

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ADVANCED LIGHTING CONCEPTS LLC,
Petitioner

v.

MATE LLC.,
Patent Owner

Case No. IPR 2023-01265

U.S. Patent No. 9,320,093

DECLARATION OF JOSEPH C. McALEXANDER IN SUPPORT OF
PETITIONER'S PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT
NO. 9,320,093 UNDER 35 U.S.C. §§311-319 AND 37 C.F.R. §42.100 ET SEQ.

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INTRODUCTION

1. My name is Joseph C. M^cAlexander III, President of M^cAlexander Sound, Inc., located at 101 W. Renner Rd., Suite 350, Richardson, TX 75082. I have been retained by Munsch Hardt Kopf and Harr, Counsel for Advanced Lighting Concepts LLC d/b/a Environmental Lights (“EL”) in connection with the above-captioned matter, to provide my analyses and conclusions in this *inter partes* review proceeding before the United States Patent and Trademark Office regarding U.S. Patent No. 9,320,093 (“the ‘093 Patent”).

2. I understand that mate., LLC is the Plaintiff and that EL is the Defendant in a patent infringement case filed in the United States District Court for the Southern District of California, Civil Action No. 3:22-cv-0195-CAB-DEB.

3. I submit this declaration based on my personal knowledge and experience, as well as the materials that I reviewed and considered in formulating my opinions.

QUALIFICATIONS AND EXPERIENCE

4. I am a technical expert in the subject matter areas relevant to the ‘446 Patent, including the design and testing of LED drivers and dimmers. I am qualified to reach the opinions and conclusions stated in this Declaration. I address my background and qualifications in Section I below and provide additional detail in my CV submitted with this report.

5. I am the Founder and President of M^cAlexander Sound, Inc., formerly IP Director of CCI and Vice President of EPI Technologies, Inc.

6. I am a Registered Professional Engineer (#79454) in the State of Texas and am also a senior lifetime member of the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and, in particular, have joined the Computer, Electron Devices, and Solid State Circuits societies of IEEE. I hold a Bachelor of Science degree in Electrical Engineering from North Carolina State University and completed 1.5 years of graduate level studies in Neurophysiology at the University of Texas Graduate School of Biomedical Science. I have been associated with the integrated circuit and electronics industry as a designer and consultant for the past 50 years and am a named inventor on 31 U.S. patents and a number of foreign patents, some of which are related to LED systems.

7. My skills and experience are in the areas of circuit design and analysis, device fabrication and assembly, testing, marketing, control system design and analysis, manufacturing operations, software development, management, and respective areas of quality, reliability, and defect/failure analysis. Specifically, I have:

- designed memories, including Dynamic Random Access Memories (DRAMs), Static Random Access Memories (SRAMs), Charge Coupled Devices (CCDs), Shift Registers (SRs), and functional circuits including I/O buffers for address and data, decoders, clocks, sense amplifiers, fault tolerant (incorporating both non-volatile EPROM and random access memory components), parallel-to-serial data paths for video applications,

level shifters, converters, pumps, and logic, as well as wireless communication systems and MEMs;

- managed operations including engineering, training, and quality assurance for device fabrication, assembly, test, analysis, and reliability assessment, as well as manufacturing control, each of which involved both volatile and non-volatile memory; testing, analysis, and control involved use of mechanical calibration and measuring equipment, including optical, scanning e-beam, IR, capacitive, and laser using phase contrast and Fast Fourier Transform (FFT) for High Aspect Ratio Inspection (HARI) applications;
- taught courses in solid-state device physics, integrated circuit design, integrated circuit fabrication, and statistical control; provided expert services, investigating both process and design technologies of various devices (microprocessor and controller, volatile and non-volatile memory, programmable logic, card, tag, module, mixed signal, custom, and other), systems (PC and peripheral, computer, control, laser measurement, switch, architecture, software, and other), and consumer products (medical, TV, telephone, VCR, facsimile, copier, lighting, game, and other); and designed and managed development, testing, and evaluation of memory devices and systems incorporating such devices, including simulation of operation. I have also had experience in programming, erasing, and wearout of electrically programmable and erasable non-volatile memories.

8. Of particular relevance is my experience as an integrated circuit designer, manager, and consultant. I spent nine years designing integrated circuit products at Texas Instruments, Inc., and an additional five years there managing wafer fabrication operations and assembly (packaging), test, and reliability analysis facilities. As such, I participated directly in the strategic design and process decisions required to bring competitive products to market and managed cost and revenue (both projected and actual) associated with those marketed products. I also worked directly with clients regarding product manufacturer-to-customer

integration, implementing direct-ship-to-customer productivity enhancements and establishing and executing product reliability and performance assessment studies. Often, such analyses suggested that certain modifications be made to design, fabrication, or assembly structures or methods, or to product flow and distribution. It was my responsibility to implement selected improvements to achieve the designated goals without negatively impacting the revenue models and time-to-market projections while maintaining and improving product yield and reliability.

9. As a designer and design manager, for example, I developed new, leading edge technology designs from conception to production. As such, my designs were always created in parallel with innovations in design simulation, in wafer processing, and in packaging architecture. I had to develop simulation behavioral models, tested against actual prototype designs, to determine the most appropriate fit between design, process, and assembly to deliver the best product to the market. In each case, my product prototype and production designs worked the first time; and the memory products were widely accepted in the market by major OEM companies.

10. I also worked with consumers evaluating performance of my designs in system applications to better match those designs to the consumers' requirements. New outgoing test methods and algorithm test patterns were designed to improve overall performance and reliability and to provide feedback for design and process

improvements. I thus developed a comprehensive understanding of the key factors, such as design, process, assembly, cost, equipment, facility, personnel resources, and timing necessary to bring a product from conception to market. These factors have continued to be key contributors to the success of products throughout the history of integrated circuits, even to the present.

11. Additionally, I have evaluated and provided expert services related to memory technology, both as standalone components and as components integrated into memory modules and systems, and also process and design technologies of various devices including microprocessors, controllers, memory, and programmable logic. I have also provided expert services related to product procurement and contract purchase order fulfillment according to contract agreement deliverables. I am also knowledgeable of communication control, addressing, and data transfer protocol as it relates to system architecture.

12. Additionally, I have innovations in the areas of LED technology, as embodied in a number of my patents, including LED drivers.

13. Because of my background, education, training, and experience, I am qualified as an expert to opine on the technology and other, related technical factors. A more detailed account of my work experience and other qualifications is listed in my Curriculum Vitae. Exhibit 1003.

I. METHODOLOGY AND MATERIALS CONSIDERED

14. My opinions expressed herein are based on my review of the U.S. Patent Nos. 8,525,446 (“the ‘446 Patent”), 8,957,601 (“the ‘601 Patent”), 9,049,759 (“the ‘759 Patent”), 9,078,310 (“the ‘310 Patent”), 9,320,093 (“the ‘093 Patent”) and 9,591,713 (“the ‘713 Patent”) (collectively, the “Challenged Patents”), their respective prosecution histories (including several patents listed within those prosecution histories), extrinsic evidence relating to the technology of the Challenged Patents, and other evidence cited in this declaration.

15. I further understand that this application is a national stage filing under 35 U.S.C. 371 of International Patent Application PCT/CA2009/001295, filed on Sep. 17, 2009, which claims the benefit of priority of U.S. Provisional Application No. 61/097,963, filed Sep. 18, 2008 and that the Patents all but the ‘713 Patent share the same specification. My opinions are also based on my technical experience, knowledge, and expertise in the area of LED drivers and dimmers.

16. More specifically, for this work, I have been asked to review the ‘093 Patent including the specification and claims, the ‘093 Patent’s prosecution history (file history). In developing my opinions related to the ‘093 Patent, I have considered the materials cited herein, including those items itemized in the Exhibit Table below.

<u>EXHIBIT</u>	<u>DESCRIPTION</u>
Ex. 1001	U.S. Patent No. 9,320,093
Ex. 1004	File Wrapper for U.S. Patent No. 9,320,093
Ex. 1005	U.S. Patent No. 7,490,957 to Leong
Ex. 1006	U.S. Patent No. US2015097484 to Lee

17. This declaration contains my opinions with respect to the subject matter of this proceeding and with the understandings as set forth herein. I specifically reserve the right to formulate and offer additional or supplemental opinions based on any additional information, depositions, discovery, or evidence that may be provided or derived, future court rulings, or agreements between the parties, to the extent permitted by the Board.

II. OVERVIEW OF LEGAL STANDARDS

18. I do not have any formal legal training, and I am not an attorney. EL's counsel has informed me of certain legal principles that I applied in my analysis. Those legal principles are summarized below.

19. I understand that patent claims are presumed valid and cannot be invalidated unless there is a showing the preponderance of the evidence demonstrates that the claim is invalid.

20. The following section summarizes the law as I have been instructed to apply it in formulating and rendering my opinions found later in this declaration. I understand that, in an *inter partes* review proceeding, patent claims may be deemed

unpatentable if it is shown that they were anticipated or rendered obvious in view of the prior art. I understand that prior art in an *inter partes* review is limited to patents or printed publications that predate the priority date of the patent at issue.

A. Person of Ordinary Skill in the Art

21. I was asked to provide my opinion as a person of skill in the art as it relates to the '093 Patent during the period leading up to the earliest claimed priority date. I considered several factors, including the types of problems encountered in the art, the solutions to those problems, the pace of innovation in the field, the sophistication of the technology, and the education level of active workers in the field. I provide that level below in Section V.

B. Anticipation

22. I understand that when determining whether a claim is anticipated is based on underlying factual issues including the content of the prior art and the level of ordinary skill in the art. I further understand that for a single reference to anticipate a claim, “the four corners of [that] document describes every element of the claimed invention, either expressly or inherently, such that a person of ordinary skill in the art could practice the invention without undue experimentation.” *In re Hodges*, 882 F.3d 1107, 1111 (Fed. Cir. 2018) (citing *Spancion, Inc. v. Int’l Trade Comm’n*, 629 F.3d 1331, 1356 (Fed. Cir. 2010)).

23. Invalidity for anticipation requires that “[t]he identical invention must be shown in as complete detail as contained in the patent claim.” *TF3 Ltd v. Tre Milano, LLC*, 894 F.3d 1366, 1374 (Fed. Cir. 2018).

C. Obviousness

24. I understand that, when determining whether a claim is “obvious,” the analysis is based on underlying factual issues including the content of the prior art and the level of ordinary skill in the art. I further understand that for a single reference or a combination of references to render the claimed invention obvious, a POSITA must have been able to arrive at the claims by modifying or combining the references.

25. I have further been informed and understand that a claim is unpatentable as obvious if the difference between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA.

