

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

PATENT OWNER'S RESPONSE
UNDER 37 C.F.R. § 42.107

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I. INTRODUCTION

By going opposite to conventional design wisdom, Patent owner, Colt International Clothing, Inc. d/b/a Colt LED (“Colt”) invented a type of bicolor white LED tube light (“Colt’s Bicolor LED Tube”) suitable for commercial image recording. Prior to Colt’s invention, there were no bicolor tubular luminaires suitable for TV and studio filming. Ex.2067, ¶13. Colt’s Bicolor LED Tube was immediately successful at Paramount Studios’ set lighting rental department. Colt’s Bicolor LED Tube not only was rented out at Paramount, but also to productions at other Big Six (now Big Five) studios, Ex.2068, ¶20, even though they rented for double the price of fluorescent tubes. Ex.2066, ¶12; Ex.2068, ¶38.

Even assuming for purposes of argument that Ducharme discloses a bicolor lighting tube, Petitioner’s proposed Grounds I and II fail to meet the “1000 Lumen Minimum” LED light system output (1[j],[j](i)) as they focus on individual LED lumens per watt ratings and ignore substantial losses to go from LED rating to luminaire output. A POSITA would be familiar with such losses. In addition, Petitioner’s arguments focus on Colt’s patent claims as if they were a recipe for a POSITA to pick and choose elements and LEDs from the art and construct the claimed bicolor luminaire “without concern.” But a POSITA would have substantial concerns about thermal management and avoiding damage to the heat-sensitive phosphors in the LEDs. Thermal issues and efficiency issues both are

diametrically opposed to what Colt did as are other design factors and tradeoffs.

As Colt's tubes were being rented out, Petitioner's predecessor, Quasar Science LLC (California)("Old Quasar") tried to design a competitive bicolor LED tube, but was unsuccessful. Then, a principal (Ray Gonzalez) from Old Quasar went to Paramount's set lighting department, obtained samples of Colt's tubes purporting to borrow it to show customers who might then rent it from Paramount. Old Quasar then gave these samples to its manufacturer instructing him to copy Colt's tubes. See, Section XI.D. *Panduit Corp. v. Dennison Mfg. Co.*, 774 F.2d 1082, 1099 (Fed.Cir. 1985), *cert. granted*, judgment vacated on other grounds, 475 U.S. 809 (1986)(Copying, though not dispositive, is "strong evidence of nonobviousness.") Quasar sold millions of dollars of S-Switch models, then together with a related model (Crossfades) that still comes within the '895 patent claims, sold well over \$10,000,000.

The Petitioner's proposed rejections use hindsight to cherry pick elements from references without regard to their compatibility and without regard to sound LED luminaire design principles. And, Petitioner has only conclusory assertions about dependent claims 12-13, 22 and 28-29 requiring at least 42 watts of input power for the narrow tube luminaire to the Warm LEDs or the Cool LEDs. The cited art has no such amount. Patent Owner respectfully requests that the validity of all challenged claims be confirmed.

II. THE '895 PATENT

The application that matured into U.S.P. 10,566,895 ('895 Patent) was filed August 12, 2019, and issued February 18, 2020. Ex.1001, Cover.

A. Priority/Effective Filing Date

The first application in a chain of continuations (leading to the '895 Patent) issued as U.S.P. 9,719,642 ("the '642 Patent" or "great-grandparent"). Ex.2003. The next application led to U.S.P. 9,845,924 ("the '924 Patent" or "grandparent"). Ex.1001, Cover; Ex.2002. The next application led to U.S.P. 10,411,582 ("the '582 Patent" or "parent"). Ex.2001, Cover; This chain of continuations under 35 U.S.C. §120 all have the same disclosure and thus Patent Owner is at least entitled to the May 17, 2013 filing date of the '642 Patent. Moreover, for purposes of this proceeding only Petitioner accepted the earliest effective filing date of the '895 Patent is May 17, 2012. Patent Owner reserves the right to prove an earlier date.

B. The '895 Patent Bicolor White LED Tube

The '895 Patent is directed to a "bicolor" LED luminaire in a form factor of a T12 fluorescent tube or narrower suitable for commercial image recording. Ex.1001, 3:18-23; Examples 1-3 (columns 11-12), and e.g., Figs. 1A,23. The bicolor tubular LED luminaire has a first set of LEDs in warm white or tungsten white and a second set of LEDs in cool white or daylight white. Ex.1001, e.g., 5:35-41; Fig. 1A.

The LED lamp is similar to a traditional fluorescent tube. *Id.*, Fig. 2, 6:20–

23. The end of lamp (8) includes a base (14) with electrical connectors (16) and is made e.g., in T8 or T12 fluorescent size (no more than about 1.5 inches or about 41 mm wide/diameter). Ex.1001: 6:23–26. The LED lamp has a diffusion cover to blend the LED light output and together with the housing makes the fluorescent form factor. Ex.1001, Claim 1[e]-1[f].

The warm and cool white LEDs are laid out in a matrix. Ex.1001, Figs. 1A-1D & 5:20-23. There is an onboard LED driver (36) that selectively lights one set of LEDs or the other. Ex.1001: 7:11-18 & Figs. 3-4. The “**LED lighting system**” whether the first or second set is on emits light “suitable for commercial image recording” which includes at least:

Broad-spectrum white light;

90+ CRI;

Less than five points of color compensation of green/magenta; and

At least 1000+ lumens when the first LEDs are on or when the second LEDs are on.

Ex.1001, Examples 1-3, columns 11-12. While Petitioner argues there is nothing new about the ‘895 Patent claims and that bicolor panels were known, Colt’s invention and all others are “almost necessarily ... 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.”)

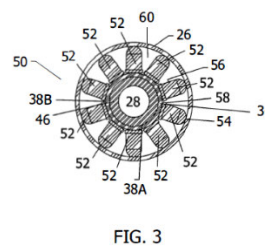
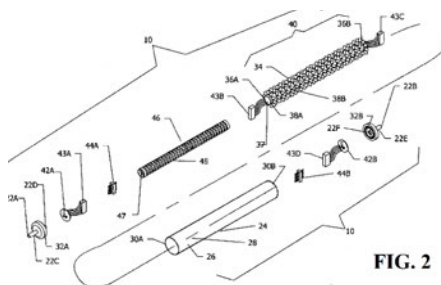
III. SUMMARY OF PRIOR ART

A. Overview of Kit—Main Purpose—Energy Savings

Kit is directed to “[a]n **energy saving** device for an LED lamp mounted to an existing fixture for a fluorescent lamp.” Ex.1004, Abstract (emphasis added). Kit focuses on energy savings for “general lighting fixtures,” e.g.:

To reduce electrical cost and [for] reliability, LED lamps have been developed to replace the conventional incandescent lamps typically used in **existing general lighting fixtures**. LED lamps consume less energy than conventional lamps and give much longer lamp life.

Ex.1004, 13:34-38 (emphasis added); also, 14:63-65 & 15:6-8. There is no mention of lighting for the film industry. Ex.1004, 13:39-43 & 16:4-9 (referring to “general lighting”). Kit shows a tubular lighting device where LEDs go all the way around the circumference of the tube. Ex.1004, Fig.2 (LED array 40) & Fig.3 (LEDs 52):



Kit does not disclose use of two different types of white LEDs in the same

luminaire, and particularly not warm white and cool white.

B. Overview of Katzir—Main Purpose—Blend to Save Energy and Avoid Green and Harshness

Katzir is a “lighting assembly [that] can replace a fluorescent tube light while providing a more comfortable and steady light source, **consuming less power** and with enhanced longevity.” Ex.1006, Abstract (emphasis added). Katzir is producing a “lighting assembly ... to consume ... **14 watts**” Ex.1006, [0026] (emphasis added).

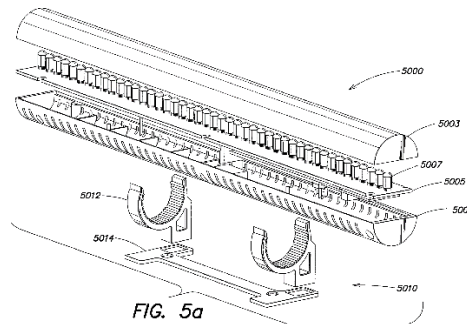
Katzir uses two or three sets of LEDs in significantly different color temperature LEDs for the express purpose of mixing their output to reduce green tones, improve brightness and other benefits. Ex.1006, [0051]. Katzir explains that to avoid the “**overly green**/blue tones and harshness of the fluorescent bulbs and the overly yellow and **dim qualities** created by tungsten bulbs” light emitted by LEDS of multiple color temperature ranges are blended to “create the most natural and comfortable wash of light without displaying any warm or cool hotspots.” Ex.1006, [0051] (emphasis added).

C. Overview of Ducharme—Main Purpose—Replacing/Retrofit Conventional Bulbs

Ducharme, U.S. Patent No. 7,350,936 is entitled “Conventionally-Shaped Light Bulbs Employing White LEDs.” Ex.1005, Title. It is directed to “LED-based light bulbs having one or more white LEDs, **for replacing/retrofitting**

conventional light bulbs.” Ex.1005, Abstract (emphasis added). Ducharme discloses some different bulb shapes. Figs. 5b,5c,5d, 7.

Fig. 5a shows an LED tube, as one possible type of luminaire of these different shapes:



Ex.1005, Fig.5a.

D. Overview of Ianiro—Main Purpose—Add Magenta to Limit Green Tones

Ianiro seeks to optimize color temperature of LED light output. Ex.1007, Abstract. Ianiro discloses that the CRI scale goes up to 100 (*Id.*, PDF¹, 4-5 (p.2, L.21– p.3, L.1), but he doesn't care much about CRI. Ex.1007, PDF 9 (p.7, Ls.6-9)(“not so much to the CRI index”).

Instead of pursuing CRI, Ianiro teaches a “mixture” of LEDs for “Red – Blue correction at a color temperature of 5500°K, a chromatic color correction for

¹ “PDF” refers to the Adobe document page number and is used where believed helpful to identify an exhibit page faster.

the remaining excess Blue and a compensation for the Green – Magenta ratio for obtaining a measure deviation not greater than 5 CC degrees.” Ex.1007, PDF, 9 (p.7, Ls.11–15). The mixture adds “Red - Amber LEDs in a percentage **from 16% to 14%** in the area of **617 – 625 nanometers.**” Ex.1007, PDF (p.7, Ls.16–18)(emphasis added). Ianiro thus teaches a substantial amount of red/amber colored LEDs in a very narrow bandwidth to essentially just combat green input.

