

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: To Be Assigned
U.S. Patent No. 10,197,224

DECLARATION OF FRED HOLMES

I, Fred Holmes, declare as follows:

I. INTRODUCTION AND QUALIFICATIONS

1. I have been retained by Quasar Science LLC (“Petitioner” or “Quasar”) to provide technical analysis and opinions relating to U.S. Patent No. 10,197,224 (“the ’224 Patent”) in this proceeding.

2. I am currently working as an electrical engineering consultant, specializing in consulting for companies working on LED light fixtures.

3. Prior to this role, I was the Co-Founder of Sportsbeams Lighting, Inc. I held this position until 2017. Sportsbeams’ flagship product is its 1500-Watt LED outdoor sports lighter which delivers 171,675 lumens. The product line also includes a 600-Watt LED fixture, 800-Watt LED fixture and a control system providing on/off control, dimming and special effects. Every fixture is controllable through an Ethernet interface or through industry standard DMX-512. Sportsbeams fixtures provided field lighting for Superbowl LV.

4. Prior to Sportsbeams, I served as In-house Counsel and Software Design Engineer at Litepanels, Inc. (from 2005–2013). In 2005, Litepanels, Inc. produced the only LED-based lighting product built specifically for television and movie production. In 2008, Litepanels negotiated an asset purchase agreement with Vitec Group, plc, a UK publicly traded company.

5. Post-acquisition, I was appointed as IP counsel for the Videocom Division of the Vitec Group, responsible for intellectual property over multiple brands from multiple business units located world-wide. In my capacity as Software Design Engineer, I developed a line of LED-based lighting products aimed at television and motion picture production with the help of four other lighting professionals.

6. From 2004–2005, I was the Director of Sensor Software Development at ShotSpotter, Inc. While at ShotSpotter, I patented a wireless gunshot detection sensor as part of a gunshot location system. I also developed a gunshot location system aimed at municipal and military clients based on a rapidly deployable, self-surveying, acoustic sensor.

7. From 1999–2004, I worked as an Associate Patent Attorney at Fellers, Snider, Blankenship, Bailey, & Tippens, P.C. In my role as Associate Patent Attorney, I was responsible for prosecuting patent applications on behalf of clients and assisted the firm in the representation of clients in patent litigation and other related matters.

8. From 1996–1998, I worked as the Director of Engineering and In-house Counsel at Bed-Check Corporation. In my roles at Bed-Check Corporation, I was responsible for resolving sale issues with contract manufacturers, updating technology in the bed-patient monitor product line, obtaining meaningful patent

protection for updated systems, identifying process changes for manufacturing the patient sensor with a potential to reduce the cost of the sensor by 85%, and implementing quality systems that reduced warranty repairs from nearly 30% to substantially less than 1% of electronic monitors produced.

9. From 1993–2005, I worked for Fisher Production Inc. Fisher specializes in leasing large-scale lighting systems. While at Fisher, I was involved in the design of a soft box controller with lighting effects capabilities for 40,000-Watt and 96,000-Watt soft boxes.

10. From 1984–1993, I held multiple positions at StairMaster Exercise Systems, which included Manager of Product Development, Senior Electronic Design Engineer, and Independent Contractor. During my time at StairMaster, I was responsible for designing electronic systems and authoring embedded software for the StairMaster 6000 ergometer, the StairMaster 4000 PT, the Gravitron assisted chin and dip machine, and the Gauntlet Stepmill. These products generated approximately \$175 million in revenue during my tenure, exceeding \$50 million dollars per year in revenue prior to my departure to focus on law school. I was also responsible for supervising the product development engineering staff, departmental secretaries, technicians, and model shop personnel. Lastly, I was a liaison with counsel for patent prosecution, product liability litigation, and patent litigation.

11. From 1981–1986, I was a Senior Electronic Design Engineer at Flightsafety International. In my role as Senior Electronic Design Engineer, I was responsible for the design of various electronic systems for flight simulators. My specialties included environmental sound effects and processor-based solutions for special projects.

12. From 1979–1981, I was a Maintainability Engineer at Texas Instruments. In my role as Maintainability Engineer, I was responsible for determining the testability of the HARM Missile (AGM–88A) and related ground support equipment. I also participated in the design of ground support equipment for the missile and its associated avionics.

13. I received a Bachelor of Science degree in Electrical Engineering from the University of Oklahoma in 1979. I also received a Juris Doctorate from the University of Tulsa College of Law in 1995.

14. Through my education, background, and work experience, I have developed a thorough understanding of lighting systems as well as their related control systems. Based on my education, training, knowledge, and professional experience, I am fully qualified to testify regarding the subject matter described and claimed in the '224 Patent.

15. My *resume* is attached to the end of this Declaration as Appendix A.

II. MATERIALS CONSIDERED

16. I have been asked to analyze Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45 (“Challenged Claims”) of the ’224 Patent.

17. In forming my opinions expressed in this Declaration, I have reviewed and considered the documents and materials identified in Appendix B to this Declaration, and I have reviewed all of the Exhibits submitted with the Petition.

18. I have further relied on my education, skill, training, and experience in the field of electrical engineering in forming my opinions. I have also considered the viewpoint of a person of ordinary skill in the art (“POSITA”) at the time of the effective filing date of the ’224 Patent.

19. I reserve the right to supplement my opinions in this Declaration to address any new information obtained in the course of this proceeding or based on any new positions taken by the Patent Owner Colt International Clothing, Inc. d/b/a Colt LED (“Patent Owner” or “Colt”).

III. COMPENSATION

20. The charges for my services in this matter are \$200 per hour. My compensation is not dependent on the outcome of this proceeding and does not affect the substance of my statements and opinions in this Declaration.

21. As far as I am aware, I have no financial interest in the Petitioner, Patent Owner, or the ’224 Patent. I also have no other conflicts of interest relating to the Petitioner, Patent Owner, or the ’224 Patent.

IV. SUMMARY OF MY OPINIONS

22. I have been asked by counsel for Petitioner to provide my opinions regarding whether or not the subject matter described in the Challenged Claims would have been obvious to a POSITA in light of the prior art.

23. Based on my review of the '224 Patent, the file history of the '224 Patent, and the documents identified in Appendix B, and relying on my education, skill, experience, common sense, and expertise in the field of electrical engineering, it is my opinion that the Challenged Claims would have been obvious to a POSITA at the time the invention was made. The bases for my opinions are detailed throughout this Declaration.

V. LEGAL PRINCIPLES

24. Petitioner's counsel has provided me with certain legal principles that I have applied in this proceeding. My analysis and opinions were developed based on the following legal principles.

25. I understand that the '224 Patent was filed on March 31, 2017 and issued on February 5, 2019. I also understand that the '224 Patent claims priority to U.S. Provisional Application No. 61/648,554, filed on May 17, 2012. For purposes of this Declaration, I have assumed that May 17, 2012 is the earliest effective filing date for the '224 Patent.

26. I understand that a patent claim is invalid as obvious under 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious to a person having ordinary skill in the art at the time the invention was made. I further understand that a claim may be found obvious in view of a single prior art reference or from a combination of two or more prior art references. I understand that an invention is obvious if a person of ordinary skill in the art would have had a reason to make the invention and a reasonable expectation of success in so doing.

27. I have been informed that when relying on a combination of prior art references to establish obviousness, it is necessary to show: (1) that the claim elements were known in the prior art; and (2) that a skilled artisan would have been motivated to combine these known elements.

28. To qualify as prior art, a reference must qualify as “analogous art.” A reference is considered analogous if it is from the same field of endeavor or is reasonably pertinent to the particular problem with which the inventor is involved. A reference is reasonably pertinent if, as a result of its subject matter, it logically would have commended itself to an inventor’s attention in considering the problem.

29. I understand that common sense and common knowledge can be considered in determining whether it would have been obvious to modify a prior

art reference if supported by evidence and a reasoned explanation, and a person of ordinary skill in the art would have been motivated to make such a modification.

30. I further understand that there are certain secondary considerations that may support or rebut the obviousness of a claim. I understand that such secondary considerations include: (i) commercial success of the patented invention, (ii) skepticism of those having ordinary skill in the art at the time of invention, (iii) unexpected results of the invention, (iv) any long-felt but unsolved need in the art that was satisfied by the alleged invention, (v) the failure of others to make the alleged invention, (vi) praise of the alleged invention by those having ordinary skill in the art, and (vii) copying of the alleged invention by others in the field.

31. I have been informed that there must be a nexus between any such secondary consideration and the alleged invention.

VI. LEVEL OF ORDINARY SKILL IN THE ART AS OF THE EFFECTIVE FILING DATE OF THE '224 PATENT

32. The '224 Patent, titled "Multicolored Tube Light With Improved LED Array," is directed to a system for "producing light using LED lighting with output within a predetermined color temperature range for commercial lighting uses which may be bicolor or may be multicolored." Ex. 1001 at Cover Page, Abstract.

33. It is my opinion that a person of ordinary skill in the art relevant to the '224 Patent at the time of the alleged 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.

VII. THE '224 PATENT

A. Scope and Content of the Prior Art Before the '224 Patent

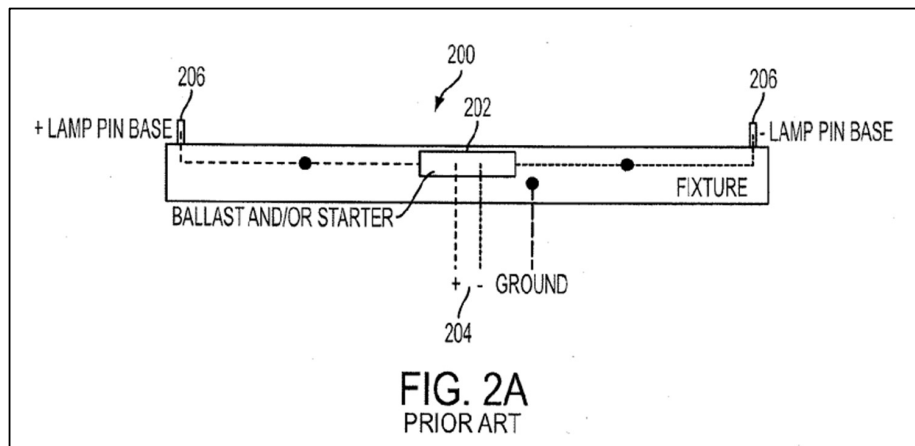
(i) *The Use of Fluorescent Lights in the Entertainment Industry was Well Known.*

34. Fluorescent light, sometimes referred to as gas-discharge light, contains mercury vapor and phosphor. Ex. 1001 at 1:33–37. When an electric current is added to the gas, it excites the mercury vapor and produces short-wave ultraviolet light. *Id.* This causes the phosphor to exhibit a fluorescent quality and emit visible light. *Id.*

35. Prior to 2012 (the priority date I have been asked to apply to this proceeding), there were a variety of applications for fluorescent lighting, from being used in commercial buildings, residential homes, and the entertainment industry for theater lighting, to television and movie sets for illumination for filming. *Id.* at 1:40–43. A POSITA would have known that fluorescent lighting has a history of use in the commercial image recording industries to produce artificial light and lighting effects on set.

36. Fluorescent light fixtures have a history of use in television and movie production going back to at least the mid-1970s. In 1987, Kino Flo, Inc. began manufacturing and selling a line of fluorescent fixtures targeted specifically for these markets. Kino Flo employed high-frequency ballasts to reduce flicker and artifacts, as well as high-output tubes to compete with light levels produced by other popular fixtures. The Kino Flo products were well received and, in fact, are generally considered the standard for fluorescent fixtures in the industry. Despite the fact that Kino Flo has shifted its focus to LED fixtures, its fluorescent fixtures are still widely used.

37. Traditionally, fluorescent bulbs were manufactured in a tubular form, with an elongated form factor. *See, e.g.*, Ex. 1004 at Fig. 51. The fixtures for the elongated, tubular form were traditionally used for retail space, offices, and housing, but fluorescent lights were also routinely found on television and film sets for illumination.



Ex. 1010 at Fig. 2A, [0018] (“FIG. 2A depicts a conventional fluorescent tube fixture.”).

38. There were known drawbacks to the use of fluorescent lighting, particularly in the entertainment industry. For example, fluorescent lights often caused lighting issues on set, such as making a person’s skin look green. Ex. 1001 at 1:62–66. Fluorescent lights are also expensive and cumbersome in size. Further, in order to produce colored light using fluorescent lights, you had to use gels or interchangeable filters or covers. Fluorescent lights had very limited dimming range, and fluorescent tubes were nearly always driven with AC power, raising potential issues with flicker or artifacts when used with video cameras. This made fluorescent lighting inflexible and not versatile. These issues with fluorescent lights were known well before 2012. For these reasons, fluorescent lighting never inspired a revolution in the industry.

39. As discussed below, one solution to the known disadvantages of fluorescent lights was to replace the fluorescents with LEDs. Because LEDs overcome these drawbacks, starting as early as 2005, LEDs were immediately a disruptive technology in the lighting space.

***(ii) The Use of LED Lights to Overcome the Drawbacks of
Fluorescent Lights was Well Known.***

40. Light emitting diode (“LED”) lighting is produced by sending electricity through the semiconducting diodes, which emit visible light.

41. Prior to 1993, LED emitters were exclusively monochromatic, typically emitting light over a narrow band located in the spectrum between near infrared and green. Nichia Corporation was a well-known manufacturer of phosphors for fluorescent tubes. Phosphors are a subset of wavelength conversion materials. Such materials are excited by radiation at a first wavelength and emit light at a different wavelength, or over a range of wavelengths. A characteristic of wavelength conversion materials is that they always convert from a higher energy wavelength to a lower energy wavelength. In the case of fluorescent tubes, the long arc in argon and mercury produces ultraviolet (UV) light. The phosphors convert the high energy UV light to a longer wavelength (lower energy) light in the visible spectrum. In the early 1990s, Nichia invested in developing a blue LED around a gallium nitride semiconductor. By 1996, Nichia had developed a reliable blue LED to excite phosphors, much like those of a fluorescent tube, to create the first white-light LED. While light that appears white can be constructed from monochromatic LEDs, it does not produce a continuous spectrum. The result is some colors will not be properly rendered by the light.

42. There are several advantages to LED lighting. For example, LEDs offer substantial decreases in energy consumption and increases in lifespan as

compared to fluorescent bulbs. *See, e.g.*, Ex. 1001 at 2:37–43. LEDs also take up less space than their tubular competitor. *Id.* Additionally, LEDs provide more flexibility to provide different color lights by utilizing well-known Red, Green, Blue (RGB) LED lights, as well as amber, orange, and broad-spectrum white lights. Also, LEDs radiate very little heat compared to other lighting technologies, so the talent is more comfortable. Further, LEDs are full-range dimmable with negligible color shift, more battery friendly, and offer much longer life.

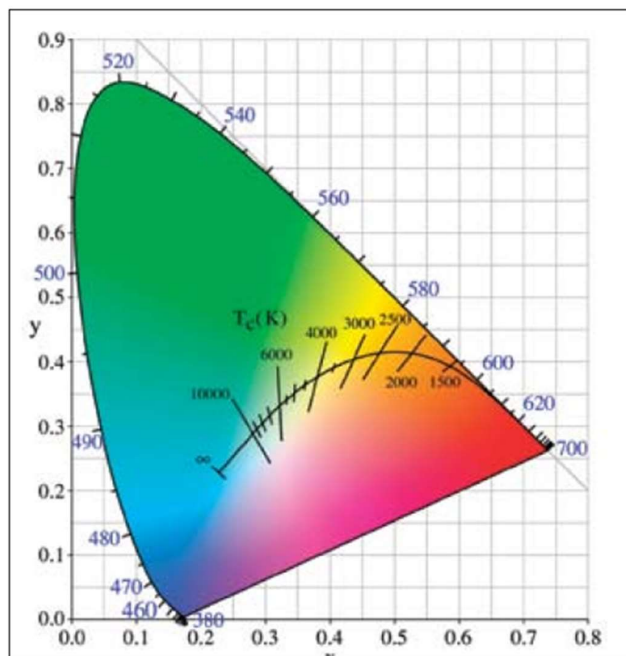
43. A POSITA would have been very familiar with the use of LED lights for film and television recording before 2012. Around 2001, Rudy Pohlert and Pat Grosswendt, lighting professionals in the film and television arts, needed a beauty light, preferably one that provided light directed along the axis of the camera lens. Grosswendt was at a local electronics distributor and witnessed a display having a single 60mW white LED. Inspired by the white LED, Pohlert and Grosswendt developed a ring light using 1080 60mW LEDs. Because of the large number of individual emitters, the ring light produced a soft, but projected, light. This product was very popular with talent, partially because the light was very flattering, but also due to the lack of heat and the ability to tune the brightness to the environment. By mid-2005, Litepanels, Inc. was producing commercially viable on-camera LED lights. Litepanels was recognized by the Academy of Television Arts and Sciences with an EMMY award in 2005, just months after

shipping its first production units. By the start of 2011, a search on AMAZON.COM for LED video lights produced over 1,000 results and a search on ALIBABA.COM for LED video lights produced over 20,000 results. By this time, virtually every TV series produced in the U.S. used at least one LED light fixture. Circa 2010, I was personally told by the director of photography for *EXTREME MAKEOVER: HOME ADDITION* and the director of photography for *KEEPING UP WITH THE KARDASHIANS* that production of their shows would have been impossible without LED lighting.

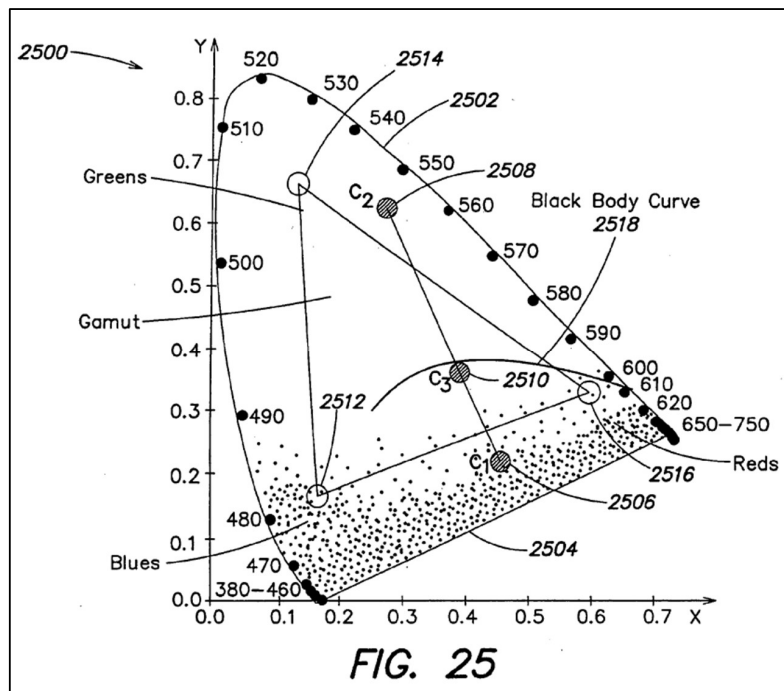
44. LED lights are particularly useful when filming or capturing images because they offer a wider scope of achievable color temperatures and the ability to efficiently switch between colors. In certain embodiments, this could mean the difference between replacing light gels for several fluorescent tubes versus the simple act of flipping a switch or toggling a command on a DMX controller.

45. Soon after the commercialization of white LEDs, lighting professionals began demanding tunable color temperature. In the architectural field, the science of daylighting created demand for light fixtures that could produce light at the same color temperature as sunlight throughout the day. In the field of film and television production, film stock was generally available balanced for either tungsten (3200K) or daylight (5600K). Video cameras typically can white balance at any color temperature between 3200K and 5600K. If the color

temperature is variable, the camera operator/director can make use of available light and match the production lighting to the ambient light. Early tunable lights simply allowed crossfading between a warm emitter (in the range of 3000K) and daylight emitter (in the range of 6000K). This raised an interesting issue.



Ex. 1011 at page 1.



Ex. 1006 at Fig. 25. As is well known in the art, color temperature is only defined along the Planckian Locus (also known as the black body line) and represents, so-called, white light. Correlated color temperature may be given for light near the Planckian Locus, but the captured image will have a tint from the hue of the light—greenish if the light is above the Planckian Locus and magenta if the light falls below. One can see that if a first array of LEDs has a color temperature of 6000K and a second array has a color temperature of 3000K, a crossfade from one array towards the other will follow a straight line connecting the two points on the locus. As a result, the light will have a magenta hue at intermediate color temperatures. This effect can be overcome by using a monochromatic amber LED in addition to the warm white LED, or even in place of the warm white LED. By

2012, this phenomenon and the possible solutions were well known in the art. As early as 2004, the need to maintain proximity to the black body line was recognized and the use of RGBWA was suggested as a way to achieve such proximity. Ex. 1006 at [205]–[209]; Ex. 1012; Ex. 1013 at 15:1–16, 16:14–21. Alternatively, one could use separate sets of LEDs to selectively produce specific temperature ranges of white light.

46. These known benefits of using LED lights have led to the increasing use of LEDs and, importantly, the replacement of antiquated fluorescent lights with more efficient and versatile LED lights. Like white LEDs, fluorescent tubes use phosphors to convert high energy UV light to lower energy visible white light. Thus, concepts such as CCT, proximity to the black body locus given as Color Compensation value, and CRI apply equally to fluorescent lighting, and were well known in the art prior to the introduction of LED lighting. Like LEDs, for a particular tube, a shift from the black body line toward green or magenta is highly correlated with lower CRI.

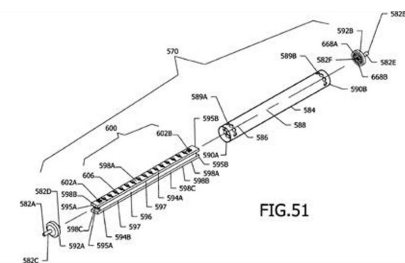
(iii) The Use of LED Lights in a Fluorescent Tube Form Factor was Well Known.

47. LEDs can be used in a variety of form factors, including the tubular form of fluorescent bulbs. *See, e.g.*, Ex. 1004; Ex. 1008; Ex. 1010. This is

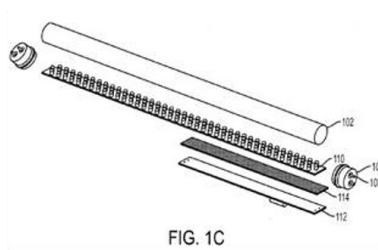
accomplished by installing LEDs on a support structure in an elongated tube having the same form factor.

48. Common form factors for tube-shaped bulbs include T8 and T12. Ex. 1010 at [0013] (listing “conventional” socket sizes). T8 tubes are one inch in diameter and T12 tubes are one- and one-half inches in diameter. *See, e.g.*, Ex. 1009 at 4:33–36.

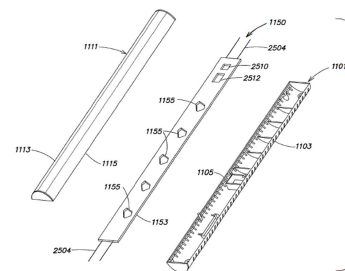
49. The concept of elongated bulbs containing LEDs existed before the priority date of the '224 Patent. Exemplary illustrations appear below:



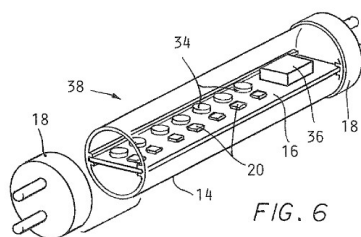
Ex. 1004 at Fig. 51.



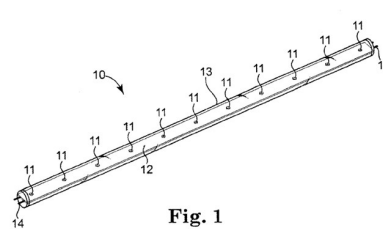
Ex. 1010 at Fig. 1C.



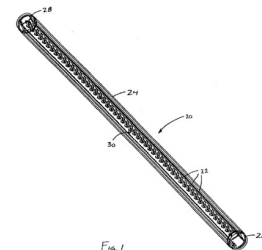
Ex. 1005 at Fig. 29.



Ex. 1008 at Fig. 6.



Ex. 1014 at Fig. 1.



Ex. 1015 at Fig. 1.

50. Products existed on the market using LED lights in a fluorescent tube form factor, such as the Astera Wireless Pixel Tube (AL1) which was on the market at least as early as 2010. Ex. 1016. Not only was it well known prior to

2012 to retrofit fluorescent tubes (such as T8 and T12 tubes) to replace the fluorescent bulbs with more energy efficient LED lights, but these retrofit LED lights were commonly used in the film and television industry at this time. LED lights in a linear, tube form factor with measurements similar to those of a T12 fluorescent tube (approximately four feet in length and 1.5 inches in diameter) were suitable for use in commercial image recording, such as on a film or television set.

51. A POSITA would know that LEDs in a particular form factor are generally available in a variety of configurations, namely monochromatic LEDs, phosphor-based color LEDs, and phosphor-based white light LEDs. In the area of white light, a POSITA would know that in a particular form factor, white LEDs are available in an array of color temperatures and an array of color rendering index (CRI) values. It is well known that the higher the CRI value, the more colors will be rendered faithfully by the LED. Thus, converting a tube LED light suitable for basic illumination to one suitable for image capture will typically involve selecting a more suitable LED from a catalog. While forward voltages may vary depending on LED color, the principles for driving any LED remain the same. As is incredibly well known in the art, the output power of an LED light is limited by the free-air dissipation of the circuit board and any added heat-sinking or forced air,

rather than the number of colors or color temperature of LEDs employed in a given light.

52. Using broad-spectrum white light (for example, in the range of 2800K to 5500K) or color LEDs (RGBAW) in a linear form factor to capture images was well-known in 2012. For example, Ducharme teaches such a use. *See, e.g.*, Ex. 1005 at Figs. 5a–5b, 12:49–67, 18:51–64, 19:14–24, 20:15–21:37.

53. Ducharme teaches that LED lights like those taught in Kit or the '224 Patent are suitable for the image recording industry by disclosing the use of LED lights in a linear, tube-like form factor. Ex. 1005 at Figs. 5a–5b, 12:49–67, 18:51–64 (describing the use of the disclosed lightings by a film director), 19:14–24 (using the disclosed lighting fixtures for image capturing). Ducharme also teaches a POSITA that “high-quality LED-based light[s] may be configured to replace a fluorescent tube,” and the LED light source would “function in an existing device designed to use fluorescent tubes.” *Id.* at 28:53–57, Figs. 28–29. Further, Ducharme discusses the proper color temperatures for LEDs and the need for high Color Rendering Index (CRI) for high-quality image capturing purposes, which match those disclosed in the '224 Patent. Ex. 1005 at 20:15–21:37.

B. The Challenged Claims

54. The '224 Patent has four independent claims (Claims 1, 13, 23, and 35) and 41 dependent claims. I address the patentability of Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45 of the '224 Patent.

C. Summary of the Prosecution History of the '224 Patent

55. The Board issued a Notice of Allowance for Claims 1–10 on February 1, 2018. Ex. 1002 at 111–20. Two weeks later, a Request for Continued Examination was filed in an attempt to amend the claims, drawings, and specification. Ex. 1002 at 146–97.

56. The April 4, 2018 Office Action objected to and/or rejected all pending claims. Ex. 1002 at 203–12. It is my understanding that the Examiner found the “multiple color LEDs” claims obvious. As a result of this Office Action and a May 30, 2018 Examiner interview, Patent Owner filed a response on July 5, 2018 to amend the claims. Ex. 1002 at 249–79.

57. The Examiner issued a second Notice of Allowance on December 10, 2018. Ex. 1002 at 286–294. The Examiner allowed the amended claims based on the Examiner’s finding that, although the prior art “disclose[d] an LED lighting device including a linear housing receiving five LEDs of different colors,” “the linear housing is closed at one end, and **does not have a light-diffusing top portion.**” Ex. 1002 at 281–94 (emphasis added).

VIII. CLAIM CONSTRUCTION

58. It is my understanding that claims in an IPR are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.

59. I have analyzed the patentability of the Challenged Claims based on their ordinary and customary meaning, unless otherwise stated below.

IX. PRIOR ART REFERENCES

60. I have considered the following prior art references in assessing the patentability of Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45 of the '224 Patent.

A. U.S. Patent No. 7,507,001 to Kit (“Kit”)

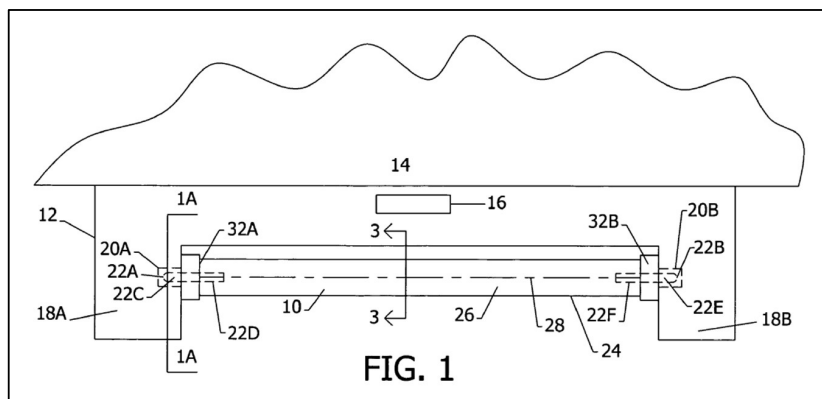
61. Kit is a U.S. patent that issued on March 24, 2009, from an application filed on May 21, 2007. Ex. 1004 at Cover Page. This reference precedes May 17, 2012, the earliest effective filing date of the '224 Patent; therefore, I have been informed that Kit is available as prior art.

62. Kit is titled, “RETROFIT LED LAMP FOR FLUORESCENT FIXTURES WITHOUT BALLAST” and is directed to “[a]n energy saving device for an LED lamp mounted to an existing fixture for a fluorescent lamp where the ballast is removed or bypassed.” Ex. 1004 at Cover Page, Abstract.

63. Kit teaches the concept of replacing fluorescent lights with LED lights. *Id.* at 16:4–9 (offering the following as a solution to lighting problems: “an

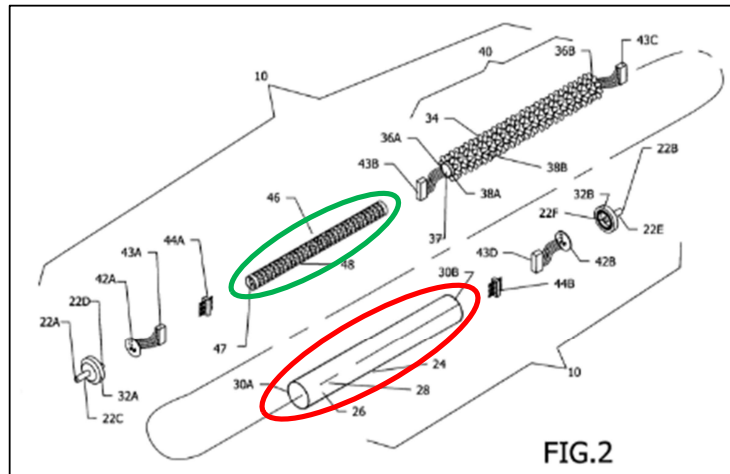
LED lamp that has a main, generally tubular housing terminating at both ends in a lamp base that inserts directly into the lamp socket of existing fluorescent lighting fixtures used for general lighting in public, private, commercial, industrial, residential buildings....”).

64. Figure 1 represents an assembled view of the LED retrofit lamp:



Id. at Fig. 1.

65. The LED lamp in Kit has an elongated housing and contains an LED array circuit board. *Id.* at 38:16–60. The disclosed LED lamp also includes an elongated support structure, which is placed within the housing. *Id.* at 39:5–29. Figure 2 represents a deconstructed view of the LED retrofit lamp. *Id.* at 25:63–64. In the below image, the support structure is circled in green, and the housing is circled in red:

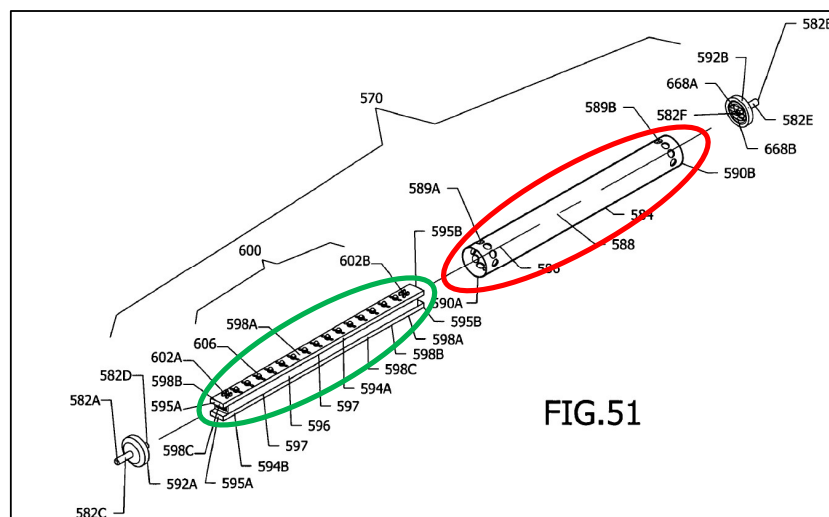


Id. at Fig. 2.

66. Figure 51 teaches an alternative embodiment of the LED retrofit lamp.

Id. at Fig. 51. This LED lamp also includes an elongated housing (circled in red).

Id. at 77:12–78:2. The housing contains an LED array circuit board and an elongated support structure (circled in green). *Id.*



Id. at Fig. 51.

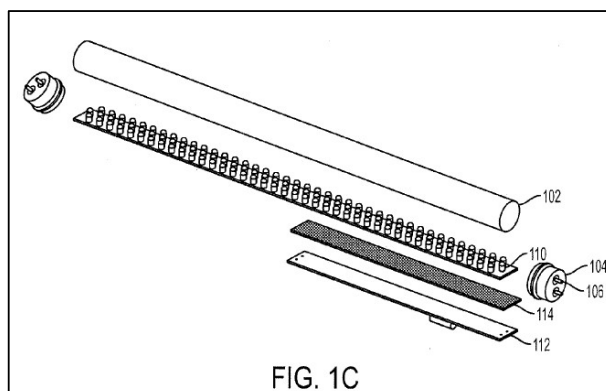
67. The disclosed support structure, such as those illustrated above in Figures 2 and 51, have an array of LEDs mounted thereto. *Id.* at Figs. 2, 4, 51, 53, 38:16–39:64, 77:12–78:2, *see also* Fig. 12. These arrays are compatible with several colors, including red, blue, green, yellow, amber, orange and varying colors of white. *Id.* at 20:50–63.

B. U.S. Patent U.S. Publication No. 2010/0102729 to Katzir *et al.* (“Katzir”)

68. Katzir was filed on October 8, 2009, and published on April 29, 2010. Ex. 1010 at Cover Page. This reference precedes May 17, 2012, the earliest effective filing date of the ’224 Patent; therefore, I understand Katzir to be available as prior art.

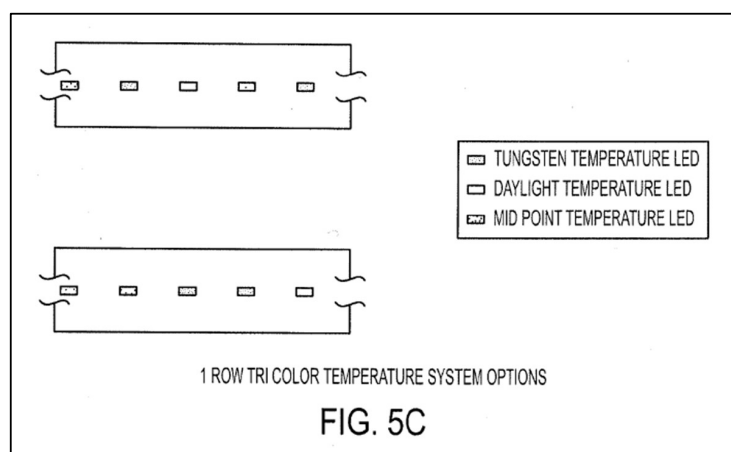
69. Katzir is titled, “LIGHT EMITTING DIODE ASSEMBLY” and is directed to a “lighting assembly [that] can replace a fluorescent tube light while providing a more comfortable and steady light source, consuming less power and with enhanced longevity.” Ex. 1010 at Cover Page, Abstract.

70. Katzir teaches that the components of the lighting assembly include “a tube, a[n LED] panel disposed within the tube, a circuit board disposed within the tube, and insulation disposed between the [LED] panel and the circuit board.” *Id.* at Abstract. Figure 1C depicts an embodiment of the LED lighting assembly:

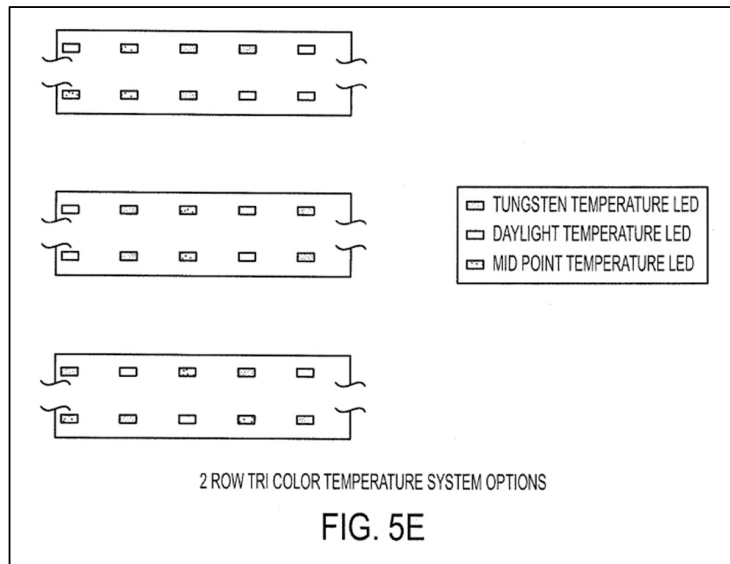


Id. at Fig. 1C, [0017].

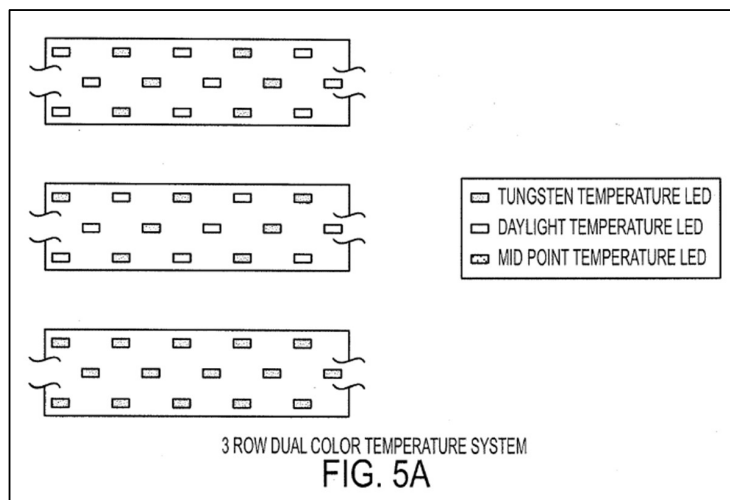
71. In one embodiment, the disclosed lighting assembly “provides LEDs with different color temperatures. *Id.* at [0050]. For example, Figures 5A–F illustrate possible LED layouts in multi-color LED panels. *Id.* at [0054]. Further, “any number of rows of LEDs may be used according to the desired intensity, power consumption, or physical configuration of the lighting assembly.” *Id.* Examples of a one-row, two-row, and three-row configuration are shown below:



Id. at Fig. 5C.



