

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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CURRENT LIGHTING SOLUTIONS, LLC,  
and  
HLI SOLUTIONS, INC.,  
Petitioners,

v.

ALSI HOLDINGS, LLC  
Patent Owner.

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U.S. Patent No. 9,699,854 to Wassel

Case No. IPR2023-00125

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**DECLARATION OF DR. JACK JOSEFOWICZ**

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**List of Exhibits**

<b>Exhibit No.</b>	<b>Description</b>	<b>Identifier</b>
1001	USPN 9,699,854	'854 Patent
1002	The '854 Patent File History	'854 File History
1003	Declaration of Dr. Jack Josefowicz	
1004	Curriculum Vitae of Dr. Jack Josefowicz	
1005	USPN 8,322,881	
1006	U.S. Provisional App. No. 61/094,571	'571 Provisional
1007	U.S. Provisional App. No. 61/094,558	'558 Provisional
1008	U.S. Provisional App. No. 61/015,713	'713 Provisional
1009	U.S. Patent App. No. 2005/0111220	Smith
1010	U.S. Provisional App. No. 60/960,473	'473 Provisional
1011	U.S. Patent No. 223,898	
1012	How the Energy Independence and Security Act of 2007 Affects Light Bulbs _ US EPA - <a href="https://www.epa.gov/mercury/how-energy-independence-and-security-act-2007-affects-light-bulbs#:~:text=Basics%20of%20the%20Energy%20Independence,that%20are%20not%20energy%20efficient">https://www.epa.gov/mercury/how-energy-independence-and-security-act-2007-affects-light-bulbs#:~:text=Basics%20of%20the%20Energy%20Independence,that%20are%20not%20energy%20efficient</a>	
1013	Recycling and Disposal of CFLs and Other Bulbs that Contain Mercury _ US EPA - <a href="https://www.epa.gov/cfl/recycling-and-disposal-cfls-and-other-bulbs-contain-mercury">https://www.epa.gov/cfl/recycling-and-disposal-cfls-and-other-bulbs-contain-mercury</a>	
1014	Disposal of Fluorescent Light Ballasts (FLB) _ US EPA - <a href="https://www.epa.gov/pcbs/disposal-fluorescent-light-ballasts-flb">https://www.epa.gov/pcbs/disposal-fluorescent-light-ballasts-flb</a>	
1015	Nakamura, <i>The Roles of Structural Imperfections in InGaN-Based Blue Light-Emitting Diodes and Laser Diodes</i> , Science Magazine, Vol. 281, pp. 956-961 at 956-957 (August 14, 1998)	Nakamura
1016	Nakada et. al., <i>Improved Characteristics of InGaN Multiple-Quantum-Well Light-Emitting Diode by GaN/AlGaIn distributed Reflector Grown on Sapphire</i> , Applied Physics Letters, Vol. 76, No. 14, pp. 1804-1806 (April 3, 2000)	Nakada

<b>Exhibit No.</b>	<b>Description</b>	<b>Identifier</b>
1017	USPN 5,578,839	
1018	Nakamura et al., “ <i>Candela-Class High-Brightness InGaN/AlGaN Double-Heterostructure Blue-Light-Emitting Diodes</i> ,” Appl. Phys. Lett. 64, pp. 1687-1689 (1994)	
1019	Mueller-Mach et al., <i>Highly efficient all-nitride phosphor-converted white light emitting diode</i> , Physica Status Solidi (A) Applications and Materials, Vol. 202, Issue 9, pp. 1727-1732 at 1728 (June 6, 2005)	
1020	USPN 7,223,998	
1021	USPN 7,405,093	
1022	U.S. Patent Publication No. 2008/0089069	Medendorp
1023	USPN 5,857,767	
1024	USPN 7,144,135	
1025	USPN 2,422,378	
1026	USPN 3,123,308	Franck
1027	USPN 4,041,306	Compton
1028	USPN 7,144,135	
1029	USPN 2,908,197	
1030	Michael Gauvin et al., “Multi-CPU architecture speeds ray tracing,” <a href="https://www.laserfocusworld.com/software-accessories/software/article/16553028/multicpu-architecture-speeds-ray-tracing">https://www.laserfocusworld.com/software-accessories/software/article/16553028/multicpu-architecture-speeds-ray-tracing</a>	
1031	National Lighting Product Information Program, Parking Lot and Area Luminaires, Vol. 9(1) (2004)	
1032	ALSI Holdings v Current Lighting Solutions, Final Claim Construction	
1033	IES Standard for Roadway Lighting, RP-8-00 (2005)	
1034	IES Standard for Roadway Lighting, RP-8-14 (2014)	
1035	ALSI infringement contentions for the ’854 Patent	
1036	U.S. Patent Pub. No. 2007/0121343	Brown
1037	USPN 6,257,735	Baar

<b>Exhibit No.</b>	<b>Description</b>	<b>Identifier</b>
1038	USPN 6,641,284	Stopa
1039	Lumen (unit) – McGraw Hill Dictionary of Scientific and Technical Terms	
1040	USPN 7,198,386	
1041	U.S. Patent App. No. 2007/0002565	Han
1042	USPN 7,766,508	
1043	USPN 7,847,486	
1044	USPN 7,648,257	Villard
1045	USPN 6,318,886	Stopa II
1046	ALSI v. Current Lighting et al., DN. 50 – Scheduling Order	Scheduling Order



I, Jack Josefowicz, hereby declare as follows:

1. I am making this declaration at the request of the above-identified Petitioners in the matter of *Inter Partes* Review of U.S. Patent No. 9,699,854 (Ex. 1001, “the ’854 Patent”) to Wassel.

2. I understand that the ’854 Patent has been assigned to ALSI Holdings, LLC (“ALSI”). ALSI may also referred to as the “Patent Owner” in this declaration.

3. In preparation of this declaration, I have studied the exhibits as listed in the Exhibit List shown above in my report.

4. In forming the opinions expressed below, I have considered:

- a. The documents listed in the Exhibit List above as well as additional patents and documents referenced herein;
- b. The relevant legal standards, including the standard for obviousness, and any additional documents cited in the body of this declaration; and
- c. My knowledge and experience based upon my work and study in this area as described below.

## **I. Qualifications and Professional Experience**

### **A. Education and Experience**

5. I have provided my full background in my curriculum vitae (“CV”). (Ex. 1004.) As indicated in my CV, I received a B.Sc. in Mathematics and Physics from Concordia University, Montreal, in Montreal, Quebec, Canada, in 1969. In

1975, I earned my Ph.D. in Physics from the University of Waterloo, in Waterloo, Ontario, Canada. In 1975, I secured the position of Research Associate at Harvard University in Cambridge, Massachusetts.

6. In my tenure as senior scientist at Hughes Research Laboratories (1984-1996), I designed and innovated new thin film deposition methods and techniques used in semi-conductor device fabrication. I have extensive experience in thin film coating methods (atomic and molecular layer by layer deposition processes; quantum well structures; epitaxial growth and lattice matching) including electron beam deposition of metals, semi-conductors, optical coatings, and insulators. I designed equipment that performed the multi-target sputtering of metals and semi-conductors, thermal evaporation depositions of metals and insulators and semi-conductors, radio frequency (RF) plasma deposition of metals, semi-conductors, and insulators, as well as spin coating techniques in photolithography and electron beam lithography.

7. I also have extensive experience in surface science of thin film properties, including optical and electronic applications for light emitting diode (LED) device design, LED light fixture design and optimization, LED Light Engine printed circuit boards (PCB), advanced electronics for LED power supply drivers and controllers, electronic system prediction analysis for reliability, semiconductor materials and design for high reliability of design in p-n junctions such as LED

devices, and lithium-ion battery development for space satellites.

8. During my tenure at Tyco Electronics as Director of Technology and R&D (1996-2008), I headed engineering divisions in 13 manufacturing facilities around the world. My work involved oversight of engineering and development groups working on advanced and high reliability design of PCBs, including metal core heat sink PCBs used as LED light engines and power supply drivers. My technical programs included PCB thin film surface mount finishes, design for solder joint reliability, process manufacturing optimization, design for manufacturability, and automation of complex process manufacturing in facilities at nine Tyco Electronics manufacturing factories, including “best practice,” statistical process control (SPC), and reliability testing.

9. I also was responsible for collaborative engineering development that improved PCB assembly and improved the reliability and strength in solder joints formed during reflow in automated assembly lines. I also served as an active member of IPC PCB surface finishes committees and participated in writing acceptance standards and specifications for surface finishes such as hot air solder level, immersion silver, electroless Ni immersion Au, and organic solderable protective coatings.

10. In 2008, I helped found LED Roadway Lighting (LRL) Limited. As Executive VP of Technology, I led a team of physicists and engineers, including

electrical and mechanical engineers, in the invention and development of new globally acclaimed high efficiency and high reliability LED streetlights, including electronics power supply driver, LED control systems including dimming and on/off controls, optics design, and fixture housing design for optimized thermal management. I also directed the qualification of suppliers for all the components that included electronic devices and components, PCB suppliers, die cast and mould design. I led a team in lean manufacturing, as well as design for manufacturing, parts, and system integration in the manufacturing of the new LED lights.

11. I am currently an independent consultant, working in the fields of PCB fabrication processes and design for manufacturability, LED device design, LED lighting, and aerospace electronic systems. I have served as an expert technologist in finding the root cause for solder joint fractures on PCB surface mount pads. I also have extensive experience in semi-conductor electronics, optical materials, electronic micro-devices, and electronic systems design.

12. I have broad experience in designing, engineering, and developing specifications for LED surface mounting, including layout of discrete LEDs, selection, and design of printed circuit material for LED light engines (including metal core PCBs) and design for surface mounting, the selection and specification of surface-mount pad materials and surface coating. I am a listed inventor of 22 patents, including LED related technology, and am an author of over 50 refereed

academic science journal articles, commercial publications, and presentations.

**B. Compensation**

13. I am being compensated for my work in this matter at a rate of \$550/hour. My compensation in no way depends on the outcome of this proceeding.

**II. Relevant Legal Standards**

14. I have been asked to provide opinions on claims of the '854 Patent (Ex. 1001) in light of the prior art.

**A. Claim Construction**

15. I understand that in proceedings at the Patent Trial and Appeal Board, claims are construed under the "*Phillips* standard." I understand that this means the claims are construed in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art in light of the specification and prosecution history of the patent. I understand that this is the same claim construction standard employed in district courts.

16. I understand that intrinsic evidence is the primary means by which claim terms are interpreted. The intrinsic evidence includes the claims themselves, the specification of the patent in which the claims appear, and the prosecution history of the patent.

17. I understand that a patentee may give a special definition to a claim term that differs from the normal meaning of the term. If the patent specification

sets out an uncommon definition that would give one of ordinary skill in the art notice of the change in meaning, the specification's definition governs the construction of that term.

18. I understand that extrinsic evidence, such as expert and inventor testimony, dictionaries, and learned treatises, can also inform the meaning of a claim term. However, extrinsic evidence is less significant than the intrinsic evidence in determining the meaning of a claim term. Further, I understand that extrinsic evidence cannot be used to vary, contradict, expand, or limit the claim language from how it is defined, even by implication, in the specification or file history.

**B. Anticipation**

19. Counsel has advised me that in order for a patent claim to be valid, the claimed invention must be novel. Counsel has further advised me that if each and every element of a claim is disclosed in a single prior art reference, then the claimed invention is anticipated, and the invention is not patentable. For the invention to be anticipated, all of the elements and limitations of the claim must be shown in a single prior art reference, arranged as in the claim. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. For a reference to inherently disclose a limitation, that claim limitation must necessarily be present in the reference.

**C. Obviousness**

20. Counsel has also advised me that a claimed invention is unpatentable if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the alleged invention was made to a person having ordinary skill in the art to which the subject matter pertains. I also understand that an obviousness analysis takes into account factual inquiries including the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed subject matter.

21. It is my understanding that the Supreme Court has recognized several rationales for combining references or modifying a reference to show obviousness of the claimed subject matter. Some of these rationales include the following: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

22. I am informed that obviousness should not be determined using

hindsight; rather, the inquiry must be from the perspective of a person of ordinary skill in the art at the time that the invention was made. I am informed that there is no requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention; a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually, and will be viewed in light of the knowledge of one skilled in the art. The inferences and creative steps a person of ordinary skill in the art would typically employ are also relevant to the determination of obviousness.

23. When a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. If a person of ordinary skill in the art can implement a predictable variation and would see the benefit of doing so, that variation is likely to be obvious. When there is design need or market pressure and there are a finite number of predictable solutions, a person of ordinary skill in the art has good reason to pursue those known options.

24. It is my understanding that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But, I understand that a “teaching, suggestion, or motivation” can be a useful guide in establishing a rationale for combining elements of the prior art.

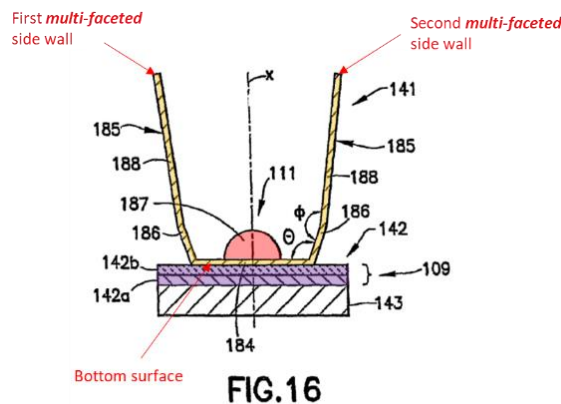
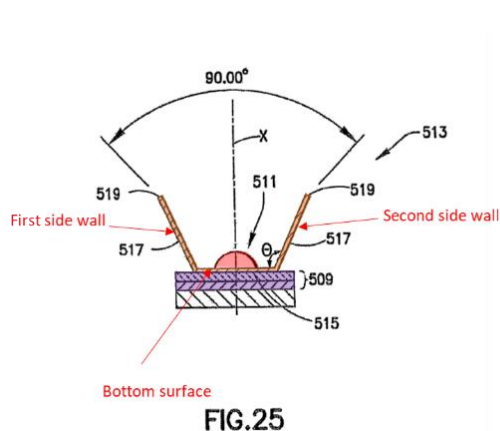


### III. Overview of the '854 Patent

25. I understand the '854 Patent was filed on December 3, 2012 and is a continuation of U.S. Patent No. 8,322,881 (Ex. 1005). I also understand the '854 Patent claims priority to provisional application No. 61/094,571 filed on Sep. 5, 2008 (the "'571 Provisional," Ex. 1006), provisional application No. 61/094,558, filed on Sep. 5, 2008 (the "'558 Provisional," Ex. 1007); and provisional application No. 61/015,713, filed on Dec. 21, 2007 (the "'713 Provisional," Ex. 1008).

26. The '854 Patent generally relates to LED lighting fixtures. (Ex. 1001, '854 Patent at 1:20-24.) The '854 Patent discloses lighting fixtures that include *lighting strips* with a plurality of LEDs. The light produced by the LEDs is directed toward the area to be illuminated using a reflector.

27. As shown below, there are two types of reflectors disclosed. Below left illustrates a reflector with two *side walls* that extend at an angle from a bottom surface of the reflector. Below right illustrates a reflector with two *multi-faceted side walls* that also extend at an angle from a bottom surface of the reflector.



**Ex. 1001, '854 Patent, Figs. 25 and 16 (annotated)**

28. As illustrated, the '854 Patent discloses a lighting strip (shaded purple) with a linearly arranged row of LEDs (shaded red above) that are used to illuminate a desired area. The reflector is then used to provide a uniform beam of light, which depending on the reflector, could be either a “focused beam” (like a spotlight) or a “diffused beam” (like an overhead office or streetlight). (Ex. 1001, '854 Patent at 5:59-6:1.)

29. The '854 Patent discloses the use of known and commercially available LEDs such as the Luxeon® Rebel or Cree® LEDs. (Ex. 1001, '854 Patent at 6:46-49.) I am aware that these – as well as many other – types of LEDs existed and were sold as individual LEDs or as LED packages that were assembled on a PCB.

30. The claims of the '854 Patent appear to be directed to the multi-faceted reflector structure. Specifically, the claims are directed to a reflector sheet that is bent to provide two multi-faceted side walls for directing the light produced by the

LEDs.

**A. '854 Patent File History**

31. I understand the claims which resulted as the '854 Patent underwent a lengthy process of revision during prosecution before finally being allowed. (Ex. 1002, "'854 File History.")

32. For instance, I understand shown below is Claim 1 as originally filed.

1. A light emitting diode (LED) lighting arrangement for a lighting fixture, comprising:

a lighting strip comprising a plurality of light emitting diodes (LEDs) arranged along a substantially planar surface of the lighting strip;

a first multi-faceted side wall reflector extending along the lighting arrangement adjacent a first side of the lighting strip at an angle such that the first multi-faceted side wall reflector extends along an entire length of the lighting strip and away from a bottom portion of a light emitting portion of each of the light emitting diodes (LEDs); and

a second multi-faceted side wall reflector extending along the lighting arrangement adjacent a second, opposite side of the lighting strip at an angle such that the second multi-faceted side wall reflector extends along an entire length of the lighting strip away from the bottom portion of the light emitting portion of each of the light emitting diodes (LEDs),

wherein the first and second multi-faceted side wall reflectors cause light produced by the plurality of light emitting diodes (LEDs) to be amplified and formed into a uniform beam.

**Ex. 1002, '854 File History, December 3, 2012 claim set at 29**

33. I understand over the course of prosecution the claim was rejected and amended numerous times based on the reflector illustrated by U.S. Patent App. No. 2005/0111220 ("Smith," Ex. 1009).

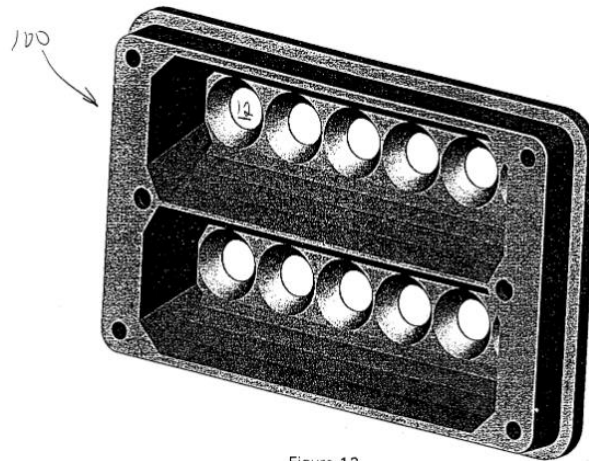


Figure 12

**Ex. 1009, Smith, Fig. 12**

34. I understand after many amendments and arguments in view of Smith's reflector, the following claim amendment was presented to the Examiner.

1. (Currently Amended) A light emitting diode (LED) lighting arrangement for a lighting fixture, comprising:

a base plate;

a lighting strip coupled to the base plate, the lighting strip comprising a plurality of light emitting diodes (LEDs) arranged along a substantially planar surface of the lighting strip;

~~a sheet-like~~ at least one reflector sheet comprising:

a first multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip with a first edge adjacent a first side of the lighting strip and extending at an angle along an entire length of the lighting strip; and

a second multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip, the second side wall having a first edge adjacent a second, opposite side of the lighting strip at an angle that extends along an entire length of the lighting strip,

wherein the first and second multi-faceted side walls extend away from the lighting strip at an angle and are configured to cause light produced by the plurality of light emitting diodes (LEDs) to be amplified and formed into a uniform beam, and

wherein the coupling between the lighting strips and the base plate provides heat transfer between the lighting strips and the base plate such that heat produced by the plurality of LEDs comprised in the lighting strip is conducted to the base plate for transfer to the ambient environment.

