

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QUASAR SCIENCE LLC
Petitioner,

v.

COLT INTERNATIONAL CLOTHING, INC. d/b/a COLT LED
Patent Owner.

Case: IPR2023-00614
U.S. Patent No. 10,566,895

DECLARATION OF KEN FISHER

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I, Ken Fisher, declare as follows:

I. INTRODUCTION

1. I have been retained by Colt International Clothing, Inc. d/b/a/ Colt LED (“Patent Owner”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”) in the case brought by Quasar Science LLC (“Petitioner” or “Quasar”) regarding U.S. Patent No. 10,566,895 (the “’895 Patent” or “’895 Invention”) (Ex. 1001).

2. I am being compensated at a rate of \$250/hour for my work in this proceeding. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding, and I am not currently working for any other lighting company.

3. In this declaration (“Declaration”), I have been asked to address certain invalidity opinions relating to the ‘895 Patent put forth by Quasar in its petition and exhibits (collectively the “Petition”) including the declaration of Fred Holmes, Ex. 1003 (“Holmes Dec.”) regarding the alleged invalidity of the ‘895 Patent.

4. I have been asked to review and consider whether the certain references contained in the Petition are combinable as recited in issued

'895 Patent claims. Specifically, I have been retained to opine on combinability and obviousness related to: **Ground I**, which asserts that Claims 1–3, 6–18, 21–24 and 27–29 as allegedly obvious based on Kit in view of Ianiro, Ducharme and Katzir; and **Ground II**, which asserts Claims 1–3, 6–18, 21–24 and 27–29 as allegedly obvious based on Ducharme in view of Ianiro, Katzir and Hasnain. Collectively the “Challenged Claims” of the '895 Patent. My opinions are set forth below.

II. BACKGROUND AND QUALIFICATIONS

5. I am an expert in the design and operation of lighting systems embodying Light Emitting Diodes (“LEDs”) used in the film, television, and video production industry.

6. I have over 30 years of relevant expertise in the pertinent art, namely designing, as well as operating, film, television, and photography lighting fixtures, including extensive experience in the design and operation of LED-based luminaires.

7. In reaching my conclusions, I have drawn on my experience and knowledge as: (1) Co-founder of Litepanels, Inc., a three-time Emmy Award winning LED Lighting company, where we pioneered, developed, and manufactured LED lighting fixtures for film and television industry; (2) Co-founder of SportsBeams, Inc., an industry leading LED-based stadium and

arena broadcast lighting equipment design and manufacturing company;

(3) Founder of FisherLight, a N. Hollywood based lighting equipment designer, manufacturer and rental company, which operated for over 30 years supplying lighting systems for feature films, television, video and still photographic projects; (4) President of BBS Lighting-USA, the U.S. arm of Europe-based BB&S (Collectively BBS Lighting), a film/TV Lighting equipment design and manufacturing company that produced both conventional LED and “remote phosphor” LED technology; (5) Co-founder of Triangle Images, a Los Angeles based motion filming production company where I served as Director of [Motion] Photography; (6) Professional photographer, with a Bachelor of Science in Photography from the Brooks Institute of Photography. As part of my photography work, I also direct on-set lighting. My photography work has been represented by Getty Images for over 25 years; and (7) Board of Directors Advisor for London-based Getty Images.

8. Accordingly, I have extensive experience in designing and commercializing lighting systems suitable for commercial image capture.

9. In addition, I have also set lighting experience, including personally using numerous film/television lighting technologies in my own film and photography work, including the following examples of on-set lighting:



10. I have used various film and television lighting technologies over the years in my own photography work, including, without limitation: (A) conventional LED technology (where the LED emitter and phosphor are localized into a single package); (B) “Remote phosphor” LED technology (which separates the LED emitter from the phosphor); (C) Conventional HMI and tungsten lighting systems from Arri™ Lighting for commercial image capture.

11. I am a named inventor on twenty-two (22) United States Patents for lighting systems used in the film, television, and video production industry. Of these twenty-two lighting technology patents, twenty expressly cover LED lighting inventions used in the film/television/video lighting industry. These patents also cover LED sub-systems such as LED

optical designs, LED electronic drivers, LED control systems, LED thermal management, and LED lighting housings.

12. Table A below contains a list of Film/Television/Video related lighting patents where I am a named inventor:

TABLE A – NAMED INVENTOR ON THE FOLLOWING PATENTS

U.S. Patent	DESCRIPTION
9,588,402	On-camera LED Fresnel lighting system including active cooling
9,097,957	Versatile [LED] lighting apparatus and associated kit
8,882,283	LED Fresnel lighting system including active cooling
8,702,255	On-camera LED Fresnel lighting system including active cooling
8,540,383	Flexible strip with [LED] light elements for providing illumination suitable for image capture
8,506,125	[LED] Lighting apparatus with adjustable lenses or filters
8,299,726	Omni voltage direct current [LED] power supply
8,025,417	[LED] Camera-mounted dimmable lighting apparatus
7,972,022	[LED] Stand-mounted light panel for natural illumination in film, television or video
7,960,920	Omni voltage direct current [LED] power supply
7,874,701	[LED] Lighting apparatus with adjustable lenses or filters
7,604,361	[LED] Versatile lighting apparatus and associated kit
7,569,996	Omni voltage direct current [LED] power supply
7,510,290	[LED] Stand-mounted light panel for natural illumination in film, television or video
7,429,117	[LED] Camera-mounted dimmable lighting apparatus
7,331,681	[LED] Lighting apparatus with adjustable lenses or filters
7,318,652	[LED] Versatile stand-mounted wide area lighting apparatus

7,163,302	[LED] Camera-mounted semiconductor lighting apparatus
7,140,742	Surface-mount semiconductor [LED] lighting apparatus
6,948,823	Wide area [LED] lighting apparatus and effects system
6,809,652	Xenon light fixture with integral ballast and remote control
6,545,416	Portable HMI fixture with integral ballast

13. These LED lighting inventions have been utilized, for example, to provide light suitable for commercial image capture (e.g., broadcast) throughout the world, including major television networks such as ABC, BBC (United Kingdom), CCTV (China), Globo TV (Brazil), and NBC (USA) to name a few. The credits further include, for example, providing LED lighting systems used for broadcast in the Whitehouse Press Briefing Room in Washington DC as shown below:



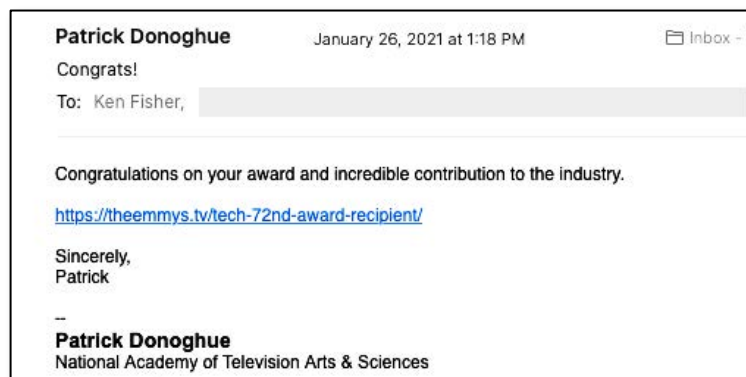
14. In 2005, the Academy of Television Arts and Sciences® awarded the Primetime Emmy® Award Plaque to both Litepanels and its

product inventors for innovative LED lighting systems. As co-inventor, I received the 2005 Primetime Emmy Award Plaque.

15. In 2009, the Academy of Television Arts and Sciences awarded the Primetime Emmy® Award Statue to both Litepanels and its product inventors for LED lighting so innovative that it "***fundamentally changed the recording of television.***" As co-inventor, I received the 2009 Primetime Emmy Award Statue.



16. In 2021, under the Television Academy's direct consideration process, and as a co-inventor, I was awarded the Primetime Emmy® Award Statue for "***Pioneering Development of LED Lighting for Television Production***".



17. Additionally, the LED commercial embodiments resulting from the aforementioned United States Patents have received over thirty

film/television/video lighting innovation awards. Attached as Exhibit A is a copy of my LinkedIn page which is a functional CV.

18. SportsBeams™ (the second LED-based broadcast lighting company co-founded) provided, for example, the LED broadcast lighting for the 2021 NFL Superbowl held in Tampa FL, via a permanent LED lighting installation of 720 high-powered LED broadcast fixtures.

19. Therefore, as a designer, inventor, professional photographer, Director of Photography, and co-founder of two separate LED broadcast lighting companies with roots dating back more than twenty years, I have extensive experience in LED fixture design parameters, as well as extensive experience in defining what is (and what is not) lighting suitable for film, television and video production image capture (collectively the "Film/TV Industry").

20. In addition, I have further design experience, for example, in electrical control systems used for high-definition cameras, including being an inventor of United States Patent 9,628,690 - Camera Controller with Context-Sensitive Interface. This patent was acquired by GoPro, Inc.

21. I have other design experience in computer control and user interfaces, including being an inventor of United States Patents 8,694,694 and 7,441,108. These patents are licensed to the Microsoft Corporation.

22. In addition to my qualifications above, I have provided expert testimony on Secondary Considerations of Non-obviousness of LED lighting systems used in the Film/TV production industry before the United States International Trade Commission (in the Matter of Certain LED Photographic Lighting Devices and Components Thereof, case number 337-TA-804).

23. In reference to the instant action, I have also provided expert testimony in the original reexamination of earlier patents in the '895 Patent's family, e.g., U.S. Patent Nos. 9,719,642 and 9,845,924 (Reexamination Nos.: 90/014,146, 90/014,150, 90/014,371 and 90/014,372).

24. In addition, I have also written and produced video tutorials on LED technology including, for example, the LED technology tutorial for Judge Davis of the United States District Court for the Eastern District of Texas (2:06-CV-167) on behalf of Litepanels.

25. I am not an attorney, but in the course of my work, I have had experience studying and analyzing patents, patent claims, and infringement from the perspective of a person skilled in the art.

III. MATERIALS REVIEWED

26. In forming my opinions expressed in this Declaration, I have reviewed and considered the documents and materials identified in Table B below.

27. I have further relied on my education, skill, training, and experience in the field of film and television lighting in forming my opinions.

28. I was also asked to analyze the cited references from the perspective of a person of ordinary skill in the art (“POSITA” as defined in Section 10 below) in Film/TV Industry luminaire design at the time of the effective filing date of the ‘895 Patent. This included analyzing the relevant art to opine on issues related to the likelihood (or unlikelihood) that the asserted references would have a reasonable expectation of success if combined and utilized for Film/TV Industry lighting purposes.

29. In forming my opinions expressed in this Declaration, I reviewed the Petition and at least the following materials and information as well as the materials and other exhibits referenced herein:

TABLE B

Exhibit No.	Exhibit Description
1001	U.S. Patent No. 10,411,582 to Macias (“the ‘895 Patent”)
1002	File History for U.S. Patent No. 10,411,582 (“File History”)
1003	Holmes Report
1004	U.S. Patent No. 7,507,001 to Kit (“Kit”)
1005	U.S. Patent No. 7,350,936 to Ducharme et al.

1006	U.S. Publication No. 2010/0102729 to Katzir et al. ("Katzir")
1007	WO 2009/063520 to Ianiro ("Ianiro")
1008	U.S. Patent No. 8,668,361 to Hasnain et al. ("Hasnain")
1009	U.S. Publication No. 2010/0102960 to Ivey et al. ("Ivey")
1010	U.S. Publication No. 2010/0315001 to Domagala et al. ("Domagala")
1011	U.S. Patent. No. 7,049,761 to Timmermans et al.
1012	U.S. Publication No. 2004/0052076 to Mueller et al.
1013	International Publication No. 2005/012997 to Morgan et al. ("Morgan")
1014	"When white light isn't white" by Mike Wood, 2008
1015	Astera LED-Technology User Manual Wireless Pixel Tube (AL1) v.3.2.20 (July 23, 2010)
2039	Declaration of Zhang, Ya Jun ("Zhang Decl.")
2041	Declaration of Todd Csernecky ("Csernecky Decl.")
2044	Image of a lighting tube taped to wall from www.quasarscience.com/products/crossfade-x , video at
2045	MacTech LED "Why LED" web page from Wayback Machine,
2047	Declaration of Kevin Baxter with Appendix A (Curriculum Vitae (CV) and Patent List of Kevin Baxter) and Appendix B
2048	Wayback Machine/Internet Archive from KinoFlo.com's website showing its Diva-Lite® fluorescent tube product,
2049	Wayback Machine/Internet Archive from KinoFlo.com's website showing its Celeb® 200 DMX LED fixture, dated
2050	"Are LED retrofits that work with existing ballasts a good idea?", by Wright, Maury, Ed., LED Magazine, June 2014,
2051	Declaration of David L. Hoffman in Support of Patent Owner's Response ("Hoffman POR Decl.")
2052	Various photos of Patent Owner Colt's Bicolor LED Tubular Light ("Colt Bicolor Photos")
2053	Claim Chart showing selected '895 Patent Claims vs. Colt's Bicolor LED Tubular Lights ("Claim Chart '895 Patent vs
2054	Wayback Machine of Old Quasar's website at www.quasarscience.com of November 2016 showing
2055	Wayback Machine of Old Quasar's website at www.quasarscience.com of November 2016 showing

2056	Wayback Machine, from Old Quasar's website at www.quasarscience.com of February 2017 showing details
2066	Declaration of Fernando Silva ("Silva Decl.")
2067	Declaration of Bruce Wonderlick with Appendix A ("Wonderlick Decl.")
2068	Declaration of Guillermo Macias ("Macias Decl.")
2069	Patent Owner Colt's website at www.colttled.com on January 12, 2019 marketing Colt's Bicolor LED Tubes
2070	Patent Owner Colt's List of TV Shows and Movies Using Colt's Bicolor LED Tubes from 2013 to beginning 2017
2071	Patent Owner Colt's Actual Sales from 2017 and 2018 to Wamco ("Actual Sales List")(CONFIDENTIAL)
2072	Patent Owner Colt's 2014 to 2021 Revenue and Calculation of Minimum Percentage from Colt's Bicolor
2073	Warner Bros. Set Lighting rental list excerpts, June 2018 ("WB 2018 Rental Excerpts")
2074	Warner Bros. Set Lighting rental list, 2023 ("WB 2023 Rental List")
2075	Quasar's web page from the internet.org archive of November 23, 2016 ("Quasar's 2016 web page")
2076	January 13, 2019 Printouts with Kino Flo retail prices from www.bhphotovideo.com (B&H) and
2077	Report No. L091914008R01 on Lux/FC/Colormetrics by Light Laboratory Inc., issued October 21, 2019 on Colt's
2078	Declaration of Bradley Brunon ("Brunon Decl.")
2079	Deposition Transcript of Ya Jun Zhang, taken October 12, 2018
2080	Declaration of Gary Allen, Ph.D. ("Allen Decl.")

30. I reserve the right to supplement my opinions in this Declaration to address any new information obtained in the course of this proceeding or based on any new positions taken by the Petitioner.

