (claim 11). However, Arndt discloses a cooling member 3 made of metal such as copper *or aluminum* on which an array of LEDs 2 surface mounted via a flexible printed circuit board (PCB 1) laminated to the cooling member 3 and through which a gas

such as air, or a liquid coolant, may flow through to improve heat elimination. Ex. 1005 at Abstract, FIG. 2B, 4:23-32, 4:2-9, 4:59-61, 2:55-60. Asami discloses that a heat transfer tube 1 comprising a tubular body 3 and internal fins 4 and external fins (flutes) 6 may be easily formed by *extrusion of an aluminum alloy* as a single integral unit to provide effective, high-performance heat transfer. Ex. 1006 at 4:9-13, 7:4-18, 7:59-66. Ex. 1008 at ¶¶ 99-101.

A POSA would have been motivated as of the '303 patent's effective filing date to produce the gear column 1 of Begemann (including, optionally, with outer heat fins as disclosed in English as explained for claims 1 and 2) using aluminum as a thermally conductive material as taught by Arndt and using an extrusion process that can provide integral external heat fins as taught by Asami, to achieve ease of fabrication of a thermally conductive gear column 1, optionally with integrally formed heat fins, as taught by Asami. Ex. 1008 at ¶ 102. There would have been a reasonable expectation of success because aluminum is easily extruded as taught by Asami with integral heat fins, and the modified aluminum gear column 1 would provide good thermal heat conduction as taught by Arndt, consistent with the design goals of the lamp of Begemann. *Id.* Thus, claims 10 and 11 are obvious in view of the teachings of Begemann, Arndt and Asami. Ex. 1008 at ¶ 102.

Should it be determined that Begemann does not expressly disclose heat

dissipating protrusions as claimed, then claims 10 and 11 are obvious under the combination of the ‘722, ‘819, ‘539 and ‘211 patents (Ground 8) with the addition of English’s cooling fins to gear column 1 as explained for claims 1 and 2. *See, e.g.,* Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Moreover, Asami discloses that an aluminum extrusion can be easily made with external flutes (fins). Ex. 1006 at 4:9-13, 7:4-18, FIGS. 3, 7. Ex. 1008 at ¶ 103.

J. Claims 12 and 13 are obvious in view of the ‘722, ‘819 and ‘539 patents (Ground 9) and obvious in view of the ‘722, ‘819, ‘539 and ‘211 patents (Ground 10)

Claim 12 depends from claim 10 and recites, “said elongate thermally conductive member is a tubular member.” Begemann discloses this subject matter at least by virtue of gear column 1, lamp cap 2 and substrate 3 shown in FIGS. 1 and 2 thereof, which together can form a tubular member 1. Ex. 1008 at ¶ 104. *See also* Ex. 1002 at 3:38-42. Since Begemann discloses the polyhedron substrate 3 as a “substrate” (indicating a thin, planar structure in electrical arts), a POSA would have understood the polyhedron substrate 3 to be hollow and considered it a tubular extension of the gear column 1. Ex. 1008 at ¶ 104.

Claim 13 depends from claim 12 and recites, “said tubular member has a polygon cross-section.” This limitation is satisfied by Begemann for the same reasons as discussed above for claim 7. Ex. 1008 at ¶ 105.

Thus, the combination of the ‘722, ‘819 and ‘539 patents render claims 12 and 13 obvious (Ground 9). *Id.*

Should it be determined that Begemann does not expressly disclose heat dissipating protrusions as claimed, then claims 12 and 13 are obvious under the combination of the ‘722, ‘819, ‘539 and ‘211 patents (Ground 10) with the addition of English’s cooling fins to gear column 1 as explained for claims 1 and 2. *See, e.g.,* Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at 106.