**Ex. 1002, '854 File History, Dec. 12, 2016 Amendment at 386-387**

35. Based on this amendment, I understand the Examiner provided a notice of allowance with the following reasons:

*Allowable Subject Matter*

Claims 1-17 and 20-26 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding independent claims 1 and 10, the prior art fails to teach or suggest a light emitting diode (LED) lighting arrangement for a lighting fixture comprising at least one reflector sheet comprising a first multi-faceted side wall of the at least one reflector sheet and a second multi-faceted side wall of the at least one reflector sheet, wherein the first and second multi-faceted side walls extend away from the lighting strip at an angle, and wherein the coupling/contact between the lighting strips and the base plate provides heat transfer between the lighting strips and the base plate such that heat produced by the plurality of LEDs comprised in the lighting strip is conducted to the base plate for transfer to the ambient environment in combination with the remaining limitations of the claims.

**Ex. 1002, '854 File History, February 10, 2017 Notice of Allowance at 406****IV. Qualifications of one of ordinary skill in the art**

36. I have reviewed the '854 Patent as well as the prior art documents. Based on this review and my knowledge of the relevant technology, it is my opinion that a person of ordinary skill in the art (abbreviated as "POSITA" throughout my declaration) would have a bachelor's degree in a relevant scientific field, e.g. physics, materials science or engineering, or electrical engineering, and two or more years of experience in the lighting design field dealing particularly with LED fixtures for lighting applications.

37. It is my opinion that this description is approximate and development experience could make up for less education or additional education could make up

for less development experience.

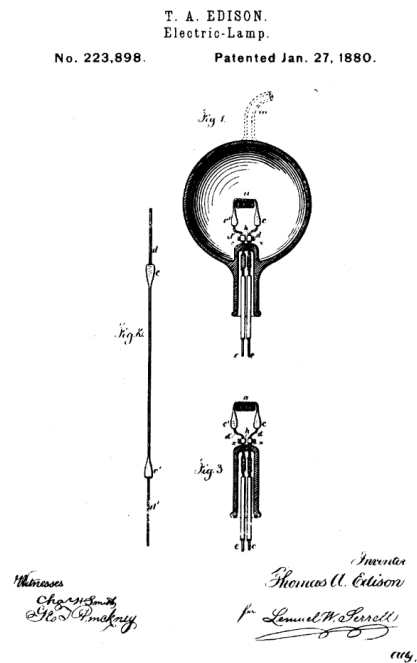
38. I also understand that this determination is made at the time of the invention, which I understand that the patentee purports as being the December 21, 2007 filing of U.S. Provisional Application No. 61/015,713 (“the ’713 Provisional,” Ex. 1008).

39. As I also discussed in my “Qualifications and Professional Experience” above, I am familiar with the level of knowledge and the abilities of a person having ordinary skill in the art at the time of the claimed invention based on my experience in the industry (both as an employee and as a professor).

## **V. State of the art**

### **A. Incandescent**

40. One of the oldest lighting technologies is the incandescent bulb where a body is heated to a high temperature and as a result sheds this energy as light. The incandescent light bulb was made commercially viable by Thomas Edison which he patented over 140 years ago. (*See* Ex. 1011, U.S. Patent No. 223,898.)

**Ex. 1011, U.S. Patent No. 223,898**

41. Even though incandescent lighting has been around for over a century, it has lower luminous efficacy than other technologies and has been shrinking in the lighting market.

42. Over the past several decades, governments have passed legislation to phase out the use of incandescent light bulbs. In the United States, the Energy Independence and Security Act (EISA) was signed into law by President Bush in 2007. The law not only set maximum power consumption limits on light source, but it also banned the sale or manufacture of any non-energy efficient incandescent light



bulbs. (Ex. 1012.<sup>1</sup>)

## **B. Metal-Halide**

43. Another lighting technology is a metal-halide light bulb. This type of lamp uses an electric arc through a gas mixture consisting of vaporized metal-halides and mercury. The metal halides are typically compounds of metals with bromine and iodine. The most common halide utilizes sodium iodide.

44. These lamps have a very high Color Rendering Index (CRI) meaning their spectrum closely matches that of the Solar spectrum and therefore renders colors accurately. Metal-halide lamps have higher luminous efficacies than incandescent lamps approximately 3-5 times higher (typical efficacies of 75-100 lumens per watt).

45. In terms of application, metal-halide lamps are typically used for wide-area general-purpose lighting such as warehouses, parking areas, stadiums, and retail stores. When xenon gas is used in the lamp they are referred to as xenon lamps which

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<sup>1</sup> How the Energy Independence and Security Act of 2007 Affects Light Bulbs \_ US EPA -<https://www.epa.gov/mercury/how-energy-independence-and-security-act-2007-affects-light-bulbs#:~:text=Basics%20of%20the%20Energy%20Independence,that%20are%20not%20energy%2Defficient>.

until recent years were commonly used as automobile headlamps.

46. Metal-halide lamps require a warm-up period of several minutes to reach full light output and proper color temperature (hue of light output). They also suffer from relatively short lifetimes of less than 15,000 hours. Another disadvantage is Metal-Halide lamps require the use of an electrical ballast which operates to limit the current, so the lamp does not fail when it exceeds the maximum power specifications.

### **C. Fluorescent**

47. A fluorescent lamp utilizes a two-step process for generating light. The first step energizes a low-pressure mercury-vapor that emits unwanted ultraviolet light. The second step converts the ultraviolet light to visible light using a mixture of rare-earth phosphors deposited on the inside of a glass envelope, typically a long cylinder. The combination yields a fairly efficient white light source with an efficacy of 50-100 lumens per watt, relatively low heat, and lifetimes of 24,000-36,000 hours.

48. The efficiency of fluorescent lamps has resulted in their utilization in a wide variety of applications. As a result, the form of the lamps is topographically varied while fundamentally the same. In general, fluorescents consist of a sealed glass enclosure using a mercury vapor at low pressure. The glass enclosure is typically a cylinder with a radius defined by the application and required light output. The most common is a long straight tube configuration known as a tube lamp having

sizes T5, T8, and T12 with varying diameters. Other applications call for the fluorescent lamp to be twisted into a helix to enable long tube length in a smaller volume. These are referred to as compact fluorescent lamps. This discussion will be limited to linear fluorescent tube lighting fixtures.



49. Tube lamps are utilized in several different types of fixtures. In general, they are all different linear-shaped enclosures incorporating reflective sides opposite the area to be illuminated. The reflective side can simply be a white coating on the inside of the fixture or include straight, curved, or parabolic flanges with either white or highly reflective coatings. These linear fixtures can either hang from the ceiling, called suspended fixtures, or recessed into a dropped ceiling grid, called troffer fixtures.

50. While more energy efficient than incandescent lights, fluorescent lights also have several known drawbacks. For instance, fluorescent lights include mercury which is a hazardous chemical. As such, the EPA recommends (and some states mandate) fluorescent lights be taken to recycling facilities for disposal. (Ex. 1013.<sup>2</sup>XX) Also, a ballast is required to power the fluorescent lights. For decades, fluorescent lighting ballasts were designed with polychlorinated biphenyls (PCBs) another hazardous chemical. The EPA therefore also issued guidance on how to dispose of older ballasts. (Ex. 1014.<sup>3</sup>XX)

51. Based on these and other known drawbacks, such as limited life expectancy, the government likewise began a phase-out for fluorescent lights which went into effect back in 2013. (Ex. 1014.XX)

#### **D. Light Emitting Diodes (LEDs)**

52. Light Emitting Diodes (LED) are different than other lighting technologies. An LED is a semiconductor light source fabricated on a silicon wafer in the same way Integrated Circuits (IC's, chips, microchips) are constructed.

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<sup>2</sup> Recycling and Disposal of CFLs and Other Bulbs that Contain Mercury \_ US EPA

- <https://www.epa.gov/cfl/recycling-and-disposal-cfls-and-other-bulbs-contain-mercury>

<sup>3</sup> <https://www.epa.gov/pcbs/disposal-fluorescent-light-ballasts-flb>

53. Electrical current passing between two different compound semiconducting materials (positive and negative doping) forming a band-gap junction. The band-gap difference is determined by the type of compound semiconductor materials used. When current passes through the band-gap, the difference in energy levels results in a surplus of energy which is shed by the emission of photons. These photons have a wavelength determined by the semiconductor materials used. If aluminum gallium arsenide (AlGaAs) is used, then red light is emitted. The use of Indium gallium nitride (InGaN) results in blue light being emitted.

54. Gallium Nitride-based blue light emitting LEDs have been known since the early 1990s. By 1992, blue light emitting LEDs using GaN films were available, and by 1994, blue light emitting LEDs using InGaN films were available. Nakamura, *The Roles of Structural Imperfections in InGaN-Based Blue Light-Emitting Diodes and Laser Diodes*, Science Magazine, Vol. 281, pp. 956-961 at 956-957 (August 14, 1998) (Ex. 1015); Nakada et. al., *Improved Characteristics of InGaN Multiple-Quantum-Well Light-Emitting Diode by GaN/AlGaN distributed Reflector Grown on Sapphire*, Applied Physics Letters, Vol. 76, No. 14, pp. 1804-1806 (April 3, 2000) (Ex. 1016). These LEDs were formed using a multi-layer semiconductor structure, including the n-type semiconductor layer, the active layer, and the p-type semiconductor layer, stacked on a substrate. (Ex. 1015, Nakamura at 956-958; Ex.

1016, Nakada at 1804-1805.)

55. On November 17, 1993, Shuji Nakamura, Takashi Mukai, and Naruhito Iwasa of Nichia Corporation, who had successfully demonstrated high-brightness blue LEDs using a gallium nitride growth process, filed a U.S. patent application that issued on November 11, 1996, as U.S. Patent 5,578,839 titled “Light-Emitting Gallium Nitride-Based Compound Semiconductor Device.” (Ex. 1017.) Furthermore, in 1994, Shuji Nakamura, Takashi Mukai, and Masayuki Senoh reported the first high brightness InGaN LEDs for blue emission. (Ex. 1018.<sup>4</sup>)

56. To produce white light, a phosphor coated LED (pc-LED) was realized by at least 1997. (Ex. 1019.<sup>5</sup>) As this article described, a phosphor material could be applied onto the blue LED. This yellow phosphor coating would then produce a visible white light as perceived by the human eye.

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<sup>4</sup> Nakamura et al., “*Candela-Class High-Brightness InGaN/AlGaN Double-Heterostructure Blue-Light-Emitting Diodes*,” Appl. Phys. Lett. 64, pp. 1687-1689 (1994).

<sup>5</sup> Mueller-Mach et al., *Highly efficient all-nitride phosphor-converted white light emitting diode*, Physica Status Solidi (A) Applications and Materials, Vol. 202, Issue 9 (June 6, 2005).

A layer of phosphor material is placed directly over a blue LED. Most of the blue light is converted to higher wavelengths spanning from about 400nm to 800nm corresponding to the perception of the human eye.

For a pc-LED, a short wavelength blue light emitting LED is used to excite luminescent materials (phosphors) which emit light of longer wavelengths (yellow) and then mix with the remains of the blue pump light to compose a desired color, e.g., white.

(*Id.* at 1727.)

57. In the years that followed up to the present day, Nakamura (who was awarded the Nobel Prize in 2014 for his work on the blue light LED) co-authored and published more than 200 LED related papers and patents. In particular, Nakamura's U.S. Patent 7,223,998 (Ex. 1020) titled "White, Single or Multi-Color Light Emitting Diodes by Recycling Guided Modes" discloses how to fabricate a high output blue light LED that is combined with fluorescent light converting layers using phosphors in the added layer that converts some of the blue light into longer wavelengths so that when longer wavelength light is combined with blue light from the LED, the resulting color perceived by the cone receptors in human eye is white light.

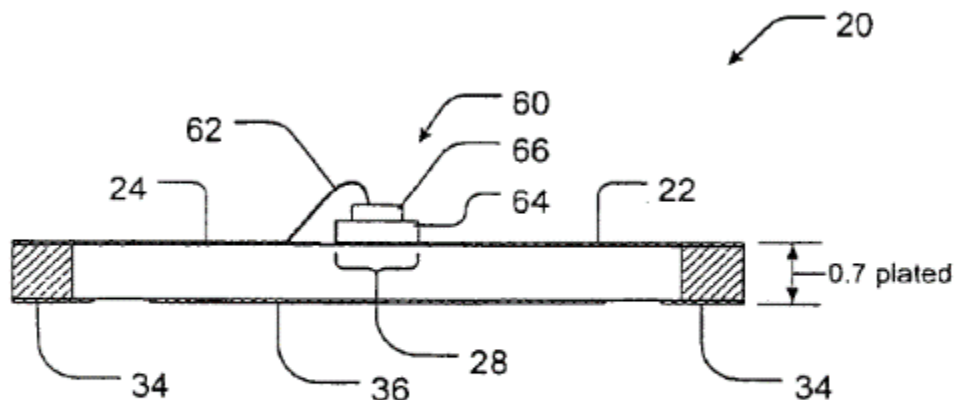
58. Furthermore, it had become common practice to employ "pick and place" in the assembly of surface mount device (SMD) design LEDs on PCBs to

assemble multiple LED on light engines, i.e., assembled on PCBs.

59. For example, U.S. Patent 7,405,093 (Ex. 1021) filed on August 18, 2004, published July 29, 2008, and titled “Methods of Assembly for a Semiconductor Light Emitting Device Package” discloses an LED SMD device that can be used for pick and place in the assembly of such LED devices.

60. U.S. Patent 7,405,093 (Ex. 1021) likewise teaches that a mount and a submount are integral design components of SMD LED devices, which makes possible surface mount “pick and place” assembly. Also, U.S. Patent 7,405,093 (Ex. 1021) discloses an LED assembly 60 including a submount 64 and a mounting pad 28, as shown in FIG. 2C. The use of insulating mounts such as mounting pad 28, as shown in FIG. 2C, was well known to allow for metal traces 22 and 24 be routed to the surface mount pads 34 used in assembly. These surface mount metal conductive pads on mounts such as mounting pad 28 enable SMD assembly on conventional “pick and place” assembly and reflow apparatus and machines prevalent for LED assembly.





**FIG. 2C**

**Ex. 1021, Fig. 2C**

61. It is generally understood present-day LEDs are significantly more efficient than incandescent, metal-halide, and fluorescent lamps. Initially, the light output was limited requiring hundreds of white LEDs to achieve comparable light levels to even the lowest incandescent lamps. Technological improvements have resulted in high-output white LEDs that are now commonplace in all areas of lighting. The small form factor of a single high-power white LED enables them to be used in a wide variety of applications and more importantly in initial lamp design or for retrofit lamps replacing prior halogen, fluorescent or incandescent light sources.

62. With regard to just fluorescent lighting, the drive to use LED lighting to retrofit or replace the most common fluorescent lamps T5, T8, and T12 troffer

style lights which had been in use for almost half a century began in the early 2000s – as described below.

LED lighting systems are becoming more prevalent as replacements for existing lighting systems. LEDs are an example of Solid state lighting and are Superior to traditional lighting Solutions such as incandescent and fluorescent lighting because they use far less energy, are far more durable, operate longer, can be combined in red-blue green arrays that can be controlled to deliver virtually any color light, and contain no lead or mercury.

(Ex. 1022, U.S. Pub. No. 2008/0089069, “Medendorp,” ¶0002.)

#### **E. Retrofitting Traditional Light Fixtures**

63. In the early years of LED adoption, it was common for existing light fixtures to be “retrofit” with LEDs rather than replacing the entire light fixture with an LED fixture. For example, it became commonplace to “retrofit” fluorescent tube fixtures with LED lighting fixtures because of their increased energy efficiency. Retrofitting can be much less expensive than replacing the entire fluorescent fixture with a new LED fixture because the retrofit kits tend to be less expensive than new fixtures, and the time and labor needed to install a retrofit kit is typically much less than the time to remove and replace an old fixture with a brand new one.

64. Indeed, one consideration in determining if a retrofit is feasible is the cost of the installation. Energy savings over time needs to offset the cost of

installation. The lower the cost of installation, the greater the savings that can be achieved. Therefore, the more easily that existing lighting fixtures can be replaced with more efficient lighting, the more money is saved.

65. A typical retrofit of the early 2000's involved removing the fluorescent bulbs and associated components and replacing them with an LED light engine. Here, the original reflector was again reused with the LEDs. The original reflector could direct the light produced by the LEDs and in a similar way as the fluorescent bulbs and thus did not require replacement of the reflector. This helped to minimize the costs of retrofitting traditional lighting fixtures with LEDs.

66. The use of traditional reflector designs was not limited to retrofit applications, and designers continued to employ traditional reflector designs even in light fixtures that were originally designed with LEDs. These reflectors were employed to help focus light produced by LEDs just like the light produced by filament or fluorescent lighting sources. Reflectors and optical lenses can be found in every LED luminaire for the purpose of distributing the light from the LED according to a desired lighting distribution. The reflectors and/or lens can be tuned for different applications, including streetlights, office lights, etc.

#### **F. Thermal Management**

67. While LEDs are more efficient than older technologies, they still may convert only about 50 percent of input electrical energy to heat (the other 50 percent

is converted to photons). As such, LED luminaires are designed with heat sinks for the purpose of cooling the LEDs during operation and for keeping the LEDs at a relatively low temperature. This is important since the efficacy and efficiency of the LED is temperature dependent. Additionally, the operating temperature also impacts the rate at which LED output illumination intensity deteriorates over time (maintenance factor) which is the rate of degradation relative to 5 and 10 years of operation.

68. After the invention of the blue light LED by Nakamura, there has been continued improvements in the efficacy and efficiency of LED devices for different areas of lighting such as indoor and outdoor lighting, such as streetlights. Since LEDs are still operating at about 50% efficiency for light production, there is the concern about keeping the temperature of the LEDs during operation as low as possible. Therefore, the problem of heat management is generally part of luminaire design.

69. It is known that LEDs exhibit negative temperature coefficient aspects, i.e., at fixed power input, as the device's operating heat rises, the device's light output decreases. The relationship between LED decrease in light output due to increased operation temperature can be expressed approximately as a negative linear relationship between the percentage light output and the degree Centigrade (C) increase in temperature. That is, as the LED's operating temperature increases one

degree C, the device will lose about one percent of its light output.

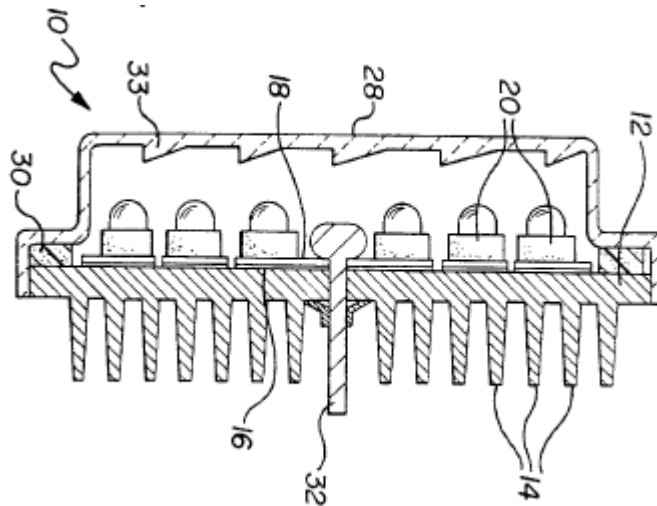
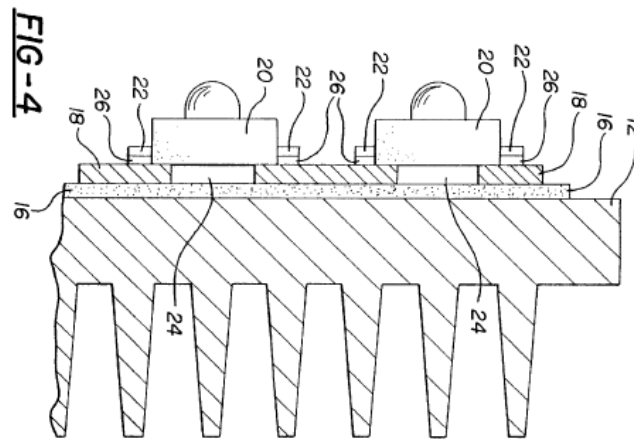
70. Physicists continue to work on reducing LED sensitivity to temperature. Nevertheless, the most effective, cost efficient, and practical way to maintain the LEDs at a lower operating temperature is to have the LEDs assembled on a heat sink. One commonly employed heat sink would include a metal plate having “fins” attached to maximize the surface area that exchanges thermal energy to ambient air.