IV. RELEVANT LEGAL PRINCIPLES

31. Patent Owner’s counsel has provided me with certain legal principles that I have applied in this proceeding, including the following key principles that are relevant to this case:

A. Combining References Requires A Reasonable Expectation Of Success

32. I have been informed that a party who petitions the Board for a determination of unpatentability based on obviousness must show that “a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.”

In re Magnum Oil Tools Int’l, Ltd., 829 F.3d 1364, 1381 (Fed. Cir. 2016)

(quotations and citations omitted).

33. It follows, therefore, that if a person of ordinary skill would not have had a reason to select and combine (or modify) prior art elements in the manner of the claimed invention, the invention would not have been obvious and indeed is inventive—see, e.g., *Henny Penny Corp. v.*

Frymaster LLC, 938 F.3d 1324, 1332 (Fed. Cir. 2019) (affirming no

motivation to combine because “a reasonable fact finder could have found

these tradeoffs to yield an unappetizing combination”); *Arctic Cat Inc. v. Polaris Indus., Inc.*, 795 F. App’x 827, 833-34 (Fed. Cir. 2019).

B. Petitioner Has Burden to Prove Unpatentability

34. I understand that Quasar as the Petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)).

35. I also understand that this burden of proof never shifts to Patent Owner. The burden of persuasion “is the ultimate burden assigned to a party who must prove something to a specified degree of certainty,” such as by a preponderance of the evidence or by clear and convincing evidence. *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed.Cir.2008)(citations omitted). In an *inter partes* review, the burden of persuasion is on the petitioner to prove “unpatentability by a preponderance of the evidence,” 35 U.S.C. § 316(e), and that burden never shifts to the patentee. “Failure to prove the matter as required by the applicable standard means that the party with the burden of persuasion

loses on that point—thus, if the fact trier of the issue is left uncertain, the party with the burden loses.” *Id.*

36. I further understand that Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements,” but “must instead articulate specific reasoning, based on evidence of record” to support an obviousness determination. *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380–81 (Fed. Cir. 2016).

C. Inventions Rely On Building Blocks Already Known

37. I have been informed that a claim is not proven obvious merely by demonstrating that each of the elements was independently known in the prior art. I have been informed that “Inventions usually rely upon building blocks long since uncovered, and claimed discoveries almost necessarily will be combinations of what, in some sense, is already known.” *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007). See also *Fromson v. Advance Offset Plate*, 755 F.2d 1549, 1556 n.3 (Fed. Cir. 1985) (“Only God works from nothing. Men must work with old elements.”)

D. Secondary Considerations—Probative Evidence Of Non-Obviousness

38. In assessing obviousness, I have also been instructed that secondary considerations can often be probative evidence of non-

obviousness and can serve to avoid hindsight bias. I have been instructed that secondary considerations can be sufficient to overcome a *prima facie* case of obviousness. *Zup, LLC v. Nash Mfg., Inc.*, 896 F.3d 1365, 1380 (Fed. Cir. 2018) ("*In Stratoflex, Inc. v. Aeroquip Corp.* , 713 F.2d 1530, 1539 (Fed. Cir. 1983), this court observed that the "so-called secondary considerations ... may often be the most probative and cogent evidence in the record," for they place the invention in the context in which it arose, and aid judges in understanding obviousness of the invention as perceived by persons in the relevant field.")

39. I also understand that secondary considerations may "give light to the circumstances surrounding the origin of the subject matter sought to be patented" (*Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18 (1966)).

40. I further understand that it's well established that copying by a competitor is a relevant consideration in the objective indicia analysis. *Iron Grip Barbell*, 392 F.3d at 1325. Such copying may be evidence that the patented invention is nonobvious. *Vandenberg v. Dairy Equip. Co.*, 740 F.2d 1560, 1567 (Fed. Cir. 1984).

V. CLAIM CONSTRUCTION

41. I understand that claim terms are typically given their ordinary and customary meanings, as would have been understood by a person of ordinary skill in the art at the Time of the Invention, which for purposes of my opinion is assumed to be the '895 patent's filing date of May 17, 2013. In considering the meaning of the claims, however, I understand that one must consider the language of the claims, the specification, and the prosecution history of record. I have been asked to consider the claim terms under their plain meanings and thus considered the claims, specification and prosecution history for the '895 patent in doing so in support of my opinions concerning the '895 patent and the prior art discussed herein.

42. I have been asked to consider the claim terms under their plain meanings and thus considered the claims, specification and prosecution history for the '895 patent in doing so in support of my opinions concerning the '895 patent and the prior art discussed herein.

VI. CLAIM TERM TERMINOLOGY

43. I incorporate the following list of defined claim terms:

1[pre] An LED light system configured for providing broad-spectrum white light suitable for a commercial image recording, in a form factor of a fluorescent light tube lamp, the LED light system comprising **[Fluorescent Form Factor]**:

1[b]. a plurality of first LEDs mounted on the top side of the support structure and configured to emit broad-spectrum white light in a first predetermined Kelvin temperature range of cool white light [**Cool LEDs**];

1[c]. a plurality of second LEDs ... configured to emit broad-spectrum white light in a second predetermined Kelvin temperature range of warm white light [**Warm LEDs**];

1[d]. circuitry mounted to the support structure including an LED driver circuit configured for driving (i) the first LEDs, to provide light in the first predetermined Kelvin temperature range;; or (ii) the second LEDs, to provide light in the second predetermined Kelvin temperature range, wherein the first and second predetermined Kelvin temperature ranges are nonoverlapping...[**Switchable LED Driver**];

1[e] an elongate cover extending substantially a length of the support structure and covering the top side of the support structure for diffusing light emitted by the first and second LEDs [**“Diffusion Cover”**];

1[f]. wherein the housing and cover together have a linear form factor [**“Linear Form Factor”**],

1[g]. wherein the LED light system is configured for receiving input power to be provided to the LED driver circuit to selectively light the first or second LEDs [**“Input for Selective Drive”**],

1[j]. wherein the light emitted from the LED light system is said suitable for the commercial image recording [**“Commercial Image Recording”**] when said emitted light: (i) is at least 1000 lumens when the first LEDs are lit and is also at least 1000 lumens when the second LEDs are lit [**“1000 Lumen Minimum”**]; (ii) is broad-spectrum white light having a color deviation corresponding to less than five points of green and less than five points of magenta (5M, 5G) of color compensation (CC) [**“G/M 5 Point Limit”**], and (iii) has a color rendering index of light emitted from each of the first LEDs or each of the second LEDs, whichever respective plurality of first or second LEDs is lit, that is greater than 90 [**“CRI>90”**] [collectively, **“The Claim 1[j](i)-(iii) Requirements”**].

Ex. 1001 at claim 1; Petition at viii-ix.

44. Claim 3 recites:

The LED light system of claim 1, wherein the first LEDs are each configured to emit light with a color temperature between 5000 K and 5800 K, and the second LEDs are each configured to emit light with a color temperature between 2800 K and 3300 K [**“Preferred Kelvin Ranges”**].

45. Claims 6-7 both recite that “the first and second LEDs are phosphor-based emitters” [**“Phosphor LEDs”**].

46. Claim 10 recites:

The LED light system of claim 1, further comprising a power supply configured to provide at least 20 watts, and wherein the LED driver is configured to selectively drive the first LEDs with at least 20 watts and the second LEDs with at least 20 watts, driving of the first or second LEDs being switchable by a toggle so that only the first LEDs are on and the second LEDs are off, or the first LEDs are off and the second LEDs are on [**“Twenty Watts Per Color”**].

47. Claim 11 is the same as Claim 10 except that it depends on Claim 3 and so further incorporates that “the first LEDs are each configured to emit light with a color temperature between 5000 K and 5800 K, and the second LEDs are each configured to emit light with a color temperature between 2800 K and 3300 K.”

48. Claim 12 recites:

The LED light system of claim 1, further comprising a power supply configured to provide at least 42 watts, and wherein the LED driver is configured to selectively drive the first LEDs with at least 42 watts and the second LEDs with at least 42 watts [**“42 Watts Per Color”**].

49. Claim 13 is the same as Claim 12, except that Claim 13 depends on Claim 8 which recites that “the housing has a length of about four feet” (“Four Foot Housing”) and depends on Claim 1.

VII. TECHNICAL BACKGROUND

50. Below, I present a brief overview of certain aspects of the technology and design considerations related to light emitting diodes (LEDs) and associated elements that were known to a person of ordinary skill in the art (“POSITA”) in the Film/TV Industry at the Time of the Invention of the ‘895 patent.

Design Process

51. From an overview standpoint, designing LED luminaires has many tradeoffs and design constraints. Such tradeoffs and design constraints are even more challenging when designing a luminaire that is suitable for film/television commercial image capture, as, for example, light flicker, or unwanted changes in color rendering fidelity, or varying brightness can be catastrophic in the context of film and television production.

52. Thus, a film/TV lighting equipment designer, when contemplating a new luminaire, analyzes various components to see what tradeoffs and risks are created when the elements are combined, with the goal of producing a fixture that is reliable under adverse conditions

53. Importantly, there is no one-size-fits-all approach. For example, “form factor” come into play when determining “suitability” for commercial

image capture. For example, the risks of involving higher wattages of [heat-sensitive] LED light emitters may be perceived as suitable in one form factor, but *unsuitable* when put into a smaller, narrower form factor.

54. More specifically, 80 watts of [highly sensitive] LED electronics may work well in a large panel form factor, but fail due to design constraints if the form factor is changed to a narrow 1" wide linear tube, as outlined below:

Proper thermal management becomes far *more* critical if the LEDs are packed into narrow tubes with other heat-sensitive electronics (such as heat-producing LED drivers). Such thermal problems are further amplified when the narrow-width circuitry is encased with outer diffusion covers ...which further blocks and restricts airflow. **This creates a detrimental heat-trap for LED electronics.**

Exhibit 2047 (Baxter Report) at ¶32. "Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not." *Leapfrog Enter., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1161 (Fed.Cir. 2007) (cite omitted).

55. Thus, tradeoffs and suitability are on a case-by-case basis. Studying the resulting tradeoffs and constraints (both actual and perceived)

persuades or dissuades a designer from integrating the components into a combined lighting system. I shall refer to such tradeoffs herein as “**Design Constraints and Tradeoffs.**”

56. I describe below what I believe are the ten (10) most important Design Constraints and Tradeoffs in this case that reflect the state of the art that a POSITA would have had knowledge of and understood prior to and at the Time of the Invention of the ‘895 patent.

57. I further rely on, and incorporate as applicable and valid (even if not expressly mentioned below), the following disclosures and opinions in this Technical Section to support my opinions in this Declaration, including the Design Constraints and Tradeoffs themselves and the opinions relating to them.

58. I believe that a thorough review of the Design Constraints and Tradeoffs listed below are pivotal in determining how and why a person of ordinary skill in the art would have been motivated (or not motivated) to combine prior art references in this case, as well as determining the reasonable expectation of success if the prior art references were to be combined as I explain below.

59. These Design Constraints and Tradeoffs listed below would have been within the knowledge and mindset of a POSITA at the time designing an LED luminaire for the film and television industry:

A. Design Constraint #1: Film and TV Lighting Must Be Reliable Even Under Harsh Conditions

60. “Film and television production is expensive, and typically exposes equipment to harsh working conditions, so lighting equipment must be **reliable even under adverse operating conditions**. This need for reliability would have been inherently understood by a POSITA at the Time of the Invention...” Exhibit 2047 (Baxter Report) at ¶29.

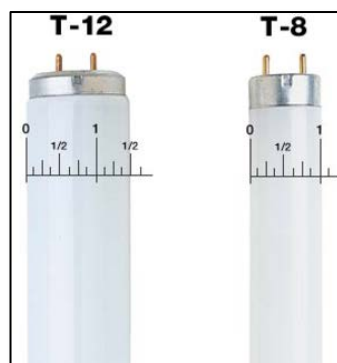
61. Gaffer (Chief Lighting Technician) Todd Csernecky, who worked on 279 episodes of “NCIS: Los Angeles” describes the abusive working conditions that tube lighting systems experience in film/TV work: “Lighting tubes in the TV and film industry are often used under unfavorable conditions for the lights, such as where airflow is limited...taped against a wall or ceiling...” Exhibit 2041 (Csernecky Decl.) at ¶¶2,24. See visual example in Exhibit 2043 and Exhibit 2041, ¶9.

62. In 2013 (Time of the Invention), the Set Lighting Technician’s Handbook described the state of the art and suitability for florescent tube lighting systems from KinoFlo™ (the top tube lighting company for studio and TV image recording): “Kino Flo ... [tube lighting] system is optimized

for...reliability even under harsh conditions....” Exhibit 2046 ((Set Lighting Handbook) Pg. 208 (emphasis added).

63. In regard to reliability, it is and has been common knowledge that “factors of safety” are an important consideration in electrical and thermal product design. A POSITA in the film/TV lighting industry would have viewed *reliability under harsh conditions* to include increasing the “factors of safety” in the design (e.g., designing the LED lighting system to minimize the chance of failure). That is, a POSITA would design for an LED luminaire to have more margin for safe operation than may be otherwise needed under standard, more predictable and consistent consumer-level operating conditions (e.g., such as conventional home or office-based LED retrofit lighting tubes)).

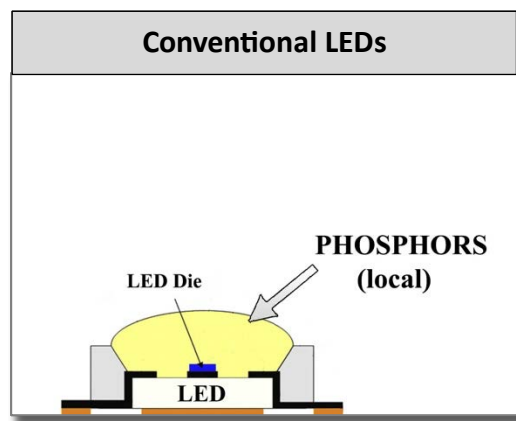
64. This is why, circa 2013 (and unlike LED tubular lights) “... almost all LED devices have large heat sinks and fins.” Exhibit 2046 (Set Lighting Handbook), Pg. 248 (emphasis added). Unfortunately, in the T8 or T12 form factor there is no room for a large heat sink while still maintain the narrow 1” or 1.5” formfactor, as illustrated below:



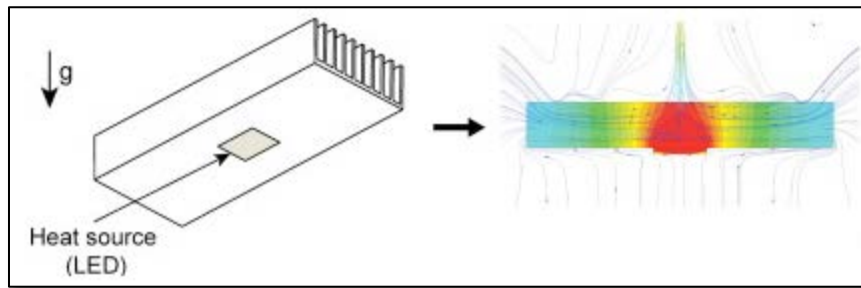
B. Design Constraint #2: Excessive Heat Renders LEDs *Unsuitable* for Commercial Image Capture

65. LEDs, or Light Emitting Diodes, operate by passing an electric current through a semiconductor material. This process generates light in conventional LEDs (via binding a small amount of phosphors to the top of the blue LED semiconductor die), as illustrated below:

Traditional LED technology produces light by coating **highly heat-sensitive phosphors** directly to (heat-producing) a blue LED emitter, as illustrated below:



66. But the process also produces *substantial heat* in and around the blue light emitting die as a by-product. Without effective dissipation of the heat generated during operation, this thermal energy accumulates and causes the LED's temperature to rise significantly (e.g., risking thermal failure and/or thermal runaway), as illustrated below:



67. The *localized* excess heat can result in a LED lighting fixture becoming inoperable for its intended purpose of film and TV lighting.