K. Claims 12 and 13 are obvious in view of the ‘722, ‘819, ‘539 and ‘678 patents (Ground 11) and obvious in view of the ‘722, ‘819, ‘539, ‘678 patents and ‘211 patents (Ground 12)

Should it be determined that the combination of the gear column 1 and substrate 3 of Begemann, with or without the lamp cap 2, are not collectively considered the claimed tubular member, claims 12 and 13 would still be obvious in view of Begemann, Arndt, Asami and Verdes (Ground 11). Specifically, a POSA would have been motivated at the time of the alleged invention to replace the hollow gear column 1 and polygon substrate 3 of Begemann with a simple vertical metal tube having the uniform polygon cross-sectional shape of the metal cylinder 35 of Verdes and top plate of Verdes, with Begemann’s LEDs 4 being mounted on the side polygon surfaces and top plate of such vertical metal tube, while retaining the fan 9 and air holes 6, 7 of Begemann inside the resulting vertical, polygon

metal tube, for reasons already explained for claims 6-8 in Section G above. Ex. 1008 at ¶ 107. A POSA also would have been motivated to form the modified vertical metal, polygon-shaped tube (that replaces gear column 1 and substrate 3) of an aluminum extrusion in view of the teachings of the Arndt and Asami, for reasons discussed above with regard to claims 10 and 11. Ex. 1008 at ¶ 107. In such a modified lamp of Begemann, with gear column 1 and substrate 3 collectively replaced with an aluminum extruded, vertical metal tube having the shape of the vertical metal cylinder 35 of Verdes, the resulting vertical metal tube would suffice as the claimed tubular member (being extruded aluminum according to the combined teachings of Arndt and Asami). Ex. 1008 at ¶ 107. Accordingly, claim 12 is obvious in view of the teachings of Begemann, Arndt, Asami, and Verdes.

Claim 13 depends from claim 12 and recites, “said tubular member has a polygon cross-section.” This limitation is met by the modified lamp of Begemann as described above (and and described in Section G herein) because the resulting vertical metal tube is purposefully modified to have the outer cross-sectional polygon shape of the vertical metal cylinder 35 of Verdes. Ex. 1008 at ¶ 108.

Thus, claims 12 and 13 are obvious in view of the teachings of Begemann, ‘819 patent, ‘539 patent, Verdes (Ground 11).

Should it be determined that the protruding threads of Begemann’s lamp cap

2 are not heat dissipating protrusions as claimed (in the modified lamp of Begemann as described above), then claims 12 and 13 are obvious under the combination of the ‘722, ‘819, ‘539, ‘678 and ‘211 patents (Ground 12) with the addition of English’s cooling fins to the outer surface of the modified vertical tube with polygon cross-sectional shape as described above (which would still contain fan 9 and air holes 6,7, as explained above). *See, e.g.*, Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at ¶ 109.

L. Claims 17 and 18 are anticipated by the ‘722 patent (Ground 3) and obvious in view of the ‘722 patent and the ‘211 patent (Ground 4)

Claims 17 depends from claim 1 and recites, “each of said light emitting diodes emits white light.” Claim 18 depends from claim 1 and recites, “at least some of said light emitting diodes emit colored light.” Begemann discloses that the LEDs 4 described therein can be red (R), green (G), yellow (Y), blue (B), or white LEDs, including combinations, *e.g.*: “A further embodiment of the invented LED lamp is characterized in that the faces of the polyhedron are provided with an array of LEDs, which preferably comprises at least one green, at least one red and at least one blue LED or at least one green, at least one red, at least one yellow and at least one blue LED or at least one white LED.” Ex. 1002 at 2:40-45. Thus, according to Begemann, the LEDs can be R, G, B, Y LEDs, or white LEDs, or combinations thereof, including that all LEDs can be white LEDs. Thus,

Begemann discloses the limitations of claims 17 and 18 (Ground 3). Ex. 1008 at ¶ 110.