71. The heat sink is found in most high-performance LED luminaires, dating back to the Nakamura invention in the 1990s.

72. For example, U.S. Patent 5,857,767 (filed Feb. 25, 1997) discloses a heat sink for the purpose of cooling a string of LEDs assembled on a PCB. (Ex. 1023.) As reproduced below, Figs. 2 and 4 illustrate LEDs 20 attached to their substrates 18, 22 and 26, that are in turn attached to a heat sink having a metal plate 12 and fins 14.

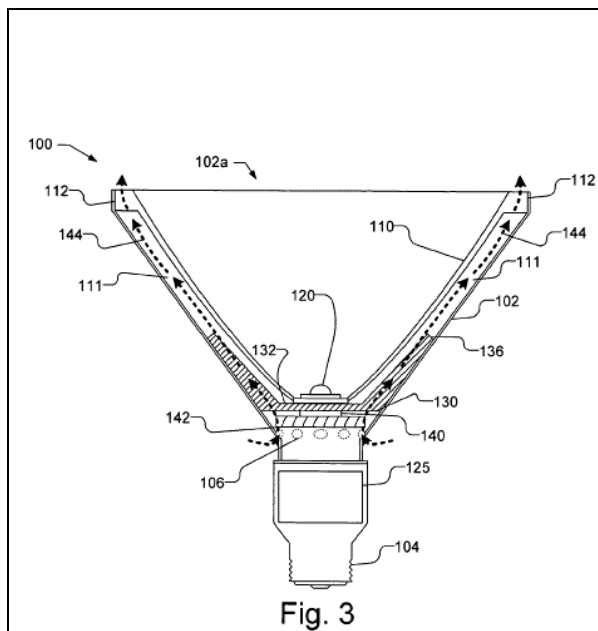
The lamp assembly 10 comprises an electrically and thermally conductive heat sink 12. In the preferred embodiment the heat sink 12 is made entirely (i.e., one hundred percent) of metal, preferably a homogenous aluminum or aluminum alloy which is also formed to include heat radiating fins 14 which dissipate heat.

(Ex. 1023 at 4:14-20.)

**Fig. 2 US '767****Fig. 4 US '767****Ex. 1023, Figs. 2 and 4**

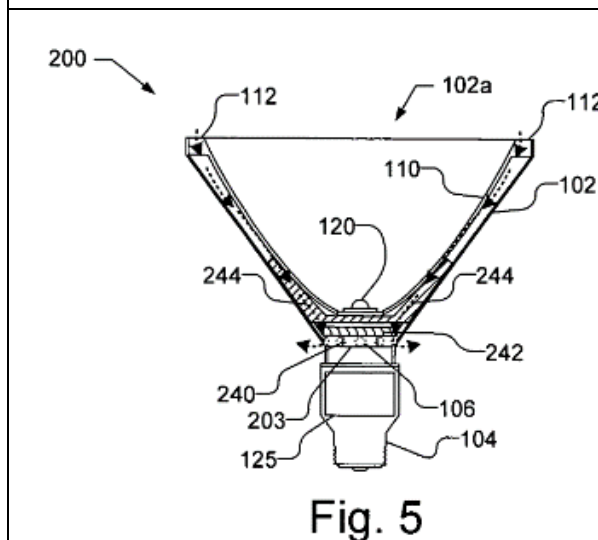
73. In addition, LEDs were also designed with other types of thermal heat management systems. For instance, U.S. Patent No. 7,144,135 (Ex. 1024) discloses an LED lamp with an exterior shell that has the same form factor as a conventional incandescent light bulb, such as a “PAR” type bulb. As shown by FIG. 3 below, the lamp is designed to include “inlet apertures 106” (i.e., holes) that allow air to

circulate through a “channel 11” and exit near the top of the lamp. Or (as shown by FIG. 5 below) a “fan 242” may be used to pull air into the “channel 112” and the “apertures 114” may be used to exhaust the hot air.



The shell 102 includes one or more apertures 106 near the base 104. Where a plurality of apertures 106 is used, the apertures 106 are approximately equally spaced around the circumference of the shell 102 near the base 104. By way of example, there may be 12 apertures 106, each with a radius of approximately  $\frac{1}{8}$  inch. **The apertures 106 serve as air intake or exhaust ports for the LED lamp 100.** If a single aperture is used in place of the plurality of apertures, the aperture should be relatively large to provide an adequate air flow.

(Ex. 1024, 2:66-3:8.)<sup>6</sup>



In another embodiment of the present invention, the direction of the air flow may be reversed. FIG. 5 illustrates a cross sectional view of a LED lamp 200, which is similar to LED lamp 100, like designated elements being the same. LED lamp 200, however, has the motor 240 and fan 242 reversed, with respect to the embodiment illustrated in FIG. 3. As shown in FIG. 5, the motor 240 is mounted to a plate 203 near the base 104 of the shell 102. **With the reversed configuration of the motor**

<sup>6</sup> All emphasis, italics and/or bold on text is added unless otherwise stated.

	<p><b>240 and fan 242, air is drawn through apertures 114, which thus serve as air inlet ports. The air is pulled through channel 111 and over the heat sink 130 and out apertures 106, which thus serve as exhaust ports. The air is illustrated in FIG. 5 as arrows 244.</b></p> <p>(Ex. 1024, 4:61-5:6.)</p>
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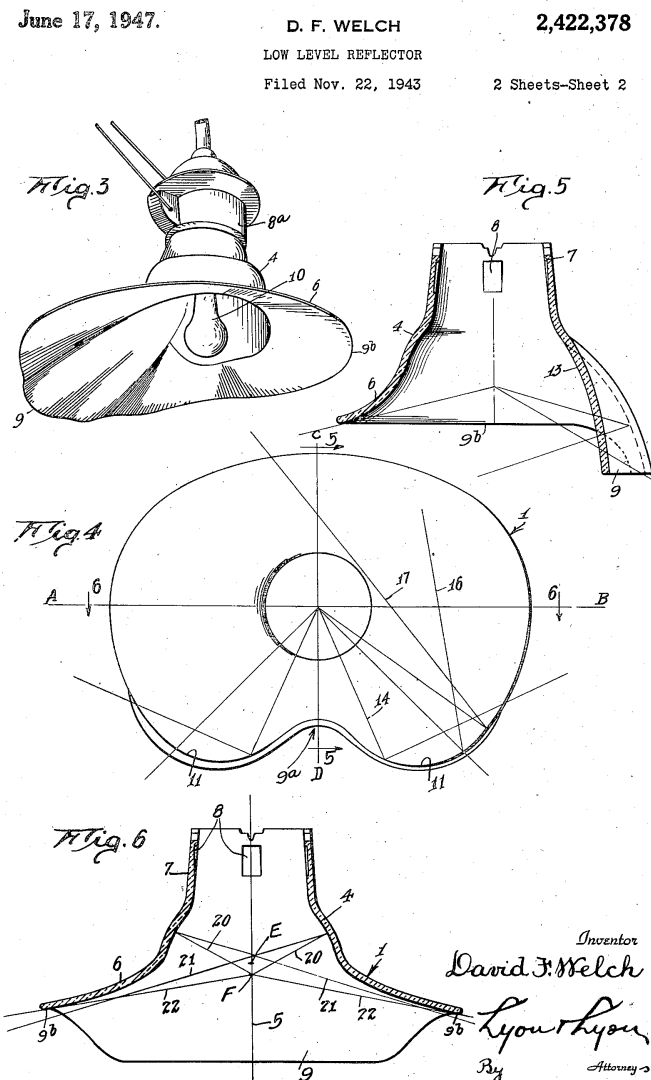
### **G. Reflector Design**

74. Since the invention of the filament light bulb, physicists and engineers have been designing light fixtures with lamps and other light sources for different applications such as indoor lighting, outdoor lighting including streetlights and architectural lights, signage lighting, etc. Critical to the practical application of the various types of light sources was, and still is, the use of reflectors to steer and focus the light source photons to an area of interest that is being illuminated.

75. For example, U.S. Patent No. 2,422,378 (Ex. 1025), issued to Welsh and titled “Low-Level Reflector,” discloses a light fixture for street illumination. In 1947, the publication date for this patent, optical physicists and engineers needed to design the reflectors and optics using hand drawn traces that followed the laws of optical physics. In Figs. 3-6, Welch shows a streetlight fixture having a multi-faceted reflector with multi-faceted reflector locations 4, 6, and 7. The figures show the hand drawn traces that emanate from the light source 10 to different surfaces, 4, 6 and 7,



on the multi-faceted reflector, and including a back section, 9b, that is in the shape of a parabola.



**Ex. 1025, Figs. 3, 4, 5 and 6**

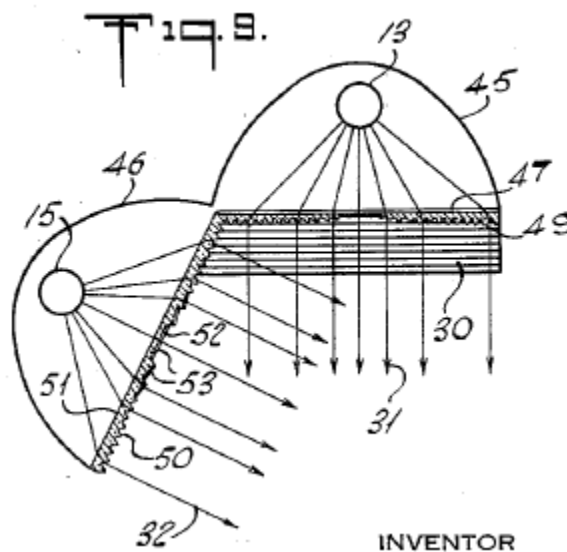
76. U.S. Patent No. 3,123,308 (Ex. 1026, "Franck") is titled "Fluorescent Street Lighting System" and discloses another example of early reflector. Franck discloses a streetlight with two light sources having reflectors that send the light to

different areas of the street. The shape of the reflectors appears to be elliptical (parabolic) since the light is at the focal points of the ellipses and are shown to reflect light beams parallel to each other as they are reflected away from the streetlight.

Claim 3 recites:

A system according to claim 1, in which the first and second reflectors are substantially parabolic troughs each enclosing one of the said light sources, the first refracting plate substantially closing the mouth of the first reflector and second refracting plate substantially closing the mouth of the second reflector.

(Ex. 1026, Franck at 5:71-6:2.)



**Ex. 1026, Franck, Fig. 8**

77. U.S. Patent No. 4,041,306 (Ex. 1027, “Compton”) titled “Luminaire and Reflector Therefor” discloses another example of a multi-faceted reflector

designed using hand drawn ray traces. The hand drawn ray traces show how and where rays of light from the light source are reflected from the multi-faceted reflector. This disclosure emphasizes that complex reflector designs were already widely used by 1975 and that they could be multi-faceted, parabolic, and free form, such as the reflector that Franck disclosed.

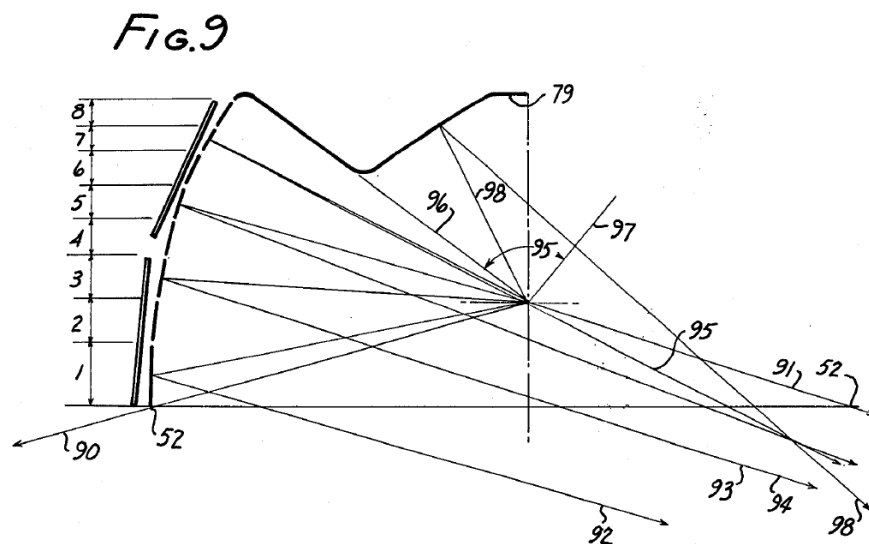


Fig. 9

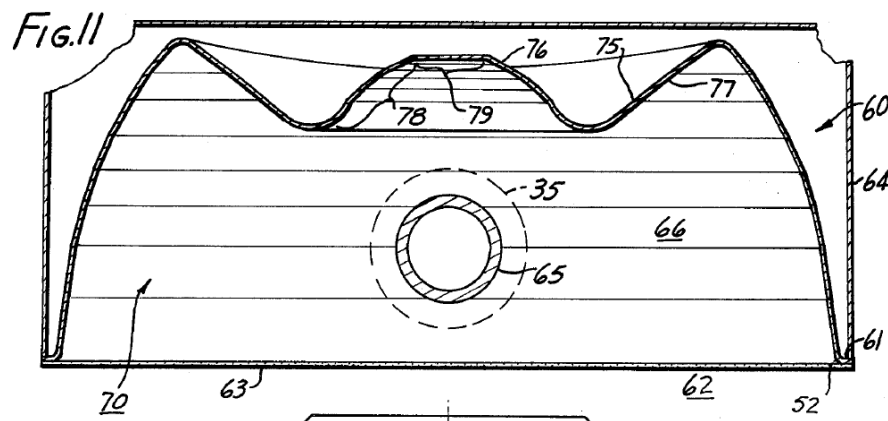


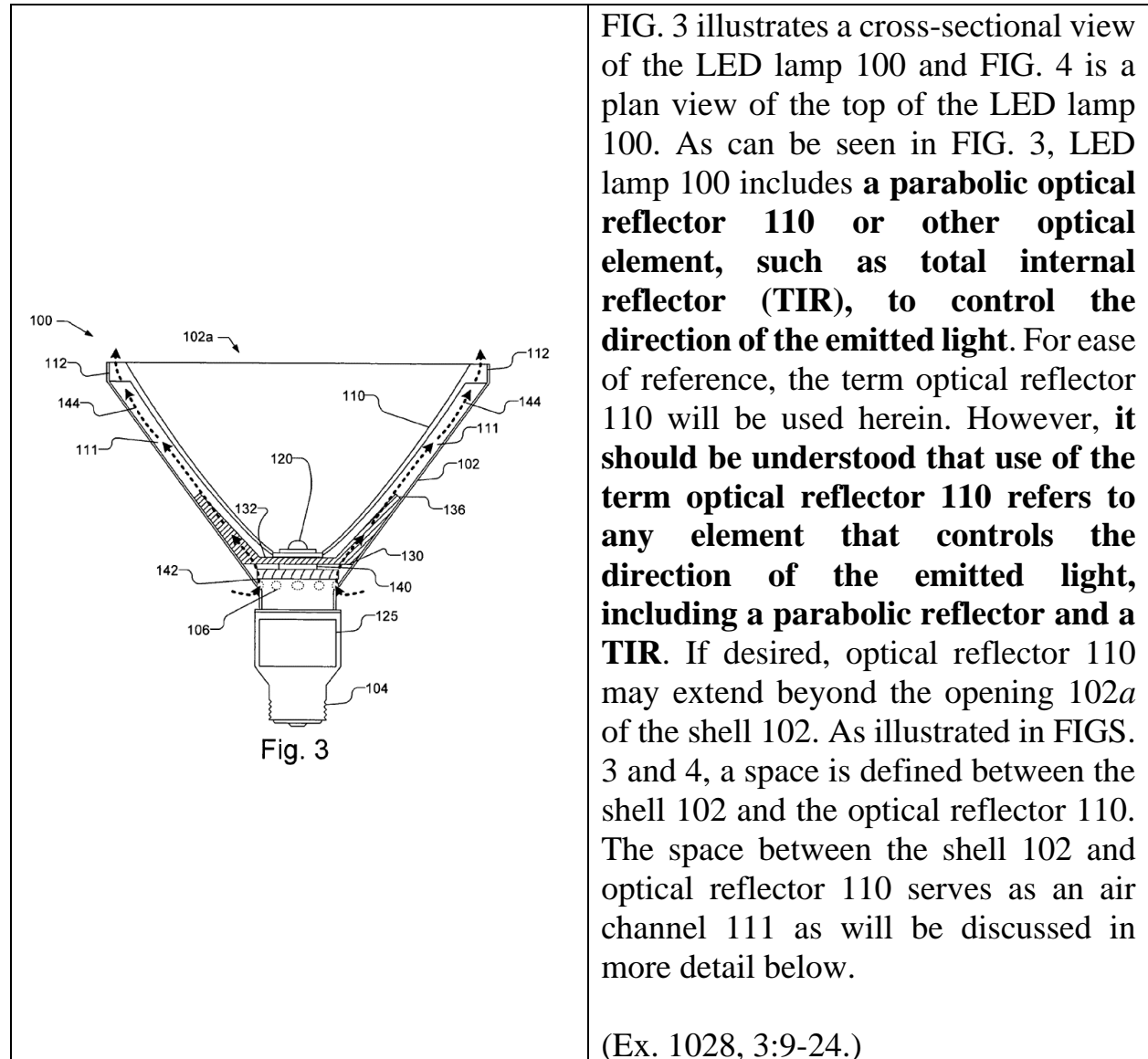
Fig. 11

Ex. 1027, Compton, Figs. 9 and 11

78. As shown in the prior art above, by the mid-1990s, reflectors of various shapes and sizes were designed to help focus the light output from different light sources well before the invention of the blue light LED by Nakamura in 1994.

79. The adoption of LEDs over traditional light bulbs did not remove the need for reflectors. Moreover, the change from light bulbs to LEDs did not require a rethinking of reflector design. Instead, designers and engineers continued to use either the same or similarly designed reflectors as was used in pre-existing lighting applications.

80. For instance, U.S. Patent 7,144,135 (Ex. 1028) again illustrates a LED PAR type lamp fixture that is used to replace pre-existing fluorescent PAR lamps. As shown below, Ex. 1028 describes a parabolic “reflector 110” being used to direct the light produced by the LEDs. As indicated, the design of the reflector may include a parabolic optical reflector or other optical elements of different shapes and properties, i.e., a total internal reflector may also be used for reflector 110.

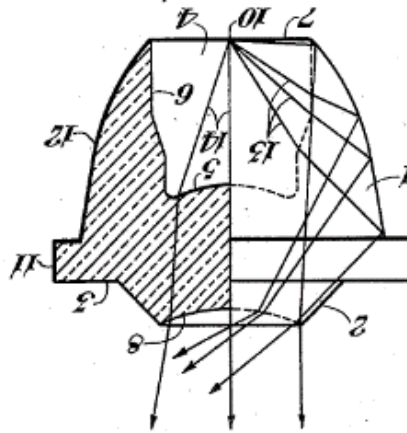


## 1. Ray Trace Analysis Background and Technology

81. As discussed above, reflectors were not only well known but have been designed using well-known ray trace analysis well-prior to the usage of LEDs. Previously, this process was done by hand and then transitioned to computer-aided design (CAD) as computer technology was developed.

82. In the early 1900s and into the first half of the 20<sup>th</sup> century, optical

engineers designed lighting fixtures by physically drawing light ray paths originating from the light bulbs. One example of this can be seen in U.S. Patent No. 2,908,197 (Ex. 1029) from the 1950s, showing light ray paths.