26. I also have been informed and understand that the combination of familiar elements according to known methods is obvious when it does no more than yield predictable results. However, I further understand that a patent claim composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. I understand that to prove a claim would have been obvious, one must demonstrate that, a POSITA would have

been motivated to combine or modify the prior art to achieve the claimed invention, while having a reasonable expectation of success in doing so.

27. I further understand that a claim may be obvious if common sense directs one to combine multiple prior art references or add missing features to reproduce the alleged invention recited in the claims. I also understand that if a POSITA could implement a predictable variation, then the claim is likely unpatentable. For the same reason, if a technique has been used to improve one device and a POSITA would recognize that it would improve similar devices in the same way, then using the technique is obvious. I further understand that a claim can be obvious if it combines old elements with no change to their respective functions, or alters prior art by merely substituting one element for another known in the field to yield a predictable result.

D. Claim Construction

28. I have been advised that “in an *inter partes* review proceeding, a claim of a patent ... shall be construed using the same claim construction standard that would be used to construe the claim in a civil action ..., including construing the claim in accordance with the ordinary and customary meaning of such claim as is understood by” a person of ordinary skill in the art (“POSITA”). 37 C.F.R. § 42.100(b). Each claim term challenged by this Petition should be construed in

accordance with its ordinary and customary meaning for the purposes of resolving the issues raised in this Petition.

29. I have followed these principles in my analysis throughout this declaration.

III. LEVEL OF ORDINARY SKILL IN THE ART

30. In determining the characteristics of a person of ordinary skill in the art at the time of the claimed invention, several things should be considered, including the factors discussed below, as well as (1) the levels of education and experience of the inventor and other persons actively working in the relevant field; (2) the types of problems encountered in the field; (3) prior art solutions to these problems; (4) the rapidity in which innovations are made; and (5) the sophistication of the relevant technology.

31. All of the opinions that I provide herein are provided through the lens of a person having ordinary skill at the relevant time (prior to 2006, which I understand is the priority date claimed by the '093 Patent). In my opinion, a person having ordinary skill in the art ("POSITA") at the time of the alleged invention would have had at least a bachelor's degree in electrical engineering, computer science, or a related field and significant experience with power regulation devices, like LED drivers and dimmers.

32. I am prepared to testify as an expert in this field and also as someone who had at least the knowledge of a POSITA, and someone who worked with other POSITAs at the time of the alleged invention.

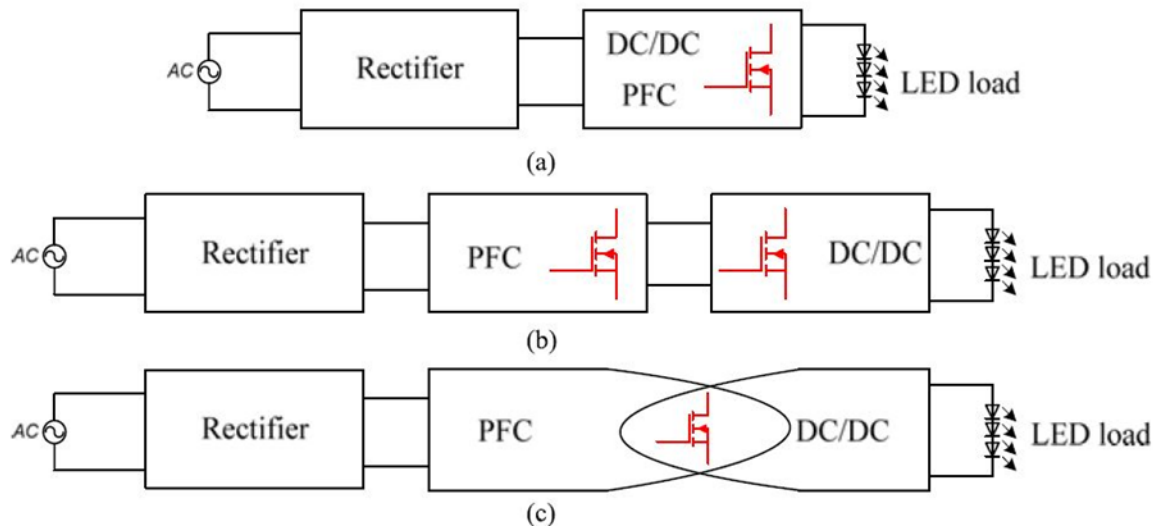
IV. TECHNICAL BACKGROUND AND THE '093 PATENT

A. Background of the Relevant Technology

33. The Challenged Patents relate to LED drivers. “LED drivers are devices that regulate and supply the power used to ‘drive’ runs of LED strip lights. Similar to traditional transformers, they convert mains voltage (240v AC) into a lower value (usually 12 or 24v).” *What Is an LED Driver & Which Driver Do I Need?*, Ultra LEDs, <https://www.ultraleds.co.uk/what-is-led-driver-what-driver-do-i-need> (last visited July 29, 2023).

34. “Generally speaking, the driver circuit plays a significant role in dominating the energy efficiency, which means the system efficiency can be further improved via an appropriate driver circuit. Traditional LED systems are based on single-stage or two-stage LED drivers.” Yijie Wang, et al., *A Review of LED Drivers and Related Technologies*, 64 IEEE TRANSACTIONS ON INDUS. ELECTRONICS 5754, 5754 (July 2017) (Ex. 1011).

35. A single-stage LED driver is a DC/DC converter with constant output current that can obtain power factor (PF) correction (PFC), while a two-stage system consists of a PFC circuit and a DC/DC converter as shown below. *Id.*



Id. at 5756 fig. 3.

36. “[D]ue to the unique characteristics of LEDs, a current loop is always included in the [DC/DC stage] in order to acquire constant current control. Moreover, in practical applications when several strings of LEDs are adopted, a current balance stage may also be required. The advantage of the above two LED drivers is that they are easy to design with more accurate control. However, one of the drawbacks of single stage converters is the high value of the storage capacitor, which also increases the volume of the driver. As for the two-stage system, more devices are needed, which means the cost is quite high and reliability is relatively low.” *Id.* at 5754-55.

37. “In recent years, many integrated-stage topologies are designed for the sake of efficiency and cost.” *Id.* at 5755. “In order to obtain high PF and low total harmonic distortion (THD), a topology which performs PFC characteristics as PFC

stage is usually chosen, and a [DC/DC] stage is selected according to the power level of the system.” *Id.* Due to the integration technology, the PFC stage and DC/DC stage can be simplified into one stage by sharing active power switches and control circuit. Therefore, cost and size of the system is reduced while ensuring high efficiency, high reliability, and fast output dynamics. *Id.*

B. Overview of the ‘093 Patent

38. The ‘093 Patent describes a configurable light emitting diode (LED) driver/dimmer for controlling a set of light fixture loads. Ex. 1001, Abstract. The ‘093 Patent purports to address the considerable challenges faced by lighting companies in adopting SSL technology due to their unfamiliarity and lack of expertise in the driving and dimming requirements for LEDs. Ex. 1001, 1:38-41.

39. The ‘093 Patent further notes: “[w]ith the rapid increase in [LED] efficacies for high powered LEDs, the latest technologies have exceeded incandescent and halogen sources and are now starting to compete with fluorescent, mercury vapour, metal halide, and sodium lighting. In addition to better energy usage, LEDs also have considerable advantages over traditional light sources such as long life, better durability, and improved color generating abilities.” Ex. 1001, 1:20-27.

40. “In recent years, controllable power sources for Solid State Lighting (SSL) applications have entered the market with integrated features. In addition,

digital controllers within power sources have enabled the development of configurable options to provide a wider flexibility of solutions for [SSL] applications.” Ex. 1001, 1:31-36. Finally, the ‘093 Patent states “[t]he ability to dim the light output of LEDs is also important to reduce energy consumption.” Ex. 1001, 1:36-37.

C. The Alleged Invention

41. The claims of the ‘093 Patent are generally directed to a configurable LED driver for configuring and powering light fixture loads for a LED low voltage distribution system. The LED driver of the ‘093 Patent includes converting power being supplied for powering the set of light fixture loads and then limiting this converted power to a set of multiple current outputs supplied to the light fixture loads. The multiple current outputs are then split or regrouped prior to being delivered to the light fixture loads. Ex. 1001, Abstract.

D. Summary of Prosecution History

42. The application that issued as the ‘093 Patent (US14/590,045) was filed on January 6, 2015, and is a continuation of U.S. Patent Application No. 13/466,509, filed May 8, 2012, which is itself a continuation-in-part of U.S. Patent Application No. 13/059,336, now U.S. Patent No. 8,525,446, filed February 16, 2011, which is a national stage filing under 35 U.S.C. § 371 of International Patent Application PCT/CA2009/001295, filed on September 17, 2009, which claims the benefit of

priority of U.S. Provisional Application No. 61/097,963, filed September 18, 2008, all of which are incorporated herein by reference. Ex. 1001, Cover page.

43. In a first Office Action, several claims were rejected on the ground of nonstatutory double patenting as being unpatentable over claim 15 of the '601 Patent. Additionally, several claims were rejected as anticipated by U.S. Patent No. 7,233,115 ("Lys"). To overcome the double patenting rejection, the Applicant combined original claims 1, 4, 13, and 14 to recite a new claim directed to a method for configuring and powering a set of light fixture loads focused on translating a data stream to LED control information and using the control information to control power. Ex. 1001, 15:38-46.

44. A Notice of Allowance was mailed on January 21, 2016, allowing pending claims 2, 5-12, and 15-25. Ex. 1004, p. 34. In the Notice, the Examiner noted that the prior art did not disclose the claim element of "wherein the LED control information is used for controlling the limited power." Ex. 1004 at 36.

45. For the reasons discussed below, each of the purportedly inventive elements of the claimed LED driver were known in the prior art at least since 2006.

E. Overview of the Prior Art

46. The challenged claims are anticipated by or are obvious over the following prior art.

47. U.S. Patent No. 7,490,957 (“Leong”) was filed on August 5, 2005, and is a continuation-in-part of application No. 10/822,579, filed on Apr. 12, 2004, now Pat. No. 6,853,151, which is a continuation of patent application Ser. No. 11/052,328 filed on Feb. 7, 2005, now U.S. Pat. No. 7,067,992 entitled “Power Controls for Tube Mounted LEDs with Ballast,” which is a continuation-in-part of Ser. No. 10/822,579 filed Apr. 12, 2004, now U.S. Pat. No. 6,853,151, entitled “LED Retrofit Lamp” and issued Feb. 8, 2005, which is a continuation-in-part of Ser. No. 10/299,870 filed Nov. 19, 2002, now U.S. Pat. No. 6,762,562, entitled “Tubular Housing with Light Emitting Diodes” which issued Jul. 13, 2004.