Should it be determined that Begemann does not expressly disclose heat dissipating protrusions as claimed, then claims 17 and 18 are obvious under the combination of the ‘722 and ‘211 patents (Ground 4) with the addition of English’s cooling fins of English to gear column 1 as explained for claims 1 and 2. *See, e.g.*, Ex. 1002 at 3:56-62, 3:66-4:16; Ex. 1003 at 4:6-9, 6:47-52, 5:6-31. Ex. 1008 at ¶ 111.

M. Claims 20 and 21 are anticipated by the ‘722 patent (Ground 13)

Independent claim 20 is identical to claim 19, except that: claim 20 does not recite the claim 19 element “said elongate thermally conductive member comprises one or more heat dissipation protrusions,” and claim 20 recites “said fluid is moved in said elongate thermally conductive member.” The latter limitation is the same as that of claim 14, which Begemann discloses as explained above for claim 14. Accordingly, claim 20 is anticipated by Begemann for the same reasons explained above for claims 19 and 14. Ex. 1008 at ¶ 112.

Similarly, independent claim 21 is identical to claim 1, except that: claim 21 does not recite the claim 1 element “said elongate thermally conductive member comprises one or more heat dissipation protrusions,” and claim 21 recites “said fluid is moved in said elongate thermally conductive member.” The latter

limitation is the same as that of claim 14, which Begemann discloses as explained above for claim 14. Accordingly, claim 21 is anticipated by Begemann for the same reasons explained above for claims 1 and 14.

For brevity, the explanations already presented above for claims 1, 19 and 14 are not presented again here. However, a claim chart showing where all of the limitations of claims 20 and 21 are found in Begemann is presented below, thereby rendering claims 20 and 21 anticipated. Ex. 1008 at ¶ 114.

CLAIMS 20 and 21

Claim Element	Prior Art Teaching
<u>Claims 20 and 21</u> A light source comprising:	Ex. 1002 (Begemann) at 1:40-41. “These and other objects of the invention are achieved by a LED lamp...”
<u>Claims 20 and 21</u> an elongate thermally conductive member having an outer surface;	Ex. 1002 at 3:39-44. “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” Ex. 1002 2:20-22. “A further interesting embodiment of the LED lamp is characterized in that the heat-dissipating means comprise a metal connection between the substrate and the lamp cap.” Ex. 1002 at 3:56-4:2. “The outer surface to the substrate (3) is made of metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4) to the column (1).... The outer surface of the gear column (1) of the LED lamp is made of a metal or metal alloy. This enables a good heat

Claim Element	Prior Art Teaching
	conduction from the substrate (3) to the (metal) lamp cap (2) to be attained.”
<u>Claim 20</u> at least one light emitting diode carried on said elongate member outer surface; <u>Claim 21</u> a plurality of light emitting diodes carried on said elongate member outer surface	Ex. 1002 at 3:40-44. “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” <i>See</i> FIG. 1 and FIG. 2 Ex. 1002 at 3:56-67. “The outer surface to the substrate (3) is made of metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4), to the column (1) The outer surface of the gear column (1) of the LED lamp is made of a metal or metal alloy.”
<u>Claim 20</u> one or more electrical conductors carried by said elongate thermally conductive member and connected to said at least one light emitting diode to supply electrical power thereto; <u>Claim 21</u> electrical conductors carried by said elongate thermally conductive member and connected to said plurality of light emitting diodes to supply electrical power thereto; and	Ex. 1002 at 4:61-63. “The LED (4) is also provided with two electrical connections (14). Via these connections, the LED is soldered onto the substrate 3.” Ex. 1002 at 3:44-46. “The space within the hollow gear column (1) accommodates the electronic gear necessary for controlling the LEDs (4).” <i>See also</i> Ex. 1002 at 1:54-58 (describing “mains supply connected” to lamp cap).
<u>Claim 20</u> said elongate thermally conductive member being configured to conduct heat away from said at least	Ex. 1002 at 3:40-44. “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of