68. More specifically, “Light Emitting Diodes (LEDs) *unlike* their fluorescent and tungsten counterparts, are extremely sensitive to heat. Thus, when employing LEDs for film and television lighting purposes, highly effective thermal management of the LED emitters is required.” Exhibit 2047 (Baxter Report) ¶¶29-30.

69. **Impact on “Suitability” Performance:**

“Thermal mismanagement destroys electronic components, and damages the phosphors contained within the LEDs—which, in turn, destroys the LEDs’ high color rendering index (“CRI”) [and brightness]. Thus, excessive heat is the enemy of LED color fidelity. This was common knowledge to a POSITA at the Time of the Invention.” Exhibit 2047 (Baxter Report) ¶31

70. Sound thermal design is critical for success of an LED lighting system, especially for the film and TV industry, where high CRI is critical: “Importantly, excessive heat can quickly (and permanently) render otherwise **high CRI LEDs unsuitable for film/TV lighting applications**

[e.g., loss of the high 90+ CRI rating].” Exhibit 2047 (Baxter Report) at ¶31.

See also Exhibit 2080 (Dr. Allen Decl.) at ¶60:

DISASTROUS EFFECTS OF HEAT ON CRI, G/M
AND COLOR CORRECTED TEMPERATURE (CCT):

Excessive heat can drastically change the SPD (Spectral Power Distribution) of a phosphor-coated white LED, with some colors (wavelengths) enhanced and some depressed, greatly and irreparably affecting CRI, CCT and G/M color deviation from the Black Body. See, Exhibit 2086 (Color Shift Report), p. 8. Moreover, significant color shifts occur at a rate of about four times as fast increasing the junction temperature by just ten degrees from 75 °C (at 75% humidity) to 85 °C (at 85% humidity).

71. Additionally, in the pursuit of high-quality broad-spectrum LED lighting with a superior Color Rendering Index (CRI), LED manufacturers deploy a combination of *different* phosphors directly on top of blue LED emitters (conventional LED technology circa 2013). However, a notable challenge arises due to the heat sensitivity of these phosphors. Certain phosphors are more susceptible to heat, leading to distinct color reactions when exposed to excess heat. This phenomenon manifests as some colors "dropping out" sooner than others (e.g., resulting in overall color shifts and loss of high CRI), a consequence of the detrimental impact of

heat on phosphors. Exhibit 2047 (Baxter Report) at ¶¶66. See also Exhibit 2080 (Dr. Allen Decl.) at ¶¶61:

The LPW, CRI, color temperature, and green/magenta deviation, and other attributes of phosphor white LEDs in 2013, and even to the present date, was very sensitive to the p-n junction temperature where LEDs get the hottest. The phosphors are applied in very thin coats, e.g., ~ 100 um, in different colors in order to obtain the different spectra of broad-spectrum white LEDs and thus CRI.

Each color phosphor has a different sensitivity to heat. Red phosphors are typically the most sensitive to heat. Therefore, when heated too much, some phosphors (especially red) drop out more quickly than others (resulting in green shift and loss of CRI), irreparably damaging CRI, green deviation, color temperature and other attributes of the LEDs.

In the Commercial Image Recording environment, due to the heat, CRI, green deviation and color temperature can all quickly be significantly distorted. While this distortion is sometimes temporary, the phosphors can quickly become permanently damaged...

Exhibit 2080 (Dr. Allen Decl.) at ¶¶61.

72. Adding to the complexity, the blue LED die emitters themselves undergo stringent binning processes to narrow down their wavelength. Unfortunately, excess heat introduces a further complication by causing a shift in the blue wavelengths of these emitters. The unwanted wavelength shift of the blue emitter sets off a cascade of color shifts by altering the wavelengths emitted at the phosphor level, compounding the challenge of maintaining consistent and high-quality broad-spectrum lighting. In essence, the interplay of heat sensitivity among phosphors and the wavelength shift of the blue emitters adds layers of intricacy to the delicate balance required for achieving and preserving the desired CRI color quality in LED lighting. Exhibit 2047 (Baxter Report) at ¶67.

C. Design Constraint #3: **Narrow Linear Tube Format is a Heat-Trap**

73. **Thermal Impact of Fluorescent Form Factor:** “Proper thermal management becomes far *more* challenging if the LEDs are packed into narrow tubes with other heat-sensitive electronics (including heat-*producing* LED drivers). Such thermal problems are further amplified when the narrow-width circuitry becomes encased with an outer diffusion cover (needed to blend the light output from the individual LEDs), which further blocks and restricts airflow. **This creates a detrimental heat-trap for LED electronics.**” Exhibit 2047 (Baxter Report) at ¶32.

74. “As is incredibly well known in the art, the output power of an LED light is limited by the free-air dissipation of the circuit board....”

Petitioner’s Exhibit 1003 (Holmes Decl.) at ¶57 (emphasis added).

75. In the context of Film/TV lighting, a POSITA designing an LED light suitable for Commercial Image Recording at the Time of the Invention, would have viewed the narrow “tubular” form factor as **thermally problematic**: “...here lies the problem—the unusually narrow form factors of T8 tubes (mere 1-inch wide) and T12 tubes (mere 1.5 inches wide) are incredibly restrictive from a thermal management standpoint. You simply do not have the physical space available, for example, to add the required large heatsinks or space the LED emitters wider apart and still have the luminaire fit within a T12 or T8 format. For example, the T12 format provides less than a one-and-a-half-inch of available circuit board space inside the housing cover.” Exhibit 2047 (Baxter Report) at ¶71.

D. Design Constraint #4: The Harsh Operating Conditions Seen In Film/Television Lighting Are Materially Different Than The Retrofit LED Tube Industry

76. Film/TV lighting systems operate in very different conditions: “...unlike conventional LED retrofit tubes, film/TV lights (e.g., single tube fluorescent and LED tube lights) are placed directly against walls or other surfaces such as ceilings during filming with no air gaps between the

surface and the tube. **The heatsink, which should dissipate heat, is now blocked, leading to overheating.**” Exhibit 2047 (Baxter Report) at ¶¶35

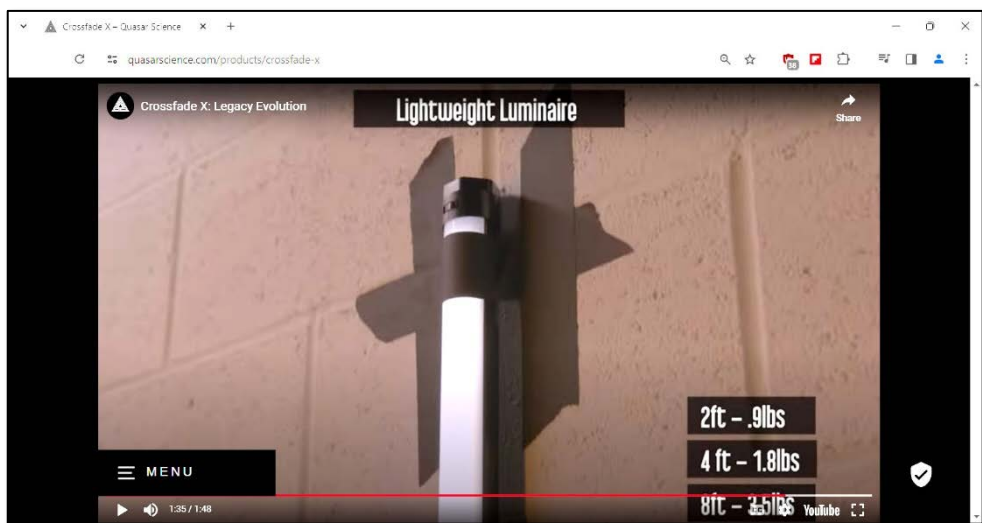


Exhibit 2043, and also see, Exhibit 2041 (Csernecky Decl.) at ¶¶s 24-27.

77. “The lack of air space in and around the heatsink creates yet another “heat trap” that severely limits the ability of the heatsink to pull heat away from the heat-sensitive LEDs.” Exhibit 2047 (Baxter Report) ¶¶35. See, e.g., Ex. 2043 (shown above).

78. **Thermal Conditions are Materially Different in Film/TV**

Work: “..[I]n the specialized field of film and television lighting, the thermal conditions for LED tube usage differ greatly from the consumer market. For conventional retrofit use same as home and office, it’s common knowledge that traditional LED retrofit tubes are mounted horizontally, a placement

that provides *beneficial* uniform convection cooling across the tube's full length.” Exhibit 2047 (Baxter Report) at ¶38.

79. Conventional drop-in LED retrofits for fluorescent fixtures are used in much more thermally friendly environments:

Furthermore, conventional LED retrofit tubes, as opposed to those used in film and TV lighting, are mounted with sufficient space away from ceilings or other surfaces. This allows for an all-around 360-degree airflow, crucial for thermal management. This contrasts sharply with the restrictive setups typical in film and TV environments, which commonly lack such thermal airflow benefits.

Exhibit 2047 (Baxter Report) at ¶39.

80. It is common that a single tube light is positioned vertically in the TV/film industry:

Moreover, when single-tube lights¹ are employed in film and TV lighting, they are commonly positioned vertically. With a vertical orientation, the thermal dynamics of narrow tube lights are completely different

¹ Note: A preferred embodiment of the ‘895 Invention is an integrated single tube and controller, vs. tube only retrofit – see Exhibit 1001 (‘895 Patent) Abstract.

from conventional LED replacement tube industry. Specifically, the heat emitted from the LEDs at the bottom of the tube is drawn upwards and absorbed by the LEDs at the top of the tube (when positioned vertically). This means the upper LEDs experience increased ambient temperatures. This thermal dynamic can commonly lead to uneven cooling throughout the vertical tube and poses further risks of overheating the upper LEDs (including damaging phosphors thereby making LEDs unsuitable for image capture).

Exhibit 2047 (Baxter Report) at ¶¶36. The below picture illustrates vertical positioning of a tube light:



BBS Lighting File Photo (Newscast): Showing harsh operating conditions – e.g., tube light in placed in vertical orientation, and addition tube lights placed on desktop (limited airflow).

81. Baxter explains, lighting placement and conditions in the film/TV industry involve harsh thermal environment:

In addition to vertical orientation, there are other punitive operating conditions in the film/TV industry which include, for example, pressing or taping the tubular lights against interior roofs of cars, and on set, taping the tubular lights against walls or in corners for filming. The harsh conditions found in film/TV lighting also include set lighting technicians who often use 'light modifiers' to shape and control the light emitted by tubular lights. For example, unlike traditional LED tube industry, film/TV lighting technicians physically wrap the tubes in heat-trapping 'blackwrap' (a blackened version of heavy aluminum foil) to alter and control the LED light output—but such abusive operating conditions can be a thermal *nightmare* for heat-sensitive LEDs (as well as other heat sensitive system components like LED drivers).

Exhibit 2047 (Baxter Report) at ¶¶43-44. See also excerpts from the Set Lighting Handbook illustrating the abusive operating conditions seen in the film/TV industry, as shown below:

It is important to allow for some ventilation to the lamps, because fluorescent lamps are liable to turn greener and bluer if they overheat. Gel or diffusion can be clipped to the barn doors or to the reflector, but if a fixture is **completely encapsulated in gel and blackwrap**, it will go off color. (emphasis added)

Exhibit 2046 at Pg. 211 (re harsh operating conditions).

The lights are spaced no more than 3 or 4 ft apart, and must extend beyond the edge of the screen to light the screen evenly all the way to the edge. **Each fluorescent is capped on both ends with blackwrap** to prevent spill onto the actor. Note that all the lights must be flagged, teased, or wrapped in blackwrap to prevent spill from the foreground onto the background screen and vice versa.... (emphasis added)

Exhibit 2046 at Pg. 463 (more on harsh conditions for lighting on set).

For a bicolor LED tube, a POSITA would have found T8 or T12 likely to fail:

Thus, at the Time of the Invention, a POSITA would have considered the slim, linear design of T8 or T12 lights as having undersized (inadequate) heat sinking provisions for LED-based systems, and thus likely to fail in film and television industry use.

Exhibit 2047 (Baxter Report) at ¶72.

E. Design Constraint #5: Heat-Induced Problems are Compounded in a Two-Color LED Embodiment

82. The '895 Patent exclusively claims two-color LED embodiments (e.g., combined warm and cool white LEDs in the same tube (as compared to monochromatic single-color tubes)). But such bi-color

embodiments only *compound* heat-induced problems related to the narrow form factor, as explained below:

83. A single-color model reduces the input wattage per LED to achieve the same amount of lumen output as a bi-color model and in turn reduces thermal issues:

[A] Designer benefits from enhanced thermal management with a Single-Color tube light (versus a warm-white and cool-white system). By having a *greater* number of single-color LEDs illuminated simultaneously, the thermal burden created from higher wattage loads can be dispersed over a much larger number of LEDs (e.g., twice as many LEDs in the Single-Color model vs a Bi-Color model). Consequently, each individual LED in the Single-Color embodiment can operate at *half the wattage* of its Bi-Color equivalent, which significantly lowers LED junction temperatures. This not only preserves color accuracy (including CRI “suitability” for image capture) but also minimizes the potential for other heat-induced issues often seen with the LEDs.

Exhibit 2047 (Baxter Report) at ¶52.

84. A single-color tube light helps avoid current droop:

Operating a Single-Color tubular light system at beneficially-*lower* wattages (e.g., 50% lower power per LED compared to bicolor for the same LPW) can make

the difference between suitable or unsuitable for commercial image capture in film/TV lighting work—for example, operating the [problematically] narrow tube format in the harsh working conditions commonly seen in the Film/TV Industry. A POSITA, at the Time of the Invention, would have looked to increase thermal safety factors in the LED-based system design (e.g., by reducing the wattage load per LED) exactly what the Single-Color model provided. Conversely, the Bi-Color system at the Time of the Invention would have been perceived by a POSITA as going in the wrong direction when operating under harsh film/TV conditions (e.g., blocked heatsink), wherein doubling the wattage of each LED could easily produce higher heat resulting in inconsistent and unpredictable variations in CRI, brightness and color temperatures. Such unsuitable changes (in an otherwise steady-state lighting) could have easily been perceived by TV and film industry cameras at the Time of the Invention (i.e., LED light that is *unsuitable* for commercial image capture).

