

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 KEVIN BAXTER

I. INTRODUCTION

1. My name is Kevin Baxter. I am making this declaration at the request of Colt LED in IPR2023-00613 and -00614, involving Patent Owner Colt International Clothing, Inc. D/B/A Colt LED (“Colt” or “Patent Owner”) brought by Petitioner Quasar Science LLC (“Quasar” or “Petitioner”) regarding U.S. Patent Nos. 10,411,582 and 10,566,895 (“the ‘582 and ‘895 Patents”)

2. I am being compensated for my work in this matter at the rate of \$200/hour. My compensation is not contingent on the outcome of this matter or the specifics of my testimony.

3. In this declaration, I have been asked to provide my expert opinions and factual experiences and insights regarding the viability of creating LED-based tubular lighting systems intended for the film and television lighting industry in and around the priority date of the ‘582 Patent.

II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE

4. My complete qualifications and professional experience are described in my Curriculum Vitae, a copy of which is submitted as **Appendix A**. The following is a brief summary of my relevant qualifications and professional experience.

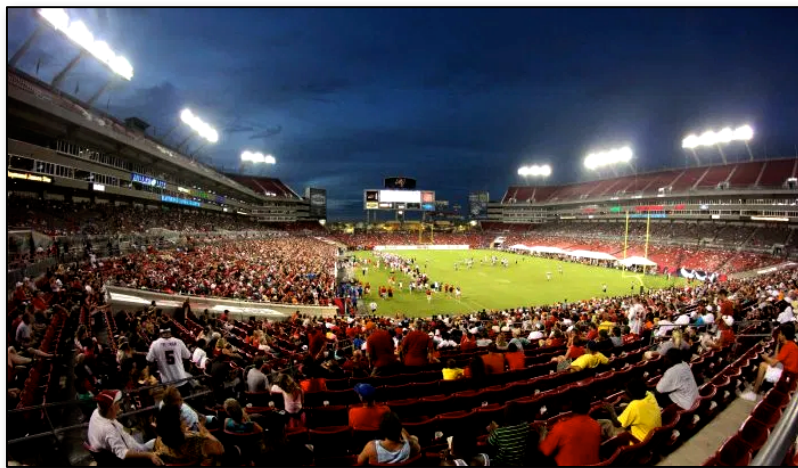
5. As shown in my curriculum vitae, I am an expert in the research, development, and engineering of LED lighting systems. My experience centers on lighting systems suitable for the film, television, and video production industry.

6. I am the former Vice President of Innovation for R Zero, a biosafety company utilizing Light Emitting Diode technology. Prior to that, I was the CTO and co-founder of Lumen Labs, LLC (which R Zero acquired in 2022).

7. I received two years training in engineering from Oklahoma State University. I received my B.S. degree in Photographic Illustration, with a minor in Color Technology in 1981 from Brooks Institute of Technology. I also have more 10 than years' experience as a professional photographer.

8. From 2014 to 2020, I co-founded and served as the Chairman of SportsBeams Lighting, Inc. During my time at SportsBeams, I co-designed and co-engineered a series of high-power LEDs for use in lighting broadcast stadiums and arenas.

9. In 2021, SportsBeams™ provided the LED broadcast lighting for the NFL Superbowl via a permanent LED lighting installation of 720 high-powered LED broadcast fixtures totaling over one-half of a million watts of LED at the Raymond James Stadium in Tampa Bay Florida, as shown below (and attached as Appendix B):



2021 Super Bowl

10. From 1990 to 2004, I was employed by Fisher Productions, Inc. as the Head of Research and Development. The company designed and manufactured specialized lines of lighting equipment specifically for the film and television industry. My duties also included being Head of Manufacturing.

11. From 2002 to 2014, I co-founded and served in various technical positions at Litepanels—a company producing LED-based lighting technology for the film and television industries. During my time at the company, I managed research, development, and engineering of more than one dozen different LED-based film/TV lighting products.