Id. at Fig. 5E.



Id. at Fig. 5A. The above Figures teach an LED arrangement similar to that of a checkboard or matrix pattern. *Id.* at Fig. 5A, 5C, 5E.

72. Katzir further discloses the LED arrays “may be configured in straight rows, staggered rows, or spaced in any other desired configuration on the LED

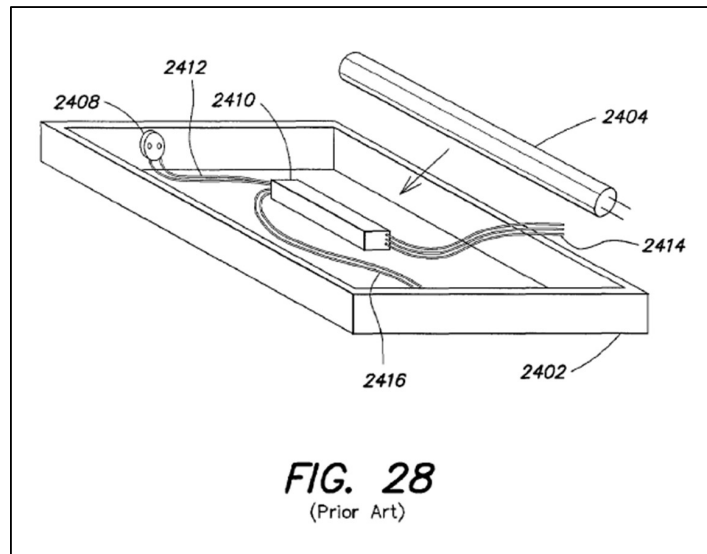
panel...” *Id.* at [0054]. Regarding color, Katzir teaches “various arrangements of LEDs in two-color and three-color configurations.” *See, e.g., Id.*

C. U.S. Patent No. 7,350,936 to Ducharme *et al.* (“Ducharme”)

73. Ducharme is a U.S. patent that issued on April 1, 2008, from an application filed on August 28, 2006. Ex. 1005 at Cover Page. This reference precedes May 17, 2012, the earliest effective filing date of the ’224 Patent; therefore, I understand Ducharme to be available as prior art.

74. Ducharme is titled, “CONVENTIONALLY-SHAPED LIGHT BULBS EMPLOYING WHITE LEDS” and is directed to “LED-based light bulbs having one or more white LEDs, for replacing/retrofitting conventional light bulbs.” Ex. 1005 at Cover Page, Abstract. The embodiments in Ducharme are not limited to white LEDs. *See, e.g., Id.* at 4:37–48.

75. Further, Ducharme discloses that “[a] high-quality LED-based light may be configured to replace a fluorescent tube,” describing an embodiment in which “a replacement high-quality LED light source useful for replacing fluorescent tubes would function in an existing device designed to use fluorescent tubes. Such a device is shown in FIG. 28.” *Id.* at 28:53–60, Fig. 28.



Id. at Fig. 28.

76. Ducharme also teaches the use of LED lights in the image recording industry. *Id.* at 18:51–64 (“a film director could find light in a location where filming does not occur and measure that light using the sensor. This could then provide the desired color which is to be produced by the lighting fixture.”), 19:14–24 (describing an image capturing application and disclosing that the system “simplifies procedures employed by cinematographers, for example, attempting to produce a consistent appearance of an object to promote continuity between scenes of a film...”).

D. U.S. Patent Publication 2005/0047134 to Mueller *et al.* (“Mueller”)

77. Mueller was filed on September 30, 2004, and published on March 3, 2005. Ex. 1006 at Cover Page. This reference precedes the earliest effective filing date of the ’224 Patent; therefore, it is available as prior art.

78. Mueller is titled, “CONTROLLED LIGHTING METHODS AND APPARATUS” and is directed to a system of providing “controlled lighting” using “both white and non-white colored” LED-based lighting units. Ex. 1006 at Cover Page, Abstract.

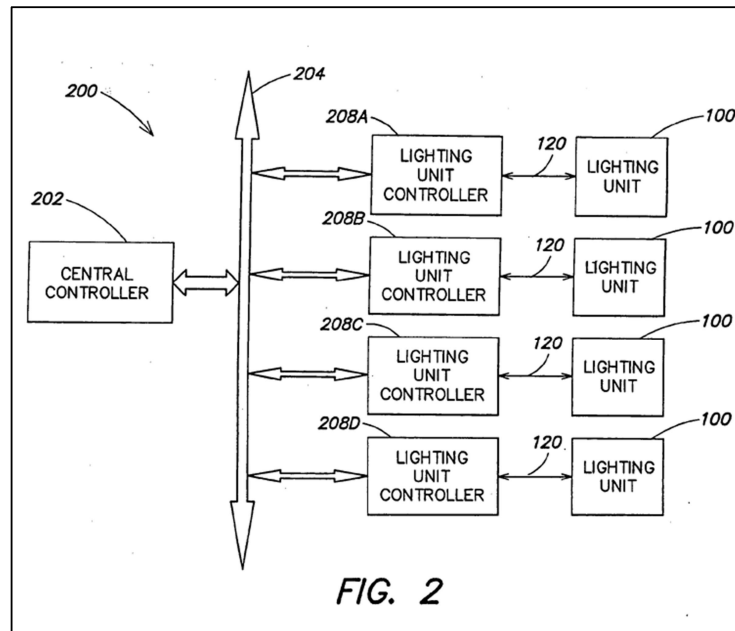
79. Mueller also discloses using “multi-color lighting units in a variety of commercial applications,” such as entertainment lighting. *Id.* at Abstract. Mueller teaches that LED-based lighting units “can thus be coordinated to be appropriate for the object being filmed or recorded by the camera. The camera 4302 could be a film camera, a digital camera, a video camera, a still camera, a motion picture camera, or other camera of any type.” *Id.* at [0265], *see also Id.* at [0049].

80. Mueller discloses that the LED-based lighting unit “may be implemented in any one of several different structural configurations.” *Id.* at [0185]. Examples of structure configurations include a “fluorescent fixture arrangement” such as those used for T12 or T8 tubes. *Id.* at [0185], [0295].

81. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of red, green, blue, amber, white, orange and UV LEDs, a **controller** for controlling the color of light coming from the LEDs, a sensor for sensing at least one of the color and the color temperature of the light coming from the LEDs and a feedback loop for adjusting the color of light coming

from the LEDs based on input from the sensor.” *Id.* at [0043] (emphasis added).

Figure 2 depicts such a controller:



Id. at Fig. 2, [0190]–[0192], *see also* [0265]–[0269].

E. U.S. Patent No. 8,026,532 to Ansems (“Ansems”)

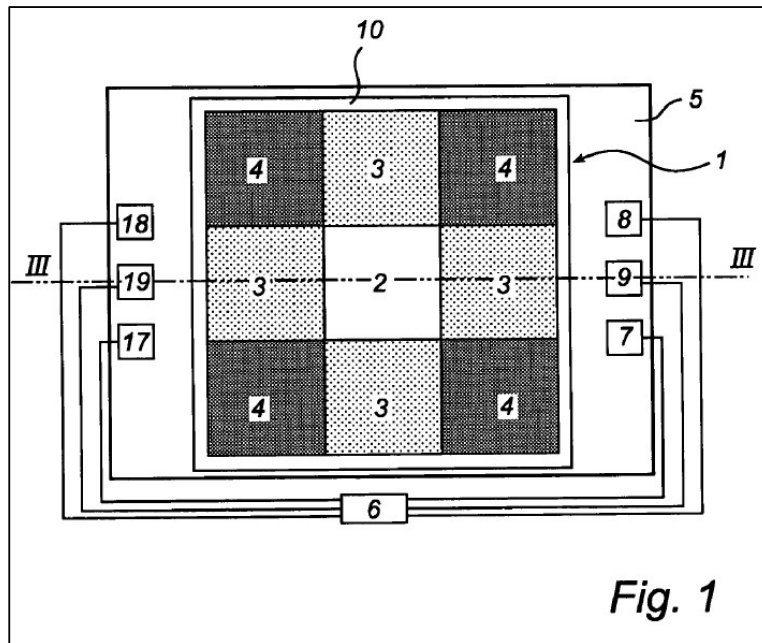
82. Ansems issued on September 27, 2011, and stemmed from an application filed on November 28, 2005. Ex. 1007 at Cover Page. Thus, this reference precedes the earliest effective filing date of the ’224 Patent and qualifies as prior art.

83. Ansems is titled, “SINGLE CHIP LED AS COMPACT COLOR VARIABLE LIGHT SOURCE” and is directed to an array of LEDs formed on a substrate to provide multiple different colors. Ex. 1007 at Cover Page, Abstract.

84. Ansems teaches that LED lighting systems may have a variety of LED colors: “white light typically utilizes multiple LEDs of different colors and the different colors are mixed together to obtain the white light, or light of any other color.” *Id.* at 1:17–21. Ansems also discloses a “color variable light-emitting device that comprises an array of a plurality of light-emitting diodes formed on one highly resistive substrate.” *Id.* at 1:43–56.

85. Further, Ansems teaches that the LED array comprises a first, second, and third set of at least one LED “arranged to provide light.” *Id.* This array “may also comprise further sets, such as a fourth and fifth set, of at least one light-emitting diodes, to provide light of further colors, such as a fourth and a fifth color respectively.” *Id.*

86. Ansems discloses an LED array arrangement similar to a repeating matrix pattern. *Id.* at *e.g.*, Fig. 1, 4:1–3, 4:17–21. Figure 1 depicts an exemplary embodiment using RGBW lights:



Id. at Fig. 1, 4:1–3, 4:17–21 (“The array in FIG. 1 thus constitutes an RGB-unit that can provide light of any color inside the color space defined by the color points of the blue, green, and red sets, respectively. By controlling the current through the different colored sets individually, the total color of the array is available.”).

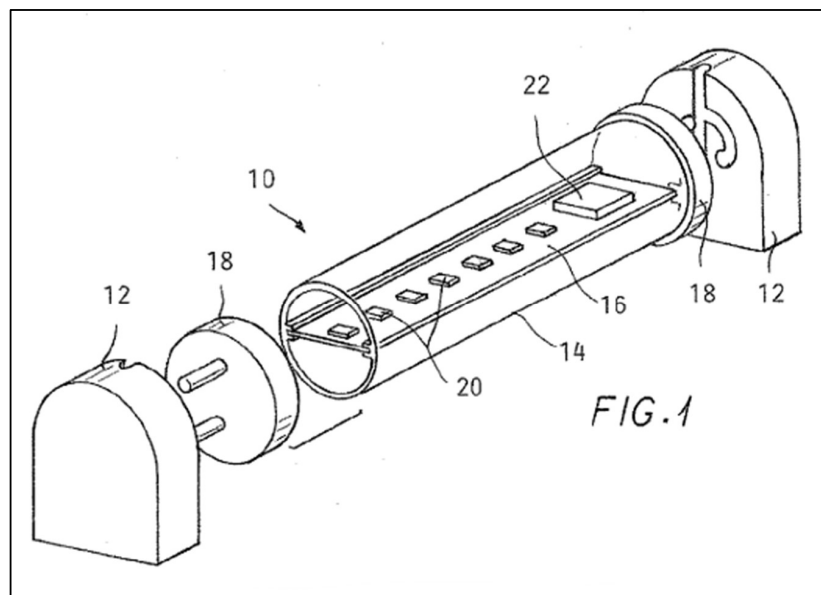
F. U.S. Publication No. 2010/0102960 to Ivey *et al.* (“Ivey”)

87. The patent application related to Ivey was filed on October 24, 2008. Ex. 1008 at Cover Page. The patent published on April 29, 2010. *Id.* Ivey precedes May 17, 2012, the earliest effective filing date of the ’224 Patent; thus, it is available as prior art.

88. Ivey is titled, “INTEGRATION OF LED LIGHTING CONTROL WITH EMERGENCY NOTIFICATION SYSTEMS,” and is directed to an LED-

based light, attached to a controller, capable of fitting in a traditional fluorescent tube lighting form factor. *Id.* at Abstract, [0015].

89. Figure 1 of Ivey is described as “an LED-based light...for use in a standard fixture..., such as a fixture designed to accept T5, T8, T10, or T12 tubes.” *Id.* at [0015].

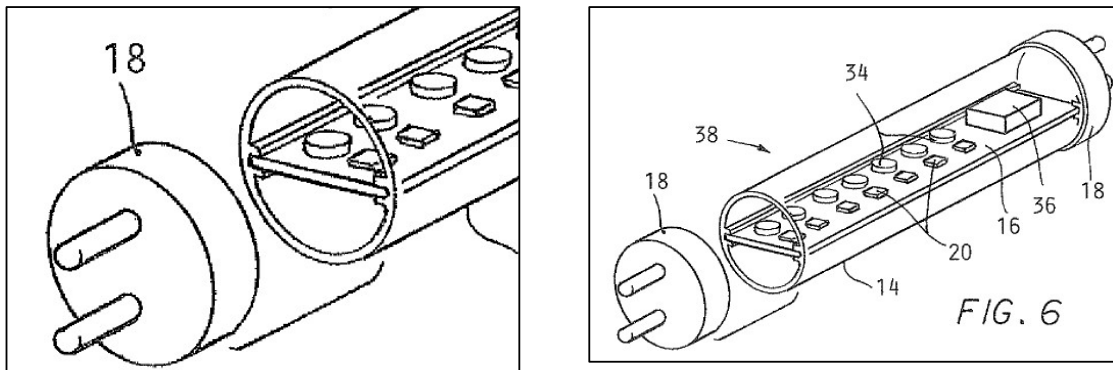


Id. at Fig. 1, [0016] (“As shown in FIG. 1, the light 10 includes a housing 14, a circuit board 16, a pair of end caps 18, multiple LEDs 20, and a controller 22 in a single package defined by the housing 14 and end caps 18.”).

90. Ivey teaches a housing with a support structure on which LED lights have been mounted, as illustrated by Figure 6:

Housing and End Cap of Prior Art

Expanded View



Id. at Fig. 6, [0006] (enlarged in left image), [0016]–[0018].

X. DETAILED UNPATENTABILITY ANALYSIS

91. I have been asked to analyze the patentability of Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45 of the '224 Patent. Claims 1, 13, 23, and 35 are independent claims. Claims 3, 4, 7–12, and 26 directly or indirectly depend from Claim 1; Claims 25 and 28–34 directly or indirectly depend from Claim 23; and Claims 36–39 and 41–45 directly or indirectly depend from Claim 35.

92. The discussion and tables below provide my analysis of how Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45 of the '224 Patent are unpatentable over the prior art references discussed above.

93. When addressing obviousness, I have considered the scope and content of the prior art and whether any differences between the alleged invention and the prior art are such that the subject matter, as a whole, would have been obvious to a person having ordinary skill in the art at the time of the alleged

invention. I have also considered the level of ordinary skill in the pertinent art at the time of the alleged invention.

A. Ground 1: Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45 Would Have Been Obvious Over Kit in View of Ducharme and Katzir Under 35 U.S.C. § 103.

94. It is my opinion that the combination of Kit, Ducharme, and Katzir satisfies every element of Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45. It is my further opinion that a POSITA would have been motivated to modify Kit in view of Katzir and Ducharme as outlined below.

(i) *Motivation to Combine Kit with Katzir and Ducharme*

95. Given their analogous and interrelated teachings, a POSITA would have been motivated to combine the teachings of Kit, Katzir, and Ducharme.

96. A POSITA would have considered the teachings of Kit, Katzir, and Ducharme in tandem since they are analogous art in the same field of endeavor as the '224 Patent. That is, all of these references relate to the use of common LED lighting devices in a fluorescent tube form factor.

97. A POSITA would have been motivated to combine the teachings of Kit, Katzir, and Ducharme insofar as they disclose related approaches for solving the problems that one of skill in the art would expect to encounter when designing an LED lighting system, including an LED lighting system for the use in the image recording industry.

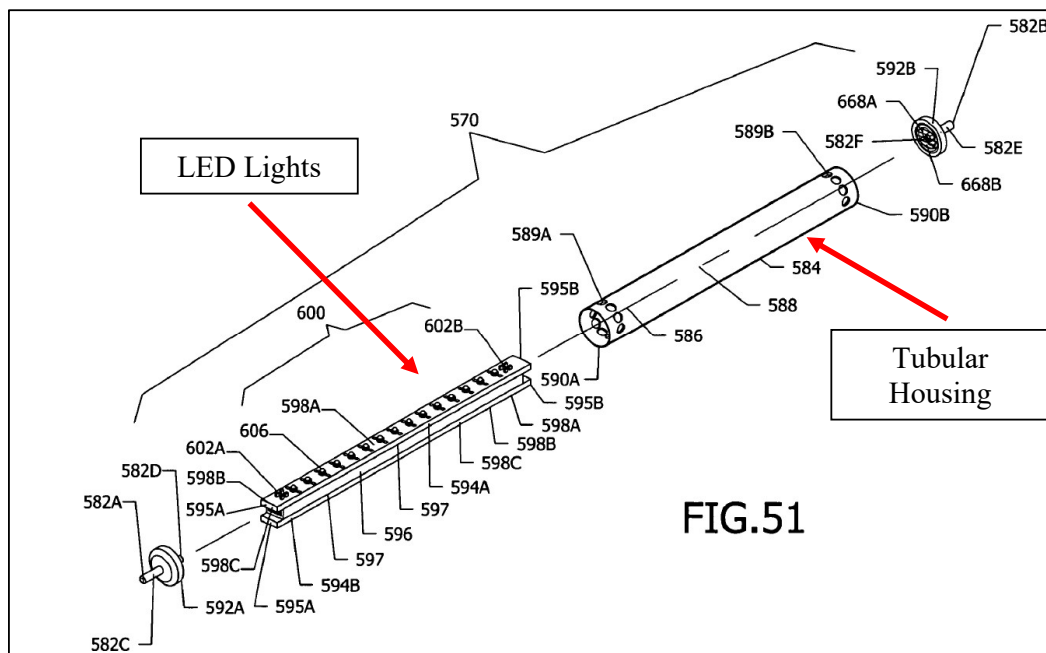
98. The POSITA would also have had a reasonable expectation of successfully combining the elements of Kit, Katzir, and Ducharme with one another, because those elements comprised well-known and commonplace LED lights and structural components, such as commonly used LED circuitry, fluorescent tube housings, and AC/DC input power. These components were familiar to a POSITA at the time of the invention. That is, the combinations of Kit, Katzir, and Ducharme proposed herein would have involved the simple combination of known materials and techniques and/or the substitutions of art-known elements to yield predictable results.

99. The alleged novelty claimed in the '224 Patent is to take four (and sometimes only three) color LEDs, along with a white LED, and place them in a specific tube form factor with a controller to control the power to the LEDs. Ex. 1001 at, *e.g.*, Claim 1. Each of these concepts was well known to a POSITA at the time of the alleged invention. Not only was it known to retrofit fluorescent tube lighting structures and fixtures to use LED lights, but a plethora of prior art teaches the use of color LEDs in a fluorescent tube form factor just like that claimed in the '224 Patent. *See, e.g.*, Ex. 1004 at 51; Ex. 1005 at Figs. 5a–5b, 29; Ex. 1010 at Fig. 1C.

100. The use of color LED lights, in conjunction with broad-spectrum LEDs, in the image recording industry (*e.g.*, film or television recording) was well-

known for years before the '224 Patent. *See, e.g.*, Ex. 1005 at 18:49–54, 19:19–24. A POSITA would recognize the many benefits of using LEDs (and color LEDs) as opposed to fluorescent lighting, and, importantly, the benefits to using LEDs in an elongated tube form factor.

101. The prior art, such as Kit, expressly discloses an LED array retrofitted in a fluorescent tube form factor, including in a T12 and/or T8 fluorescent tube form. *See, e.g.*, Ex. 1004 at 6:1–11 (describing retrofit options, which “include replacing the old lamp with a new LED retrofit lamp only, or using the new tubular LED linear retrofit lamp in the existing fixture.”), 12:65–13:3. The retrofit LED array in a tube housing is shown in Figure 51 of Kit:



Id. at Fig. 51, 77:12–78:2.

102. Kit further discloses using multiple LEDs that emit five (or more) colors, including red, green, blue, orange, amber, and various temperatures of white light. *Id.* at 20:50–63.

103. A POSITA would have known that the LED lights disclosed in Kit would have been suitable for use with any lighting environment, including the “commercial image recording” industry, and would have been motivated to use the LEDs disclosed in Kit as a suitable lighting device for use with commercial image recording. Further, the use of the LED lights in Kit would have been successfully used with image recording based on the high-powered LEDs, with disclosed broad-spectrum white light temperatures in the daylight and tungsten ranges.

104. Kit explains that the disclosed LED lamp can be inserted “directly into the lamp socket of existing fluorescent lighting fixtures used for general lighting in public, private, commercial, industrial, residential buildings” Ex. 1004 at 16:4–9. These existing fluorescent lights replaced by Kit were known in the lighting industry to be used for image recording purposes, such as “TV, stage, auditorium, and/or film studio use,” as discussed in the ’224 Patent itself. Ex. 1001 at 1:40–44. Before 2012, movie studios would have had existing fluorescent lighting fixtures already in place, and a POSITA would have been motivated to replace the fluorescent lights with LED lights because LED lights are cheaper, more reliable, and more versatile. A POSITA would have been motivated to

replace the existing fluorescent lights used for commercial image recording with the LEDs disclosed in Kit.

105. The '224 Patent incorrectly asserts that LED lights in a fluorescent form factor were not suitable for film/TV light. Ex. 1001 at 4:5–62. For example, the '224 Patent asserts that a luminaire designer would not have been motivated to use a “highly restrictive linear tube form factor” to design LED lights for the film/tv industry due to “inconsistent light level output” and “undesirable color shifting.” Ex. 1001 at 4:5–62. This is not correct and is unsupported. There is nothing unique to the LED lights disclosed in the '224 Patent that would make them particularly suitable for use in a tube form factor, as opposed to any other LED lights, like those disclosed in Kit or Katzir.

106. The '224 Patent utilizes standard LED lights that achieve RGBAW colors and/or broad-spectrum white light in standard temperature ranges, such as 2800K to 5800K. Ex. 1001 at 16:23–29. A POSITA would have had no concern using a linear form factor to house LEDs of this nature and use such LED lighting to capture images.

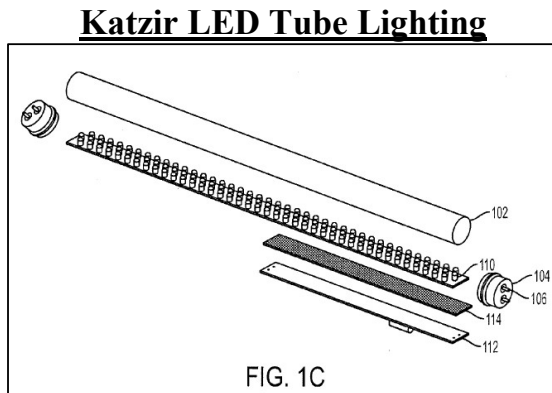
107. A POSITA would have been motivated to use the LED lighting in Kit for commercial image recording industry to take advantage of the versatility, and cost savings realized by using LEDs, and would have had an expectation of success in doing so based at least on the teachings of Ducharme. *See, e.g.*, Ex.

1005 at Figs. 5a–5b, 12:49–67, 18:51–64 (describing the use of the disclosed lightings by a film director), 19:14–24 (using the disclosed lighting fixtures for image capturing). Ducharme expressly teaches that LED lights like those taught in Kit are suitable for the image recording industry by disclosing the use of LED lights in a linear, tube-like form factor. *Id.* at Figs. 5a–5b, 29, 12:49–67, 18:51–64 (describing the use of the disclosed lightings by a film director), 19:14–24 (using the disclosed lighting fixtures for image capturing). Ducharme teaches a POSITA that “high-quality LED-based light[s] may be configured to replace a fluorescent tube,” and the LED light source would “function in an existing device designed to use fluorescent tubes.” *Id.* at 28:53–57, Figs. 28–29. Ducharme also discloses the proper color temperatures for LEDs and the need for high Color Rendering Index (CRI) for high-quality image capturing purposes, which match the disclosures in the ’224 Patent. *Id.* at 20:15–21:37.

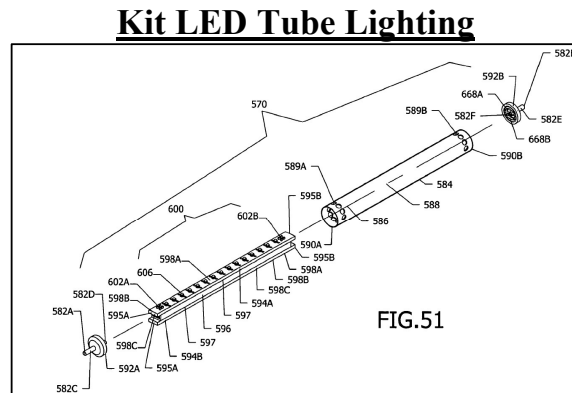
108. The use of Kit’s LED lighting device in the “image recording” industry is nothing more than using a known lighting device for a well-known purpose to yield predictable results. A POSITA would have had an expectation of success as using Kit’s LED lights in a linear form factor would have worked to capture high-quality images. *See Id.* at 20:15–21:37.

109. A POSITA would also have been motivated to combine the teachings of Kit with that of Katzir. Katzir discloses an LED lighting device in a fluorescent

tube form factor. Ex. 1010 at Fig. 1C, [0027]. This LED device is substantially similar to that disclosed in Kit, as shown below:



Ex. 1010 at Fig. 1C.



Ex. 1004 at Fig. 51.

110. Both Kit and Katzir teach using LED of various colors in a fluorescent tube form factor, like a T8 or T12 fluorescent tube. Katzir also discloses various LED array layouts that a POSITA would have looked to when designing an LED tube lighting like that disclosed in Kit. Ex. 1010 at Figs. 5A–5F, [0054]. A POSITA would have had strong motivation to look to Katzir to design an LED array to be retrofit in a fluorescent tube form factor.

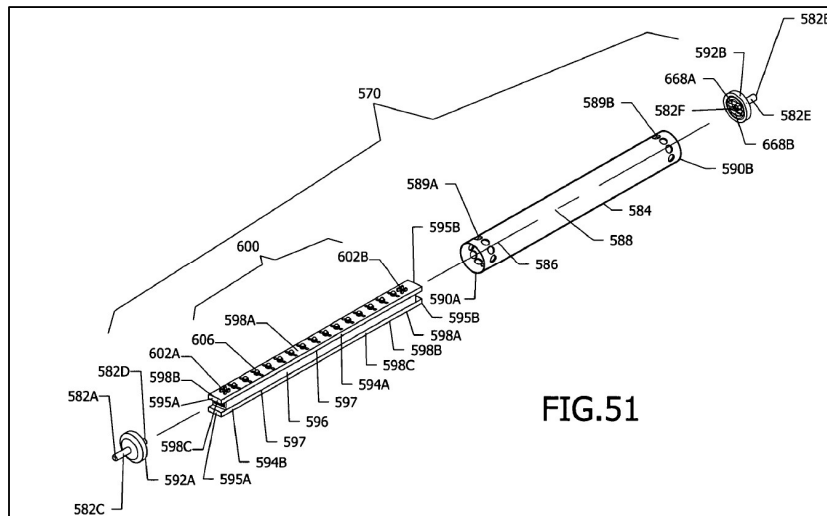
111. Fluorescent fixtures produce an extremely soft light. Soft light is traditionally produced by large sources, *e.g.*, an array of fluorescent, and creates subtle shadows. This feature tends to be very flattering for talent with less than perfect skin. While individual LEDs are small, many LEDs are used to achieve light levels associated with film and television production. As the LEDs are spread out over a circuit board, they quickly take on the attributes of a large source. A

POSITA wishing to replicate the soft light of a fluorescent fixture would see LEDs as an obvious alternative. A POSITA would also turn to diffusion if an even softer light was desired. Both Kit and Ducharme teach adding diffusion to the tubular cover/housing to further soften the light output from their devices. Ex. 1004 at 16:21–23; Ex. 1005 at 12:8–9.

(ii) Claim 1[pre]: An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:

112. Kit, in view of Ducharme, satisfies the preamble of Claim 1.

113. Both Kit and the '224 Patent teach the concept of upgrading fluorescent lights with LED lights. *See, e.g.*, Ex. 1004 at 12:53–13:3. For example, Kit discloses “[a]n energy saving device for an LED lamp mounted to an existing fixture for a fluorescent lamp where the ballast is removed or bypassed. The LEDs are positioned within a tube and electrical power is delivered from a power source to the LEDs.” *Id.* at Abstract, 16:4–33, Figs. 2, 51.



Id. at Fig. 51.

114. The '224 Patent claim 1 preamble includes “suitable for a commercial image recording” as an intended use for the LED lighting device; however, the '224 Patent does not recite any structural differences between the LED lighting device or tubular form factor in the '224 Patent and Kit, or the other prior art. The LED lights disclosed in the '224 Patent and Kit are the same, can be used in the same way, and can be used for the same purposes.

115. Even if Kit does not disclose the use of its LED device for the purpose of “image recording,” a POSITA would have found it obvious to use the LED lighting device disclosed in Kit for such a purpose because it would have known that Kit’s LED lights could be used in other lighting environments, such as image recording applications in the “commercial image recording” industry. A POSITA would know the white LEDs of Kit would be available in a plethora of color

temperatures and CRI values and that using such LEDs would simply be a design choice and have no effect on other aspects of the design of the device. The temperature ranges of the LED lights disclosed in Kit would have allowed for high quality image capturing based on the Planckian Locus.

116. Kit teaches that LED lamps may be inserted “directly into the lamp socket of existing fluorescent lighting fixtures used for general lighting in public, private, commercial, industrial, residential buildings . . .” Ex. 1004 at 16:4–9. It was known that the fluorescent lights Kit sought to replace were used in the lighting industry and had a variety of application such as “TV, stage, auditorium, and/or film studio use.” Ex. 1001 at 1:40–44.

117. Since 2005, the use of LEDs for illumination in entertainment applications has been expanding. LEDs offer advantages over all other types of lighting such as: virtually no radiated heat, which means talent stays cooler; reduced energy consumption, which radically reduces, or even eliminates, the need for generators on location; full-range dimmability with little or no color shift; longevity; easily configurable for battery operation for “cordless” lighting; configurable for true direct current operation eliminates the potential for flicker, even with extreme shutter speeds/frame rates; and ruggedness (with no need for a glass envelope, LEDs are relatively unbreakable). These advantages led to rapid

adoption, particularly in the television arts. By 2012, the use of LED lights in the image recording industry was well-known in the art. *See* Paragraphs 43–44 above.

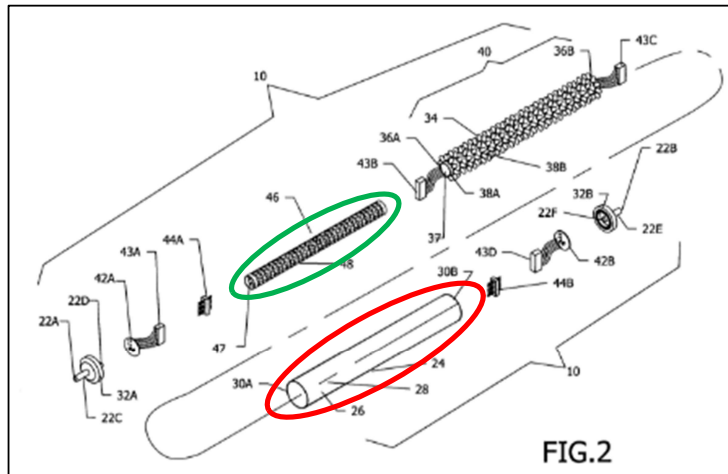
118. To the extent this limitation is not obvious in view of Kit alone, a POSITA would have known that the LED lighting in Kit would have been used in, and suitable for, commercial image recording industry based on the teachings of Ducharme. Ducharme expressly teaches that color LED lights like those taught in Kit are suitable for the image recording industry by disclosing the use of LED lights (which could be used as a replacement or retrofit of conventional fixtures). Ex. 1005 at Figs. 5a–5b, 12:49–67, 18:51–64 (describing the use of the disclosed lightings by a film director), 19:14–24 (using the disclosed lighting fixtures for image capturing).

(iii) Claim 1[a]: a support structure;

119. Kit satisfies this limitation of Claim 1.

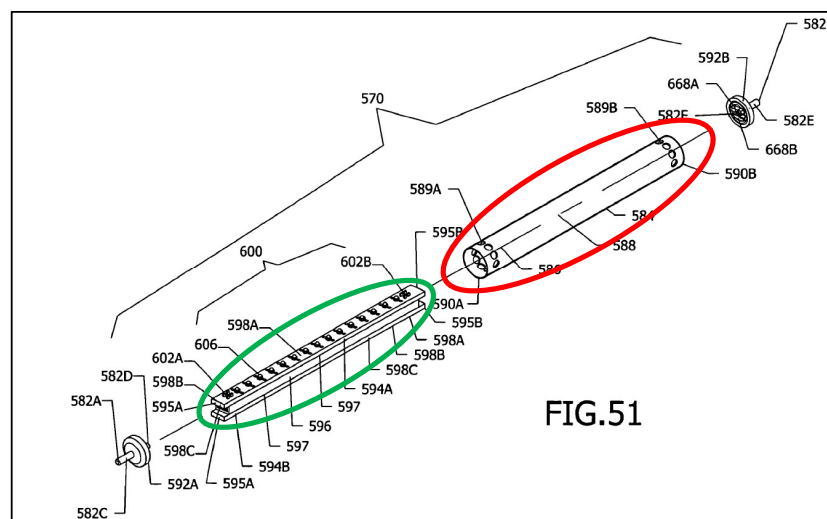
120. Kit discloses a “support structure” similar to that of the ’224 Patent. For example, Kit’s Figure 2 teaches a support structure and its housing, with an array of LED emitting devices mounted on the support structure. Ex. 1004 at 38:16–39:64.

121. Figure 2 is illustrated below, with the housing circled in red and the support structure circled in green. *Id.* at Fig. 2, 38:16–39:64.



Id. at Fig. 2. The support structure, which is positioned within the housing, acts as support for the cylindrical LED array and LED array circuit board. *Id.* at 38:16–39:64, *see also* 18:7–19:7.

122. Kit’s Figure 51 discloses an alternative embodiment. *Id.* at Fig. 51. This Figure is shown below, with the housing circled in red and the support structure circled in green:



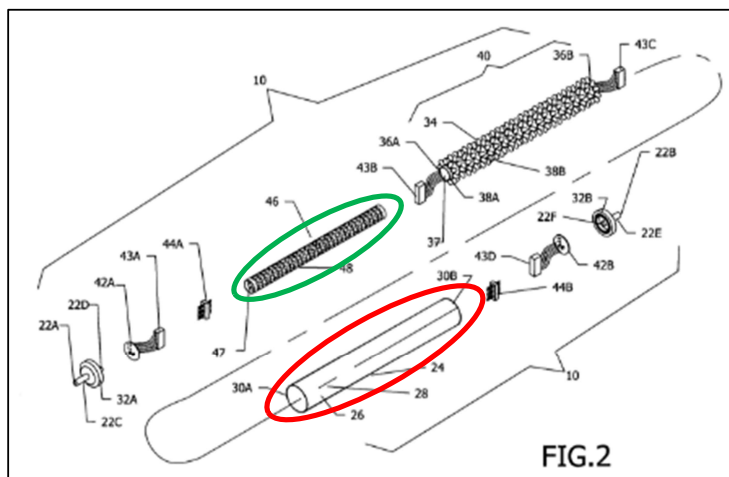
Id. at Fig. 51, 77:12–78:2.

(iv) **Claim 1[b]: a housing for the support structure;**

123. Kit satisfies this limitation of Claim 1.

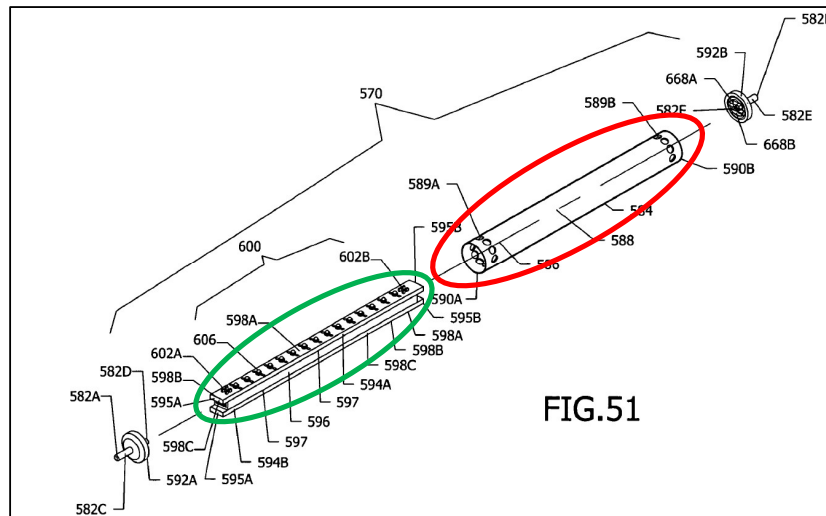
124. Kit teaches “a housing for the support structure” like that of the '224 Patent. For example, Kit’s Figure 2 teaches a support structure and its housing, with an array of LED emitting devices mounted on the support structure. *Id.* at 38:16–39:64.

125. Figure 2 is illustrated below, with the housing circled in red and the support structure circled in green. *Id.* at Fig. 2, 38:16–39:64.



Id. at Fig. 2. The support structure, which is positioned within the housing, acts as support for the cylindrical LED array and LED array circuit board. *Id.* at 38:16–39:64, *see also* 18:7–19:7.

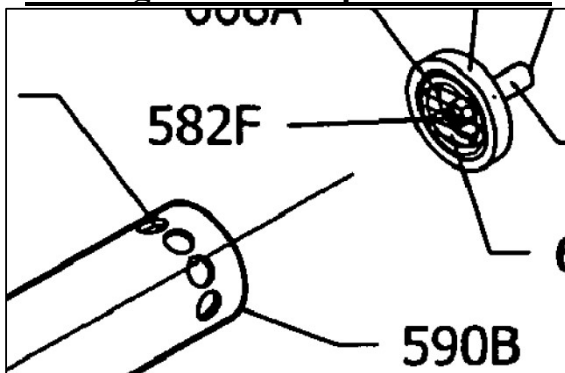
126. Kit’s Figure 51 discloses an alternative embodiment. *Id.* at Fig. 51. This figure is shown below, with the housing circled in red and the support structure circled in green:



Id. at Fig. 51, 77:12–78:2.

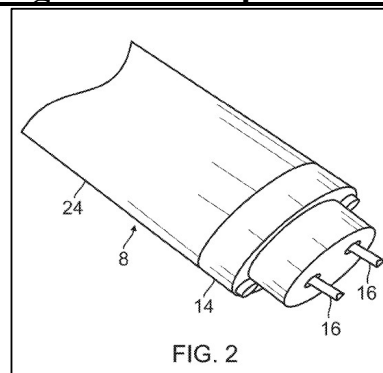
127. The housings disclosed in Kit and the '224 Patent are substantially identical, as illustrated by the figures below.