Exhibit 2047 (Baxter Report) at ¶53.

85. Benefits of Avoiding Droop Loss: Current and thermal droop losses can be substantial. The more wattage with which an LED is driven, the greater the inefficiency becomes (lowering lumens-per-watt) due to higher current and higher operating temperatures. These additional

inefficiencies result from current droop and also from thermal droop because you are increasing the p-n junction temperature. This is yet another reason why a Bi-Color LED tube light is a bad idea. As Baxter explains: “Furthermore, an optimized Single-Color LED Core Tube System, characterized by reduced wattage and reduced LED junction temperatures, generally produces a higher output of system lumens, providing a more efficient lumens-per-watt ratio than the Bi-Color embodiment.” Exhibit 2047 (Baxter Report) at ¶54.

F. Design Constraint #6: The Promise and Pitfalls of the Color Rendering Index “CRI” Circa 2013

86. LED binning practices at the Time of the Invention were another challenge. The characteristics of LEDs within specific “bins” varied. Some underperformed compared to the bin’s characteristics and some overperformed, but more underperformed than overperformed. As Expert Baxter puts it:

To fully understand the excess heat challenges related to CRI problems faced by a POSITA at the Time of the Invention, it's crucial to delve into the LED binning process. LEDs are not uniform; there are inherent variations in color and performance. Binning involves categorizing LEDs based on their characteristics, and [LED] manufacturers often market their products based

on the better-performing units *within* a color graded bin. However, this practice led to significant disparities between advertised CRI values and the actual performance of the majority of LEDs within a binned group.

Exhibit 2047 (Baxter Report) at ¶63.

87. Baxter further explains the issues binning causes:

Outliers vs. Averages: One of the central issues in 2013 was the prevalence of outliers. LED manufacturers would highlight the performance of the better-performing LEDs within a color binned group, showcasing them as representative of the entire batch “on average”. For example, a manufacturer advertising a 90 CRI LED might have been referring to an outlier, while the average CRI of the bin when combined into a fixture was substantially lower (e.g., below 90 CRI).

Exhibit 2047 (Baxter Report) at ¶64.

88. The binning practices added a layer of uncertainty to LED performance due to the above disparities between advertised and actual performance. See Exhibit 2047 (Baxter Report) at ¶65.

G. Design Constraint #7: High-CRI, Highly Heat-Resistant “Remote Phosphor” Technology Solves Many LED Problems but has a Tradeoff (No Bi-Color Tubes)

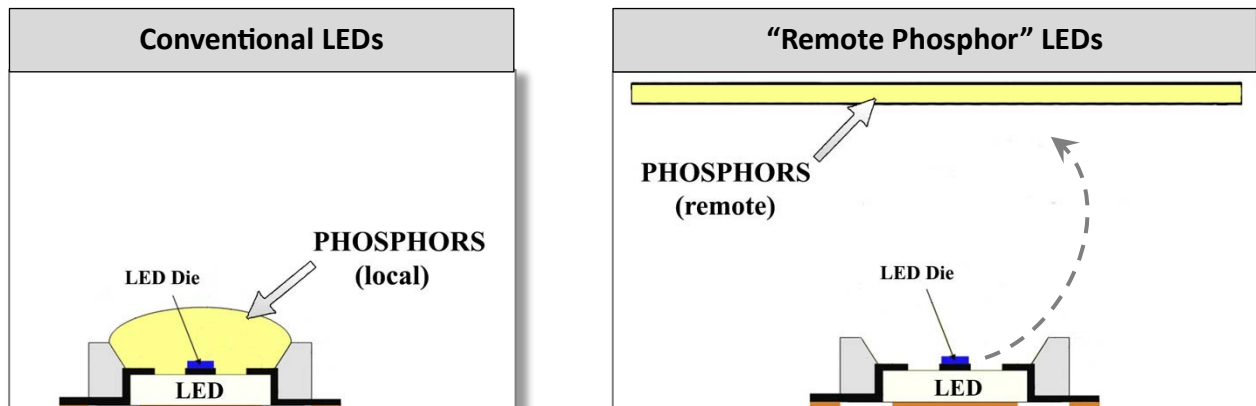
89. A POSITA had better options than bicolor tubes: “Instead, a POSITA, at the Time of the Invention, looking for LED-based CRI values above 90 CRI (e.g., to match Kino Flo’s high-quality 95 CRI fluorescent systems) would have naturally looked to other approaches such as “remote phosphor” technology.” Exhibit 2047 (Baxter Report) at ¶¶68.

90. “The Remote Phosphor approach **advantageously moves the phosphors away from the [hot] blue LED emitters** to address the pitfalls of film/TV lighting and achieve **higher-quality (over 95+) CRI** lighting values. Such remote phosphor systems were available from Intematix™ in “fixed” color temperatures like 3200 and 5600 Kelvin at the Time of the Invention.” Exhibit 2047 (Baxter Report) at ¶¶68.

91. Below is an illustration that I prepared showing the differences between “conventional” LEDs (local phosphors), and “remote phosphor”

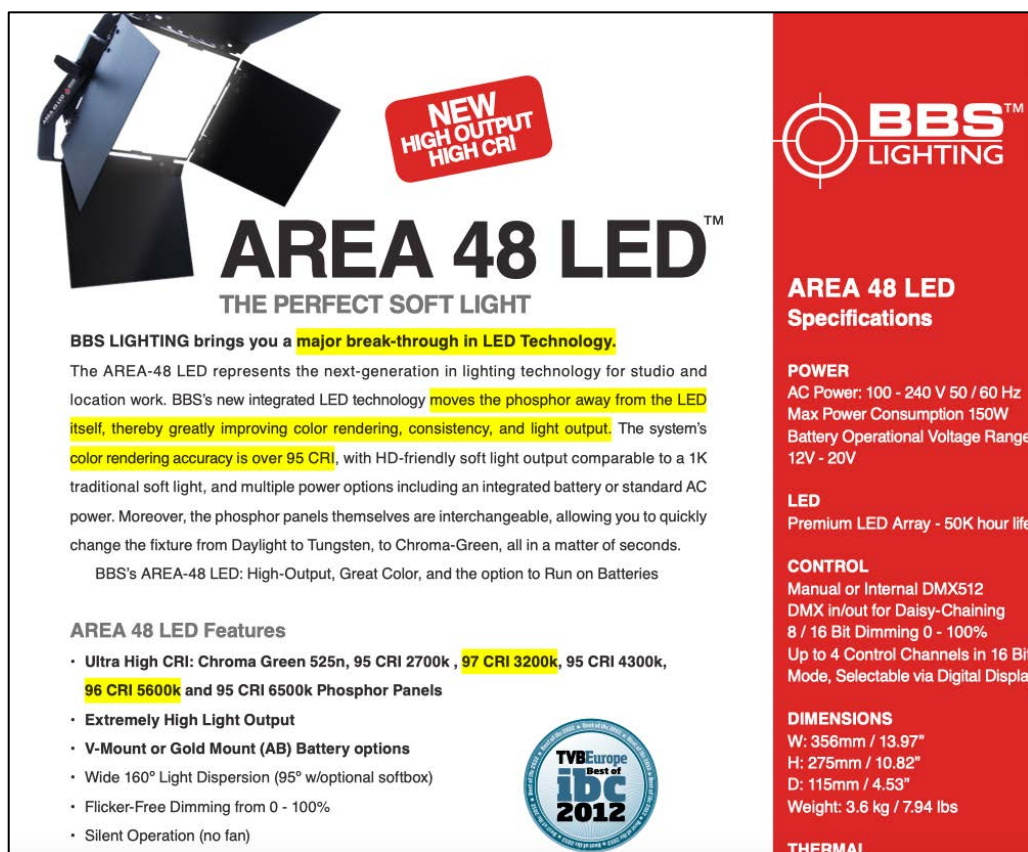
LED systems:

Moving the phosphors *away* from the hot blue LED emitter provides higher CRI (e.g., 95+), and makes the lighting system more heat-resilient, as shown below:



92. The following BBS Lighting datasheet from 2013 is representative of many of the benefits of “remote phosphor,” including 95+ CRI and higher lumen light output, and low green bias, as shown below:

*2013: “major break-through in LED Technology...moves the phosphor away from the LED itself, thereby **greatly improving color rendering, consistency, and light output.** The system’s **color rendering accuracy is over 95 CRI..**” (emphasis added)*

The image shows a product datasheet for the BBS AREA 48 LED lighting fixture. The top left features a photograph of the black, V-shaped light fixture. A red banner with white text reads "NEW HIGH OUTPUT HIGH CRI". The product name "AREA 48 LED" is prominently displayed in large, bold, black letters, with "THE PERFECT SOFT LIGHT" underneath in smaller text. The main body of the sheet contains descriptive text about the technology, highlighting that it moves the phosphor away from the LED to improve color rendering and light output. A list of features includes ultra-high CRI options (up to 97 CRI), high light output, and various mounting and dimming capabilities. A circular seal from the "TVB Europe Best of IBC 2012" awards is visible. On the right side, a red vertical bar contains the BBS Lighting logo and a "Specifications" section detailing power requirements, LED array life, control options (DMX512), dimensions (356mm x 275mm x 115mm), and weight (3.6 kg).

NEW
HIGH OUTPUT
HIGH CRI

AREA 48 LED™

THE PERFECT SOFT LIGHT

BBS LIGHTING brings you a **major break-through in LED Technology.**

The AREA-48 LED represents the next-generation in lighting technology for studio and location work. BBS's new integrated LED technology **moves the phosphor away from the LED itself, thereby greatly improving color rendering, consistency, and light output.** The system's **color rendering accuracy is over 95 CRI**, with HD-friendly soft light output comparable to a 1K traditional soft light, and multiple power options including an integrated battery or standard AC power. Moreover, the phosphor panels themselves are interchangeable, allowing you to quickly change the fixture from Daylight to Tungsten, to Chroma-Green, all in a matter of seconds.

BBS's AREA-48 LED: High-Output, Great Color, and the option to Run on Batteries

AREA 48 LED Features

- Ultra High CRI: Chroma Green 525n, 95 CRI 2700k, **97 CRI 3200k**, 95 CRI 4300k, **96 CRI 5600k** and 95 CRI 6500k Phosphor Panels
- Extremely High Light Output
- V-Mount or Gold Mount (AB) Battery options
- Wide 160° Light Dispersion (95° w/optional softbox)
- Flicker-Free Dimming from 0 - 100%
- Silent Operation (no fan)

TVB Europe
Best of
IBC
2012

BBS™
LIGHTING

AREA 48 LED Specifications

POWER
AC Power: 100 - 240 V 50 / 60 Hz
Max Power Consumption 150W
Battery Operational Voltage Range 12V - 20V

LED
Premium LED Array - 50K hour life

CONTROL
Manual or Internal DMX512
DMX in/out for Daisy-Chaining
8 / 16 Bit Dimming 0 - 100%
Up to 4 Control Channels in 16 Bit Mode, Selectable via Digital Display

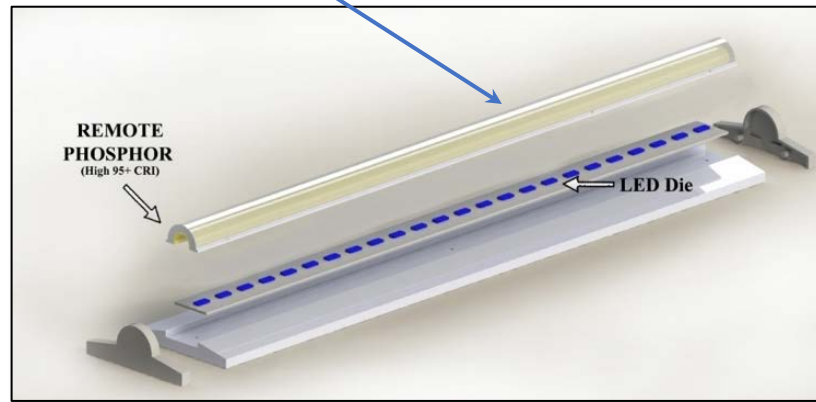
DIMENSIONS
W: 356mm / 13.97"
H: 275mm / 10.82"
D: 115mm / 4.53"
Weight: 3.6 kg / 7.94 lbs

THERMAL

Exhibit 2101 (BBS Remote Phosphor Data Sheet)(emphasis added).

93. **Great benefits, but one major tradeoff with Remote**

Phosphor and narrow (e.g. 1") tubes: "HIGH OUTPUT", "HIGH CRI", but NO Bi-Color feature (only single-color "remote phosphor" covers):



H. Design Constraint #8: Conventional LED Manufacturers Overstated their Lumen Outputs Circa 2013

94. A POSITA would know that actual LED lumens-per-watt ("LPWs") were significantly less than manufacturers stated LPWs for any given bin:

At the Time of the Invention, "real-world" lumen output played a vital role in the design process because a POSITA would know that LED manufacturers' lumens-per-watt claims were substantially higher than seen in actual usage. It was common knowledge among Designers that manufacturer-provided lumen statistics (for example, the lumens-per-watt listed on LED sales datasheets) were far too optimistic during the Time-Frame--i.e., the lumen output of the LEDs was

substantially lower in real-world applications. Instead, a Designer, during the Time-Frame (including the Time of the Invention), would have known to apply significant reductions to the LED efficacy numbers supplied by manufacturers, meaning a POSITA would have known to calculate lumen output using much lower lumens-per-watt forecast in their design projections than those claimed by the LED manufacturers.

Exhibit 2047 (Baxter Report) at ¶¶55-56.

95. In 2013, contemporaneous with the Time of the Invention, Harry Box's experience and research bore this out as he reported in his book:

*[I]t has turned out to be much more difficult for fixture manufacturers **to realize anything close to the kind of lumen efficiency** that the LED manufacturers publish for their emitters.... This is especially challenging when the light fixture's purpose is lighting motion picture photography....*

Exhibit 2046 (Set Lighting Handbook) pp. 227-228)(emphasis added).

I. Design Constraint #9: Top Fluorescent Manufacturer KinoFlo Abandoned "Tube" Form factor in 2012 When Moving To LED Technology

96. In 2012, just before the Time of the Invention, Kino Flo Lighting Systems had been the innovator and leader for about 25 years in tubular (fluorescent) lighting for the film and television industry. In the mid

to late 1980s, Kino Flo had invented the high-frequency, remote ballast, which improved brightness and eliminated flicker (unlike off-the-shelf fluorescent tubes). See, Exhibit 2046 (Set Lighting Handbook), Pg. 208 (“Kino Flo Lamps and Ballasts” – first two paragraphs). But in 2012 when it came to transitioning to LED lighting, Kino Flo chose a panel light form factor, not a linear tube:

Kino Flo...in 2012 when transitioning from fluorescent-technology tubes into LED technology...abandoned their 25+ year history of the narrow tubular format...Kino Flo Lighting Systems had been making fluorescent tube lighting for the Film and TV industry for about 25 years at that point in 2012. When Kino Flo came out with its LED lighting in or about 2012, the Celeb® 200 DMX LED, it was a large flat panel light (no tubes). See Exhibit 2050 which is a printout of the Wayback Machine/Internet Archive from KinoFlo.com’s website showing its Celeb® 200 DMX LED fixture.