48. Leong teaches: “[A] power saving device for a light emitting diode (LED) lamp mounted to an existing fixture for a fluorescent lamp having a ballast assembly and LEDs positioned within a tube and electrical power delivered from the ballast assembly to the LEDs. The LED lamp includes means for controlling the delivery of the electrical power from the ballast assembly to the LEDs wherein the use of electrical power can be reduced or eliminated automatically during periods of non-use. Such means for controlling can include an on-off switch mounted in the tube or can also include a current driver dimmer mounted in the tube that regulates the amount of power delivered to the LEDs.” Ex. 1005, 9:39-51.

49. U.S. Patent Application No. 20150097484A1 (“Lee”) was filed on October 6, 2014, and was published on April 9, 2015. Lee is directed to: [A]

dimmable alternating current (AC) driven light emitting diode (LED) illuminating apparatus, and more particularly, to an AC driven light emitting diode (LED) illuminating apparatus capable of displaying an appropriate dimming level over an entire section of the dimming level using a TRIAC dimmer configured to perform dimming control via phase control. Ex. 1006, 1[0003].

V. SUMMARY OF MY OPINIONS

50. Having reviewed the '093 Patent and the prior art discussed herein, I have formed the following opinions:

- U.S. Patent Application No. 20050162101A1 to Leong ("Leong") discloses all limitations of claims 1-2, 9-13, and 19-20, and these claims are anticipated by Leong.
- The combination of Leong and U.S. Patent Application No. 20150097484 Lee to ("Lee") discloses all limitations of claims 2, 3, 5, and 7, and these claims are rendered obvious by this combination.
- In support, I have attached a chart to this declaration establishing the prior art teaches the limitations of each claim. Ex. A.

A. Opinions

1. Ground 1: Leong Anticipates Claims 1-2, 9-13, and 19-20

51. Independent claims 1 and 11 and dependent claims 2-3, 9-10, 12-13, and 19-20 of the '093 Patent are anticipated by Leong under 35 U.S.C. § 102.

a. Claim 1

52. LED drivers, or LED power supplies, provide LED light bulbs with the electricity they require to function and perform at their best, much like a ballast does

for a fluorescent lamp and a transformer does for low-voltage bulbs. *Why do my LED Drivers Need Bulbs?*, 1000BULBS.COM <https://www.1000bulbs.com/fil/categories> https://www.1000bulbs.com/fil/categories/leddrivers?gclid=EAIaIQobChMIp96h-tS9gAMV0TbUAR1CXgptEAAYASAAEgLqNfD_BwE (last visited August 2, 2023).

53. Leong discloses LED lamps that contain a means for controlling the delivery of electrical power from the ballast assembly to the LEDs. Ex. 1005, 18:3-13. A POSITA would understand that Leong's disclosure of the electrical power delivery means is equivalent to the method of configuring (*i.e.*, controlling) and powering (*i.e.*, delivery of electrical power) a set of light fixture loads in a light emitting diode (LED).

54. The rectifier circuit is used to convert the AC (Alternating Current) into DC (Direct Current). Rectifiers are mainly classified into three types: half-wave, full-wave, and bridge rectifier. The main function of all these rectifiers is the same as the conversion of current, but efficiently convert the current from AC to DC in various degrees of efficiency. The center tapped full wave rectifier, as well as the bridge rectifier, convert more efficiently. A bridge rectifier circuit is a common part of electronic power supplies. Many electronic circuits require a rectified DC power supply for powering the various electronic basic components from available AC mains supply. This rectifier can be found in a wide variety of electronic AC power

devices like home appliances, motor controllers, modulation processes, welding applications, etc. *What is a Bridge Rectifier: Circuit Diagram & Its Working*, ELPROCUS, <https://www.elprocus.com/bridge-rectifier-circuit-theory-with-working-operation> (last visited August 2, 2023). A POSITA would readily understand that using a bridge rectifier to perform an AC to DC voltage conversion is analogous to the power conversion step of the '093 Patent. Therefore, Leong discloses the step of converting power for powering the set of light fixture loads.

55. Voltage surge absorbers are devices or circuit components designed to protect electrical equipment from over-voltage transients caused by external (lightning) or internal (switching) events. Put another way, a surge absorber is a protective device that absorbs the high voltage surges and reduces the steepness of the surge wavefronts. The traveling waves set up by the surges on the transmission lines caused due to lightning and electrostatic induction possess an amplitude of 10 to 15kV, which has the ability to damage the equipment connected to that line. *What is Surge Absorber or Lighting Absorber?*, ELECTRICAL DECK (Nov. 12, 2021), <https://www.electricaldeck.com/2021/11/what-is-surge-absorber-types-of-surge-absorbers.html> (last visited August 2, 2023). A POSITA would readily understand that using the voltage surge absorbers to limit the voltage to a “workable voltage” is equivalent to limiting converted power.

56. LED drivers, or LED power supplies, provide LED light bulbs with the electricity they require to function and perform at their best, much like a ballast does for a fluorescent lamp and a transformer does for low-voltage bulbs. *Why do my LED Drivers Need Bulbs?*, 1000BULBS.COM <https://www.1000bulbs.com/fil/categories> https://www.1000bulbs.com/fil/categories/leddrivers?gclid=EAIaIQobChMIp96h-tS9gAMV0TbUAR1CXgptEAAYASAAEgLqNfD_BwE (last visited August 2, 2023).

57. A POSITA would understand that the ballast assembly described in Leong functions as an LED driver which is configurable and can provide power to the LEDs. Fluorescents use ballasts, while LEDs use drivers (LED drivers can be considered ballasts as well, but most documentation prefers ‘drivers’ or ‘power supply’ to avoid confusion with fluorescent ballasts).

58. Both ballasts and drivers do more than simply charge up their respective lights. They are an essential element to triggering and controlling light fixtures, from the first flip of a switch through tens of thousands of hours of performance. Dan Stout, *What Ignites Your Lights? Ballasts v. Drivers*, NEEDHAM ELECTRIC SUPPLY (Sept. 11, 2020) <https://www.needhamelectric.com/index.jsp?path=blog&cat=Articles&ID=1599855056315#:~:text=Fluorescents%20use%20ballasts%2C%20while%20LEDs,charge%20up%20their%20respective%20lights.> A POSITA would further understand that the LED ballast circuit is analogous to the

apparatus for configuring and powering a set of light fixture loads because the LED ballast circuit determines the input voltage needed to power the LED based on the number of LEDs to be powered. The LED ballast circuit then powers the LEDs based on the calculated input voltage.

59. A POSITA would further understand that using the ballast assembly, in the manner described in Leong to supply current to individual LED strings before providing power to the individual LEDs, is equivalent to splitting or regrouping the multiple current outputs necessary to power the LEDs because drive current is first sent to the LED string and then provided to the individual LEDs. Therefore, Leong discloses the step of splitting or regrouping the multiple current outputs prior to delivery of the multiple current outputs to the set of light fixture loads.

60. A control signal is a pulse or frequency of electricity or light that represents a control command as it travels over a network, a computer channel, or wireless. In the data communications world, control signals typically travel the same path as the data either as separate packets or contained within the data packets. *Control Signal*, PCMAG, <https://www.pcmag.com/encyclopedia/term/control-signal> (last visited August 2, 2023). Further, communication protocols assist varied network devices to converse with each other by transmitting the analog signals, digital signals, different files & process the data from one device to other devices. *What are Communication Protocols & Their Working*, ELPROCUS,

<https://www.elprocus.com/communication-protocols/> (last visited August 2, 2023).

61. A POSITA would understand that receiving a wireless data control signal using WiFi/802.11 or Bluetooth technology or receiving a data control signal from a direct hard-wire connection including DMX512, RS232, Ethernet, DALI, Lonworks, RDM, TCPIP, or CEBus Standard EIA-600, X10 is equivalent to receiving a protocol because a POSITA would know that the protocol (in the form of the set of signals) could be transmitted in data packets (*i.e.*, a data stream) and received by any of the communication protocols outlined above. Moreover, a POSITA would understand that the data control signal must be from an external source in order to be received wirelessly or from a direct hard-wire connection.

62. A POSITA would understand that the data signals would need to be converted upon receipt from the external transmitter into a form usable by the LED controller/dimmer. A POSITA would further understand that comparison of the sensor data signals received in accordance with a computer monitoring program and transmitting computer signals to dimmers is analogous to converting into a data stream.

63. Here, as discussed above, a POSITA would understand that the data signals would need to be converted into a form usable by the dimmer. A POSITA would further understand that using the dimmer to decode the data control signals sent by computer 894 and to provide the proper current drive power required to

operate LED array 884 is analogous to converting data streams to LED control information.

64. A POSITA would understand from Leong's disclosure of using a computer program to control the current output of dimmers 1102A and 1102B in order to prevent flickering of LED lamps 1086A and 1086B is equivalent to using the LED control information to limit power. As such, Leong discloses that the LED control information is used for limiting the power.

65. With respect to claim 9, Leong discloses: receiving an alternating current (AC) power; converting the AC power to a low voltage direct current (DC) power; and converting the low voltage DC power to the multiple current outputs. Specifically, Leong discloses that "[i]nputs are provided from a voltage sense input digitized by A/D convertor 244; a current sensor 451C input digitized by A/D convertor 453A; and a phase/polarity detector 242 comprising the detector previously described or, for example, an opto-isolator series-connected between the AC line and neutral via a diode. When applied to controlled transition dimming, outputs are provided to the device gate control means 220P and 220N controlling power devices 519P and 519N, either directly or via additional hardware logic." Ex. 1005, 26:10-22. A POSITA would understand from the disclosure in Leong that AC power is received from the current sensor input which is then converted to DC power by A/D converter 435. A POSITA would further understand that the converted DC

power is then provided to the gates (multiple current outputs) of 220P and 220N which will power devices 519P and 519N.

66. A photocell or photoresistor is a sensor that changes its resistance when light shines on it. The resistance generated varies depending on the light striking the surface. Venkatanarayanan, A., E. Spain, in *Comprehensive Materials Processing*, 201. Photocells have myriad uses, especially as switches and sensors including in automatic lights, streetlights, and timers that measure the speeds of runners during a race.

67. With respect to claim 13, a POSITA would understand that Leong's disclosure of using a photocell when luminance on the photocell drops below a certain value to manipulate the brightness of the LEDs is equivalent to limiting power to a calibrated value when an event failure occurs. The event failure is equivalent to the photocell not receiving enough luminance. Therefore, Leong discloses limiting power to a calibrated value when an event failure occurs.

68. With respect to claim 20, a POSITA would understand that Leong's discussion of using the dimmers 898 (which contain the necessary electronics needed to decode the data control signals) to control the multiple LED arrays is analogous to adjusting at least one of the multiple current outputs and providing the adjusted output current to at least one LED in the LED array. Therefore, Leong discloses adjusting at least one of the multiple current outputs in accordance with

the protocol and delivering the adjusted at least one current output to an associated light fixture load.