E. Overview of Hasnain—Main Purpose—Heat Sinking

Hasnain teaches an LED luminaire made to replace fluorescent tubes **without removing the ballast** and made to fit inside a metal housing for the tubes. Ex.1008, Fig.4, 4:58-5:6. Hasnain says LEDs can generate 70 to 100 lumens per watt, but there is no disclosure of color temperature, CRI or green/magenta deviation for such LEDs. Ex.1008, 4:1-3. Further, as an integral part of Hasnain, **there is no diffusion cover** in order to get maximum airflow to the LEDs. Ex.1008, Figs.2-3 (light device without cover); 4:23-27 (dissipation to surrounding air). In other embodiments the LED luminaire has a large heat sink vitiating any T12 format or tube format of the LED luminaire. Ex.1008, Figs. 4-5.

IV. LEVEL OF ORDINARY SKILL IN THE ART

Petitioner proposes that a person of ordinary skill in the art (“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 lighting systems, and the design and use of LEDs. Petition, p.14. For purposes of this Response, Patent Owner's proposed POSITA:

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.

Ex.2047 (Baxter Decl.), ¶s 16-17; Ex.2100 (Fisher Decl.), ¶s 156-161.

In the studio/TV lighting field, commonly owners/operators were gaffers or the like. For example, Ken Fisher and Kevin Baxter formerly of Litepanels both have photography degrees; Kino Flo founded by gaffers; and even Petitioner's website says "Quasar was started ... by... Lighting Technicians [gaffers]... [w]ith over 100 years combined expertise in lighting movie sets...." Ex.2100, ¶s 156-167, esp. 165.

From prior art, it is clear that a POSITA would, regardless of which definition is adopted, familiarize themselves with the typical uses of the lighting in the television and/or motion picture industry, such as use of gels, positioning of the lighting on set including air flow and heat sources and typical ambient temperature on set. Ex.2100, ¶s 16-17.

Regardless of which definition of a POSITA is applied, the conclusion(s) would be the same.

V. CLAIM CONSTRUCTION

Claim terms “are generally given their ordinary and customary meaning” as understood by a POSITA at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed.Cir. 2005)(*en banc*).

For purposes of this Response and proceeding only, Patent Owner agrees that the terms recited in the Challenged Claims can each be given their plain and ordinary meaning (see Petition, p.14), and that no express constructions are needed for now unless otherwise stated herein. In addition, whether or not the use of “suitable for the commercial image recording” in the preamble of each of the independent claims (claims 1, 16, 23) is an intended use or is a claim element is simple since the term is used in the body of claim 1 as having the elements in 1[j]. Moreover, the claim itself sets forth that “suitable for the commercial image recording” includes elements 1[j](i), 1[j](ii), 1[j](iii).

Patent Owner will use the term “film industry” (or similar) to refer to the industry involving cinematography, studio or TV/movie set filming.

VI. THE ELEMENTS OF THE INDEPENDENT CLAIMS

A. Independent Claim 1 Recites a Narrow Tubular Luminaire with Cool White LEDs and Warm White LEDs, Separately Driven, Producing Light “Suitable for the Commercial Image Recording” Whichever Is On

Claim 1 recites “[a]n **LED light system** configured for providing broad-

spectrum white light suitable for commercial image recording, in a form factor of a fluorescent light tube...” including:

1[a] – a housing...

1[b]. a plurality of first LEDs...configured to emit broad-spectrum white light in a first predetermined Kelvin temperature range of cool white light [**“Cool White LEDs”** or **“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 White LEDs”** or **“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,...[**“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, claim 1 (Petition, pp.(viii)-(ix))(shorthand names in bold added for reference). Element 1[g] also recites that the LEDs are in a plurality of rows.

This claimed combination results in a bicolor LED luminaire in tubular, T12 format or narrower, which selectively produces light in cool white using the cool white LEDs or in warm white using the warm white LEDs, and whichever mode (warm white or cool white) it is in, the light is “suitable for commercial image recording” including the elements set forth in 1[j], which include the 1000 Lumen Minimum of 1[j](i), the G/M 5 Point Limit of 1[j](ii) and the CRI > 90,

collectively, “The Claim 1[j](i)-(iii) Requirements.”

It is important to note that in this luminaire, the “1000 Lumen Minimum” applies whether the light system is in warm mode or cool mode, because warm white LEDs have substantially less lumen output than cool white LEDs. The luminaire as claimed can be used on set for filming without having to switch out the lighting device whether warm or cool white is desired and without having to use gels or filters.

VII. PETITIONER FAILS TO MEET THE 1000 LUMENS OF THE LIGHT SYSTEM OF THE INDEPENDENT CLAIMS

The Petition’s proposed Grounds I and II fail to meet the burden to show that the combined references into an “LED light system” would yield 1000 or more lumens for both the cool white and the warm white LEDs. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 851 F.3d 1270, 1274-75 (Fed.Cir. 2017) (missing limitations cannot be filled in even if “a skilled artisan would immediately envision them.”).

A. Claim 1 Requires the 1000 Lumen Minimum 1[j](1) for the Light System, Whether the Cool LEDs or the Warm LEDs Are On

Claim 1 includes the Switchable LED Driver and the 1000 Lumen Minimum of the “LED light system.”, Petition, pp.(viii)-(ix); Claim 1, 1[d], 1[j]. The Warm White LEDs and the Cool White LEDs, whichever is switched on, will cause the luminaire to emit 1000+ lumens. *Id.* More specifically, the Cool White LEDs

(1[b]) or the Warm White LEDs (1[c]) are selectively lit using:

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,...

Id., 1[d].

Claim element 1[j] recites that the “**light system**” emits at least 1000 lumens when the first LEDs are lit and also emits at least 1000 lumens when the second LEDs are lit:

wherein the light emitted from the LED **light system** is said suitable for the 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**....

Ex.1001: Claim 1, 1[j]. The system has modes of operation including cool white mode and warm white mode and either mode emits 1000 lumens or more.

B. Petitioner's Calculation of “Light System” Lumens by Simply Multiplying the Number of LEDs by Their Stated Lumens Per Watt (“LPW”) Is Incomplete and Based on Speculation

1. It Is Speculative to Assert Any Luminaire Output for the Light System Based on Just the Stated LPW of LEDs

Petitioner must show that its art meets the 1000+ lumen output of the “LED light system” of claim 1, including all the elements of claim 1. The Petition's

assertion of meeting the 1000 Lumen Minimum of element 1[j](i) is based on speculation and improper calculation of luminaire (“light system”) output.

Petitioner determines the luminaire’s total lumens by simply multiplying the LPW of each 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.

Ex.1003 (Holmes Decl.), ¶s 141, 233, 274, 283 (emphasis added). But a POSITA would know that this calculation is just a component of the luminaire’s output.

Ex.2080 (Dr. Allen Decl.), ¶s 21-33; Ex.2100, ¶s 175-179.

Using the (manufacturer’s stated) LPW efficacy alone ignores claim 1’s specific language requiring an “LED **light system**” emitting 1000 lumens. Petition, p.(ix), 1[j]. Petitioner asserts “*Kit discloses an LED lighting device that...outputs 1,040 lumens.*” Petition, p.33 (1st full paragraph). The support for this proposition is Kit’s assertion of 1040 lumen output. Ex.1004, 4:65-66. But this is not how one calculates luminaire (“light system”) output. There are numerous significant losses in lumen output going from LPW of LEDs to luminaire output. Ex.2080, ¶s 21-33; Ex.2100, ¶s 175-179. The Petition’s failure to include these losses caused by various elements of the claimed “light system” fails to treat the invention as a whole.

2. Exemplary Substantial Luminaire Lumen Output Losses Omitted from Petitioner's Calculations

The losses are below with corresponding claim element(s):

- Diffusion losses (Diffusion Cover of 1[e] lowers system lumens)
- CRI losses (CRI >90 lowers system lumens) (1[j](iii))
- Green index rating losses (G/M 5 Point Limit lowers system lumens)(1[j](ii))
- Color temperature losses (e.g., warmer white lowers lumens compared to cool white)(1[c], 1[j](1) requiring 1000 lumens from the Warm White LEDs as well as the Cool White LEDs)
- Thermal droop losses (e.g., linear/fluorescent tube format (1[f]) with a cover (1[e]) increases LED p-n junction temperature, which lowers LED LPW)
- Current droop losses (bi-color needs to be operated at higher, e.g., at least double (per driven LED), current to get system lumens output of a comparable mono-color, causing LED LPW to drop due to current droop)(1[b],1[c],1[d],1[j](i))
- Driver/circuitry losses (Switchable LED Driver 1[d])

Ex.2080 (Dr. Allen Decl.), ¶s 21-33; Ex.2100 (Fisher Decl.)(also inherent optical losses), ¶177; Petition, pp. (viii) – (ix) (elements of claim 1). These losses are substantial. Dr. Allen sets forth some exemplary amounts of loss, which depend,

e.g., on the LEDs' actual specifications, amount of power to drive current per LED, LED p-n junction temperature, and other factors described in his report. Ex.2080, e.g., ¶s 21-33; also, Ex.2100, e.g., ¶s 175-179. For example, there can easily be a **35%** or more reduction in lumen output from each LED due to the requirements of claim elements 1[j](ii)-(iii) (G/M 5 Point Limit and CRI > 90). Ex.2080, ¶s 26-27 (G/M 5 Point Limit losses), ¶s 28-29 (CRI = 90 losses) and ¶31 (combined losses). A POSITA would not overlook such losses. *Id.*

Also, the LED driver, diffusion cover and thermal droop losses are substantial. Ex.2080, ¶s 22-23 (“a POSITA would know that droop losses would likely be substantial”); Ex.2100, ¶177. Accordingly, assertions of lumen output of a luminaire by Petitioner which are based merely on LPW are speculative.Ex.2080, ¶32. There is a further loss due to warm white LEDs having lower lumen output than cool white LEDs. Ex.2080, ¶33.

The Petition's and Holmes Declaration's lumen calculations based on Kit, Katzir and Hasnain has no mention of the above losses, with the exception of a passing conclusory/dismissive reference to possible lost lumen output due to high CRI and/or color temperature:

- i. Re Ground I: Petition, p.33, (see last three lines): reference to warm white having only 45 LPW (only 75%) compared to 60 LPW for cool white, but no other losses mentioned; no support

for speculative 42-watt input; no mention of K2's green deviation (or CRI), citing Ex.1003, ¶s 142, 177 & others (having same issues); and

- ii. Re Ground II: Petition, p.62 (1st full para.)-p.63: no reference to losses; simple mention of 70-100 LPW by Hasnain without reference to LEDs' CRI and green deviation; mention of inputs of "22 watts" and "44 watts" based on free-air dissipation in a luminaire with **no diffusion cover**, as explained in more detail below, citing Ex.1003, e.g., ¶351 & others (having same issues).