Claim Element	Prior Art Teaching
one light emitting diode to fluid contained by said elongate thermally conductive member; and <u>Claim 21</u> said elongate thermally conductive member being configured to conduct heat away from said light emitting diodes to fluid contained by said elongate thermally conductive member; and	LEDs (4).” Ex. 1002 at 3:56-4:2. “The outer surface of the substrate (3) is made of a metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4) to the column (1). . . . The outer surface of the gear column (1) of the LED lamp is made of a metal or a metal alloy. This enables a good heat conduction from the substrate (3) to the (metal) lamp cap (2) to be attained.” Ex. 1002 at 4:7-16. “The LED lamp shown in FIG, 1 also includes a fan (9) incorporated in the gear column (1, which fan generates an air flow during operation of the lamp. This air flow leaves the gear column (1) via holes (6) provided in the gear column, and re-enters the gear column via the holes (7) provided in the gear column.... By virtue thereof, an improved heat dissipation from the substrate and the LEDs is obtained.” <i>See also</i> Ex. 1002 at 2:33-39.
said fluid is moved in said elongate thermally conductive member.	Ex. 1002 at 2:33-39. “Yet another embodiment of the LED lamp is characterized in that means are incorporated in the column, which are used to generate an air flow in the lamp. Such means, preferably in the form of a fan, can be used, during operation of the lamp, to generate forced air cooling. In combination with the heat dissipating means, this measure enables good heat dissipation from the gear column and the substrate.” Ex. 1002 at 4:7-16. “The LED lamp shown in FIG, 1 also includes a fan (9) incorporated in the gear column (1, which fan generates an air flow during operation of the lamp. This air flow leaves the gear column (1) via holes (6) provided in the gear column, and re-enters the gear column via the holes

Claim Element	Prior Art Teaching
	(7) provided in the gear column.... By virtue thereof, an improved heat dissipation from the substrate and the LEDs is obtained.”

N. Claim 22 is anticipated by the ‘722 patent (Ground 15)

Independent claim 22 is identical to claim 1, except that: claim 22 does not recite the claim 1 element “said elongate thermally conductive member comprises one or more heat dissipation protrusions,” and claim 22 recites “a coating carried on said elongate thermally conductive member.” Explanations for how Begemann discloses all limitations other than the last limitation of claim 22 have already been presented above for claim 1 and are not presented again here.

Regarding the claim element “a coating carried on said elongate thermally conductive member,” Begemann does not define a “coating” but indicates that such coating is satisfied by an adhesive, e.g., *epoxy*. The ‘303 patent states, “Flexible printed circuit 113, in the illustrative embodiment is *coated* with a nonelectrically conductive *epoxy* that may be infused with optically reflective materials. Flexible printed circuit 113 is adhered to the tube 101 with a heat conducting *epoxy* to aid in the transmission of the heat from LEDs 109 to tube 101.” Ex. 1001 at 3:37-44. Similarly Begemann discloses a coating carried on said elongate thermally conductive member as required by claim 22: “If LEDs with a high luminous flux (5 lm or more) are used, then a so-called metal-core PCB is

customarily used. Such PCBs have a relatively high heat conduction. By providing these PCBs on the (preferably metal) substrate by means of a heat-conducting *adhesive*, a very good heat dissipation from the LED arrays to the gear column is obtained.” Ex. 1002 at 2:53-59. Accordingly, Begemann discloses adhesive coatings in a manner commensurate with that described in of the ‘303 patent and claimed in claim 22 thereof, and therefore discloses this limitation, thereby anticipating claim 22. Ex. 1008 at ¶ 116. A claim chart showing where all of the limitations of claim 22 are found in Begemann is presented below, immediately following the next section.