12. As a co-founder and co-inventor of the Litepanels LED lighting systems, I have been awarded three separate Prime Time Emmy® Awards for technical achievements in LED lighting systems.

13. In addition, I also have many years of film/TV set lighting experience—both as professional photographer, as well as set lighting technician as part of my work with Fisher Productions.

14. I am a named inventor on over 38 US patents relating to Light Emitting Diodes and/or film/television lighting as shown in the list attached to my Curriculum Vitae.

III. PERSON OF ORDINARY SKILL IN THE ART

15. My opinions in this declaration are based on the understandings of a person of ordinary skill in the art, which I understand is sometimes referred to as an “ordinary artisan” or by the acronym “**POSITA**” (person of ordinary skill in the art), as of the time of the invention. For the purposes of this Declaration, I have been informed to assume a date of invention of May 17, 2013. I understand that the person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention.

16. I have reviewed Petitioner’s definition of the POSITA, which is “[A] person of ordinary skill in the art relevant to the ’582 and ’895 Patents at the time of the invention would have had, at a minimum, a Bachelor of Science degree in electrical engineering,

or a closely related field, and two or more years of experience in the design of entertainment lighting systems, along with the design and use of LED lights.”

17. I have also reviewed Patent Holder’s definition of the POSITA, which is “[A] person of ordinary skill in the art relevant to the ’582 and ’895 Patents 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.”

18. It is my opinion that Patent Holder’s definition, including on-set lighting experience, more accurately reflects a POSITA at the Time of the Invention. For purposes of this Declaration, in general, and unless otherwise noted, my statements and opinions, such as those regarding my experience and the understanding of a POSITA generally reflect the knowledge that existed in the field as of May 17, 2013 (the “Time of the Invention”). Unless otherwise stated, when I provide my understanding and analysis below, it is consistent with the level of a POSITA as of that priority date.

19. My conclusions in this report regarding any motivations to combine; or apparent reasons to combine the prior art elements; as well as any reasonable expectations of success in combining the elements discussed herein would not change if I were to apply Petitioner’s or Patent Owner’s definitions of a POSITA. In this Declaration, I will also use the term “**Designer**” which shall have the same meaning as “POSITA”.

IV. LED-TUBULAR LIGHT FEASIBILITY ANALYSIS – CIRCA 2009/2010

20. During the 2009 to 2014 timeframe, I was the Chief Technical Officer (CTO) at Litepanels.

21. In and around 2009-2010, I evaluated the viability of creating four-foot LED tube lighting systems specifically intended for the film and television lighting industry (the “Evaluation”).

22. The Evaluation specifically covered designing LED “tubular” lighting fixtures, including the unique design challenges therein.

23. As a CTO with a focus on LED lighting technology, who actually assessed in 2009-2010 the viability [or non-viability] of LED tubular lighting systems in the film and TV industry, offers insights, that I believe, are indicative of the prevailing opinions and beliefs of typical lighting equipment designers (i.e., Designer/POSITA as defined above) working in the film/TV industry circa 2009 to 2013 (the “Time-Frame”). I believe the Evaluation results also apply beyond the Time-Frame—i.e., through 2013 and later.

24. The results of my Evaluation were as follows:

25. Litepanels, as an Emmy® Award winning developer of LED-based lighting systems for the film and television industry, had the technical capability to develop and manufacture a full range of 4ft. LED tube lights starting at least as early as 2009. More specifically, at the time of the Evaluation, Litepanels had the technical capability to build (1) single-color LED tube versions, e.g., single tubes with either 5600K cool white, or 3200K warm white LEDs (collectively “Single-Color” or “Mono-Color”); and (2) two-color models, e.g., single tubes containing both 5600K cool white and 3200K warm white LEDs (collectively “Bi-Color”)—but for the reasons stated below, I believe (at minimum) that pursuing the LED Core Tube System (as defined below) would have been **counter-intuitive** to Designers during the Time-Frame (including at the Time of the Invention).