By failing to account for known losses from LED LPW in determining the "light system" lumen output, Petitioner does not meet all claim limitations and fails to prove obviousness. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 851 F.3d 1270, 1274-75 (Fed.Cir. 2017).

C. Petitioner's Exemplary Lumen Calculations for Grounds I and II Are Not Sufficient to Support a 1000 Lumen Minimum in a Bicolor LED Light System

(a) Petitioner's lumen calculations based on Kit

Petitioner asserts "Kit discloses an LED lighting device that...outputs 1,040 lumens." Petition, pp.33, Ex.1004 (Kit), 4:45-5:4. Petitioner asserts that Kit's "20 Cree XLamp 7090 white LEDs" can produce 1,040 lumens (i.e., 20 LEDs x 52

LPW presumably at 1 watt each LED = 1,040 lumens)). This calculation fails to take into account substantial losses going from LED output to “LED light system” output, including all elements required by claim 1. Ex.2080, ¶s 21-33; Ex.2100, ¶s 175-179. As Dr. Allen explains:

78....Even if Kit's luminaire were as efficient as the GE Energy Star winning LED bulb (67%)(which I designed with others while at GE and which was in a bulb format, not T12), the net luminaire output would be $1040 - 0.33 \times (1040) = 697$ lumens, before any Color Correction and CRI Losses, which as noted in Section I above are substantial. There is also no accounting in Kit for drive current droop.

Ex.2080, ¶78 (emphasis added); see also, ¶80.

In discussing Kit and Ground I, Petitioner also postulates another luminaire in which “[a]t one watt, a cool white K2 LED could yield about 60 lumens, while a warm white could yield about 45 lumens. Even discounting the lumen yield for high CRI, the output would have been well over 1000 lumens and capable of well over 42 watts while maintaining a greater than 90 CRI.” Ex.1003, ¶142. But there is no support presented as to why a POSITA would apply **42 watts**. Ex.2080, ¶82 (no support in any of the references for a 42-watt input); *In re Kahn*, 441 F.3d 977, 988 (Fed.Cir.2006) (“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”)). See

Section XII.B. and XII.C. for more on the at least 42-watt input (dependent claims 12-13, 22, 28-29).

(b) Petitioner's Example of Lumen Calculation Adding Katzir

As a backup to Kit's example, Petitioner refers to Katzir's assertion of putting as many as 225 or more LEDs into a fluorescent form factor. Ex.1003, ¶143. Petitioner asserts that this combination could have a CRI over 90 (based on Ducharme's teachings). Petition, p.34 (1st para.); Ex.1003, ¶s 142,144. But as noted above, even at a CRI of 90, Kit's example produces insufficient lumens once losses are considered. Further, at a CRI over 90, there will be an additional loss due to CRI. Adding in that '895 Patent claim 1 recites over 90 CRI and green deviation less than 5G/5M would make Kit's efficient light significantly less efficient.

Katzir's disclosure of 225 to 400 LEDs in a luminaire does not teach anything relevant regarding lumen output. Ex.2080, ¶85. The number of LEDs does not change Kit's limitations above. *Id.* Moreover, this postulated luminaire fails to consider that Katzir's primary purpose is to create an efficient luminaire, e.g., with a 14-watt input. Ex.1006 (Katzir), [0026](“**14 watts**”); [0004](“there is disclosed an LED tube light that **consumes less power**....”)(emphasis added).

Further, Katzir's teachings on output would be disregarded by a POSITA because, as explained by Dr. Allen, Katzir would need an efficacy of **221 LPW**. Ex.2080, ¶s 84-85 (regardless of the number of LEDs, Katzir does not teach a 1000

lumen-plus luminaire from one half of the LEDs or otherwise).

(c) Petitioner's example of lumen calculation using Hasnain

Petitioner, citing to Hasnain, argues that “assuming using LEDs capable of emitting 70 LPW, 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.” Petition, p.63, Ls.5-6, Ex.1003, ¶s 350-351.

Petitioner again omits substantial lumen losses. Holmes and Hasnain “[fail] to consider lumen reducing penalties resulting from... the Diffusion Cover, the LED Driver, the G/M 5 Point Limit and CRI > 90 [thus failing] to address the lumen output of the luminaire as a combined lighting “system””) Ex.2080, ¶s 18-19 and generally 16-33; Ex.2100, Fisher ¶s 180(b)-183.

Claim 1 requires a Diffusion Cover (1[e]), but Hasnain is an open-air LED light board and has unspecified CRI and green deviation. Ex.2080, ¶20; Ex.1008, Fig. 4, 5:1-11.

Hasnain's thermal analysis, even assuming for purposes of argument that it is accurate, would only apply to a test bench, open-air device with unspecified LED optical qualities, not a luminaire with a cover with the elements of claim 1. See Section VIII below (substantial thermal concerns of a POSITA).

D. It Is Speculative to Assert Any Luminaire Output from Kit for One Half of the LEDs

While the Petition asserts that the light emitted from Kit's luminaire will be

over 1000 lumens, there is no disclosure or suggestion of lighting one half of the LEDs and obtaining 1000+ lumens from the luminaire. Therefore, Kit's 1000+ lumen "examples" are not suggesting this element of the claimed invention.

All of the other references (including Katzir) in Ground I suffer from the same issue as Kit.

Similarly, the references (including Katzir and Hasnain) in Ground II do not provide any basis to support a luminaire that produces 1000+ lumens when half of the LEDs are lit.

E. The Independent Claims Recite the Same 1000 Lumen Minimum Therefore No Claims Are Invalid

Since all independent claims, 1, 16, and 23, claim an "**LED lighting system**" that emits "**at least 1000 lumens**" regardless of which LEDs are lit, Petitioner has failed to combine references to achieve all elements of the claims. Petitioner, p.(ix)(1[j]), p.(xi)(16[i]), pp.(xiii)-(xiv)(23[j]).

VIII. THE '895 PATENT CLAIMS WOULD NOT HAVE BEEN OBVIOUS IN VIEW OF A POSITA'S SUBSTANTIAL THERMAL CONCERNS

A. A POSITA Would Not Combine the References As Proposed in Grounds I and II of the Petition Due to Substantial Concerns Regarding Thermal Issues and Would Not Have Had a Reasonable Expectation of Success

The combination of claim 1 would not have been obvious to a POSITA due to substantial thermal concerns making it a bad design. *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”):

The Board credited Frymaster's expert's testimony that following Iwaguchi's method of diverting and cooling the oil in Kauffman's system would introduce “additional plumbing and complexity” and lead to “decreased efficiency.” Decision, 2017 WL 6551237, at *11. The Board thus found that a person of ordinary skill would not have been motivated to integrate Iwaguchi's TPM sensor into Kauffman's system.

Id.

A POSITA must have both motivation to combine the references and a “reasonable expectation of success.” *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1381 (Fed.Cir. 2016) (quotations and citations omitted).

The Petition asserts that “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.” Petition, p.17 (last three lines). Also, Ex.1003, ¶98 (last sentence). But a POSITA would have substantial concerns. A bicolor tube with the claimed elements suitable for commercial image recording would have been seen as a bad idea at the Time of the Invention. Ex.2100, ¶s 85, 98, 137; Ex.2047, ¶76.

Even assuming for purposes of argument that e.g., Ducharme, teaches a bicolor tube, Ducharme does not teach a bicolor tube with the 1000 Lumen

Minimum (from each color temperature) (1[j]/[j](i)), the G/M 5 Point Limit (1[j](ii)) in combination with CRI >90 (1[j](iii)), Warm White LEDs and Cool White LEDs (1[b]-[c]). This is not mere optimization. This is a bad idea to put these elements together in a luminaire with a Diffusion Cover 1[e], where getting the 1000 Lumen Minimum from each color temperature. The idea is bad for several reasons. One is thermal concerns. Others are discussed in the next section.

In LED luminaire design at the Time of the Invention, thermal issues were critical. A POSITA would know that it would not take much heat to render the luminaire “unsuitable for commercial image recording.” (See below citations.) This specifically includes, according to the claim language itself, the elements of 1[j](i)-1[j](iii).

U.S. Patent No. 8,754,594 to Lenk (published as US2013/0033179 February 2013) discusses heat problems. Each LED produces heat and “drive circuitry may also produce significant amounts of heat.” Ex.2098, 1:21-31. Other factors such as “the nature of the enclosure into which the LED bulb is installed..., the insulating properties surrounding the LED bulb, and the direction of the convective air stream flowing over the LED bulb [all] may have a **dramatic effect** on the build-up of heat....” Ex.2098, 1:32-39 (emphasis added).

Both Holmes' declaration and Hasnain fail to show obviousness or that a POSITA would have any reasonable likelihood of success in a luminaire design

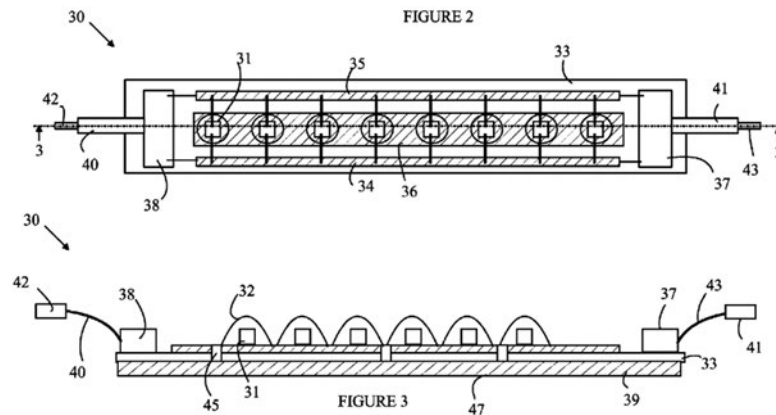
due to **failure to properly take into account thermal management considerations that are critical to a successful luminaire design including achieving the 1000 Lumen Minimum, the G/M 5 Point Limit and the CRI > 90 of 1[j](i)-(iii).**” Ex.2080, ¶36 (emphasis added); Ex.2100, ¶s 59-83; Ex.2047, ¶s 29-49.

B. Petitioner's Thermal Analyses Are Improperly Based on Hasnain's Open-Air, Benchtop LED Design

Petitioner relies on Hasnain but only in Ground II. Ex.1008; Petition, pp.6-7. Petitioner cites to Hasnain for disclosing that LEDs generate 70-100 LPW. Ex.1008, 4:2–3. Petitioner further relies on Hasnain's disclosure that between 0.5 and 1 watt of heat per square inch of surface area can be dissipated without raising the temperature of the LEDs by more than 30°C above ambient. *Id.*, 4:37–40; see, Ex.1003, ¶s 350-351 (similar, e.g., ¶s 369, 374, 492, 497 and 83). Petitioner, through declarant Holmes, asserts that a POSITA would use Hasnain's teachings “to produce 1,540 lumens from just 22 watts, and up to 3,080 lumens at 44 watts.” Ex.1003, e.g., ¶351. In short, Petitioner asserts, in reliance on Hasnain, that between 0.5 and 1 watt of heat per square inch of surface area can be dissipated without raising the temperature of the LEDs by more than 30°C above ambient. But, Hasnain's analysis is inapplicable.