69. Further, a POSITA would understand that the disclosure of dimmers containing the necessary electronics needed to decode the data control signals sent by the computer described above are digital devices because they each process data as a sequence of discrete values.

2. Ground 2: Leong in View of Lee Renders Claims 5-7 and 15-17 Obvious

70. Claims 5-7 and 15-17 of the '093 Patent are rendered obvious under 35 U.S.C. § 103 by Leong in view of Lee.

71. With respect to claim 5, a POSITA would understand that the voltage input terminal VP and dimming level signal input terminal Adim are a set of input channels. The Leong-Lee combination thus discloses the step of receiving power via a set of input channels and renders claim 5 obvious.

72. With respect to Claim 6, a POSITA would understand that the current paths connected between the cathode and anode terminals of the LED group is analogous to delivering power to the set of light fixture loads via a set of output channels. The Leong-Lee combination thus discloses the step of further comprising delivering power to the set of light fixture loads via a set of output channels and renders claim 6 obvious.

73. With respect to claim 7, a POSITA would understand that the multiple inputs and outputs described above are analogous to splitting the set of input channels into the set of output channels. The Leong-Lee combination thus discloses the step of splitting the set of input channels into the set of output channels and renders claim 7 obvious.

74. With respect to claim 15, a POSITA would understand that the voltage input terminal VP and dimming level signal input terminal Adim are a set of input channels. The Leong-Lee combination thus discloses the step of receiving power via a set of input channels and renders claim 15 obvious.

75. With respect to claim 16, POSITA would understand that the current paths connected between the cathode and anode terminals of the LED group and further connected to internal power generating unit 230 is analogous to delivering power to the set of light fixture loads via a set of output channels. The Leong-Lee combination thus discloses the step of further comprising delivering power to the set of light fixture loads via a set of output channels and renders claim 16 obvious.

76. With respect to Claim 17, a POSITA would understand that the multiple inputs and outputs described above are analogous to splitting the set of input channels into the set of output channels. The Leong-Lee combination thus discloses the step of splitting the set of input channels into the set of output channels and renders claim 17 obvious.

VI. MOTIVATION TO COMBINE LEONG AND LEE

77. A POSITA would have been motivated to combine Leong and Lee for several reasons.

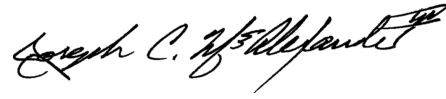
78. First, Leong and Lee are analogous art to the ‘093 Patent because they are in the same field of endeavor—namely, LED Drivers. The ‘093 Patent defines its “Technical Field” as a “novel LED Driver/dimmer for solid state lighting applications.” Ex. 1001, 1:40-41. Like the ‘093 Patent, Leong and Lee are directed to powering and controlling solid state lighting applications. For example, Leong discloses a “power saving device for a light emitting diode (LED) lamp mounted to an existing fixture for a fluorescent lamp having a ballast assembly and LEDs positioned within a tube and electrical power delivered from the ballast assembly to the LEDs.” Ex. 1005, Abstract. Similarly Lee discloses that its “Field” is “a dimmable alternating current (AC) driven light emitting diode (LED) illuminating apparatus, and more particularly, to an AC driven light emitting diode (LED) illuminating apparatus capable of displaying an appropriate dimming level over an entire section of the dimming level using a TRIAC dimmer configured to perform dimming control via phase control.” Ex. 1005, Abstract.

79. Moreover, Leong and Lee are analogous to the ‘093 Patent because they are pertinent to the technical problem allegedly addressed by the claimed invention. *For* example, the ‘093 Patent discloses that a novel LED driver/dimmer for solid

state lighting application is needed. Ex. 1001, 1:42-43. Similarly, Leong discloses that “Light emitting diode (LED) lamps and organic light emitting diode (OLED) lamps that retrofit fluorescent lighting fixtures using existing ballasts, or other power supplies can help to relieve some of the above power and environmental problems.” Ex. 1006, 2:0028. Further, Lee discloses that “a circuit of the light emitting apparatus has become complicated, and a cost required for manufacturing the light emitting apparatus has increased.” Ex. 1006, 1:005.

80. Finally, a POSITA would have had a reasonable expectation of success in making this modification. The LED Driver components described in Leong and Lee were well-known at the time. As such, it would also have been straightforward for a POSITA to modify the LED driver of Leong to include Lee’s Triac dimmer and splitting and regroup of input and output channels (in order to simultaneously power multiple LEDs).

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

A handwritten signature in black ink, appearing to read "Joseph C. McAlexander III". The signature is written in a cursive, flowing style with some capitalization and a prominent "M" and "A".

Joseph C. McAlexander III

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Claims	Prior Art References	
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1[p]. A method of configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:	“Electrical compensation of daylight can be controlled either by dimming (varying the light output to provide the desired brightness) or by switching (turning individual lamps or fixtures in different areas of a building or room on or off as necessary). Just as a typical two-lamp fixture containing the LED retrofit lamps of the present invention can be switched to illuminate both LED retrofit lamps, one LED retrofit lamp, or neither LED retrofit lamp, multiple fixtures all containing the LED retrofit lamps of the present invention can be turned on or off individually to illuminate each part of a room in just the needed amount of light. In addition, the internal dimming function located in each LED retrofit lamp of the present invention can adjust the output of the individual LED	

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	retrofit lamps to achieve greater control.” Leong, 18:3-16. “The single series LED string 80 of LEDs 52 as described above works ideally with the high-brightness or brighter high flux white LEDs available from Lumileds and Nichia in the SMD (surface mounted device) packages as discussed earlier herein. Since these new devices require more current to drive them and run on low voltages, the high current available from existing fluorescent ballast outputs with current outputs of 300 mA and higher, along with their characteristically higher voltage outputs provide the perfect match for the present invention. The high-brightness LEDs 52A have to be connected in series, so that each high-brightness LED 52A within the same single LED string 80 will see the same current and therefore	

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	output the same brightness. The total voltage required by all the high-brightness LEDs 52A within the same single LED string 80 is equal to the sum of all the individual voltage drops across each high-brightness LED 52A and should be less than the maximum voltage output of ballast assembly 16.” Leong, 34:58-35-8.	
1(a). converting power for powering the set of light fixture loads;	“Given these various voltage considerations, the present invention is designed to work with all existing ballast output configurations. The improved LED lamp does not require the pre-heating of a filament like a fluorescent lamp and does not need the ignition voltage to function. The circuit is designed so that the electrical contact pins of the two lamp base end caps of the LED lamp may be reversed, or the entire lamp assembly can be swapped end	

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	for end and still function correctly similar to a fluorescent lamp. In the preferred electrical design, a single LED circuit board array can be powered by two separate power electronics at either end of the improved LED lamp consisting of bridge rectifiers to convert the AC voltage to DC voltage. Voltage surge absorbers are used to limit the high voltage to a workable voltage, and optional resistor(s) may be used to limit the current seen by the LEDs. The current limiting resistor(s) is purely optional, because the existing fluorescent ballast is already a current limiting device. The resistor(s) then serve as a secondary protection device. In a normal fluorescent lamp and ballast configuration, the ignition voltage travels from one end of the lamp to the other end. In the new and improved LED retrofit lamp, the common or lower	

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	potential of both circuits are tied together, and the difference in potential between the two ends will serve as the main direct current or DC voltage potential to drive the LED circuit board array. That is the anode will be the positive potential and the cathode will be the negative potential to provide power to the LEDs. The individual LEDs within the LED circuit board array can be electrically connected in series, in parallel, or in a combination of series and/or parallel configurations.” Leong, 14:16-45.	
1(b). limiting converted power to multiple current outputs supplied to the set of light fixture loads;	“Given these various voltage considerations, the present invention is designed to work with all existing ballast output configurations. The improved LED lamp does not require the pre-heating of a filament like a fluorescent lamp and does	

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	not need the ignition voltage to function. The circuit is designed so that the electrical contact pins of the two lamp base end caps of the LED lamp may be reversed, or the entire lamp assembly can be swapped end for end and still function correctly similar to a fluorescent lamp. In the preferred electrical design, a single LED circuit board array can be powered by two separate power electronics at either end of the improved LED lamp consisting of bridge rectifiers to convert the AC voltage to DC voltage. Voltage surge absorbers are used to limit the high voltage to a workable voltage, and optional resistor(s) may be used to limit the current seen by the LEDs. The current limiting resistor(s) is purely optional, because the existing fluorescent ballast is already a current limiting device. The resistor(s) then serve as a secondary	

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	protection device. In a normal fluorescent lamp and ballast configuration, the ignition voltage travels from one end of the lamp to the other end. In the new and improved LED retrofit lamp, the common or lower potential of both circuits are tied together, and the difference in potential between the two ends will serve as the main direct current or DC voltage potential to drive the LED circuit board array. That is the anode will be the positive potential and the cathode will be the negative potential to provide power to the LEDs. The individual LEDs within the LED circuit board array can be electrically connected in series, in parallel, or in a combination of series and/or parallel configurations.” Leong, 14:16-45.	