**Ex. 1029, Fig. 1**

83. Considering all the components that the light rays would interact with inside of the fixture, including the index of refraction and reflection characteristics of the material used for the optical component, the designers could make a rough estimate of the illumination intensity distribution of the light fixture output. However, manually drawing rays from the light bulb through the light fixture's reflective and refractive components was an arduous and time-consuming task. Hand drawing light rays from the light source to the various components the light ray interacted with prior to exiting the light fixture had limited accuracy. Often the design would not produce the desired light fixture output distribution, and several rounds of prototypes would need to be built to optimize and finalize the light fixture

design.

84. In 1957, Dr. Patrick M. Hanratty developed PRONTO, the first commercial numerical control programming (NCP) system. As PRONTO was commercialized, it was soon followed by the creation of another NCP called SKETCHPAD. The software code for SKETCHPAD was created by Ivan Sutherland in 1960 at MIT's Lincoln Laboratory. This invention, and the further development of computers, led to CAD, which ultimately resulted in a monumental leap forward in design methodology.

85. Computer-aided ray trace analysis was not only substantially faster than the hand drawing methods but was also much more accurate. Therefore, instead of having to produce a physical model for testing and iterating the design until the desired distribution was achieved, computerized ray trace analysis allowed for more accurate design files at a fraction the cost of building and testing physical models. Furthermore, the ability of ray trace programs to add a much higher degree of precision and accuracy in reflectance angles as well as refraction angles enables ray trace analysis to produce illumination intensity distribution results for new fixture designs that match the desired measured illumination intensity distribution output on the first prototype rather than requiring a series of prototypes.

86. For more than 20 years, it has been common practice to use CAD-based ray trace analysis to analyze millions of ray traces and produce accurate analyses in

virtual space, prior to building and testing a light fixture.

Because of this trend, optical-engineering software has become available in some programs, such as FRED from Photon Engineering, that incorporates multithreaded algorithms, making it possible to run single separate ray traces on each core and to accelerate ray-tracing speed by a factor almost equal to the number of cores and CPUs in the computer, minus the overhead associated with creating and managing these multithreading tasks. In four different actual systems, multithreaded algorithms sped up ray tracing by factors of 2.24 to 3.79 over single-threaded single-core raytracing (see table).

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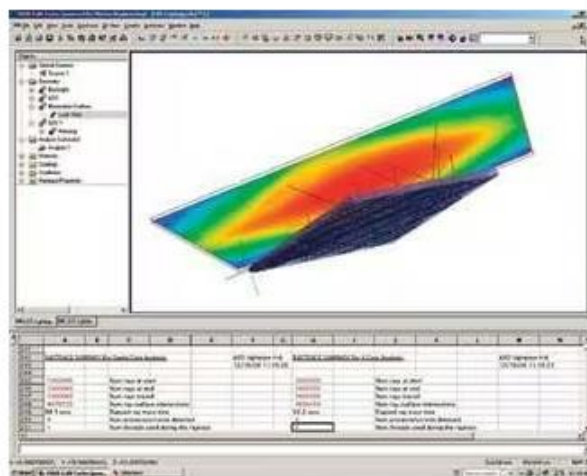
*A user simulating an LED backlight for uniformity issues, for instance, can trace 1 million rays in 1.5 minutes on a single core (see Fig. 1).* Simulating this same system using multithreaded algorithms and a quad-core computer accelerates this ray trace by a factor of 2.75, 72% efficiency per core.

Ex. 1030,<sup>7</sup> pp. 1-2.)

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<sup>7</sup> Michael Gauvin et al., “Multi-CPU architecture speeds ray tracing,” <https://www.laserfocusworld.com/software-accessories/software/article/16553028/multicpu-architecture-speeds-ray-tracing>





(Ex. 1030, Fig. 1, p. 3.)

88. This integration made it possible to produce fast and accurate optical lens designs in virtual space, thereby eliminating the need to make prototypes. The

combination of Photopia® and SolidWorks, based on the configuration concept of an LED light fixture design, i.e., the type of LED used and its Illumination Engineering Society (IES) output distribution file, the location of the LED relative to proposed reflectors and/or lenses, and the desired output distribution from the LED light fixture as might be defined by an IES specified distribution, such as a type of street light distribution referred to as Type I, Type II, Type III, Type IV or Type V, would produce the lens design and also define it as a SolidWorks file that would allow a plastic lens mold to be created to mass produce the lenses. Examples of these distributions are shown in National Lighting Product Information Program, Parking Lot and Area Luminaires, Vol. 9(1) (2004) (Ex. 1031).

89. The Photopia® software, along with products from other companies, use a library of standards for illumination intensity distribution such as the output distributions defined and published by the Illuminating Engineering Society of North America (IES or IESNA) going back to 1983, including the IES Standard for Roadway Lighting, RP-8-1983, and its successors, reaffirmed in 2005, RP-8-00 (2005) (Ex. 1033), and reaffirmed in 2014, RP-8-14 (2014) (Ex. 1034) and reaffirmed in 2019, RP-8-18 (2019). The IES defined illumination distributions of different types, namely, Types I through V. *See* RP-8-00 (Ex. 1033) and National Lighting Product Information Program, Parking Lot and Area Luminaires, Vol. 9(1) (2004) (Ex. 1031).

90. In sum, these standards define different lighting output distributions that became widely used throughout the world after they were published. For more than two decades, it was and remains common practice to use integrated programs to produce all forms of light fixtures or luminaires (including LED fixtures) with a specific IES illumination intensity output distribution in virtual space once a generic optical physics and engineering design parameters are defined for a LED light fixture.

**VI. Challenged Claims of the '854 Patent and Proposed Claim Constructions**

91. I have been asked to review claims 1-15 and 18-20.

92. In order to properly evaluate these claims, I understand that the terms of the claims must first be construed.

93. For purposes of this declaration, I understand the parties have offered the below constructions with regard to claim 1. I also understand the Western District of Texas has provided a preliminary claim construction for certain terms. I have applied the both parties and the W.D. Texas Court constructions for my analysis. For all other terms, I have applied a plain and ordinary meaning to each limitation.

<b>Term</b>	<b>ALSI Proposed Construction</b>	<b>Petitioner Proposed Construction</b>	<b>W.D. Texas Preliminary Claim Construction (Ex. 1032)</b>
the first and second multi-faceted side walls extend away from the lighting strip at an angle	Plain and ordinary meaning	the first and second multi-faceted side walls extend away from the lighting strip <i>at the same</i> angle	Plain and ordinary meaning

## **VII. Overview of the Prior Art**

### **A. U.S. Patent Pub. No. 2007/0121343 (“Brown”)**

#### **1. Status as Prior Art**

94. The application for U.S. Patent Pub. No. 2007/0121343 (Ex. 1036, “Brown”), Serial No. 11/554,403, was filed October 30, 2006. The publication date is May 31, 2007. Therefore, it is my understanding that Brown qualifies as prior art to the ‘854 Patent under 35 U.S.C. § 102.

#### **2. Overview of Brown**

95. Brown discloses an illumination device that includes LEDs, such as high-power white LEDs.

The present invention discloses an illumination device for illuminating users of a multimedia communication terminal. In particular, the illumination device includes high power white LEDs together with a reflector and a diffuser integrated in, or connected to, the terminal. Preferably, the light intensity and the position and angle relative to the terminal are controllable through a user interface.

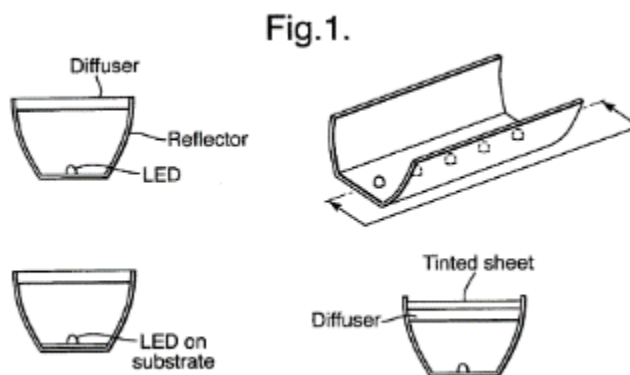
(Ex. 1036, Brown at Abstract.)

96. Brown recognized as early as 2005 an illumination device including a gutter-shaped reflector unit for use with a linear array of LEDs.

The present invention provides an illumination device for illuminating one or more users in front of a multimedia communication terminal comprising a gutter-shaped housing with a generally angular or U-shaped cross section consisting of a light reflecting material, a LED array including a number of light emitting diodes attached to the bottom of said gutter-shaped housing, and a diffuser sheet consisting of light diffusing, partly transparent material mounted on top of said gutter-shaped housing.

(Ex. 1036, Brown at ¶0016.)

97. As described with respect to Figure 1, Brown illustrates a LED lighting strip and a parabolic shaped reflector.



**Ex. 1036, Brown, Fig. 1**

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom. The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings. The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)

98. The reflectors of the reflector unit may be formed from a single folded sheet and the reflectors may have a parabolic shape. (Ex. 1036, Brown at ¶¶0016, 0026-0027, Fig. 1). “The design of the reflector may be adjusted to suit the application the light will be used for, and can for example be such that a focused beam of light can be projected a certain distance, alternatively the reflector can

spread the light over a wide area if required for short distance lighting.” (Ex. 1036, Brown at ¶0025.)

**B. U.S. Patent Pub. No. 2008/0089069 (“Medendorp”)**

**1. Status as Prior Art**

99. The application for U.S. Patent Pub. No. 2008/0089069 (Ex. 1022, “Medendorp”) was filed October 11, 2006. Therefore, it is my understanding that Medendorp qualifies as prior art under 35 U.S.C. § 102.

**2. Overview of Medendorp**

100. Medendorp discloses that “a more cost effective, lower weight, and lower physical profile approach to heat dissipation is highly desirable for solid state fixtures, such as LED-based lighting fixtures intended to replace standard fluorescent lighting fixtures.” (Ex. 1022, Medendorp at ¶0008.)

101. Medendorp discloses an “LED subassembly 450” that can be used in conventional lighting to retrofit (i.e., replace) the original fluorescent bulbs and associated components. (Ex. 1022, Medendorp at ¶¶0010, 0024, 0031, and Fig. 5.) The subassembly 450 includes a reflector 420, a circuit board 422, LEDs 404 attached to the circuit board 422, and a heat spreader 414. Medendorp’s design discloses “techniques for more efficiently transferring heat away from LEDs to the surrounding metal or other materials of a mounting fixture, such as the reflective metal of a luminaire fixture.” (Ex. 1022, ¶0008.) As I discuss below, Medendorp

teaches dissipating heat away from the LEDs to a top surface of the luminaire fixture.

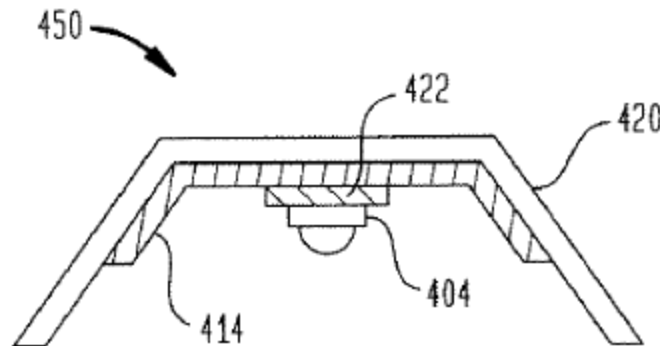


Fig. 5

**Ex. 1022, Medendorp, Fig. 5**

**C. U.S. Patent No. 6,257,735 (“Baar”)**

**1. Status as Prior Art**

102. The application for U.S. Patent No. 6,257,735 (Ex. 1037, “Baar”) was filed February 19, 2000 and the patent issued July 10, 2001. Therefore, it is my understanding that Baar qualifies as prior art to the ‘854 Patent under 35 U.S.C. § 102.

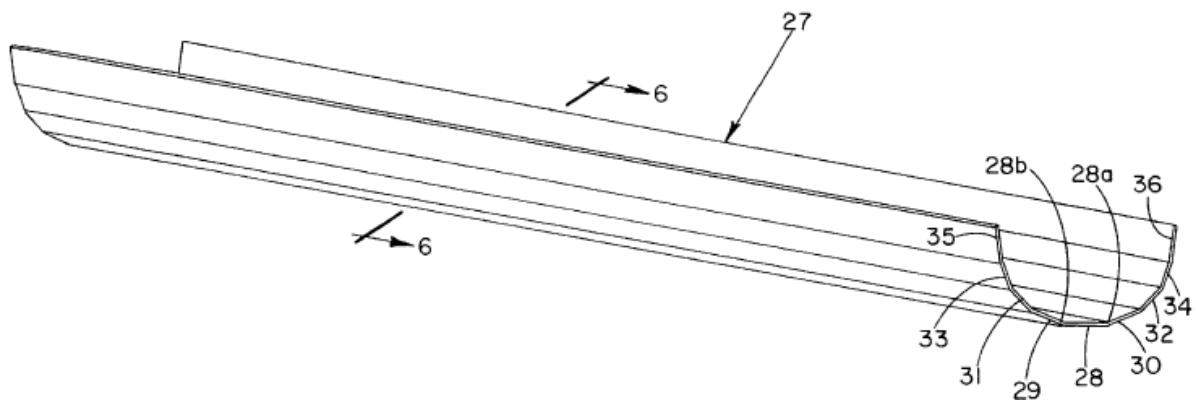
**2. Overview of Baar**

103. Baar discloses “an elongated light fixture configured to create patterns of light saturation which is free of shadows and spots and provides a more uniform light distribution while affecting a substantial saving in energy costs . . . In addition, such a plurality of light fixtures will produce a higher ratio of vertical to horizontal illuminance where vertical surfaces are needed to be amply lighted. The elongated fixtures characterized by its U-shaped cross-sectional configuration which has an



interior light-reflective surface comprised of a plurality of elongated parallel panels which are interconnected and extend at a prescribed angle to each other.” (Ex. 1037, Baar at Abstract.) Baar discloses his reflector is advantageous for sports arenas, warehouses, supermarkets, and other large areas. (Ex. 1037, Baar at 1:14-26.)

104. The reflector includes a channel member 27 having multifaceted sidewalls. The channel member 27 includes a bottom panel 28 interconnected with a plurality of other reflective panels, e.g., panels 30-36, joined in a U-shape such that the channel member 27 includes first and second reflector sidewalls. (Ex. 1037, Baar at 3:47-4:19.) This shape spreads out the light and also provides a much more uniform light distribution that reduces shadows. (Ex. 1037, Baar at 4:30-49.)



**Ex. 1037, Baar, Fig. 5**

**D. U.S. Patent 6,641,284 (“Stopa”)**

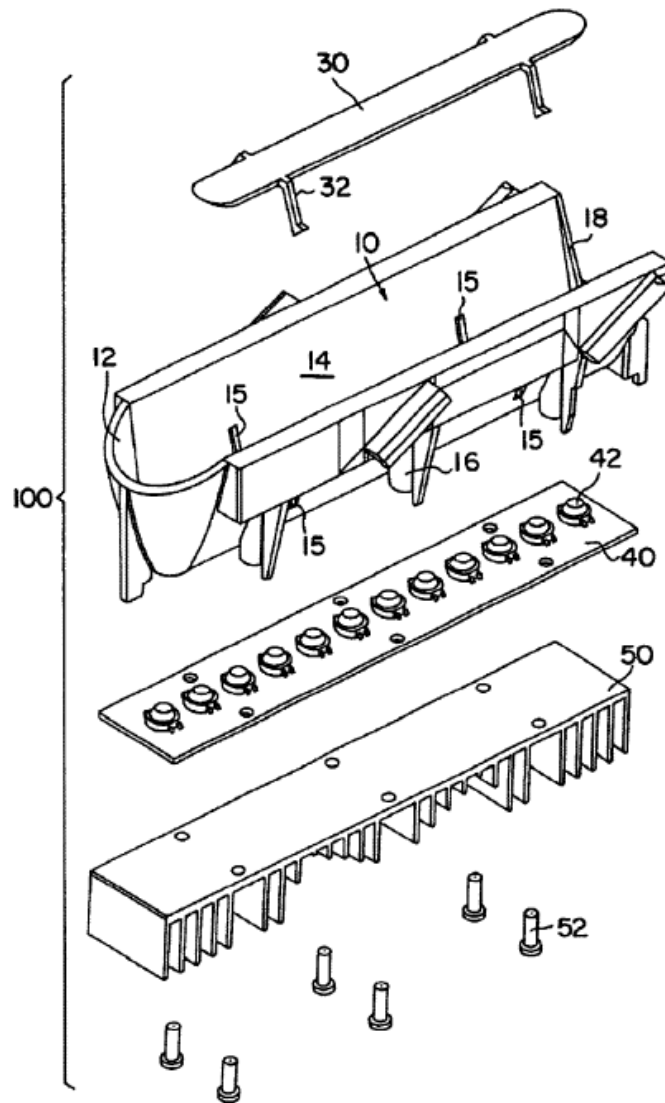
**1. Status as Prior Art**

105. The application for U.S. Patent No. 6,641,284 (Ex. 1038, “Stopa”) was

filed February 21, 2002 and the patent issued November 4, 2003. Therefore, it is my understanding that Stopa qualifies as prior art to the '854 Patent under 35 U.S.C. § 102.

## **2. Overview of Stopa**

106. Stopa discloses a LED light assembly 100 having a parabolic reflector 10. The reflector 10 includes a linear parabolic section 14, parabolic dish end 12, and either a second parabolic dish end or an opened end 18 depending upon the embodiment. (Ex. 1038, Stopa at Abstract, 5:5-27, 6:24-29.) The reflector 10 defines an open slot for receiving a linear array of LEDs 42 that are supported on a PC board 40. The reflector 10 is attached to a heat sink 50 with the PC board 40 is sandwiched therebetween. (Ex. 1038, Stopa at 4:59-65, 5:5-10.) The reflector 10 provides a uniform light output. (Ex. 1038, Stopa at 3:31-35.)



**Ex. 1038, Stopa, Fig. 1**

**E. U.S. Patent 6,318,886 (“Stopa II”, Ex. 1045)**

**1. Status as Prior Art**

107. The application for U.S. Patent No. 6,318,886 (Ex. 1045, “Stopa II”) was issued November 20, 2001. Therefore, it is my understanding that Stopa II qualifies as prior art to the ‘854 Patent under 35 U.S.C. § 102.

## 2. Overview of Stopa

108. Stopa discloses a one piece reflector for a LED light assembly. The reflector includes a “plurality of individual frustoconical reflectors 12” that are connected by “interconnecting grooves 14.” (Ex. 1045, Stopa II at 3:52-64.) As shown, the reflector includes three rows of LEDs. *Id.* Notably, Stopa II discloses a metalized coating can be applied to the surface of the reflector, which may be aluminum. *Id.* This reflective coating would provide a thin sheet of metal to the outer surface of the reflector. *Id.*

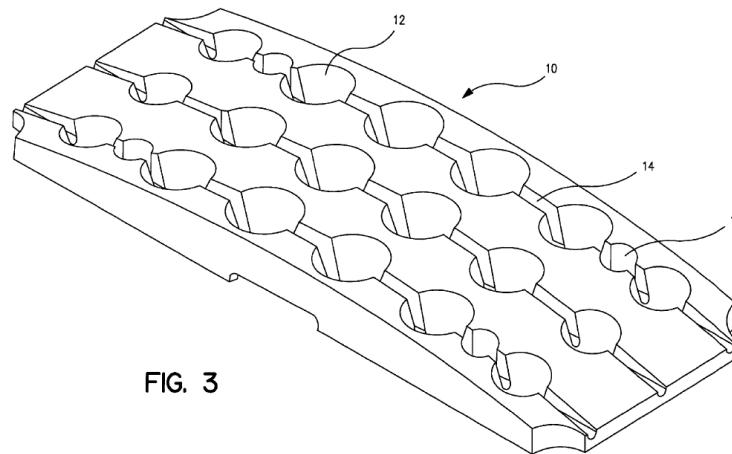
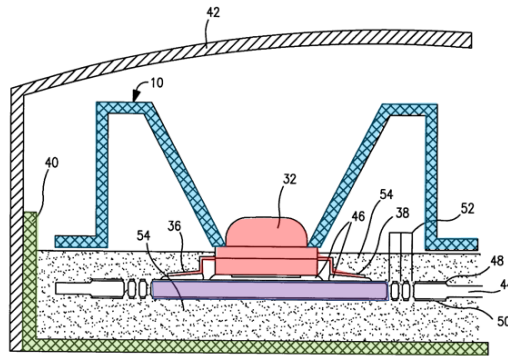


FIG. 3

### Ex. 1045, Stopa II, Fig. 3

109. As illustrated above, Stopa II’s reflector could receive three linear rows of LEDs. (Ex. 1045, Stopa II at 3:50-65.) Shown further below is a cross section which illustrates Stopa II’s reflector (blue) surrounding one of the LEDs (red) which is assembled on a printed circuit board (purple). (Ex. 1045, Stopa II at 4:54-63.)