First, a POSITA would know this 30°C above ambient was from a benchtop experiment by Hasnain just to quantify thermal management of his heat dissipating

structure (36) of Figs. 2-3 (reproduced below). Ex.2080, ¶42. But this is “only a very small subset of the many thermal management issues that must be quantitatively included in the design of a commercial product...” Ex.2080, ¶42.



Ex.1008, Figs. 2-3, 3:51-53. Dr. Allen’s exemplary analysis shows that a POSITA would find that Hasnain and Holmes omitted critical factors that “would cause the junction temperature of the LED to be overheated by at least about 50°C in a typical Commercial Image Recording application (and possibly substantially more...)” Ex.2080, ¶41 (emphasis added). That much “overheat would be expected to result in a rapid shift of the color point from its initial color, resulting in unacceptable performance of the luminaire in the Commercial Image Recording application, i.e., by **very quickly irreparably destroying phosphors in the LED and thus very quickly irreparably destroying CRI and/or resulting in loss of the G/M 5 Point Limit of 1[j](ii) and 1[j](iii).**” Ex.2080, ¶41 (emphasis in original). Dr. Allen further concludes that:

[A] POSITA would not have a reasonable expectation of

success of such a design, particularly one of claim 1 having a Switchable LED Driver (1[d]), Diffusion Cover (1[e]), 1000 Lumen Minimum (1[j](i)), G/M 5 Point Limit (1[j](ii)) and CRI > 90 (1[j](iii)) for Commercial Image Recording. A POSITA, designing a luminaire for commercial image recording having the claimed elements ... **would want a thermal design that stays significantly below risking and below appearing to risk any damage to the LEDs and thus to The Claim 1[j](i)-(iii) Requirements to maintain suitability for commercial image recording.**

Ex.2080, ¶41 (emphasis added). Just some of the factors contributing to this at least 50° C overheat of the LEDs' p-n junction temperature are described below.

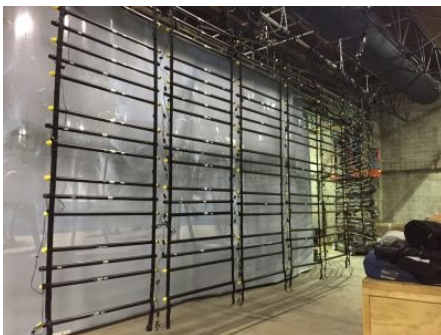
C. A POSITA would know that a Diffusion Cover would change the thermal analysis significantly from Hasnain

Most important is that Hasnain is a benchtop situation in a lab with free-air. “the LEDs are distributed on heat-dissipating structure 36 such that the surface area presented by the heat-dissipating structure is sufficient to dissipate a significant fraction of the heat of each LED **to the surrounding air....**” Ex.1008, 4:23-27 (emphasis added); Ex.2080, ¶49. Free-air dissipation is admitted by Petitioner. Ex.1003, ¶57 (admitting that “...output power of an LED light is limited by the free-air dissipation of the circuit board.”)

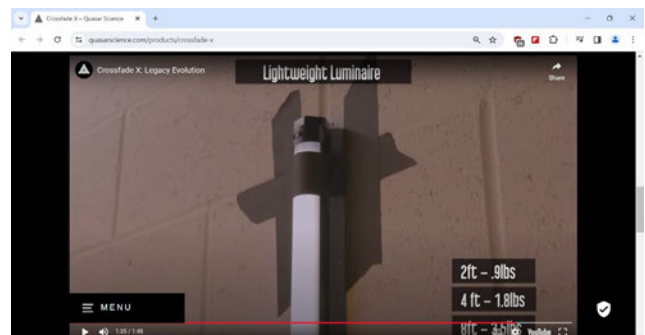
Effect of Cover: The linear/fluorescent form factor having the housing and cover, claim 1, 1[e]-1[f], has a substantial effect in raising the LEDs' junction

temperature due to thermal insulation from the cover. Ex.2080, ¶50 (“A POSITA would recognize this and increase Hasnain’s Postulated Rise of 30 °C LED temperature above ambient...to a **substantially greater temperature rise to make sure to account for a Diffusion Cover and housing...**”)(emphasis added). This temperature rise could be **at least 20° C** due to the cover. Ex.2080, ¶51.

Actual Ambient: A POSITA would also design for use on set, where lighting sources can be close together and/or have limited air flow around them, and/or have heat dissipation blocked or partly blocked. Ex.2080, ¶53; Ex.2041 (Csernecky Decl.), e.g., ¶s 7, 9 and its Exs.2042-2043. Mr. Csernecky, a chief lighting technician (aka “gaffer”) and assistant chief lighting technician (aka “best boy”) for almost 30 years including twelve years on “NCIS: Los Angeles,” explains that the LED lights are used in a “ladder” format sometimes just inches apart from each other, e.g., close to and facing a backdrop and sometimes they can be taped to a wall, as shown below:



Ex.2042



Ex.2043 (from Petitioner's website)

Ex.2041, ¶s 7, 9. When an LED tube is positioned in a vertical orientation, heat

risers inside the tube towards the upper LEDs. Ex.2047 (Baxter Decl.), ¶36.

Accordingly, a POSITA would account for these types of luminaire layouts (which add to ambient heat) in a thermal analysis. Dr. Allen states that ambient should be estimated at about 45°C. Ex.2080, ¶53.

P-N Junction Design Limit: A POSITA would follow the manufacturer's guidelines to design for the suggested 80°C for the LEDs' p-n junctions. Ex.2083 (Cree Design Guide, copyright 2016), p.8 (last full paragraph); Ex.2080, ¶44. As Dr. Allen explains:

[D]ue to the combination of the need for maintaining the G/M 5 Point Limit and the CRI > 90 as well as the lumen output, and on film or TV set conditions such as wrapping a luminaire in black wrap or a gel and/or taping it against a wall where the thermal circuit is blocked or hampered, **a POSITA would certainly not want to go above the Cree Design Guide recommended p-n junction 80 °C limit.**

Ex.2080, ¶44; Ex.2083, p.8. As one can see in the graph in the Cree Design Guide, LPW drops dramatically with junction temperature increases. Ex.2083, p.8. And this dramatic drop is for a "best-in-class LED thermal design" a few years after the date of invention. Ex.2080, ¶44.

Color Adjustment Overheat: If one is trying to overcome lumen losses due to the 5 G/M Limit and the CRI>90, then the additional input wattage is much higher and this increase would add at least another 27°C. Ex.2080, ¶54.

Dr. Allen calculates (even assuming Hasnain's open-air, bench top experiment 30°C rise is correct for a 0.5-1.0 watt per LED load and assuming Hasnain's ideal conditions), that junction temperature would be "overheated by a **minimum of about 50° C**" over the 80°C Cree Design Guide recommended limit on LED junction temperature. Ex.2080, ¶59. This minimum 50°C overhear is further increased by limited airflow usage, such as wrapping in black wrap or gel, such that the junction temperature would be expected to be **at least 140°C to 150°C** or more in those situations. *Id.* This would result "in unacceptable color, photometric and chromaticity stability and extremely short life, and thus a POSITA would not have a reasonable expectation of success." *Id.*

Damage/Destruction to CRI, green deviation, color temperature and LPW from excess heat: Dr. Allen further explains that excess heat causes damage or irreparable damage that can occur to LPW, CRI, color temperature and the green/magenta deviation of phosphor white LEDs in 2013, at the Time of the Invention, and even today. Ex.2080, ¶s 60-61; also, Ex.2100, ¶s 65-67; Ex.2047, ¶s 31, 61-62. The thin layers of phosphor on the LED are different colors, and some colors are more sensitive to heat than others, resulting in significant distortion to the optical qualities of the LED output. Ex.2080, ¶s 60-61. It is evident that a POSITA would have substantial concerns about excess heat and avoid such heat problems to avoid serious damage or the risk of serious damage to the performance

of the LEDs, particularly where LED CRI, color temperature, and G/M color deviation are critical. *Id.*; Ex.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) (reinforcing the Cree Design Guide p-n junction temperature limit).” Ex.2080, ¶60; Ex.2086, p.19 (“The move from 75/75 to 85/85 corresponds to an acceleration factor of approximately 4X.”) The Color Shift report was in 2017 and shows the relatively unpredictable nature of LED luminaire design even as late as 2017. Ex.2080, ¶60.

D. Petitioner's Ground II Also Fails Because It Would Not Have Been Obvious to Combine Hasnain with Ducharme

The claimed “LED light system” has a Diffusion Cover, 1[e]. Ducharme shows a cover. Petitioner asserts that Ducharme teaches a “linear, tube-like form factor” [and] “teaches the use of a diffusion cover.” Petition, p.28 (just below diagram); Ex.1005, Figs. 5a-5b.

By contrast, as explained above, a critical part of Hasnain's structure is to provide no cover, i.e., open-air for cooling the LEDs that he wants to drive with 0.5 to 1.0 watts. Ex.1008, Figs. 2-3; 4:23-27 (open-air heat dissipation). Use of a cover and use of no cover **are incompatible**. A POSITA would not combine any teaching of wattage/drive current of Hasnain (0.5 to 1.0 watt) with the teachings of Ducharme. Accordingly, the combination would not have been obvious to make

(or would lack a Diffusion Cover).

E. The Above Analysis Applies to Independent Claims 16 and 23, and Also Dependent Claims 6 and 27 as well as Others

CLAIMS 16 and 23: Because independent claims 16 and 23 recite all the above discussed elements present in Claim 1, the reasoning set forth above applies equally to these claims. Claim 16 also includes phosphors (16[j]).

CLAIMS 6 and 27: These claims specifically recite phosphor LEDs and depend on independent claims 1 and 23. Therefore the reasoning above applies to these claims as well.

CLAIMS 12-13, 22 and 28-29: These recite 42-Watt input, which to a POSITA would be a thermal nightmare. See also, Sections XII.B. and XII.C. (and Sections VII.C.-D. and VIII.B. above).