Exhibit 2047 (Baxter Report) at ¶77.

97. The tubular form factor is difficult to work with: “It was common sense and sound design to move away from a highly-narrow and restrictive

tubular format, rather than take on the unpredictability of the tubular format.” Exhibit 2047 (Baxter Report) at ¶78.

J. Design Constraint #10: Despite Bi-Color LED Lights Being Well-Known in Film/TV Work for Many Years, There Was No Such Thing as a Bi-Color LED “Tube” Until The ‘895 Patent’s Commercial Embodiment

98. Trying to design a bi-color LED tube for the harsh and demanding film and TV industry would have been a bad idea: “A Designer, at the Time of the Invention, would have viewed the LED Core Tube Systems as a “bad idea...” Exhibit 2047 (Baxter Report) at ¶76.

99. Colt’s Bicolor LED Tube was a new type of product: Paramount Pictures Set Lighting Rental Manager Bruce Wonderlick stated that *prior* to Patent Owner’s “Bicolor LED Tube Invention... there were no bicolor LED tubular lights... in the form factors of fluorescent tubes known or available in the [film/TV] industry.” Exhibit 2067 (Wonderlick Decl.) at ¶8.

100. NCIS Gaffer (chief lighting technician), Todd Csernecky, explains that in/around 2013 that tube lights were “**not** bicolor, even though bicolor had existed for years in a panel light [form].” Exhibit 2041 (Csernecky Decl.) at ¶12 (emphasis added).

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VIII. THE '895 PATENT AND ITS COMMERCIAL EMBODIMENTS

A. Overview of the '895 Patent

101. From an overview standpoint, the Subject '895 Patent teaches a professional, narrow-form factor, Film/TV lighting instrument, wherein only one set (e.g., "half") of the total LEDs are available at any one time to produce light suitable for film/TV lighting.

102. Claim 1 is representative of the '895 Invention with 1000 Lumen Minimum (1[j](i)) of Cool LEDs (1[b]) and Warm LEDs (1[c]) in a Fluorescent Form Factor/Linear Form Factor (1[pre] and 1[f]), with Switchable LED Driver (1[d]), Diffusion Cover (1[e]), G/M 5 Point Limit (1[j](ii)), and CRI > 90 (1[j](iii)) for Commercial Image Recording.

103. In a preferred embodiment, the invention is a single integrated lighting system (vs. drop-in retrofit) including a tubular LED lamp having substantially the same size and dimensions as a traditional fluorescent lamp tube and a control box for controlling power input and power gain to the first, second, or both groups of LEDs (see, e.g., '895 Abstract). This means, for example, that the single-tube "stand-alone" '895 Invention (with integrated controller) can easily be operated under harsh operating conditions (materially different from those found in consumer-level retrofits bulbs like those found in homes or offices). This includes, for example

pressed directly against wall surfaces and/or in a vertical orientation during operation, or wrapped in heat-trapping light modifiers such as black foil.

B. Priority Date of the '895 Patent

104. I have been asked to consider that the Time of the Invention of the '895 patent be around May 17, 2013 ("Time of the Invention"). My opinions reflect how one of ordinary skill in the art (which I described below) would have understood the '895 patent, at the Time of the Invention.

C. The Colt LED Products

105. Colt's Bicolor LED Tube was commercially introduced in about late 2013.

106. Before Colt's inventions at issue here, there was no such thing as a Bi-Color Tube light suitable for film/TV image capture.

107. The Colt Bicolor LED Tube finally solved the long-felt need for a suitable way to provide electronically switchable Bi-Color tube lights.

108. Its impact was immediately recognized by the industry, as for example, Paramount promptly purchased approximately \$200,000 dollars' worth of Colt's Bicolor LED Tubes (Ex.2068 (Macias Decl.), ¶13).

109. Colt created the Bi-Color tube market (e.g., 100% share before Petitioner's copycat version), and, for example, achieved about 90% usage

on all new productions that Paramount supplies. Ex.2067 (Wonderlick Decl.), ¶14.

110. The patented Colt design was directly copied by Petitioner Quasar –see, e.g., Declaration from Quasar’s product manufacturer “*Mr. Gonzalez [Quasar’s co-founder] asked me if I could duplicate tube. **We examined and analyzed the tube and figured out how to make a copy of the tube.** I then manufactured approximately 10,000 pcs T12 bi-color for Mr. Gonzalez and Quasar.*” Ex.2039 (Zhang Decl.), ¶s 1-4; Ex.2068 (Macias Decl.), ¶s 24, 26-28 (verifying Zhang Decl.); Ex.2079 (Zhang Depo Transcript), PDF 94-95.

111. The patented Colt design (including copies) generated at least about \$6.6 million within the first four years of its launch. Exhibit 2068 (Macias Decl.) at ¶21 (Colt’s \$3 million plus) and ¶31 (Quasar’s copy \$3.6 million plus). Even more stunning was the fact that these millions in sales were achieved with virtually no marketing (e.g., many years without even a website) (Macias Decl. at ¶18). Thus, despite violating nearly every product sales and marketing rule, the Colt LED Bi-Color ‘895 invention having the core combination of elements and the core combination of 1000 Lumen Minimum (1[j](i)) of Cool LEDs (1[b]) and Warm LEDs (1[c]) in a Fluorescent Form Factor/Linear Form Factor (1[pre] and 1[f]), with

Switchable LED Driver (1[d]), Diffusion Cover (1[e]), G/M 5 Point Limit (1[j](ii)), and CRI > 90 (1[j](iii)) for Commercial Image Recording was still a run-away commercial success.

IX. MAIN OPINION – VALIDITY CONCLUSION

112. My opinions contained in this Declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the state of the art, the prior art, and the claims and the specification of the '895 Patent at the Time of the Invention, as I discuss in detail below.

113. First initial matter: It is my opinion that Quasar's Petition has flaws which cause the Petition to fail to reach the claimed invention. These flaws include the Petition's failure to combine its proposed references *in the way required* to achieve the claimed invention and thus fails to prove obviousness of claim 1 or any of the other independent claims (16 and 23). I discuss Quasar's failure to even reach the claimed invention in Conclusion #2 in Section XI below.

114. Second initial matter: Petitioner [incorrectly] states that the relevant artisan in 2013 would have had "*no concern*" combining heat-

sensitive elements in lighting for critical film and TV scenes, without considering the inherent risks and tradeoffs involved, as shown below:

A POSITA would have had no concern using sets of LEDs in predetermined color temperatures in a linear form factor to house LEDs of this nature and use such LED lighting to capture images.

Petitioner Ex. 1003 at ¶¶ 98 (emphasis added).

115. In my opinion, Petitioner ignores the risks and tradeoffs in construction of a bi-color LED luminaire in accordance with the claimed invention. This also shows a failure to prove obviousness to a POSITA at the Time of the Invention and a failure to show a reasonable likelihood of success. Quasar's assertions that a POSITA would have "*no concern*" picking and choosing elements of the claimed invention reveals Petitioner's failure to consider design constraints present in 2013 when engineering a luminaire with a form factor that is thermally challenging. Petitioner's conclusory statement of a POSITA having "*no concern*" is a summary dismissal of critical design issues when placing the elements of the claimed invention into the combination of claim 1. That is not what a POSITA would do. Instead, a POSITA would definitely have had concerns about heat-sensitive LED emitters and heat-sensitive phosphors that operate under challenging thermal conditions.

116. This flaw –the *failure* to consider design constraints and tradeoffs– is present throughout Quasar’s Petition. It is my understanding that prior art "must be considered in its entirety, i.e., as a whole, including portions that **would lead away from the invention in suit.**" *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1568 (Fed. Cir. 1987) (emphasis added).

117. Looking at the prior art in its entirety at the Time of the Invention, the skilled artisan would have known to consider all risks and tradeoffs when assessing the likelihood of success for the *positively* recited light “suitable for image capture” claim element.

118. The relevant artisan, at the Time of the Invention, would have viewed *significant reliability issues* that arise from Petitioner’s proposed combinations (both Grounds 1 and 2). These reliability issues include, for example, that excess heat would quickly render Quasar’s proposed combination of references unsuitable for its intended purpose—meaning unsuitable for the ‘895 Patent’s positively recited “suitable for commercial image capture”, including loss of color rendering fidelity (CRI of “90+”)(see, e.g., Section VII, B. (¶¶s 65-72) above; see also Design Constraint #2: Excessive Heat Renders LEDs Unsuitable for Commercial Image Capture.

119. More specifically, the skilled artisan would have quickly envisioned, for example, a blocked or partly blocked heatsink (common in film/TV lighting) causing runaway thermal conditions in the [problematically] narrow tubular light. See, e.g., ¶¶ 53-55, 76-77 and 83-85 above.

120. It was common knowledge at the Time of the Invention that excess heat was the “*Achilles’ heel*” of conventional LEDs—and that runaway thermal conditions would manifest in the destruction of luminaire’s LED phosphors, and consequently, *loss* of the [positively claimed] “CRI” color rendering claim element (and other elements such as lumen claims and others)—resulting in a light *unsuitable* for its intended purpose. “[A]n obviousness determination requires that a skilled [film/television] artisan would have perceived a reasonable expectation of success in making the invention in light of the prior art.” *Amgen Inc. v. F. Hoffman-La Roche Ltd.*, 580 F.3d 1340, 1362 (Fed. Cir. 2009) ; see also *Procter & Gamble Co. v. Teva Pharm. USA, Inc.* , 566 F.3d 989, 994 (Fed. Cir. 2009).

121. In other words, the skilled artisan would understand, for example, that effective dissipation of heat with vulnerable LED electronics and phosphors is fundamental to achieve a light “suitable for commercial image capture.” Heat sinks, being primary thermal management tools, play a pivotal role in this process (including the “suitable” and “90+” claim

elements). Unfortunately, Petitioner’s proposed Bi-Color combinations, including, for example, *Kit’s* LEDs (e.g., Pet. 24 (citing Ex. 1004, 3:20–38, 22:9–35)) and *Hasnian’s* consumer-level “experimental” heat-dissipation performance numbers (e.g., Pet. p. 68 (citing Ex. 1003 at ¶¶ 369, 374, 379 and 384 (similar to Ex. 1003, ¶¶ 461, 483, 492, 497))(which also lacks required claim elements such as a Diffusion Cover) provides little to no value in critical film/television lighting when the LEDs’ primary (and undersized) thermal management element becomes compromised (e.g., blocked or obstructed heat sink).

122. For example, Patent Owner acknowledges that the individual claims elements were well known, but the invention is the combination as a whole. There was no such thing as a Bi-Color tube lights in film/TV until the commercial embodiment of the ‘895 Invention. The demand certainly existed, as there was a significant long-felt need for Bi-Color LED tubes in 2012, as explained by Paramount Pictures’ Set Lighting Sales Manager Fernando Silva:

I showed him [Inventor of ‘895 Patent] some of the Kino Flo fluorescent lighting tubes and explained various problems these tubes had. For example, they were only one color temperature. When filming, if a new scene had to be shot with a different color temperature, gels had to be placed on the fluorescent light tubes

or the tubes had to be changed out to another fluorescent tube at or closer to the right color temperature. **This was and had been a significant problem given the number of tubes used on set, often a hundred or more.**

Ex.2066 (Silva Decl.) ¶7 (emphasis added).

123. Paramount's long-felt, but unmet need, for a Bi-Color tube option is illustrative of the fact that the '895 Invention was perceived (right or wrong) by the POSITA as lacking common sense—i.e., it was counter-intuitive in the context of film/television. More specifically, the prevailing opinion in 2013 was “why shoot yourself in the foot” by embracing such a problematic design approach for mission-critical lighting applications? Instead, the POSITA had other (better) ways to protect vulnerable electronics and phosphors, which allowed the designer to achieve a reliable high output, high CRI, low green light source that was suitable for commercial image capture.

124. I believe my time at BBS Lighting (a competitor to Patent Owner Colt LED) where we were developing circular tube lighting systems at the *same* Time of the Invention is highly insightful in showing the innovative nature of the '895 Patent.

125. Specifically, in 2013, I was the head of BBS Lighting-USA, where BBS Lighting was developing both conventional (“local” phosphor)

and “remote” phosphor LED lighting systems, including circular tube lighting systems with many elements similar to those claimed in ‘895 Invention (e.g., tubular form approx. 1” wide x 48”, high-output 1000+lumens, high-CRI 90+, low green bias (<3G)).

126. During the concurrent development time of the new BBS “Pipeline™” tubular lights, I personally had significant reliability concerns regarding the ability of *conventional* LED technology approaches (including the Bi-Color approach as claimed in the ‘895 Patent) to produce a high lumen output, high CRI (e.g., above 90 CRI) with low green bias (e.g., less than 5G). For example, I am quoted multiple times in TV Technology Magazine in and around the Time of the Invention regarding the venerability of traditional LED technology, as shown below:

TV Technology Magazine- 2013 (Time of the Invention)

*Ken Fisher, director... points to some of the advantages for remote phosphor technology in LED lighting. “There are **a lot of the inherent problems with the traditional LED construction that go away when you move to the remote phosphor approach**,” he said.*

Exhibit 2102 (Lighting Advances Efficiency) at Pg. 4 (second to last paragraph) (emphasis added).

TV Technology Magazine- 2014

*“The separation of the phosphor layer from LED bulbs also keeps the LED’s heat from damaging the phosphors themselves. “It allows you to put more **power behind the LED without adversely affecting the phosphors themselves,**” Fisher added.”*
(emphasis added)

Exhibit 2103 (More Versatility) at Pg. 4 (first full paragraph).