Stopa II discloses the heat generated by the LEDs may be dissipated to the “conductive base” (green). (Ex. 1045, Stopa II at 4:64-5:46.)



**Ex. 1045, Stopa II at Fig. 3 and 7.**

## **VIII. Grounds for Challenge**

**A. Ground 1 – Claims 1-15 and 18-20 are obvious in view of U.S. Patent No. 6,641,284 (Stopa), U.S. Patent No. 6,318,886 (Stopa II), and the knowledge of a POSITA**

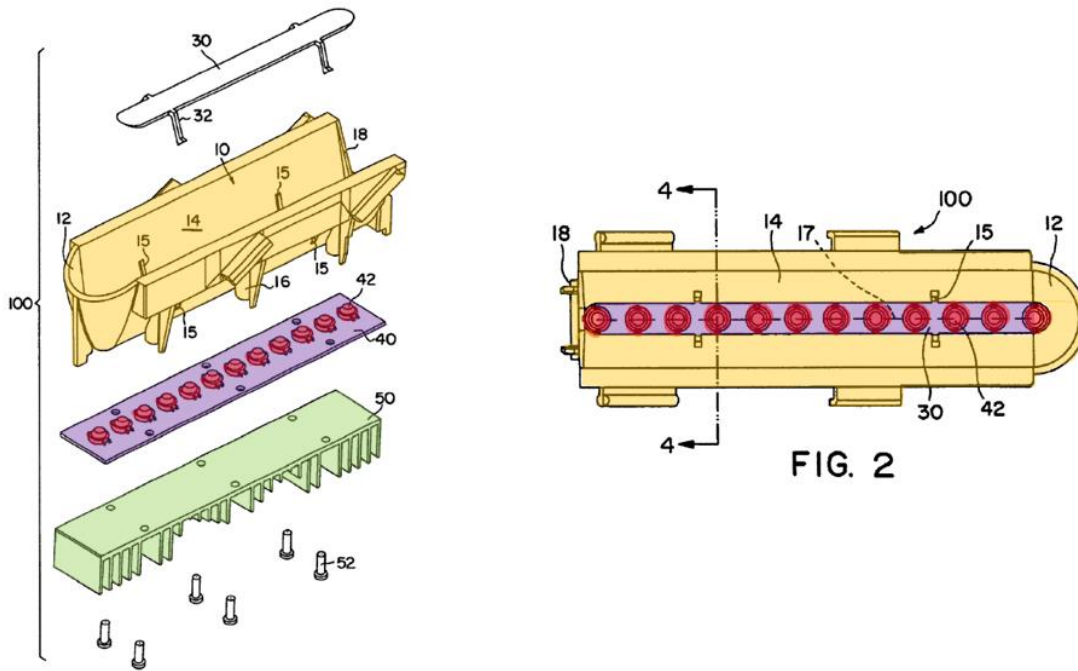
### **1. Claim 1**

***[1.0] A light emitting diode (LED) lighting arrangement for a lighting fixture, comprising:***

110. It is my understanding that a preamble is not limiting where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention. While it is my understanding the preamble may not be limiting, Brown does disclose this limitation.

111. For instance, Stopa discloses a LED light assembly (i.e., lighting fixture) that includes a reflector (orange) having: (1) parabolic side-walls; (2) a linear row of LEDs (red) assembled onto a printed circuit board (purple); and (3) a heat

sink (green). Specifically, as shown in Figure 2, the reflector has an open slot to receive the linear row of high-output LEDs (*i.e.*, *LED lighting arrangement*) used for illumination.



**Ex. 1038, Stopa, Figs. 1 and 2<sup>8</sup>**

FIG. 1 is an exploded view of *an LED light assembly 100* in accordance with the present invention. The LED light assembly 100 includes a reflector 10 having a linear parabolic section 14, a PC board 40 with a plurality of high-output LEDs 42 arranged in a linear array and a heat sink 50 configured for assembly adjacent the rear side of the PC board.

(Ex. 1038, Stopa at 4:59-65.)

<sup>8</sup> All coloring and red-annotations are added unless otherwise noted.

An light source utilizes a parabolic reflector to collimate light emitted from at greater than a predetermined angle relative to the optical axis of an LED arranged at the focus of the reflector. An optional collimating lens is arranged to collimate light emitted at less than the predetermined angle. Both variations provide light in the form of a substantially collimated beam. The parabolic reflector is preferably extended along its focal point to form a linear parabolic section having a linear focal axis. A linear array of LEDs is arranged such that the linear focal axis passes through the area of light emission of each LED. The linear parabolic section may be provided with parabolic dish ends. Alternatively, the ends of the parabolic section may be left open for increased wide angle visibility.

(Ex. 1038, Stopa at Abstract.)

The reflector 10 has a linear parabolic section 14 that defines a linear focal axis 17 extending the length of the parabolic section 14. With particular reference to FIGS. 2 and 4, the rear of the reflector 10 (adjacent the focal axis 17) is configured as an open slot to ***receive and align the array of high-output LEDs 42 with the focal axis 17.***

(Ex. 1038, Stopa at 5:5-10.)

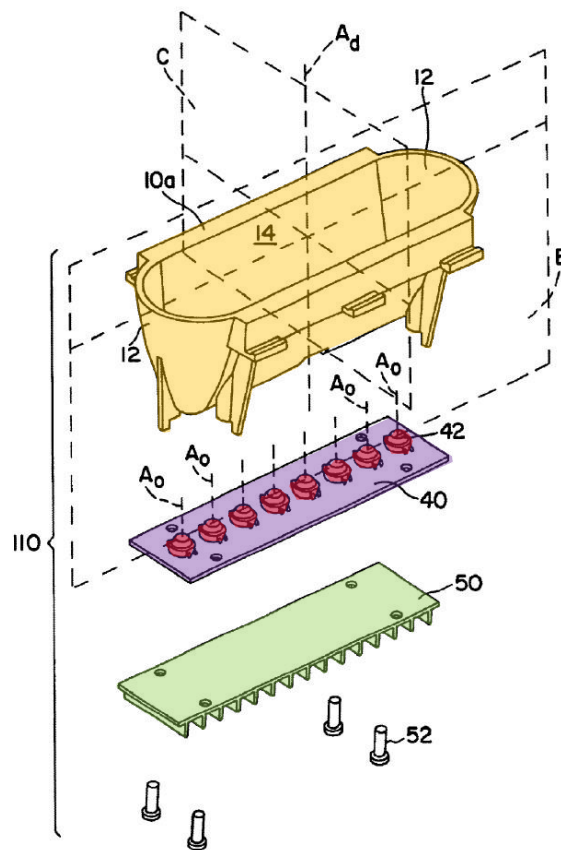
**FIG. 7****Ex. 1038, Stopa, Fig. 7**

FIG. 7 illustrates an alternative LED light assembly 110 in which the linear parabolic reflector 10a is closed at both ends by parabolic dish ends 12. Similar in configuration to the dish end 12 described with reference to the embodiment illustrated in FIGS. 1-6. It will be noted that the embodiment of FIG. 7 does not include the optional collimating lens 30 or its associated mounting grooves 15. As previously discussed, LEDs are primarily directional point light sources. The linear parabolic section 14 and associated parabolic dish ends 12 redirect “wide angle” light from the LEDs as previously discussed. Even without an optional collimating lens, the light output from the embodiment of FIG. 7 is



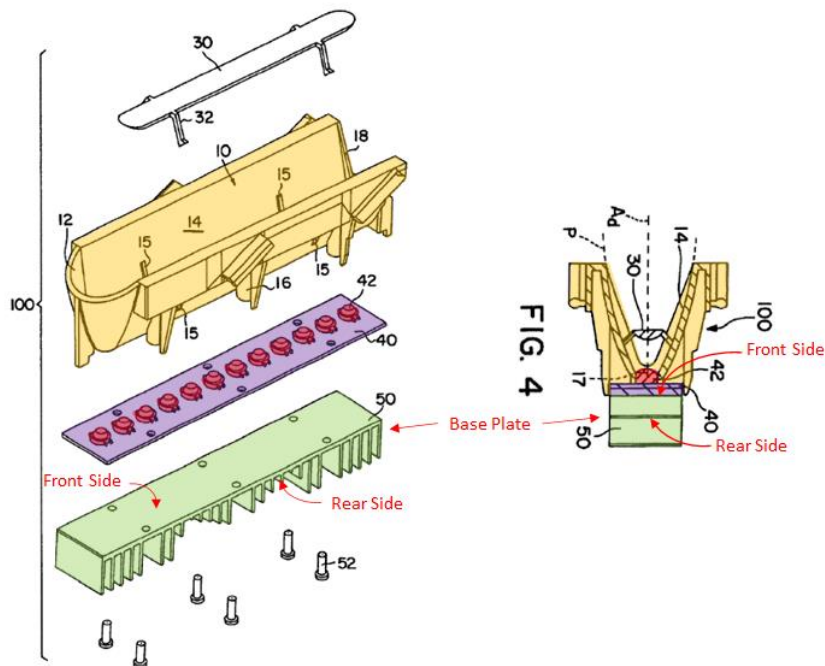
organized into a wide angle beam and may be efficiently focused or directed in accordance with the needs of the lighting application.

(Ex. 1038, Stopa at 6:24-39.)

112. Stopa discloses limitation [1.0].

**[1.1] a base plate;**

113. Stopa discloses a heat sink (green below) that includes a flat surface or plate having a front side and rear side. The PC board (with LEDs) is assembled on the front side of the heat sink's surface. The rear side of the heat sink includes conventional fins that allow for the heat generated by the LEDs to be dissipated to the ambient environment. The heat sink (particularly the front side surface) would satisfy the recited *base plate*.



**Ex. 1038, Stopa, Figs. 1 and 4**

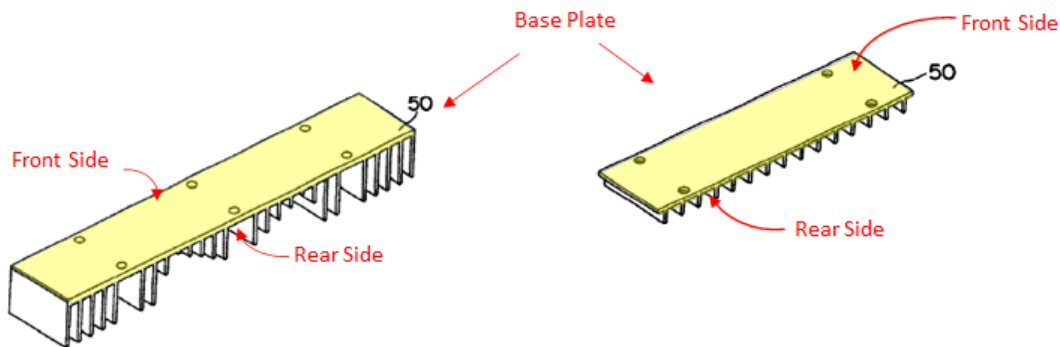
FIG. 1 is an exploded view of an LED light assembly 100 in accordance with the present invention. The LED light assembly 100 includes a reflector 10 having a linear parabolic section 14, a PC board 40 with a plurality of high-output LEDs 42 arranged in a linear array and *a heat sink 50 configured for assembly adjacent the rear side of the PC board.*

(Ex. 1038, Stopa at 4:59-65.)

FIG. 4 clearly illustrates that the *PC board 40 is sandwiched or tightly compressed between the rear end of the reflector 10 and a conventional finned heat sink 50.* This compressed relationship is maintained by fasteners 52 passing through the heat sink 50 and PC board 40 to engage fastener receptacles 16 molded in the reflector 10. A tightly compressed relationship enhances thermal transfer between the PC board 40 and the heat sink 50. Thermal transfer can further be enhanced by copper cladding on both sides of the PC board, copper-clad through holes and/or thermally conductive adhesives or materials disposed between the PC board and the heat sink. The slugs 49 of each LED are mounted to the PC board in such a manner as to enhance heat transfer from the slug to the copper cladding of the PC board. Although a conventional finned heat sink is illustrated, numerous heat absorption and transfer mechanisms are known in the art and may be appropriate for incorporation into an LED light assembly 100 in accordance with the present invention. Conducting heat away from the high output LEDs is important because overheating interferes with the efficient operation and seriously shortens the life of an LED as is known in the art.

(Ex. 1038, Stopa at 5:56-6:10.)

114. Specifically, as I have further annotated below, the heat sinks disclosed by Figures 1 and 7 include a flat plate surface (highlighted yellow) that is meant to receive the bottom side of the PC board. This plate surface includes a front side and rear side. The variations of the heat sink (base plate) shown below show the fins can be made smaller, larger, or the same. Fins provide additional surface area for allowing the dissipation of heat generated by the LEDs.

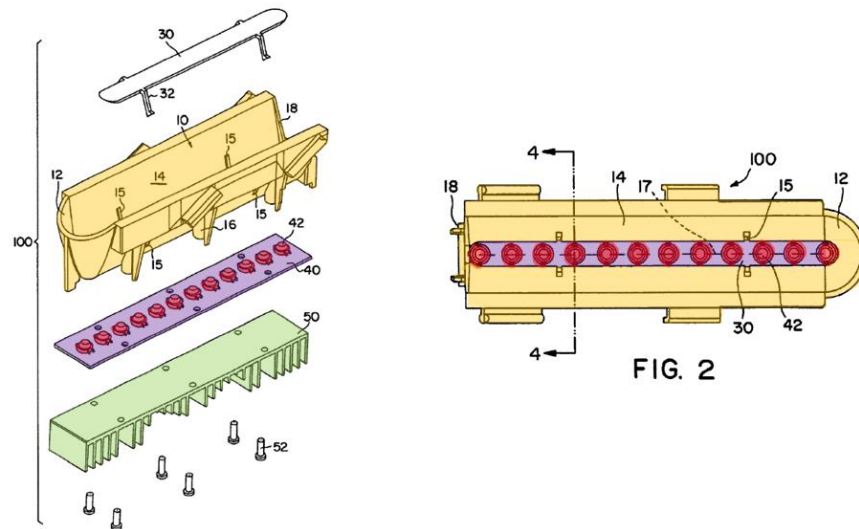


**Figs 1 and 7 (showing just heat sink)**

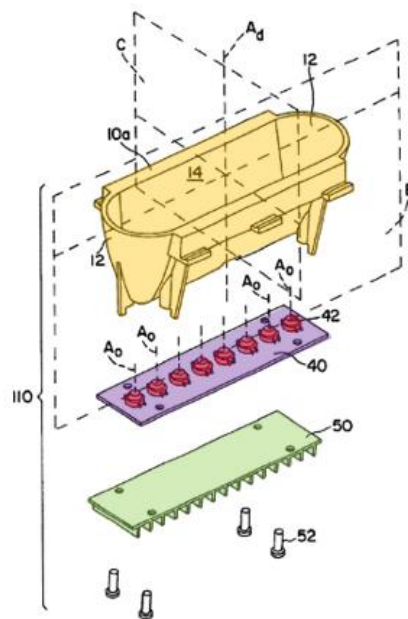
115. Stopa disclose limitation [1.1].

***[1.2] a lighting strip coupled to the base plate, the lighting strip comprising a plurality of light emitting diodes (LEDs) arranged along a substantially planar surface of the lighting strip;***

116. Stopa illustrates and discloses a linear row of high-output LEDs (red) that are arranged/assembled on the top flat planar surface of a printed circuit board (purple). The printed circuit board and LEDs satisfies the recited *lighting strip*.



**Ex. 1038, Stopa, Figs. 1 and 2**



**FIG. 7**

**Ex. 1038, Stopa, Fig. 7**

In accordance with the present invention, a linear array of high-output LEDs is arranged on a printed circuit board (PC board).

(Ex. 1038, Stopa at 3:24-26.)

FIG. 1 is an exploded view of an LED light assembly 100 in accordance with the present invention. The LED light assembly 100 includes a reflector 10 having a linear parabolic section 14, a PC board 40 with a plurality of high-output LEDs 42 arranged in a linear array and *a heat sink 50 configured for assembly adjacent the rear side of the PC board.*

(Ex. 1038, Stopa at 4:59-65.)

*FIGS. 1 and 7 illustrate a linear array of LEDs mounted to a PC board* in accordance with the present invention. The LEDs in the illustrated embodiments are mounted approximately 12 mm apart center to center. Center to center spacing of less than approximately 9 mm is difficult in view of the overall size of the chip package.

(Ex. 1038, Stopa at 6:11-17.)

117. Again, and as illustrated above, the bottom surface of the printed circuit board is coupled to the heat sink's front side – i.e., top surface. As I explained in limitation [1.1] above, the heat sink is a *base plate*. The PC board with LEDs (*i.e., lighting strip*) is therefore coupled to the claimed *base plate*.

FIG. 4 clearly illustrates that the *PC board 40 is sandwiched or tightly compressed between the rear end of the reflector 10 and a conventional finned heat sink 50*. This compressed relationship is maintained by fasteners 52 passing through the heat sink 50 and PC board 40 to engage fastener receptacles 16 molded in the reflector 10. A tightly compressed relationship enhances thermal transfer between the PC board 40 and the heat sink 50. Thermal transfer can further be

enhanced by copper cladding on both sides of the PC board, copper-clad through holes and/or thermally conductive adhesives or materials disposed between the PC board and the heat sink. The slugs 49 of each LED are mounted to the PC board in such a manner as to enhance heat transfer from the slug to the copper cladding of the PC board. Although a conventional finned heat sink is illustrated, numerous heat absorption and transfer mechanisms are known in the art and may be appropriate for incorporation into an LED light assembly 100 in accordance with the present invention. Conducting heat away from the high output LEDs is important because overheating interferes with the efficient operation and seriously shortens the life of an LED as is known in the art.

(Ex. 1038, Stopa at 5:56-6:10.)

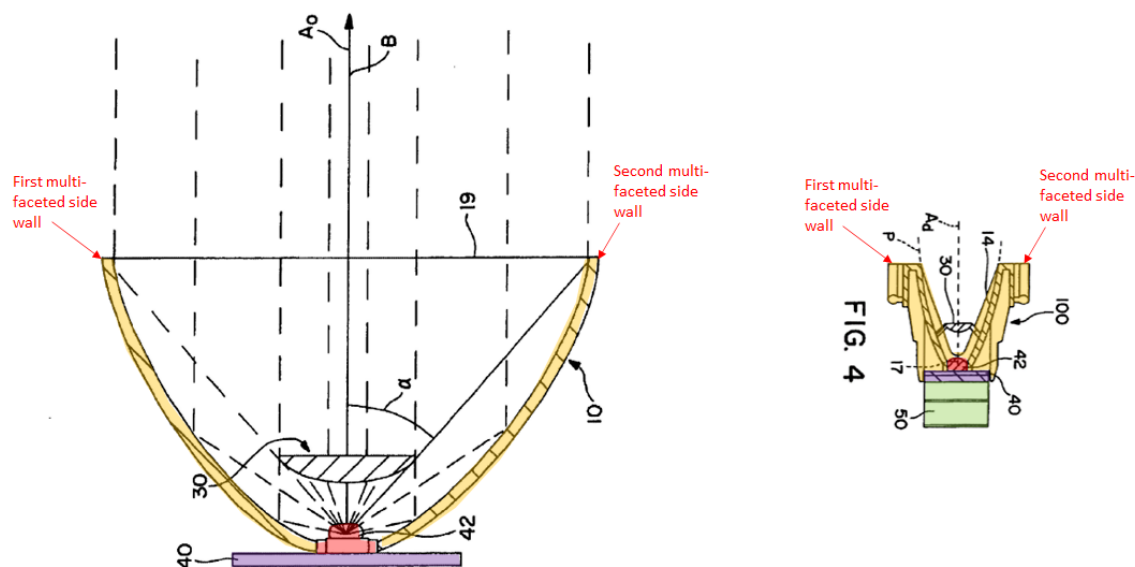
118. Stopa discloses this limitation.