O. Claim 22 is obvious in view of the ‘722 patent and the ‘347 patent (Ground 15)

Claim 22 is obvious in view of Begemann in combination with Wu, in an alternative treatment of the claimed coating recited in the final limitation of claim 22. Wu discloses LED illumination sources comprising LED arrays, *e.g.*, illustrated in FIGS. 3C, 5C and 7C, that can fit with common incandescent lamp bases. Ex. 1007 at 3:64-4:1 Wu discloses that a surface of a frame (*e.g.*, printed circuit board) on which the LEDs are mounted may “*coated with a reflective material*” and that such “configuration *results in lamp 20 evenly illuminating an area*” and “*brightly and evenly illuminates* two opposing faces.” *Id.* at 4:17-21, 5:63-66. *See also id.* at 5:33-35, Abstract, FIGS. 3C, 5C, and 7C. A POSA would have been motivated at the time of the alleged invention to provide a reflective

coating as disclosed in Wu on the surface of the substrate 3 on which the LEDs 4 of Begemann are mounted for the purpose of facilitating bright and even illumination as taught by Wu. Ex. 1008 at ¶ 117. There would have been a reasonable expectation of success since providing such a coating of reflective material would have been conventional in the art (so conventional, in fact, that Wu does not disclose any particular method for doing so), and such coating of optically reflective material reasonably would have been understood by a POSA to improve uniformity of illumination as disclosed in Wu. *Id.* A variety of coating approaches would have been applicable, such as brushing a liquid suspension with reflective material, spraying such a liquid suspension, solution plating (such as electroplating or electroless plating), and the like. *Id.*

Wu was applied by the PTO for the same teaching of a coating of optically reflective material in rejecting substantially similar claims in U.S. Patent Application No. 10/430,696 (“the ‘696 application,” abandoned), a sibling of the ‘303 patent, which the Applicant did not dispute. *See* Ex. 1019, Pros. Hist. of the ‘696 application at 32-33, 38, 55.

A claim chart showing where all of the limitations of claim 22 are found in Begemann singly or in combination with Wu is shown below. Ex. 1008 at ¶ 119.

CLAIM 22 – Anticipation and Obviousness

Claim Element	Prior Art Teaching
Claim 22. A light source	Ex. 1002 (Begemann) at 1:40-41. “These and other

Claim Element	Prior Art Teaching
comprising:	objects of the invention are achieved by a LED lamp...”
an elongate thermally conductive member having an outer surface;	Ex. 1002 at 3:39-44. “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” Ex. 1002 at 2:20-22. “A further interesting embodiment of the LED lamp is characterized in that the heat-dissipating means comprise a metal connection between the substrate and the lamp cap.” Ex. 1002 at 3:56-4:2. “The outer surface to the substrate (3) is made of metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4) to the column (1).... The outer surface of the gear column (1) of the LED lamp is made of a metal or metal alloy. This enables a good heat conduction from the substrate (3) to the (metal) lamp cap (2) to be attained.”
a plurality of light emitting diodes carried on said elongate member outer surface	Ex. 1002 at 3:40-44. “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” <i>See</i> FIG. 1 and FIG. 2 Ex. 1002 at 3:56-67. “The outer surface to the substrate (3) is made of metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4), to the column (1) The outer surface of the gear column (1) of the LED lamp is made of a metal or metal alloy.”
at least some of said light emitting diodes being	Ex. 1002 at 3:53-61. “In the example described herein, the substrate (3) has the shape of a pyramid