26. As described in detail below, the core components of the 2009-2010 Evaluation included the following elements for combination (collectively the “LED Core Tube System”):

- (1) high-output LEDs w/integrated phosphors (and LED driver electronics);
- (2) single (narrow form factor) tube (T8 1” wide, or T12 1.5” wide);
- (3) diffusion cover; and
- (4) heat sink maintained within T8/T12 form factor (operating in a thermally challenging environment of film/television).

27. **Likelihood of Success: NO.** After finishing the Evaluation, 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—thereby creating financial liabilities, including a high risk of product recalls. So, I killed the idea of doing tubular LED lights.

28. I provide the rationale for my conclusion that attempting to design a Bi-Color LED tube for the film and television industry would fail, i.e., be unlikely to succeed, below.

Background

29. 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, as Light Emitting Diodes (LEDs) *unlike* their fluorescent and tungsten counterparts, are extremely sensitive to heat.

30. Thus, when employing LEDs for film and television lighting purposes, *highly* effective thermal management of the LED emitters is required.

31. 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. 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].

32. Proper thermal management becomes far *more* challenging 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 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.**

33. To achieve suitability during the Time-Frame, a Designer would have needed to understand the adverse working conditions typically seen in the film/TV lighting industry, and why the lighting equipment requirements in the film/TV industry is significantly different than those in the more conventional industries, including the traditional LED retrofit tube industry.

34. For example, the absence of substantial infrared (IR) radiation allows standalone single-tube LED fixtures in film/TV industry (like their fluorescent tube counterparts) to be positioned far closer to surfaces during filming as compared to conventional light sources such as [hot] tungsten lighting systems.

35. This means, for example, that 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.** 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.

36. Moreover, when single-tube lights 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 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).

37. Such abusive equipment conditions are common in the film/TV industry, as opposed to other typical (less demanding) applications such as tubular lights for consumer and office use.

38. Thus, in 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.

39. 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. See, e.g., Exhibit 2043

40. Consequently, traditional LED retrofit tubes typically function within manageable environments, such as being placed in a horizontal plane, installed with spacing away from ceiling surfaces to allow open-air circulation, and located within the controlled climates of air-conditioned homes and offices.

41. Despite these more advantageous operating conditions seen in the consumer and office retrofit industry, it was common knowledge that **traditional consumer LED retrofit bulbs were unreliable** during the Time-Frame—and that was my experience as well. Issues such as persistent flickering, shifts in color, and early failure were common. Given the substantial hourly costs associated with film and TV production, the likelihood of opting for consumer-level products known to be *unreliable* would be low or non-existent. An example of such unreliability, circa 2014, is provided below:

commentary



Are LED retrofits that work with existing ballasts a good idea?

My answer is that **I'm not so sure it's a good idea**, but I fully expect broader availability of LED-based tubes and lamps that work with existing fluorescent or high-intensity discharge (HID) ballasts. Line-powered LED replacement lamps including A-lamps will be the most broadly installed solid-state lighting (SSL) products in the near term — despite the fact that lighting experts will tell you that integral luminaires are superior in terms of aesthetics, light quality, efficiency, and reliability. **Lamps or tubes that work with an installed ballast are compromised to a greater degree in terms of reliability and efficiency.**

of the choice. The existing ballast does represent an additional point of failure. Proponents of the technology will tell you that state-of-the-art ballasts will last virtually as long as LED lamps, especially since the ballasts operate at far lower temperatures while supplying a lesser power load to LED lamps.