Housing and End Cap of Prior Art



Ex. 1004 at Fig. 51 (enlarged).

Housing and End Cap of '224 Patent



Ex. 1001 at Fig. 2.

- (v) ***Claim 1[c]: an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit five different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third***

color; a fourth set of LED emitting elements configured to emit light of at a fourth color; and a fifth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and

128. Kit satisfies this limitation of Claim 1.

129. As described in Paragraphs 120–122, Kit teaches an array of LEDs mounted on a support structure. Ex. 1004 at Figs. 2, 4, 51, 53, 38:16–39:64, 77:12–78:2, *see also* Fig. 12. Kit further discloses that the array of LED emitting devices is configured to produce five or more different colors (including white), using five sets of LEDs. *Id.* at 24:27–41. This is supported by the following disclosure:

“Another circuit module can be a color effects module for use with color LEDs instead of white LEDs used in the LED lamps. This module allows the LED lamp to change colors. The controllers used for the dimming modules can be modified to achieve the color changing function required here. There will be a minimum of RGB color LEDs, but Amber or A can also be used.” *Id.* at 24:27–41, *see also* 22:9–35.

130. Kit notes that there are several kinds of LED lights, all of which are compatible for use in Kit’s LED array:

LEDs are now available in colors like Red, Blue, Green, Yellow, Amber, Orange, and many other colors including White. . . . The use of color LEDs eliminates the need to wrap the fluorescent lamp body in colored gel medium to achieve color dispersions. Color LEDs give the end user more flexibility on output power distribution and color

mixing control. The color mixing controls are necessary to achieve the desired warm tone color temperature and output.

Id. at 20:50–63.

131. This is further evidenced by Kit’s disclosure that “[b]y correctly combining an appropriate mix of LEDs, the Luxeon Lamps themselves have well-controlled and consistent color temperatures of 3200K (warm white), 4100K (commercial white) or 5500K (cool white).” *Id.* at 3:20–38. Kit discloses that there are many types of LED lights, all of which may be used in the LED array disclosed in Kit, and the fifth set of LEDs can emit broad-spectrum white light within a predetermined Kelvin temperature range such as warm white, commercial white, or cool white light. *Id.*

(vi) ***Claim 1[d]: a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light consisting of varying amounts of the five different colors provided by the first, second, third, fourth, and fifth sets of LED emitting elements to produce many different colors outputted from the lighting device;***

132. Kit satisfies this limitation of Claim 1.

133. Kit teaches a controller coupled to the LED array and configured to receive commands. Ex. 1004 at 24:3–32, 139:21–31. These commands allow for operation of select LEDs with the claimed “varying amounts of power to produce

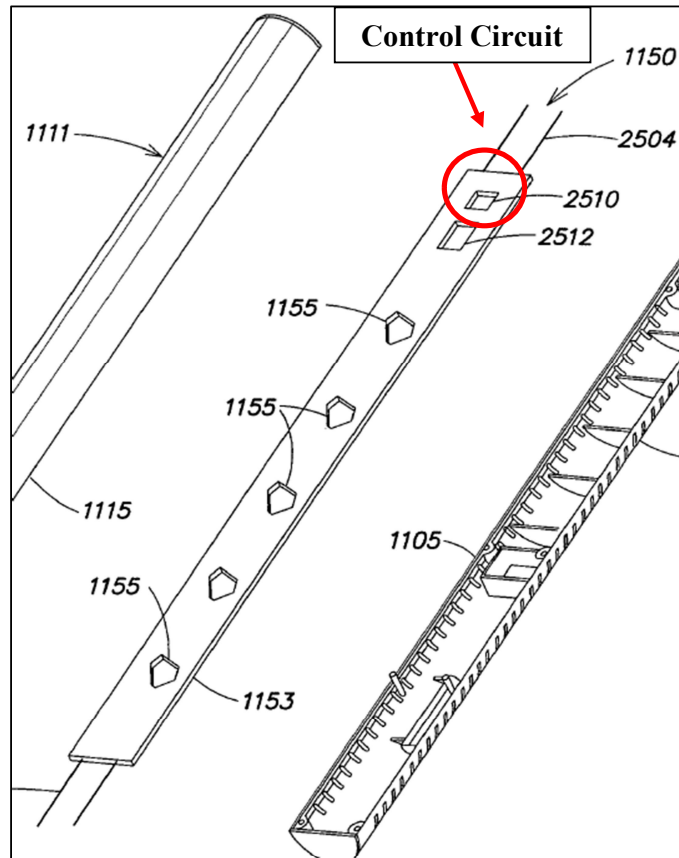
light consisting of varying amounts of the five different colors.” *Id.* at 24:27–41.

For example, Kit teaches:

Another circuit module can be a color effects module for use with color LEDs instead of white LEDs used in the LED lamps. **This module allows the LED lamp to change colors. The controllers used for the dimming modules can be modified to achieve the color changing function required here.** There will be a minimum of RGB color LEDs, but Amber or A can also be used. The dimming module described hereinbefore used a single channel to dim the entire array of white LEDs, but this circuit module will require 3 or 4 channels of dimming control to achieve different color combinations.

Id. at 24:3–41 (emphasis added). This disclosure describes the use of a controller that is coupled to the LED array and can be used for dimming or changing the LED colors. *Id.* at 24:3–41. The LED array is not limited to the colors listed in the above disclosure. *Id.* at 20:50–63. Kit teaches an LED driver configured to selectively provide electrical power to the LED array. *Id.* at 23:31–55, 24:27–41. For instance, Kit discloses a “color effects module,” a circuit module that can create different color combinations by using channels to selectively change LED colors. *Id.* at 24:27–42. The color effects module supplies three or four channels of dimming to individually control each array of colored LEDs. It can also act as a replacement for a “dimming module” in order to change the colors on the LED arrays. *Id.* The “color effects module” and power control module disclosed in Kit

“can be incorporated into the electrical circuits used in the LED retrofit lamp.” *Id.* at 23:31–33. Kit discloses that the circuit modules “contain the necessary electronics to decipher data input control signals and provide the current driver power to operate the LED arrays.” *Id.* at 23:31–33. Kit also discloses the use of a dimming module; however, as noted above, a color effects module may also be used. *Id.* at 23:31–42, 24:27–42. The color effects module drives each array of colored LEDs, making it possible to “achieve different color combinations.” *Id.* at 24:27–42. Ducharme further discloses a controller coupled to the array of LEDs that can receive commands for operating the LEDs. Ducharme’s controller can provide varying amounts of power to the LEDs. For instance, Figure 29 discloses a “control circuit” (2510) that is mounted on a support structure and can control color temperature and power to an LED. Ex. 1005 at Fig. 29 (control circuit circled in red), 29:44–55 (“The control circuit (2510) may control the LEDs (1155) . . . or control circuit (2510) may generate control signals to operate the LEDs.”), 30:35–31:4, Figs. 10a and b, 17:59–18:33.



Ex. 1005 at Fig. 29. Additionally, a POSITA would have been motivated to modify Ducharme to include an LED driver that can separately control the pluralities of LEDs based on Katzir. Ex. 1006 at [0011]–[0013], [0033]–[0034].

(vii) ***Claim 1[e]: and further comprising an LED driver, the LED driver configured to selectively provide electrical power to the array of LED emitting devices***

134. Kit satisfies this limitation of Claim 1.

135. Kit teaches an LED driver configured to selectively provide electrical power to the LED array. Ex. 1004 at 23:31–55, 24:27–42. For instance, Kit

discloses a “color effects module,” a circuit module that can create different color combinations by using channels to selectively change LED colors. *Id.* at 24:27–42. The color effects module supplies three or four channels of dimming to individually control each array of colored LEDs. *Id.* It can also act as a replacement for a “dimming module” in order to change the colors on the LED arrays. *Id.* Kit’s “color effects module” and the power control module “can be incorporated into the electrical circuits used in the LED retrofit lamp.” *Id.* at 23:31–55. Kit teaches that the disclosed circuit modules “contain the necessary electronics to decipher data input control signals and provide the current driver power to operate the LED arrays.” *Id.* One of the examples in Kit uses a dimming module; however, a color effects module can also be used to power the LED lights and change colors. *Id.* at 24:27–42. The color effects module drives each array of colored LEDs making it possible to achieve different color combinations. Further, Kit discloses that the disclosed power control module in Kit “can be incorporated into the electrical circuits used in the LED retrofit lamp” of Kit. *Id.* at 15:20–47, 23:31–33, Fig. 53.

136. Ducharme discloses circuitry mounted on the support structure that includes a driver to selectively switch between driving the first or second LEDs. This may include switching some LEDs off while other LEDs are on. For example, Figure 29 discloses a “control circuit” (2510) that is mounted on a

support structure and can control color temperature and power to an LED. Ex. 1005 at Fig. 29, 29:44–55 (“The control circuit (2510) may control the LEDs (1155) with constant D.C. voltage or control circuit (2510) may generate control signals to operate the LEDs. In a preferred embodiment, the control circuit (2510) would include a processor for generating pulse width modulated control signals, or other similar control signals, for the LEDs.”), 30:35–31:4, Fig. 10a and b, 17:59–18:33. In addition, to the extent this limitation is not disclosed by Kit or Ducharme, a POSITA would have been motivated to modify Kit in view of Katzir to include an LED driver that can separately control the pluralities of LEDs. Ex. 1006 at [0011]–[0013], [0033]–[0034].

(viii) Claim 1[f]: wherein the housing has a linear form factor substantially that of a fluorescent tube having an axial direction and having a diameter of no greater than about 41 mm, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and

137. Kit satisfies this limitation of Claim 1.

138. The housing for the LED light in Kit has a linear form factor and an axial direction, similar to a fluorescent tube. Ex. 1004 at Figs. 2, 51, 16:4–12, 19:35–43, 77:20–78:2. This shared form factor allows for the replacement of standard fluorescent tubes with LED light arrays, as taught by Kit. *Id.* at 1:42–48, 12:57–13:3. Kit also describes the linear form factor as having a diameter of about 41mm or less. *Id.* at, e.g., 41:18–22, 42:24–28.

139. Further, the linear form factor in Kit has an electrical input connection. *Id.* at 15:20–33, 79:60–65. This electrical input connection is designed to receive input power and communicates with the LED driver. *Id.* In support, Kit discloses that LED lamps can be connected or wired between input lines. *Id.* at 19:35–43, 77:12–50.

140. Kit discloses that fluorescent lamps “are available in a wide variety of shapes and sizes,” ranging between “6 inches in length with a diameter of 5/8 inches, up to 215 watts extending eight feet in length with diameters exceeding 2 inches.” *Id.* at 9:15–19. Kit also explicitly discloses a housing with a diameter of 1.5 inches (which is not larger than 41mm). *Id.* at 42:24–28.

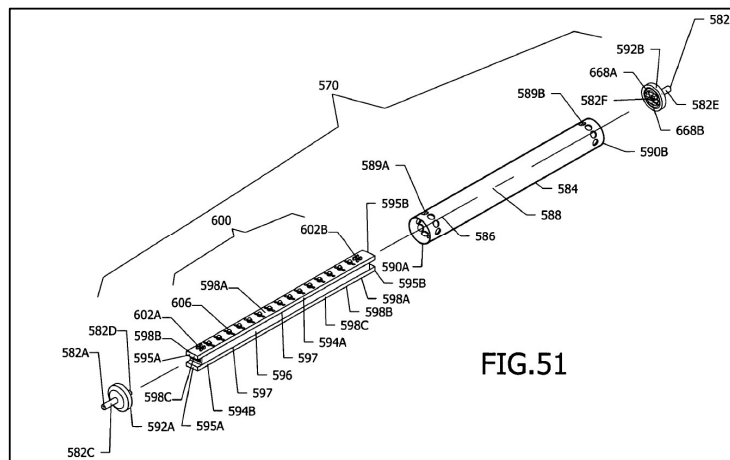
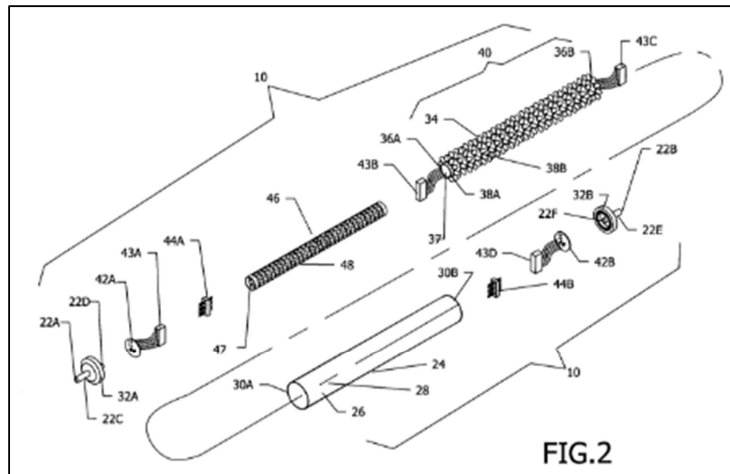
141. Kit teaches the use of T12 tubes, which have a diameter of one- and one-half inches. *Id.* at, *e.g.*, 12:65–13:3. Kit also teaches the use of T8 tubes, which have a one-inch diameter. *Id.* A POSITA would be familiar with the standard diameter of a T12 or T8 fluorescent tube. The tube housing in Kit may be 1.5 inches, as taught by Kit, making the tube housing no larger than 41mm. *Id.* at, *e.g.*, 42:24–28 (“twenty LEDs 52 are shown connected in series within each LED string 80 because of the fact that only ten LEDs 52 of the 4 mm discrete type of LED will fit around the circumference of a 1.5-inch diameter lamp housing.”).

(ix) ***Claim 1[g]: wherein the housing has opposite ends and the support structure is in a form of an elongated and narrow surface extending in the axial direction and the housing***

having a top side and a bottom side which each extend in the axial direction, and;

142. Kit satisfies this limitation of Claim 1.

143. The support structure in Kit has an elongated form with a narrow surface that extends in an axial direction within the housing. Ex. 1004 at Figs 2, 51, 38:16–39:29, 77:10–50. The corresponding housing has opposite ends, as illustrated by Figures 2 and 51. *Id.* at Figs 1, 51, 38:16–60, 77:10–50.



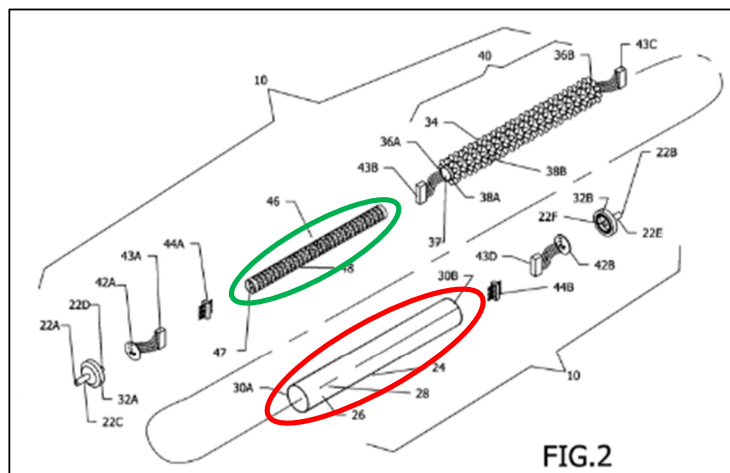
Id. at Figs. 2, 51.

144. The housing pictured above also top side and a bottom side, which each extend in an axial direction. *Id.* at Figs. 2, 51, 38:16–60, 77:10–50.

(x) *Claim 1[h]: wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.*

145. Kit satisfies this limitation of Claim 1.

146. Kit teaches LEDs that are arranged to produce light from the top side of the housing between its opposite ends. Ex. 1004 at Figs. 2 and 51; 16:21-23. Kit also discloses a diffusion cover on the top side of the housing. *Id.* at Figs. 2 and 51, 16:21–23 (“The surface of the main outer tubular housing can be diffused or can be coated with a white translucent film to create a more dispersed light output similar to present fluorescent lamps.”), 38:16-21. This diffusion cover extends the axial length of the support structure between the opposite ends, as illustrated below. *Id.* at Figs. 2 and 51, 16:21–23, 38:16-21.



(xi) *Independent Claims 1, 13, 23, and 35*

147. A POSITA would not perceive any substantive differences of scope between Claim 1 and Claims 13, 23, and 35 and the foregoing reasoning regarding Claim 1 applies with equal force to Claims 13, 23, and 35.

148. To illustrate the fact that Claims 1, 13, 23, and 35 do not differ substantially in their scope, the claims are reproduced below with notable differences bolded:¹

Claim 1	Claim 13	Claim 23	Claim 35
1[pre] An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:	13[pre] An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:	23[pre] An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:	35[pre] An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:
1[a] a support structure;	13[a] a support structure;	23[a] a support structure;	35[a] a support structure;
1[b] a housing for the support structure;	13[b] a housing for the support structure;	23[b] a housing for the support structure;	35[b] a housing for the support structure;
1[c] an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit	13[c] an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit	23[c] an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit	35[c] an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit

¹ The claim comparison charts throughout this Declaration apply equally to Grounds 1 and 2.

five different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; a fourth set of LED emitting elements configured to emit light of at a fourth color; and a fifth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and	four different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; and a fourth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and	five different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; a fourth set of LED emitting elements configured to emit light of at a fourth color; and a fifth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and	four different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; and a fourth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and
1[d] a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light	13[d] a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light	23[d] a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light	35[d] a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light

consisting of varying amounts of the five different colors provided by the first, second, third, fourth, and fifth sets of LED emitting elements to produce many different colors outputted from the lighting device 1[e] and further comprising an LED driver, the LED driver configured to selectively provide electrical power to the array of LED emitting devices	consisting of varying amounts of the four different colors provided by the first, second, third, and fourth sets of LED emitting elements to produce many different colors outputted from the lighting device, and further comprising an LED driver, the LED driver configured to selectively provide electrical power to the array of LED emitting devices,	consisting of varying amounts of the five different colors provided by the first, second, third, fourth, and fifth sets of LED emitting elements to produce many different colors outputted from the lighting device, 23[e] and an LED driver configured to selectively provide electrical power to the array of LED emitting devices;	consisting of varying amounts of the five different colors provided by the first, second, third, and fourth sets of LED emitting elements to produce many different colors outputted from the lighting device which are uniform in color, and an LED driver configured to selectively provide electrical power to the array of LED emitting devices
1[f] wherein the housing has a linear form factor substantially that of a fluorescent tube having an axial direction and having a diameter of no greater than about 41 mm, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and	13[e] wherein the housing has a linear form factor substantially that of a fluorescent tube of one of a T12 and T8 form, and having a length of no greater than about four feet and a diameter of no greater than about 41 mm, and further comprising an electrical input connection for receiving input power, and	23[f] wherein the housing has a linear form factor substantially that of one of a T12 and T8 form, and fluorescent tube light, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and	35[e] wherein the housing has a linear form factor substantially that of a fluorescent tube light of one of a T12 and T8 form, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and

1[g] wherein the housing has opposite ends and the support structure is in a form of an elongated and narrow surface extending in the axial direction and the housing having a top side and a bottom side which each extend in the axial direction, and; 1[h] wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.	13[f] wherein the input connection is in electrical communication with the LED driver, wherein the housing has opposite ends and the support surface is in a form of an elongated and narrow surface extending in the axial direction, and the housing having a top side and a bottom side which each extend in the axial direction, and 13[g] wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.	23[g] wherein the housing has opposite ends and the support structure is in a form of an elongated and narrow surface extending in the axial direction and the housing having a top side and a bottom side which each extend in the axial direction, and wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.	35[f] wherein the housing has opposite ends and the support structure is in a form of an elongated and narrow surface extending in the axial direction and the housing having a top side and a bottom side which each extend in the axial direction, and 35[g] wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.
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(xii) ***Dependent Claim 3: The LED lighting device of claim 1, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in increments of about 1/255 to***

selectively produce at least 255 different colors from the lighting device.

149. Kit discloses Claim 3.

150. Kit discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

151. Kit discloses that the LED lights can be controlled using a DMX512 signal, which can act as a color effect module to incrementally control the color of RGBAW lights. Ex. 1004 at 24:3–42. The DMX signal in Kit allows a user to fully control the RGBAW array to achieve “different color combinations,” and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.*

152. Claims 3, 25, and 37 are substantially identical.

153. A POSITA would not perceive any substantive differences of scope between Claims 3, 25, and 37. The foregoing reasoning regarding Claim 3 applies with equal force to Claims 25 and 37.

154. To illustrate the fact that Claims 3, 25, and 37 do not differ substantially in their scope, the claims are reproduced below:

Claim 3	Claim 25	Claim 37
3 The LED lighting device of claim 1 , wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in increments of about 1/255 to selectively produce at least 255 different colors from the lighting device.	25 The LED lighting device of claim 23 , wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth and fifth set of LED emitting elements in increments of about 1/255 to selectively produce at least 255 different colors from the lighting device.	37 The LED lighting device of claim 35 , wherein the LED driver is adapted for selectively driving each of the first set, second set, third set and fourth set of LED emitting elements in increments of about 1/255 to selectively produce at least 255 different colors from the lighting device.

(xiii) ***Dependent Claim 4: The LED lighting device of claim 3, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an entertainment industry color wheel emitted from the lighting device.***

155. Kit discloses Claim 4.

156. Kit discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These

increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

157. Kit discloses that the LED lights can be controlled using a DMX512 signal, which can act as a color effect module to incrementally control the color of RGBAW lights. Ex. 1004 at 24:3–42. The DMX signal in Kit allows a user to fully control the RGBAW array to achieve “different color combinations,” and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.*

158. Claims 4, 26, 38, and 39 are substantially identical.

159. A POSITA would not perceive any substantive differences of scope between Claims 4, 26, 38, and 39. The foregoing reasoning regarding Claim 4 applies with equal force to Claims 26, 38, and 39.

160. To illustrate the fact that Claims 4, 26, 38, and 39 do not differ substantially in their scope, the claims are reproduced below:

Claim 4	Claim 26	Claim 38	Claim 39
4 The LED lighting device of claim 3 , wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX	26 The LED lighting device of claim 5 , wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX	38 The LED lighting device of claim 37 , wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX	39 The LED lighting device of claim 35 , wherein the LED driver is adapted for selectively driving each of the first set, second set, third set and fourth set of LED emitting elements to selectively produce

signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an entertainment industry color wheel emitted from the lighting device.	signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an entertainment industry color wheel emitting from the lighting device.	signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an entertainment industry color wheel emitted from the lighting device.	at least 255 different colors of a color wheel from the lighting device.
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(xiv) ***Dependent Claim 7: The LED lighting device of claim 1, wherein the fluorescent tube light has a substantially T12 form.***

161. Kit discloses Claim 7.

162. As discussed in Paragraphs 138–141 above, Kit teaches an elongated LED lighting device that has the same form factor as a T12 tube. Ex. 1004 at 5:15–34 (describing “possible fluorescent fixture retrofit options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the base model with no upgrade done here.”), 12:53–13:3.

163. Claims 7, 29, and 41 are substantially identical.

164. A POSITA would not perceive any substantive differences of scope between Claims 7 and 29. The foregoing reasoning regarding Claim 7 applies with equal force to Claims 29 and 41.

165. To illustrate the fact that Claims 7, 29, and 41 do not differ substantially in their scope, the claims are reproduced below:

Claim 7	Claim 29	Claim 41
7 The LED lighting device of claim 1 , wherein the fluorescent tube light has a substantially T12 form.	29 The LED lighting device of claim 23 , wherein the fluorescent tube light has a substantially T12 form.	41 The LED lighting device of claim 35 , wherein the fluorescent tube light has a substantially T12 form.

(xv) ***Dependent Claim 8: The LED lighting device of claim 1, wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.***

166. Kit teaches Claim 8.

167. Kit teaches LED lights having a length within the range identified for fluorescent tubes. As stated above with respect to Claim 7, Kit teaches an LED device having the same elongated form factor as T12 fluorescent tubes. Ex. 1004 at 5:15–34 (describing “possible fluorescent fixture retrofit options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the based model with no upgrade done here.”), 12:53–13:3.

168. Kit also teaches variations in length for fluorescent tubes, including those lengths between one to four feet long. *Id.* at 9:15–24 (“Fluorescent lamps sold in the United States today are available in a wide variety of shapes and sizes.”), 17:49–56, 18:58–66. Kit teaches that the length of fluorescent tubes may range between six inches and eight feet and the tubes are “available in one, two, four, six, and eight feet lengths.” *Id.* at 9:15–24, 17:49–51. Further, Kit discloses that “the flexible circuit board can be designed in increments of one-foot lengths.”

Id. at 17:49–52. For example, Kit discloses a “basic tubular 4-foot LED retrofit lamp.” *Id.* at 4:50–55.

169. Claims 8, 30, and 42 are substantially identical.

170. A POSITA would not perceive any substantive differences of scope between Claims 8, 30, and 42. The foregoing reasoning regarding Claim 8 applies with equal force to Claims 30 and 42.

171. To illustrate the fact that Claims 8, 30, and 42 do not differ substantially in their scope, the claims are reproduced below:

Claim 8	Claim 30	Claim 42
8 The LED lighting device of claim 1 , wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.	30 The LED lighting device of claim 23 , wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.	42 The LED lighting device of claim 35 , wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.

(xvi) ***Dependent Claim 9: The LED lighting device of claim 1, wherein at least one of the colors of the LEDs is amber.***

172. Kit discloses LEDs containing amber-colored light, and thus satisfies Claim 9. *See, e.g.*, Ex. 1004 at 20:50–57.

173. Kit teaches the availability of LEDs “in colors like Red, Blue, Green, Yellow, **Amber**, Orange, and many other colors including White. Although any type and color of LED can be used in the LED arrays used on the circuit boards of the present invention, an LED with a wide beam angle will provide a better

blending of the light beams from each LED thereby producing an overall generally even distribution of light output omni-directionally and in every position.” *Id.* at 20:50–57 (emphasis added).

174. Kit discloses the use of an amber LED to reduce the CCT of a white LED while still maintaining a high CRI. This practice was well-known and a POSITA would have been familiar with this practice prior to 2009.

175. Claims 9, 31, and 43 are substantially identical.

176. A POSITA would not perceive any substantive differences of scope between Claims 9, 31, and 43. The foregoing reasoning regarding Claim 9 applies with equal force to Claims 31 and 43.

177. To illustrate the fact that Claims 9, 31, and 43 do not differ substantially in their scope, the claims are reproduced below:

Claim 9	Claim 31	Claim 43
9 The LED lighting device of claim 1 , wherein at least one of the colors of the LEDs is amber.	31 The LED lighting device of claim 23 , wherein at least one of the colors of the LEDs is amber.	43 The LED lighting device of claim 35 , wherein at least one of the colors of the LEDs is amber.

(xvii) *Claim 10: The LED lighting device of claim 1, wherein the first, second, third and fourth LEDs are red, green, blue and amber, respectively.*

178. Kit teaches Claim 10 by disclosing an LED device with the first four LEDs can be colored red, green, blue, and amber. Ex. 1004 at 20:50–57.

179. Kit teaches the availability of LEDs “in colors like Red, Blue, Green, Yellow, Amber, Orange, and many other colors including White. Although any type and color of LED can be used in the LED arrays used on the circuit boards of the present invention, an LED with a wide beam angle will provide a better blending of the light beams from each LED thereby producing an overall generally even distribution of light output omni-directionally and in every position.” *Id.* at 20:50–57.

180. Claims 10 and 32 are substantially identical.

181. A POSITA would not perceive any substantive differences of scope between Claims 10 and 32. The foregoing reasoning regarding Claim 10 applies with equal force to Claim 32.

182. To illustrate the fact that Claims 10 and 32 do not differ substantially in their scope, the claims are reproduced below:

Claim 10	Claim 32
10 The LED lighting device of claim 1 , wherein the first, second, third and fourth LEDs are red, green, blue and amber, respectively.	32 The LED lighting device of claim 23 , wherein the first, second, third and fourth LEDs are red, green, blue and amber, respectively.

(xviii) ***Claim 11: The LED lighting device of claim 1, wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.***

183. Kit discloses Claim 11.

184. Kit discloses LEDs in the following color temperature ranges: “3200K (warm white), 4100K (commercial white) or 5500K (cool white).” Ex. 1004 at 3:26–38; *compare to* Ex. 1001 at 2:7–11 (“[F]or example 3050 to 3300 K for tungsten (warm white), and, for example, 5400 to 5600 K for daylight (cool white).”)

185. Thus, Kit teaches an LED lighting device producing white light in the daylight temperature range. A POSITA would know that 5400–5600K CCT describes a daylight temperature color. Ex. 1001 at 2:7–11.

186. A POSITA would know that the term “tungsten and daylight temperature ranges” stems from color film stock which was balanced for either indoor lighting or outdoor lighting. Traditionally, indoor lighting was mostly from incandescent bulbs, generally about 3200K and outdoor was from sunlight. Over the hours of usable sunlight, the color temperature averages about 5500K.

187. Midday sunlight averages around 5500K. “Daylight” film stock was balanced for this color temperature because movies were often filmed using available light for outdoor scenes. “Daylight” is contrasted with “tungsten”. When filming in a studio, traditionally incandescent, or tungsten filament, bulbs were used. When supplied with the proper voltage, these bulbs emit light in the vicinity of 3200K. As color television cameras were developed white balance presets were often provided for 5500K and 3200K.

188. Kit also teaches an LED lighting device producing white light in the tungsten temperature range. Ex. 1004 at 22:9–14 (“[m]ore recently, Lumileds Lighting, LLC now offers a Luxeon warm white LED with a 90 CRI (Color Rendering Index) and **3200 degrees Kelvin** CCT (Correlated Color Temperature). Lumileds Luxeon warm white is the first generally available low CCT and high CRI warm white solid-state light source.”) (emphasis added). By 2007, Litepanels, Inc. was using a custom LED from Everlight that had a CCT of 3200 degrees Kelvin and CRI above 90. Because the temperature range for tungsten white light is 3050 to 3300 degrees Kelvin, a POSITA would know that 3200 degrees Kelvin CCT describes a tungsten temperature color. Ex. 1001 at 2:7–11. A POSITA would have known and had an expectation of success in emitting broad-spectrum white light with a high CRI above 90.

189. The film and television industries evolved around artificial light for indoor production. For many years, that light was predominately generated by incandescent lamps, commonly halogen lamps. Depending on the voltage presented at the bulb, a halogen bulb generally burns in the 3200K range. If the voltage is lower than rated, the color temperature will fall. Conversely, if the voltage is above the rated voltage, the color temperature will rise. Film stock for movie production and white balance presets for video cameras have historically used 3200K as the indoor standard.

190. Claims 11, 33, and 44 are substantially identical.

191. A POSITA would not perceive any substantive differences of scope between Claims 11, 33, and 44. The foregoing reasoning regarding Claim 11 applies with equal force to Claims 33 and 44.

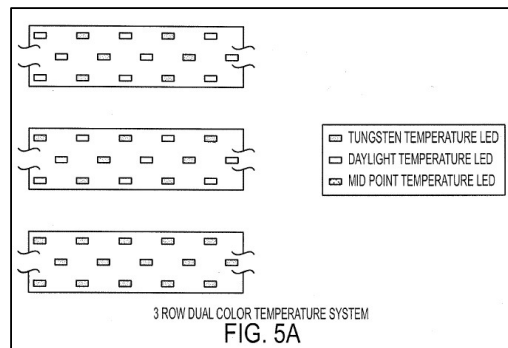
192. To illustrate the fact that Claims 11, 33, and 44 do not differ substantially in their scope, the claims are reproduced below:

Claim 11	Claim 33	Claim 44
11 The LED lighting device of claim 1 , wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.	33 The LED lighting device of claim 23 , wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.	44 The LED lighting device of claim 35 , wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.

(xix) ***Claim 12: The LED lighting device of claim 1, wherein the first, second, third, fourth and fifth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.***

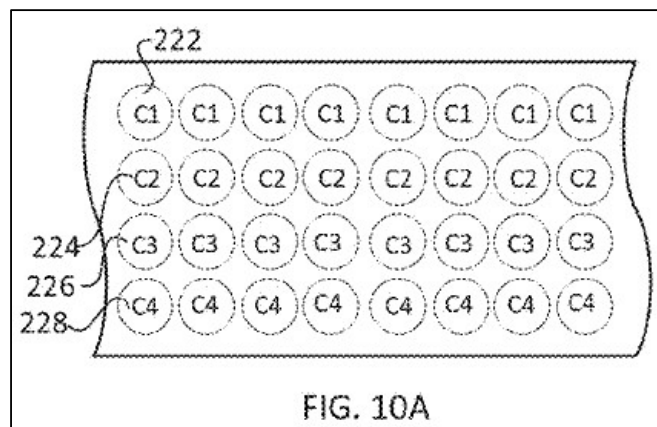
193. Katzir discloses an LED arrangement similar to a checkerboard or matrix pattern. Ex. 1010 at [0054], Figs. 5A–5F; *compare with* Ex. 1001 at 6:3–6 (“The first and second types of LEDs are preferably arranged within the matrix in a checkerboard pattern, a row of LEDs alternating between the first type and the second type of LEDs.”). Both color and white LED lights can be used in this arrangement. *See, e.g.*, Ex. 1010 at [0050], [0054].

194. One example of the matrix/checkerboard arrangement disclosed in Katzir is illustrated in Figure 5A below:



Ex. 1010 at Fig. 5A.

195. This matrix-like arrangement of LEDs is similar to the embodiments disclosed in the '224 Patent.



Ex. 1001 at Fig. 10A.

196. Claims 12, 34, and 45 are substantially identical.

197. A POSITA would not perceive any substantive differences of scope between Claims 12, 34, and 45. The foregoing reasoning regarding Claim 12 applies with equal force to Claims 34 and 45.

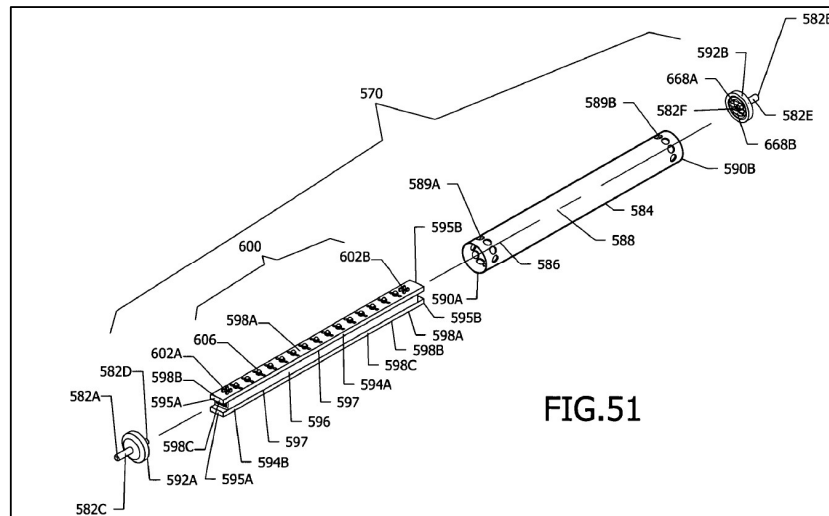
198. To illustrate the fact that Claims 12, 34, and 45 do not differ substantially in their scope, the claims are reproduced below:

Claim 12	Claim 34	Claim 45
12 The LED lighting device of claim 1 , wherein the first, second, third, fourth and fifth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.	34 The LED lighting device of claim 23 , wherein the first, second, third, fourth and fifth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.	45 The LED lighting device of claim 35 , wherein the first, second, third, and fourth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.

(xx) ***Claim 13[pre]: An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:***

199. Kit, in view of Ducharme, satisfies the preamble of Claim 13.

200. Both Kit and the '224 Patent teach the concept of upgrading fluorescent lights with LED lights. *See, e.g.,* Ex. 1004 at 12:53–13:3. For example, Kit discloses “[a]n energy saving device for an LED lamp mounted to an existing fixture for a fluorescent lamp where the ballast is removed or bypassed. The LEDs are positioned within a tube and electrical power is delivered from a power source to the LEDs.” *Id.* at Abstract, 16:4–33, Figs. 2, 51.



Id. at Fig. 51.

201. The '224 Patent preamble includes “suitable for a commercial image recording” as an intended use for the LED lighting device; however, this does not cause any structural differences between '224 Patent and Kit, or the other prior art. The LED lights disclosed in the '224 Patent and Kit are the same, can be used in the same way, and can be used for the same purposes.

202. Even if Kit did not satisfy this limitation, a POSITA would have found it obvious because it would have known that Kit's LED lights could be used in other lighting environments, such as image recording applications in the "commercial image recording" industry. A POSITA would know the white LEDs of Kit would be available in a plethora of color temperatures and CRI values and that using such LEDs would simply be a design choice and have no effect on other aspects of the design of the device. The temperature ranges of the LED lights

disclosed in Kit would have allowed for high quality image capturing based on the Planckian Locus.

203. Kit teaches that LED lamps may be inserted “directly into the lamp socket of existing fluorescent lighting fixtures used for general lighting in public, private, commercial, industrial, residential buildings . . .” Ex. 1004 at 16:4–9. It was known that the fluorescent lights Kit sought to replace were used in the lighting industry and had a variety of application such as “TV, stage, auditorium, and/or film studio use.” Ex. 1001 at 1:40–44.

204. Since 2005, the use of LEDs for illumination in entertainment applications has been expanding. LEDs offer advantages over all other types of lighting such as: virtually no radiated heat, which means talent stays cooler; reduced energy consumption, which radically reduces, or even eliminates, the need for generators on location; full range dimmability with little or no color shift; longevity; easily configurable for battery operation for “cordless” lighting; configurable for true direct current operation eliminates even the potential for flicker, even with extreme shutter speeds/frame rates; and ruggedness, with no need for a glass envelope, LEDs are relatively unbreakable. These advantages led to rapid adoption, particularly in the television arts. By 2012, the use of LED lights in the image recording industry was well-known in the art. *See* Paragraphs 43–44 above.

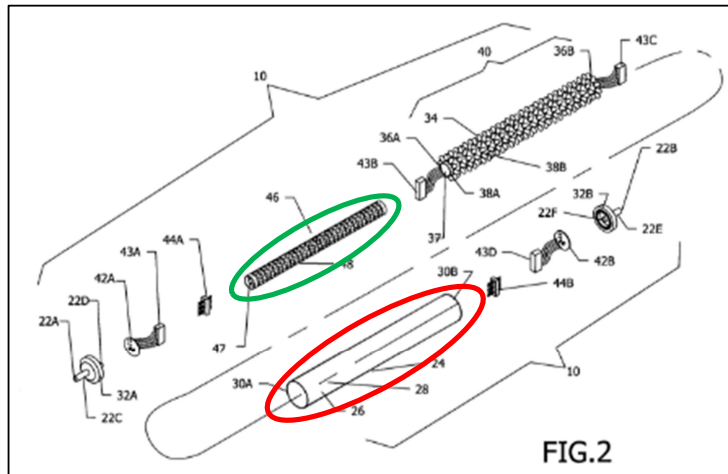
205. To the extent this limitation is not obvious in view of Kit alone, a POSITA would have known that the LED lighting in Kit would have been used in, and suitable for, commercial image recording industry based on the teachings of Ducharme. Ducharme expressly teaches that color LED lights like those taught in Kit are suitable for the image recording industry by disclosing the use of LED lights (which could be used as a replacement or retrofit of conventional fixtures). Ex. 1005 at Figs. 5a–5b, 12:49–67, 18:51–64 (describing the use of the disclosed lightings by a film director), 19:14–24 (using the disclosed lighting fixtures for image capturing).