***[1.3] at least one reflector sheet comprising***

119. The '854 Patent generally describes a reflector constructed of a "a sheet of silver-coated aluminum with a protective polymer coating." (Ex. 1001, '854 Patent at 18:39-40.) However, the '854 Patent discloses a reflector sheet can be "any highly-reflective material ... used to construct the reflector assemblies." (Ex. 1001, 18:43-46.) A POSITA would understand reflector sheet as being any highly-reflective material used to form the reflector assembly. Stopa discloses a reflector sheet.

120. Stopa discloses a single parabolic reflector sheet (orange) that includes

two side walls whose shapes may vary from being narrow, tall and steep to side walls that are shaped to be shallow and wide. Stopa states the parabola is used to define the “reflecting surface.” Stopa even claims a reflector having a “concave reflecting surface” that flares from an “inner vertex to an open outer end.” (Ex. 1038, Stopa at 8:66-93.) This reflecting surface is the inner walls of the reflector assembly. As shown below, this inner reflecting surface is designed from a reflective material. The inner walls of Stopa’s reflector would be understood as being a *reflector sheet*.



### Ex. 1038, Stopa, Figs 4 and 8

It should be noted that a parabolic *reflector may be configured to be very narrow, tall and steep or shallow and wide, depending on mathematical definition of the parabola used to define the reflecting surface*. In a steep and narrow parabolic reflector, angle  $\alpha$  will be

correspondingly small as the reflector will capture and redirect a greater portion of the light emitted from the LEDs. In a broader, shallower parabola, angle  $\alpha$  will be greater and an associated collimating lens 30 correspondingly wider to achieve the same functionality, i.e., light output in the form of a substantially collimated beam of parallel rays. The depth and configuration of the parabolic reflector will vary in accordance with design constraints and the requirements of the lighting application.

(Ex. 1038, Stopa at 7:54-67.)

121. Regardless, by 2007 a POSITA understood that it was known and common to use a material having highly reflective properties for redirecting light – e.g., aluminum. (Ex. 1031 at pg. 9.) A POSITA would have understood highly reflective materials such as aluminum are capable of reflecting and directing light emitted from a light source. Indeed, reflective materials such as aluminum were known and commonly used for nearly a century in traditional incandescent and fluorescent light fixtures. A POSITA understood that the reflectors could be hydroformed aluminum or formed using a punching process. *Id.* A POSITA also understood that by 2004 “one-piece reflectors” could be “manufactured economically” and would “perform consistently.” *Id.* As such it would have been obvious to form Stopa’s reflector out of a highly reflective material (e.g., a one-piece aluminum) using these known processes.

122. To the extent it is argued Stopa’s reflector is not a single reflector sheet,



it is my opinion that Stopa teaches and therefore renders obvious constructing the recited “one reflector sheet.” For instance, Stopa describes as prior art a commonly assigned patent which describes a high-flux LED assembly surrounded by a reflector.

U.S. Pat. No. 6,318,886, assigned to the assignee of the present invention, the entire contents of which are hereby incorporated by reference into this specification, describes a high-flux LED assembly in which an array of LEDs are provided with a reflector surrounding each LED.

(Ex. 1038, Stopa at 2:20-24.)

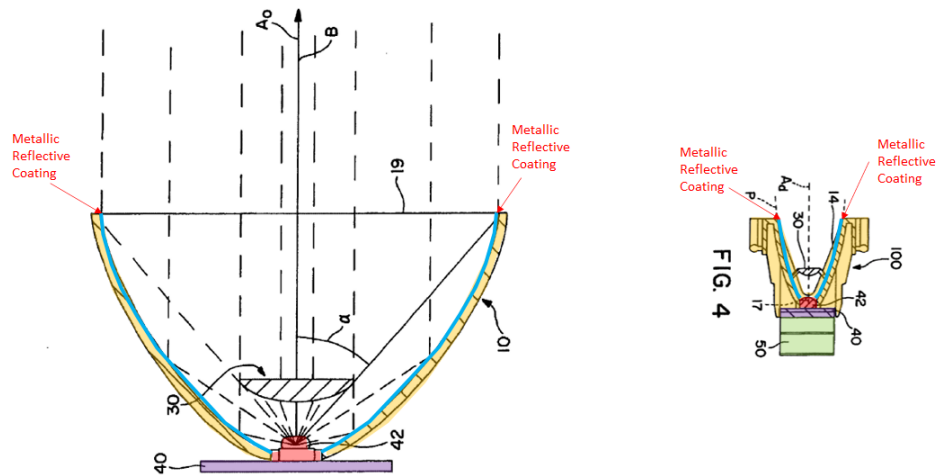
123. In describing the reflector, U.S. Pat. No. 6,318,886 (Ex. 1045, “ Stopa II”) discloses a one-piece plastic molded assembly upon which a metallic sheet would be applied to provide a reflective coating. Stopa II states the preferred coating would be an aluminum film that is applied by vacuum deposition.

A one piece reflector assembly which cooperates with an array of eighteen LED's is indicated generally at 10 in FIG. 3. The assembly 10 includes a plurality of individual frustoconical reflectors 12. The reflectors 12, which may be better seen from and will be described in the discussion of FIG. 4, are arranged in rows and columns, i.e., a matrix of closely spaced reflectors 12 is presented. In the disclosed embodiment the matrix comprises three rows and six columns. ***The assembly 10 is preferably a molded plastic component which will be metalized to provide a reflective coating on all of the forward facing***

*surfaces thereof. The reflective coating, which has not been separately shown, will typically be a film of aluminum applied by vacuum deposition.*

(Ex. 1045, Stopa II at 3:50-63.)

124. It is my opinion that it would have been obvious to include the metallic coating to Stopa's reflector for providing a highly reflective coating. A POSITA would have understood and known how to apply this metallic coating using the vacuum deposition disclosed by Stopa II. A POSITA would have understood based on the express teachings of Stopa incorporating the teachings of Stopa II that it would have been obvious to try applying the metallic coating to help increase the reflective properties of Stopa's reflector design. Once applied, a POSITA would consider the metallic reflective coating (e.g., aluminum coating) a metallic reflector sheet.



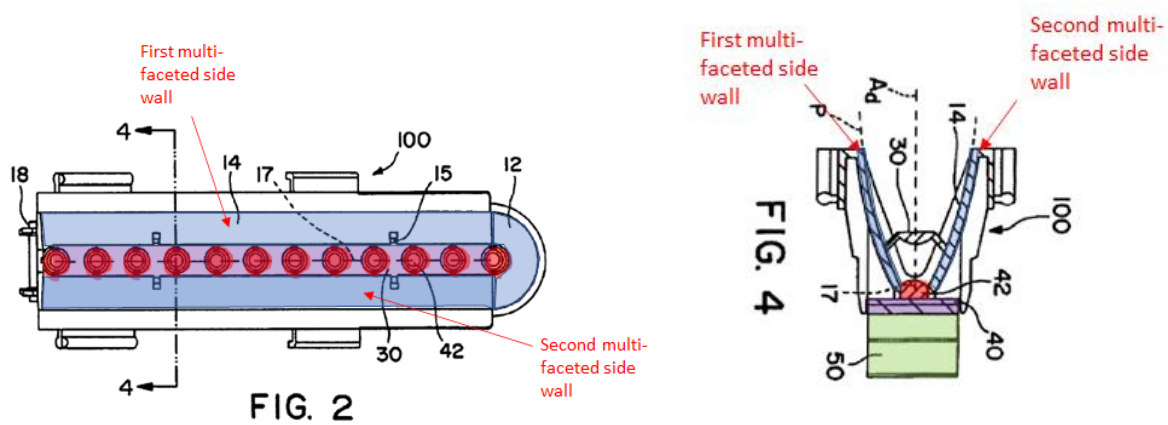
### Ex. 1038, Stopa, Figs 8 and 4

125. Stopa therefore discloses or renders obvious limitation [1.3].

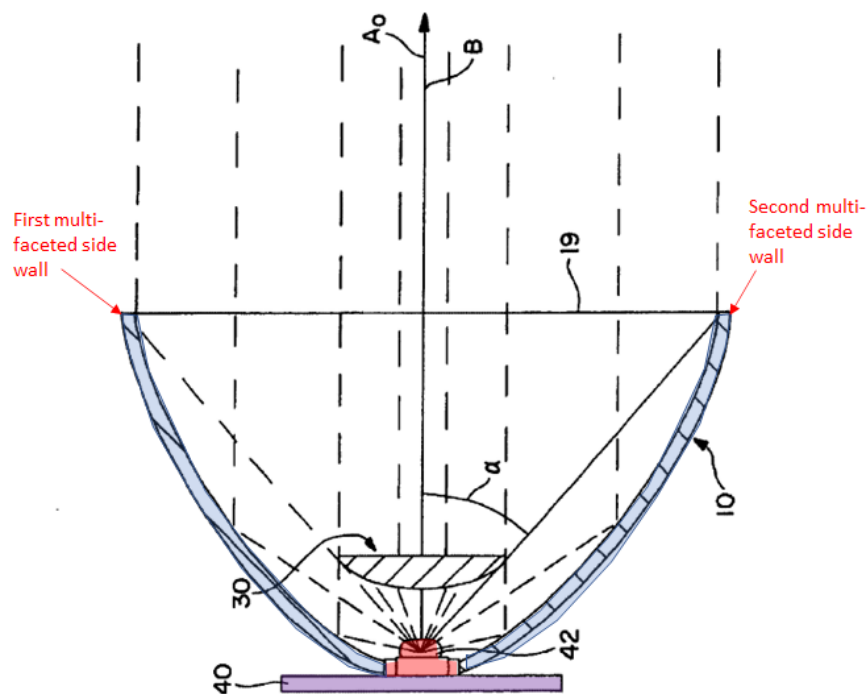
*[1.4a] a first multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip with a first edge adjacent a first side of the lighting strip and extending at an angle along an entire length of the lighting strip; and*

*[1.4b] a second multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip, the second side wall having a first edge adjacent a second, opposite side of the lighting strip at an angle that extends along an entire length of the lighting strip,*

126. Again, Stopa discloses the parabolic reflector includes two side parabolic walls (outlined in blue) whose shapes may vary from being narrow, tall and steep to side walls that are shaped to be shallow and wide.



Ex. 1038, Stopa, Figs. 2 and 4



Ex. 1038, Stopa, Fig 8

It should be noted that *a parabolic reflector may be configured to be very narrow, tall and steep or shallow and wide, depending on mathematical definition of the parabola used to define the reflecting*

*surface*. In a steep and narrow parabolic reflector, angle  $\alpha$  will be correspondingly small as the reflector will capture and redirect a greater portion of the light emitted from the LEDs. In a broader, shallower parabola, angle  $\alpha$  will be greater and an associated collimating lens 30 correspondingly wider to achieve the same functionality, i.e., light output in the form of a substantially collimated beam of parallel rays. The depth and configuration of the parabolic reflector will vary in accordance with design constraints and the requirements of the lighting application.

(Ex. 1038, Stopa at 7:54-67.)

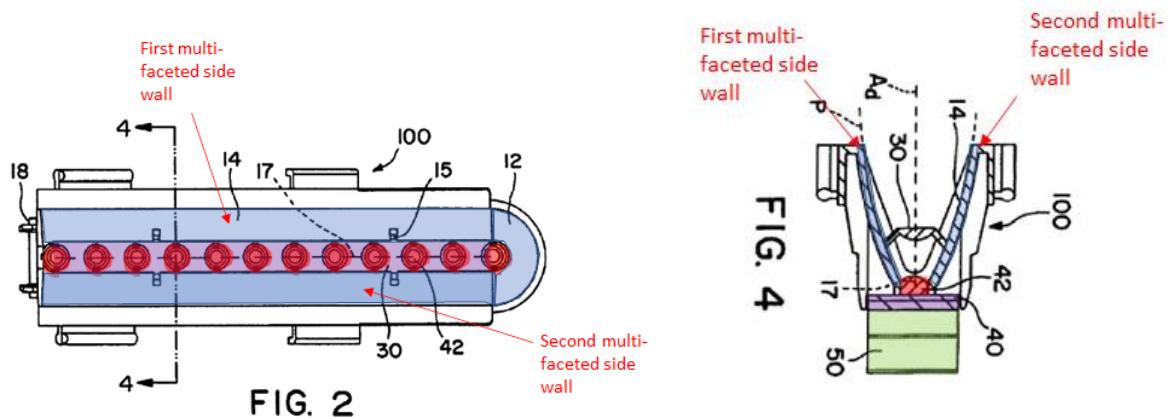
127. The '854 Patent states "multi-faceted," includes side walls having a parabolic shape.

Each side wall 185 of reflector assembly 141 includes a first facet or first portion 186 defining a first angle  $\theta$  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187 of LED 111, and a second facet or second portion 188 that defines a second angle  $\Phi$  with first portion 186. The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111. It is contemplated that the multiple facets reflect the light that is output from the LEDs back toward other facets of the walls of reflector 141, thereby amplifying the light. *However, this is not to be construed as limiting as this definition of a multi-faceted reflector may also include reflectors having a parabolic shape.*

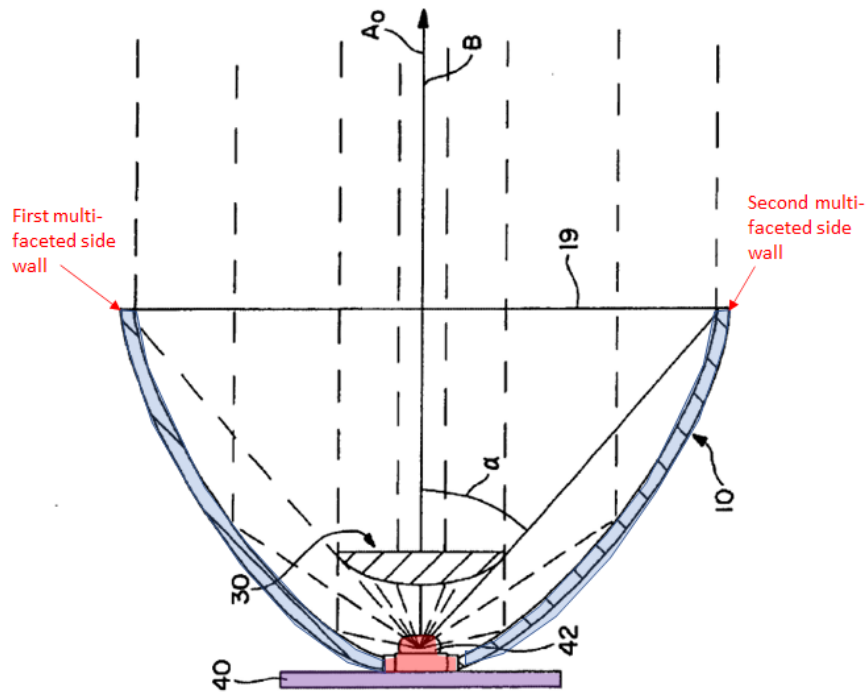
(Ex. 1001, '854 Patent at 17:41-54.)

128. Each of Stopa's parabolic surfaces are side walls that satisfy the recited a *first* and *second multi-faceted side wall*.

129. Again, Stopa discloses a parabolic reflector includes an open slot to receive the complete linear row of high-output LEDs (red) that are assembled on a printed circuit board (purple). I have emphasized the side walls in blue.



Ex. 1038, Stopa, Figs. 2 and 4



**Ex. 1038, Stopa, Fig 8**

FIG. 1 is an exploded view of *an LED light assembly 100* in accordance with the present invention. The LED light assembly 100 includes a reflector 10 having a linear parabolic section 14, a PC board 40 with a plurality of high-output LEDs 42 arranged in a linear array and a heat sink 50 configured for assembly adjacent the rear side of the PC board.

(Ex. 1038, Stopa at 4:59-65.)

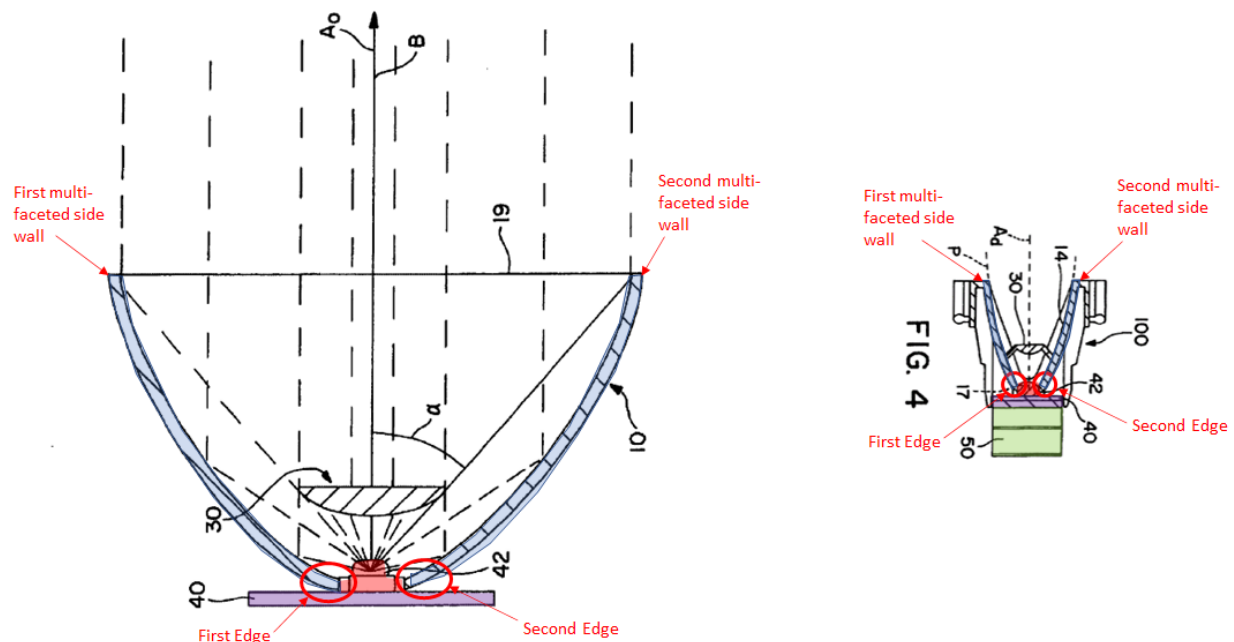
The reflector 10 has a linear parabolic section 14 that defines a linear focal axis 17 extending the length of the parabolic section 14. With particular reference to FIGS. 2 and 4, the rear of the reflector 10 (adjacent the focal axis 17) is configured as an open slot to *receive and align the array of high-output LEDs 42 with the focal axis 17*.

(Ex. 1038, Stopa at 5:5-10.)