But what are the chances that the fixture, into which you install a new replacement lamp or tube, also has a state-of-the-art ballast? I'd say near zero. Had facility management upgraded a building's fluorescent lighting recently, for instance, they wouldn't already be considering an LED tube or lamp. More likely that existing ballast is five, ten, or

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LED tubes perceived as *unreliable* (Exhibit 2050, LED Magazine June 2014 pg. 4) (emphasis added)

42. Accordingly, any heat dissipation forecasts (e.g., dissipation of watt-seconds per square inch) garnered from the traditional consumer LED tube retrofit industry would most likely be and should be disregarded by a POSITA when designing for film and television, or at a minimum, be substantially discounted—e.g., by adding multiple factors of safety to the design—due to the far more thermally-challenging operating conditions seen in our industry.

43. 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.

44. 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).

45. Moreover, the LEDs and their supporting electronics are also encased in heavy diffusion covers used to properly blend the LED output to optically match their fluorescent counterparts.

46. But such diffusion covers significantly block airflow, which further exacerbates heat-induced problems experienced by the solid-state electronic components.

47. In addition, adding outer diffusion covers also reduces the lumen output of the combined system.

48. The thermal and optical issues mentioned above would have been **especially problematic for a Bi-Color version** of the LED Core Tube System for a POSITA at the Time of the Invention.

49. More specifically, a Bi-Color model inherently requires the 'sharing' of limited circuit board space with an equal distribution of warm-white and cool-white LEDs (as in a 50/50 split for the two different colors). By contrast, the Single-Color model provides the option to *completely* fill the circuit board space with just a one color of LEDs, whether it be 3200K or 5600K LEDs. Limiting the tube light to just a Single-Color LEDS provides system-wide benefits, including better thermal control, higher lumens, and improved color consistency.

50. The resulting benefits to a POSITA at the Time of the Invention are as follows:

51. First, the Single-Color model provided the Designer with a meaningful optical advantage. Lighting all LEDs simultaneously (vs. only 50% in the Bi-Color model) substantially diminishes the (uneven) "point-light" appearance of the individual LEDs. Consequently, the Single-Color model would need less diffusion to visually match fluorescent lights, thereby providing a **higher lumen output** relative to a Bi-Color option. This is because In the Bi-Color LED model, greater diffusion is necessary not only to create bright light but also because it operates with alternate LEDs turned on, resulting in wider gaps between the illuminated LEDs. This contrasts with the Single-Color LED model, where the same level of brightness can be attained with each LED producing only

half the lumens compared to the Bi-Color LEDs. Additionally, in the single-color model, the illuminated LEDs are spaced more closely together than in the bi-color model.

52. Second, for the same reasons, 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 LEDs.

53. 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).

54. 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.

55. 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.

56. 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.

57. Taking into account the overinflated lumen forecasts observed by manufacturers during the Time-Frame, in conjunction with the major thermal failure risks, and optical design issues related to the narrow circular tube form factor (particularly in the context of the Bi-Color model), meant that the Designer would have been discouraged from even attempting to develop the LED Core Tube System (i.e., no reasonable

expectation of success) due to the above-mentioned design problems, and especially due to the thermal issues and having to further compensate for the substantial reduction in lumen output of using only one half of the LEDs.

58. Thus, during the Time-Frame (including the Time of the Invention), I found that pursuing a LED Core Tube System, particularly in a Bi-Color model, was **counter-intuitive and I conclude that it was counter-intuitive to a POSITA** at the Time of the Invention.

59. Product warranty risks at the Time of the Invention would also have been a factor in a Designer's go/no-go decision because that would be indicative of a likely failure. I know if we (Litepanels) productized the LED Core Tube Systems, I envisioned major warranty expenses and damaging product recalls.

60. In other words, I judged the product failure risk (and attendant warranty risks) to be far *higher* than usual, given the problematic narrow form factor, combined with the thermal failure risks and optical issues mentioned above. The average POSITA would have viewed the failure risk as high and thus the attendant warranty risk factor very negatively, and such a negative assessment would have provided the POSITA with another reason not to pursue LED Core Tube Systems during the Time-Frame (including at the Time of the Invention), particularly in a Bi-Color model.