(xxi) Claim 13[a]: a support structure;

206. Kit satisfies this limitation of Claim 13.

207. Kit discloses a “support structure” similar to that of the ’224 Patent. For example, Kit’s Figure 2 teaches a support structure and its housing, with an array of LED emitting devices mounted on the support structure. Ex. 1004 at 38:16–39:64.

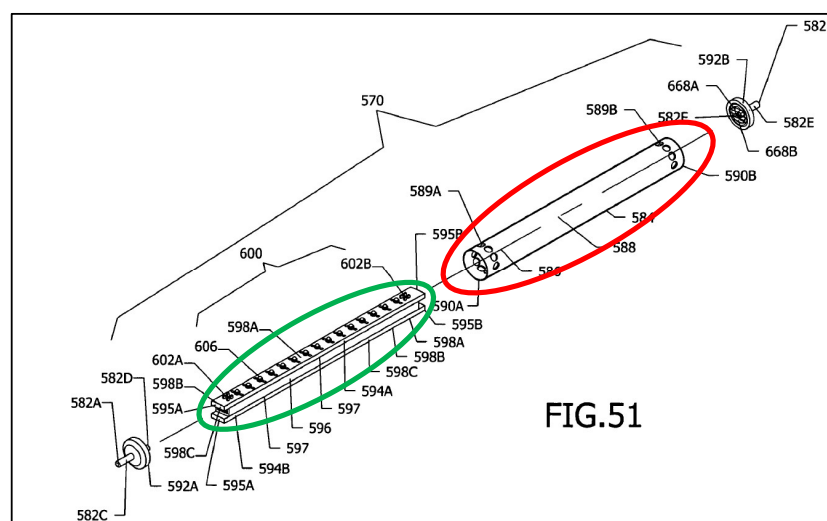
208. Figure 2 is illustrated below, with the housing circled in red and the support structure circled in green. *Id.* at Fig. 2, 38:16–39:64.



Id. at Fig. 2. The support structure, which is positioned within the housing, acts as support for the cylindrical LED array and LED array circuit board. *Id.* at 38:16–39:64, *see also* 18:7–19:7.

209. Kit's Figure 51 discloses an alternative embodiment. *Id.* at Fig. 51.

This figure is shown below, with the housing circled in red and the support structure circled in green:



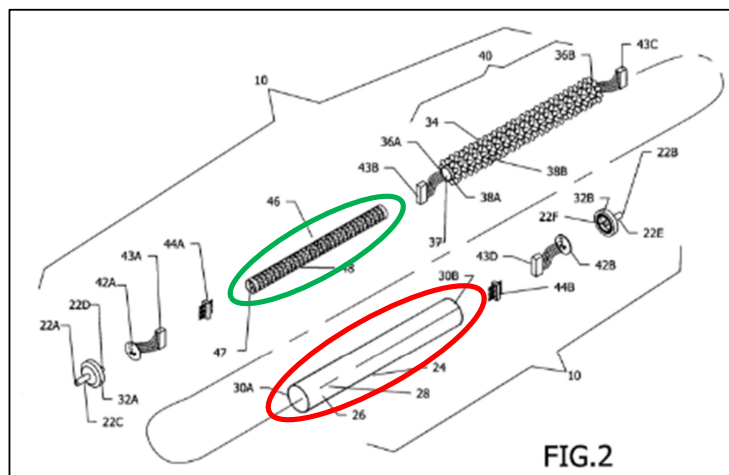
210. *Id.* at Fig. 51; 77:12–78:2.

(xxii) *Claim 13[b]: a housing for the support structure;*

211. Kit satisfies this limitation of Claim 13.

212. Kit teaches “a housing for the support structure” like that of the ’224 Patent. For example, Kit’s Figure 2 teaches a support structure and its housing, with an array of LED emitting devices mounted on the support structure. Ex. 1004 at 38:16–39:64.

213. Figure 2 is illustrated below, with the housing circled in red and the support structure circled in green. *Id.* at Fig. 2, 38:16–39:64.



Id. at Fig. 2. The support structure, which is positioned within the housing, acts as support for the cylindrical LED array and LED array circuit board. *Id.* at 38:16–39:64, *see also* 18:7–19:7.

214. Kit's Figure 51 discloses an alternative embodiment. Ex. 1004 at Fig. 51. This figure is shown below, with the housing circled in red and the support structure circled in green:

of LED emitting elements configured to emit light of a third color; and a fourth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and

216. Kit satisfies this limitation of Claim 13.

217. As described in Paragraphs 120–122, Kit teaches an array of LEDs mounted on a support structure. Ex. 1004 at Figs. 2, 4, 51, 53, 38:16–39:64, 77:12–78:2, *see also* Fig. 12. Kit further discloses that the array of LED-emitting devices is configured to produce four or more different colors (including white), using at least four sets of LEDs. *Id.* at 24:27–41. This is supported by the following disclosure: “Another circuit module can be a color effects module for use with color LEDs instead of white LEDs used in the LED lamps. This module allows the LED lamp to change colors. The controllers used for the dimming modules can be modified to achieve the color changing function required here. There will be a minimum of RGB color LEDs, but Amber or A can also be used.” *Id.* at 24:27–41, *see also* 22:9–35.

218. Kit notes that there are several kinds of LED lights, all of which are compatible for use in Kit’s LED array:

LEDs are now available in colors like Red, Blue, Green, Yellow, Amber, Orange, and many other colors including White. . . . The use of color LEDs eliminates the need to wrap the fluorescent lamp body in colored gel medium to achieve color dispersions. Color LEDs give the end user more flexibility on output power distribution and color

mixing control. The color mixing controls are necessary to achieve the desired warm tone color temperature and output.

Id. at 20:50–63. Any combination of color LEDs may be used.

219. This is further evidenced by Kit’s disclosure that “[b]y correctly combining an appropriate mix of LEDs, the Luxeon Lamps themselves have well-controlled and consistent color temperatures of 3200K (warm white), 4100K (commercial white) or 5500K (cool white).” *Id.* at 3:20–38.

(xxiv) ***Claim 13[d]: a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light consisting of varying amounts of the four different colors provided by the first, second, third, and fourth sets of LED emitting elements to produce many different colors outputted from the lighting device, and further comprising an LED driver, the LED driver configured to selectively provide electrical power to the array of LED emitting devices,***

220. Kit satisfies this limitation of Claim 13.

221. Kit teaches a controller coupled to the LED array and configured to receive commands. Ex. 1004 at 24:3–32, 139:21–31. These commands allow for operation of select LEDs with the claimed “varying amounts of power to produce light consisting of varying amounts of the five different colors.” *Id.* at 24:27–41.

For example, Kit teaches:

Another circuit module can be a color effects module for use with color LEDs instead of white LEDs used in the LED lamps. **This module**

allows the LED lamp to change colors. The controllers used for the dimming modules can be modified to achieve the color changing function required here. There will be a minimum of RGB color LEDs, but Amber or A can also be used. The dimming module described hereinbefore used a single channel to dim the entire array of white LEDs, but this circuit module will require 3 or 4 channels of dimming control to achieve different color combinations.

Id. at 24:3–41 (emphasis added).

222. This disclosure describes the use of a controller that is coupled to the LED array and can be used for dimming or changing the LED colors. *Id.* at 24:3–41. The LED array is not limited to the colors listed in the above disclosure. *Id.* at 20:50–63.

223. Kit teaches an LED driver configured to selectively provide electrical power to the LED array. Ex. 1004 at 23:31–55, 24:27–41. For instance, Kit discloses a “color effects module,” a circuit module that can create different color combinations by using channels to selectively change LED colors. Ex. 1004 at 24:27–42. The color effects module supplies three or four channels of dimming to individually control each array of colored LEDs. It can also act as a replacement for a “dimming module” in order to change the colors on the LED arrays. Ex. 1004 at 24:27–42.

224. Kit’s “color effects module” and the power control module “can be incorporated into the electrical circuits used in the LED retrofit lamp.” Ex. 1004 at 23:31–33. Kit teaches that the disclosed circuit modules “contain the necessary electronics to decipher data input control signals and provide the current driver power to operate the LED arrays.” Ex. 1004 at 23:31–33. One of the examples in Kit uses a dimming module; however, a color effects module can also be used to power the LED lights and change colors. Ex. 1004 at 24:3–42, 24:27–42. The color effects module drives each array of colored LEDs making it possible to “achieve different color combinations.” *Id.* at 24:27–42. Ducharme further discloses a controller coupled to the array of LEDs that can receive commands for operating the LEDs. Ducharme’s controller can provide varying amounts of power to the LEDs. For instance, Figure 29 discloses a “control circuit” (2510) that is mounted on a support structure and can control color temperature and power to an LED. Ex. 1005 at Fig. 29 (control circuit circled in red), 29:44–55 (“The control circuit (2510) may control the LEDs (1155) . . . or control circuit (2510) may generate control signals to operate the LEDs.”), 30:35–31:4, Figs. 10a and b, 17:59–18:33, Ex. 1005 at Fig. 29. Additionally, a POSITA would have been motivated to modify Ducharme to include an LED driver that can separately control the pluralities of LEDs based on Katzir. Ex. 1006 at [0011]–[0013], [0033]–[0034].

(xxv) ***Claim 13[e]: wherein the housing has a linear form factor substantially that of a fluorescent tube of one of a T12 and T8 form, and having a length of no greater than about four feet and a diameter of no greater than about 41 mm, and further comprising an electrical input connection for receiving input power, and***

225. Kit satisfies this limitation of Claim 13. Kit teaches LED lights having a length within the range identified for fluorescent tubes. The disclosed LED lighting device may have a housing form factor similar to that of T12 and T8 fluorescent tubes. Ex. 1004 5:15–34 (describing “possible fluorescent fixture retrofit options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the base model with no upgrade done here.”). A POSITA would know that a T12 fluorescent tube has a diameter of 1.5 inches, which is less than 41mm.

226. Kit also teaches variations in length for fluorescent tubes, including those lengths between one to four feet long. *Id.* at 9:15–17 (“Fluorescent lamps sold in the United States today are available in a wide variety of shapes and sizes.”), 17:49–51. Kit teaches that the length of fluorescent tubes may range between six inches and eight feet and are “available in one, two, four, six, and eight feet lengths.” *Id.* at 9:15–24, 17:49–51. Further, Kit discloses that “the flexible circuit board can be designed in increments of one-foot lengths.” *Id.* at 17:49–52. For example, Kit discloses a “basic tubular 4-foot LED retrofit lamp.” *Id.* at 4:50–55.

227. Kit also teaches a linear form factor having a diameter of about 41mm or less. *Id.* at 41:19–22, 42:24–28, 79:60–65. Further, the linear form factor has an electrical input connection. *Id.* at 15:20–33. This electrical input connection is designed to receive input power and communicates with the LED driver. *Id.*

228. Kit discloses that fluorescent lamps “are available in a wide variety of shapes and sizes,” ranging between “6 inches in length with a diameter of 5/8 inches, up to 215 watts extending eight feet in length with diameters exceeding 2 inches.” *Id.* at 9:15–19. Thus, the diameter of these fluorescent lamps is no larger than about 41mm.

229. Kit teaches the use of T12 tubes, which have a diameter of 1 – 1.5 inches. Ex. 1004 at 12:65–13:3. Kit also teaches the use of T8 tubes, which have a one-inch diameter. A POSITA would be familiar with the standard diameter of a T12 or T8 fluorescent tube, which is 1 – 1.5 inches. The tube housing in Kit may be 1.5 inches, as taught by Kit, making the tube housing no larger than 41 mm. Ex. 1004 at, e.g., 42:24–28 (“twenty LEDs 52 are shown connected in series within each LED string 80 because of the fact that only ten LEDs 52 of the 4 mm discrete type of LED will fit around the circumference of a 1.5-inch diameter lamp housing.”).

(xxvi) ***Claim 13[f]: wherein the input connection is in electrical communication with the LED driver, wherein the housing has opposite ends and the support surface is in a form of an elongated and narrow surface extending in the axial***

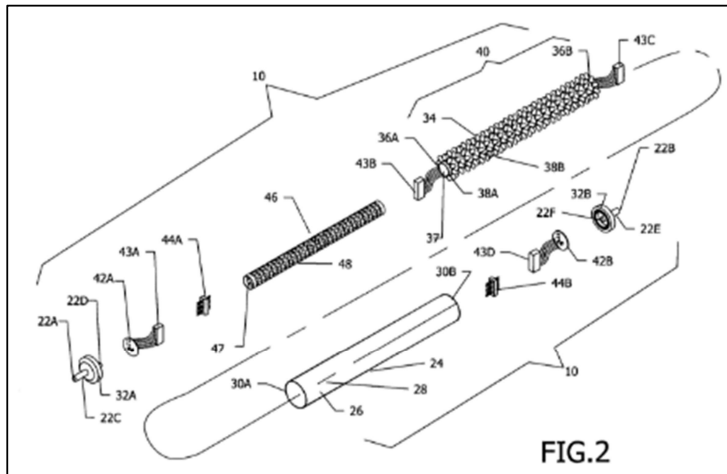
direction, and the housing having a top side and a bottom side which each extend in the axial direction, and

230. Kit satisfies this limitation of Claim 13.

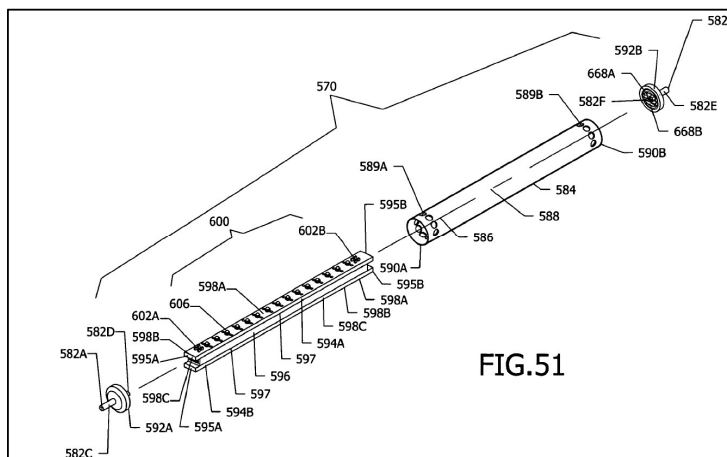
231. The housing for the LED light in Kit has a linear form factor and axial direction, similar to a fluorescent tube. Ex. 1004 at Figs. 2, 51, 16:4–12, 19:35–43, 77:20–78:2. This shared form factor allows for the replacement of standard fluorescent tubes with LED light arrays, as taught by Kit. *Id.* at 1:42–48, 12:57–13:3.

232. Further, the linear form factor in Kit has an electrical input connection. *Id.* at 15:20–33, 79:60–65. This electrical input connection is designed to receive input power and communicates with the LED driver. *Id.* In support, Kit discloses that LED lamps can be connected or wired between input lines. *Id.* at 19:35–43, 77:12–50.

233. The support structure in Kit has an elongated form with a narrow surface that extends in an axial direction within the housing. *Id.* at Figs 2, 51, 38:16–39:29, 77:10–50. The corresponding housing has opposite ends, as illustrated by Figures 2 and 51. *Id.* at Figs. 2, 51, 38:16–60, 77:10–50.



Id. at Fig. 2.



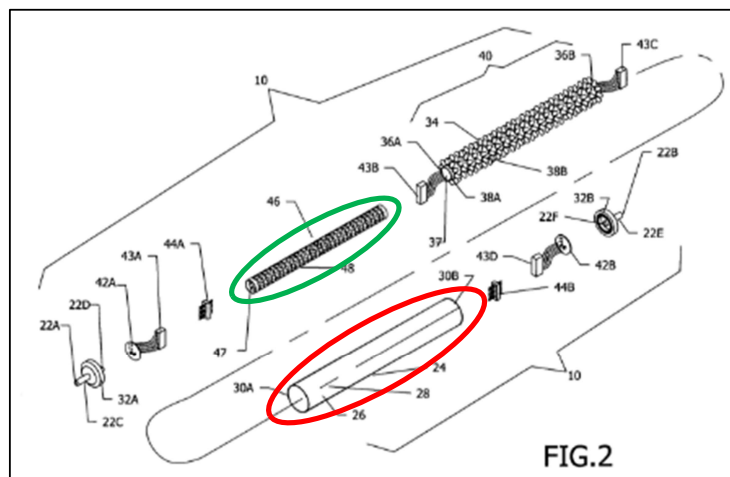
Id. at Fig. 51.

234. The housing pictured above also top side and a bottom side, which each extend in an axial direction. *Id.* at Figs. 2, 51, 38:16–60, 77:10–50.

(xxvii) ***Claim 13[g]: wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.***

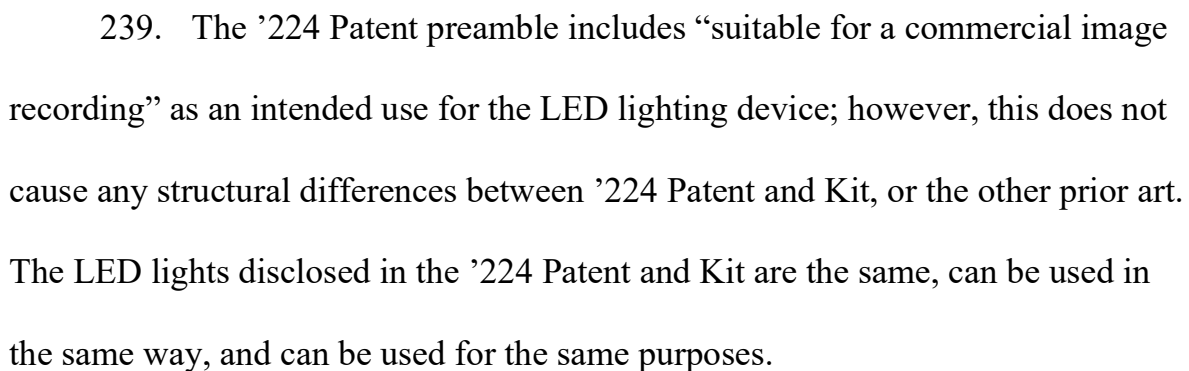
235. Kit and Ducharme satisfy this limitation of Claim 13.

236. Kit teaches LEDs that are arranged to produce light from the top side of the housing between its opposite ends. Ex. 1004 at Figs. 2 and 51, 16:21–23. Kit also discloses a diffusion cover on the top side of the housing. *Id.* at Figs. 2 and 51, 16:21–23 (“The surface of the main outer tubular housing can be diffused or can be coated with a white translucent film to create a more dispersed light output similar to present fluorescent lamps.”), 38:16-21. This diffusion cover extends the axial length of the support structure between the opposite ends, as illustrated below. *Id.* at Figs. 2 and 51, 16:21–23, 38:16-21.



Id. at Fig. 2 (support structure circled in green, housing circled in red), 38:16–21 (describing Figure 2 that contains “an elongated housing 24 particularly configured as a tubular wall 26 circular in cross-section taken transverse to a center line 28 that is made of a translucent material such as plastic or glass and **preferably having a diffused coating.**”) (emphasis added).

Id. at Fig. 51.



95

“commercial image recording” industry. A POSITA would know the white LEDs of Kit would be available in a plethora of color temperatures and CRI values and that using such LEDs would simply be a design choice and have no effect on other aspects of the design of the device. The temperature ranges of the LED lights disclosed in Kit would have allowed for high quality image capturing based on the Planckian Locus.

241. Kit teaches that LED lamps may be inserted “directly into the lamp socket of existing fluorescent lighting fixtures used for general lighting in public, private, commercial, industrial, residential buildings . . .” Ex. 1004 at 16:4–9. It was known that the fluorescent lights Kit sought to replace were used in the lighting industry and had a variety of application such as “TV, stage, auditorium, and/or film studio use.” Ex. 1001 at 1:40–44.

242. Since 2005, the use of LEDs for illumination in entertainment applications has been expanding. LEDs offer advantages over all other types of lighting such as: virtually no radiated heat, which means talent stays cooler; reduced energy consumption, which radically reduces, or even eliminates, the need for generators on location; full range dimmability with little or no color shift; longevity; easily configurable for battery operation for “cordless” lighting; configurable for true direct current operation eliminates even the potential for flicker, even with extreme shutter speeds/frame rates; and ruggedness, with no

need for a glass envelope, LEDs are relatively unbreakable. These advantages led to rapid adoption, particularly in the television arts. By 2012, the use of LED lights in the image recording industry was well-known in the art. *See* Paragraphs 43–44 above.

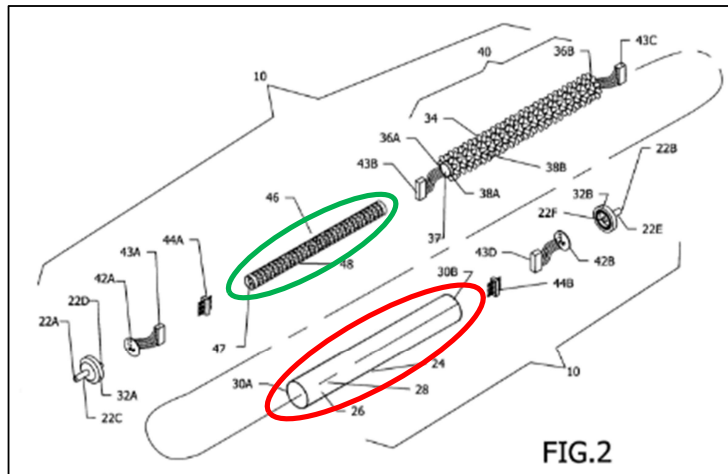
243. To the extent this limitation is not obvious in view of Kit alone, a POSITA would have known that the LED lighting in Kit would have been used in, and suitable for, commercial image recording industry based on the teachings of Ducharme. Ducharme expressly teaches that color LED lights like those taught in Kit are suitable for the image recording industry by disclosing the use of LED lights (which could be used as a replacement or retrofit of conventional fixtures). Ex. 1005 at Figs. 5a–5b, 12:49–67, 18:51–64 (describing the use of the disclosed lightings by a film director), 19:14–24 (using the disclosed lighting fixtures for image capturing).

(xxix) *Claim 23[a]: a support structure;*

244. Kit satisfies this limitation of Claim 23.

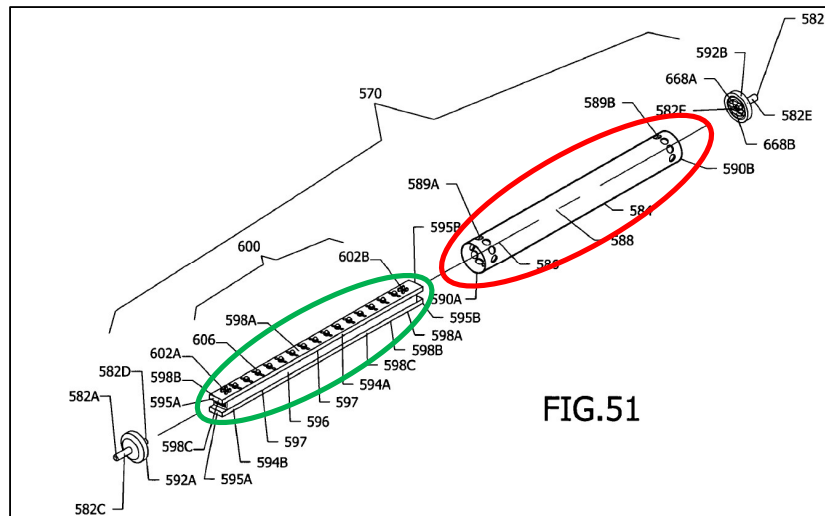
245. Kit discloses a “support structure” similar to that of the ’224 Patent. For example, Kit’s Figure 2 teaches a support structure and its housing, with an array of LED emitting devices mounted on the support structure. Ex. 1004 at 38:16–39:64.

246. Figure 2 is illustrated below, with the housing circled in red and the support structure circled in green. *Id.* at Fig. 2, 38:16–39:64.



Id. at Fig. 2. The support structure, which is positioned within the housing, acts as support for the cylindrical LED array and LED array circuit board. *Id.* at 38:16–39:64, *see also* 18:7–19:7.

247. Kit's Figure 51 discloses an alternative embodiment. *Id.* at Fig. 51. This Figure is shown below, with the housing circled in red and the support structure circled in green:



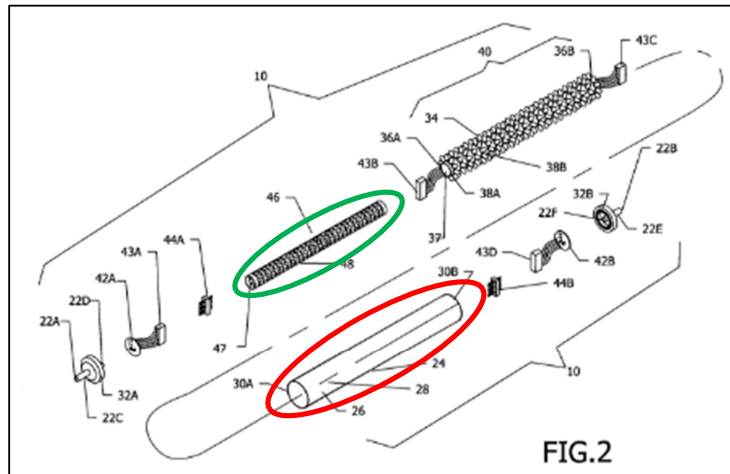
Id. at Fig. 51, 77:12–78:2.

(xxx) **Claim 23[b]: a housing for the support structure;**

248. Kit satisfies this limitation of Claim 23.

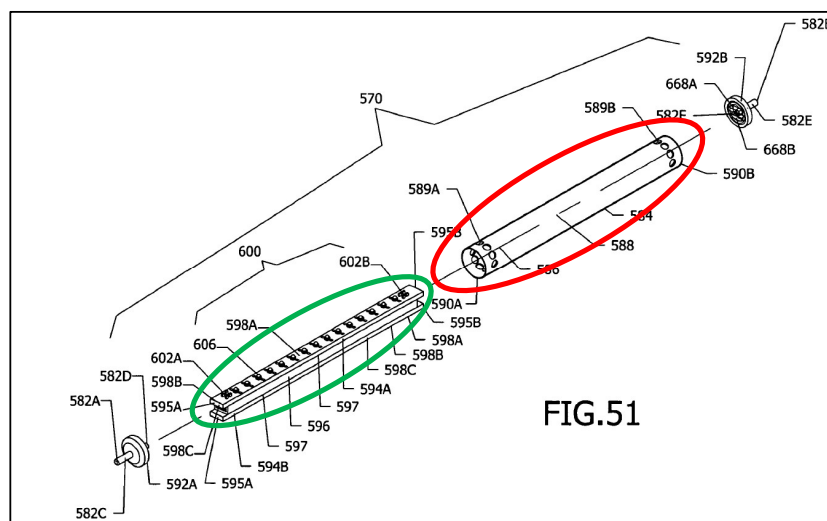
249. Kit teaches “a housing for the support structure” like that of the ’224 Patent. For example, Kit’s Figure 2 teaches a support structure and its housing, with an array of LED emitting devices mounted on the support structure. Ex. 1004 at 38:16–39:64.

250. Figure 2 is illustrated below, with the housing circled in red and the support structure circled in green. *Id.* at Fig. 2, 38:16–39:64.



Id. at Fig. 2. The support structure, which is positioned within the housing, acts as support for the cylindrical LED array and LED array circuit board. *Id.* at 38:16–39:64, *see also* 18:7–19:7.

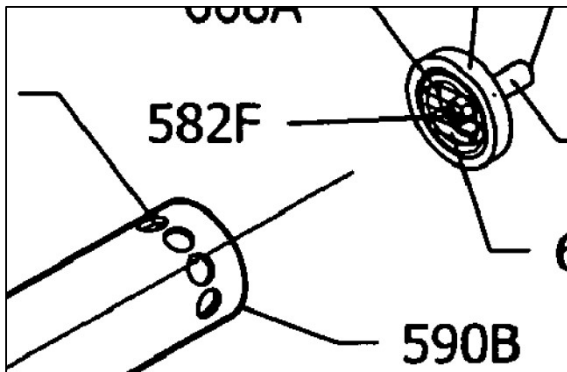
251. Kit’s Figure 51 discloses an alternative embodiment. *Id.* at Fig. 51. This figure is shown below, with the housing circled in red and the support structure circled in green:



Id. at Fig. 51, 77:12–78:2.

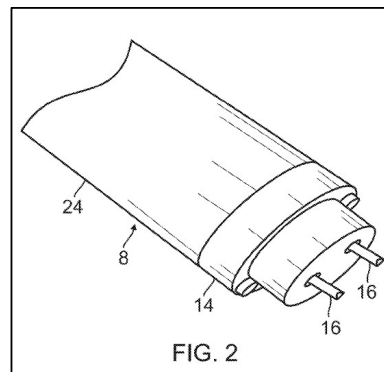
252. The housings disclosed in Kit and the '224 Patent are substantially identical, as illustrated by the figures below.

Housing and End Cap of Prior Art



Ex. 1004 at Fig. 51. (enlarged)

Housing and End Cap of '224 Patent



Ex. 1001 at Fig. 2.

(xxxi) ***Claim 23[c]: an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit five different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; a fourth set of LED emitting elements configured to emit light of at a fourth color; and a fifth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and***

253. Kit satisfies this limitation of Claim 23.

254. As described in Paragraphs 120–122, Kit teaches an array of LEDs mounted on a support structure. Ex. 1004 at Figs. 2, 4, 51, 53, 38:16–39:64, 77:12–78:2, *see also* Fig. 12. Kit further discloses that the array of LED-emitting is configured to produce five or more different colors (including white), using five

sets of LEDs. *Id.* at 24:27–41. This is supported by the following disclosure:

“Another circuit module can be a color effects module for use with color LEDs instead of white LEDs used in the LED lamps. This module allows the LED lamp to change colors. The controllers used for the dimming modules can be modified to achieve the color changing function required here. There will be a minimum of RGB color LEDs, but Amber or A can also be used.” *Id.* at 24:27–41, *see also* 22:9–35.

255. Kit notes that there are several kinds of LED lights, all of which are compatible for use in Kit’s LED array:

LEDs are now available in colors like Red, Blue, Green, Yellow, Amber, Orange, and many other colors including White. . . . The use of color LEDs eliminates the need to wrap the fluorescent lamp body in colored gel medium to achieve color dispersions. Color LEDs give the end user more flexibility on output power distribution and color mixing control. The color mixing controls are necessary to achieve the desired warm tone color temperature and output.

Id. at 20:50–63.

256. This is further evidenced by Kit’s disclosure that “[b]y correctly combining an appropriate mix of LEDs, the Luxeon Lamps themselves have well-controlled and consistent color temperatures of 3200K (warm white), 4100K (commercial white) or 5500K (cool white).” *Id.* at 3:20–38.

(xxxii) ***Claim 23[d]: a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light consisting of varying amounts of the five different colors provided by the first, second, third, fourth, and fifth sets of LED emitting elements to produce many different colors outputted from the lighting device,***

257. Kit satisfies this limitation of Claim 23.

258. Kit teaches a controller coupled to the LED array and configured to receive commands. Ex. 1004 at 24:3–32, 139:21–31. These commands allow for operation of select LEDs with the claimed “varying amounts of power to produce light consisting of varying amounts of the five different colors.” *Id.* at 24:27–41.

For example, Kit teaches:

Another circuit module can be a color effects module for use with color LEDs instead of white LEDs used in the LED lamps. **This module allows the LED lamp to change colors. The controllers used for the dimming modules can be modified to achieve the color changing function required here.** There will be a minimum of RGB color LEDs, but Amber or A can also be used. The dimming module described hereinbefore used a single channel to dim the entire array of white LEDs, but this circuit module will require 3 or 4 channels of dimming control to achieve different color combinations.

Id. at 24:3–41 (emphasis added). This disclosure describes the use of a controller that is coupled to the LED array and can be used for dimming or

changing the LED colors. *Id.* at 24:3–41. The LED array is not limited to the colors listed in the above disclosure. *Id.* at 20:50–63. Kit teaches an LED driver configured to selectively provide electrical power to the LED array. *Id.* at 23:31–55, 24:27–41. For instance, Kit discloses a “color effects module,” a circuit module that can create different color combinations by using channels to selectively change LED colors. *Id.* at 24:27–42. The color effects module supplies three or four channels of dimming to individually control each array of colored LEDs. It can also act as a replacement for a “dimming module” in order to change the colors on the LED arrays. *Id.* The “color effects module” and power control module disclosed in Kit “can be incorporated into the electrical circuits used in the LED retrofit lamp.” *Id.* at 23:31–33. Kit discloses that the circuit modules “contain the necessary electronics to decipher data input control signals and provide the current driver power to operate the LED arrays.” *Id.* at 23:31–33. Kit also discloses the use of a dimming module; however, as noted above, a color effects module may also be used. *Id.* at 23:31–42, 24:27–42. The color effects module drives each array of colored LEDs, making it possible to “achieve different color combinations.” *Id.* at 24:27–42. Ducharme further discloses a controller coupled to the array of LEDs that can receive commands for operating the LEDs. Ducharme’s controller can provide varying amounts of

power to the LEDs. For instance, Figure 29 discloses a “control circuit” (2510) that is mounted on a support structure and can control color temperature and power to an LED. Ex. 1005 at Fig. 29, 29:44–55 (“The control circuit (2510) may control the LEDs (1155) . . . or control circuit (2510) may generate control signals to operate the LEDs.”), 30:35–31:4, Figs. 10a and b, 17:59–18:33, Ex. 1005 at Fig. 29. Additionally, a POSITA would have been motivated to modify Ducharme to include an LED driver that can separately control the pluralities of LEDs based on Katzir. Ex. 1006 at [0011]–[0013], [0033]–[0034].

(xxxiii) *Claim 23[e]: and an LED driver configured to selectively provide electrical power to the array of LED emitting devices;*

259. Kit satisfies this limitation of Claim 23.

260. Kit teaches an LED driver configured to selectively provide electrical power to the LED array. Ex. 1004 at 23:31–55, 24:27–41. For instance, Kit discloses a “color effects module,” a circuit module that can create different color combinations by using channels to selectively change LED colors. *Id.* at 24:27–42. The color effects module supplies three or four channels of dimming to individually control each array of colored LEDs. *Id.* It can also act as a replacement for a “dimming module” in order to change the colors on the LED arrays. *Id.*

261. Kit's "color effects module" and the power control module "can be incorporated into the electrical circuits used in the LED retrofit lamp." *Id.* at 23:31–55. Kit teaches that the disclosed circuit modules "contain the necessary electronics to decipher data input control signals and provide the current driver power to operate the LED arrays." *Id.* One of the examples in Kit uses a dimming module; however, a color effects module can also be used to power the LED lights and change colors. *Id.* at 24:27–42. The color effects module drives each array of colored LEDs making it possible to achieve different color combinations. Further, Kit discloses that the disclosed power control module in Kit "can be incorporated into the electrical circuits used in the LED retrofit lamp" of Kit. *Id.* at 15:20–47, 23:31–33, Fig. 53. Ducharme discloses circuitry mounted on the support structure that includes a driver to selectively switch between driving the first or second LEDs. This may include switching some LEDs off while other LEDs are on. For example, Figure 29 discloses a "control circuit" (2510) that is mounted on a support structure and can control color temperature and power to an LED. Ex. 1005 at Fig. 29, 29:44–55 ("The control circuit (2510) may control the LEDs (1155) with constant D.C. voltage or control circuit (2510) may generate control signals to operate the LEDs. In a preferred embodiment, the control circuit (2510) would include a processor for generating pulse width modulated control signals, or other similar control signals, for the LEDs."), 30:35–31:4, Fig. 10a and b, 17:59–

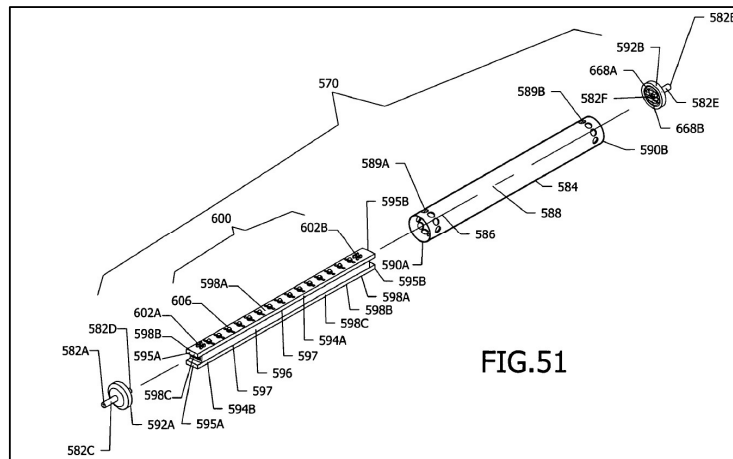
18:33. In addition, to the extent this limitation is not disclosed by Kit or Ducharme, a POSITA would have been motivated to modify Kit in view of Katzir to include an LED driver that can separately control the pluralities of LEDs. Ex. 1006 at [0011]–[0013], [0033]–[0034].

(xxxiv) ***Claim 23[ff]: wherein the housing has a linear form factor substantially that of one of a T12 and T8 form, and fluorescent tube light, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and***

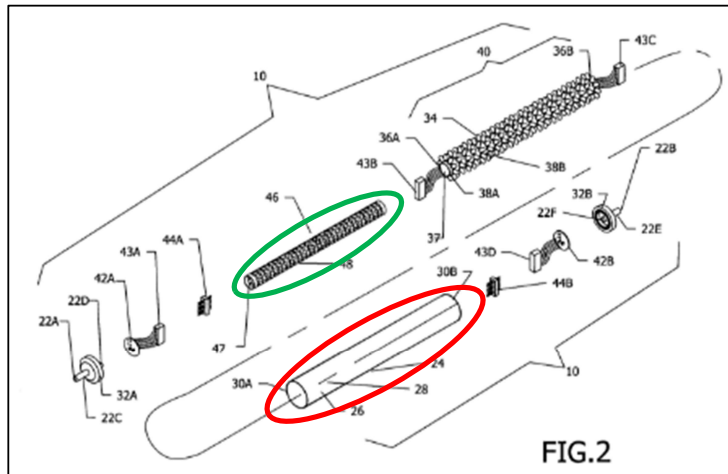
262. Kit satisfies this limitation of Claim 23.

263. The disclosed LED lighting device may have a housing form factor similar to that of T12 and T8 fluorescent tubes. Ex. 1004 at 5:15–34 (describing “possible fluorescent fixture retrofit options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the base model with no upgrade done here.”). This shared form factor allows for the replacement of standard fluorescent tubes with LED light arrays, as taught by Kit. *Id.* at 1:42–48, 12:57–13:3.