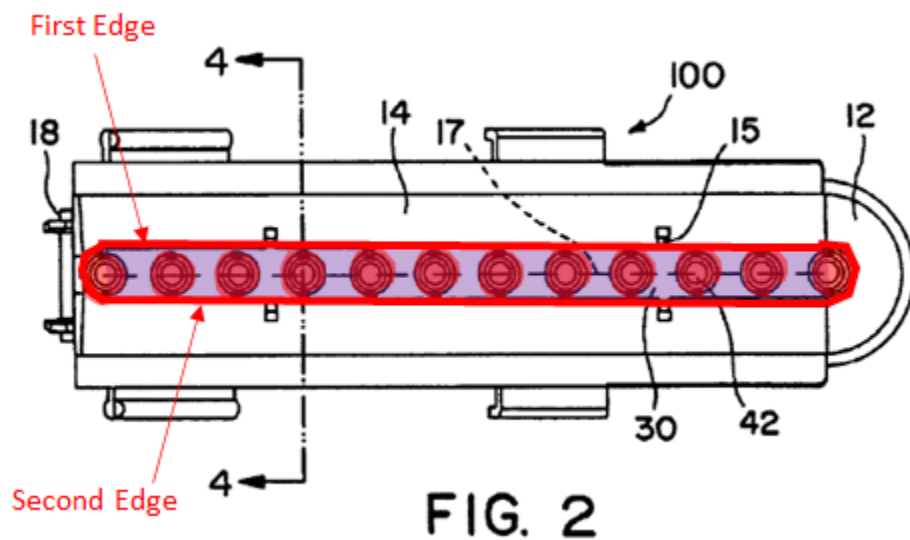
130. Again, Stopa discloses a linear array of LEDs or *LED lighting arrangement*. (Ex. 1038, Stopa at 6:11-17.) Stopa also discloses the LEDs are assembled onto a PC board – collectively the *lighting strip*. Both of Stopa's *first/second multi-faceted side walls* are disclosed and shown as extending the entire length of the *lighting arrangement* and *lighting strip*. Stopa (as shown and emphasized above) discloses the reflector includes a slot for receiving the linear row of LEDs.

131. As shown below, each of Stopa's side walls also include a *first edge* adjacent the first side and a *second edge* adjacent the *second side*. Stopa illustrates the first edge and second edge extend the entire length of the *lighting strip*. As I also illustrate in limitation [1.5] below, Stopa's reflector is symmetrical and the *sidewalls* extend from the reflector bottom at *an angle* or the same angle.





Ex. 1038, Stopa, Figs. 4 and 8



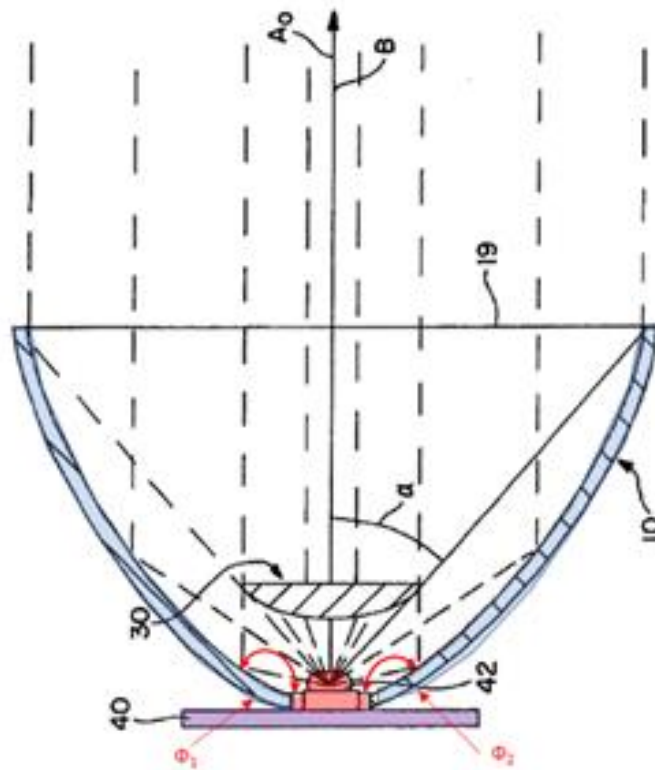
Ex. 1038, Stopa, Fig. 2

132. Therefore, Stopa discloses limitation [1.4a] and [1.4b].

*[1.5] wherein the first and second multi-faceted side walls extend away from the lighting strip at an angle and are configured to cause light produced by the plurality of light emitting diodes (LEDs) to be*

*amplified and formed into a uniform beam,*

133. Stopa discloses *first and second multi-faceted* (i.e., parabolic) *side walls* that extend away from the light strip at an angle which I have annotated below as  $\Phi_1$  and  $\Phi_2$ .



**Ex. 1038, Stopa, Fig. 8**

134. I note the '854 Patent states that a "uniform beam" may be a focused beam (e.g., spotlight) or a diffused beam (office light/street lamp).

Additional embodiments are directed to amplifying reflectors that may be associated with the lighting strips so that light produced by the plurality of light emitting diodes (LEDs) may be amplified and formed into a *uniform beam* which may be a *focused beam* useful, for

example, as a spotlight, *or a diffused beam* useful, for example, as an overhead streetlight or possibly as an overhead office light.

(Ex. 1001, '854 Patent at 5:61-6:1.)

135. Stopa discloses the parabolic reflector is shaped to reflect and focus the light into a uniform light pattern.

In accordance with the present invention, a linear array of high-output LEDs is arranged on a printed circuit board (PC board). The PC board is then mounted such that each LED in the array is positioned along the linear focal axis of a reflector having a linear parabolic section. This may require a linear parabolic reflector with a slot-like opening adjacent the focal axis of the parabolic section. A reflector in accordance with the present invention is arranged to redirect “wide angle” light (light emitted at a large angle relative, to the optical axis of the LED) so that such light emerges from the reflector in a plane parallel to the optical axes of the LEDs. Even though the LEDs are distinct point light sources, *the parabolic reflector combines the overlapping “wide angle” light of adjacent LEDs such that the light output from the assembly is substantially uniform, rather than closely spaced points of light*, as would be expected.

(Ex. 1038, Stopa at 3:24-39.)

Another object of the present invention is to provide a new and improved LED light assembly that efficiently integrates the light output of a plurality of point source LEDs *into a substantially uniform light pattern*.

(Ex. 1038, Stopa at 3:66-4:2.)

FIG. 7 illustrates an alternative LED light assembly 110 in which the linear parabolic reflector 10a is closed at both ends by parabolic dish ends 12 similar in configuration to the dish end 12 described with reference to the embodiment illustrated in FIGS. 1-6. It will be noted that the embodiment of FIG. 7 does not include the optional collimating lens 30 or its associated mounting grooves 15. As previously discussed, LEDs are primarily directional point light Sources. The linear parabolic section 14 and associated parabolic dish ends 12 redirect “wide angle” light from the LEDs as previously discussed. Even without an optional collimating lens, *the light output from the embodiment of FIG. 7 is organized into a wide angle beam and may be efficiently focused or directed in accordance with the needs of the lighting application.*

(Ex. 1038, Stopa at 6:25-39.)

136. Claim limitation [1.5] also recites the side walls “are configured to cause light produced by the plurality of light emitting diodes (LEDs) **to be amplified.**” With regard to this limitation, the ’854 Patent states the angles of the reflector walls creates facets which amplify (i.e., focus) the light provided by the LEDs.

*The combination of these angles creates facets in side walls 303 of reflector 300 which amplify the light provided by LEDs 11 or LEDs 111.* In addition, side walls 303 of reflector 300 direct the light from each of the plurality of lighting strips 9 of LEDs 11 or strips 109 of LEDs 111 and focus the light into what outwardly appears to be a

uniform beam of light. Reflector assemblies 300 are constructed from silver-coated aluminum with a protective polymer coating as described previously.

(Ex. 1001, '854 Patent at 19:4-12.)

With reference to FIGS. 20 and 21, yet another possible configuration for a reflector is shown and is denoted gener-ally as reference numeral 400. This reflector 400 includes a base portion or member 401 with a pair of integral side walls 403 extending from opposite sides thereof at an angle. Each side wall 403 of reflector 400 has several angles therein as shown in FIG. 20. Each side wall 403 of reflector 400 includes a first portion 405 that extends from base member 401 at a first angle  $\Theta$  of, for example, about  $110^\circ$  to about  $120^\circ$ , such as about  $115^\circ$ . Side walls 403 further include a second portion 407 that defines a second angle  $\Phi$  with the first portion 405; this angle is, for example, about  $170^\circ$  to about  $180^\circ$ , such as about  $177^\circ$ . *The combination of the foregoing angles creates facets in the reflector 400 that amplify the light provided by LEDs 11 or LEDs 111.* In addition, side walls 403 of reflector assemblies 400 direct the light from each of the plurality of lighting strips 9 of LEDs 11 or strips 109 of LEDs 111 and focus the light into 30 what outwardly appears to be a uniform beam of light. Reflector assemblies 400 are also constructed from silver-coated aluminum with a protective polymer coating in like manner to previous embodiments.

(Ex. 1001, '854 Patent at 19:13-34.)

The combination of reflectors *for amplifying or intensifying* the light and the heat dissipation provided through the thermal radiation

properties of the housing provides for a lighting fixture adapted to provide effective light output for use as a street light, while not overheating and reducing the life span or safety of the street light.

(Ex. 1001, '854 Patent at 6:1-7.)

137. However, a POSITA would understand amplification of light by a reflector is physically impossible. In this context, a POSITA would understand amplification likely refers to the intensity or output of the LEDs, which is typically expressed in lumens. A POSITA would understand that a reflector can collect photons originating from the LED and focus those photons onto a surface so that more luminous flux is directed onto a specific area of a surface than would be the case if the LEDs radiated that surface directly without a reflector.

**Lumen** – the unit of luminous flux, equal to the luminous flux emitted within a unit solid angle (1 steradian) from a point source having a uniform intensity of 1 candela...

(Ex. 1039, McGraw-Hill Dictionary of Scientific and Technical Terms.)

138. As illustrated by the above definition, a reflector – regardless of the number of angles included – cannot increase the integrated total lumens output of an LED light source. Even the most reflective materials absorb some portion of the light energy. To amplify, the reflector would have to reflect more energy (i.e., energy from the LED) than it receives which is simply not possible.

139. A POSITA reading the '854 Patent would understand the intent of the

wording “amplification” to mean the more angles used can provide a more “focused” light beam. A focused beam directs more of the total LED light produced to a particular targeted area. In contrast, a non-focused beam spreads the total LED light produced across a larger area. The focused beam directed on a specific surface area may appear brighter on that surface area than the non-focused beam but the total light output from the LED is not more; it is simply focusing some of the light output from the LEDs to a surface area where lighting is desired.

140. Stopa discloses focusing the light produced by the LEDs. Stopa even describes this focusing – like claim 1 of the '854 Patent – as being *amplified* into a continuous area or band of light.

FIG. 8 illustrates the behavior of light emitted generally perpendicular to the length of the LED light assembly. Luxeon™ LEDs are point light sources that emit light radially in a 360 pattern and axially in a 110 to 160 arc to produce the above mentioned “half globe”. The illustrated preferred embodiment uses a low dome Luxeon™ emitter which produces a “batwing” light pattern about the optical axis. The open interior of the linear parabolic reflector permits the radial and axial light from adjacent LEDs to overlap as illustrated in FIG. 14. *Thus, the light output of a plurality of point light source LEDs is effectively integrated and amplified into a continuous area or band of light.* Testing has proven that such an area or band of light is more visible to the human eye than a distinct point of light, even if the point is several times more intense. The human eye is better able to retain a fix on the

position of the larger light Source as well as judge the distance to the light source.

(Ex. 1038, Stopa at 7:5-20.)

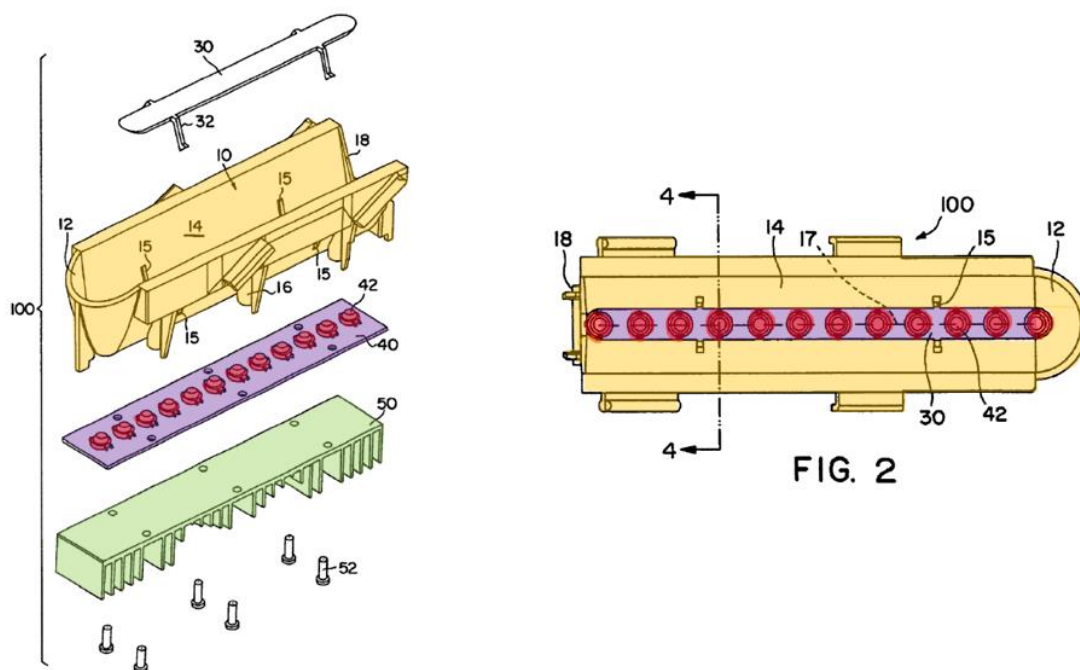
141. It is therefore my opinion, Stopa discloses that the *first/second side walls* are *multi-faceted* and extend at *from the lighting strip at an angle* (either the same or different angles) to increase the focused LED output intensity (*amplify*) of the light beam redirected by the reflects in order to produce more light on a specific surface area than would be produced by the LEDs without the reflector.

142. Stopa discloses limitation [1.5].

*[1.6] and wherein the coupling between the lighting strips and the base plate provides heat transfer between the lighting strips and the base plate such that heat produced by the plurality of LEDs comprised in the lighting strip is conducted to the base plate for transfer to the ambient environment.*

143. Again, Stopa discloses an LED light assembly having: (1) a linear row of LEDs (red) assembled on a printed circuit board (purple); and (2) a heat sink (green).





### Ex. 1038, Stopa, Figs. 1 and 2

FIG. 1 is an exploded view of *an LED light assembly 100* in accordance with the present invention. The LED light assembly 100 includes a reflector 10 having a linear parabolic section 14, a PC board 40 with *a plurality of high-output LEDs 42 arranged in a linear array and a heat sink 50 configured for assembly adjacent the rear side of the PC board.*

(Ex. 1038, Stopa at 4:59-65.)

144. Stopa expressly discloses multiple methods for coupling the *lighting strip* to the *base plate* of the heat sink. For instance, Stopa discloses the PC board may include a metallic copper cladding that may come in contact with the *base plate* of the heat sink to transfer heat dissipated by the LEDs. Stopa also discloses a conductive adhesive may be applied to the *base plate* to further aid in transferring

the heat dissipated by the LEDs to the heat sink. A POSITA would understand the heat generated by the LEDs would be received by the Stopa's heat sink for transfer and remove thermal energy produced by the LEDs so that they operate at a lower desired temperature. A POSITA would understand that the output of the LED and the expected operating life of the LEDs are improved with lower operating temperature. A POSITA would understand this is the purpose of the finned heat structure disclosed by Stopa, that was the common structure for a heat sink for reducing the operating temperature of the LEDs at the time of filing the '854 Patent. Stopa even discloses other heat dissipating mechanisms may be used. A POSITA would understand these mechanisms would be constructed of a thermally conductive material – e.g., aluminum – for transferring and dissipating the heat away from the LEDs.

FIG. 4 clearly illustrates that the *PC board 40 is sandwiched or tightly compressed between the rear end of the reflector 10 and a conventional finned heat sink 50*. This compressed relationship is maintained by fasteners 52 passing through the heat sink 50 and PC board 40 to engage fastener receptacles 16 molded in the reflector 10. A tightly compressed relationship enhances thermal transfer between the PC board 40 and the heat sink 50. *Thermal transfer can further be enhanced by copper cladding on both sides of the PC board, copper-clad through holes and/or thermally conductive adhesives or materials disposed between the PC board and the heat sink*. The slugs

49 of each LED are mounted to the PC board in such a manner as to enhance heat transfer from the slug to the copper cladding of the PC board. Although a conventional finned heat sink is illustrated, numerous heat absorption and transfer mechanisms are known in the art and may be appropriate for incorporation into an LED light assembly 100 in accordance with the present invention. *Conducting heat away from the high output LEDs is important because overheating interferes with the efficient operation and seriously shortens the life of an LED as is known in the art.*

(Ex. 1038, Stopa at 5:56-6:10.)

8. The light assembly of claim 7, wherein each said LED emits heat which traverses through said slug and said PC board comprises heat transfer means for transferring said heat to said heat sink.

(Ex. 1038, Stopa at 8:51-54.)

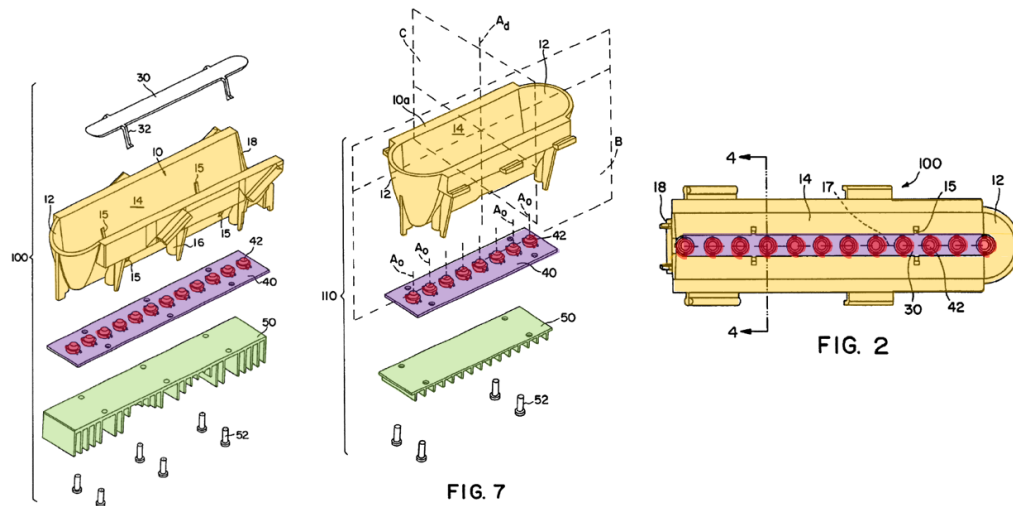
145. Accordingly, it is my opinion that Brown either discloses or renders obvious limitation [1.6].

## **2. Claim 2**

*[2] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the light emitting diodes (LEDs) are arranged in a linear row along the length of the lighting strip.*

146. As I discussed above in limitation [1.2], Stopa discloses a linear row of LEDs (red) arranged along the entire length of a PC board (purple), which together

is the recited *lighting strip*.



**Ex. 1038, Stopa, Figs. 1, 7 and 2**

***FIGS. 1 and 7 illustrate a linear array of LEDs mounted to a PC board*** in accordance with the present invention. The LEDs in the illustrated embodiments are mounted approximately 12 mm apart center to center. Center to center spacing of less than approximately 9 mm is difficult in view of the overall size of the chip package.

(Ex. 1038, Stopa at 6:11-17.)