61. As mentioned herein, excessive heat can quickly render otherwise high CRI LEDs unsuitable for film/TV lighting. Excessive heat also alters (e.g., inconsistently varying) the brightness, color, and shifting the Kelvin color temperature and CRI of the LEDs. All of these factors create unpredictable light output, and thus unsuitability for film and television application.

62. Excessive heat risks would have been a further concern in the design and operation stages as a POSITA expecting high-quality lighting based on the CRI values advertised on datasheets often found themselves disappointed with the actual CRI color fidelity performance at the Time of the Invention. In other words, excess heat would have been perceived as making the already *unreliable* CRI rating claims made by manufacturers (explained below) go from **bad** to **worse** at the Time of the Invention.

63. 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 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.

64. 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).

65. As Chief Technical Officer of Litepanels, I was personally responsible for the CRI fidelity of the LEDs used in our lighting systems, and I was constantly frustrated with the disparity between the CRI values advertised and their actual performance—that I *personally* experienced—as Litepanels (and by extension, the POSITA) rarely got the CRI advertised during the Time-Frame.

66. 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.

67. 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.

68. 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. 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 components were

available from Internatix™ in “fixed” color temperatures like 3200 and 5600 Kelvin at the Time of the Invention.

69. In the context of the film/TV industry, a Designer tasked with creating a single-tube LED Core Tube System for challenging film/TV lighting scenarios would have been also aware during the Time-Frame that conventional approaches to thermal management was likely to fail—for instance, a design that overlooked the impact of air-obstructed heat sinks or usage in a thermally-challenging vertical orientation. Such a Designer would have recognized the need to incorporate significantly greater thermal “safety margins” (e.g., increased factors of safety) when designing for film/TV settings during the Time-Frame, so as to best-ensure that the LED-based lighting operates reliably, even under adverse conditions.

70. To establish light that is suitable to the specific demands of film and television production, which includes integrating higher thermal safety margins, it was common knowledge within our industry during the Time-Frame to (1) employ large heat sinks, (2) increase airflow across the circuit board, and (3) allow for increased spacing between LEDs. In fact, such strategies were *more than* common knowledge at the Time of the Invention due to the overly harsh operating conditions commonly encountered in Film/TV lighting. See, for example, the Set Lighting Technician’s Handbook (2013) at pg. 248: “*The balance a fixture designer can strike will also depend on the limitations posed by the spacing of emitters, the efficiency of the heat management. This is why **almost all LED devices have large heat sinks and fins.***” 4th edition, 2013 (emphasis added).

71. But 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.

72. 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.

Summary

73. For the reasons stated above, the idea of commercializing single-tube LED Core Tube Systems that combined (1) highly heat-sensitive high-output LEDs with onboard phosphors (including LED driver electronics); (2) problematically narrow form factors of T8 tubes (1" wide) or T12 tube (1.5" wide); (3) heat-trapping diffusion covers; (4) limited heat sinks, operating in the thermally-challenging environment of film and television lighting during the Time-Frame (2009-2013), would have been viewed as highly risky and likely to fail by a POSITA in the context of film/TV lighting.

74. This problematic mix of components in the LED Core Tube System—*especially* in the Bi-Color version—would have discouraged Designers from pursuing such a system during the Time-Frame. In fact, as the former CTO of Litepanels, I can tell you I thought it would fail during the Time-Frame (including at the Time of the Invention).