Claim Element	Prior Art Teaching
disposed in a first plane and others of said light emitting diodes being disposed in a second plane not coextensive with said first plane;	with four flat faces.... Each of the faces of the pyramid is provided with a number (five or six) LEDs (4), which are secured to the faces by means of a heat-conducting adhesive.” Ex. 1002 4:23-31. “In the example described with respect to FIG. 2, the substrate (3) is cube-shaped with six flat faces.... Each one of the faces ... is provided with a number (eight or nine) LEDs (4). ...”
electrical conductors carried by said elongate thermally conductive member and connected to said plurality of light emitting diodes to supply electrical power thereto; and	Ex. 1002 at 4:61-63. “The LED (4) is also provided with two electrical connections (14). Via these connections, the LED is soldered onto the substrate 3.” Ex. 1002 at 3:44-46. “The space within the hollow gear column (1) accommodates the electronic gear necessary for controlling the LEDs (4).” <i>See also</i> Ex. 1002 at 1:54-58 (describing “mains supply connected” to lamp cap).
said elongate thermally conductive member being configured to conduct heat away from said light emitting diodes to fluid contained by said elongate thermally conductive member; and	Ex. 1002 at 3:40-44. “This lamp comprises a tubular, hollow gear column (1), which is connected with one end to a lamp cap (2). The other end of the gear column (1) is connected to a substrate (3), which is provided with a number of LEDs (4).” Ex. 1002 at 3:56-4:2. “The outer surface of the substrate (3) is made of a metal or a metal alloy, thereby enabling a good heat conduction from the LEDs (4) to the column (1). . . . The outer surface of the gear column (1) of the LED lamp is made of a metal or a metal alloy. This enables a good heat conduction from the substrate (3) to the (metal) lamp cap (2) to be attained.”

Claim Element	Prior Art Teaching
	Ex. 1002 at 4:7-12. “The LED lamp shown in FIG, 1 also includes a fan (9) incorporated in the gear column (1, which fan generates an air flow during operation of the lamp. This air flow leaves the gear column (1) via holes (6) provided in the gear column, and re-enters the gear column via the holes (7) provided in the gear column.... By virtue thereof, an improved heat dissipation from the substrate and the LEDs is obtained.” <i>See also</i> Ex. 1002 at 2:33-39.
a coating carried on said elongate thermally conductive member.	<u>Anticipation</u> Ex. 1002 at 2:53-59. “If LEDs with a high luminous flux (5 lm or more) are used, then a so-called metal-core PCB is customarily used. Such PCBs have a relatively high heat conduction. By providing these PCBs on the (preferably metal) substrate by means of a heat-conducting <i>adhesive</i>, a very good heat dissipation from the LED arrays to the gear column is obtained.” <u>Obviousness</u> Ex. 1007 (Wu) at 3:66-4:1. “The PC boards are connected together to form a lamp frame 26 that defines a U-shaped front face 27 on which the pair of LED arrays are mounted.” Ex. 1007 at 4:17-21. “The front surface 27 may be formed from, or coated with, a reflective material. This configuration results in lamp 20 evenly illuminating an area of the adjacent sign face that is significantly wider than the width of the lamp itself.” <i>See also</i> 5:33-35, 5:63-67.

P. Claim 23 is obvious in view of the ‘722 patent and the ‘347 patent (Ground 16)

Claim 23 depends from claim 22 and recites, “said coating is infused with optically reflective material.” The combination of Begemann and Wu disclose this subject matter as explained above for claim 22. Wu discloses LED illumination sources comprising LED arrays with a surface of a frame on which the LEDs are mounted that may be coated with a reflective material so as facilitate even illumination as discussed above with regard to the obviousness treatment of claim 22 in view of the combination of Begemann and Wu. Ex. 1007 at 3:64-4:1, 4:17-21, 5:33-35, 5:63-67, Abstract. Accordingly, claim 23 is obvious in view of the combination of Begemann and Wu as explained above for claim 22. Ex. 1008 at ¶ 120.

VI. MANDATORY NOTICES PURSUANT TO 37 C.F.R. § 42.8(A)(1)

Pursuant to 37 C.F.R. § 42.8(a)(1), the mandatory notices identified in 37 C.F.R. § 42.8(b) are provided below as part of this Petition.

A. C.F.R. § 42.8(b)(1): Real Party-In-Interest

Cree, Inc. is the real party-in-interest for Petitioner.

B. C.F.R. § 42.8(b)(2): Related Matters

The ‘303 patent is currently the subject of a patent infringement lawsuit brought by the alleged assignee of the ‘303 patent: *OptoLum, Inc. v. Cree, Inc.*, U.S. District Court for the District of Arizona, Civil Action No. 2:16-cv-3828.