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1(c). splitting or regrouping the multiple current outputs prior to delivery of the multiple current outputs to the set of light fixture loads;	“Ballast assembly 16 regulates the electrical current through LEDs 52 to the correct value of 20 mA for each LED 52. The fifteen LED strings 80 equally divide the total current applied to LED array circuitry 72. Those skilled in the art will appreciate that different ballasts provide different current outputs. If the forward drive current for LEDs 52 is known, then the output current of ballast assembly 16 divided by the forward drive current gives the exact number of parallel strings of LEDs 52 in the particular LED array, here LED array 40. The total number of LEDs in series within each LED string 80 is arbitrary since each LED 52 in each LED string 80 will see the same current. Again in this example, ten LEDs 52 are shown connected in series within each LED	

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	string 80 because of the fact that only ten LEDs 52 of the 5 mm discrete type of LED will fit around the circumference of a 1.5-inch diameter lamp housing. Ballast assembly 16 provides 300 mA of current, which when divided by the fifteen LED strings 80 of ten LEDs 52 per LED string 80 gives 20 mA per LED string 80. Each of the ten LEDs 52 connected in series within each LED string 80 sees this 20 mA. In accordance with the type of ballast assembly 16 used, when ballast assembly 16 is first energized, a high voltage may be applied momentarily across ballast socket contacts 20A and 20B, which conduct to pin contacts 22A and 22B. Such high voltage is normally used to help ignite a fluorescent tube and establish conductive phosphor gas, but high voltage is unnecessary for LED array circuitry 72 and	

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	voltage surge absorber 76 absorbs the voltage applied by ballast circuitry 68, so that the initial high voltage supplied is limited to an acceptable level for the circuit. Optional resettable fuse 78 is also shown to provide current protection to LED array circuitry 72.” Leong, 32:60-33:18.	
1(d). receiving a protocol from an external transmitter;	“The dimming controller can be used to program presets during the day or have a manual adjustment to dim the LED lamp down to full off or anywhere between 0% and 100% brightness. This dimming controller will send the control signal directly to the LED lamp itself and not change the AC voltage to the light fixture like conventional dimmers do. A data control signal to a computer based control system driving the dimming controller can be wireless, including using IR (Infra-Red), RF (Radio-Frequency), WiFi/802.11, FHSS (Frequency Hopping Spread Spectrum, or Bluetooth technology. The	

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	data control signal can also be a direct hard-wire connection including DMX512, RS232, Ethernet, DALI, Lonworks, RDM, TCPIP, CEBus Standard EIA-600, X10, and other Power Line Carrier Communication (PLC) protocols.” Leong, 18:17-31.	
1(e). converting the protocol into a data stream; and	“The dimming controller can be used to program presets during the day or have a manual adjustment to dim the LED lamp down to full off or anywhere between 0% and 100% brightness. This dimming controller will send the control signal directly to the LED lamp itself and not change the AC voltage to the light fixture like conventional dimmers do. A data control signal to a computer based control system driving the dimming controller can be wireless, including using IR (Infra-Red),	

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	RF (Radio-Frequency), WiFi/802.11, FHSS (Frequency Hopping Spread Spectrum, or Bluetooth technology. The data control signal can also be a direct hard-wire connection including DMX512, RS232, Ethernet, DALI, Lonworks, RDM, TCPIP, CEBus Standard EIA-600, X10, and other Power Line Carrier Communication (PLC) protocols.” Leong, 18:17-31. “Computer 1106 continuously compares the sensor data signals received in accordance with a computer monitoring program and transmits computer signals to dimmers 1102A and 1102B in accordance with a computer program, so as to control the current output of dimmers 1102A and 1102B, so as to prevent flickering of LED lamps 1086A and 1086B. Thus signaling dimmers 1102A and 1102B either to	

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	maintain full power to LED arrays 1088A and 1088B in accordance with preset power reductions, so that LED arrays 1088A and 1088B emit full capacity light, or on the other hand to reduce power after a set time delay to LED arrays 1088A and 1088B with the result that as a person walks about the illumination areas of LED lamps 1086A and 1086B, both lamps emit the same less than full capacity illumination with the result that continuous flickering caused by different power controls at dimmers 1102A and 1102B is avoided. In summary, the operational networking of LED lamp network 1086 prevents flickering from occurring.” Leong, 99:26-43.	
1(f). translating the data stream to LED control information;	“FIG. 73A shows another embodiment of the present invention, in particular shown as a schematic block diagram of an LED lamp 882 that includes an LED array 884	

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	comprising a plurality of LEDs positioned in a translucent tube 886. LED array 884 is connected to a power supply comprising a source of VAC power 888 electrically connected to a ballast 890, which is external to tube 886. An electrical connection 892A positioned in tube 886 is powered from ballast 890 and transmits AC power to AC-DC power converter 891, which in turn transmits DC power to a computer 894 by way of electrical connection 892B and to dimmer 898 by way of a similar electrical connection (not shown). Both computer 894 and dimmer 898 are also positioned in tube 886. Power from ballast 890 can be either AC or DC voltage. In the case of DC power going into AC-DC power converter 891, DC power will continue to be sent to computer 894 and dimmer 898. Computer 894 is electrically and operatively connected by an electrical control connection 896 to dimmer 898. An electrical connection 900	

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	connects dimmer 898 to LED array 884. Dimmer 898 will contain the necessary electronics needed to decode the data control signals sent by computer 894, and will provide the proper current drive power required to operate LED array 884. Single LED array 884 controlled by dimmer 898 can represent multiple LED arrays 884 each correspondingly controlled by one of a plurality of dimmers 898 (not shown), wherein the plurality of dimmers 898 are each independently controlled by computer 894. Computer 894 includes a microprocessor, a program installed therein, memory, input/output means, and addressing means.” Leong, 91:33-67.	

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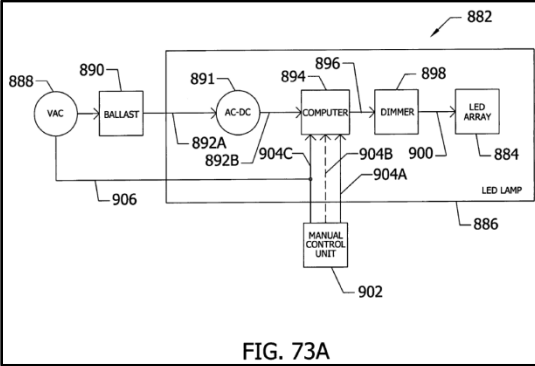
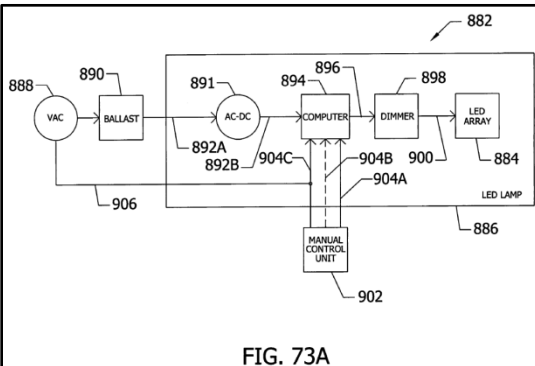
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	 FIG. 73A Leong, fig. 73A.	
1(g). wherein the LED control information is used for controlling the limited power.	 FIG. 73A Leong, fig. 73A.	

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U.S. Patent No. 9,320,093	U.S. Patent No. 7,490,957 to Leong	U.S. Patent Application No. 20150097484A1 to Lee
	“FIG. 73A shows another embodiment of the present invention, in particular shown as a schematic block diagram of an LED lamp 882 that includes an LED array 884 comprising a plurality of LEDs positioned in a translucent tube 886. LED array 884 is connected to a power supply comprising a source of VAC power 888 electrically connected to a ballast 890, which is external to tube 886. An electrical connection 892A positioned in tube 886 is powered from ballast 890 and transmits AC power to AC-DC power converter 891, which in turn transmits DC power to a computer 894 by way of electrical connection 892B and to dimmer 898 by way of a similar electrical connection (not shown). Both computer 894 and dimmer 898 are also positioned in tube 886. Power from ballast 890 can be either AC or DC voltage. In the case of DC power going into AC-DC power converter 891, DC power will continue to be sent to computer 894	

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	and dimmer 898. Computer 894 is electrically and operatively connected by an electrical control connection 896 to dimmer 898. An electrical connection 900 connects dimmer 898 to LED array 884. Dimmer 898 will contain the necessary electronics needed to decode the data control signals sent by computer 894, and will provide the proper current drive power required to operate LED array 884. Single LED array 884 controlled by dimmer 898 can represent multiple LED arrays 884 each correspondingly controlled by one of a plurality of dimmers 898 (not shown), wherein the plurality of dimmers 898 are each independently controlled by computer 894. Computer 894 includes a microprocessor, a program installed therein, memory, input/output means, and addressing means.” Leong, 91:33-67. “Computer 1106 continuously compares the sensor data signals received in accordance with a computer monitoring	

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	program and transmits computer signals to dimmers 1102A and 1102B in accordance with a computer program, so as to control the current output of dimmers 1102A and 1102B, so as to prevent flickering of LED lamps 1086A and 1086B. Thus signaling dimmers 1102A and 1102B either to maintain full power to LED arrays 1088A and 1088B in accordance with preset power reductions, so that LED arrays 1088A and 1088B emit full capacity light, or on the other hand to reduce power after a set time delay to LED arrays 1088A and 1088B with the result that as a person walks about the illumination areas of LED lamps 1086A and 1086B, both lamps emit the same less than full capacity illumination with the result that continuous flickering caused by different power controls at dimmers 1102A and 1102B is avoided. In summary, the operational networking of LED lamp network 1086 prevents flickering from occurring.” Leong, 99:26-43.	

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2. The method of claim 1 wherein limiting converted power comprises: limiting converted power to the multiple current outputs being supplied to a set of Organic LED (OLED) or LED light fixture loads.	“Given these various voltage considerations, the present invention is designed to work with all existing ballast output configurations. The improved LED lamp does not require the pre-heating of a filament like a fluorescent lamp and does not need the ignition voltage to function. The circuit is designed so that the electrical contact pins of the two lamp base end caps of the LED lamp may be reversed, or the entire lamp assembly can be swapped end for end and still function correctly similar to a fluorescent lamp. In the preferred electrical design, a single LED circuit board array can be powered by two separate power electronics at either end of the improved LED lamp consisting of bridge rectifiers to convert the AC voltage to DC voltage. Voltage surge absorbers are used to limit the high voltage to a workable	

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	voltage, and optional resistor(s) may be used to limit the current seen by the LEDs. The current limiting resistor(s) is purely optional, because the existing fluorescent ballast is already a current limiting device. The resistor(s) then serve as a secondary protection device. In a normal fluorescent lamp and ballast configuration, the ignition voltage travels from one end of the lamp to the other end. In the new and improved LED retrofit lamp, the common or lower potential of both circuits are tied together, and the difference in potential between the two ends will serve as the main direct current or DC voltage potential to drive the LED circuit board array. That is the anode will be the positive potential and the cathode will be the negative potential to provide power to the LEDs. The individual LEDs within the LED circuit board array	

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	can be electrically connected in series, in parallel, or in a combination of series and/or parallel configurations.” Leong, 14:16-45.	
5. The method of claim 1 wherein converting power for powering comprises: receiving power via a set of input channels.		“As shown in FIG. 3, the LED driving module 200 may include LED group driving units 220, a LED driving control unit 210, and an internal power generating unit 230, in order to drive and control the LED groups 310 to 340. In addition, the LED driving module 200 may be implemented as an integrated circuit (IC) and may include a driving voltage input terminal VP to which the driving voltage VP is input, a dimming level signal input terminal Adim to which the dimming level signal Adim is input, a connection terminal Rset to which a maximum driving current setting resistor RS is connected, a ground terminal GND to which a ground is connected, a connection terminal ST4 to which a fourth current path P4 connected to a cathode terminal of the fourth LED group 340 is connected, a connection