127. Thus, to negate the vulnerabilities of conventional LED technology discussed above, the design choices in 2013 to achieve suitability for film/TV included moving to thermally-attractive, large Bi-Color panel lights (i.e., abandon the “tube” form factor). This is exactly what other film/TV light equipment manufacturers such as Kino Flow, Arri, and Mac Tech (and others) all did—abandon the “tubular” format when moving to LED-based lighting systems—which teaches away from the ‘895 Invention, as shown below:

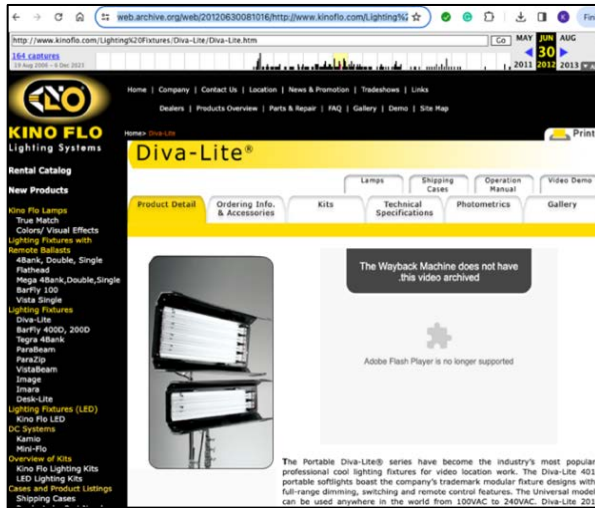
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KINO FLO EXAMPLE (Abandoning Tube format)

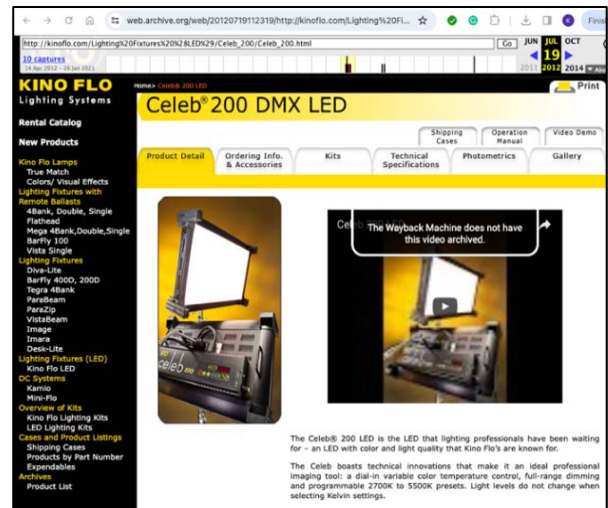
2102 Fluorescent



Ex. 2048 (fluorescent- using tubes)

2012 BI-COLOR LED

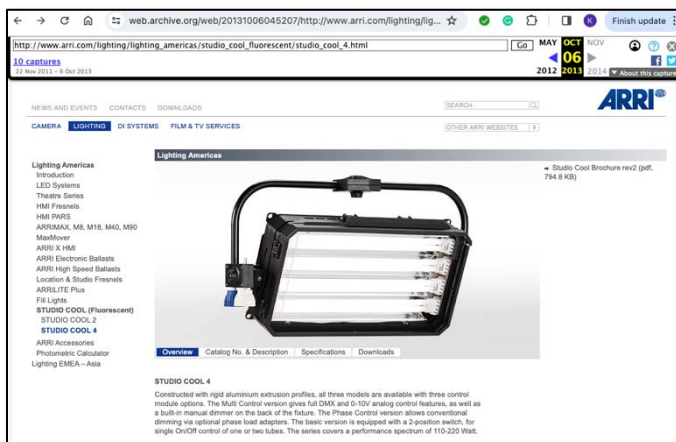
(abandoning the “tube” format)



Ex. 2049 (LED panel- no tubes)

ARRI EXAMPLE (Abandoning Tube format)

2013 Fluorescent



Ex. 2104 (Arri 2013 Studio Cool)

Fluorescent- using tubes in 2013

2015 LED

(abandoning the “tube” format)



Ex. 2105 (Arri 2015 SkyPanel)

LED panel in 2015—not a tube

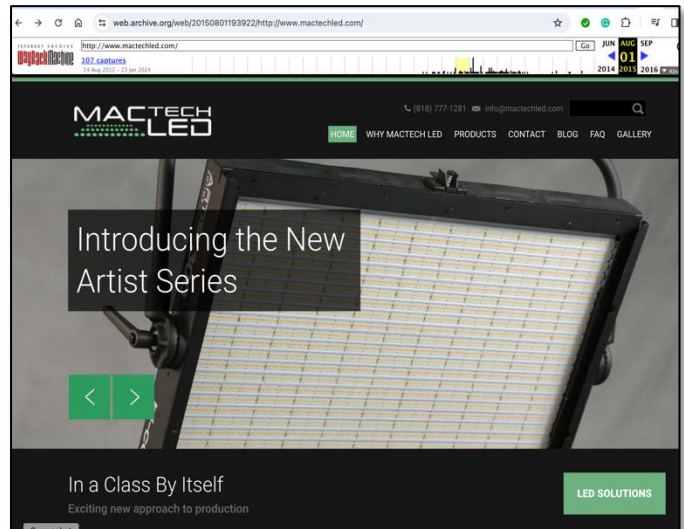
MAC TECH EXAMPLE (Abandoning Tube format)

2013 Single-Color Tube LED



Ex.2106 (MacTech 2013 LED Tube)
LED Tubes

2015 BI-COLOR Panel LED (abandoning the “tube” format)



Ex.2107 (MacTech 2015 LED Panel)
LED Panel- no tubes

128. In my roles at both Litepanels and BBS Lighting [USA] between 2002 and 2015, I personally studied and kept track of all LED competitors and their products. This includes, for example, personally observing Kino Flo transitioning from tubular fluorescent technology (as shown in Ex. 2048) to non-tubular format when transitioning to LED-based technology in 2012 (as shown in Ex 2049).

129. In addition, I personally observed Arri transitioning from tubular fluorescent technology (as shown in Ex. 2104) to non-tubular format when transitioning to LED-based technology in 2015 (as shown in Ex. 2105).

130. Moreover, I personally observed Mac Tech transition from tubular single-color LED technology (as shown in Ex. 2106) to *non*-tubular format when moving to Bi-Color LED systems in 2015 (as shown in Ex. 2107).

131. As illustrated above, Kino Flo, Arri, and Mac Tech all abandoned the tubular format when moving to LED-based technology with electronically-switchable Kelvin temperatures (e.g., warm-white and cool-white). In my opinion, a POSITA at the Time of the Invention would have done the same—abandon the tubular format. It was the expected move.

132. Expert Baxter witnessed Kino Flo's 2012 debut of their panel-style LED luminaire:

Kino Flo's move away from the troublesome tubular format (when changing to LED technology in or about 2012) made perfect sense to me when I personally witnessed Kino Flo's Celeb® 200 DMX LED at the 2012 National Association of Broadcasters Tradeshow. It was common sense and sound design to move away from a highly-narrow and restrictive tubular format, rather than take on the unpredictability of the tubular format.

Exhibit 2047 (Baxter Report) at ¶78.

133. Conversely, if the relevant artisan (including at BBS Lighting) wanted keep the narrow tubular circa 2013, the common-sense approach

was to embrace the [heat-resilient] "major break-through in LED Technology" of remote phosphor as we did at BBS Lighting. But, as explained above, the remote phosphor design constraints of maintaining the circular T8 and T12 form factor constrained our options to single-color (no Bi-Color narrow single tubes²).

134. The datasheet below shows that BBS Lighting Pipeline tube system (which was under development in 2013 and launched early 2015), included the following elements:

- (A) **narrow tube format** (approx. 1") up to 4 ft length;
- (B) **high CRI (95+)**;
- (C) **high lumen output (over 1000 lumens)**;
- (D) **low green bias (under 3G)**; but
- (E) **NO** Bi-Color single tube (design constraint).

² A major negative in our BBS Lighting approach in the T8 or T12 tube format required giving up the Bi-color feature when used in narrow single tubes. This meant, for example, the BBS tube lights had the same problem as described by Paramount's Head of Set Lighting – where the tubes needed to be physically changed to a different color tube. Equally negative, to achieve a "makeshift" Bi-Color system required placing two separate tubes side-by-side (one warm-white and one cool-white).



BBS™ LIGHTING

PRELIMINARY SPECIFICATIONS

PIPELINE REMOTE PHOSPHOR LED SYSTEM™

THE PERFECT SOFT LIGHT

From BBS Lighting, the company that pioneered remote phosphor technology in LED lighting fixtures, comes a revolutionary next step: the Pipeline LED System.

In a convenient cylindrical form factor in lengths of 1' 2' 3' and 4', the Pipeline remote phosphor provides ultra-high TLCI (Television Lighting Consistency Index) soft light that is controllable and dimmable with no color shift or flickering. Whether installed in an optional single or multi-lamp reflector bank, or deployed stand-alone, Pipelines are the perfect soft-light lamp for modeling faces and illuminating backgrounds.

Among Pipeline's numerous advantages are low power draw, high light output, wide light dispersion, heatless and fan-less operation and optional wireless DMX 512 controller. The Pipes are available in 3200K, 4300K or 5600K color temperature outputs, and can be used in a bi-color arrangement mixing different color temperature Pipes to achieve mid-range color temperatures.

Pipeline LED System Features

- Ultra High TLCI: 3200K, 4300K or 5600K
- Available in 1', 2', 3' or 4' lengths
- Extremely high light output
- Wide 180° light dispersion
- Flicker-free dimming from 100%-0
- Silent operation (no fan)
- Wireless DMX 512 with optional controller

POWER
AC Power: 100-240V 50/60Hz
Max Power Draw: 10 Watts per foot
Battery Operation: 14V DC

LED
Premium LED Array - 50K hour life
Hi Quality 5600K -TLCI 95+
Hi Quality 4300K -TLCI 95+
Hi Quality 3200K -TLCI 95+

More than 1000 Lumens per foot

CONTROL
Manual dimmers and wireless DMX

DIMENSIONS
Length: 1' / 305mm
Length: 2' / 610mm
Length: 3' / 914mm
Length: 4' / 1219mm

THERMAL
Ambient Operating Temperature:
-10° - 40°C / 14° - 104°F

Exhibit 2111 (BBS "Pipeline" 2013 LED Data Sheet)(quoted above and shown above).

135. Remote Phosphor achieves suitability for film/TV: Moving the phosphor away from the heat-producing LED emitter greatly improves color rendering (95+ CRI), consistency (little to no green bias plus protection of

the phosphors from excess heat), and high lumen light output (1,000 lumens tube light systems)—BUT, as introduced above, such advantageous features come at a price—the designer must accept the tradeoff loss of the Bi-Color feature due to narrow circular T8 or T12 format (again teaching away from the ‘895 Invention), as shown below:

BBS “PIPELINE” TUBES Under development in 2013	FEATURE	TRADEOFF
Narrow Circular Tube Format (T8 or T12)		
High Color Rendering (CRI 95+)		
High Lumen Output (over 1000 lumens)		
Low Green Bias (under 3G)		
Bi-Color (electronically switchable)		No Bi-Color

136. In choosing remote phosphor for making a narrow, T8 and/or T12 tube light, the Bi-Color feature could not be achieved, because the narrow outer diffusion cover is also the [fixed single-color] phosphor layer (using remote phosphor). This was BBS’s choice because circa 2013. Thus, it only made sense to a POSITA to select between “Single-Color LED tube light, or Bi-Color [spacious] Panel Light.”

137. This means that a POSITA, circa 2013, did not even consider the Bi-Color feature (as claimed in the ‘895 Patent) in a narrow “tube”

format as a suitable option for commercial image capture. I know that I did not. Moreover, between 2007 and 2013, I attended numerous film/TV industry tradeshows all over the world—and no one else had a Bi-color LED tube light. The Bi-Color system as claimed in the '895 Patent was considered a bad idea at the Time of the Invention.

138. In my opinion (and as confirmed by the development of BBS's "Pipeline" system during the very same time), if the relevant artist (POSITA) wanted to design and manufacture a narrow, high output, high color fidelity (90+ CRI with low green bias) tube light in 2013, the *last* place they would go is the system as claimed in the '895 Patent.

139. In addition, during my time as co-founder of industry leading Litepanels, we faced a similar choice just a few years earlier in the 2009-2010 timeframe regarding the viability of tube lighting systems.

140. Specifically, Litepanels invented the Bi-Color LED approach for the film and TV industry in about 2002 for a panel light (e.g., see e.g., claims 8-10 (dependent on claim 1 to a panel light) of U.S. Patent No. 6,948,823 (Exhibit 2108, "the '823 Patent"), where I am a named inventor).

Litepanels, owner of the '823 Patent³, then considered pursuing a Bi-Color tube. More specifically, as determined by Litepanels then CTO Kevin Baxter (also a co-inventor of the Bi-Color panel '823 Patent), tube lighting systems similar to the '895 Patent were “**highly risky and likely to fail...in the context of film/TV lighting**” Exhibit 2047 at ¶73 (emphasis added). And, Litepanels chose to move away from such a tubular lighting system, rather than towards it due to likely failure:

Bottomline- Within the specialized area of film and TV lighting, my Evaluation showed the LED Core Tube System was likely to fail. Therefore, we [Litepanels] deliberately chose not to proceed. A POSITA at the time of Colt's invention would have made the same decision. Exhibit 2047 at ¶79

My decision not to move forward with LED Core Tube Systems was sound and wise at the time, considering the overly restrictive design constraints faced when individual components are combined. Exhibit 2047 at ¶80

³ Originally filed by Contrast Lighting Services with a duty to assign to Litepanels.

141. As shown above, there simply was no motivation (and no reasonable expectation of success) to pursue a Bi-Color LED tube light suitable for the film and television industry, such as that of claim 1 of the '895 Patent. The obviousness inquiry "concerns whether a skilled artisan not only could have made but would have been motivated to make the combinations or modifications of prior art to arrive at the claimed invention." See *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015).

142. Furthermore, Petitioner's own words reinforce the inventive nature of the '895 Invention as Petitioner's expert Holmes admits that:

- *starting as early as 2005, [8 years before the '895 Invention] LEDs were immediately a disruptive technology in the [film/TV] lighting space.* (Ex. 1003 (Holmes Decl.) at ¶44).
- *"fluorescent tube form factor in the image recording industry...was well-known for years before the '895 Patent.* (Ex. 1003 at ¶302)
- in 2011, Amazon search for "*LED video lights produced over 1,000 results*" and Alibaba search produced "*over 20,000 results*" (Ex. 1003 at ¶48)

- “A POSITA would have been very familiar with the use of LED lights for film and television recording before 2012” (Ex. 1003 at ¶48), and
- By this time [2011, two years before the Colt invention], *virtually every TV series produced in the U.S. used at least one LED light fixture.*” (Ex. 1003 at ¶48).

143. Yet, despite the widespread knowledge, including the fact that most all of the individual LED component had existed for many years *before* the Colt Invention, **no one** put them together into a bi-color LED tube in accordance with claim 1 before the Patent Owner did.

144. It is my understanding that the Federal Circuit has held that in such a situation, “[t]he length of the intervening time between the publication dates of the prior art and the claimed invention can . . . qualify as an objective indicator of nonobviousness.” *Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1359 (Fed. Cir. 2013); see also *Arkie Lures, Inc. v. Gene Larew Tackle, Inc.*, 119 F.3d 953, 957-58 (Fed. Cir. 1997) (“Indeed, the years of use of salty bait and of plastic lures, without combining their properties, weighs on the side of unobviousness of the combination.”).

145. In fact, the “*intervening time between the publication dates of the prior art and the claimed invention*” is about **10 years** in this case. More

specifically, I am co-inventor of United States Patent 6,948,823 (the “823 Patent”). In 2002, as a co-inventor I personally wrote Bi-Color patent claims for the application which was filed in 2002 including e.g., the following (Bi-Color) claims:

27. The illumination system of claim 21, wherein a first plurality of said surface-mount semiconductor light elements emit light at a first color temperature range suitable for image capture, and a second plurality of said surface-mount semiconductor light elements emit light at a second color temperature range suitable for image capture.