IX. IN VIEW OF A WEB OF DESIGN ISSUES FACED BY A POSITA, IT WOULD NOT HAVE BEEN OBVIOUS TO COMBINE THE REFERENCES IN GROUNDS I OR II TO ACHIEVE THE CLAIMED INVENTION, AND A POSITA WOULD HAVE NO REASONABLE EXPECTATION OF SUCCESS IN TRYING TO DO SO

Petitioner's arguments involve cherry picking. But this is impermissible hindsight. *Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325, 1332 (Fed.Cir. 2010) ("claims cannot be 'treated ... as mere catalogs of separate parts, in disregard of the part-to-part relationships ... that give the claims their meaning.'") Moreover, that process is not how a POSITA would go about designing a

luminaire. Rather, a POSITA would consider the claimed invention a very bad idea for multiple reasons due to a myriad of competing design constraints and attendant complex tradeoffs.

A. Claim 1 Would Not Have Been Obvious And of Highly Questionable Success

What inventor Macias did was not obvious or routine. He went the wrong way. And the more he went the wrong way, the worse the idea seemed according to conventional wisdom. But then, he went so far the wrong way, that he created something great. Paramount was “very pleased” with what he did. Ex.2066, ¶s 10-11. Old Quasar saw it and liked it too. They tried to make it but could not so they copied it. See, Section XI.C.5. and XII.D. And, as noted in the secondary considerations section, other industry lighting designers avoided this path, yet the products embodying the claimed invention sold in the millions in just the first few years and were accepted at major studios for filming. See, Section XI.E.1.-2. and XI.F.1.-3.

Just some of the wrong ways that the inventor went are:

1. High Lumen Output for Each Color Contrary to Thermal Management and Efficiency Due to Current Droop and Thermal Droop:
Seeking high lumen output (1000+ lumens) from the luminaire from only one set of the LEDs (due to the bicolor white luminaire) means increasing (at least doubling) the wattage input per LED compared to a mono-color white luminaire.

Ex.2100, ¶177 (doubling drive current per LED causing current droop losses);

Ex.2047, ¶53 (near bottom p.13).

2. Narrow Form Factor for a Bicolor Suitable for Commercial Image Recording Contrary to Thermal Management Needs a Strong Diffusion Cover to Avoid Point Source Light But That Reduces Output and Worsens Thermal Issues: Selecting a narrow linear form factor/fluorescent form factor, including a cover, in which to put bicolor which means more challenging thermal management and the spacing of the same color LEDs is further apart requiring more diffusion to look uniform. Ex.2080, ¶s 39-61; Ex.2100 (Fisher Decl.), ¶s 73-75 (and 53-54, 64, 138, 151); Ex.2047, ¶s 45-51 (heavy diffusion cover to limit point source look due to LEDs and greater spacing of each color temperature LED) ¶s 32 (narrow form factor and cover causes thermal problems).

3. High CRI Together with Low Green Contrary to High Lumen Output and Efficiency: Going over 90 CRI along with low green deviation LEDs which has a substantial lumen loss and thus is contrary to trying to get efficiency and lumen output and is also contrary to thermal concerns if one needs more wattage per LED. Ex.2080, e.g., ¶s 22 & 78; Ex.2100, e.g., ¶85 (re significant adverse effects of more wattage). Putting a lot of wattage into the narrow tubular form factor LED luminaire having a diffusion cover, especially for dependent claims 10-11 and independent claim 16 at 16(k)(20 watts dissipated across only

one set of the LEDs at a time) and most especially for dependent **claims 12-13, 22 and 28-29** (“**at least 42 watts**” input for the cool white or the warm white LEDs).

Ex.2047, ¶s 52-54 (in a bicolor one needs to drive the LEDs of one color with twice the wattage of a single color to get the same lumen output). This raises the LED junction temperatures and so is a bad idea. Ex.2100, ¶85; Ex.2047, e.g., ¶s 31, 52-54; Ex.2083, p.13 (junction temperature design limit 80°C); Ex. 2086, p.19 (“The move from 75/75 to [just] 85/85 corresponds to an **acceleration factor of approximately 4X**” with substantial losses in color spectrum).

As explained by expert Fisher, who for many years formed and ran multiple companies that designed and sold lighting for TV and film set use, the claimed invention is a bad idea due to incurring the substantial losses and thus substantial inefficiency of current droop and thermal droop from increasing the p-n junction temperature. Ex.2100, ¶85; Ex.2047, ¶54.

4. **Thermal design issues with all elements of claim one including onboard LED driver:** These thermal issues are substantial and are covered in Section VIII above. The issues are greatly exacerbated when trying to design to make up for the high lumen losses of Section VII above. To a POSITA this direction would be very risky and a direction to be avoided in order to avoid damage to the LEDs.

5. The above four major steps by the inventor in the wrong direction compared with sound design principles show that it would not have been obvious to a POSITA to combine the proposed art of Grounds I or II into the luminaire of claim 1. *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed.Cir. 2019) (no motivation to combine where tradeoffs yielded an “unappetizing combination”).

B. No Reasonable Likelihood of Success to a POSITA

In addition to the above design principles creating four thorny trade-offs and pointing away from the invention, these design principles and thorny tradeoffs would result in a POSITA lacking a reasonable expectation of success in combining all the elements of the prior art into the “light system” of claim 1.

As Dr. Allen puts it:

105. In 2013, design of LED luminaires was focused on efficiency of lumen output and on achieving lumen output to try to match legacy luminaires such as fluorescent and metal halide discharge lamps. LED luminaire design was also at least somewhat unpredictable relative to the impact of the thermal management design and the ambient thermal environment of the application on luminaire maintenance of lumens and color shift, as well as lifetime; and in the photometric specifications of the LED and the resultant LED luminaire even when specified from a selected manufacturer's chromaticity bin.

Ex.2080, ¶104. Further, “cherry picking” is not the way a POSITA would design an LED luminaire in 2013 and not even now and would not expect success from that. *Id.*, ¶106. Dr. Allen concludes that the claimed invention would not have been obvious. *Id.*, ¶109.

C. Due to the Many Tradeoffs and Design Constraints a POSITA Would Not Be Pointed to the Claimed Invention

A more extensive list of design constraints involved in LED luminaire design that would point a POSITA away from the invention and create the thorny web of tradeoffs is provided along with the associated claim elements, by Expert Fisher. Ex. 2100, ¶177. Rather than go to the extreme of the invention, a POSITA had better options such as a single-color LED luminaire. *Id.*, ¶s 48-58. In addition, a POSITA looking for high CRI (above 90), e.g., to match existing Kino Flo fluorescent tubes, would have considered “remote phosphor” technology too. *Id.*, ¶68 (better thermally since phosphors are on the diffusion cover instead of the LEDs).

Around the Time of the Invention, Harry Box, an experienced gaffer, updated his handbook on set lighting. His experience and research underscores a POSITA's struggles designing an LED luminaire for the film industry:

[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....

Ex.2046 (Set Lighting Handbook) pp. 227-228; see p.211 (gel and blackwrap can cause fixtures to go off color). Moreover, this handbook recognizes the “harsh conditions” of set lighting and need for reliability. *Id.*, ¶208; Ex.2100, ¶s 61-62 and 80-81; Ex.2047, ¶s 29, 43-44. Under such conditions and in view of the difficult design constraints, need for reliability and maintaining accurate color, a POSITA would certainly design with a greater factor of safety in mind than consumer-level retrofit lighting such as in the references. Ex.2100, ¶s 63-64.

Expert Fisher, who holds 22 LED patents and a designer of LED lighting including a co-inventor on Pohlert (bicolor LED white panel) identifies at least ten competing design constraints in an LED luminaire design for film/TV productions. Ex.2100, ¶s 58-100.

As explained in the commercial success Section, XI.C., several companies moved away from the counterintuitive tube format for their LED lights and bicolor LED lights at the Time of the Invention.

D. Additional Challenges to a POSITA

1. Binning Practices in 2013 Presented Challenges to a POSITA

Petitioner refers to ANSI/NEMA binning standards but show a binning diagram from “Madpcb.” Ex.1003, ¶51 (diagram from Madpcb). But this is not an ANSI approved standard; moreover, it is from at least three years after the Time of

the Invention. Ex.2080, ¶s 70-73. Further, Petitioner's assertion of simply selecting from the "right half" of bin 573 for low green LEDs is not correct. Ex.2080, ¶72.

Petitioner's Declarant Holmes was IP counsel for Vitec Group (now Videndum, **an interested party to the Petition**). Ex.1003, ¶s 4-5 (refers to Vitec Group - current name is Videndum); see Petition, p.4 (**interested party Videndum**); Ex.2022 (name change).

2. Ducharme's High CRI Embodiment Is Only Theoretical

Petitioner cites Ducharme for high CRI. But Ducharme's embodiment, Fig. 16, with high CRI from a luminaire using just three LEDs is a fictional construct. Ex.2080, ¶s 94-104.

X. GROUND I AND II ALSO FAIL TO MAKE A PRIMA FACIE CASE AS THEY BOTH LACK ELEMENTS BEYOND THE 1000 LUMENS

Even assuming Petitioner has met the 1000 Lumen Minimum element of the '895 Patent claims, in Ground I, Kit is not a bicolor luminaire.

A. Kit lacks a bicolor luminaire

The Petition asserts that Kit has LEDs of various temperatures of white light, but Kit lacks any disclosure of a bicolor luminaire with cool white and with warm white LEDs. Petition, p.16 (just below diagram). The Petition does not assert that Kit teaches use of cool white with warm white. Kit only discloses that the LED lamp will produce in a certain color temperature:

an appropriate mix of LEDs [provide the] Luxeon

Lamps consistent color temperatures of 3200K (warm white), 4100K (commercial white) or 5500K (cool white).

Ex.1004, 3:33-36 (emphasis added). This is not bicolor. Kit uses the word “or” and nothing in his drawings or text refers to use of both cool white and warm white LEDs in the same luminaire. Rather, Kit is talking about matching LEDs to get a consistent color temperature output:

The solution to the **wide manufacturing tolerances** for achieving a **consistent color temperature** and intensity was to introduce **color-matched** white Luxeon Lamps....

Ex. 1004, 3:28-31 (emphasis added) see also, 3:53-56 (discussing efficiency of each color temperature lamp separately).

B. Modification of Kit by Ianiro and/or Ducharme As Proposed in the Petition Would Still Not Be a Bicolor Tubular Luminaire As Required By Claim 1

The Petition argues that Ianiro and Ducharme teach use of LEDs for the film industry, and that Kit would be modified to have a high CRI for such use. Petition, pp.18-20. But modifying kit by Ducharme, even assuming Ducharme teaches a bicolor luminaire, would not make sense because Kit is all about efficiency. Ex.1004, Abstract (“[a]n energy saving device....”) and 13:34-38 (reducing electrical cost). But bicolor as in claim 1 would reduce efficiency substantially due to the lumen losses from thermal and current droop explained above.