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		terminal ST3 to which a third current path P3 between a cathode terminal of the third LED group 330 and an anode terminal of the fourth LED group 340 is connected, a connection terminal ST2 to which a second current path P2 between a cathode terminal of the second LED group 320 and an anode terminal of the third LED group 330 is connected, and a connection terminal ST1 to which a first current path P1 between a cathode terminal of the first LED group 310 and an anode terminal of the second LED group 320 is connected, as shown in FIG. 3. Although the LED driving module 200 includes eight terminals as shown in FIG. 3, the number of terminals may be changed as needed.” Lee, 5[0067].
6. The method of claim 5 further comprising delivering power to the set of light		“As shown in FIG. 3, the LED driving module 200 may include LED group driving units 220, a LED driving control unit 210, and an internal power generating unit 230, in order to drive and control the LED groups 310 to 340. In

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U.S. Patent No. 9,320,093	U.S. Patent No. 7,490,957 to Leong	U.S. Patent Application No. 20150097484A1 to Lee
fixture loads via a set of output channels.		addition, the LED driving module 200 may be implemented as an integrated circuit (IC) and may include a driving voltage input terminal VP to which the driving voltage VP is input, a dimming level signal input terminal Adim to which the dimming level signal Adim is input, a connection terminal Rset to which a maximum driving current setting resistor RS is connected, a ground terminal GND to which a ground is connected, a connection terminal ST4 to which a fourth current path P4 connected to a cathode terminal of the fourth LED group 340 is connected, a connection terminal ST3 to which a third current path P3 between a cathode terminal of the third LED group 330 and an anode terminal of the fourth LED group 340 is connected, a connection terminal ST2 to which a second current path P2 between a cathode terminal of the second LED group 320 and an anode terminal of the third LED group 330 is connected, and a connection terminal ST1 to which a first current path P1 between a cathode terminal of

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		the first LED group 310 and an anode terminal of the second LED group 320 is connected, as shown in FIG. 3. Although the LED driving module 200 includes eight terminals as shown in FIG. 3, the number of terminals may be changed as needed.” Lee, 5[0067].
7. The method of claim 6 wherein splitting or regrouping comprises: splitting the set of input channels into the set of output channels.		“As shown in FIG. 3, the LED driving module 200 may include LED group driving units 220, a LED driving control unit 210, and an internal power generating unit 230, in order to drive and control the LED groups 310 to 340. In addition, the LED driving module 200 may be implemented as an integrated circuit (IC) and may include a driving voltage input terminal VP to which the driving voltage VP is input, a dimming level signal input terminal Adim to which the dimming level signal Adim is input, a connection terminal Rset to which a maximum driving current setting resistor RS is connected, a ground terminal GND to which a ground is connected, a connection terminal ST4 to which a fourth current path P4

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		connected to a cathode terminal of the fourth LED group 340 is connected, a connection terminal ST3 to which a third current path P3 between a cathode terminal of the third LED group 330 and an anode terminal of the fourth LED group 340 is connected, a connection terminal ST2 to which a second current path P2 between a cathode terminal of the second LED group 320 and an anode terminal of the third LED group 330 is connected, and a connection terminal ST1 to which a first current path P1 between a cathode terminal of the first LED group 310 and an anode terminal of the second LED group 320 is connected, as shown in FIG. 3. Although the LED driving module 200 includes eight terminals as shown in FIG. 3, the number of terminals may be changed as needed.” Lee, 5[0067].
9. The method of claim 1 wherein	“Given these various voltage considerations, the present invention is	

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converting power comprises: receiving an alternating current (AC) power; converting the AC power to a low voltage direct current (DC) power; and converting the low voltage DC power to the multiple current outputs.	designed to work with all existing ballast output configurations. The improved LED lamp does not require the pre-heating of a filament like a fluorescent lamp and does not need the ignition voltage to function. The circuit is designed so that the electrical contact pins of the two lamp base end caps of the LED lamp may be reversed, or the entire lamp assembly can be swapped end for end and still function correctly similar to a fluorescent lamp. In the preferred electrical design, a single LED circuit board array can be powered by two separate power electronics at either end of the improved LED lamp consisting of bridge rectifiers to convert the AC voltage to DC voltage. Voltage surge absorbers are used to limit the high voltage to a workable voltage, and optional resistor(s) may be used to limit the current seen by the LEDs.	

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	The current limiting resistor(s) is purely optional, because the existing fluorescent ballast is already a current limiting device. The resistor(s) then serve as a secondary protection device. In a normal fluorescent lamp and ballast configuration, the ignition voltage travels from one end of the lamp to the other end. In the new and improved LED retrofit lamp, the common or lower potential of both circuits are tied together, and the difference in potential between the two ends will serve as the main direct current or DC voltage potential to drive the LED circuit board array. That is the anode will be the positive potential and the cathode will be the negative potential to provide power to the LEDs. The individual LEDs within the LED circuit board array can be electrically connected in series, in parallel, or in a combination of series	

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	and/or parallel configurations.” Leong, 14:16-45. “The present invention works ideally with the brighter high flux white LEDs available from Lumileds and Nichia in the SMD packages. Since these new devices require more current to drive them and run on low voltages, the high current available from existing fluorescent ballast outputs with current outputs of 300 mA and higher, along with their characteristically higher voltage outputs provide the perfect match for the present invention. The high-brightness SMD LEDs 724A have to be connected in series, so that each high-brightness SMD LED 724A within the same single LED string 754 will see the same current and therefore output the same brightness. The total voltage required by all the high-brightness SMD LEDs 724A	

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	within the same single LED string 754 is equal to the sum of all the individual voltage drops across each high-brightness SMD LED 724A and should be less than the maximum voltage output of rapid start ballast assembly 686.” Leong, 83:58-84:6.	
10. The method of claim 1 further comprising, after receiving the protocol: adjusting at least one of the multiple current outputs in accordance with the protocol; and delivering the adjusted at least one current output to an	“Ballast assembly 16 regulates the electrical current through LEDs 52 to the correct value of 20 mA for each LED 52. The fifteen LED strings 80 equally divide the total current applied to LED array circuitry 72. Those skilled in the art will appreciate that different ballasts provide different current outputs. If the forward drive current for LEDs 52 is known, then the output current of ballast assembly 16 divided by the forward drive current gives the exact number of parallel strings of LEDs 52 in the particular LED	

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associated light fixture load.	array, here LED array 40. The total number of LEDs in series within each LED string 80 is arbitrary since each LED 52 in each LED string 80 will see the same current. Again in this example, ten LEDs 52 are shown connected in series within each LED string 80 because of the fact that only ten LEDs 52 of the 5 mm discrete type of LED will fit around the circumference of a 1.5-inch diameter lamp housing. Ballast assembly 16 provides 300 mA of current, which when divided by the fifteen LED strings 80 of ten LEDs 52 per LED string 80 gives 20 mA per LED string 80. Each of the ten LEDs 52 connected in series within each LED string 80 sees this 20 mA. In accordance with the type of ballast assembly 16 used, when ballast assembly 16 is first energized, a high voltage may be applied momentarily across ballast socket	

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	contacts 20A and 20B, which conduct to pin contacts 22A and 22B. Such high voltage is normally used to help ignite a fluorescent tube and establish conductive phosphor gas, but high voltage is unnecessary for LED array circuitry 72 and voltage surge absorber 76 absorbs the voltage applied by ballast circuitry 68, so that the initial high voltage supplied is limited to an acceptable level for the circuit. Optional resettable fuse 78 is also shown to provide current protection to LED array circuitry 72.” Leong, 32:60-33:18. “FIG. 73A shows another embodiment of the present invention, in particular shown as a schematic block diagram of an LED lamp 882 that includes an LED array 884 comprising a plurality of LEDs positioned in a translucent tube 886. LED array 884 is connected to a power supply comprising a	

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	source of VAC power 888 electrically connected to a ballast 890, which is external to tube 886. An electrical connection 892A positioned in tube 886 is powered from ballast 890 and transmits AC power to AC-DC power converter 891, which in turn transmits DC power to a computer 894 by way of electrical connection 892B and to dimmer 898 by way of a similar electrical connection (not shown). Both computer 894 and dimmer 898 are also positioned in tube 886. Power from ballast 890 can be either AC or DC voltage. In the case of DC power going into AC-DC power converter 891, DC power will continue to be sent to computer 894 and dimmer 898. Computer 894 is electrically and operatively connected by an electrical control connection 896 to dimmer 898. An electrical connection 900	

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	connects dimmer 898 to LED array 884. Dimmer 898 will contain the necessary electronics needed to decode the data control signals sent by computer 894, and will provide the proper current drive power required to operate LED array 884. Single LED array 884 controlled by dimmer 898 can represent multiple LED arrays 884 each correspondingly controlled by one of a plurality of dimmers 898 (not shown), wherein the plurality of dimmers 898 are each independently controlled by computer 894. Computer 894 includes a microprocessor, a program installed therein, memory, input/output means, and addressing means.” Leong, 91:39-67.	
11[p]. A method of configuring and powering a set of light fixture loads in	“Electrical compensation of daylight can be controlled either by dimming (varying the light output to provide the desired	

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a light emitting diode (LED) low voltage distribution system comprising:	brightness) or by switching (turning individual lamps or fixtures in different areas of a building or room on or off as necessary). Just as a typical two-lamp fixture containing the LED retrofit lamps of the present invention can be switched to illuminate both LED retrofit lamps, one LED retrofit lamp, or neither LED retrofit lamp, multiple fixtures all containing the LED retrofit lamps of the present invention can be turned on or off individually to illuminate each part of a room in just the needed amount of light. In addition, the internal dimming function located in each LED retrofit lamp of the present invention can adjust the output of the individual LED retrofit lamps to achieve greater control.” Leong, 18:3-16. “The single series LED string 80 of LEDs 52 as described above works ideally with	

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	the high-brightness or brighter high flux white LEDs available from Lumileds and Nichia in the SMD (surface mounted device) packages as discussed earlier herein. Since these new devices require more current to drive them and run on low voltages, the high current available from existing fluorescent ballast outputs with current outputs of 300 mA and higher, along with their characteristically higher voltage outputs provide the perfect match for the present invention. The high-brightness LEDs 52A have to be connected in series, so that each high-brightness LED 52A within the same single LED string 80 will see the same current and therefore output the same brightness. The total voltage required by all the high-brightness LEDs 52A within the same single LED string 80 is equal to the sum of all the	

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	individual voltage drops across each high-brightness LED 52A and should be less than the maximum voltage output of ballast assembly 16.” Leong, 34:58-35:8.	
11(a). converting power for powering the set of light fixture loads;	“Given these various voltage considerations, the present invention is designed to work with all existing ballast output configurations. The improved LED lamp does not require the pre-heating of a filament like a fluorescent lamp and does not need the ignition voltage to function. The circuit is designed so that the electrical contact pins of the two lamp base end caps of the LED lamp may be reversed, or the entire lamp assembly can be swapped end for end and still function correctly similar to a fluorescent lamp. In the preferred electrical design, a single LED circuit board array can be powered by two separate	