* * *

29. The illumination system of claim 27, wherein said first color temperature range includes daylight color temperature, and wherein said second color temperature range comprises tungsten color temperature.

Exhibit 2007 (Pohlert), Claims 27 and 29.

146. These claims were published in April 2003. Exhibit 2007 (Pohlert).

147. But our invention of Bi-Color was in a panel form, as we never pursued the tubular versions. The 2003 published Bi-Color patent application was **ten years before** the ‘895 Patent’s Time of the Invention. See, Exhibit 2012 (Pohlert), e.g., [0108] and Fig. 33, tungsten LEDs 3303

and daylight LEDs 3304 on lighting effects system 3300 in the form of a panel or frame, not a tube (see Abstract, first sentence).

148. In addition, in our Bi-Color panel '823 Patent as introduced above (and in its publication) we expressly discouraged and taught away from the use of this highly-restrictive legacy tube form-factor in the context of film/TV/video luminaires, for example, in paragraph 12 of Pohlert '156 where we state:

Fluorescent lighting systems...have their own drawbacks or limitations. For example, fluorescent lighting systems...are often large and cumbersome. Fluorescent bulbs are generally tube-shaped, which can limit the lighting configuration or mounting options.

Exhibit 2012 (Pohlert) at [0012].

149. In addition, I personally oversaw the successful introduction of Bi-Color (1'x1') panel fixtures into the Film/TV Industry about five-years earlier in 2008:

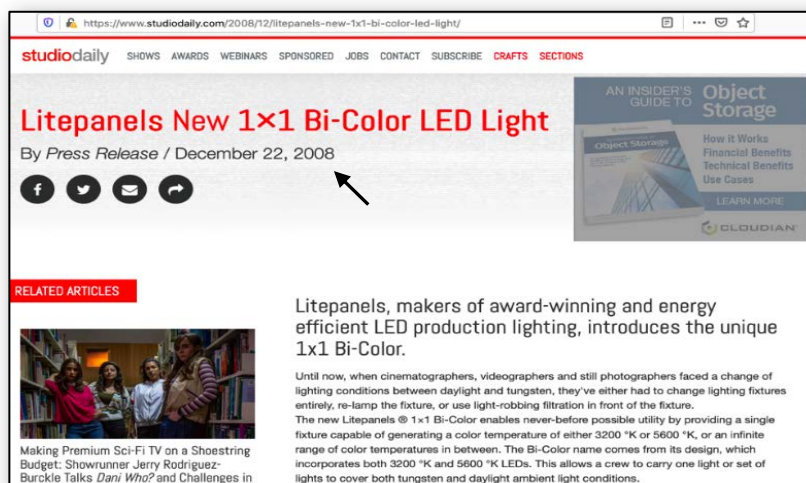


Exhibit 2109 (Litepanels 2008 Bi-Color Panel Launch)

Opinion Summary

150. Based on my experience and expertise, it is my opinion that the Challenged Claims would NOT have been obvious to a POSITA at the time the invention was made—because an ordinary artisan would NOT have been motivated to combine the references as there was no reasonable expectation of success.

151. Specifically, in light of the major design concerns listed herein, including, without limitation, the ten Design Constraints and Tradeoffs that I addressed above (including LED electronics and phosphors being placed in a problematically-narrow tubular format combined with the harsh working conditions experienced in the Film/TV Industry), the skilled artisan designing an LED luminaire that was “suitable for commercial image capture” would not have looked in the direction of an “elongated and narrow surface” form factor circa 2013 for a Bi-Color luminaire having the combination of elements of Claim 1 (and Claims 16 and 23) as listed in Paragraph 43 above. A POSITA would certainly not have combined the Bi-Color elements as shown in Claim 1, nor with the phosphor LEDs as in dependent Claims 6 and 27 (and independent claim 16, element (j)).

152. In 2013, a person of ordinary skill in the art (POSITA) would have considered the design constraints and tradeoffs resulting from the

combinations presented by the Petitioner in both Ground I and Ground II to be substantial. *In fact*, as illustrated by both the Litepanels and BBS Lighting examples provided herein (e.g., ¶¶124-141 above), these punitive factors were viewed at the Time of Invention as so significant that the proposed combinations were deemed inoperable for their intended purpose of Film/TV lighting.

153. Thus, a POSITA, at the Time of the Invention, would not have been motivated to combine either Kit in view of Ducharme, Ianiro and Katzir (Ground I) or Ducharme in view of Ianiro, Katzir and Hasnain (Grounds II) to achieve the invention as recited in independent claims 1, 16 and 23 of the '895 Patent (and dependent claims 6 and 27, and see claim 16, element (j)), because doing so would have resulted in no reasonable expectation of success in doing so.

154. Furthermore, there are extensive secondary considerations of non-obviousness present, including Quasar's directly copying every feature⁴ of the subject '895 Patent, that make clear that the Challenged Claims are not unpatentable.

⁴ See, Exhibit 2039 (copy of Zhang declaration at ¶s 1-4) in which Mr. Zhang of manufacturer Laysion, admits copying of Colt's T-12 bi-color tube for Quasar

155. Petitioner attempts to reach the counter-intuitive '895 Invention by cherry picking elements of prior art references while concurrently ignoring the significant Design Constraints and Tradeoffs created by its proposed combinations. This approach dismisses the expertise, creativity, and common sense of a POSITA in evaluating prior art combinations.

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Science in or about 2013 and Exhibit 2079 (Zhang Depo Transcript, e.g., page 25, lines 21-25) where Mr. Zhang again admits copying (“Q. Okay. Did Andy Lau provide you and your company more than one tube to take apart and copy? A. Yes.”)

X. ADDITIONAL CONCLUSION #1: PETITIONER'S PROPOSED PERSON OF ORDINARY SKILL IN THE ART IS TOO NARROW

156. Petitioner proposes that a POSITA would have had:

at least a Bachelor of Science degree in electrical engineering, or a closely related field, along with at least two years of experience in the design of entertaining [sic, entertainment] lighting systems, and the design and use of LEDs lights.

Petition, p. 14 (citing, Exhibit 1003 (Holmes) ¶32).

157. Based on the materials and information I have reviewed and based on my experience in the technical lighting areas relevant to the '895 patent, it is my opinion the specification of professional work experience as proposed by Petitioner is unduly narrow. The challenged claims are aimed explicitly at lighting systems designed for "commercial image recording" (Petition, pp. viii-ix, e.g., Claim 1[pre] and 1[j]), in essence, systems that adhere to the rigorous standards of the film and television industry.

158. In my judgment, Petitioner's proposal constrains the POSITA's experience too narrowly, as it omits practical set lighting experience—which could impair objectivity in this case.

159. Specifically, excluding set lighting experience, as will be illustrated below, could lead to erroneous determinations driven by an

undue reliance on engineering formulas, and an overemphasis on merging individual prior art elements, rather than appreciating the insights that practical set lighting work experience contributes when evaluating claim elements pertaining to "suitability" for "commercial image capture."

160. More specifically, in my opinion, many of the Petition's opinions suffer from a *lack* of insight garnered from experience as a set lighting technician. For example, consider Petitioner's proposed "formula" to determine the '895 Patent's 1000 lumen limitation⁵ (below left), vs. insights garnered from practical set lighting work experience (below right):

Petitioner's Proposal:	Insights from Set Lighting Handbook:
<i>"The desired [claimed] lumens can easily be calculated by taking the [manufacturer-provided] lumens per LED multiplied by the number of LEDs."</i>	<i>"...it has turned out to be much more difficult for fixture manufacturers to realize anything close to the kind of lumen efficiency that the LED manufacturers publish for their emitters... This is especially challenging when the light fixture's purpose is lighting motion picture photography..."</i>

⁵ e.g., Claim 18[i] of '895 Patent: "wherein the light emitted from the LED light system is at least 1000 lumens..":

Exhibit 1003 (Holmes Decl.), ¶s 141, 233, 274, 283 (last sentence of each)(emphasis added).	Exhibit 2046 (Set Lighting Technician's Handbook 2013, the Time of the Invention)at pp. 227-228)(emphasis added)
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161. The divergency involving the lumen limitation above suggests that expanding the experience of the POSITA to include set lighting work would likely bolster the credibility and impartiality of any derived conclusions. It also emphasizes the Petition's failure to consider the well-known constraint that cumulative lumen output of LEDs (whether rated or actual values) is not anywhere near the same as luminaire output. See also, Exhibit 2080 (Dr. Allen Decl.) at e.g., ¶s 21-33 for examples of losses/reductions in luminaire lumen output compared to LPW per LED.

162. It is my understanding that the Supreme Court in *KSR* cautioned against rigid, narrow approaches to determining obviousness I understand from counsel that "The obviousness analysis cannot be confined by a formalistic conception....or by overemphasis on the importance of published articles and the explicit content of issued patents." *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 419 (2007).

163. I also understand from counsel that (if Petitioner's proposed combination(s) have all of the claim elements then) the obviousness debate

hinges on "whether there was an apparent reason to combine" the prior-art elements. *KSR*, 550 U.S. at 418, 127 S.Ct. 1727—See, e.g., Pet. 14 (“...Motivated to Combine Kit with Ducharme, Ianiro, and Katzir), and 47 (“Motivated to Combine Ducharme in View of Ianiro, Katzir, and Hasnain”). It stands to reason that individuals versed in the nuances of on-set lighting are best positioned to discern the motivations behind combining—or not combining—the proposed elements.

164. More important, many film/TV lighting equipment designers also have backgrounds as set lighting technicians—including as chief lighting technicians (“gaffers”). Gaffers or former gaffers are uniquely qualified to know what constitutes “suitable” lighting systems for film and TV. There are many examples of film/TV gaffers and/or best boys (assistant gaffers) who are also founders of lighting equipment companies:

It took the **innovations of a determined gaffer** and his best boy [assistant chief lighting technician] to overcome these obstacles. Freider Hochheim and Gary Swink designed fixtures, ballasts, and lamps tailored to the needs of film production. Their company, Kino Flo, Inc., continues to make groundbreaking advances in the photographic applications of fluorescent technology.

Exhibit 2046 (Set Lighting Handbook) at pp. 227-228) (emphasis added).

165. In addition, Petitioner's own words support broadening the scope of work experience to encompass set lighting expertise:

SET LIGHTING TECHNICIANS [GAFFERS] AS EQUIPMENT

DESIGNERS:

Petitioner's Example 1:	Petitioner's Example 2:	Petitioner's Example 3:
<i>"Around 2001, [Gaffers] Rudy Pohlert and Pat Grosswendt, lighting professionals in the film and television arts...developed a ring light using 1080 60mW LEDs."</i> Petitioner's Exhibit 1003 (Holmes Decl.) at ¶48:	<i>"Kino Flo products [a company founded by <u>Gaffers</u>] were well received and, in fact, are generally considered the standard for fluorescent fixtures in the [film/TV] industry."</i> Petitioner's Exhibit 1003 (Holmes Decl.) at ¶41	<i>"Quasar was started in 2012...by a group of I.A.T.S.E. Local 728 Studio Electrical Lighting Technicians [Gaffers]. With over 100 years combined expertise in lighting movie sets..."</i> Exhibit 2110 (Quasar's About Us Web Page: Petitioner's own Website)

166. Thus, in my experience, it would be essential to include real-world set lighting experience so as to enable a proper assessment of such systems' fitness for commercial image capture. By providing actual working knowledge of what qualifies (or does not qualify) as suitable for commercial

image recording, satisfies the prerequisite needed to accurately assess the motivation to combine references, their likelihood of success, and ultimately, the validity of the Challenged Claims at hand.

DEFINITION OF POSITA: CONCLUSION #1

167. Therefore, it is my opinion that a POSITA in the art relevant to the '895 Patent at the Time of the Invention would have had 2 to 4 years' experience in electrical engineering/design of film and television lighting systems, including the design and use of LED lights, combined with two to three years of work experience as a set lighting technician in television and/or motion picture industry. I apply this understanding in my analysis herein. I do however note that I would reach the same conclusions even were I to adopt Petitioner's proposed definition. That is because Petitioner's definition of a POSITA mentions having "at least two years of experience in the design of entertaining [sic, entertainment] lighting systems" and more importantly, a POSITA designing such specialized lighting would need to make sure that he/she had a good understanding of the use of set lighting equipment including the types of harsh conditions referred to herein.

XI. ADDITIONAL CONCLUSION #2: PETITIONER’S PRIOR ART FAILS TO ACHIEVE THE CLAIMED INVENTION.

168. As a threshold matter, I understand from counsel that “obviousness concerns ... combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC* , 805 F.3d 1064, 1073 (Fed. Cir. 2015)(emphasis added). But, in multiple instances, the Petition fails to meet the threshold of claimed invention.

169. Below I illustrate three examples where the Petitioner has not assembled its references in a way that met the elements as claimed in the ‘895 Patent:

A. Petitioner’s Kit + *Ducharme* + *Katzir* Fail to Reach the 1000 Lumen “System” Claims

170. Independent Claims 1, 18, and 23 of the ‘895 Patent specifically claim a **LED lighting system that emits “at least 1000 lumens”**:

<i>“LED light system is at least 1000 lumens”</i>		
1[j]: wherein the light emitted from the LED light system...(i) is at least 1000 lumens...	16[i]: wherein the light emitted from the LED light system is at least 1000 lumens... ;	23[g]: wherein the light emitted from the LED light system is at least 1000 lumens ...;

171. Petitioner's invalidity theory regarding the claim element 1[j](i), the 1000 Lumen Minimum requires, in relevant part, combining three references to reach portions of the claimed invention--specifically:

- *Katzir and Ducharme* for “**fluorescent tube form factor**” (Pet. at 47–48, 50–51 (citing Ex. 1005, 28:53–65, Figs. 5a, 29; Ex. 1006 ¶ 27, Fig. 1C));
- *Ducharme* for “**diffusing cover**” (Pet. at 57-58 (citing Ex. 1005 at Fig. 29, 29:15–55, 12:3-15))(See, §§ on Claim 1[e] to 1[f]; and
- *Kit* for “**LED**” (Pet. 24 (citing Ex. 1004, 3:20–38, 22:9–35))(See § on Claims 1[b] and 1[c].

172. In trying to meet the 1000 Lumen Minimum element, Petitioner *oversimplifies* the lumen calculation process by stating that the luminaire's total lumens can be calculated simply by multiplying the lumens per LED times the number of LEDs:

The desired lumens can easily be calculated by taking the [manufacturer-provided] lumens per LED multiplied by the number of LEDs.

Exhibit 1003 (Holmes Decl.), ¶s 141, 233, 274, 283 (last sentence of each)(emphasis added). This is statement is incorrect, as Petitioner erroneously focuses on the LED component's *standalone (manufacturer's stated)* efficacy (measured in lumens per watt per LED), while entirely

ignoring the '895 Patent claim language requiring a “**lighting system**” emitting 1000 lumens. Petition, p. (ix), Claim element 1[j].