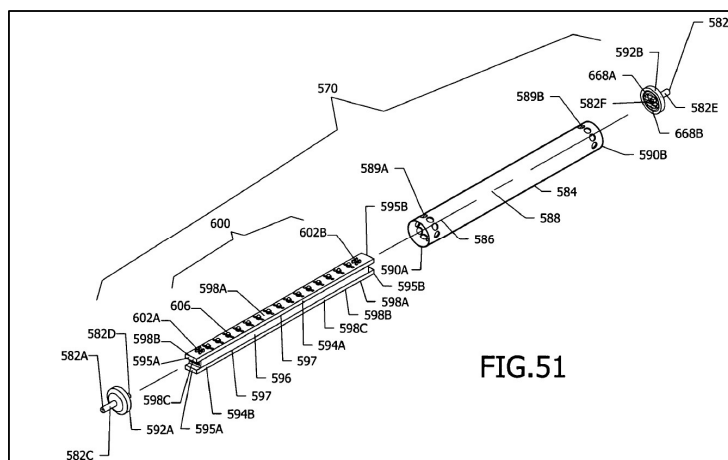
264. Further, the linear form factor in Kit has an electrical input connection. *Id.* at 15:20–33, 79:60–65. This electrical input connection is designed to receive input power and communicates with the LED driver. *Id.* In support, Kit discloses that LED lamps can be connected or wired between input lines. *Id.* at 19:35–43, 77:12–50.



Id. at Fig. 51. The housing pictured above also top side and a bottom side, which each extend in an axial direction. *Id.* at Figs. 2, 51, 38:16–60, 77:10–50. Kit teaches LEDs that are arranged to produce light from the top side of the housing between its opposite ends. *Id.* at Figs. 2 and 51, 16:21–23. Kit also discloses a diffusion cover on the top side of the housing. *Id.* at Figs. 2 and 51; 16:21–23 (“The surface of the main outer tubular housing can be diffused or can be coated with a white translucent film to create a more dispersed light output similar to present fluorescent lamps.”), 38:16–21. This diffusion cover extends the axial length of the support structure between the opposite ends, as illustrated below. *Id.* at Figs. 2 and 51, 16:21–23, 38:16–21.



Id. at Fig. 2 (support structure circled in green, housing circled in red), 38:16–21 (describing Figure 2 that contains “an elongated housing 24 particularly configured as a tubular wall 26 circular in cross-section taken transverse to a center line 28 that is made of a translucent material such as plastic or glass and **preferably having a diffused coating.**”) (emphasis added).



Id. at Fig. 51, 77:10–50 (describing Figure 51 as an LED lamp that contains “an elongated housing 584 particularly configured as a tubular wall 586 circular in cross-section taken transverse to a center line 588 that is made of a translucent

material such as plastic or glass and **preferably having a diffused coating.**”).

Ducharme also teaches the use of a diffusion cover with a fluorescent tube retrofit with LEDs. Ex. 1005 at 12:5–16 (disclosing an embodiment that uses a diffusing filter, which may be attached to the body section), 27:19–26 (discussing “the transmission loss associated with a standard polycarbonate diffuser which is often used in light fixtures.”).

(xxxvi) ***Dependent Claim 25: The LED lighting device of claim 23, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth and fifth set of LED emitting elements in increments of about 1/255 to selectively produce at least 255 different colors from the lighting device.***

267. Kit discloses Claim 25.

268. Kit discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

269. Kit discloses that the LED lights can be controlled using a DMX512 signal, which can act as a color effect module to incrementally control the color of RGBAW lights. Ex. 1004 at 24:3–42. The DMX signal in Kit allows a user to

fully control the RGBAW array to achieve “different color combinations,” and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.*

(xxxvii) ***Dependent Claim 26: The LED lighting device of claim 5, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an entertainment industry color wheel emitting from the lighting device.***

270. Kit discloses Claim 26.

271. Kit discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

272. Kit discloses that the LED lights can be controlled using a DMX512 signal, which can act as a color effect module to incrementally control the color of RGBAW lights. Ex. 1004 at 24:3–42. The DMX signal in Kit allows a user to fully control the RGBAW array to achieve “different color combinations,” and a

POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.*

(xxxviii) *Dependent Claim 28: The LED lighting device of claim 23, wherein the electrical input connection is configured to receive AC input power.*

273. Kit teaches Claim 28.

274. Kit discloses that the housing has an electrical input connection for receiving power where the input is in electrical communication with the LED driver. Kit teaches that the LED lamps can be connected or wired between input power lines and can receive AC input power. Ex. 1004 at Fig. 75, 6:41–45, 19:35–43, 77:12–50. For example, Kit discloses using a LED linear retrofit lamp with “direct line voltage AC to power the new LED retrofit lamp.” *Id.* at 6:1–11, 12:53–60.

(xxxix) *Dependent Claim 29: The LED lighting device of claim 23, wherein the fluorescent tube light has a substantially T12 form.*

275. Kit teaches Claim 29.

276. As discussed in Paragraphs 138–141 above, Kit teaches an elongated LED lighting device that has the same form factor as a T12 tube. Ex. 1004 at 5:15–34 (describing “possible fluorescent fixture retrofit options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the base model with no upgrade done here.”), 12:53–13:3.

(xl) ***Dependent Claim 30: The LED lighting device of claim 23, wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.***

277. Kit teaches Claim 30.

278. Kit teaches LED lights having a length within the range identified for fluorescent tubes. As stated above with respect to Claim 29, Kit teaches an LED device having the same elongated form factor as T12 fluorescent tubes. Ex. 1004 at 5:15–34 (describing “possible fluorescent fixture retrofit options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the base model with no upgrade done here.”), 12:53–13:3.

279. Kit also teaches variations in length for fluorescent tubes, including those lengths between one to four feet long. Ex. 1004 at 9:15–24 (“Fluorescent lamps sold in the United States today are available in a wide variety of shapes and sizes.”), 17:49–56, 18:58–66. Kit teaches that the length of fluorescent tubes may range between six inches and eight feet and are “available in one, two, four, six, and eight feet lengths.” *Id.* at 9:15–24, 17:49–51. Further, Kit discloses that “the flexible circuit board can be designed in increments of one-foot lengths.” *Id.* at 17:49–52.

280. Kit teaches LED lights having a length within the range identified about for fluorescent tubes. For example, Kit discloses a “basic tubular 4-foot LED retrofit lamp.” *Id.* at 4:50–55.

(xli) *Dependent Claim 31: The LED lighting device of claim 23, wherein at least one of the colors of the LEDs is amber.*

281. Kit discloses LEDs containing amber-colored light, and thus satisfies Claim 31. *See, e.g.*, Ex. 1004 at 20:50–57.

282. Kit teaches the availability of LEDs “in colors like Red, Blue, Green, Yellow, **Amber**, Orange, and many other colors including White. Although any type and color of LED can be used in the LED arrays used on the circuit boards of the present invention, an LED with a wide beam angle will provide a better blending of the light beams from each LED thereby producing an overall generally even distribution of light output omni-directionally and in every position.” *Id.* at 20:50–57 (emphasis added).

283. Kit discloses the use of an amber LED to reduce the CCT of a white LED while still maintaining a high CRI. This practice was well-known and a POSITA would have been familiar with this practice prior to 2009.

(xlii) *Dependent Claim 32: The LED lighting device of claim 23, wherein the first, second, third and fourth LEDs are red, green, blue and amber, respectively.*

284. Kit teaches Claim 32 by disclosing an LED device with the first four LEDs that can be colored red, green, blue, and amber. Ex. 1004 at 20:50–57.

285. Kit teaches the availability of LEDs “in colors like Red, Blue, Green, Yellow, Amber, Orange, and many other colors including White. Although any type and color of LED can be used in the LED arrays used on the circuit boards of

the present invention, an LED with a wide beam angle will provide a better blending of the light beams from each LED thereby producing an overall generally even distribution of light output omni-directionally and in every position.” *Id.* at 20:50–57.

(xliii) *Dependent Claim 33: The LED lighting device of claim 23, wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.*

286. Kit discloses Claim 33.

287. Kit discloses LEDs in the following color temperature ranges: “3200K (warm white), 4100K (commercial white) or 5500K (cool white).” Ex. 1004 at 3:26–38; *compare to* Ex. 1001 at 2:7–11 (“[F]or example 3050 to 3300 K for tungsten (warm white), and, for example, 5400 to 5600 K for daylight (cool white).”)

288. Thus, Kit teaches an LED lighting device producing white light in the daylight temperature range. A POSITA would know that 5400–5600K CCT describes a daylight temperature color. Ex. 1001 at 2:7–11.

289. A POSITA would know that the term “tungsten and daylight temperature ranges” stems from color film stock which was balanced for either indoor lighting or outdoor lighting. Traditionally, indoor lighting was mostly from incandescent bulbs, generally about 3200K and outdoor was from sunlight. Over the hours of usable sunlight, the color temperature averages about 5500K.

290. Midday sunlight averages around 5500K. “Daylight” film stock was balanced for this color temperature because movies were often filmed using available light for outdoor scenes. “Daylight” is contrasted with “tungsten”. When filming in a studio, traditionally incandescent, or tungsten filament, bulbs were used. When supplied with the proper voltage, these bulbs emit light in the vicinity of 3200K. As color television cameras were developed white balance presets were often provided for 5500K and 3200K.

291. Kit also teaches an LED lighting device producing white light in the tungsten temperature range. Ex. 1004 at 22:9–14 (“[m]ore recently, Lumileds Lighting, LLC now offers a Luxeon warm white LED with a 90 CRI (Color Rendering Index) and **3200 degrees Kelvin** CCT (Correlated Color Temperature). Lumileds Luxeon warm white is the first generally available low CCT and high CRI warm white solid-state light source.”) (emphasis added). By 2007, Litepanels, Inc. was using a custom LED from Everlight that had a CCT of 3200 degrees Kelvin and CRI above 90.

292. Because the temperature range for tungsten white light is 3050 to 3300 degrees Kelvin, a POSITA would know that 3200 degrees Kelvin CCT describes a tungsten temperature color. Ex. 1001 at 2:7–11. A POSITA would have known and had an expectation of success in emitting broad-spectrum white light with a high CRI above 90.

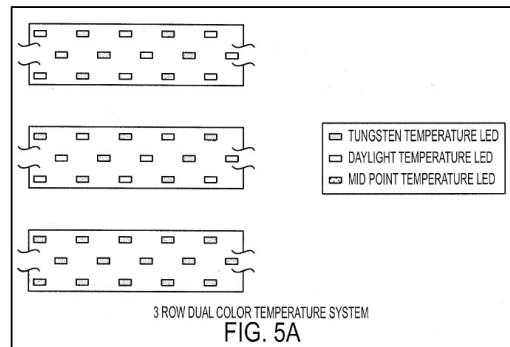
293. The film and television industries evolved around artificial light for indoor production. For many years, that light was predominately generated by incandescent lamps, commonly halogen lamps. Depending on the voltage presented at the bulb, a halogen bulb generally burns in the 3200K range. If the voltage is lower than rated, the color temperature will fall. Conversely, if the voltage is above the rated voltage, the color temperature will rise. Film stock for movie production and white balance presets for video cameras have historically used 3200K as the indoor standard.

(xliv) *Dependent Claim 34: The LED lighting device of claim 23, wherein the first, second, third, fourth and fifth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.*

294. Katzir discloses Claim 34.

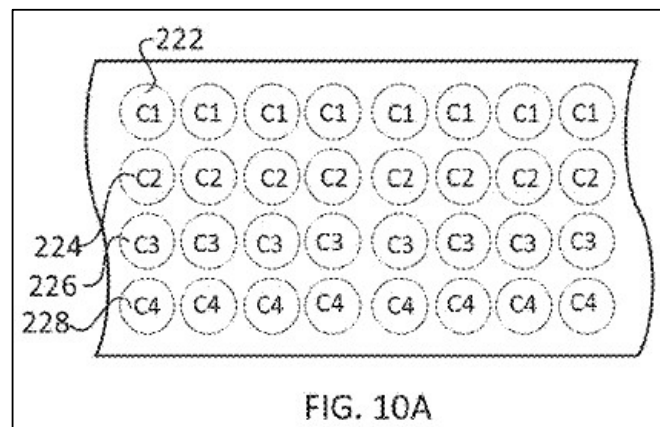
295. Katzir discloses an LED arrangement similar to a checkerboard or matrix pattern. Ex. 1010 at [0054], Figs. 5A–5F; *compare with* Ex. 1001 at 6:3–6 (“The first and second types of LEDs are preferably arranged within the matrix in a checkerboard pattern, a row of LEDs alternating between the first type and the second type of LEDs.”). Both color and white LED lights can be used in this arrangement. Ex. 1010 at [0050], [0054].

296. One example of the matrix/checkerboard arrangement disclosed in Katzir is illustrated in Figure 5A below:



Ex. 1010 at Fig. 5A.

297. This matrix-like arrangement of LEDs is similar to the embodiments disclosed in the '224 Patent.



Ex. 1001 at Fig. 10A.

(xlv) ***Claim 35[pre]: An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:***

298. Kit, in view of Ducharme, satisfies the preamble of Claim 35.

299. Both Kit and the '224 Patent teach the concept of upgrading fluorescent lights with LED lights. *See, e.g.,* Ex. 1004 at 12:53–13:3. For example, Kit discloses “[a]n energy saving device for an LED lamp mounted to an existing

300. The '224 Patent preamble includes “suitable for a commercial image recording” as an intended use for the LED lighting device; however, this does not cause any structural differences between '224 Patent and Kit, or the other prior art. The LED lights disclosed in the '224 Patent and Kit are the same, can be used in the same way, and can be used for the same purposes.

of Kit would be available in a plethora of color temperatures and CRI values and that using such LEDs would simply be a design choice and have no effect on other aspects of the design of the device. The temperature ranges of the LED lights disclosed in Kit would have allowed for high quality image capturing based on the Planckian Locus.

302. Kit teaches that LED lamps may be inserted “directly into the lamp socket of existing fluorescent lighting fixtures used for general lighting in public, private, commercial, industrial, residential buildings . . .” Ex. 1004 at 16:4–9. It was known that the fluorescent lights Kit sought to replace were used in the lighting industry and had a variety of application such as “TV, stage, auditorium, and/or film studio use.” Ex. 1001 at 1:40–44.

303. Since 2005, the use of LEDs for illumination in entertainment applications has been expanding. LEDs offer advantages over all other types of lighting such as: virtually no radiated heat, which means talent stays cooler; reduced energy consumption, which radically reduces, or even eliminates, the need for generators on location; full range dimmability with little or no color shift; longevity; easily configurable for battery operation for “cordless” lighting; configurable for true direct current operation eliminates even the potential for flicker, even with extreme shutter speeds/frame rates; and ruggedness (with no need for a glass envelope, LEDs are relatively unbreakable). These advantages led

to rapid adoption, particularly in the television arts. By 2012, the use of LED lights in the image recording industry was well-known in the art. *See* Paragraphs 43–44 above.

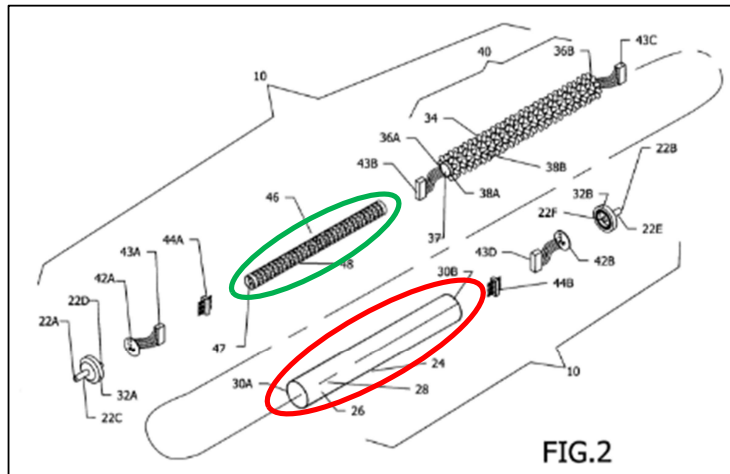
304. To the extent this limitation is not obvious in view of Kit alone, a POSITA would have known that the LED lighting in Kit would have been used in, and suitable for, commercial image recording industry based on the teachings of Ducharme. Ducharme expressly teaches that color LED lights like those taught in Kit are suitable for the image recording industry by disclosing the use of LED lights (which could be used as a replacement or retrofit of conventional fixtures). Ex. 1005 at Figs. 5a–5b, 12:49–67, 18:51–64 (describing the use of the disclosed lightings by a film director), 19:14–24 (using the disclosed lighting fixtures for image capturing).

(xlvii) Claim 35[a]: a support structure;

305. Kit satisfies this limitation of Claim 35.

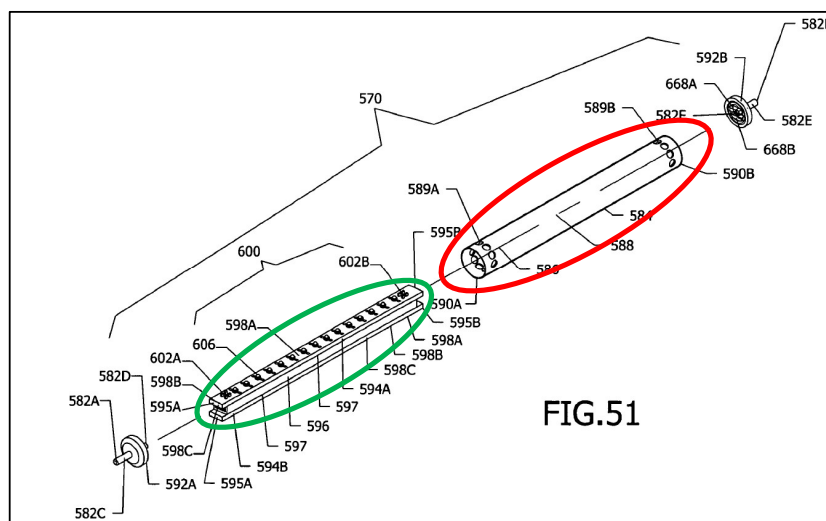
306. Kit discloses a “support structure” similar to that of the ’224 Patent. For example, Kit’s Figure 2 teaches a support structure and its housing, with an array of LED emitting devices mounted on the support structure. Ex. 1004 at 38:16–39:64.

307. Figure 2 is illustrated below, with the housing circled in red and the support structure circled in green. *Id.* at Fig. 2, 38:16–39:64.



Id. at Fig. 2. The support structure, which is positioned within the housing, acts as support for the cylindrical LED array and LED array circuit board. *Id.* at 38:16–39:64, *see also* 18:7–19:7.

308. Kit’s Figure 51 discloses an alternative embodiment. *Id.* at Fig. 51. This figure is shown below, with the housing circled in red and the support structure circled in green:



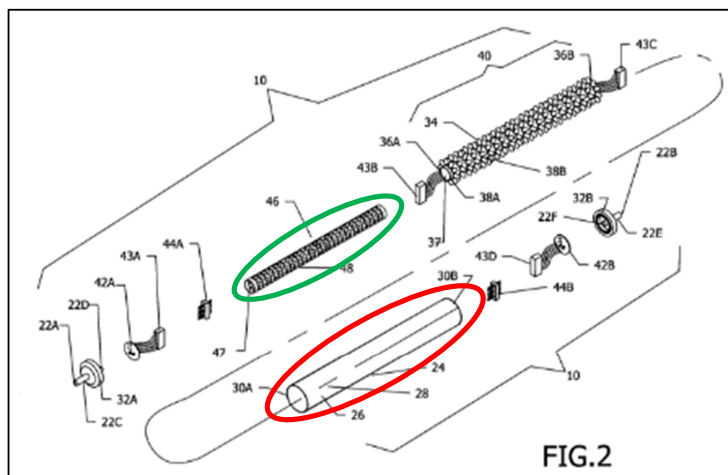
309. *Id.* at Fig. 51, 77:12–78:2.

(xlvii) **Claim 35[b]: a housing for the support structure;**

310. Kit satisfies this limitation of Claim 35.

311. Kit teaches “a housing for the support structure” like that of the ’224 Patent. For example, Kit’s Figure 2 teaches a support structure and its housing, with an array of LED emitting devices mounted on the support structure. *Id.* at 38:16–39:64.

312. Figure 2 is illustrated below, with the housing circled in red and the support structure circled in green. *Id.* at Fig. 2, 38:16–39:64.



Id. at Fig. 2. The support structure, which is positioned within the housing, acts as support for the cylindrical LED array and LED array circuit board. *Id.* at 38:16–39:64, *see also* 18:7–19:7.

313. Kit’s Figure 51 discloses an alternative embodiment. *Id.* at Fig. 51. This figure is shown below, with the housing circled in red and the support structure circled in green:

of LED emitting elements configured to emit light of a third color; and a fourth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and

315. Kit satisfies this limitation of Claim 35.

316. As described in Paragraphs 120–122, Kit teaches an array of LEDs mounted on a support structure. Ex. 1004 at Figs. 2, 4, 51, 53, 38:16–39:64, 77:12–78:2, *see also* Fig. 12. Kit further discloses that the array of LED-emitting devices is configured to produce five or more different colors (including white), using five sets of LEDs. *Id.* at 24:27–41. This is supported by the following disclosure:

“Another circuit module can be a color effects module for use with color LEDs instead of white LEDs used in the LED lamps. This module allows the LED lamp to change colors. The controllers used for the dimming modules can be modified to achieve the color changing function required here. There will be a minimum of RGB color LEDs, but Amber or A can also be used.” *Id.* at 24:27–41, *see also* 22:9–35.

317. Kit notes that there are several kinds of LED lights, all of which are compatible for use in Kit’s LED array:

LEDs are now available in colors like Red, Blue, Green, Yellow, Amber, Orange, and many other colors including White. . . . The use of color LEDs eliminates the need to wrap the fluorescent lamp body in colored gel medium to achieve color dispersions. Color LEDs give the end user more flexibility on output power distribution and color

mixing control. The color mixing controls are necessary to achieve the desired warm tone color temperature and output.

Id. at 20:50–63.

318. This is further evidenced by Kit’s disclosure that “[b]y correctly combining an appropriate mix of LEDs, the Luxeon Lamps themselves have well-controlled and consistent color temperatures of 3200K (warm white), 4100K (commercial white) or 5500K (cool white).” *Id.* at 3:20–38.

(xlix) ***Claim 35[d]: a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light consisting of varying amounts of the five different colors provided by the first, second, third, and fourth sets of LED emitting elements to produce many different colors outputted from the lighting device which are uniform in color, and an LED driver configured to selectively provide electrical power to the array of LED emitting devices***

319. Kit satisfies this limitation of Claim 35.

320. Kit teaches a controller coupled to the LED array and configured to receive commands. Ex. 1004 at 24:3–32, 139:21–31. These commands allow for operation of select LEDs with the claimed “varying amounts of power to produce light consisting of varying amounts of the five different colors.” *Id.* at 24:27–41.

321. Kit also teaches an LED driver configured to selectively provide electrical power to the LED array. *Id.* at 23:31–55, 24:27–41. For instance, Kit discloses a “color effects module,” a circuit module that can create different color

combinations by using channels to selectively change LED colors. *Id.* at 24:27–42.

The color effects module supplies three or four channels of dimming to individually control each array of colored LEDs. It can also act as a replacement for a “dimming module” in order to change the colors on the LED arrays. *Id.* at 24:27–42.

322. Further, Kit teaches:

Another circuit module can be a color effects module for use with color LEDs instead of white LEDs used in the LED lamps. **This module allows the LED lamp to change colors. The controllers used for the dimming modules can be modified to achieve the color changing function required here.** There will be a minimum of RGB color LEDs, but Amber or A can also be used. The dimming module described hereinbefore used a single channel to dim the entire array of white LEDs, but this circuit module will require 3 or 4 channels of dimming control to achieve different color combinations.

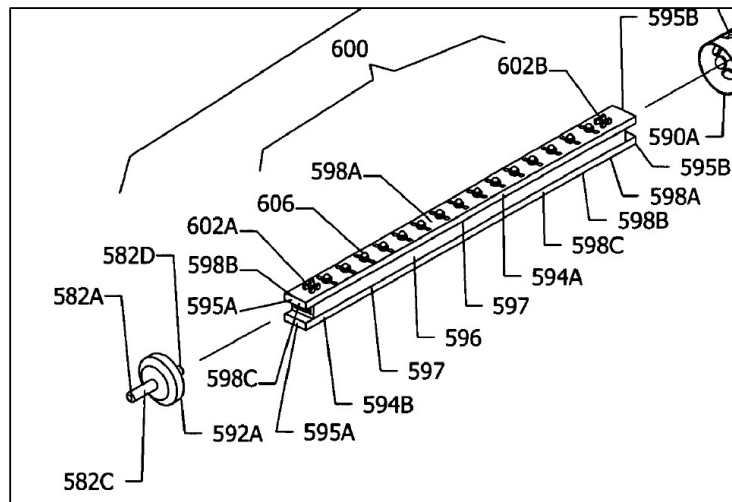
Id. at 24:3–41 (emphasis added). This disclosure describes the use of a controller that is coupled to the LED array and can be used for dimming or changing the LED colors. *Id.* at 24:3–41. The LED array is not limited to the colors listed in the above disclosure. *Id.* at 20:50–63.

323. Kit’s “color effects module” and the power control module “can be incorporated into the electrical circuits used in the LED retrofit lamp.” *Id.* at 23:31–33. Kit teaches that the disclosed circuit modules “contain the necessary

electronics to decipher data input control signals and provide the current driver power to operate the LED arrays.” *Id.* One of the examples in Kit uses a dimming module. *Id.* at 23:31–42, 24:27–42. However, as noted above, a color effects module can also be used to power the LED lights and change the colors. *Id.* The color effects module drives each array of colored LEDs making it possible to achieve different color combinations. *Id.* at 24:27–42. Ducharme further discloses a controller coupled to the array of LEDs that can receive commands for operating the LEDs. Ducharme’s controller can provide varying amounts of power to the LEDs. For instance, Figure 29 discloses a “control circuit” (2510) that is mounted on a support structure and can control color temperature and power to an LED. Ex. 1005 at Fig. 29 (control circuit circled in red), 29:44–55 (“The control circuit (2510) may control the LEDs (1155) . . . or control circuit (2510) may generate control signals to operate the LEDs.”), 30:35–31:4, Figs. 10a and b, 17:59–18:33, Ex. 1005 at Fig. 29. Additionally, a POSITA would have been motivated to modify Ducharme to include an LED driver that can separately control the pluralities of LEDs based on Katzir. Ex. 1006 at [0011]–[0013], [0033]–[0034].

324. Kit teaches that the LED lights are “preferably positioned and arranged equidistant from one another....” *Id.* at 79:44–49 (referring to Fig. 53, which relates to Figure 51). For example, Figure 51 depicts a support structure

with LED lights (606), which are evenly dispersed along the length of the structure:

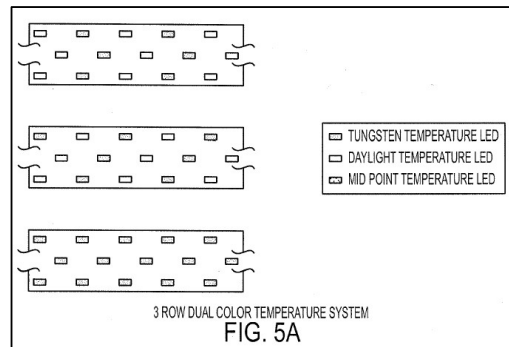


Id. at Fig. 51 (enlarged).

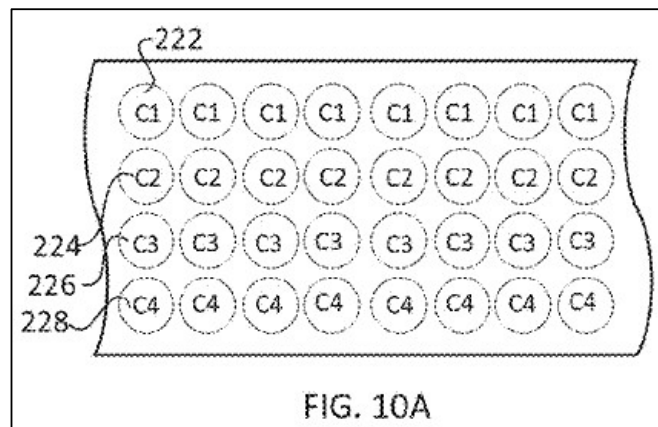
325. Further, Kit discloses a diffusion cover on the top side of the housing.

Id. at Figs. 2 and 51, 16:21–23 (“The surface of the main outer tubular housing can be diffused or can be coated with a white translucent film to create a more dispersed light output similar to present fluorescent lamps.”), 38:16-21, 77:10–50. A POSITA would understand that the disclosed LED arrangement, in combination with the diffusion cover, would produce light that is uniform in color. Ex. 1001 at 18:32–37.

326. In addition, Katzir discloses an LED arrangement similar to a checkerboard or matrix pattern, which would also produce light that is uniform in color. Ex. 1010 at [0054], Figs. 5A–5F. One example of the matrix/checkerboard arrangement disclosed in Katzir is illustrated in Figure 5A below:



Id. at Fig. 5A. This matrix-like arrangement of LEDs is similar to the embodiments disclosed in the '224 Patent:



Ex. 1001 at Fig. 10A.

- (l) ***Claim 35[e]: wherein the housing has a linear form factor substantially that of a fluorescent tube light of one of a T12 and T8 form, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and***

327. Kit satisfies this limitation of Claim 35. The disclosed LED lighting device may have a housing form factor similar to that of T12 and T8 fluorescent tubes. Ex. 1004 at 5:15–34 (describing “possible fluorescent fixture retrofit

options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the base model with no upgrade done here.”). This shared form factor allows for the replacement of standard fluorescent tubes with LED light arrays, as taught by Kit. *Id.* at 1:42–48, 12:57–13:3.

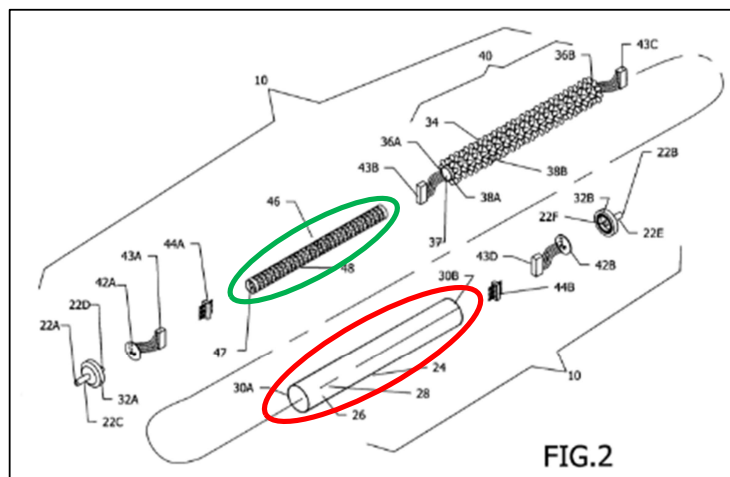
328. Further, the linear form factor in Kit has an electrical input connection. *Id.* at 15:20–33, 79:60–65. This electrical input connection is designed to receive input power and communicates with the LED driver. *Id.* In support, Kit discloses that LED lamps can be connected or wired between input lines. *Id.* at 19:35–43, 77:12–50.

(li) Claim 35[ff]: wherein the housing has opposite ends and the support structure is in a form of an elongated and narrow surface extending in the axial direction and the housing having a top side and a bottom side which each extend in the axial direction, and

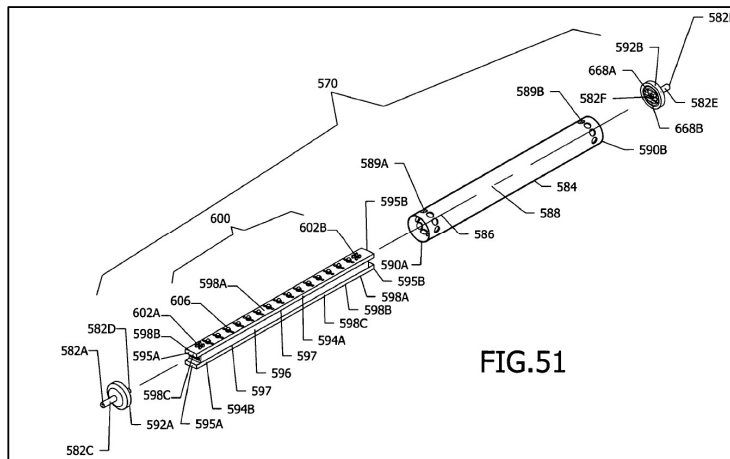
329. Kit satisfies this limitation of Claim 35.

330. The support structure in Kit has an elongated form with a narrow surface that extends in an axial direction within the housing. Ex. 1004 at Figs 2, 51, 38:16–39:29, 77:10–50. The corresponding housing has opposite ends, as illustrated by Figures 2 and 51. *Id.* at Figs 1, 51, 38:16–60, 77:10–50.

333. Kit teaches LEDs that are arranged to produce light from the top side of the housing between its opposite ends. Ex. 1004 at Figs. 2 and 51, 16:21-23. Kit also discloses a diffusion cover on the top side of the housing. *Id.* at Figs. 2 and 51, 16:21–23 (“The surface of the main outer tubular housing can be diffused or can be coated with a white translucent film to create a more dispersed light output similar to present fluorescent lamps.”), 38:16-21. This diffusion cover extends the axial length of the support structure between the opposite ends, as illustrated below. *Id.* at Figs. 2 and 51, 16:21–23, 38:16-21.



Id. at Fig. 2 (support structure circled in green, housing circled in red), 38:16–21 (describing Figure 2 as an LED lamp that contains “an elongated housing 24 particularly configured as a tubular wall 26 circular in cross-section taken transverse to a center line 28 that is made of a translucent material such as plastic or glass and **preferably having a diffused coating.**”) (emphasis added).



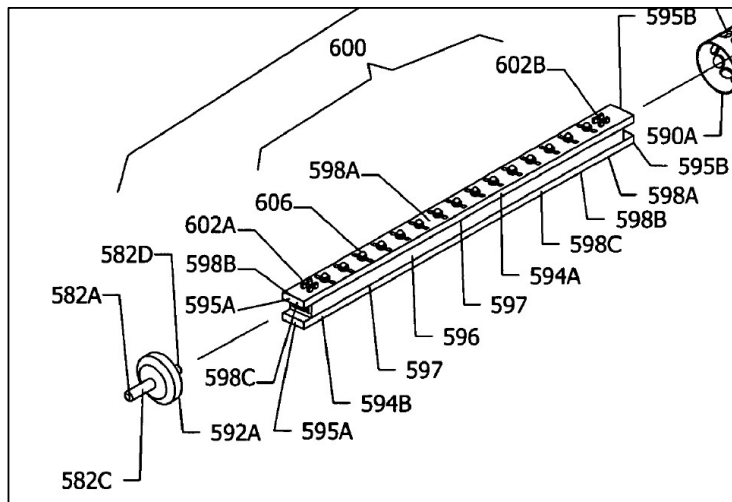
Id. at Fig. 51, 77:10–50 (describing Figure 51 as an LED lamp that contains “an elongated housing 584 particularly configured as a tubular wall 586 circular in cross-section taken transverse to a center line 588 that is made of a translucent material such as plastic or glass and **preferably having a diffused coating**.”).

Ducharme also teaches the use of a diffusion cover with a fluorescent tube retrofit with LEDs. Ex. 1005 at 12:5–16 (disclosing an embodiment that uses a diffusing filter, which may be attached to the body section), 27:19–26 (discussing “the transmission loss associated with a standard polycarbonate diffuser which is often used in light fixtures.”).

(liii) ***Dependent Claim 36: The LED lighting device of claim 35, wherein the first, second, third and fourth sets of LED light emitting elements are evenly dispersed along the length of the lighting device.***

334. Kit discloses Claim 36

335. In one example, Figure 51 from Kit shows a support structure placed within the housing. Ex. 1004 at Fig. 51. The support structure contains LED lights (606), which are evenly dispersed along the length of the structure.



Id. at Fig. 51.

336. Kit teaches that the LED lights are “preferably positioned and arranged equidistant from one another....” *Id.* at 79:44–49 (referring to Fig. 53, which relates to Figure 51).

(liv) ***Dependent Claim 37: The LED lighting device of claim 35, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set and fourth set of LED emitting elements in increments of about 1/255 to selectively produce at least 255 different colors from the lighting device.***

337. Kit discloses Claim 37.

338. Kit discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a

DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

339. Kit discloses that the LED lights can be controlled using a DMX512 signal, which can act as a color effect module to incrementally control the color of RGBAW lights. Ex. 1004 at 24:3–42. The DMX signal in Kit allows a user to fully control the RGBAW array to achieve “different color combinations,” and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.*

(lv) ***Dependent Claim 38: The LED lighting device of claim 37, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an entertainment industry color wheel emitted from the lighting device.***

340. Kit teaches Claim 38.

341. Kit discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These

increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

342. Kit discloses that the LED lights can be controlled using a DMX512 signal, which can act as a color effect module to incrementally control the color of RGBAW lights. Ex. 1004 at 24:3–42. The DMX signal in Kit allows a user to fully control the RGBAW array to achieve “different color combinations,” and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.*

(lvi) ***Dependent Claim 39: The LED lighting device of claim 35, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set and fourth set of LED emitting elements to selectively produce at least 255 different colors of a color wheel from the lighting device.***

343. Kit teaches Claim 39.

344. Kit discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

345. Kit discloses that the LED lights can be controlled using a DMX512 signal, which can act as a color effect module to incrementally control the color of RGBAW lights. Ex. 1004 at 24:3–42. The DMX signal in Kit allows a user to fully control the RGBAW array to achieve “different color combinations,” and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.*

(lvii) *Dependent Claim 41: The LED lighting device of claim 35, wherein the fluorescent tube light has a substantially T12 form.*

346. Kit teaches Claim 41.

347. As discussed in Paragraph 138–141 above, Kit teaches an elongated LED lighting device that has the same form factor as a T12 tube. Ex. 1004 at 5:15–34 (describing “possible fluorescent fixture retrofit options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the base model with no upgrade done here.”), 12:53–13:3.

(lviii) *Dependent Claim 42: The LED lighting device of claim 35, wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.*

348. Kit teaches Claim 42.

349. Kit teaches LED lights having a length within the range identified for fluorescent tubes. As stated above with respect to Claim 41, Kit teaches an LED device having the same elongated form factor as T12 fluorescent tubes. Ex. 1004 at

5:15–34 (describing “possible fluorescent fixture retrofit options,” e.g., “an existing fluorescent fixture using an old magnetic ballast and an old T12 type lamp” that “serves as the base model with no upgrade done here.”), 12:53–13:3.

350. Kit also teaches variations in length for fluorescent tubes, including those lengths between one to four feet long. *Id.* at 9:15–17 (“Fluorescent lamps sold in the United States today are available in a wide variety of shapes and sizes.”), 17:49–56, 18:58–66. Kit teaches that the length of fluorescent tubes may range between six inches and eight feet and are “available in one, two, four, six, and eight feet lengths.” *Id.* at 1004 at 9:15–24, 17:49–51. Further, Kit discloses that “the flexible circuit board can be designed in increments of one-foot lengths.” *Id.* at 17:49–52.

351. Kit teaches LED lights having a length within the range identified about for fluorescent tubes. For example, Kit discloses a “basic tubular 4-foot LED retrofit lamp.” Ex. 1004 at 4:50–55.