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	power electronics at either end of the improved LED lamp consisting of bridge rectifiers to convert the AC voltage to DC voltage. Voltage surge absorbers are used to limit the high voltage to a workable voltage, and optional resistor(s) may be used to limit the current seen by the LEDs. The current limiting resistor(s) is purely optional, because the existing fluorescent ballast is already a current limiting device. The resistor(s) then serve as a secondary protection device. In a normal fluorescent lamp and ballast configuration, the ignition voltage travels from one end of the lamp to the other end. In the new and improved LED retrofit lamp, the common or lower potential of both circuits are tied together, and the difference in potential between the two ends will serve as the main direct current or DC voltage potential to drive the	

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	LED circuit board array. That is the anode will be the positive potential and the cathode will be the negative potential to provide power to the LEDs. The individual LEDs within the LED circuit board array can be electrically connected in series, in parallel, or in a combination of series and/or parallel configurations.” Leong, 14:16-45.	
11(b). limiting converted power to multiple current outputs supplied to the set of light fixture loads;	“Given these various voltage considerations, the present invention is designed to work with all existing ballast output configurations. The improved LED lamp does not require the pre-heating of a filament like a fluorescent lamp and does not need the ignition voltage to function. The circuit is designed so that the electrical contact pins of the two lamp base end caps of the LED lamp may be reversed, or the	

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	entire lamp assembly can be swapped end for end and still function correctly similar to a fluorescent lamp. In the preferred electrical design, a single LED circuit board array can be powered by two separate power electronics at either end of the improved LED lamp consisting of bridge rectifiers to convert the AC voltage to DC voltage. Voltage surge absorbers are used to limit the high voltage to a workable voltage, and optional resistor(s) may be used to limit the current seen by the LEDs. The current limiting resistor(s) is purely optional, because the existing fluorescent ballast is already a current limiting device. The resistor(s) then serve as a secondary protection device. In a normal fluorescent lamp and ballast configuration, the ignition voltage travels from one end of the lamp to the other end. In the new and improved	

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	LED retrofit lamp, the common or lower potential of both circuits are tied together, and the difference in potential between the two ends will serve as the main direct current or DC voltage potential to drive the LED circuit board array. That is the anode will be the positive potential and the cathode will be the negative potential to provide power to the LEDs. The individual LEDs within the LED circuit board array can be electrically connected in series, in parallel, or in a combination of series and/or parallel configurations.” Leong, 14:16-45.	
11(c). splitting or regrouping the multiple current outputs prior to delivery of the multiple current	“Ballast assembly 16 regulates the electrical current through LEDs 52 to the correct value of 20 mA for each LED 52. The fifteen LED strings 80 equally divide the total current applied to LED array	

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outputs to the set of light fixture loads;	circuitry 72. Those skilled in the art will appreciate that different ballasts provide different current outputs. If the forward drive current for LEDs 52 is known, then the output current of ballast assembly 16 divided by the forward drive current gives the exact number of parallel strings of LEDs 52 in the particular LED array, here LED array 40. The total number of LEDs in series within each LED string 80 is arbitrary since each LED 52 in each LED string 80 will see the same current. Again in this example, ten LEDs 52 are shown connected in series within each LED string 80 because of the fact that only ten LEDs 52 of the 5 mm discrete type of LED will fit around the circumference of a 1.5-inch diameter lamp housing. Ballast assembly 16 provides 300 mA of current, which when divided by the fifteen LED strings 80 of ten LEDs 52 per LED string 80 gives 20 mA per LED string 80. Each of	

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	the ten LEDs 52 connected in series within each LED string 80 sees this 20 mA. In accordance with the type of ballast assembly 16 used, when ballast assembly 16 is first energized, a high voltage may be applied momentarily across ballast socket contacts 20A and 20B, which conduct to pin contacts 22A and 22B. Such high voltage is normally used to help ignite a fluorescent tube and establish conductive phosphor gas, but high voltage is unnecessary for LED array circuitry 72 and voltage surge absorber 76 absorbs the voltage applied by ballast circuitry 68, so that the initial high voltage supplied is limited to an acceptable level for the circuit. Optional resettable fuse 78 is also shown to provide current protection to LED array circuitry 72.” Leong, 32:60-33:18.	
11(d). receiving a data stream from an external transmitter; and	“The dimming controller can be used to program presets during the day or have a manual adjustment to dim the LED lamp	

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	down to full off or anywhere between 0% and 100% brightness. This dimming controller will send the control signal directly to the LED lamp itself and not change the AC voltage to the light fixture like conventional dimmers do. A data control signal to a computer based control system driving the dimming controller can be wireless, including using IR (Infra-Red), RF (Radio-Frequency), WiFi/802.11, FHSS (Frequency Hopping Spread Spectrum, or Bluetooth technology. The data control signal can also be a direct hard-wire connection including DMX512, RS232, Ethernet, DALI, Lonworks, RDM, TCPIP, CEBus Standard EIA-600, X10, and other Power Line Carrier Communication (PLC) protocols.” Leong, 18:17-31.	

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	“Computer 1106 continuously compares the sensor data signals received in accordance with a computer monitoring program and transmits computer signals to dimmers 1102A and 1102B in accordance with a computer program, so as to control the current output of dimmers 1102A and 1102B, so as to prevent flickering of LED lamps 1086A and 1086B. Thus signaling dimmers 1102A and 1102B either to maintain full power to LED arrays 1088A and 1088B in accordance with preset power reductions, so that LED arrays 1088A and 1088B emit full capacity light, or on the other hand to reduce power after a set time delay to LED arrays 1088A and 1088B with the result that as a person walks about the illumination areas of LED lamps 1086A and 1086B, both lamps emit the same less than full capacity illumination with the	

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	result that continuous flickering caused by different power controls at dimmers 1102A and 1102B is avoided. In summary, the operational networking of LED lamp network 1086 prevents flickering from occurring.” Leong, 99:26-43.	
11(e). translating the data stream to LED control information;	FIG. 73A Leong, fig. 73A. “FIG. 73A shows another embodiment of the present invention, in particular shown as a schematic block diagram of an LED lamp 882 that includes an LED array 884	

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	comprising a plurality of LEDs positioned in a translucent tube 886. LED array 884 is connected to a power supply comprising a source of VAC power 888 electrically connected to a ballast 890, which is external to tube 886. An electrical connection 892A positioned in tube 886 is powered from ballast 890 and transmits AC power to AC-DC power converter 891, which in turn transmits DC power to a computer 894 by way of electrical connection 892B and to dimmer 898 by way of a similar electrical connection (not shown). Both computer 894 and dimmer 898 are also positioned in tube 886. Power from ballast 890 can be either AC or DC voltage. In the case of DC power going into AC-DC power converter 891, DC power will continue to be sent to computer 894 and dimmer 898. Computer 894 is electrically and operatively connected by an electrical control connection 896 to dimmer 898. An electrical connection 900	

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	connects dimmer 898 to LED array 884. Dimmer 898 will contain the necessary electronics needed to decode the data control signals sent by computer 894, and will provide the proper current drive power required to operate LED array 884. Single LED array 884 controlled by dimmer 898 can represent multiple LED arrays 884 each correspondingly controlled by one of a plurality of dimmers 898 (not shown), wherein the plurality of dimmers 898 are each independently controlled by computer 894. Computer 894 includes a microprocessor, a program installed therein, memory, input/output means, and addressing means.” Leong, 91: 39- 67	

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11(f). wherein the LED control information is used for controlling the limited power.	FIG. 73A Leong, fig. 73A. “FIG. 73A shows another embodiment of the present invention, in particular shown as a schematic block diagram of an LED lamp 882 that includes an LED array 884 comprising a plurality of LEDs positioned in a translucent tube 886. LED array 884 is connected to a power supply comprising a source of VAC power 888 electrically connected to a ballast 890, which is external to tube 886. An electrical connection 892A positioned in tube 886 is powered from ballast 890 and transmits AC	

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	power to AC-DC power converter 891, which in turn transmits DC power to a computer 894 by way of electrical connection 892B and to dimmer 898 by way of a similar electrical connection (not shown). Both computer 894 and dimmer 898 are also positioned in tube 886. Power from ballast 890 can be either AC or DC voltage. In the case of DC power going into AC-DC power converter 891, DC power will continue to be sent to computer 894 and dimmer 898. Computer 894 is electrically and operatively connected by an electrical control connection 896 to dimmer 898. An electrical connection 900 connects dimmer 898 to LED array 884. Dimmer 898 will contain the necessary electronics needed to decode the data control signals sent by computer 894, and will provide the proper current drive power required to operate LED array 884. Single LED array 884 controlled by dimmer 898 can represent multiple LED arrays 884 each	

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	correspondingly controlled by one of a plurality of dimmers 898 (not shown), wherein the plurality of dimmers 898 are each independently controlled by computer 894. Computer 894 includes a microprocessor, a program installed therein, memory, input/output means, and addressing means.” Leong, 91:39-67. “Computer 1106 continuously compares the sensor data signals received in accordance with a computer monitoring program and transmits computer signals to dimmers 1102A and 1102B in accordance with a computer program, so as to control the current output of dimmers 1102A and 1102B, so as to prevent flickering of LED lamps 1086A and 1086B. Thus signaling dimmers 1102A and 1102B either to maintain full power to LED arrays 1088A and 1088B in accordance with preset power reductions, so that LED arrays 1088A and 1088B emit full capacity light, or on the other hand to reduce power after a set time	

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	delay to LED arrays 1088A and 1088B with the result that as a person walks about the illumination areas of LED lamps 1086A and 1086B, both lamps emit the same less than full capacity illumination with the result that continuous flickering caused by different power controls at dimmers 1102A and 1102B is avoided. In summary, the operational networking of LED lamp network 1086 prevents flickering from occurring.” Leong, 99:26-43.	
Claim 12: The method of claim 11 wherein limiting converted power comprises: limiting converted power to the multiple current outputs being supplied to a set of Organic LED	“Given these various voltage considerations, the present invention is designed to work with all existing ballast output configurations. The improved LED lamp does not require the pre-heating of a filament like a fluorescent lamp and does not need the ignition voltage to function. The circuit is designed so that the electrical contact pins of the two lamp base end caps of the LED lamp may be reversed, or the	

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(OLED) or LED light fixture loads.	entire lamp assembly can be swapped end for end and still function correctly similar to a fluorescent lamp. In the preferred electrical design, a single LED circuit board array can be powered by two separate power electronics at either end of the improved LED lamp consisting of bridge rectifiers to convert the AC voltage to DC voltage. Voltage surge absorbers are used to limit the high voltage to a workable voltage, and optional resistor(s) may be used to limit the current seen by the LEDs. The current limiting resistor(s) is purely optional, because the existing fluorescent ballast is already a current limiting device. The resistor(s) then serve as a secondary protection device. In a normal fluorescent lamp and ballast configuration, the ignition voltage travels from one end of the lamp to the other end. In the new and improved	