C. Kit, Ducharme and other cited references are drop-in replacements/retrofits

While Ducharme mentions the film industry, his luminaire, Kit's, Hasnain's and other luminaires are drop-in replacements for fluorescent tubes. E.g., Ex.1004, Abstract; Ex.1005, Abstract. But a drop-in replacement using an existing fluorescent ballast is unreliable and unsuited for the film industry, as would be known to a POSITA. Ex.2094 (Finn Decl.), ¶s 20-31; Ex.2100, ¶s 79, 103. And rewiring troffers to bypass ballasts is not a practical option. Ex.2094 (Finn Decl.), ¶s 32-35; Ex.2041, ¶28.

D. Independent Claims 16 and 23

Independent claims 16 and 23 have at least the same elements of claim 1 as follows:

Claim 16	Claim 1
16[b] and 16[c]	1[b] and 1[c]
16[d]	1[d]
16[e]	1[e]
16[f]	1[f]
16[g], 16[h], and 16[i]	1[i] and 1[j]

Claim 23	Claim 1
-----------------	----------------

123[b] and 23[c]	1[b] and 1[c]
23[d]	1[d]
23[h]	1[f]
23[e], 23[f] and 23[i]	1[i] and 1[j]

E. The 42-Watts -- Claims 12-13, 22, 28-29

For claims 12-13, 22 and 28-29 reciting 42 watts of input power, the tradeoffs and design constraints would be even more discouraging to a POSITA, as is evident from the above. Applying 42 watts to the luminaire, and to only some of the LEDs, is extreme. A POSITA would not go there. See Sections XII.B.-C., VII.C.-D. and VIII.B.

**XI. SECONDARY CONSIDERATIONS EMPHASIZE
NONOBVIOUSNESS**

Secondary considerations include whether the claimed invention has been commercially successful, whether it solved a long-felt but unsolved need in the art, and whether the relevant industry praised it. See *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18, 86 S. Ct. 684, 15 L. Ed. 2d 545 (1966). To be relevant, such a secondary consideration must have a “legally and factually sufficient connection” (nexus) to the claimed invention. *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed.Cir. 2019).

A. NEXUS

If a patentee shows that asserted evidence is tied to a specific product and that product "is the invention disclosed and claimed," there is a rebuttable presumption of nexus. *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392 (Fed.Cir. 1988). That is, presuming nexus is appropriate "when the patentee shows that the asserted objective evidence is tied to a specific product and that product 'embodies the claimed features, and is coextensive with them.'" *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1072 (Fed.Cir. 2018) (quoting *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1130 (Fed.Cir. 2000)).

A nexus analysis need not be limited to a discussion of only novel features. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1330 (Fed.Cir. 2016) ("proof of nexus is not limited to only when objective evidence is tied to the supposedly 'new' feature(s)"). It is instead important to consider "the invention as a whole," rather than on a "limitation-by-limitation" basis. *Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, 4 F.4th 1370, 1377 (Fed.Cir. 2021).

1. Colt's Bicolor LED Tubes Are Co-Extensive with the Claimed Invention

Colt's Bicolor LED Tubes are co-extensive with the claims and therefore entitled to a presumption of nexus. *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed.Cir. 2019).

Colt's Bicolor LED Tube embodies '895 Patent claim 1. Ex.2051 (Hoffman Decl.), ¶5; Ex.2053 (Claim Chart '895 Patent vs Colt Bicolor) and exhibits cited therein; Ex.2068, ¶39. Therefore, nexus is presumed, and "the burden shifts to the party asserting obviousness to present evidence to rebut the presumed nexus." *Fox Factory*, 944 F.3d at 1373.

The combination of novel and nonobvious elements (listed in Section VI.A. above) are key features of the invention as is clear from the declaration evidence: Ex.2041, ¶s 14, 20-22; Ex.2066, ¶s 10-11; Ex.2067, ¶s 12-14; Ex.2068, ¶s 10, 19. Colt's website markets the photometrics and specifications:

FIG. 1 LUMINAIRE

Test Summary					
Distance (ft)	Color Settings	CCT	CRI	Lux	FC
4	D	5796	94.5	597	55.46
8				165.91	15.41
12				74.71	6.94
16				42.56	3.95
4	T	3107	96.6	554	51.47
8				154.11	14.32
12				69.51	6.46
16				39.51	3.67

Ex.2077 (Lumen and Colormetrics Report), bottom p.2: Ex.2072 (ColtLED Home Page)(touting low green and high CRI, and attendant no need for gels).

2. Quasar's S-Switch and Crossfade Models Bicolor LED Tubes Also Are Co-Extensive

Old Quasar's S-Switch lights are also co-extensive or nearly co-extensive with the claims and therefore patent owner is entitled to a presumption of nexus for this product too. There is no doubt that the Old Quasar bicolor tube ("S-Switch")

has all of the claimed features. Ex.2051 (Hoffman Decl.), ¶12; Ex.2059 (Claim Chart '895 Patent vs Quasar S-Switch) and exhibits cited therein; Ex.2065 (Claim Chart '895 Patent vs Quasar Crossfade and Crossfade X) and exhibits cited therein.

In fact, the Quasar S-Switch was created by copying Colt's Bicolor LED Tubes. (See subsection D, below)

The claim charts show that the S-Switch products match at least claims 1, 3, 6, 8-9 and 12-13. Ex.2059. Claim charts show a match for the Crossfades as well. Ex.2065 (claims e.g., 1, 6, 8-9 and 12-13).

Moreover, marketing materials for Petitioner QUASAR's predecessor Old Quasar's S-Switch models promote patented features which are novel and recited in the claims. The novel combination of the '895 Patent includes the above-listed elements. Old Quasar's marketing materials promote the S-Switch models with a combination of warm LEDs and cool LEDs in a tubular luminaire, switchable between a 3000K (warm) setting and a 5600K (cool) setting (Ex.2032, PDF2-3) and the emitted light having "the highest lumens per watt" along with a "CRI of 95+ with 0CC (no Magenta or Green spikes)" for "photography and cinematography." Ex.2032 (Old QuasarScience.com marketing excerpts), PDF8. These are the elements 1[b]-1[g] and 1[j](i)-(iii). The "tubular" device is formed by the housing and diffusion cover and thus 1[e]-1[f] are met, as shown in the claim charts. Ex.2059, e.g., PDF6. Petitioner QUASAR does not appear to publicly

market S-Switch models anymore, but it continues to market its

Crossfade/Crossfade X bicolor tubes which have the same corresponding novel and highly desirable elements of claim 1 (and others) as the S-Switch models have. See Ex.2033 (Petitioner QuasarScience.com Marketing Excerpts), PDF2-3 and Ex.2036, ¶8 (showing same features as S-Switch was marketed as having), which further supports the importance and desirability of these elements. Exs.2059, 2065.

Several third parties selling and/or renting Quasar's bicolor LED luminaires prominently market this same novel combination. Exs.2034 to 2038; Ex.2036, ¶s 9-10. The "Movie Men Web Marketing" page is representative. Ex. 2034, PDF3, promoting: "90 lumens per watt," "color temperature from Tungsten 2000K to Daylight 6000K," "CRI of 95+ and no green or magenta spike" for an "LED replacement for a T12."

Accordingly, Quasar's S-Switch and Crossfade/Crossfade X products are co-extensive with the claims and Colt is entitled to a presumption of nexus.

3. Colt Has Shown a Nexus Between Commercial Success and the Claimed Invention

Even if, for purposes of argument, Colt has not shown that the products are co-extensive with the claimed invention, nexus is still present. As shown above with regard to the marketing materials and the declaration evidence, the features that are marketed and desirable are those of the claimed invention and Quasar's S-Switch and Crossfade models, especially 1[j](i)-(iii): brightness/lumen output, low

green and high CRI (above 90), along with 1[b]-1[d] that the light has warm and cool LEDs and is switchable to emit warm or cool light.

B. Long Felt But Unsolved Need and Significant Time From the 2003 Bicolor to 2013

Prior to the Time of the Invention, the film/TV lighting industry had known about limiting green and had gels to remove as little as 3.5 CC green. Ex.2122 (1993 Handbook Excerpts), p.102 (Table 3.17 shows “minus-green” correction gels; and first paragraph: “Minus-green gel comes in rolls.” And second paragraph: “Once the green is removed....” And third paragraph: “Gels are expensive.”)

LED luminaires, even a single-color tube luminaire, were no different in that regard as MacTech LED's tube only had only one color temperature LEDs and had a lot of green hues according to gaffers that were renting tubes. It had to be gelled and/or changed out just like fluorescents. Ex.2066, ¶8.

Paramount had several employees in the set lighting department working to change out color temperature fluorescent tubes and to add gels or remove them from Kino Flo tubes. Mr. Macias saw “six Paramount employees changing out hundreds of fluorescent tubes working on a long table to swap out one Kino Flo tube of one-color temperature for another Kino Flo tube of another color temperature and they explained that they did this all day as scene changes required.” Ex.2068, ¶4; Ex.2066, ¶7 (last sentence).

Paramount's set lighting manager Silva also explained that this cumbersome

gelling and fluorescent tube switching process was quite a significant problem often involving a hundred tubes or more at a time. Ex.2066, ¶7 (describing gelling/ungelling and swapping out tubes which “was and had been a significant problem given the number of tubes used on set, often a hundred or more.”)

C. Others Attempted and/or Considered a Tube Format But Did Not See a Path to Success

1. Litepanels failed to see a path to success

In and around 2010, a well-known and innovative, Emmy Award winning entertainment industry lighting company, Litepanels, considered making a bicolor LED tubular light, but considered it unworkable and unlikely to succeed. Ex.2047, ¶12 (co-inventor of LED lighting panels and Emmy-Award), ¶s 20-28, especially ¶27 (“...it was my firm conclusion that combining the components into an integrated LED Core Tube System would likely fail under the demanding conditions seen in film and television lighting industry....”). Ex.2047, ¶27; Ex.2100, ¶s 133-149.

Litepanels had invented a bicolor LED panel light and filed a patent application on it in 2002. Ex.2012 (Pohlert), e.g., Abstract; Ex.2100, ¶s 7, 14-15, 140 (Litepanels bicolor panel light and awards). Pohlert's application was published in 2003, ten years before the Time of the Invention (May 2013). Ex. 2012, cover; Ex.2003 (Great Grandparent, '642 Patent).

The length of time, about ten years, between Pohlert's publication of a

bicolor panel light for commercial image recording and the Time of the Invention is itself an indicator of nonobviousness. *Arkie Lures, Inc. v. Gene Larew Tackle, Inc.*, 119 F.3d 953, 957-58 (Fed.Cir. 1997) (About nine years from key 1972 publications to the filing date of subject patent on a salty fishing lure); Ex.2117 (U.S. 4,530,179 Larew), cover (filed in 1981). Moreover, Ducharme was published in 2006. Ex.1005, cover. And, Petitioner admits that the “fluorescent tube form factor in the image recording industry ... was well-known for years before the ‘895 Patent. Ex.1003, ¶302.