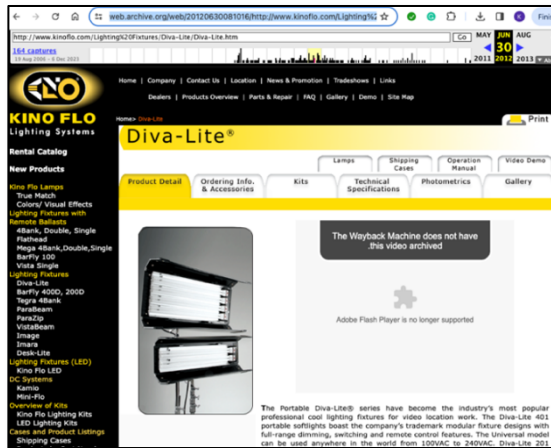
75. In our case, circa 2009-2010 (as well as the full Time-Frame), and for the reasons cited earlier, I concluded that merging the individual elements of the LED Core Tube System as elaborated earlier into commercial products tailored for film and

television lighting would not have been met with success—so therefore I had no desire or motivation to pursue such combination.

76. I also conclude that my strong skepticism towards such LED Core Tube Systems would have been the view of a POSITA/Designer at the time of the Colt invention. This conclusion is bolstered considering that, to my knowledge, no company across our industry worldwide had managed to create such systems between 2009 and 2013, or earlier. A Designer, at the Time of the Invention, would have viewed the LED Core Tube Systems as a “bad idea” for all of the reasons discussed above.

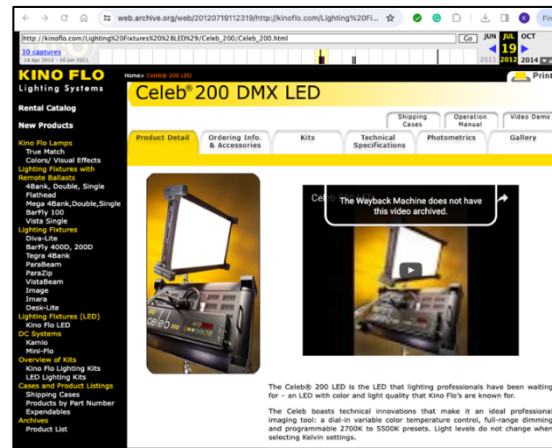
77. Instead, the intuitive move for a relevant Designer (POSITA) at the Time of the Invention would have been to abandon the tubular format and move to structural designs offering larger heatsinks and wider LED spacing, thereby reducing thermal loads and increasing the safety factors needed to achieve “suitability” for commercial image capture. That’s exactly what Kino Flo did in 2012 when transitioning from fluorescent-technology tubes into LED technology—they abandoned their 25+ year history of the narrow tubular format. Exhibit 2048 is a printout of the Wayback Machine/Internet Archive from KinoFlo.com’s website showing its Diva-Lite® fluorescent tube product. 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 flat panel light (no tubes). See Exhibit 2049 which is a printout of the Wayback Machine/Internet Archive from KinoFlo.com’s website showing its Celeb® 200 DMX LED fixture, as shown below:

2102 Fluorescent



From Ex. 2048 (using tubes)

2012 LED (abandoning the “tube” format)



From Ex. 2049 (LED- no tubes)

78. 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.

Bottomline

79. 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.

80. 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.

Epilogue

81. I have been informed that since 2013, Colt LED has successfully designed and commercialized a warm and cool white Bi-Color version of the LED Core Tube System to the film and TV market (including operating at or above 20 watts being input to one half of the LEDs at a time and producing over 1000 lumens in a four-foot T12 tube, with low green bias (under 5 points of green) and a CRI above 90.

82. These accomplishments, particularly for a T12 Bi-Color model, are surprising to me—as they contrast sharply with the outcomes that I had predicted during the Time-Frame. I foresaw only failure and financial burdens if we pursued such systems.

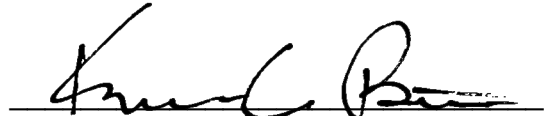
83. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or 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.

84. 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 following is true and correct.

Executed on February 3rd , 2024.