173. Specifically, Petitioner asserts “*Kit discloses [an] LED lighting device that outputs 1,040 lumens.*” Pet. 33 (Kit’s math is “20 Cree LEDs⁶ x “52 lumens⁷” per watt (20 x 52 = 1,040 lumens)). In the same paragraph, Petitioner claims to meet the 1000 Lumen Minimum limitation “...*cited references disclose these [1000 lumen] parameters.*” But this is not how one calculates luminaire (“light system”) output.

174. A proper analysis, would instead measure the lumen output when operated as the complete fixture (i.e., as required by the '895 Patent claims), including considering all integral claim element components and their interactive effects. Instead, Petitioner provides only *abstract* assertions that fail to meet the claimed invention ‘as a whole’.

175. A skilled artisan knows the LEDs are not the “light system,” but mere components of the system, and also knows that system lumens are determined by *many* factors—not just stated LED efficacy times the number of LEDs.

⁶ *Kit* at 4:47-48 “20 Cree XLamp 7090 white LEDs”

⁷ *Kit* at 4:33-34 “radiant flux of 52 lumens...”

176. For example, the relevant artisan knows that placing *Ducharme's* diffusing cover in front of *Kit's* LEDs reduces system lumens substantially—yet Petitioner omits any mention of this loss (and other) lumen-reducing losses that result from the proposed combinations of Grounds I and II.

177. More specifically, Petitioner *omits* numerous calculation steps when determining the "system" lumens of *Kit* (as well as *all* other alternative lumen references), including ignoring all **tradeoffs** that occur when combining *Kit* with the other system elements inherent in and as a direct result of the claimed invention, including but not necessarily limited to:

- Diffusion losses (e.g., due to the Diffusion Cover 1[e])
- Color Rendering Index (CRI) losses (e.g., higher CRI lowers lumens) (1[j](iii))
- Green index rating losses (e.g., lower green lowers lumens)(1[j](ii))
- Color temperature losses (e.g., warmer white lowers lumens)(1[c])

- Thermal droop losses (e.g., restrictive tube format increases junction heat, thereby lowering lumens)(1[f] and 1[e])
- Current droop losses (bi-color would need to be operated at higher, double, current in a narrow tube (in order to get system lumens output of a comparable mono-color)(1[b], 1[c], 1[d] and 1[j](i))
- Optical lumen losses such as lenses or other optics (1[j](i)Lumens)
- Driver losses (element 1[d]) and
- Power supply lumen losses (1[j](i)Lumens)

Petition, pp. (viii) – (ix) (claim 1).

178. By omitting claim elements and omitting the resulting inherent tradeoffs shown above, Quasar's Petition significantly overstates the actual lumen output of the system of the *Kit* reference.

179. By failing to account for the "light system" lumen output of claim 1[j] of the '895 Patent, Petitioner does not meet all claim limitations (much less prove obviousness). It is my understanding that Petitioner must establish unpatentability by a preponderance of the evidence. 35 U.S.C.

§316(e); 37 C.F.R. § 42.1(d). It is my opinion that Petitioner Quasar Science has not done so here.

B. Example 2: Petitioner’s Alternative References Also Fail To Meet the 1000 Lumen “System” Claims

180. As a backup alternative, Petitioner argues that other prior art teaches LEDs suitable for generating “at least 1000 lumens”—specifically:

a) Petitioner’s interpretation of the *Hasnain* reference at Pet. 63:

“assuming using **LEDs capable of emitting 70 lumens per watt**, an LED-based lamp having an elongated 44-inch long and 1-inch-wide circuit board would be able to produce 1,540 lumens from just 22 watts, and up to 3,080 lumens at 44 watts.”; and

b) Petitioner’s interpretation of *Kit* reference (2nd embodiment) at

Pet. 33 (bottom): “at one watt, a **cool white K2 LED could yield approximately 60 lumens**, while **a warm white could deliver approximately 45 lumens**.... The output would have been well over 1,000 lumens...”.(emphasis added)

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<i>“LED light system is at least 1000 lumens”</i>		
REFERENCE	LED component's <i>standalone</i> LPW efficacy	LED “ <i>Light System</i> ” Lumen Output (as claimed)
<u>Alt. Ref. #1:</u> <i>Hasnain</i> reference at Pet. 63 (ls 2-3): “assuming using <u>LEDs capable of emitting 70 lumens per watt..</u> ”		
<u>Alt. Ref. #2:</u> <i>Kit</i> reference (2nd embodiment) at Pet. 33 (bottom): “at one watt, a <u>cool white K2 LED could yield approximately 60 lumens</u> , while <u>a warm white could deliver approximately 45 lumens.</u> ”		

181. But, as shown above, Petitioner has used the *same flawed process*—omitting well-known lumen losses of the claimed combination—for its alternative references when calculating the ‘895 Patent’s 1000 Lumen Minimum claim “light system” limitation. That is, Petitioner again focused only on the LED component's *standalone* LPW efficacy (as shown in the underlined text above), again ignoring the claim language requiring

the “light system” to produce the 1000 Lumen Minimum⁸ including all lumen losses discussed in the previous section⁹. Claim 1[jj](“wherein the light emitted from the light system...”)

182. By again failing to combine the references *in the way required* to achieve the claim invention, all of Petitioner’s statements regarding meeting the 1000 Lumen Minimum claim limitation using only one color are simply uncorroborated speculation.

183. Thus, the Petition’s Ground I and Ground II fail to teach an LED “light system” emitting at least 1000 lumens when the first LEDs are on and

⁸ See also Set Lighting Technician’s Handbook: “...it has turned out to be much more **difficult** for fixture manufacturers **to realize anything close to the kind of lumen efficiency** that the LED manufacturers publish for their emitters This is especially challenging when the light fixture’s purpose is lighting motion picture photography...” Exhibit 2046 at pp. 227-228) (emphasis added).

⁹ Petitioner tries to compensate for one tradeoff factor in one of its references to Kit—specifically, the lumen differences between the “warm white” (45 lumens per watt) and “cool white” (60 lumens per watt) LEDs—yet provides no evidence to support for its 45 and 60 lumens-per-watt lumen claims—Ex. 1003 at ¶e.g., 142 and 177 (also see Pet. at ¶133).

the second LEDs are off, and when the second LEDs are on and the first LEDs are off, as required by claim 1 of the '895 Patent, in the "light system" of claim, i.e., including required claim elements such as the Diffusion Cover (1[e]), CRI>90 1[j](iii), G/M 5 Point Limit (1[j](ii), Switchable LED Driver (1[d]), etc. More specifically, there is no "lumen" evidence on record that "combines references in the way to achieve the claim invention."

184. Consequently, Petitioner's contentions do not show that independent claims 1, 16, and 23 are unpatentable over the asserted grounds. Similarly, Petitioner's contentions do not show that dependent claims reciting the phosphor-based LEDs (claims 6, 16[j], and 27).

C. Example 3: Ducharme + Kit + Hasnain Misses the Mark on 22 Watt and 44 Watt Claims

185. Petitioner Quasar's approach to the '895 Patent's wattage claims is similarly flawed.

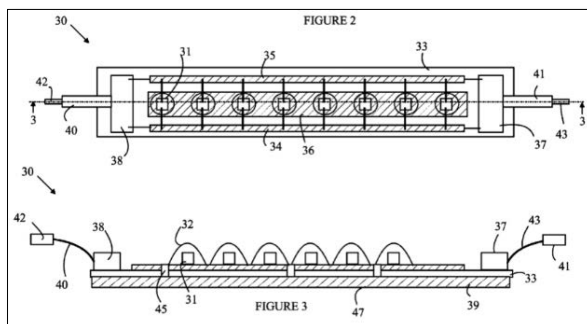
186. In attempting to meet the wattage requirements of **Claims 10, 11, and 18** ("*20 watts*") and **Claims 12, 13, 29 and 30** ("*42 watts*"), Petitioner again ignores claim elements and resulting tradeoffs required by the '895 Patent.

187. Specifically, Petitioner's invalidity theory in Ground II requires, in relevant part, on combining three or more references to reach portions of the claimed invention:

- *Katzir and Ducharme* for “**fluorescent tube form factor**” (Pet. at pp. 47–48, 50–51 (citing Ex. 1005, 28:53–65, Figs. 5a, 29; Ex. 1006 ¶ 27, Fig. 1C));
- *Ducharme* for “**LEDs ... having a high CRI at a specified color temperature with minimal points of green.**” (Pet. at p. 49, citing Ex. 1003 at ¶311 and:
- *Hasnain* to dissipate “**up to 44 watts**” of heat (Pet. pp. 67 (last line)-68 (top) (citing Ex. 1003 at ¶¶ 369, 374, 379 and 384 [similar to Ex. 1003, ¶¶461, 483, 492, 497])).

188. To support its wattage assertions, Petitioner Quasar relies mainly on *Hasnain*—stating, in relevant part, that Hasnain shows sufficient “...surface area to dissipate heat...up to 44 watts...” (Pet. p. 67 (bottom)). But no specific support is cited for a POSITA to apply anywhere near 44 watts to the proposed combination. The unsupported implication is that there is a motivation to combine, and reasonable expectation of success. Moreover, Petitioner Quasar ignores the **heat-inducing consequences of encasing LEDs (31), LED drivers (37 and 38) with an outer Diffusion Cover** as required by the ‘895 Invention. Specifically, *Hasnain* has no

Diffusion Cover, as is clear from Figure 3 below as well as having no mention of a cover:



189. By ignoring the Diffusion Cover element and its significant adverse thermal impact, Petitioner overstates the actual heat dissipating capabilities of the proposed combination of references in Ground II.

190. Under a proper thermal analysis, a POSITA would have known to include *all factors* related to LED temperature performance, especially a Diffusion Cover (1[e]), to determine a reasonable expectation of success. Thermal analysis is a critical part of any LED luminaire that a POSITA would consider. But Petitioner Quasar's omission of the outer Diffusion Cover in turn omits the critical role of ensuring sufficient thermal cooling for highly heat-sensitive LED phosphors (as well as electronics) in the luminaire.

191. A POSITA would also have understood that the lack of an outer diffusion cover in *Hasnain* (when added to the *Ducharme's* LEDs) would provide free ambient cooling. Accordingly, *Hasnain's* heat dissipation

analysis would be inapplicable to Petitioner’s proposed Ground II because a POSITA would understand that the claimed Diffusion Cover would act as an insulator, thereby significantly reducing the efficiency of heat dissipation to the surrounding environment.

192. A POSITA would further know that encasing LEDs in a luminaire with an outer cover also eliminates free-air flow on the circuit board—e.g., reduced ventilation should be expected to limit the system wattage. Petitioner Quasar’s own words support this “...output power of an LED light is limited by the free-air dissipation of the circuit board...(Ex. 1003 ¶57) (emphasis added).

SUMMARY: CONCLUSION #2 (Failures to Reach the Claimed Invention)

193. Petitioner Quasar provides no analysis at all relating to the adverse thermal impact of the system elements, including the Diffusion Cover and onboard LED Driver as claimed in the ‘895 Invention. In fact, Hasnain infers that a POSITA **should remove any diffusion cover** if a POSITA were to put together a luminaire to be driven with higher wattage. Moreover, Petitioner is *completely silent* on how its proposed combinations (including thermal-related *Hasnain* Pet. pp. 67-68) meet the positively recited “**suitability for commercial image capture**” as required by the

'895 Invention (as *unsuitable* thermal management results in an *unsuitable* light source for film/TV purposes).

194. Consequently, Petitioner's proposed combinations in Ground II do not show that Claims 10, 11, 12, 13, 18, 29 and 30 are unpatentable over the asserted grounds. In other words, Ground II is either missing the diffusion cover (if Hasnain is followed) or one of ordinary skill in the art would not apply Hasnain's teachings regarding heat dissipation if a diffusion cover is to be used as Hasnain's teachings would be inapplicable to use of a diffusion cover.

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XII. ADDITIONAL CONCLUSION #3: THE PRESENTLY CLAIMED INVENTION HAD UNEXPECTED AND SURPRISING RESULTS

195. It is especially noteworthy and relevant to the patentability of the present claims to note that in or around 2015, I was invited to Paramount Pictures to view the Patent Holder's commercial embodiment of the Subject '895 Patent at Set Lighting Department in Hollywood California. Paramount was renting out commercial embodiments of the Subject '895 Patent. At this time, it was years before I was retained in this matter, and I had no knowledge of the Subject '895 Patent or its pending application.

196. During this visit to Paramount Pictures, I was surprised and uniquely impressed with the lighting performance of this new Colt LED light source (in view of the design criteria followed by POSITAs as outlined above). In particular, I was immediately fascinated, as I simply did not expect the commercial embodiment of the '895 Patent (the "Colt Bi-Color LED" product) tubular luminaire to be suitable for film/TV/video image capture, as for example and not limitation, it was a surprising bright and diffused film/TV luminaire with consistent high-fidelity color. More specifically, the Colt Bi-Color LED was a surprise to me as it directly contradicted my own preconceived design expectations (based on my many years of experience in the relevant art, including *concurrent* tube light development activities), and thus, as supported above, it contradicted the

preconceived expectations of those of ordinary skill in the art. “[T]he fact that the elements worked together in an unexpected and fruitful manner supported the conclusion that [the combination] was not obvious.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). And this visit to Paramount Pictures where I saw the inventive bicolor tubular luminaire was about two years after the 2013 filing date of the utility application leading to the Subject ’895 Patent. Moreover, I immediately saw its strong commercial value.

197. The unexpected and superior results that I personally experienced in 2015, two years after the Time of the Invention, included seeing an ultra-high lumen switchable Kelvin bi-color luminaire suitable for commercial image capture (including as claimed in the ’895 Patent (e.g. Claim 1), which I found most surprising given my own (and the film/TV industry’s) strong design bias against the narrow legacy tubular form-factor for Bi-Color LED-based light sources.

XIII. IDENTIFICATION OF ELEMENTS OF QUASAR SCIENCE PRODUCT

198. The below photo shows phosphor-based LEDs, where the warm white LEDs have the orange-ish color and the cool white LEDs have the yellow color.



Ex. 2057 (S-Switch Photos)(left) at PDF 1; Ex. 2060 (Crossfade Photos)(middle); and Ex. 2061 (Crossfade X Photos)(right)

199. 2000K and 3000K are warm white color temperatures. 5600K and 6000K are cool white color temperatures.

CONCLUSION

200. Drawing on my experience as a co-inventor of Bi-Color LED technology and former competitor developing tube-based lighting systems during the same timeframe, it is my expert opinion that the *unique* genius of the '895 Patent was going *against* the convention that the invention was bound to fail.

201. Patent Holder did what no one else did, and surprisingly, achieved success despite well-established obstacles. Such innovation merits patentable recognition.

Certification

202. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

203. In signing this Declaration, I understand that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 5th day of February 2024.



Ken Fisher