2. Kino Flo, long-time film and TV fluorescent lighting tube manufacturer also bypassed the fluorescent form factor when it moved into LED lighting

Kino Flo was the top fluorescent lighting company for studio and TV image recording. Ex.2100, ¶s 10 and 96 (25 years industry leader/innovator). In the late 80s, Kino Flo created special phosphors to eliminate green and magenta deviation. Ex.2046, p.208 (“Kino Flo Lamps and Ballasts” – 1st two paragraphs). In 2012, just before the Time of the Invention, when it came to transitioning to LED lighting, Kino Flo chose a panel light form factor, not a linear tube: “the Celeb® 200 DMX LED, [which] **was a large flat panel light (no tubes)**. Ex.2047, ¶77; also, Ex.2049 (KinoFlo.com’s Celeb® 200 DMX LED fixture 2012); Ex.2048 (Kino Flo’s “Diva-Lite® May 2012 Wayback”). Kino Flo had decades of fluorescent tubes, such as its Diva-Lite® yet Kino Flo’s foray into LED was with a panel, the Celeb

200. *Id.* Kino Flo was an innovator in the field of lighting. Ex.2100, ¶96; Ex.2119 (1992 EP patent application by Kino Flo founders Hochheim and Swink); Ex.2120 (2013 Kino Flo patent, co-inventor Hochheim, on an LED light to maintain fluorescent color temperature to avoid too much green in filming).

3. Others, including Arri and MacTech avoided tubes and used panels for bicolor LED lights

Others in the field including Arri and MacTech introduced panel lights for bicolor LED lights and avoided tubes. Ex.2100, ¶126, 127-132 (Like Kino Flo had done, **MacTech and Arri** introduced **bicolor panel lights** in or about **2015**; not in tube format.) MacTech had a single-color LED tube but not bicolor. Ex.2066, ¶8. Thus, three innovative, leading studio lighting companies went away from and skipped over a bicolor LED tube in near and even two years after the Time of the Invention and after Colt's introduction of its Bicolor LED Tubes.

4. BBS Lighting went to remote phosphor technology

BBS Lighting, yet another innovative lighting company, created only a single-color LED tube light at the Time of the Invention, using remote phosphor technology. Ex.2100 (Fisher Decl.), ¶s 123-125, 133.

5. Petitioner Quasar's predecessor, Old Quasar, tried and failed

Old Quasar also considered and tried to make bicolor LED tube lights but encountered difficulty:

Q ... did he ever bring any products to you to -- to take apart

and copy?

A. In the beginning he only instructed us with some simple target. And then we created the product according to his instruction, **but he was not satisfied with that. And following that he sent us some** [pictures of Colt's product].

Ex.2079, P.21, Ls.7-19, P.14, L.10 - p.16, L.10 (emphasis added) and manufacturer's text messages with **photos of Colt's product at PDF 94-95.**

D. Old Quasar Copied The S-Switch Bicolor Tube

“[A]lthough copying is not alone dispositive of nonobviousness, we have usually considered a determination of copying to be "strong evidence of nonobviousness." *Panduit Corp. v. Dennison Mfg. Co.*, 774 F.2d 1082, 1099 (Fed.Cir. 1985), *cert. granted*, judgment vacated on other grounds, 475 U.S. 809 (1986).” The Federal Circuit has maintained that copying is “often...the **most probative and cogent evidence** of nonobviousness." *Advanced Display Sys. v. Kent State Univ.*, 212 F.3d 1272, 1285 (Fed.Cir. 2000)(emphasis added).

As shown in the immediately prior section (C.5.), Petitioner's predecessor Old Quasar tried to make a bicolor LED tube, but it could not make a good one. Ex.2079, P.21,Ls.7-19, P.14,L.10 - p.16,L.10 (emphasis added) and see **photos of Colt's product at PDF 94-95.**

1. Old Quasar obtained Colt's Bicolor from Paramount

That Old Quasar, through one of its principals, Mr. Ray Gonzalez, obtained

some of Colt's Bicolor LED Tubes in 2013 from Paramount by asking to borrow them (but never returning them) is confirmed by Mr. Silva. Ex.2066, ¶s15-18. In 2013, Ray Gonzalez "borrowed" some of Colt's Bicolor LED Tubes stating the purpose was to show some clients to potential rent the tubes from Paramount and he said he would return them in about a week. Id. ¶15. But he never returned the tubes. ¶17. Mr. Silva later learned that Ray Gonzalez was a cofounder of Old Quasar. Ex.2066, ¶18.

2. Old Quasar Copied Colt's Bicolor

Principals of Old Quasar gave the product samples they borrowed from Paramount to their manufacturer Laysion (Mr. Zhang) and instructed him to copy it. Ex.2039, ¶s 1-4; Ex.2068, ¶s 22-28; Ex.2079 (quoted below).

The Zhang Declaration shows that principals of Old QUASAR (including Mr. Andy Lau and Mr. Ray Gonzalez) brought COLT's product to Laysion, Mr. Zhang's company, to copy and he did copy it:

1. I am the owner of Laysion.... My company designs and manufactures LED lights....
2. In approximately **2013**, I met a man I know as **Ray Gonzalez**, who is associated with a company known as Quasar Science. He was with ... **Andy Lau**... with Quasar....
3. **Mr. Gonzalez** had a lighting tube **T-12 bi-color with the name Colt**
4. Mr. Gonzalez 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, ¶s 1-4; Ex.2068, ¶s 24, 26-28 (Zhang's oral admissions verifying Zhang Decl.); Ex.2079 (Zhang Depo Transcript), PDF 94-95.

That Zhang copied Colt's Bicolor LED Tubular Light for Old Quasar is well supported by his 2018 deposition testimony admitting receiving Colt's product from Old Quasar's principal and being instructed to copy it:

[Transcript, p.14:L.10-p.16:L.10]

Q. ... so you produced product for Mr. Lau for a while?

A. (In English) You mean Andy?

Q. Yes.

A. (In English) Andy? Yes.

* * *

Q. ... do you recall what the pictures included?

A. ... A lighting tube.

Q. Then, you ... got a sample from ... Andy Lau?

A. Yes.

* * *

Q Okay. Can you describe what parts ... you took apart?

A There is a switch that you turn on/off.

Q On/off?

A Not on/off. Switch for color switching.

Q Color of the lights?

A Correct.

* * *

[Transcript, p.17:Ls.23-25]

Q. What range of time did you make lighting tubes for Quasar Science?

A. (In English) 2013 to 2017.

* * *

[Transcript, p.21:L.20–p.23:L.17]

Q Let me hand you what we call Exhibit 3... And 4....

* * *

[Transcript, p.22:Ls.3-25]

THE WITNESS: This is the chatting record between our company's general manager and Alex – Alex Su, S-U.

BY MR. CUNNINGHAM:

Q And I see that --

A This is the input right here. This is the sample we got at the time.

* * *

Q And I see the word "Colt LED" in the chat message immediately below the photos on Exhibit 3.

A ...You mean this one, "Colt LED"?

Q Yes. Can you read what that chat message says right there?

A "Is this Colt LED product"?

* * *

[Transcript, p.23]

BY MR. CUNNINGHAM:

Q And you're referring to Exhibit 3; correct?

A Yes.

* * *

Q So the photo immediately above the chat message that says "Colt LED" in English is the sample that you received from Andy Lau; is that correct?

A Yes....

* * *

[Transcript, p.25:Ls.21-25]

Q. Okay. Did Andy Lau provide you and your company **more than one tube to take apart and copy?**

A. Yes

Ex. 2079, at p.14:L.10 - p.16:L.10; p.17:Ls.23-25; p.21:L.20 – p.23:L.17; p.22-23; and p.25:Ls.21-25 and Exhibits 3 and 4 thereto (showing **photos of Colt's Bicolor LED Tube Lights disassembled**) (Ex.2079, **PDF 94-95** - showing text messages with photos of Colt's product)(emphasis added); Ex.2068, ¶s 24, 26-28.

That the disassembled products in Exhibits 3-4 of the Zhang deposition transcript are Colt's 2013 switchable bicolor LED tube lights is confirmed by Mr. Macias. Ex.2068, ¶26 ("I know the LED lights shown in the above photos [in paragraph 25] were Colt's Bicolor LED Tubes because I recognize all of the following as from the 20 to 30 sample tubes that I gave to Paramount in 2013." And then paragraph 26 continues to set forth the elements Mr. Macias recognizes.)

That Mr. Andy Lau was with Old Quasar is confirmed by Mr. Zhang's deposition transcript. Ex.2079, p.71:Ls.8-12.

E. Colt's Bicolor LED Tubes Were a Commercial Success

1. Colt's Revenue

Colt's Bicolor LED Tube had total revenue of "about \$2,000,000" for its initial three-year period just renting the Colt Bicolor LED Tubes through Paramount. Ex.2068, ¶20. Then, due to competition from Quasar, Colt added sales efforts: "Actual sales of Colt's Bicolor LED Tubes to Wamco (a leading specialty lighting company) in less than a one-year period of 2017 totaled \$917,500. Ex.2071 ("Wamco Sales")." Ex.2068, ¶21. This brought "total revenue for Colt's Bicolor LED Tubes from 2014 to 2017 [to] **well over \$3,000,000.**" Ex.2068, ¶21. Colt sold this much without any appreciable marketing. Ex.2068, ¶18 (very little marketing and no website until 2016).

2. Quasar's Revenue:

For a similar period of time, late 2013 or early 2014 to 2018, Mr. Macias conservatively estimates Quasar's sales at **\$3.6 million.** Ex.2068, ¶s 29-33 (estimate in ¶33; ¶s 29-32 explain the basis of the estimate including, but not limited to, information gained from competitive quoting with Quasar and manufacturer Mr. Zhang).

Old Quasar's stated S-Switch sales (obtained in discovery in this IPR as relayed by Petitioner Quasar) provide total revenue in 2017 which number may be used to help assess the reasonableness of Mr. Macias's estimate. These sales and rentals add up to \$ [REDACTED] for S-Switch Models in 2017. Ex.2093 (Petitioner's

Interrog. Responses), see Tables pp. 11-13 (“3056S” Models at top half of charts).
Colt’s ‘924 and ‘642 Patents issued in the second half of 2017. Ex.2002, Ex.2003.
From the tables, Old Quasar stopped selling the S-Switch in 2018. But it started
selling a similar bicolor tube, the Crossfade (later Crossfade X), which also comes
within the claimed invention (Ex.2065-claim charts). Crossfade/Crossfade X (plus
S-Switch 2017) sales totaled \$ [REDACTED] (Ex.2093, charts in responses 4-5, pp.
11-13) just from 2017 to April 6, 2021 (about [REDACTED] dollars per year).