(lix) ***Dependent Claim 43: The LED lighting device of claim 35, wherein at least one of the colors of the LEDs is amber.***

352. Kit discloses LEDs containing amber-colored light, and thus satisfies Claim 43. *See, e.g.*, Ex. 1004 at 20:50–57.

353. Kit teaches the availability of LEDs “in colors like Red, Blue, Green, Yellow, **Amber**, Orange, and many other colors including White. Although any type and color of LED can be used in the LED arrays used on the circuit boards of

the present invention, an LED with a wide beam angle will provide a better blending of the light beams from each LED thereby producing an overall generally even distribution of light output omni-directionally and in every position.” *Id.* at 20:50–57 (emphasis added).

354. Kit discloses the use of an amber LED to reduce the CCT of a white LED while still maintaining a high CRI. This practice was well-known and a POSITA would have been familiar with this practice prior to 2009.

(lx) *Dependent Claim 44: The LED lighting device of claim 35, wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.*

355. Kit discloses Claim 44.

356. Kit discloses LEDs in the following color temperature ranges: “3200K (warm white), 4100K (commercial white) or 5500K (cool white).” Ex. 1004 at 3:26–38; *compare to* Ex. 1001 at 2:7–11 (“[F]or example 3050 to 3300 K for tungsten (warm white), and, for example, 5400 to 5600 K for daylight (cool white).”).

357. Thus, Kit teaches an LED lighting device producing white light in the daylight temperature range. A POSITA would know that 5400–5600K CCT describes a daylight temperature color. Ex. 1001 at 2:7–11.

358. A POSITA would know that the term “tungsten and daylight temperature ranges” stems from color film stock which was balanced for either

indoor lighting or outdoor lighting. Traditionally, indoor lighting was mostly from incandescent bulbs, generally about 3200K and outdoor was from sunlight. Over the hours of usable sunlight, the color temperature averages about 5500K.

359. Midday sunlight averages around 5500K. “Daylight” film stock was balanced for this color temperature because movies were often filmed using available light for outdoor scenes. “Daylight” is contrasted with “tungsten”. When filming in a studio, traditionally incandescent, or tungsten filament, bulbs were used. When supplied with the proper voltage, these bulbs emit light in the vicinity of 3200K. As color television cameras were developed white balance presets were often provided for 5500K and 3200K.

360. Kit also teaches an LED lighting device producing white light in the tungsten temperature range. Ex. 1004 at 22:9–14 (“[m]ore recently, Lumileds Lighting, LLC now offers a Luxeon warm white LED with a 90 CRI (Color Rendering Index) and **3200 degrees Kelvin** CCT (Correlated Color Temperature). Lumileds Luxeon warm white is the first generally available low CCT and high CRI warm white solid-state light source.”) (emphasis added). By 2007, Litepanels, Inc. was using a custom LED from Everlight that had a CCT of 3200 degrees Kelvin and CRI above 90.

361. Because the temperature range for tungsten white light is 3050 to 3300 degrees Kelvin, a POSITA would know that 3200 degrees Kelvin CCT

describes a tungsten temperature color. Ex. 1001 at 2:7–11. A POSITA would have known and had an expectation of success in emitting broad-spectrum white light with a high CRI above 90.

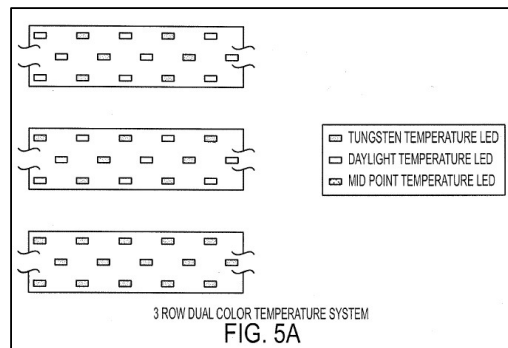
362. The film and television industries evolved around artificial light for indoor production. For many years, that light was predominately generated by incandescent lamps, commonly halogen lamps. Depending on the voltage presented at the bulb, a halogen bulb generally burns in the 3200K range. If the voltage is lower than rated, the color temperature will fall. Conversely, if the voltage is above the rated voltage, the color temperature will rise. Film stock for movie production and white balance presets for video cameras have historically used 3200K as the indoor standard.

(lxi) *Dependent Claim 45: The LED lighting device of claim 35, wherein the first, second, third, and fourth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.*

363. Katzir discloses Claim 45.

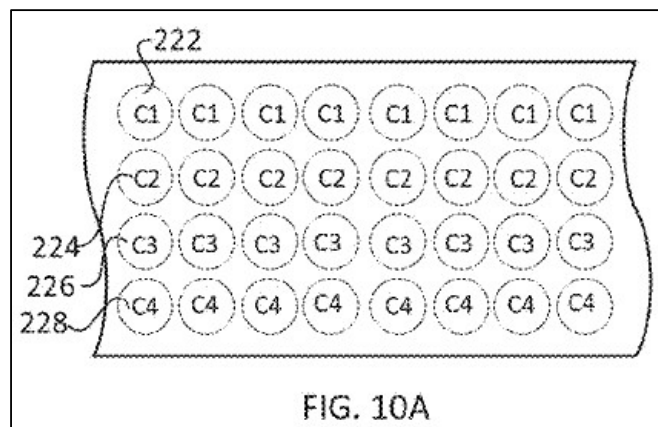
364. Katzir discloses an LED arrangement similar to a checkerboard or matrix pattern. Ex. 1010 at [0054], Figs. 5A–5F; *compare with* Ex. 1001 at 6:3–6 (“The first and second types of LEDs are preferably arranged within the matrix in a checkerboard pattern, a row of LEDs alternating between the first type and the second type of LEDs.”). Both color and white LED lights can be used in this arrangement. *See, e.g.*, Ex. 1010 at [0050], [0054].

365. One example of the matrix/checkerboard arrangement disclosed in Katzir is illustrated in Figure 5A below.



Ex. 1010 at Fig. 5A.

366. This matrix-like arrangement of LEDs is similar to the embodiments disclosed in the '224 Patent.



Ex. 1001 at Fig. 10A.

- B. Ground 2: Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45 Would Have Been Obvious Over Mueller in view of Ivey and Ansems under 35 U.S.C. § 103.**

367. It is my opinion that the combination of Mueller, Ivey, and Ansems satisfies each and every element of Claim 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45.

(i) *Motivation to Combine Mueller with Ivey and Ansems*

368. The combination of Mueller, Ivey, and Ansems discloses each and every element of Claims 1, 3, 4, 7–13, 23, 25, 26, 28, 29–39, and 41–45 of the '224 Patent. Given their respective teachings, a person of ordinary skill in the art would have been motivated to combine the teachings of these references.

369. A POSITA would have considered the teachings of Mueller, Ivey, and Ansems in tandem since they are analogous art in the same field of endeavor as the '224 Patent—namely, the field of providing color-controlled illumination.

370. Further, a POSITA would have been motivated to combine the teachings of Mueller, Ivey, and Ansems insofar as they disclose related approaches for solving the problems that one of skill in the art would expect to encounter when designing an LED lighting system.

371. The POSITA would also have had a reasonable expectation of successfully combining the elements of Mueller, Ivey, and Ansems with one another, because those elements comprised well-known and commonplace LED lights and structural components that were familiar to a POSITA at the time of the invention. That is, the combination of Mueller, Ivey, and Ansems proposed herein

are combinations of known techniques and/or substitutions of art-known elements to yield predictable results.

372. Mueller discloses an LED array to be used for image capturing purposes, such as with “studio, theatre, TV and video lamps.” Ex. 1006 at [0295]. The LED array disclosed in Mueller includes multiple LED-based light sources, including color LEDs like those disclosed in the ’224 Patent. *Id.* at [0064], [0194], Fig. 3.

373. Mueller also discloses specific temperature ranges suitable for the light emitted by the LED lights used for commercial image recording, such as warm and cool daylight lights. *See, e.g., Id.* at [0295], [0047]–[0049], [0062]–[0063]. Mueller teaches that the “lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes, and/or electrical and mechanical connection configurations.” *Id.* at [0064]. This includes tubular linear housings like those of traditional fluorescent lights. Such a configuration would have been well-known to a POSITA.

374. A POSITA would have been motivated to use an elongated tube-like form factor for the LED lighting device disclosed in Mueller for a number of reasons. Fluorescent tubes were well-known to be used by movie studios before 2012, and a POSITA would have been motivated to replace the fluorescent lights

in the already existing fluorescent light fixtures with LED lights as LED lights are cheaper, more reliable, and more versatile.

375. A POSITA would have had no concern or issue with using a linear form factor to house LEDs of this nature and use such LED lighting to capture images. Ivey would have provided further teachings to a POSITA to use a fluorescent, linear form factor with the types of LEDs disclosed in Mueller. Ivey, for instance, discloses a fluorescent form factor for LED lights, just like that disclosed in the '224 Patent. Ex. 1008 at Fig. 6, [006], [0016]–[0018]. Using the fluorescent form factor of a traditional T12 fluorescent lamp is nothing more than using a known lighting device for a well-known purpose to yield predictable results.

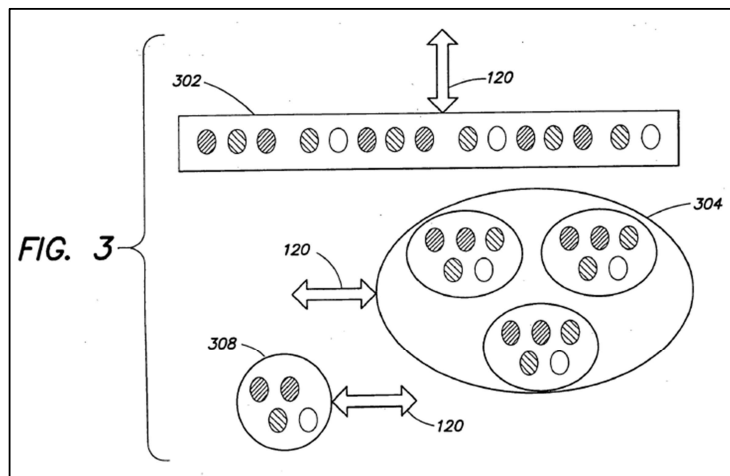
376. A POSITA would also have been motivated to combine Mueller with the teachings of Ansems. Ansems provides specific teachings regarding the use of LED lights, the arrangement of colored LED lights on a substrate, and how a user may address the LED lights by individually providing power to the LEDs. Ansems discloses LEDs that are arranged substantially in a repeating matrix pattern, and it would have been obvious to a POSITA to use such a repeating matrix pattern on Mueller's LED device as it would have produced a uniform color combination and makes it easier to control the color output by the LEDs.

(ii) ***Claim 1[pre]: An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:***

377. Mueller satisfies the preamble of Claim 1. Mueller discloses an LED lighting device suitable for a commercial image recording. Ex. 1006 at Abstract, [0251], [0262], [0265], [0295].

378. Mueller is directed to a system for controlled lighting. *Id.* at Abstract. One example disclosed by Mueller is “an LED-based lighting unit,” defined as “a lighting unit that includes one or more LED-based light sources as discussed above, alone or in combination with other non LED-based light sources.” *Id.* at [0064].

379. Exemplary configurations of the lighting systems 100 are illustrated in Figure 3:



Id. at Fig. 3. Mueller teaches that “[t]he various embodiments described throughout this specification encompass all possible combinations of LEDs in

lighting units 100, so that light of varying color, intensity, saturation and color temperature can be produced on demand under control of a processor 102. Combinations of LEDs with other mechanisms, such as phosphors, are also encompassed herein.” *Id.* at [0194.]

380. Mueller discloses that “[l]ighting units 100 can also include a wide variety of colors of LED, in various mixtures, including red, green, and blue LEDs to produce a color mix, as well as one or more other LEDs to create varying colors and color temperatures of white light.” *Id.* Mueller also teaches that lighting units 100 can include “specialty lamps, such as for...industrial or commercial applications, such as...studio, theatre, TV and video lamps...” *Id.* at [0295].

381. The methods and systems disclosed in Mueller may include “a method of lighting a motion picture environment, including providing a camera, providing a processor to control the camera, providing a lighting system, the lighting system including a plurality of LEDs selected from the group...and using the processor to simultaneously control the camera and the lighting system.” *Id.* at [0049].

(iii) Claim 1[a]: a support structure;

382. Mueller, or the combination of Mueller and Ivey, satisfy this limitation of Claim 1.

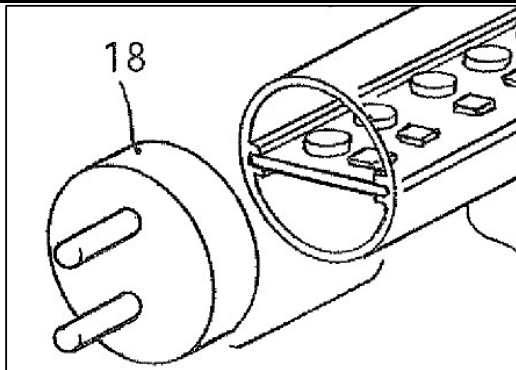
383. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention.

Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.* at [0185].

384. Similar to the '224 Patent, the disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* A POSITA would know that the standard support structure for T12 and T8 fluorescent lights have a support structure to support the lighting element.

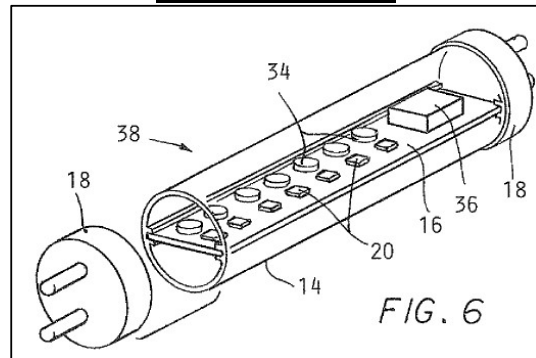
385. Ivey also discloses a housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018]. There are strong similarities between the housings and end caps in Ivey and the '224 Patent, as illustrated below. *Id.*

Housing and End Cap of Prior Art

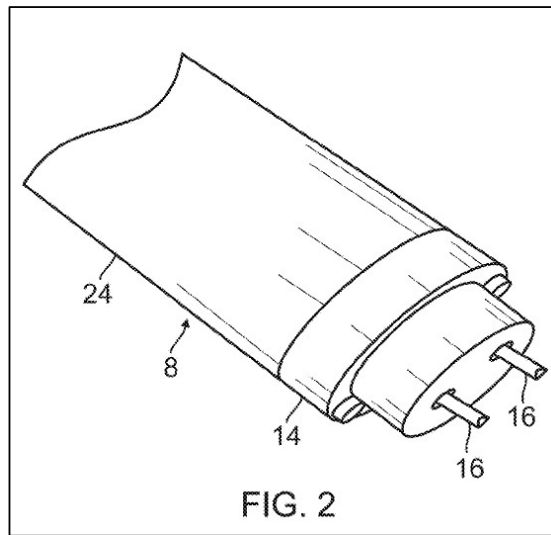


Ex. 1008 at Fig. 6. (enlarged in left image)

Expanded View



Housing and End Cap of '224 Patent



Ex. 1001 at Fig. 2.

(iv) Claim 1[b]: a housing for the support structure;

386. Mueller, or the combination of Mueller and Ivey, satisfy this limitation of Claim 1.

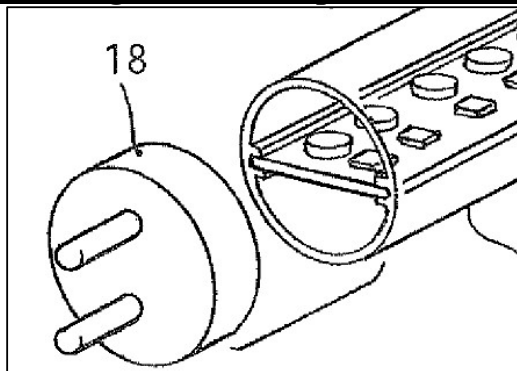
387. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.* at [0185].

388. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* at

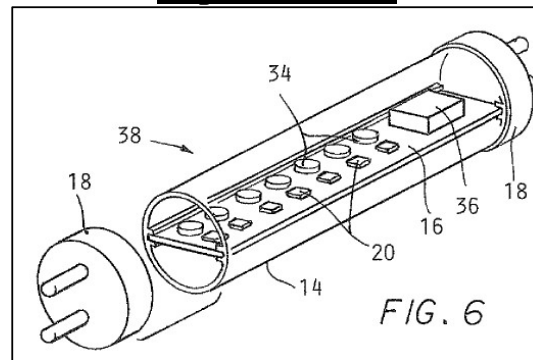
[0295]. It is well-known in the art that standard T12 and T8 fluorescent lights have a tubular housing structure that houses the lighting elements.

389. Ivey also discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art



Expanded View



Ex. 1008 at Fig. 6. (enlarged in left image)

- (v) ***Claim 1[c]: an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit five different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; a fourth set of LED emitting elements configured to emit light of at a fourth color; and a fifth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and***

390. Mueller satisfies this limitation of Claim 1.

391. Mueller discloses a lighting unit 100, such as an LED lighting device, of a linear configuration that can include “a wide variety of colors of LED, in various mixtures, including red, green, and blue LEDs to produce a color mix, as

well as one or more other LEDs to create varying colors and color temperatures of white light. For example, red, green and blue can be mixed with amber, white, UV, orange, IR or other colors of LED.” Ex. 1006 at [0194].

392. Mueller also teaches “a method of providing illumination, including providing a plurality of LEDs selected from the group consisting of red, green, blue, amber, white, orange and UV LEDs, controlling at least one of the color and color temperature of light coming from the LEDs.” *Id.* at [0046]. In addition, Mueller discloses that the “LED lighting units 100 can be combined to provide a high-quality, broad spectrum LED-based light source.” *Id.* at [0308].

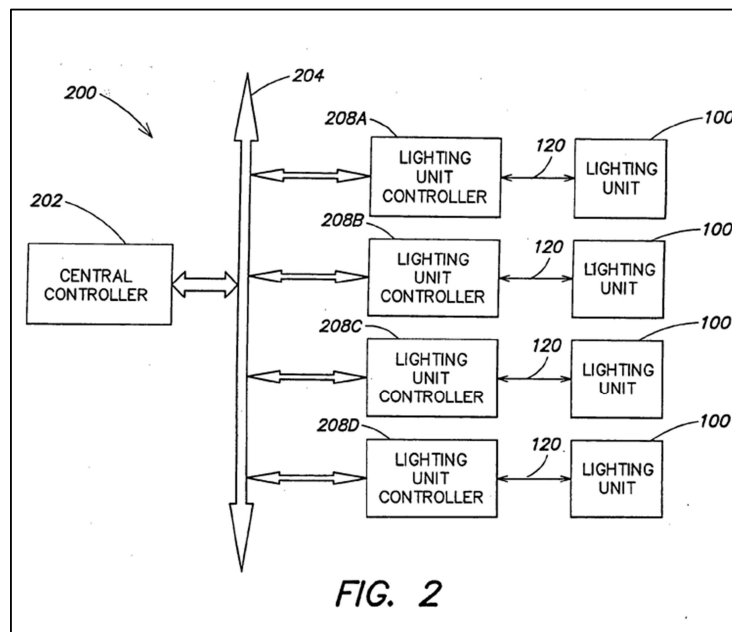
(vi) ***Claim 1[d]: a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light consisting of varying amounts of the five different colors provided by the first, second, third, fourth, and fifth sets of LED emitting elements to produce many different colors outputted from the lighting device;***

393. Mueller, Ivey, and/or Ansems satisfy this limitation of Claim 1.

394. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of red, green, blue, amber, white, orange and UV LEDs, a controller for controlling the color of light coming from the LEDs, a sensor for sensing at least one of the color and the color temperature of the light coming from the LEDs and a feedback loop for adjusting the color of light coming from the LEDs based on input from the sensor.” Ex. 1006 at [0043]. The LED

lighting units 100 “optionally may be associated with (e.g., include, be **coupled** to and/or packaged together with) various other components (e.g., control circuitry) relating to the operation of the light source(s).” *Id.* at [0064] (emphasis added).

395. Figure 2 from Mueller illustrates a controller capable of controlling each lighting unit 100 and power the LEDs to vary the amount of power provided to each LED:



Id. at Fig. 2; [0190]–[0192], *see also* [0265]–[0269].

396. Ansems discloses an “array divided into three individual sets of LEDs,” “[t]he three sets are separately connected to a LED driver unit 6 which independently can control the voltage and/or current through the three separate sets through the individual connectors for blue 7 (to cathode) and 17 (to anode), green 8

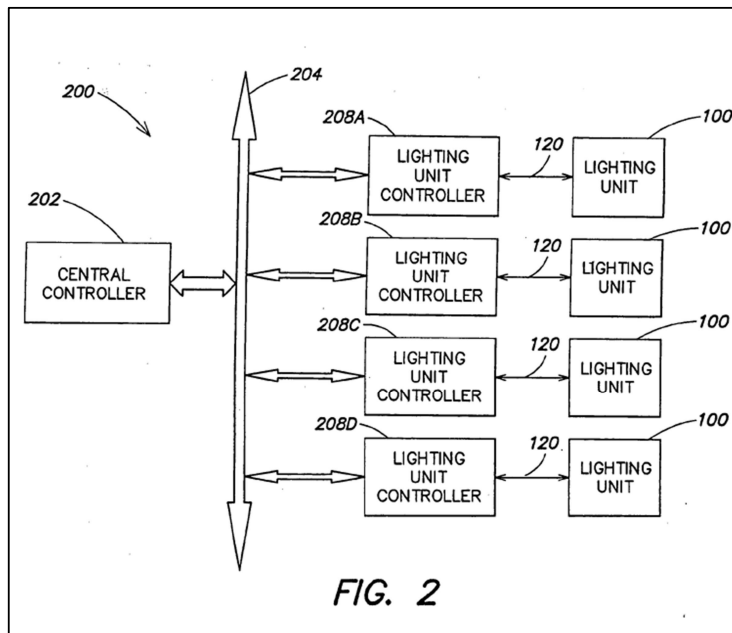
(to cathode) and 18 (to anode) and red 9 (to cathode) and 19 (to anode).” Ex. 1007 at 4:4–24.

397. Ivey teaches a controller that “can be configured to control an amount of power provided to each LED 20 using pulse width modulation.” Ex. 1008 at [0020]–[0021].

(vii) ***Claim 1[e]: and further comprising an LED driver, the LED driver configured to selectively provide electrical power to the array of LED emitting devices***

398. Mueller and Ansems satisfy this limitation of Claim 1.

399. The controller disclosed in Mueller powers the LED lights through the use of an LED driver that can control the power to the LED devices. Ex. 1006 at [0064]. Figure 2 from Mueller illustrates a controller capable of controlling each lighting unit 100 and power the LEDs to vary the amount of power provided to each LED:



Id. at Fig. 2, [0190]–[0192], *see also* [0265]–[0269].

400. Mueller discloses that lighting units “optionally may be associated with (e.g., include, be coupled to and/or packaged together with) various other components (e.g., control circuitry) relating to the operation of the light source(s).”

Id. at [0064].

401. Ansems teaches an “array divided into three individual sets of LEDs,” “[t]he three sets are separately connected to a LED driver unit 6 which independently can **control the voltage and/or current** through the three separate sets through the individual connectors for blue 7 (to cathode) and 17 (to anode), green 8 (to cathode) and 18 (to anode) and red 9 (to cathode) and 19 (to anode).”

Ex. 1007 at 4:4–24 (emphasis added).

(viii) ***Claim 1[f]: wherein the housing has a linear form factor substantially that of a fluorescent tube having an axial direction and having a diameter of no greater than about 41 mm, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and***

402. Mueller and/or Ivey satisfy this limitation of Claim 1.

403. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

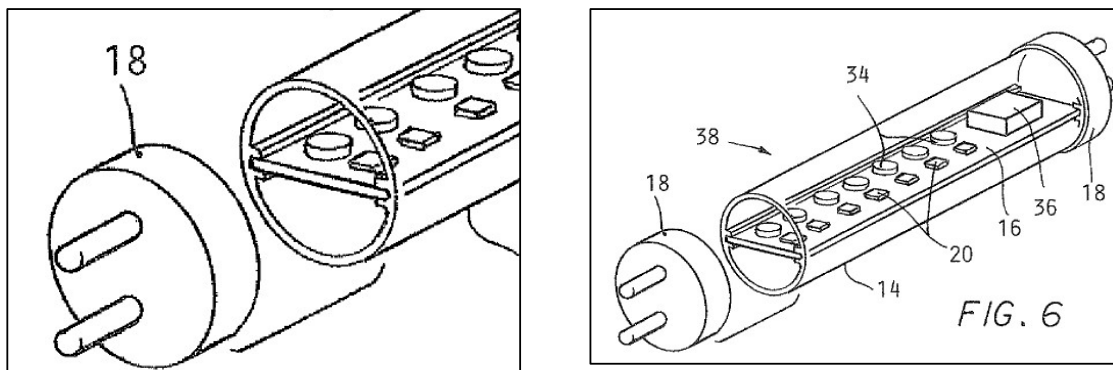
404. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.*

405. It is well-known in the art that the form factor for standard T12 and T8 fluorescent lights is tubular, linear, and has an axial direction, and that the diameter of standard T12 fluorescent tubes is about 41mm or less. Ex. 1004 at Figs. 2, 51, 9:15–24, 38:16–39:29, 77:10–50.

406. Ivey discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art

Expanded View



Ex. 1008 at Fig. 6. (enlarged in left image)

407. Ivey teaches that, “for compatibility with the fixture 12 . . . the housing 14 can have a length such that the light 10 is approximately 48” long and the housing 14 can have a 0.625”, 1.0”, or 1.5” diameter.” Ex. 1008 at [0016]. Further, Ivey discloses that “[t]he light 10 can include two bi-pin end caps 18 (i.e., each end cap 18 can carry two pins), one at each longitudinal end of the housing 14, for physically and electrically connecting the light 10 to the fixture 12....The end caps 18 can be electrically connected to the circuit board 16 to provide power to the LEDs 20.” *Id.* at [0018].

(ix) ***Claim 1[g]: wherein the housing has opposite ends and the support structure is in a form of an elongated and narrow surface extending in the axial direction and the housing having a top side and a bottom side which each extend in the axial direction, and;***

408. Mueller and/or Ivey satisfy this limitation of Claim 1.

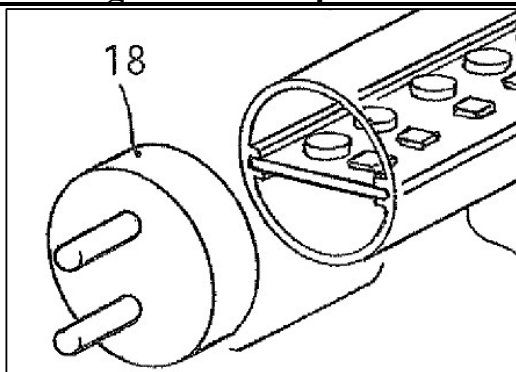
409. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention.

Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

410. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* It is well known in the art that the form factor for standard T12 and T8 fluorescent lights is tubular and linear, with opposite ends and a narrow support structure. Ex. 1004 at Figs. 2, 51, 38:16–39:29, 77:10–50.

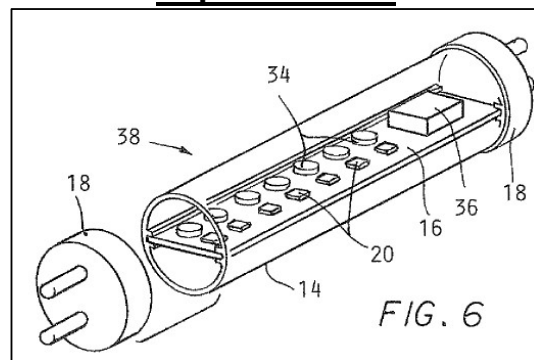
411. Ivey discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art



Id. at Fig. 6. (enlarged in left image)

Expanded View



412. The housing illustrated above has opposite ends (18) and a top and bottom side. *Id.* at Fig. 6, [0006], [0016]–[0018].

- (x) ***Claim 1[h]: wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.***

413. Mueller and/or Ivey satisfy this limitation of Claim 1.

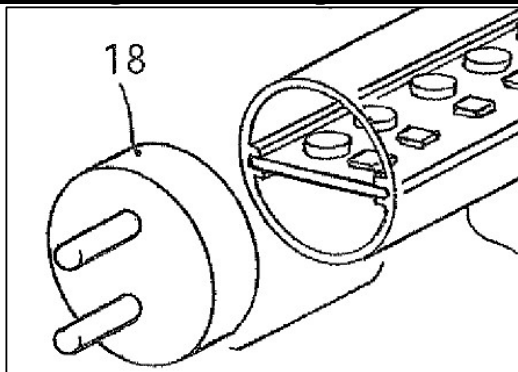
414. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention.

Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

415. The LEDs disclosed in Mueller emit light from the top side of a housing, such as a T12 or T8 fluorescent tube form factor.

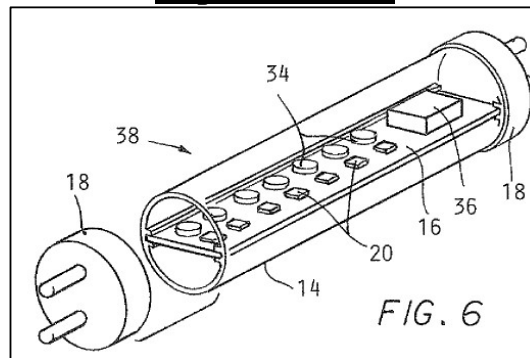
416. Ivey discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art



Id. at Fig. 6. (enlarged in left image)

Expanded View



417. The housing illustrated above has opposite ends (18) and a top and bottom side. *Id.* at Fig. 6, [0006], [0016]–[0018]. The LEDs mounted on the support structure emit light out of the top side of the housing. *Id.*

418. Ivey teaches that:

another example of a housing can be formed by attaching multiple individual parts, not all of which need to be light transmitting. For example, such a housing can include an opaque lower portion and a lens or other transparent cover attached to the lower portion to cover the LEDs 20. The housing 14 can be manufactured to include light diffusing or refracting properties, such as by surface roughening or applying a diffusing film to the housing 14.

Id. at [0006], [0016]–[0018].

(xi) ***Dependent Claim 3: The LED lighting device of claim 1, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in increments of about 1/255 to selectively produce at least 255 different colors from the lighting device.***

419. Mueller discloses Claim 3.

420. Mueller discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These

increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs. Mueller discloses that the LED lights can be controlled using a DMX signal that can incrementally control the color of RGBAW lights. Ex. 1006 at [0183], [0158]. The DMX signal in Mueller allows a user to fully control the RGBAW array to achieve different color combinations, and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.* at [0158] (“[E]ach of the colors is driven with PWM to vary its apparent intensity. This system allows for the generation of millions of colors (e.g., 16.7 million colors when 8-bit control is used on each of the PWM channels).”), [0043] (disclosing RGBAW).

(xii) ***Dependent Claim 4: The LED lighting device of claim 3, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an entertainment industry color wheel emitted from the lighting device.***

421. Mueller discloses Claim 4.

422. Mueller discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of $1/255$, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to

increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

423. Mueller discloses that the LED lights can be controlled using a DMX signal that can incrementally control the color of RGBAW lights. Ex. 1006 at [0183], [1058]. The DMX signal in Mueller allows a user to fully control the RGBAW array to achieve different color combinations, and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.* at [0158] (“[E]ach of the colors is driven with PWM to vary its apparent intensity. This system allows for the generation of millions of colors (e.g., 16.7 million colors when 8-bit control is used on each of the PWM channels).”), [0043] (disclosing RGBAW).

(xiii) *Dependent Claim 7: The LED lighting device of claim 1, wherein the fluorescent tube light has a substantially T12 form.*

424. Mueller teaches Claim 7.

425. Mueller teaches that LED lighting unit can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” Ex. 1006 at [0295].

426. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T12 fluorescent tubes. *Id.*

(xiv) ***Dependent Claim 8: The LED lighting device of claim 1, wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.***

427. Mueller, or the combination of Mueller and Ivey, teaches Claim 8.

428. Mueller teaches that LED lighting units can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” Ex. 1006 at [0295].

429. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* For example, the lighting units 100 can be configured to resemble different types of T12 fluorescent tubes. *Id.* It is well known in the art that, by far, the most common length of standard T12 fluorescent tubes is approximately four feet. The '224 Patent itself teaches that this form factor was known. *See, e.g.,* Ex. 1001 at Examples 1–3.

430. Ivey teaches that, “for compatibility with the fixture 12 . . . the housing 14 can have a length such that the light 10 is approximately 48” long and the housing 14 can have a 0.625”, 1.0”, or 1.5” diameter.” Ex. 1008 at [0016].

- (xv) ***Dependent Claim 9: The LED lighting device of claim 1, wherein at least one of the colors of the LEDs is amber.***

431. Mueller discloses Claim 9.

432. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of red, green, blue, **amber**, white, orange and UV LEDs....” Ex. 1006 at [0043] (emphasis added), *see also* [0044]–[0051].

- (xvi) ***Dependent Claim 10: The LED lighting device of claim 1, wherein the first, second, third and fourth LEDs are red, green, blue and amber, respectively.***

433. Mueller teaches Claim 10.

434. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of **red, green, blue, amber**, white, orange and UV LEDs....” Ex. 1006 at [0043] (emphasis added), *see also* [0044]–[0051].

435. Mueller also discloses that “[l]ighting units 100 can also include a wide variety of colors of LED, in various mixtures, including **red, green, and blue** LEDs to produce a color mix, as well as one or more other LEDs to create varying colors and color temperatures of white light. For example, red, green and blue can be mixed with **amber**, white, UV, orange, IR or other colors of LED.” *Id.* at [0194] (emphasis added).

- (xvii) ***Dependent Claim 11: The LED lighting device of claim 1, wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.***

436. Mueller discloses Claim 11.

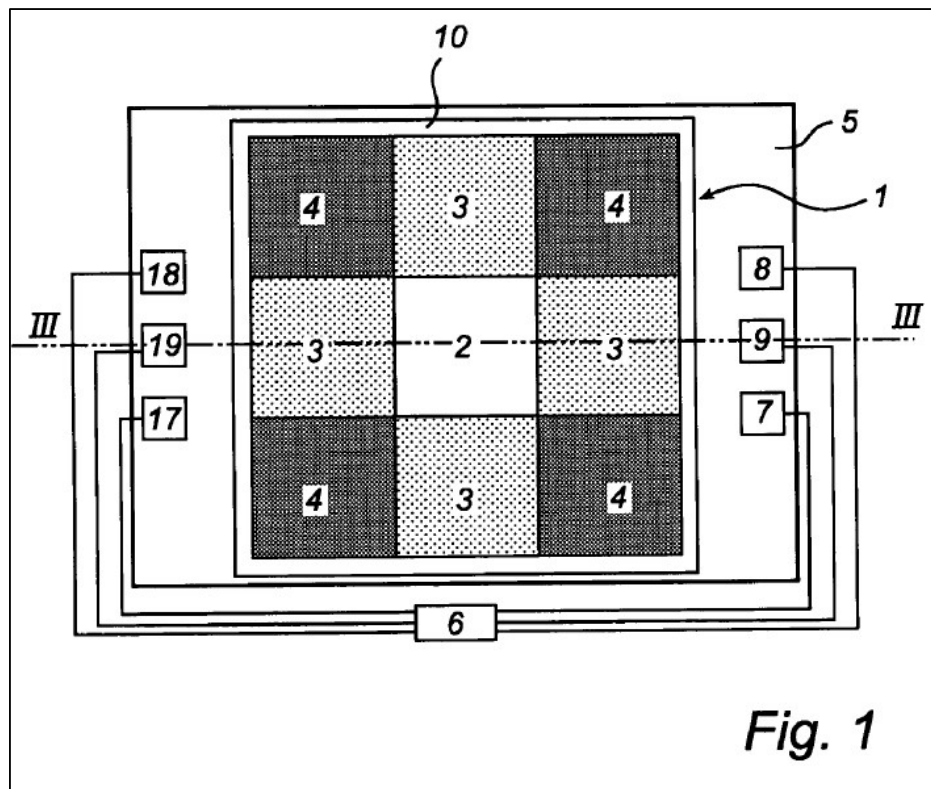
437. Mueller teaches that “red, green and blue can be mixed with amber, white, UV, orange, IR or other colors of LED. Amber and white LEDs can be mixed to offer varying colors and color temperatures of white.” Ex. 1006 at [0194].

438. Mueller also discloses that “[t]he color temperature of white light generally falls within a range of from approximately 700 degrees K (generally considered the first visible to the human eye) to over 10,000 degrees K.” *Id.* at [0062], *see also* [0063] (describing the difference color temperatures for white light). A POSITA would know that the color temperatures for tungsten white light and daylight white light fall within this 700 degrees K to 10,000 degrees K range.

(xviii) ***Dependent Claim 12: The LED lighting device of claim 1, wherein the first, second, third, fourth and fifth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.***

439. Mueller in view of Ansems discloses Claim 12.

440. Ansems discloses LEDs that are arranged substantially in a repeating matrix pattern, and it would have been obvious to a POSITA to use such a repeating matrix pattern on Mueller’s LED device. Ansems Figure 1 discloses an LED array with RGBW lights:



Ex. 1007 at Fig. 1. Ansems teaches that the array may include more LEDs and can be in any geometry with any active elements. *Id.* at 5:2–16.

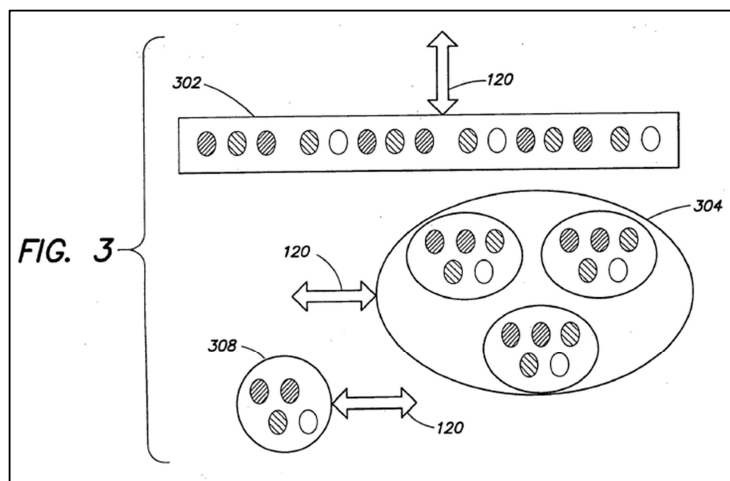
(xix) ***Claim 13[pre]: An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:***

441. Mueller satisfies the preamble of Claim 13. Mueller discloses an LED lighting device suitable for a commercial image recording. Ex. 1006 at Abstract, [0251], [0262], [0265], [0295].

442. Mueller is directed to a system for controlled lighting. *Id.* at Abstract. One example disclosed by Mueller is “an LED-based lighting unit,” defined as “a

lighting unit that includes one or more LED-based light sources as discussed above, alone or in combination with other non LED-based light sources.” *Id.* at [0064].

443. Exemplary configurations of the lighting systems 100 are illustrated in Figure 3:



Id. at Fig. 3. Mueller teaches that “[t]he various embodiments described throughout this specification encompass all possible combinations of LEDs in lighting units 100, so that light of varying color, intensity, saturation and color temperature can be produced on demand under control of a processor 102. Combinations of LEDs with other mechanisms, such as phosphors, are also encompassed herein.” *Id.* at [0194.]