This judicial matter may affect, or be affected by, decisions made in this proceeding. In addition, Petitioner is concurrently filing another petition for *inter partes* review of the '028 patent, which claims priority to the '303 patent, as Case No. IPR2017-01261.

C. C.F.R. § 42.8(b)(3) and (4): Lead and Back-up Counsel and Service Information

Cree, Inc. provides the following designation of counsel:

Lead Counsel	Backup Counsel
Blaney Harper Reg. No. 33,897 Jones Day 51 Louisiana Ave, N.W. Washington, D.C. 20001 (202) 879-3939 bharper@jonesday.com	Douglas Pearson Reg. No. 47,851 Jones Day 51 Louisiana Ave, N.W. Washington, D.C. 20001 (202) 879-3939 dhpearson@jonesday.com David B. Cochran Reg. No. 39,142 Jones Day North Point, 901 Lakeside Avenue Cleveland, Ohio 44114 (216) 586-3939 dcochran@jonesday.com

Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition. Please address all correspondence to lead and back-up counsel at the Washington, DC address above. Cree, Inc. also consents to electronic service by email at the email addresses listed above.

VII. CONCLUSION

For the foregoing reasons, this petition for *Inter Partes* Review of U.S. Patent No. 6,831,303 should be granted. Petitioner has established a reasonable likelihood of prevailing with respect to at least one claim of the '303 patent and requests that an *Inter Partes Review* be instituted regarding claims 1-4, 6-23.

The undersigned representative of Petitioner authorizes the Patent Office to charge the \$26,200.00 Petition Fee, along with any additional fees, to Deposit Account 503013, ref: 388838-600011. Twenty two (22) claims are being reviewed, and excess claim fees in the amount of \$3200.00 are required.

Date: April 11, 2017

Respectfully submitted,

By: /Douglas H. Pearson/

Blaney Harper, Reg. No. 33,897

Douglas H. Pearson, Reg. No. 47,851

Jones Day

51 Louisiana Ave, N.W.

Washington, D.C. 20001

(202) 879-3939

David B. Cochran, Reg. No. 39,142

Jones Day

North Point, 901 Lakeside Avenue

Cleveland, Ohio 44114

(216) 586-3939

CERTIFICATION OF COMPLIANCE

This brief complies with the type-volume limitation of 37 C.F.R. § 42.24(a)(1)(i) because the brief contains 13701 words, excluding the parts of the brief exempted by 37 C.F.R. § 42.24(a)(1). The brief has been prepared in a proportionally spaced typeface using Microsoft Word 2007 in 14-point Times New Roman font.

Dated: April 11, 2017

/Douglas H. Pearson/
Douglas H. Pearson
51 Louisiana Avenue, N.W.
Washington, DC 20001
(202) 879-3939

CERTIFICATION OF SERVICE

The undersigned hereby certifies that a copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 6,831,303 including all Exhibits, was served on April 11, 2017 via Priority Mail Express service of the USPS directed to the attorney of record for the '303 patent as shown in USPTO PAIR at the following address:

DONALD J. LENKSZUS
PO BOX 3064
CAREFREE, AZ 85377-3064

A courtesy copy has also been provided on April 11, 2017 via e-mail to the Patent Owner's counsel in the concurrent litigation matter at:

ROBERT A. BROOKS (*pro hac vice*)
KIA L. FREEMAN (*pro hac vice*)
KEITH E. TOMS (*pro hac vice*)
MEAD MISIC (*pro hac vice*)
LEAH R. MCCOY (*pro hac vice*)
McCARTER & ENGLISH, LLP
265 FRANKLIN ST.
BOSTON, MA 02110

Respectfully submitted,

Date: April 11, 2017

/Douglas H. Pearson/
Douglas H. Pearson
Reg. No. 47,851