F. Colt’s Bicolor LED Tubes Experienced Other Indicia of Commercial Success

1. Colt’s Bicolor LED Tubes Were Quickly Accepted by Major Studios

Colt’s Bicolor LED Tubes Were an Instant Success. The light replaced the
25-year fluorescent tubes as standard. Paramount promptly purchased a substantial
number of Colt’s Bicolor LED Tubes) Ex.2067, ¶14; Ex.2068, ¶13 (“Paramount
purchased **approximately \$200,000 dollars’** worth of Colt’s Bicolor LED
Tubes.”); Ex.2066, ¶13 (“While I have noticed over the years that gaffers are
resistant to change lighting, almost immediately the VH1/CBS show “Hit The
Floor” rented many of Colt’s Bicolor LED Tube lights.”)

In that first 3 to 4 year period from introduction, many well-known shows
adopted Colt’s Bicolor LED Tubes including: “NCIS, NCIS-LA, Rizzoli & Isles,
Grace and Frankie, School of Rock, VEEP, Thundermans, Transformers and Bay

Watch.” Ex.2068, ¶20 (last 4 lines)(exemplary shows are in Ex.2070).

Paramount's set lighting manager Mr. Wonderlick describes Colt's Bicolor LED Tube's highly successful market penetration at Paramount:

Since introduction of Colt's Bicolor Tube light at Paramount, it has been used in **about 90% of all new productions that Paramount supplies**. This equates to about 18 of the 20 new productions per year.

Ex.2067, ¶14. Moreover, Paramount supplies productions beyond its own studios.

Other “Big 6” (now “Big 5”) studios went to Paramount to rent Colt's Bicolor LED Tubes too. Mr. Macias describes this early (about 2014-2016) success with other studios as follows:

Paramount sub-rented Colt's Bicolor LED Tubes to such large and well-known Big 5/Big 6 studios as NBC/Universal, Fox, Sony and Warner Bros. Other relatively large studios also sub-rented Colt's Bicolor LED Tubes from Paramount such as CBS, MBS (Manhattan Beach Studios), Sunset Gower, Insight and Quixote.

Ex.2068, ¶20.

2. Colt's Bicolor LED Tubes Had a Significant Price Differential over Existing Lights at the Time of the Invention, and Maintained That Differential for Years

Upon introduction, Colt's Bicolor LED Tubes rented for significantly more than the rental price of Kino Flo fluorescent tubes:

[W]hen Colt's Bicolor LED was first introduced Paramount charged twice for rental of Colt's Bicolor LEDs as for fluorescent tubes and our customers were happy to pay that.

Ex.2066, ¶12. Ex.2068, ¶38. Colt's tubes at retail are about **ten times** as much as Kino Flo's fluorescent tubes. Colt's Bicolor LED Tubes in four-foot size retailed for \$250 while Kino Flo's were about \$23 per tube. Ex.2068, ¶37; Ex.2076.

3. Colt's Bicolor LED Tubes obtained and the bicolor tubes (Colt's Bicolor and Quasar's Bicolor Models) have a large/substantial market share

"Colt's Bicolor Tube light has completely replaced fluorescent tube lights as the standard at Paramount." Ex.2067, ¶16. Long time gaffer/chief lighting technician Mr. Csernecky's experience reinforces the market share:

More than half of all productions that I have worked on or seen over the past seven to eight years or so have used Colt's Bicolor T12 Tubes (or Quasar Science's bicolor T12 tubes having all the same above-listed features in paragraph 14)....Over the last two to three years, **almost every production that I have worked on has used one of Colt's or other (Quasar's) bicolor LED lighting tubes.**

Ex.2041, ¶18.

XII. WATTAGE CLAIMS 10-13, 16, 22, 28-29

A. Dependent Claims 10-11 and Claim 16[k]

Dependent claim 10 recites that 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.

Accordingly, the first LEDs are driven with at least 20 watts. Since the driver can drive Warm White LEDs or Cool White LEDs, this puts at least about twice as much drive current through one set of LEDs or the other as compared with a single-color LED tube, e.g., as taught by Kit. See Sections VII and VIII above. Accordingly, creates more thermal droop and more current droop, as the drive current of each LED being driven is roughly equivalent to putting 40 watts and using all the LEDs. See, Ex.2100, ¶85; Ex.2047, e.g., ¶s 31, 52-54; Ex.2083, p.13. Accordingly, the reasons that a POSITA would not go in this direction of Sections VII (e.g., VIII.C.-D.), VIII (e.g., B.) and IX above apply to claim 10.

Hasnain's teachings, as explained above, apply to all of the LEDs being provided with 0.5 watt to 1.0 watt per square inch. Moreover, as discussed above, Hasnain's teaching only apply to a coverless LED device.

Hasnain also teaches complex heat sink structure that well-exceed a T12 format and still does not have a cover. See, e.g., Section VIII.B.-D. above.

Claim 11 is similar to dependent claim 10 and thus patentable for the same

reasons as claim 10. Independent claim 16 recites this 20-watt input for each color temperature and is patentable for the same reasons. Ex.1001, claim 16, element (k).

B. Dependent Claims 12-13, 22 and 28-29

Dependent claim 12 recites:

12. The LED light system of claim 1, further comprising a power supply configured to provide **at least 42 watts**, 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”**].

Ex.1001, claim 12 (emphasis added). In addition to Claim 12, Claims 13, 22 and 28-29 also recite the same “at least 42 watts.”

For the same reasons as discussed above with respect to claims 10-11, these claims are also patentable. Moreover, the wattage in these 42-watt claims is even more diametrically opposed to sound design principles at the Time of the Invention for a T12 (1.5” diameter) or narrower LED luminaire. It would require “extreme measures” according to Dr. Allen. Ex.2080, ¶66 (and support ¶s 63-69); Ex.2100, ¶s 186-192.

Petitioner has no support for anywhere near this input wattage.

C. The Alleged Input Wattages of Petitioner Are Conclusory

1. Kit's Mention of Cree's 28 Watts

Petitioner asserts that Kit teaches a 20-watt input, a 28-watt Cree LED light driving LEDs:

Kit teaches the LEDs can be driven with at least 20 watts. Ex. 1003 at ¶¶ 175, 183, 186, 192. In one embodiment, Kit discloses an LED lamp driven at 28-watts (using a Cree LED light). Ex. 1004 at 6:24–40, 4:10–5:4, 12:22–33 (discussing 80-watt LEDs).

Petition, p.37 (middle). But each of these two examples in Kit is inapplicable to the claimed bicolor LED.

First, Kit's disclosure of 28 watts is for a lamp by Cree. Ex.1004, 6:25-27. But there are no details of this lamp, other than that it is a "4-foot LED retrofit lamp" and Kit appears to be guessing that it "**should** consume about 28-watts." *Id.*, Moreover, since there is no evidence of how this lamp is constructed, e.g., whether it has a cover and/or any on-board driver or power supply or other circuitry, there is no basis to compare this potential "28-watt" lamp with the claimed invention. Further, there is no evidence of the type of LEDs used in this lamp, for example, they may not be broad-spectrum phosphor LEDs and thus may have substantially higher heat resistance, and low CRI and/or green deviation.

It is also important to note, as explained above, Kit is not a bicolor LED. Section X.A. As also explained above, even if for purposes of argument one were to use 28 watts for a luminaire, there is no disclosure of applying that full wattage to only Warm White LEDs or only Cool White LEDs in a bicolor white luminaire, as such would at least double the drive current per LED compared to application to

all LEDs in the full luminaire. And that, as explained above, would exacerbate current droop and thermal droop.

2. The Petition's Reference to Katzir does not support 20 or 28 watts

Katzir is a “lighting assembly [that] can replace a fluorescent tube light while providing a more comfortable and steady light source, **consuming less power** and with enhanced longevity.” Ex.1006, Abstract (emphasis added). Katzir is producing a “lighting assembly ... to consume ... **14 watts**” Ex.1006, [0026] (emphasis added). Katzir would not use the level of wattage claimed. Ex.2080, ¶s 81-85.

3. Kit's Mention of the GE 80-Watt OLED Panel Is Irrelevant

Petitioner asserts that Kit teaches an 80-watt OLED panel but any comparison to the claimed tubular luminaire is apples to oranges. Holmes asserts that the 80-watt input is for a “**24-square-inch** OLED panel.” Ex.1003, ¶175 (emphasis added); Ex.1004 (Kit), 12:22-33. But this is incorrect. The GE panel was a twenty-four inch square, i.e., **576 square inches**. See, Ex.2082 (GE Global Research OLED); Ex.2080 (Dr. Allen Decl.), ¶90 (“GE publication (Exhibit 2082) clearly identifies it as a “**24-inch by 24-inch panel**”)(emphasis added).

Accordingly, the GE OLED had **576 square inches** of surface area for thermal management. *Id.*, ¶s 90-93. Dr. Allen adds that he worked on GE's experimental OLED panels, and they were experimental and uncovered. *Id.*, ¶89. Dr. Allen

further notes that GE used “extreme measures to manage the heat load.” *Id.*, ¶90.

Accordingly, there is only speculation and conclusory allegations in the Petition with respect to the 42-watt input.

4. Reference to Hasnain Is Irrelevant

Petitioner also, as discussed above, has relied on Hasnain for heat dissipation assertions. However, as also explained above in e.g., Sections VIII.A.-C., Hasnain is inapplicable, because it has no cover. *Id.* Further, due to the size of Hasnain's heat sink in his extreme embodiment of Figs. 4-5, Hasnain is no longer a T8 or T12 size. Ex.1008, Figs. 4-5; Ex.2080, ¶66 (part of troffer).

XIII. CONCLUSION

The Petition's asserted 35 U.S.C. §103 combinations of prior art in Grounds 1 and 2 would not have been obvious to a POSITA at the time of the invention without the benefit of impermissible hindsight as explained above. Therefore, confirmation of patentability of all claims is respectfully requested.

Dated: February 8, 2024

Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing **PATENT OWNER'S RESPONSE** was served on February 8, 2024, via email directed to counsel of record for Petitioner at the following:

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**CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME
REQUIREMENTS UNDER 37 C.F.R. § 42.24**

Under 37 C.F.R. § 42.24(d), the undersigned certifies that the PATENT OWNER'S RESPONSE complies with the type-volume requirements of 37 C.F.R. § 42.24(b)(2) because it contains fewer than 14,000 words excluding the parts of the Patent Owner Response exempted by 37 C.F.R. § 42.24(a), (b).

This Patent Owner Response also complies with the typeface requirements of 37 C.F.R. § 42.6(a)(2)(ii) and the type style requirements of 37 C.F.R. § 42.6(a)(2)(iii) and (iv).

Dated: February 8, 2024

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