444. Mueller discloses that “[l]ighting units 100 can also include a wide variety of colors of LED, in various mixtures, including red, green, and blue LEDs to produce a color mix, as well as one or more other LEDs to create varying colors

and color temperatures of white light.” *Id.* Mueller also teaches that lighting units 100 can include “specialty lamps, such as for...industrial or commercial applications, such as...studio, theatre, TV and video lamps...” *Id.* at [0295].

445. The methods and systems disclosed in Mueller may include “a method of lighting a motion picture environment, including providing a camera, providing a processor to control the camera, providing a lighting system, the lighting system including a plurality of LEDs selected from the group...and using the processor to simultaneously control the camera and the lighting system.” *Id.* at [0049].

(xx) Claim 13[a]: a support structure;

446. Mueller, or the combination of Mueller and Ivey, satisfy this limitation of Claim 13.

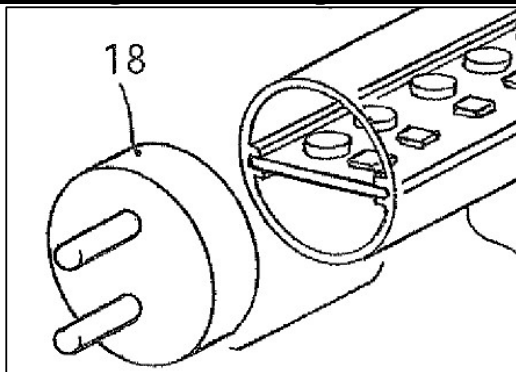
447. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

448. Similar to the ’224 Patent, the disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent

tubes. *Id.* A POSITA would know that the standard support structure for T12 and T8 fluorescent lights have a support structure to support the lighting element.

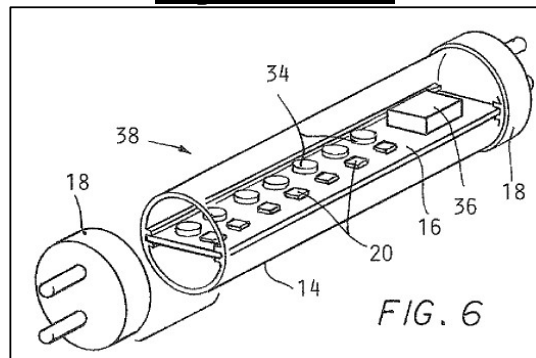
449. Ivey also discloses a housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018]. There are strong similarities between the housings and end caps in Ivey and the '224 Patent, as illustrated below. *Id.*

Housing and End Cap of Prior Art

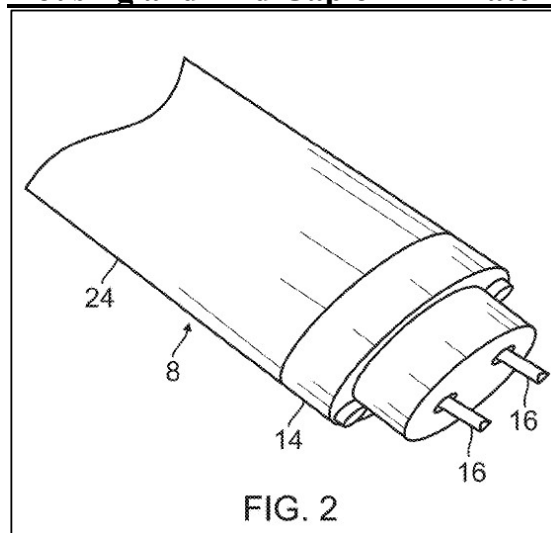


Ex. 1008 at Fig. 6. (enlarged in left image)

Expanded View



Housing and End Cap of '224 Patent



Ex. 1001 at Fig. 2.

(xxi) ***Claim 13[b]: a housing for the support structure;***

450. Mueller, or the combination of Mueller and Ivey, satisfy this limitation of Claim 13.

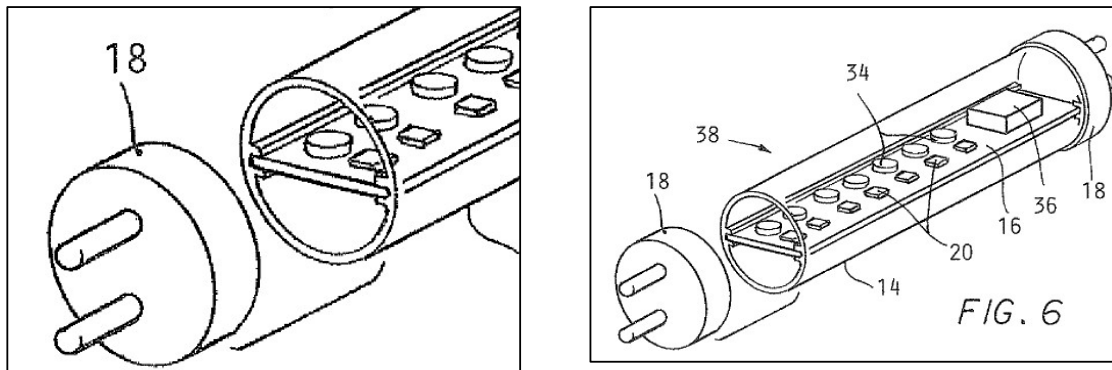
451. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

452. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* It is well-known in the art that standard T12 and T8 fluorescent lights have a tubular housing structure that houses the lighting elements.

453. Ivey also discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art

Expanded View



Ex. 1008 at Fig. 6. (enlarged in left image)

- (xxii) ***Claim 13[c]: an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit four different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; and a fourth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and***

454. Mueller satisfies this limitation of Claim 13.

455. Mueller discloses a lighting unit 100, such as an LED lighting device, of a linear configuration that can include “a wide variety of colors of LED, in various mixtures, including red, green, and blue LEDs to produce a color mix, as well as one or more other LEDs to create varying colors and color temperatures of white light. For example, red, green and blue can be mixed with amber, white, UV, orange, IR or other colors of LED.” Ex. 1006 at [0194].

456. Mueller also teaches “a method of providing illumination, including providing a plurality of LEDs selected from the group consisting of red, green,

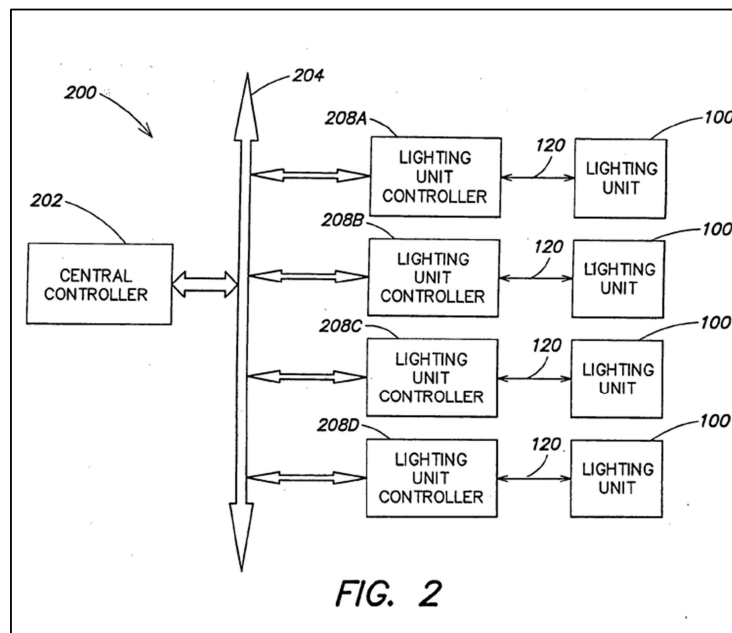
blue, amber, white, orange and UV LEDs, controlling at least one of the color and color temperature of light coming from the LEDs.” *Id.* at [0046]. In addition, Mueller discloses that the “LED lighting units 100 can be combined to provide a high-quality, broad spectrum LED-based light source.” *Id.* at [0308].

(xxiii) ***Claim 13[d]: a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light consisting of varying amounts of the four different colors provided by the first, second, third, and fourth sets of LED emitting elements to produce many different colors outputted from the lighting device, and further comprising an LED driver, the LED driver configured to selectively provide electrical power to the array of LED emitting devices,***

457. Mueller, Ivey and/or Ansems satisfy this limitation of Claim 13.

458. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of red, green, blue, amber, white, orange and UV LEDs, a controller for controlling the color of light coming from the LEDs, a sensor for sensing at least one of the color and the color temperature of the light coming from the LEDs and a feedback loop for adjusting the color of light coming from the LEDs based on input from the sensor.” Ex. 1006 at [0043]. The LED lighting units 100 “optionally may be associated with (e.g., include, be **coupled** to and/or packaged together with) various other components (e.g., control circuitry) relating to the operation of the light source(s).” *Id.* at [0064] (emphasis added).

459. The controller disclosed in Mueller powers the LED lights through the use of an LED driver that can control the power to the LED devices. *Id.* Figure 2 from Mueller illustrates a controller capable of controlling each lighting unit 100 and power the LEDs to vary the amount of power provided to each LED:



Id. at Fig. 2, [0190]–[0192], *see also* [0265]–[0269].

460. Ansems discloses an “array divided into three individual sets of LEDs,” “[t]he three sets are separately connected to a LED driver unit 6 which independently can control the voltage and/or current through the three separate sets through the individual connectors for blue 7 (to cathode) and 17 (to anode), green 8 (to cathode) and 18 (to anode) and red 9 (to cathode) and 19 (to anode).” Ex. 1007 at 4:4–24.

461. Ivey teaches a controller that “can be configured to control an amount of power provided to each LED 20 using pulse width modulation.” Ex. 1008 at 3:64–67.

(xxiv) ***Claim 13[e]: wherein the housing has a linear form factor substantially that of a fluorescent tube of one of a T12 and T8 form, and having a length of no greater than about four feet and a diameter of no greater than about 41 mm, and further comprising an electrical input connection for receiving input power, and***

462. Mueller, or the combination of Mueller and Ivey, satisfy this limitation of Claim 13.

463. Mueller teaches that the lighting units 100 can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” Ex. 1006 at [0295]. More specifically, Mueller discloses that the disclosed lighting units 100 may “be configured to resemble fluorescent lamps,” such as T8 and T12 fluorescent tubes. *Id.* It is well-known in the art that standard T12 fluorescent tubes are approximately four feet long and 1.5” in diameter. *See, e.g.,* Ex. 1001 at Examples 1–3, 4:1–2, 10:47–49.

464. Ivey teaches that, “for compatibility with the fixture 12 . . . the housing 14 can have a length such that the light 10 is approximately 48” long and the housing 14 can have a 0.625”, 1.0”, or 1.5” diameter,” which is less than 41 mm. Ex. 1008 at [0016].

(xxv) ***Claim 13[f]: wherein the input connection is in electrical communication with the LED driver, wherein the housing has opposite ends and the support surface is in a form of an elongated and narrow surface extending in the axial direction, and the housing having a top side and a bottom side which each extend in the axial direction, and***

465. Mueller and/or Ivey satisfy this limitation of Claim 13.

466. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention.

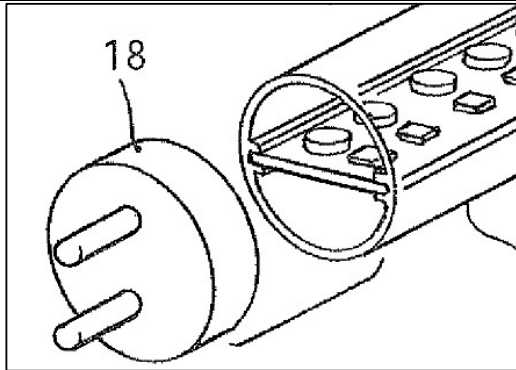
Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.* at [0064].

467. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* A POSITA would know that the form factor for standard T12 and T8 fluorescent lights is tubular and linear, with opposite ends and a narrow support structure. Ex. 1010 at Fig. 2A, [0018], [0027].

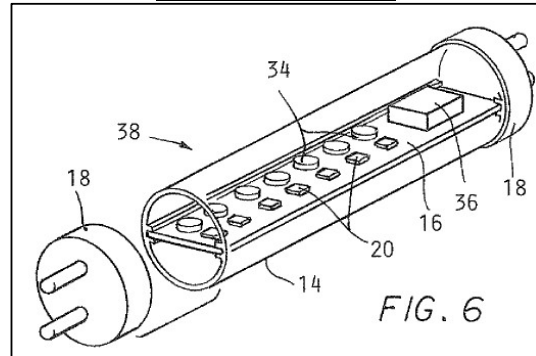
468. Mueller teaches an electrical input connection, which communicates with the LED array and the drivers. Ex. 1006 at [0064].

469. Ivey discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art



Expanded View



Ex. 1008 at Fig. 6. (enlarged in left image)

470. The housing illustrated above has opposite ends (18) and a top and bottom side. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

471. Ivey also teaches an electrical input connection, which communicates with the LED array and the drivers. *Id.*

(xxvi) ***Claim 13[g]: wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.***

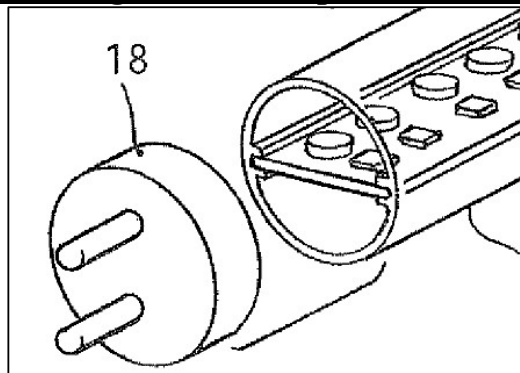
472. Mueller and/or Ivey satisfy this limitation of Claim 13.

473. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

474. The LEDs disclosed in Mueller emit light from the top side of a housing, such as a T12 or T8 fluorescent tube form factor.

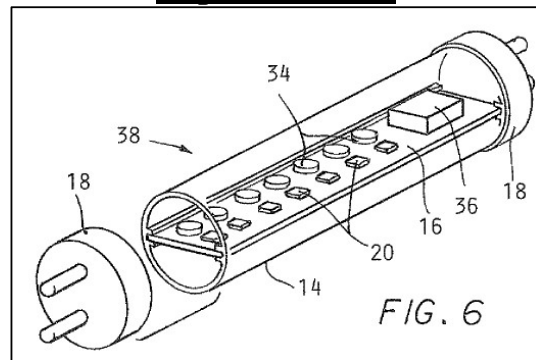
475. Ivey discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art



Ex. 1008 at Fig. 6. (enlarged in left image)

Expanded View



476. The housing illustrated above has opposite ends (18) and a top and bottom side. *Id.* at Fig. 6, [0006], [0016]–[0018]. The LEDs mounted on the support structure emit light out of the top side of the housing. *Id.*

477. Ivey teaches that:

another example of a housing can be formed by attaching multiple individual parts, not all of which need to be light transmitting. For example, such a housing can include an opaque lower portion and a lens or other transparent cover attached to the lower portion to cover the LEDs 20. The housing 14 can be manufactured to include light diffusing or refracting properties, such as by surface roughening or applying a diffusing film to the housing 14.”

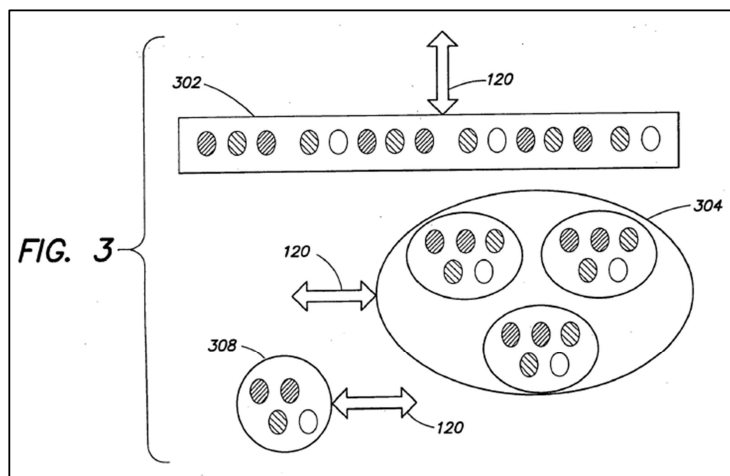
Id.

(xxvii) ***Claim 23[pre]: An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:***

478. Mueller satisfies the preamble of Claim 23. Mueller discloses an LED lighting device suitable for a commercial image recording. Ex. 1006 at Abstract, [0251], [0262], [0265], [0295].

479. Mueller is directed to a system for controlled lighting. *Id.* at Abstract. One example disclosed by Mueller is “an LED-based lighting unit,” defined as “a lighting unit that includes one or more LED-based light sources as discussed above, alone or in combination with other non LED-based light sources.” *Id.* at [0064].

480. Exemplary configurations of the lighting systems 100 are illustrated in Figure 3:



Id. at Fig. 3. Mueller teaches that “[t]he various embodiments described throughout this specification encompass all possible combinations of LEDs in lighting units 100, so that light of varying color, intensity, saturation and color temperature can be produced on demand under control of a processor 102. Combinations of LEDs with other mechanisms, such as phosphors, are also encompassed herein.” *Id.* at [0194.]

481. Mueller discloses that “[l]ighting units 100 can also include a wide variety of colors of LED, in various mixtures, including red, green, and blue LEDs to produce a color mix, as well as one or more other LEDs to create varying colors and color temperatures of white light.” *Id.* Mueller also teaches that lighting units 100 can include “specialty lamps, such as for...industrial or commercial applications, such as...studio, theatre, TV and video lamps...” *Id.* at [0295].

482. The methods and systems disclosed in Mueller may include “a method of lighting a motion picture environment, including providing a camera, providing a processor to control the camera, providing a lighting system, the lighting system including a plurality of LEDs selected from the group...and using the processor to simultaneously control the camera and the lighting system.” *Id.* at [0049].

(xxviii) Claim 23[a]: a support structure;

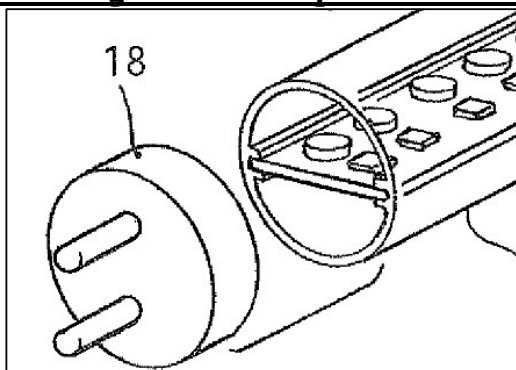
483. Mueller, or the combination of Mueller and Ivey, satisfy this limitation of Claim 23.

484. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.* at [0185].

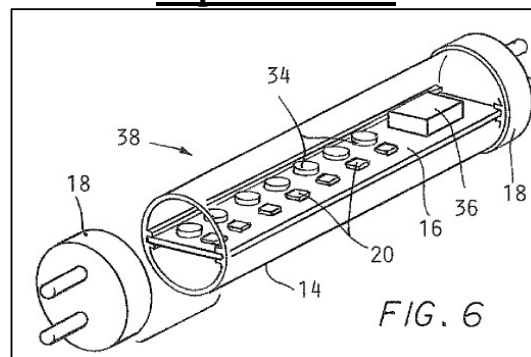
485. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* A POSITA would know that the standard support structure for T12 and T8 fluorescent lights have a support structure to support the lighting element.

486. Ivey also discloses a housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018]. There are strong similarities between the housings and end caps in Ivey and the ’224 Patent, as illustrated below. *Id.*

Housing and End Cap of Prior Art

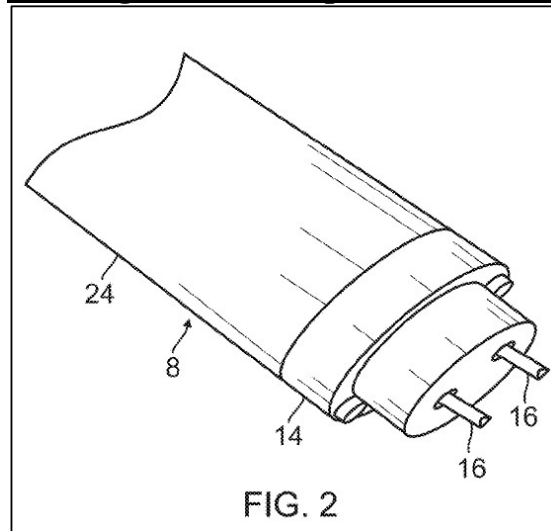


Expanded View



Ex. 1008 at Fig. 6. (enlarged in left image)

Housing and End Cap of '224 Patent



Ex. 1001 at Fig. 2.

(xxix) ***Claim 23[b]: a housing for the support structure;***

487. Mueller, or the combination of Mueller and Ivey, satisfy this limitation of Claim 23.

488. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

489. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be

490. Ivey also discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Ex. 1008 at Fig. 6. (enlarged in left image)

(xxx) *Claim 23[c]: an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit five different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; a fourth set of LED emitting elements configured to emit light of at a fourth color; and a fifth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and*

492. Mueller discloses a lighting unit 100, such as an LED lighting device, in near configuration that can include “a wide variety of colors of LED, in

various mixtures, including red, green, and blue LEDs to produce a color mix, as well as one or more other LEDs to create varying colors and color temperatures of white light. For example, red, green and blue can be mixed with amber, white, UV, orange, IR or other colors of LED.” Ex. 1006 at [0194].

493. Mueller also teaches “a method of providing illumination, including providing a plurality of LEDs selected from the group consisting of red, green, blue, amber, white, orange and UV LEDs, controlling at least one of the color and color temperature of light coming from the LEDs.” *Id.* at [0046]. In addition, Mueller discloses that the “LED lighting units 100 can be combined to provide a high-quality, broad spectrum LED-based light source.” *Id.* at [0308].

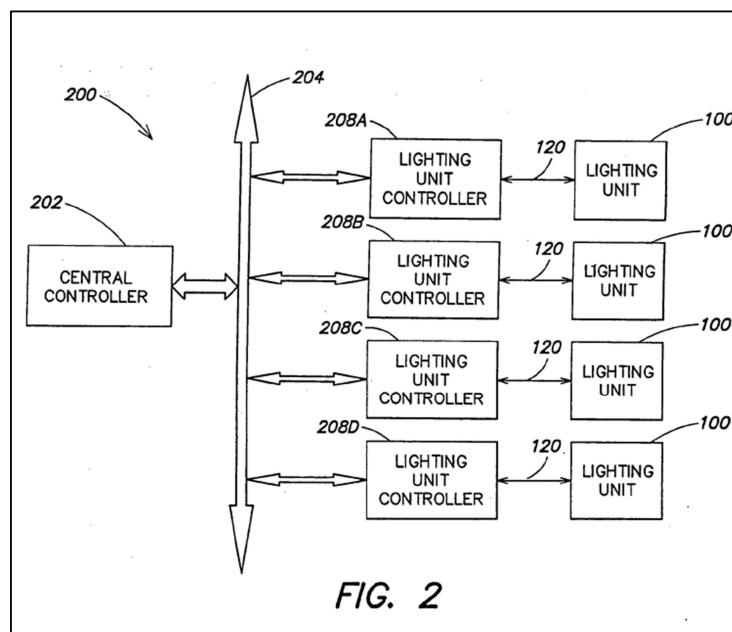
(xxxi) ***Claim 23[d]: a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light consisting of varying amounts of the five different colors provided by the first, second, third, fourth, and fifth sets of LED emitting elements to produce many different colors outputted from the lighting device,***

494. Mueller, Ivey and/or Ansems satisfy this limitation of Claim 23.

495. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of red, green, blue, amber, white, orange and UV LEDs, a controller for controlling the color of light coming from the LEDs, a sensor for sensing at least one of the colors and the color temperature of the light coming from the LEDs and a feedback loop for adjusting the color of light coming

from the LEDs based on input from the sensor.” Ex. 1006 at [0043]. The LED lighting units 100 “optionally may be associated with (e.g., include, be **coupled** to and/or packaged together with) various other components (e.g., control circuitry) relating to the operation of the light source(s).” *Id.* at [0064] (emphasis added).

496. Figure 2 from Mueller illustrates a controller capable of controlling each lighting unit 100 and power the LEDs to vary the amount of power provided to each LED:



Id. at Fig. 2, [0190]–[0192], *see also* [0265]–[0269].

497. Ansems discloses an “array divided into three individual sets of LEDs,” “[t]he three sets are separately connected to a LED driver unit 6 which independently can control the voltage and/or current through the three separate sets through the individual connectors for blue 7 (to cathode) and 17 (to anode), green 8

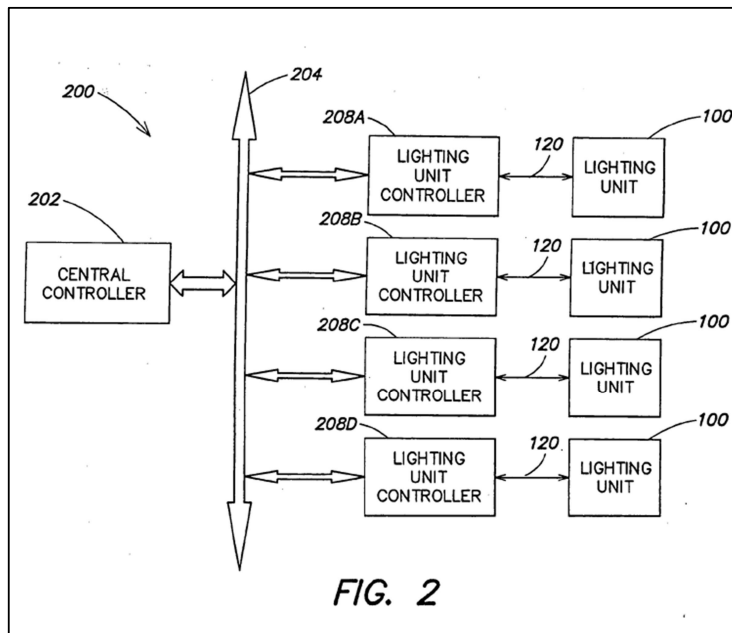
(to cathode) and 18 (to anode) and red 9 (to cathode) and 19 (to anode).” Ex. 1007 at 4:4–24.

498. Ivey teaches a controller that “can be configured to control an amount of power provided to each LED 20 using pulse width modulation.” Ex. 1008 at [0020]–[0021].

(xxxii) ***Claim 23[e]: and an LED driver configured to selectively provide electrical power to the array of LED emitting devices;***

499. Mueller and Ansems satisfy this limitation of Claim 23.

500. The controller disclosed in Mueller powers the LED lights through the use of an LED driver that can control the power to the LED devices. Ex. 1006 at [0064]. Figure 2 from Mueller illustrates a controller capable of controlling each lighting unit 100 and power the LEDs to vary the amount of power provided to each LED:



Id. at Fig. 2, [0190]–[0192], *see also* [0265]–[0269].

501. Mueller discloses that lighting units “optionally may be associated with (e.g., include, be coupled to and/or packaged together with) various other components (e.g., control circuitry) relating to the operation of the light source(s).”

Id. at [0064].

502. Ansems teaches an “array divided into three individual sets of LEDs,” “[t]he three sets are separately connected to a LED driver unit 6 which independently can **control the voltage and/or current** through the three separate sets through the individual connectors for blue 7 (to cathode) and 17 (to anode), green 8 (to cathode) and 18 (to anode) and red 9 (to cathode) and 19 (to anode).”

Ex. 1007 at 4:4–24 (emphasis added).

(xxxiii) ***Claim 23[ff]: wherein the housing has a linear form factor substantially that of one of a T12 and T8 form, and fluorescent tube light, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and***

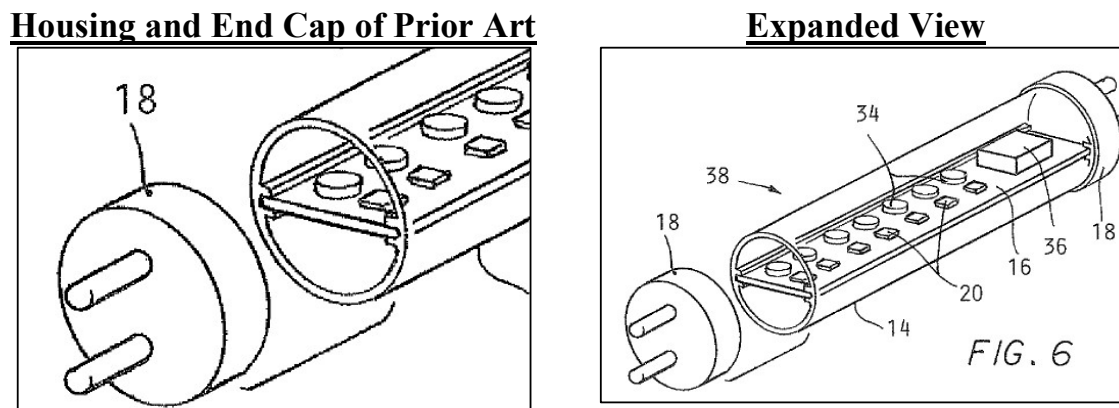
503. Mueller and/or Ivey satisfy this limitation of Claim 23.

504. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

505. Further, Mueller teaches that the lighting units 100 can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” *Id.* at [0295]. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* It is well known in the art that the form factor for standard T12 and T8 fluorescent lights is tubular and linear. Ex. 1010 at Fig. 2A, [0018], [0027].

506. Ivey teaches that, “for compatibility with the fixture 12 . . . the housing 14 can have a length such that the light 10 is approximately 48” long and

the housing 14 can have a 0.625", 1.0", or 1.5" diameter." Ex. 1008 at 3:5–8. Ivey discloses a tubular housing having a support structure with LED lights mounted thereto. *Id.* at Fig. 6, [0006], [0016]–[0018].



Id. at Fig. 6. (enlarged in left image)

The housing illustrated above has opposite ends (18) and a top and bottom side. *Id.* at Fig. 6, [0006], [0016]–[0018].

507. Both Mueller and Ivey teach an electrical input connection that communicates with the LED array and the drivers. Ex. 1006 at [0064]; Ex. 1008 at [0006], [0016]–[0018].

(xxxiv) *Claim 23[g]: wherein the housing has opposite ends and the support structure is in a form of an elongated and narrow surface extending in the axial direction and the housing having a top side and a bottom side which each extend in the axial direction, and wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.*

508. Mueller and/or Ivey satisfy this limitation of Claim 23.

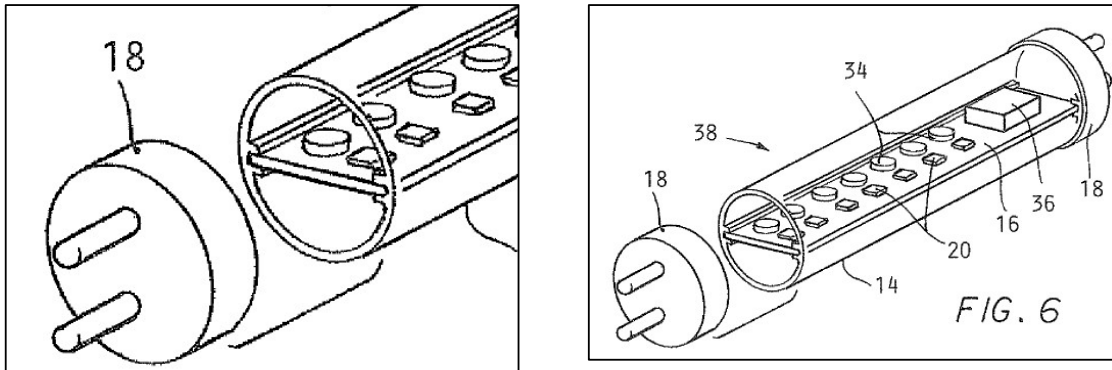
509. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.* The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* It is well known in the art that the form factor for standard T12 and T8 fluorescent lights is tubular and linear, with opposite ends and a narrow support structure. Ex. 1004 at Figs. 2, 51, 38:16–39:29, 77:10–50.

510. The LEDs disclosed in Mueller emit light from the top side of a housing, such as a T12 or T8 fluorescent tube form factor.

511. Ivey discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art

Expanded View



Ex. 1008 at Fig. 6. (enlarged in left image)

The housing illustrated above has opposite ends (18) and a top and bottom side. *Id.* at Fig. 6, [0006], [0016]–[0018]. The LEDs mounted on the support structure emit light out of the top side of the housing. *Id.*

512. Ivey teaches that:

another example of a housing can be formed by attaching multiple individual parts, not all of which need to be light transmitting. For example, such a housing can include an opaque lower portion and a lens or other transparent cover attached to the lower portion to cover the LEDs 20. The housing 14 can be manufactured to include light diffusing or refracting properties, such as by surface roughening or applying a diffusing film to the housing 14.”

Id.

(xxv) ***Dependent Claim 25: The LED lighting device of claim 23, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth and fifth set of LED emitting elements in increments of about 1/255 to selectively produce at least 255 different colors from the lighting device.***

513. Mueller discloses Claim 25.

514. Mueller discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

515. Mueller discloses that the LED lights can be controlled using a DMX signal that can incrementally control the color of RGBAW lights. Ex. 1006 at [0183], [0158]. The DMX signal in Mueller allows a user to fully control the RGBAW array to achieve different color combinations, and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.* at [0158] (“[E]ach of the colors is driven with PWM to vary its apparent intensity. This system allows for the generation of millions of colors (e.g., 16.7 million colors when 8-bit control is used on each of the PWM channels).”), [0043] (disclosing RGBAW).

(xxxvi) ***Dependent Claim 26: The LED lighting device of claim 5, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an***

entertainment industry color wheel emitting from the lighting device.

516. Mueller discloses Claim 26.

517. Mueller discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

518. Mueller discloses that the LED lights can be controlled using a DMX signal that can incrementally control the color of RGBAW lights. Ex. 1006 at [0183], [0158]. The DMX signal in Mueller allows a user to fully control the RGBAW array to achieve different color combinations, and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.* at [0158] (“[E]ach of the colors is driven with PWM to vary its apparent intensity. This system allows for the generation of millions of colors (e.g., 16.7 million colors when 8-bit control is used on each of the PWM channels).”), [0043] (disclosing RGBAW).

(xxvii) ***Dependent Claim 28: The LED lighting device of claim 23, wherein the electrical input connection is configured to receive AC input power.***

519. Mueller teaches Claim 28.

520. Mueller discloses an electrical input connection to receive AC input power. For instance, Mueller teaches that the lighting device can be configured to receive numerous types of power, including AC input power. Ex. 1006 at [0184].

521. Ivey also discloses that “[f]or compatibility with the fixture 12 . . . the housing 14 can have a length such that the light 10 is approximately 48” long and the housing 14 can have a 0.625”, 1.0”, or 1.5” diameter.” Ex. 1008 at [0016]. Ivey also discloses that the housing ends (18) contain bi-pins for physically and electrically connecting the light to the fixture, and to provide power to the LEDs. *Id.* at 3:22–38.

(xxxviii) ***Dependent Claim 29: The LED lighting device of claim 23, wherein the fluorescent tube light has a substantially T12 form.***

522. Mueller teaches Claim 29.

523. Mueller teaches that LED lighting units can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” Ex. 1006 at [0295].

524. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* For example, the lighting units 100 can be configured to resemble different types of T12 fluorescent tubes. *Id.*

(xxxix) ***Dependent Claim 30: The LED lighting device of claim 23, wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.***

525. Mueller, or the combination of Mueller and Ivey, expressly teaches Claim 30.

526. Mueller teaches that LED lighting units can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” Ex. 1006 at [0295].

527. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* For example, the lighting units 100 can be configured to resemble different types of T12 fluorescent tubes. *Id.* It is well known in the art that, by far, the length of standard T12 fluorescent tubes is approximately four feet. *See, e.g.*, Ex. 1001 at Examples 1–3.

528. Ivey teaches that, “for compatibility with the fixture 12 . . . the housing 14 can have a length such that the light 10 is approximately 48” long and the housing 14 can have a 0.625”, 1.0”, or 1.5” diameter.” Ex. 1008 at [0016].

(xl) ***Dependent Claim 31: The LED lighting device of claim 23, wherein at least one of the colors of the LEDs is amber.***

529. Mueller teaches Claim 31.

530. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of red, green, blue, **amber**, white, orange and UV LEDs....” Ex. 1006 at [0043] (emphasis added), *see also* [0044]–[0051].

(xli) ***Dependent Claim 32: The LED lighting device of claim 23, wherein the first, second, third and fourth LEDs are red, green, blue and amber, respectively.***

531. Mueller discloses Claim 32.

532. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of **red, green, blue, amber**, white, orange and UV LEDs....” Ex. 1006 at [0043] (emphasis added), *see also* [0044]–[0051].

533. Mueller also discloses that “[l]ighting units 100 can also include a wide variety of colors of LED, in various mixtures, including **red, green, and blue** LEDs to produce a color mix, as well as one or more other LEDs to create varying colors and color temperatures of white light. For example, red, green and blue can be mixed with **amber**, white, UV, orange, IR or other colors of LED.” *Id.* at [0194] (emphasis added).

(xlii) ***Dependent Claim 33: The LED lighting device of claim 23, wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.***

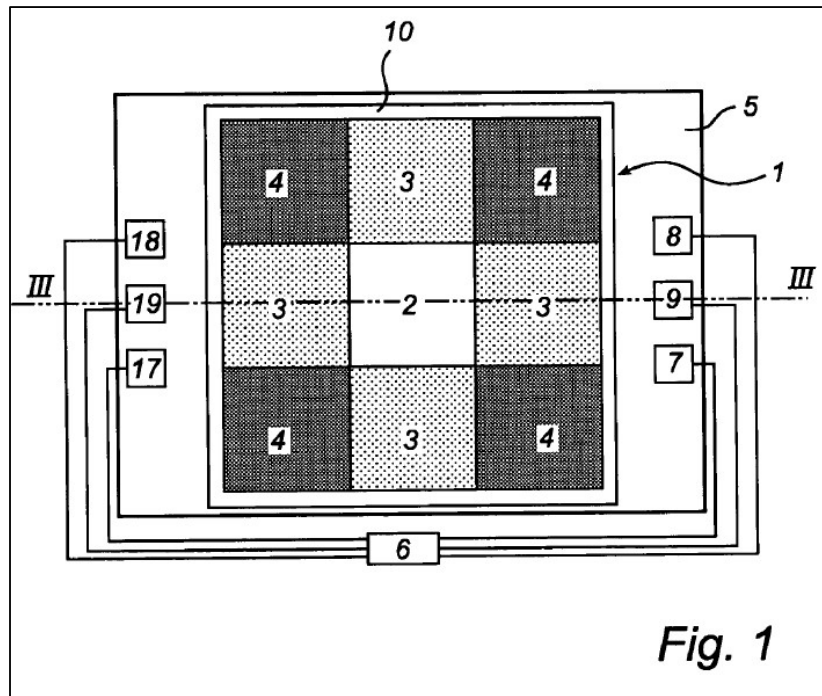
534. Mueller discloses Claim 33.

535. Mueller teaches that “red, green and blue can be mixed with amber, white, UV, orange, IR or other colors of LED. Amber and white LEDs can be mixed to offer varying colors and color temperatures of white.” Ex. 1006 at [0194].

536. Mueller also discloses that “[t]he color temperature of white light generally falls within a range of from approximately 700 degrees K (generally considered the first visible to the human eye) to over 10,000 degrees K.” *Id.* at [0062], *see also* [0063] (describing the difference color temperatures for white light). A POSITA would know that the color temperatures for tungsten white light and daylight white light fall within this 700 degrees K to 10,000 degrees K range.