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	LED retrofit lamp, the common or lower potential of both circuits are tied together, and the difference in potential between the two ends will serve as the main direct current or DC voltage potential to drive the LED circuit board array. That is the anode will be the positive potential and the cathode will be the negative potential to provide power to the LEDs. The individual LEDs within the LED circuit board array can be electrically connected in series, in parallel, or in a combination of series and/or parallel configurations.” Leong, 14:16-45.	
Claim 13: The method of claim 11 wherein limiting converted power comprises:	“Power control modules and other components can be incorporated into the electrical circuits used in the LED lamp of the present invention. The first circuit module may be a dimming module placed in between the DC voltage input to the LED	

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limiting power to a calibrated value when an event failure occurs.	array. This dimming module can take a control input either from a hard-wired sensor like an occupancy sensor, a timer, a computer or from a hand-held or wall mounted remote control box that sends the dimming signal to the dimming module located within the LED lamp. The dimming current driver module will contain the necessary electronics to decipher data input control signals and provide the current driver power to operate the LED arrays. LED current control can be accomplished by time and amplitude domain control or other means well known in the arts. The occupancy sensor can be preset to dim the LED lamp to perhaps 50% brightness to conserve energy when no one is in a room, for example while a light level photosensor can switch on and off the power to the ballast or LED array. The LED retrofit lamp would be programmed to turn the LED arrays on when luminance on the photocell drops below a certain value, and	

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	turn the LED arrays off when the luminance due to sunlight reaches a higher cut-off value. This value could be adjustable depending on the user's needs. Instead of turning on and off the LED arrays, the LED arrays can likewise be dimmed.” Leong, 17:46-18:2.	
15. The method of claim 11 wherein converting power for powering comprises: receiving power via a set of input channels.		“In addition, the LED driving module 200 may be implemented as an integrated circuit (IC) and may include a driving voltage input terminal VP to which the driving voltage VP is input, a dimming level signal input terminal Adim to which the dimming level signal Adim is input, a connection terminal Rset to which a maximum driving current setting resistor RS is connected, a ground terminal GND to which a ground is connected” Lee, 5[0067]. “As shown in FIG. 3, the LED driving module 200 may include LED group driving units 220, a LED driving control unit 210, and an internal power generating unit 230, in order to drive

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		and control the LED groups 310 to 340.” Lee, 5[0067].
16. The method of claim 15 further comprising delivering power to the set of light fixture loads via a set of output channels.		“[A] connection terminal ST4 to which a fourth current path P4 connected to a cathode terminal of the fourth LED group 340 is connected, a connection terminal ST3 to which a third current path P3 between a cathode terminal of the third LED group 330 and an anode terminal of the fourth LED group 340 is connected, a connection terminal ST2 to which a second current path P2 between a cathode terminal of the second LED group 320 and an anode terminal of the third LED group 330 is connected, and a connection terminal ST1 to which a first current path P1 between a cathode terminal of the first LED group 310 and an anode terminal of the second LED group 320 is connected, as shown in FIG. 3. Although the LED driving module 200 includes eight terminals as shown in FIG. 3, the number of terminals may be changed as needed.” Lee, 5[0067].

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		Fig. 3 Lee, fig. 3.
17. The method of claim 16 wherein splitting or regrouping comprises: splitting the set of input channels into		“[A] connection terminal ST4 to which a fourth current path P4 connected to a cathode terminal of the fourth LED group 340 is connected, a connection terminal ST3 to which a third current path P3 between a cathode terminal of the third LED group 330 and an anode terminal of the fourth LED group 340 is connected, a connection terminal ST2 to which

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the set of output channels.		a second current path P2 between a cathode terminal of the second LED group 320 and an anode terminal of the third LED group 330 is connected, and a connection terminal ST1 to which a first current path P1 between a cathode terminal of the first LED group 310 and an anode terminal of the second LED group 320 is connected, as shown in FIG. 3. Although the LED driving module 200 includes eight terminals as shown in FIG. 3, the number of terminals may be changed as needed.” Lee, 5[0067].

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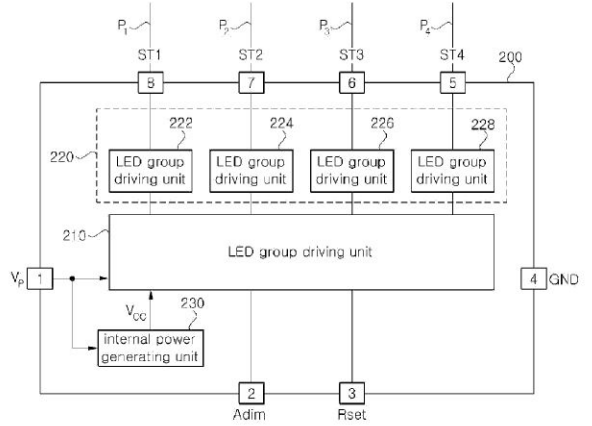
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		Fig. 3  Lee, fig. 3.
19. The method of claim 11 herein converting power comprises: receiving an alternating current (AC) power; converting the AC power to a low	“Given these various voltage considerations, the present invention is designed to work with all existing ballast output configurations. The improved LED lamp does not require the pre-heating of a filament like a fluorescent lamp and does not need the ignition voltage to function. The circuit is designed so that the electrical	

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voltage direct current (DC) power; and converting the low voltage DC power to the multiple current outputs.	contact pins of the two lamp base end caps of the LED lamp may be reversed, or the entire lamp assembly can be swapped end for end and still function correctly similar to a fluorescent lamp. In the preferred electrical design, a single LED circuit board array can be powered by two separate power electronics at either end of the improved LED lamp consisting of bridge rectifiers to convert the AC voltage to DC voltage. Voltage surge absorbers are used to limit the high voltage to a workable voltage, and optional resistor(s) may be used to limit the current seen by the LEDs. The current limiting resistor(s) is purely optional, because the existing fluorescent ballast is already a current limiting device. The resistor(s) then serve as a secondary protection device. In a normal fluorescent lamp and ballast configuration, the ignition	

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	voltage travels from one end of the lamp to the other end. In the new and improved LED retrofit lamp, the common or lower potential of both circuits are tied together, and the difference in potential between the two ends will serve as the main direct current or DC voltage potential to drive the LED circuit board array. That is the anode will be the positive potential and the cathode will be the negative potential to provide power to the LEDs. The individual LEDs within the LED circuit board array can be electrically connected in series, in parallel, or in a combination of series and/or parallel configurations.” Leong, 14:16-45. “The present invention works ideally with the brighter high flux white LEDs available from Lumileds and Nichia in the SMD packages. Since these new devices require	

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	more current to drive them and run on low voltages, the high current available from existing fluorescent ballast outputs with current outputs of 300 mA and higher, along with their characteristically higher voltage outputs provide the perfect match for the present invention. The high-brightness SMD LEDs 724A have to be connected in series, so that each high-brightness SMD LED 724A within the same single LED string 754 will see the same current and therefore output the same brightness. The total voltage required by all the high-brightness SMD LEDs 724A within the same single LED string 754 is equal to the sum of all the individual voltage drops across each high-brightness SMD LED 724A and should be less than the maximum voltage output of rapid start ballast assembly 686.” Leong, 83:58-84:6.	

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20. The method of claim 11 further comprising, after receiving the data stream: adjusting at least one of the multiple current outputs in accordance with the data stream; and delivering the adjusted at least one current output to the associated light fixture.	“Ballast assembly 16 regulates the electrical current through LEDs 52 to the correct value of 20 mA for each LED 52. The fifteen LED strings 80 equally divide the total current applied to LED array circuitry 72. Those skilled in the art will appreciate that different ballasts provide different current outputs. If the forward drive current for LEDs 52 is known, then the output current of ballast assembly 16 divided by the forward drive current gives the exact number of parallel strings of LEDs 52 in the particular LED array, here LED array 40. The total number of LEDs in series within each LED string 80 is arbitrary since each LED 52 in each LED string 80 will see the same current. Again in this example, ten LEDs 52 are shown connected in series within each LED	

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	string 80 because of the fact that only ten LEDs 52 of the 5 mm discrete type of LED will fit around the circumference of a 1.5-inch diameter lamp housing. Ballast assembly 16 provides 300 mA of current, which when divided by the fifteen LED strings 80 of ten LEDs 52 per LED string 80 gives 20 mA per LED string 80. Each of the ten LEDs 52 connected in series within each LED string 80 sees this 20 mA. In accordance with the type of ballast assembly 16 used, when ballast assembly 16 is first energized, a high voltage may be applied momentarily across ballast socket contacts 20A and 20B, which conduct to pin contacts 22A and 22B. Such high voltage is normally used to help ignite a fluorescent tube and establish conductive phosphor gas, but high voltage is unnecessary for LED array circuitry 72 and	

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	voltage surge absorber 76 absorbs the voltage applied by ballast circuitry 68, so that the initial high voltage supplied is limited to an acceptable level for the circuit. Optional resettable fuse 78 is also shown to provide current protection to LED array circuitry 72.” Leong, 32:60-33:18. “FIG. 73A shows another embodiment of the present invention, in particular shown as a schematic block diagram of an LED lamp 882 that includes an LED array 884 comprising a plurality of LEDs positioned in a translucent tube 886. LED array 884 is connected to a power supply comprising a source of VAC power 888 electrically connected to a ballast 890, which is external to tube 886. An electrical connection 892A positioned in tube 886 is powered from ballast 890 and transmits AC power to AC-DC power converter 891, which in turn transmits DC power to a computer 894 by way of electrical	

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	connection 892B and to dimmer 898 by way of a similar electrical connection (not shown). Both computer 894 and dimmer 898 are also positioned in tube 886. Power from ballast 890 can be either AC or DC voltage. In the case of DC power going into AC-DC power converter 891, DC power will continue to be sent to computer 894 and dimmer 898. Computer 894 is electrically and operatively connected by an electrical control connection 896 to dimmer 898. An electrical connection 900 connects dimmer 898 to LED array 884. Dimmer 898 will contain the necessary electronics needed to decode the data control signals sent by computer 894, and will provide the proper current drive power required to operate LED array 884. Single LED array 884 controlled by dimmer 898 can represent multiple LED arrays 884 each correspondingly controlled by one of a plurality of dimmers 898 (not shown), wherein the plurality of dimmers 898 are	

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	each independently controlled by computer 894. Computer 894 includes a microprocessor, a program installed therein, memory, input/output means, and addressing means.” Leong, 91:39-67.	