Kevin Baxter

APPENDIX A

Kevin C. Baxter - Curriculum Vitae - LED Lighting Expert

A technical innovator for over 40 years with expertise in LED lighting, photography, rocket sciences, and manufacturing. With well over 40 patents in various fields and disciplines

Work Experience

Vice President of Innovation	11/2022 to 8/2023
R Zero	Salt Lake City, UT
Continued IP of Lumen Labs after acquisition	

CTO/Founder	4/2020 to 11/2021
Lumen Labs, LLC.	Poway California
Designed safe Far UV lighting fixtures and all IP	

Founder/Chairman	7/2014 to 4/2020
SportsBeams Lighting, Inc.	Round Rock Texas
Designed the first single optic sports light	

Founder/CTO/Manufacturing	5/2005 to 7/2014
Litepanels, Inc.	Burbank California
Head of R&D	
CTO	
Head of Manufacturing	

Founder	9/2004 to 5/2005
ShotSpotter, Inc.	Mountain View California
Largest IP contributor to present	

CTO	1/1990 to 9/2004
Fisher Productions, Inc.	Los Angeles California
Head of R&D	
Head of Manufacturing	

Professional Photographer	11/1981 to 1/1990
Kevin Baxter	Tulsa Oklahoma

Education

Bachelor of Science	Photographic Illustration	Minor color Technology	
Brooks Institute	Santa Barbara California		10/1981
Oklahoma State University	Engineering		1978-1980
Mullsjö Folkensköllen	Mullsjö Sweden		
Phillips University	Enid Oklahoma		
Oklahoma University	Norman Oklahoma		

NAMED INVENTOR ON THE FOLLOWING PATENTS:

US-6545416	Portable HMI fixture with integral ballast
US-6809652	Xenon light fixture with integral ballast and remote control
US-6948823	Wide area lighting apparatus and effects system
US-7140742	Surface-mount semiconductor lighting apparatus
US-7163302	Camera-mounted semiconductor lighting apparatus
US-7318652	Versatile stand-mounted wide area lighting apparatus
US-7331681	Lighting apparatus with adjustable lenses or filters
US-7429117	Camera-mounted dimmable lighting apparatus
US-7510290	Stand-mounted light panel for natural illumination in film, television or video
US-7569996	Omni voltage direct current power supply
US-7604361	Versatile lighting apparatus and associated kit
US-7874701	Lighting apparatus with adjustable lenses or filters
US-7960920	Omni voltage direct current power supply
US-7972022	Stand-mounted light panel for natural illumination in film, television or video
US-8025417	Camera-mounted dimmable lighting apparatus
US-8299726	OMNI voltage direct current power supply
US-8506125	Lighting apparatus with adjustable lenses or filters
US-8540383	Flexible strip with light elements for providing illumination suitable for image capture
US-8702255	On-camera LED fresnel lighting system including active cooling
US-8882283	LED Fresnel lighting system including active cooling
US-9097957	Versatile lighting apparatus and associated kit
US-9341362	LED venue lighting system with first and second housing having an air passage therebetween
US-9588402	On-camera LED fresnel lighting system including active cooling
US-9752738	LED based searchlight/sky light
US-10006609	Plug compatible LED replacement for incandescent light
US-10317065	LED lighting system with forced air cooling
US-10359159	Liquid cooled venue light
US-10738967	Venue light including variable LED array size etched lens and segmented reflector
US-10738990	Single optic LED venue lighting fixture
US-11313726	Safe UV-C dosimeter
US-11338050	Safe UV C bulb assembly
US-11351284	Shock-free far UV C bulb assembly
US-11357879	Far UV C power supply
US-11466842	Adjustable light shaping visor
US-11478563	Highly efficient UV C source
US-11576991	Low voltage far UV C bulb assembly
US-11752228	Highly efficient UV C bulb with multifaceted filter
US-11771789	General illumination LED system including far UV C

APPENDIX B



2021 Superbowl: 720 high-powered LED broadcast fixtures totaling over one-half of a million watts of LED