(xliii) *Dependent Claim 34: The LED lighting device of claim 23, wherein the first, second, third, fourth and fifth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.*

537. Mueller in view of Ansems expressly discloses Claim 34. Ansems discloses LEDs that are arranged substantially in a repeating matrix pattern, and it would have been obvious to a POSITA to use such a repeating matrix pattern on Mueller’s LED device. Ansems Figure 1 discloses an LED array with RGBW lights:



Ex. 1007 at Fig. 1. Ansems teaches that the array may include more LEDs and can be in any geometry with any active elements. *Id.* at 5:2–16.

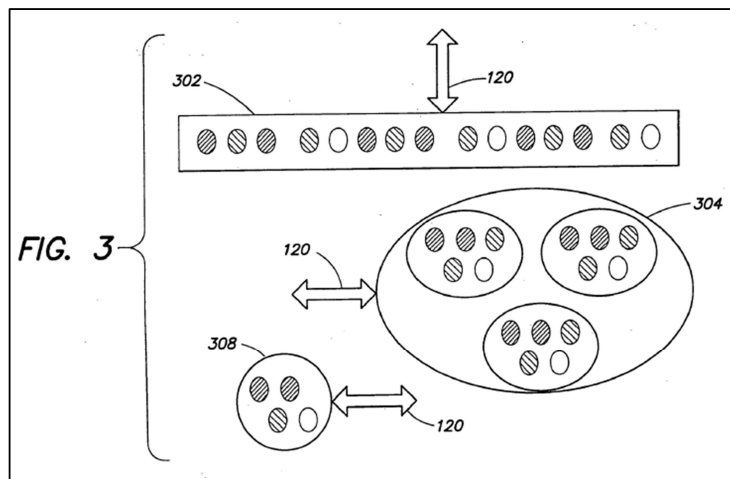
(xliv) ***Claim 35[pre]: An LED lighting device configured for providing light suitable for a commercial image recording, the LED lighting device comprising:***

538. Mueller satisfies the preamble of Claim 35. Mueller discloses an LED lighting device suitable for a commercial image recording. Ex. 1006 at Abstract, [0251], [0262], [0265], [0295].

539. Mueller is directed to a system for controlled lighting. *Id.* at Abstract. One example disclosed by Mueller is “an LED-based lighting unit,” defined as “a lighting unit that includes one or more LED-based light sources as discussed

above, alone or in combination with other non LED-based light sources.” *Id.* at [0064].

540. Exemplary configurations of the lighting systems 100 are illustrated in Figure 3:



Id. at Fig. 3. Mueller teaches that “[t]he various embodiments described throughout this specification encompass all possible combinations of LEDs in lighting units 100, so that light of varying color, intensity, saturation and color temperature can be produced on demand under control of a processor 102. Combinations of LEDs with other mechanisms, such as phosphors, are also encompassed herein.” *Id.* at [0194].

541. Mueller discloses that “[l]ighting units 100 can also include a wide variety of colors of LED, in various mixtures, including red, green, and blue LEDs to produce a color mix, as well as one or more other LEDs to create varying colors and color temperatures of white light.” *Id.* Mueller also teaches that lighting units

100 can include “specialty lamps, such as for...industrial or commercial applications, such as...studio, theatre, TV and video lamps...” *Id.* at [0295].

542. The methods and systems disclosed in Mueller may include “a method of lighting a motion picture environment, including providing a camera, providing a processor to control the camera, providing a lighting system, the lighting system including a plurality of LEDs selected from the group...and using the processor to simultaneously control the camera and the lighting system.” *Id.* at [0049].

(xlv) Claim 35[a]: a support structure;

543. Mueller, or the combination of Mueller and Ivey, satisfies this limitation of Claim 35.

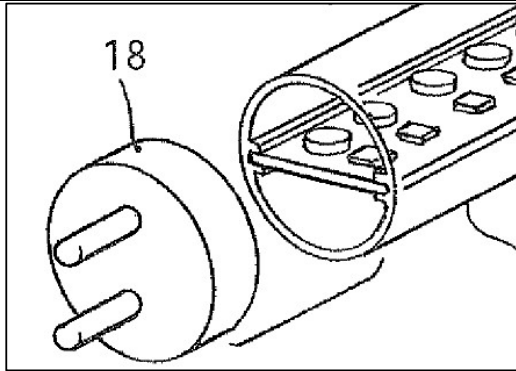
544. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.* at [0185].

545. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* A

POSITA would know that the standard support structure for T12 and T8 fluorescent lights have a support structure to support the lighting element.

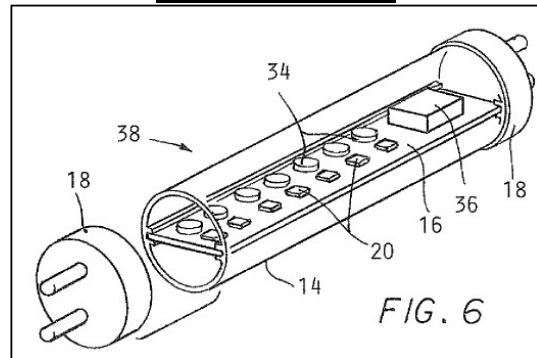
546. Ivey also discloses a housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018]. There are strong similarities between the housings and end caps in Ivey and the '224 Patent, as illustrated below. *Id.*

Housing and End Cap of Prior Art

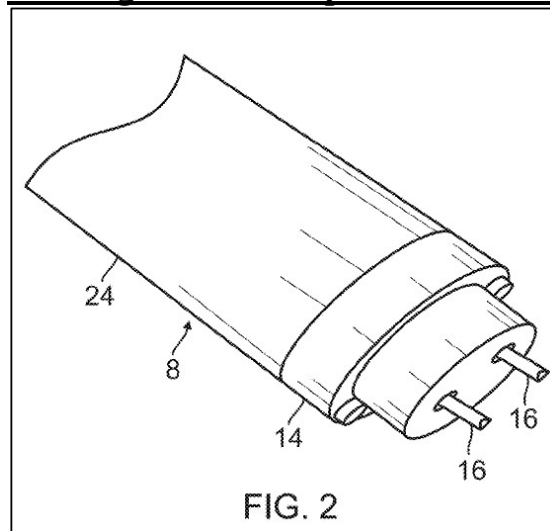


Ex. 1008 at Fig. 6. (enlarged in left image)

Expanded View



Housing and End Cap of '224 Patent



Ex. 1001 at Fig. 2.

(xlvi) Claim 35[b]: a housing for the support structure;

547. Mueller, or the combination of Mueller and Ivey, satisfies this limitation of Claim 35.

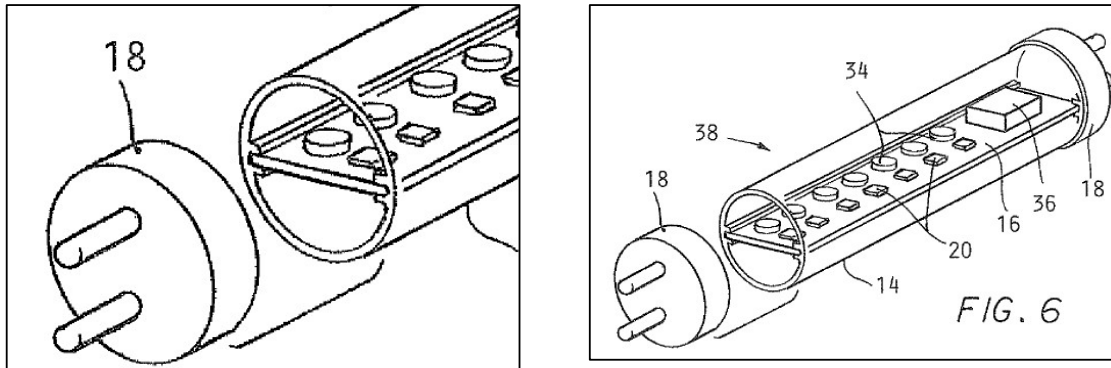
548. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.* at [0185].

549. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* It is well-known in the art that standard T12 and T8 fluorescent lights have a tubular housing structure that houses the lighting elements.

550. Ivey also discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art

Expanded View



Ex. 1008 at Fig. 6. (enlarged in left image)

Claim 35[c]: an array of LED emitting devices mounted on the support structure, wherein the array of LED emitting devices is configured to emit four different colors of light and comprises: a first set of LED emitting elements configured to emit light of a first color; a second set of LED emitting elements configured to emit light of a second color; a third set of LED emitting elements configured to emit light of a third color; and a fourth set of LED emitting elements configured to emit a broad-spectrum white light within a predetermined Kelvin temperature range; and

551. Mueller satisfies this limitation of Claim 35.

552. Mueller discloses a lighting unit 100, such as an LED lighting device, of a linear configuration that can include “a wide variety of colors of LED, in various mixtures, including red, green, and blue LEDs to produce a color mix, as well as one or more other LEDs to create varying colors and color temperatures of white light. For example, red, green and blue can be mixed with amber, white, UV, orange, IR or other colors of LED.” Ex. 1006 at [0194].

553. Mueller also teaches “a method of providing illumination, including providing a plurality of LEDs selected from the group consisting of red, green, blue, amber, white, orange and UV LEDs, controlling at least one of the color and

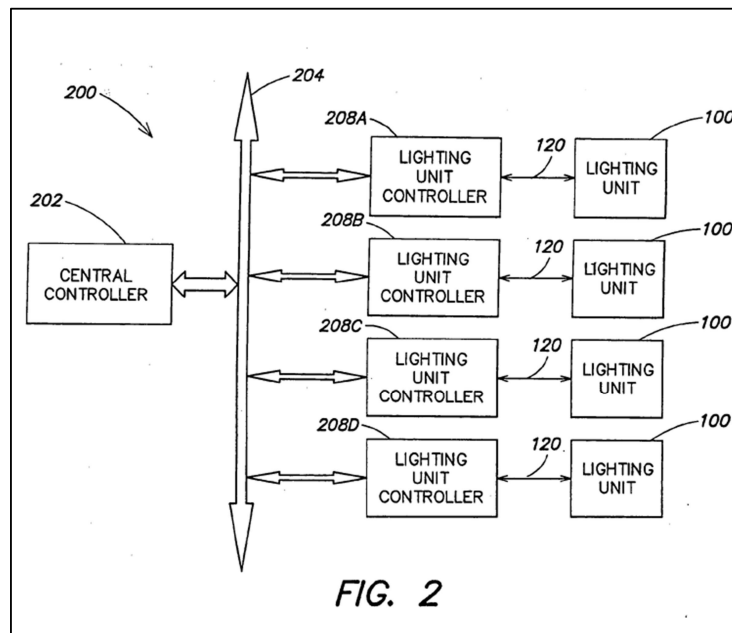
color temperature of light coming from the LEDs.” *Id.* at [0046]. In addition, Mueller discloses that the “LED lighting units 100 can be combined to provide a high-quality, broad spectrum LED-based light source.” *Id.* at [0308].

(xlvii) ***Claim 35[d]: a controller coupled to the array of LED emitting devices and configured to receive commands for operating select ones of the LED emitting devices with varying amounts of power to produce light consisting of varying amounts of the five different colors provided by the first, second, third, and fourth sets of LED emitting elements to produce many different colors outputted from the lighting device which are uniform in color, and an LED driver configured to selectively provide electrical power to the array of LED emitting devices***

554. Mueller, Ivey, and/or Ansems satisfy this limitation of Claim 35.

555. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of red, green, blue, amber, white, orange and UV LEDs, a controller for controlling the color of light coming from the LEDs, a sensor for sensing at least one of the color and the color temperature of the light coming from the LEDs and a feedback loop for adjusting the color of light coming from the LEDs based on input from the sensor.” Ex. 1006 at [0043]. The LED lighting units 100 “optionally may be associated with (e.g., include, be **coupled** to and/or packaged together with) various other components (e.g., control circuitry) relating to the operation of the light source(s).” *Id.* at [0064] (emphasis added).

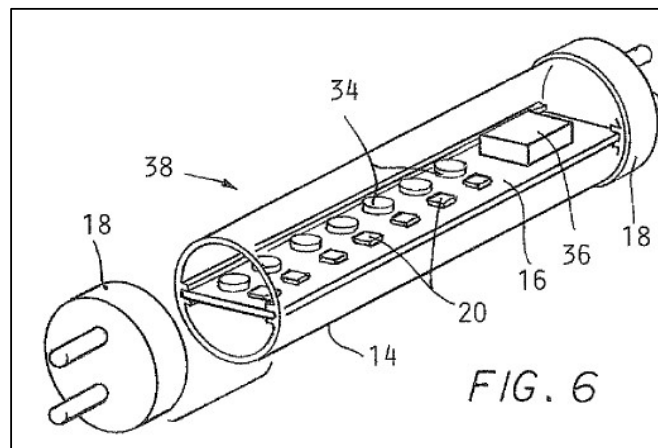
556. Figure 2 from Mueller illustrates a controller capable of controlling each lighting unit 100 and power the LEDs to vary the amount of power provided to each LED:



Id. at Fig. 2, [0190]–[0192], *see also* [0265]–[0269].

557. Ansems discloses an “array divided into three individual sets of LEDs,” “[t]he three sets are separately connected to a LED driver unit 6 which independently can control the voltage and/or current through the three separate sets through the individual connectors for blue 7 (to cathode) and 17 (to anode), green 8 (to cathode) and 18 (to anode) and red 9 (to cathode) and 19 (to anode).” Ex. 1007 at 4:4–24. Ivey teaches a controller that “can be configured to control an amount of power provided to each LED 20 using pulse width modulation.” Ex. 1008 at [0020]–[0021].

558. Mueller also discloses that the produced light can be “uniform and homogenous” to produce uniform color. Ex. 1006 at [0213]. In addition, Ivey discloses that the LED lights are evenly dispersed along the length of the lighting device. Ex. 1008 at [0020]. (“The LEDs 20 can be evenly spaced along the circuit board 16, and the spacing of the LEDs 20 can be determined based on, for example, the light distribution of each LED 20 and the number of LEDs 20.”). For example, in Figure 6, LED lights are evenly dispersed along the LED array on the support structure:



Id. at Fig. 6. The housing disclosed in Ivey has opposite ends (18) and a top side and bottom side, and the LEDs emit light out of the top side of the housing. *Id.* at Fig. 6, [0006], [0016]–[0018]. The housing in Ivey “can include an opaque lower portion and a lens or other transparent cover attached to the lower portion to cover the LEDs 20. The housing 14 can be manufactured to include light diffusing or refracting properties, such as by surface roughening or applying a diffusing film to

the housing 14.” *Id.* A POSITA would understand that the disclosed LED arrangement, in combination with the diffusion cover, would produce light that is uniform in color. Ex. 1001 at 18:32–37 (teaching that the “uniform appearance [of the emitted light] is due to the packing of the LEDs on a strip with a diffuser cover”).

(xlvi) ***Claim 35[e]: wherein the housing has a linear form factor substantially that of a fluorescent tube light of one of a T12 and T8 form, and further comprising an electrical input connection for receiving input power, wherein the input connection is in electrical communication with the LED driver, and***

559. Mueller and/or Ivey satisfy this limitation of Claim 35.

560. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

561. Further, Mueller teaches that the lighting units 100 can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” Ex. 1006 at [0295]. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” Ex. 1006 at [0295]. For example, the

lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* It is well known in the art that the form factor for standard T12 and T8 fluorescent lights is tubular and linear. Ex. 1010 at Fig. 2A, [0018], [0027].

562. Ivey teaches that, “for compatibility with the fixture 12 . . . the housing 14 can have a length such that the light 10 is approximately 48” long and the housing 14 can have a 0.625”, 1.0”, or 1.5” diameter.” Ex. 1008 at [0016].

563. Both Mueller and Ivey teach an electrical input connection that communicates with the LED array and the drivers. Ex. 1006 at [0064]; Ex. 1008 at [0006], [0016]–[0018].

(xlix) ***Claim 35[f]: wherein the housing has opposite ends and the support structure is in a form of an elongated and narrow surface extending in the axial direction and the housing having a top side and a bottom side which each extend in the axial direction, and***

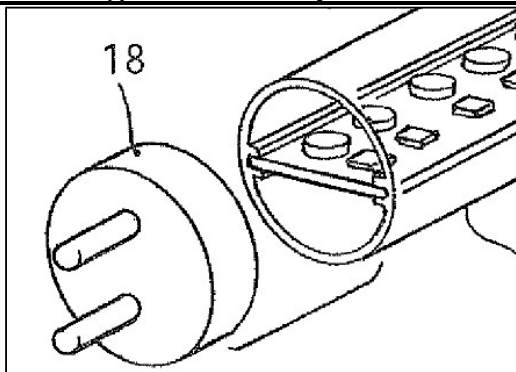
564. Mueller and/or Ivey satisfy this limitation of Claim 35.

565. Mueller teaches that the lighting unit 100 is not limited to any one specific structural configuration from the various embodiments in the invention. Ex. 1006 at [0185]. Rather, “a given lighting unit may have any one of a variety of mounting arrangements for the light source(s), enclosure/housing arrangements and shapes to partially or fully enclose the light sources, and/or electrical and mechanical connection configurations. *Id.*

566. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* at [0295]. For example, the lighting units 100 can be configured to resemble different types of T8 and T12 fluorescent tubes. *Id.* It is well known in the art that the form factor for standard T12 and T8 fluorescent lights is tubular and linear, with opposite ends and a narrow support structure. Ex. 1004 at Figs. 2, 51, 38:16–39:29, 77:10–50

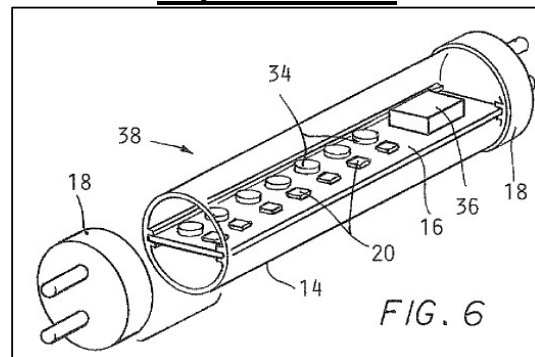
567. Ivey discloses a tubular housing having a support structure with LED lights mounted thereto. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

Housing and End Cap of Prior Art



Id. at Fig. 6. (enlarged in left image)

Expanded View



568. The housing illustrated above has opposite ends (18) and a top and bottom side. Ex. 1008 at Fig. 6, [0006], [0016]–[0018].

- (l) ***Claim 35[g]: wherein the LEDs are configured to emit light from the top side of the housing along a length of the housing between the opposite ends, and the top side of the housing has a diffusion cover extending the axial length of the support between the ends.***

569. Mueller and/or Ivey satisfy this limitation of Claim 35.

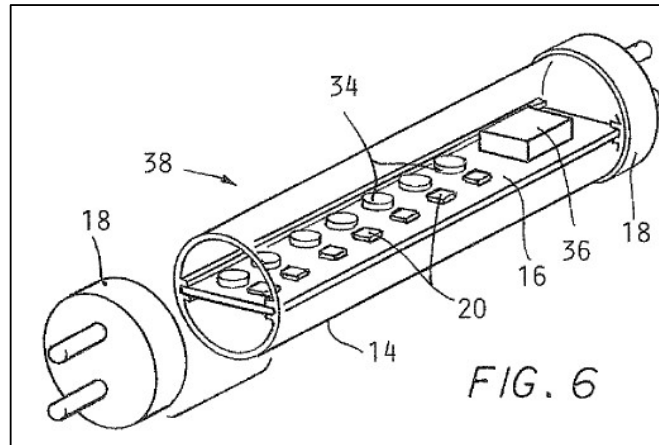
another example of a housing can be formed by attaching multiple individual parts, not all of which need to be light transmitting. For example, such a housing can include an opaque lower portion and a lens or other transparent cover attached to the lower portion to cover the LEDs 20. The housing 14 can be manufactured to include light diffusing or refracting properties, such as by surface roughening or applying a diffusing film to the housing 14.”

Id. at [0006], [0016]–[0018].

(li) ***Dependent Claim 36: The LED lighting device of claim 35, wherein the first, second, third and fourth sets of LED light emitting elements are evenly dispersed along the length of the lighting device.***

575. Mueller and Ivey disclose an LED lighting device with evenly-dispersed sets of LED lights along the length of the device; therefore, Mueller and Ivey satisfy Claim 36.

576. Mueller discloses that LED lights may be evenly dispersed along the length of the lighting device. Ex. 1005 at Fig. 3. Additionally, Figure 6 below illustrates the even dispersion of LED lights along the LED array of the support structure placed within the housing:



Ex. 1008 at Fig. 6.

- (lii) ***Dependent Claim 37: The LED lighting device of claim 35, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set and fourth set of LED emitting elements in increments of about 1/255 to selectively produce at least 255 different colors from the lighting device.***

577. Mueller discloses Claim 37.

578. Mueller discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

579. Mueller discloses that the LED lights can be controlled using a DMX signal that can incrementally control the color of RGBAW lights. Ex. 1006 at [0183]. The DMX signal in Mueller allows a user to fully control the RGBAW

array to achieve different color combinations, and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.* at [0158] (“[E]ach of the colors is driven with PWM to vary its apparent intensity. This system allows for the generation of millions of colors (e.g., 16.7 million colors when 8-bit control is used on each of the PWM channels).”), [0043] (disclosing RGBAW).

(liii) ***Dependent Claim 38: The LED lighting device of claim 37, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set, fourth set and fifth set of LED emitting elements in response to DMX signals from an external computer console or lighting control board to selectively produce the at least 255 different colors of an entertainment industry color wheel emitted from the lighting device.***

580. Mueller teaches Claim 38.

581. Mueller discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

582. Mueller discloses that the LED lights can be controlled using a DMX signal that can incrementally control the color of RGBAW lights. Ex. 1006 at

[0183], [0158]. The DMX signal in Mueller allows a user to fully control the RGBAW array to achieve different color combinations, and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.* at [0158] (“[E]ach of the colors is driven with PWM to vary its apparent intensity. This system allows for the generation of millions of colors (e.g., 16.7 million colors when 8-bit control is used on each of the PWM channels).”), [0043] (disclosing RGBAW).

(liv) Dependent Claim 39: The LED lighting device of claim 35, wherein the LED driver is adapted for selectively driving each of the first set, second set, third set and fourth set of LED emitting elements to selectively produce at least 255 different colors of a color wheel from the lighting device.

583. Mueller teaches Claim 39.

584. Mueller discloses that the LED driver is adapted to selectively drive the five sets of LEDs in increments of 1/255, which can produce more than 255 different colors. The '224 Patent describes that the claimed LED device uses a DMX signal with an RGBAW array (red, green, blue, amber, and white) to increment the color from zero (off) and 255 (full on). Ex. 1001 at 7:14–26. These increments correspond “to the different values of an 8 bit DMX signal.” *Id.* This disclosure is the standard use of a DMX signal to control RGBAW LEDs.

585. Mueller discloses that the LED lights can be controlled using a DMX signal that can incrementally control the color of RGBAW lights. Ex. 1006 at

[0183]. The DMX signal in Mueller allows a user to fully control the RGBAW array to achieve different color combinations, and a POSITA would understand that a DMX signal could increment the RGBAW LEDs from 0 (being off) through 255 and achieve more than 255 different colors. *Id.* at [0158] (“[E]ach of the colors is driven with PWM to vary its apparent intensity. This system allows for the generation of millions of colors (e.g., 16.7 million colors when 8-bit control is used on each of the PWM channels).”), [0043] (disclosing RGBAW).

(lv) *Dependent Claim 41: The LED lighting device of claim 35, wherein the fluorescent tube light has a substantially T12 form.*

586. Mueller teaches Claim 41.

587. Mueller teaches that LED lighting unit can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” Ex. 1006 at [0295].

588. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* For example, the lighting units 100 can be configured to resemble different types of T12 fluorescent tubes. *Id.*

(lvi) *Dependent Claim 42: The LED lighting device of claim 35, wherein the fluorescent tube light has a substantially T12 form and is about one to four feet long.*

589. Mueller, or the combination of Mueller and Ivey, teaches Claim 42.

590. Mueller teaches that LED lighting device can be “configured to resemble all conventional light bulb types, so that lighting units 100 can be conveniently retrofitted into fixtures and environments suitable for such environments.” Ex. 1006 at [0295].

591. The disclosed lighting units 100 may “be configured to resemble fluorescent lamps.” *Id.* For example, the lighting units 100 can be configured to resemble different types of T12 fluorescent tubes. *Id.* It is well known in the art that, by far, the most common length of standard T12 fluorescent tubes is approximately four feet. *See, e.g.*, Ex. 1001 at Examples 1–3.

592. Ivey teaches that, “for compatibility with the fixture 12 . . . the housing 14 can have a length such that the light 10 is approximately 48” long and the housing 14 can have a 0.625”, 1.0”, or 1.5” diameter.” Ex. 1008 at [0016].

(lvii) ***Dependent Claim 43: The LED lighting device of claim 35, wherein at least one of the colors of the LEDs is amber.***

593. Mueller discloses Claim 43.

594. Mueller teaches “a lighting system that includes a plurality of LEDs selected from the group consisting of red, green, blue, **amber**, white, orange and UV LEDs....” Ex. 1006 at [0043] (emphasis added), *see also* [0044]–[0051].

(lviii) ***Dependent Claim 44: The LED lighting device of claim 35, wherein among the colors the driver is configured to selectively produce are white light in each of daylight and tungsten temperature ranges.***

595. Mueller discloses Claim 44.

596. Mueller teaches that “red, green and blue can be mixed with amber, white, UV, orange, IR or other colors of LED. Amber and white LEDs can be mixed to offer varying colors and color temperatures of white.” Ex. 1006 at [0194].

597. Mueller also discloses that “[t]he color temperature of white light generally falls within a range of from approximately 700 degrees K (generally considered the first visible to the human eye) to over 10,000 degrees K.” *Id.* at [0062], *see also* [0063] (describing the difference color temperatures for white light). A POSITA would know that the color temperatures for tungsten white light and daylight white light fall within this 700 degrees K to 10,000 degrees K range.

(lix) *Dependent Claim 45: The LED lighting device of claim 35, wherein the first, second, third, and fourth LEDs are arranged substantially in a repeating matrix pattern along the length of the axial direction.*

598. Mueller in view of Ansems teaches Claim 45.

599. Ansems discloses LEDs that are arranged substantially in a repeating matrix pattern, and it would have been obvious to a POSITA to use such a repeating matrix pattern on Mueller’s LED device. Ansems Figure 1 discloses an LED array with RGBW lights:

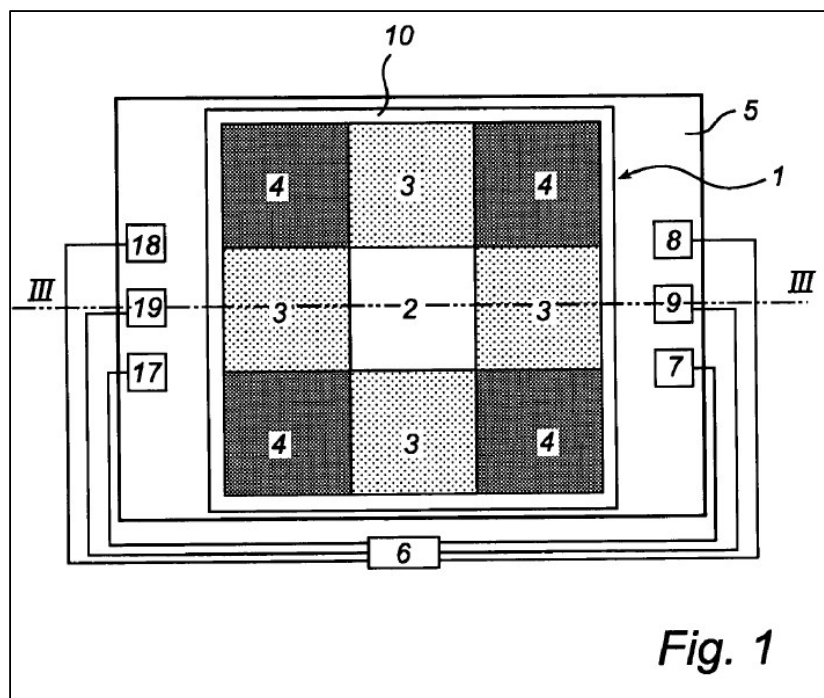


Fig. 1

Ex. 1007 at Fig. 1. Ansems teaches that the array may include more LEDs and can be in any geometry with any active elements. *Id.* at 5:2–16.

XI. CONCLUSION

600. As explained above, it is my opinion that the Challenged Claims would have been obvious to one of ordinary skill in the art at the time of the invention in light of the prior art.

601. I reserve the right to supplement my opinions in the future to respond to any arguments that Patent Owner raises and to take into account new information as it becomes available to me.

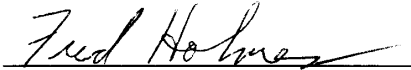
602. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are

believed to be true, and that these statements were made with 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.

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

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

Executed on February 16, 2023.


Fred Holmes

APPENDIX A

FRED HOLMES

431 Palm Island SE · Clearwater, FL 33767
fred@myloirelei.com · (818) 373-9535

PROFESSIONAL EXPERIENCE

GO2GREEN, LLC – Frisco, TX **Co-Founder**

2018-Present

Developed an evacuation system for active shooter and other emergency events.

A system consisting of indoor acoustic gunshot sensors and LED lighting to assist in the evacuation of people who can reach safety without encountering the shooter. Green lights provide a path to safety while red lights indicate the path to danger. First responders follow the red lights to find the shooter.

When used in a school, additional colors augment notification of students in conformance with a *standard response protocol* to direct appropriate responses to situations requiring students to *evacuate, lockdown, shelter, secure, or hold*.

Installed across the Pilot Point, TX Independent School District.

SPORTBEAMS LIGHTING, INC. – Plano, TX **Co-Founder**

2014-2017

Vice President Engineering / General Counsel

Developed a line of LED based sports/outdoor area lighting products.

Sportsbeams' flagship product is its 1500 Watt LED outdoor sports lighter. This fixture delivers 171,675 lumens and was the brightest LED fixture listed on the U.S. Department of Energy website: <http://www.lightingfacts.com/products> at the end of the DOE project. The product line also includes a 600 Watt LED fixture, an 800 Watt LED fixture and a control system providing on/off control, dimming and special effects. Every fixture is controllable through an Ethernet interface or through industry standard DMX-512. Sportsbeams fixtures provided field lighting for Superbowl LV.

LITEPANELS, INC. – Van Nuys, CA **Co-Founder**

2005-2013

Division IP Counsel

In-house Counsel/Software Design Engineer

Along with four lighting professionals, developed a line of LED based lighting products aimed at television and motion picture production.

In 2005 Litepanels, Inc. produced the only LED based lighting product built specifically for television and movie production. In 2008 negotiated an asset purchase agreement with the Vitec Group, plc, a UK publicly traded company. The acquisition resulted in an initial payment of \$14.5 million and potential additional earn-out of \$50 million over a 40-month period. Through continuous improvement in technology and a careful IP strategy, maintained a world-wide market share of approximately 85%.

Post-acquisition, appointed as IP counsel for the Videocom Division of the Vitec Group, responsible for intellectual property over multiple brands from multiple business units located world-wide.

Key Achievements:

- Negotiated key provisions of the asset purchase agreement.
- Developed system level design for the entire line of Litepanels products. Contributed to the hardware design and authored software for the entire line of products.
- Pressed sane IP strategy aimed at forcing license agreements with competitors to allow Litepanels to maintain profit margins:
 - In multiple actions, sued seven defendants for patent infringement in Federal Court.
 - Brought action in the International Trade Commission against fourteen domestic importers and foreign manufacturers of infringing products resulting in the entry of a General Exclusion Order. Worked with IPRB and CEE groups within US Customs and Border Protection to identify sources of excluded goods.
- Recipient of three Engineering and Technical Emmy Awards from the National Academy of Television Arts and Sciences for Excellence in Engineering (2005), Outstanding Achievement in Technical or Engineering Development (2009), and Pioneering LED lighting in the Television Industry (2021).
- Assisted contract manufacturers in technology improvements in LED circuit board production.

SHOTSPOTTER, INC. – Mountain View, CA

2004-2005

Co-founder

Director of Sensor Software Development

Patented a wireless gunshot detection sensor as part of a gunshot location system. Re-founded ShotSpotter, Inc., an existing gunshot location provider, to take advantage of the advancement in the state-of-the-art and to attract venture capital. Developed a gunshot location system aimed at municipal and military clients based on a rapidly deployable, self-surveying, acoustic sensor.

Key Achievements:

- Obtained a series of patents covering key aspects of time-stamping in an acoustic gunshot sensor, a feature which makes a wireless/digital sensor possible.
- Brought-up first wireless gunshot location system in North Charleston, SC in cooperation with the National Law Enforcement Technology Center.
- Provided the technology that made acoustic gunshot location a commercially viable enterprise. Today, ShotSpotter is a public traded entity (NASDAQ: SSTI) with a market cap of approximately \$ 440 million.

**FELLERS, SNIDER, BLANKENSHIP,
BAILEY, & TIPPENS, P.C – Tulsa, OK**

1999-2004

Associate Patent Attorney

Prosecuted patent applications on behalf of clients and assisted firm in representation of clients in patent litigation as well as other matters.

**BED-CHECK CORPORATION – Tulsa, OK
Director of Engineering/In-house Counsel**

1996-1998

Resolved stale issues with contract manufacturers, updated technology in the bed-patient monitor product line, obtained meaningful patent protection for updated systems, identified process changes for manufacturing the patient sensor with a potential to reduce the cost of the sensor by 85%. Implemented quality systems that reduced warranty repairs from nearly 30% to substantially less than 1% of electronic monitors produced.

**STAIRMASTER EXERCISE SYSTEMS – Tulsa, OK
Manager of Product Development
Senior Electronic Design Engineer
Independent Contractor**

1984-1993

Designed electronic systems and authored embedded software for the StairMaster 6000 ergometer, the StairMaster 4000 PT, the Gravitron assisted chin and dip machine, and the Gauntlet Stepmill. These products generated approximately \$175 million in revenue during my tenure, exceeding \$50 million dollars per year in revenue prior to my departure to focus on law school. Supervised the product development engineering staff, departmental secretaries, technicians and model shop personnel. Liaison with counsel for patent prosecution, product liability litigation, and patent litigation.

Key Achievements:

- Prior to my involvement, the company had a single product and only \$70,000 in total sales. Designed a line of products that led to the StairMaster brand becoming one of the leading trademarks in the fitness industry.
- Designed processor-based electronics to improve the workout experience for the user.
- Diplomat to sole distributor.
 - Managed continuity in technology, customer service, business systems, and operations during merger with distributor.
 - Attended tradeshow with distributor to transfer technical knowledge to sales staff and meet with customers.
 - In attendance at distributor's home office one week per month to maintain a "single entity" appearance to our customers.

FLIGHTSAFETY INTERNATIONAL – Tulsa, OK

1981-1986

Senior Electronic Design Engineer

Responsible for the design of various electronic systems for flight simulators. Specialties included environmental sound effects and processor-based solutions for special projects.

Key Achievements:

- Created first microprocessor-based sound effects system in the industry.
- Designed the electronics and authored software for the multi-function display for the OH-58D procedures trainer. System level design of the video chain from laser disk players, through a digital zoom, and through an overlay graphics board to the cockpit CRT display.
- Designed a programmable microprocessor-based sound effects system for the Bell Helicopter in-house engineering simulator for the XV-15 Tilt Rotor Aircraft.
- Designed a weather radar simulator for business class aircraft simulators allowing the use of unmodified cockpit displays.
- Developed an LCD long-life solution for simulating the engine tape instruments in the B-1 bomber simulator.

TEXAS INSTRUMENTS – Dallas, TX

1979-1981

Maintainability Engineer

Determined the testability of the HARM Missile (AGM-88A) and related peculiar ground support equipment. Participated in the design of peculiar ground support equipment for the missile and its associated avionics.

CONSULTANT

Electrical Engineering/Technology Management

Designed Electronic Systems for various products and provided strategic direction for various companies.

Key Achievements:

- Designed solid-state digital controls for the *Fisher Light*, a large soft box used primarily for filming car commercials. The small luminaire was 40 Kilowatts, the larger box was 96 Kilowatts.
- Designed a microprocessor-based HMI power supply for balloon-based area lighting for motion picture and television production.
- Designed drivers for custom LED lighting used on the HBO series *Family Bonds*.

- Designed drivers for custom LED lighting used on the clone centrifuge in the Michael Bay film *The Island*.
- Designed a battery cart inverter for long-arc xenon lightning effect fixtures, capable of delivering 120VAC at 1000 amps for short durations.

Named Inventors on the following U.S. patents:

10,738,990	10,738,967	10, 359, 159	10,317065
10,317,065	10,006,609	9,752,738	9,588,402
9,341,362	9,001,729	8,882,283	8,702,255
8,299,726	8,063,773	7,960,920	7,755,495
7,751,282	7,719,428	7,710,278	7,602,329
7,586,812	7,569,996	7,532,542	7,420,878
7,139,222	7,080,017	6,847,587	6,784,797
6,686,702	6,608,452	6,441,742	6,111,509
5,945,914	5,540,639	5,499,959	5,312,313
5,256,117			

EDUCATION

Juris Doctorate (JD) · University of Tulsa College of Law – Tulsa, OK

- Graduated December, 1995 in top 5% of class.
- *Order of the Curule Chair*
- Tulsa Law Journal

Bachelor of Science in Electrical Engineering · University of Oklahoma – Norman, OK

- Graduated May, 1979

PROFESSIONAL ASSOCIATIONS

Oklahoma Bar Association – OK Bar No. 16847

Registered to Practice Before the U.S. Patent and Trademark Office – Reg. No. 43677

APPENDIX B

LISTING OF MATERIALS CONSIDERED

Exhibit No.	Exhibit Description
1001	U.S. Patent No. 10,197,224 to Macias <i>et al.</i> (“the ’224 Patent”)
1002	File History of the U.S. Patent No. 10,197,224 (“the File History”)
1004	U.S. Patent No. 7,507,001 to Kit (“Kit”)
1005	U.S. Patent No. 7,350,936 to Ducharme <i>et al.</i> (“Ducharme”)
1006	U.S. Patent Publication 2005/0047134 to Mueller (“Mueller”)
1007	U.S. Patent No. 8,026,532 to Ansems (“Ansems”)
1008	U.S. Publication No. 2010/0102960 to Ivey <i>et al.</i> (“Ivey”)
1009	U.S. Patent No. 8,668,361 to Hasnain (“Hasnain”)
1010	U.S. Publication No. 2010/0102729 to Katzir <i>et al.</i> (“Katzir”)
1011	“When white light isn’t white” by Mike Wood, 2008
1012	U.S. Publication No. 2004/0052076 to Mueller <i>et al.</i> (“Mueller ’076”)
1013	International Publication No. 2005/012997 to Morgan <i>et al.</i> (“Morgan”)
1014	U.S. Publication No. 2010/0315001 to Domagala <i>et al.</i> (“Domagala”)
1015	U.S. Patent. No. 7,049,761 to Timmermans <i>et al.</i> (“Timmermans”)
1016	Astera LED-Technology User Manual Wireless Pixel Tube (AL1) v.3.2.20 (July 23, 2010)