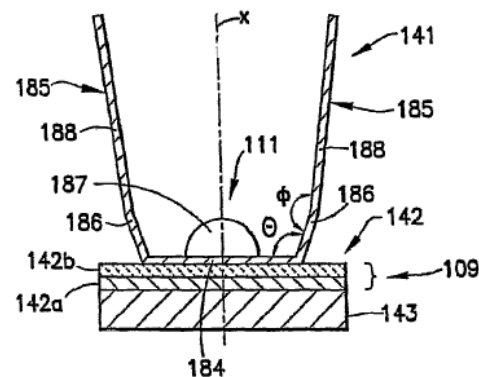
147. Accordingly, Stopa discloses or renders obvious claim 2.

### 3. Claim 3

*[3] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the first and second multi-faceted side walls extend away from a base member defining a plurality of openings receiving at least a light emitting portion of the plurality of light emitting diodes (LEDs), respectively.*

148. The '854 Patent explains a *base member* as a bottom portion of the

reflector from which both side walls extend.



**FIG. 16**

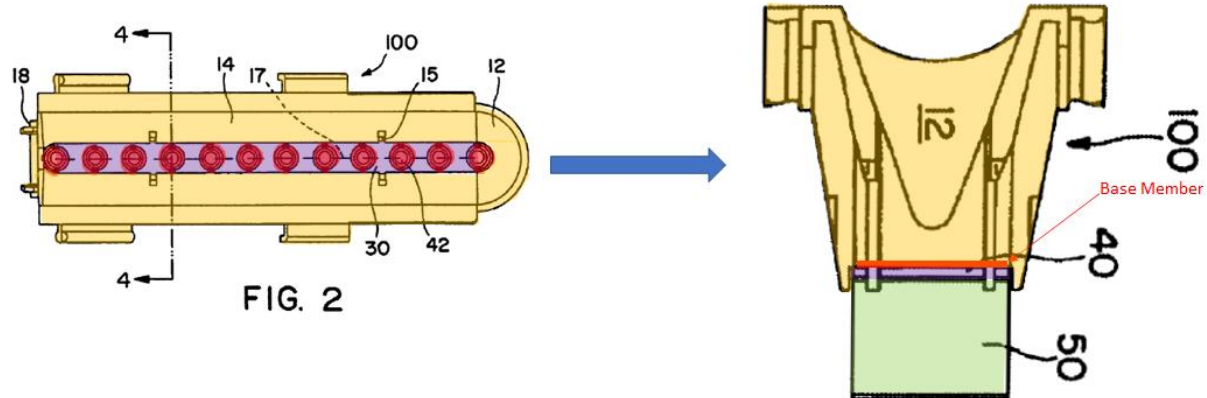
**Ex. 1001, '854 Patent, Fig. 16**

With reference to FIG. 16, a cross-sectional view of an exemplary lighting strip 109 having LEDs 111 mounted thereon and a reflector assembly 141 extending therefrom is illustrated. In this exemplary embodiment, the reflector assembly includes a base member 184 and a pair of desirably integral side walls 185 extend from opposite sides of the base member 184 at an angle. Each LED 111 includes a light emitting portion 187. Reflector assembly 141 is mounted to lighting strip 109 such that a bottom edge of each side wall 185 extends from a bottom portion of light emitting portion 187 of LED 111. Each side wall 185 of reflector assembly 141 includes a first facet or first portion 186 defining a first angle  $\theta$  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187 of LED 111, and a second facet or second portion 188 that defines a second angle  $\Phi$  with first portion 186. The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111.

(Ex. 1001, '854 Patent at 17:31-53.)

149. I understand in district court, the Patent Owner has asserted the bottom portion of a reflector as satisfying the recited “base member.” (Ex. 1035 at C21.)

150. A POSITA would have understood Stopa includes a base portion to support both the first and second reflector walls. Without such a base portion, the two walls would not be assembled as one reflector cup and the walls would necessarily be two separate and distinct pieces. But, Figure 3 is described as being a “right end view of the LED light assembly of FIG. 2.” (Ex. 1038, Stopa at 4:20-21.) Figure 5 is stated as being “a rear view of the LED light assembly of FIG. 2.” (Ex. 1038, Stopa at 4:25-26.) As shown below, the right-hand view of Stopa’s reflector illustrates a base portion (just above the *lighting strip* in purple) where that joins the side walls together as one piece. At least the portion I have outlined below would be understood as being the *base member*. Furthermore, the bottom view (Figure 5) illustrates the *base member* extending the entire length of the lighting strip which is covered by the heat sink (green) shown



Ex. 1038, Stopa at Figs. 2 and 3

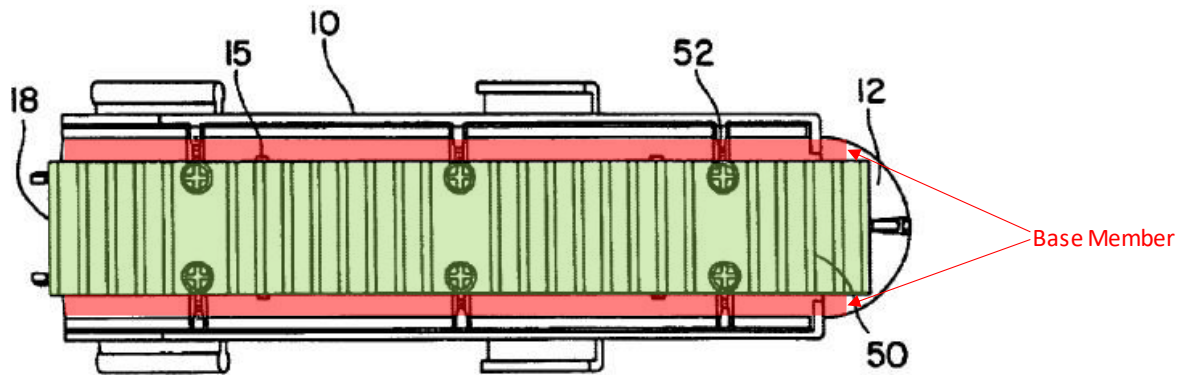


FIG. 5

Ex. 1038

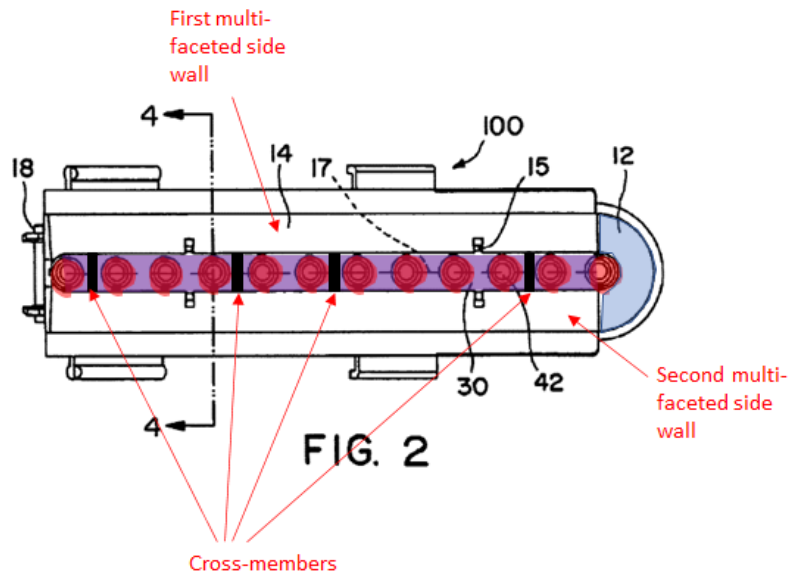
151. As I have explained above, Stopa discloses an open slot between the *first/second sidewalls* for receiving all the LEDs.

The reflector 10 has a linear parabolic section 14 that defines a linear focal axis 17 extending the length of the parabolic section 14. With particular reference to FIGS. 2 and 4, the rear of the reflector 10 (adjacent the focal axis 17) is configured as an *open slot to receive and align the array of high-output LEDs 42 with the focal axis 17*.

(Ex. 1038, Stopa at 5:5-10.)

152. While Stopa discloses just one open slot, it would have been obvious to a POSITA that Stopa's opening could be designed to include additional openings. Indeed, Stopa discloses the spacing and alignment of the LEDs on the PC board. (Ex. 1038, Stopa at 6:11-16.) A POSITA would have therefore known if additional strength and rigidity was needed, cross members could be added in the spacing between each LED. I have illustrated cross-members (in black below) that a POSITA would have known how to add. Such a technique is commonly employed for all different applications. For instance, a bed frame will include cross-members to help support the mattress and to provide strength to the overall bed frame. Kitchen chairs will include cross-members between the legs to provide increased strength and rigidity. A POSITA would have understood that adding such cross-members would have been nothing more than applying a known technique of adding increased strength to a reflector through the use of cross-members. The cross members would therefore provide a *plurality of openings* for receiving Stopa's linear array of LEDs.





**Ex. 1038, Stopa at Fig. 2**

153. Stopa would render obvious the limitations of claim 3.

#### **4. Claim 4**

***[4] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 3, wherein the first and second multi-faceted side walls are formed integral with the base member.***

154. As I discussed in limitations [1.4a] and [1.4b], Stopa discloses a reflector having parabolic or *multi-faceted side walls*.

155. As I explained in claim 3 above, a POSITA would have understood Stopa includes a base portion to support both the first and second reflector walls. Without such a base portion, the two walls would not be assembled as one reflector cup. Instead, the walls would necessarily be two separate and distinct pieces. This base member would be understood as being integrally formed with the sidewalls as

Stopa discloses the reflector

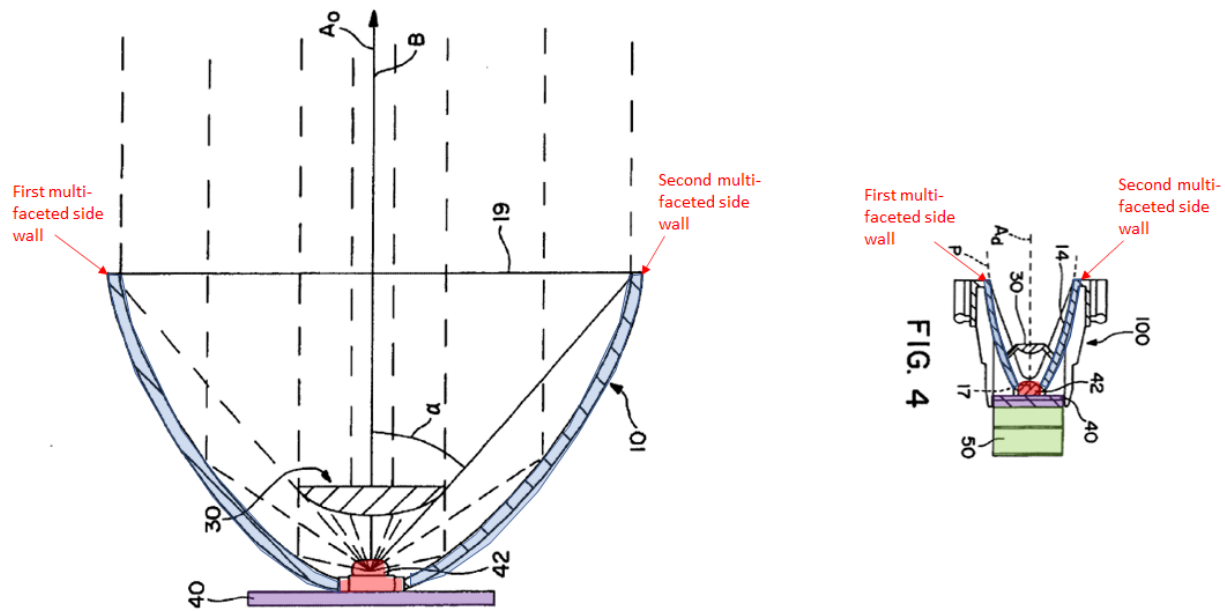
156. Alternatively, a POSITA would have found it obvious to add cross-member supports to Stopa's reflector – which would then constitute the recited *base member*. Such cross-member supports would likewise be formed integral with the *side walls*.

157. Accordingly, it is my opinion that Stopa renders obvious claim 4.

### **5. Claim 5**

***[5] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 3, wherein the first and second multi-faceted side walls comprise multi-angle side walls.***

158. Again, the '854 Patent broadly defines “multi-faceted” to include “reflectors having a parabolic shape.” (Ex. 1001, '854 Patent at 10:51-60 and 17:41-54.) As explained in limitations [1.4a] and [1.4b] above, Stopa teaches a reflector having a parabolic side walls (highlighted in blue) which are multi-faceted. Stopa teaches the depth and configuration of the reflector's design can change based on a given application. Stopa even discusses the angle “ $\alpha$ ” between “steep and narrow” and “shallower” reflector designs could vary.

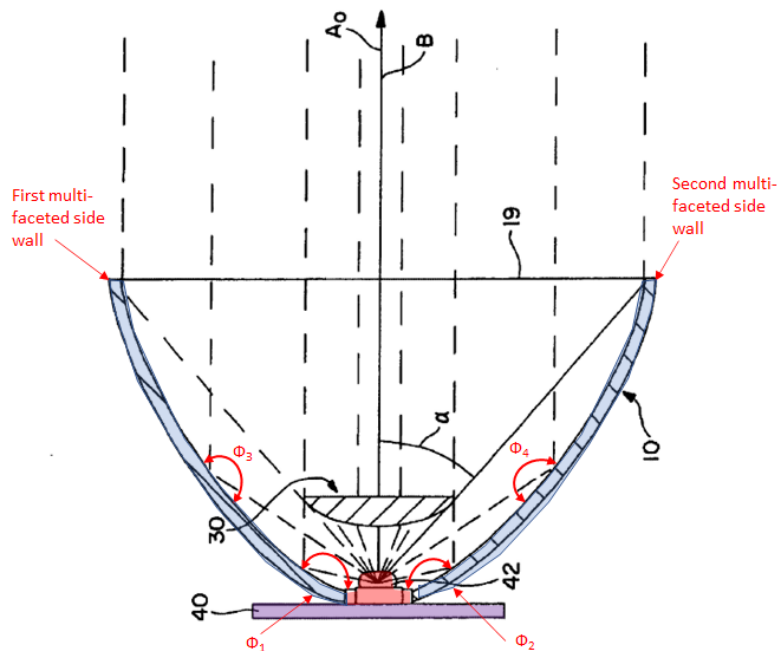


#### Ex. 1038, Stopa, Figs 4 and 8

It should be noted that *a parabolic reflector may be configured to be very narrow, tall and steep or shallow and wide, depending on mathematical definition of the parabola used to define the reflecting surface*. In a steep and narrow parabolic reflector, angle  $\alpha$  will be correspondingly small as the reflector will capture and redirect a greater portion of the light emitted from the LEDs. In a broader, shallower parabola, angle  $\alpha$  will be greater and an associated collimating lens 30 correspondingly wider to achieve the same functionality, i.e., light output in the form of a substantially collimated beam of parallel rays. The depth and configuration of the parabolic reflector will vary in accordance with design constraints and the requirements of the lighting application.

(Ex. 1038, Stopa at 7:54-67.)

159. As shown below, Stopa illustrates the light emitted from an LED being reflected off different portions of the reflector cup. As shown, the angle of light and the reflection occur at different angles due to Stopa's parabolic design. Stopa's parabolic reflector has a *first multi-faceted sidewall* having a first angle ( $\Phi_1$ ) and a second angle ( $\Phi_2$ ). Stopa's reflector also includes a *second multi-faceted sidewall* having a first angle ( $\Phi_3$ ) and a second angle ( $\Phi_4$ ). A POSITA would understand that the parabolic surface is made up of continuously varying angles, and as such would be continually multi-faceted.



**Ex. 1038, Stopa, Fig. 8**

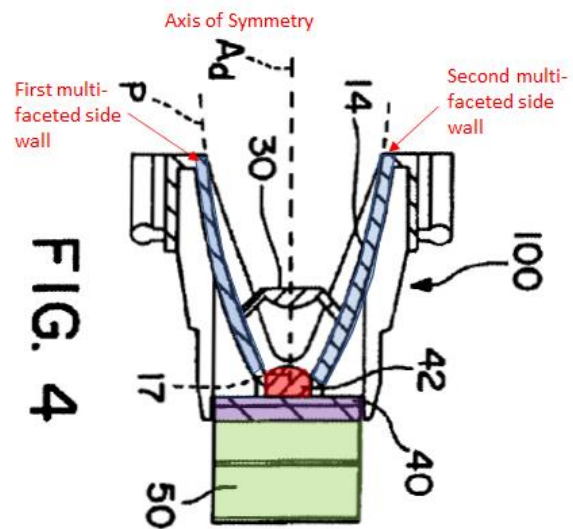
160. Accordingly, it is my opinion that Stopa renders obvious claim 5.

## 6. Claim 6

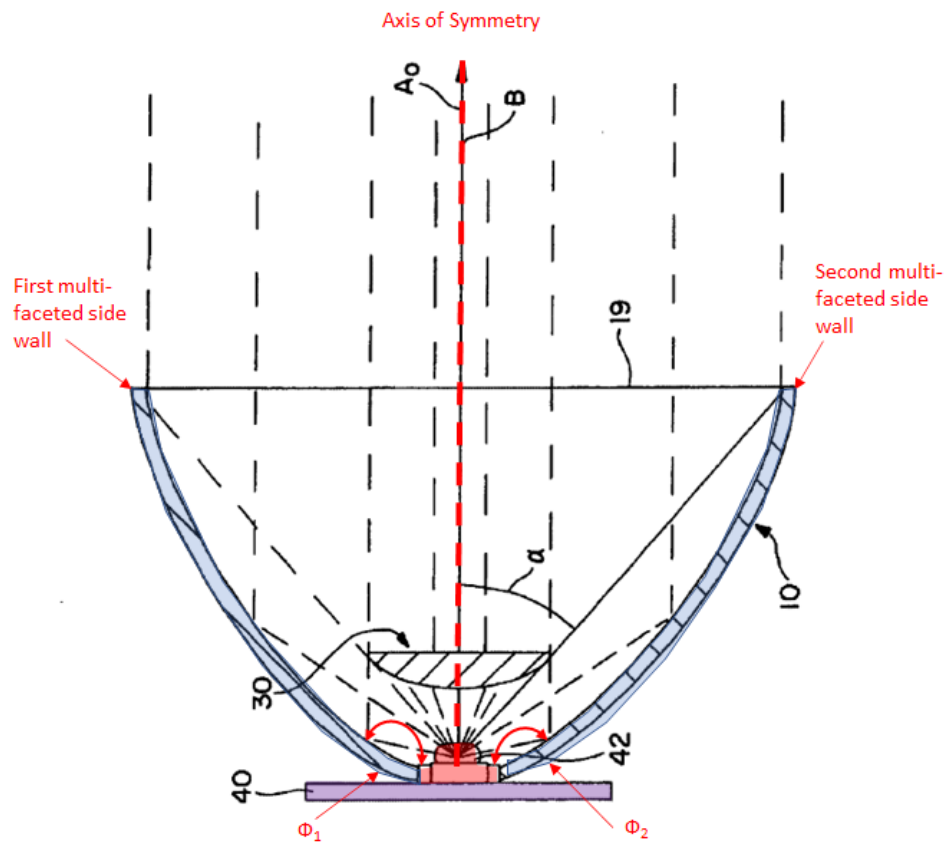
*[6] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the first and second multi-faceted side walls extend away from a base member and are symmetrical about an axis of symmetry that runs through a center of the base member.*

161. Again, the '854 Patent broadly defines "multi-faceted" to include "reflectors having a parabolic shape." (Ex. 1001, '854 Patent at 10:51-60 and 17:41-54.) As explained in limitations [1.4a] and [1.4b] above, Stopa teaches a reflector having a parabolic side walls which are multi-faceted.

162. Stopa describes (with reference to Figure 4) a line "A<sub>d</sub>" bisects the parabola walls through the "focus and vertex of the parabola P." Stopa then further recites this intersection and states the "reflecting surface flaring from an inner vertex to an open outer end, said reflecting surface *being symmetrical to a plane through said vertex.*" Stopa therefore discloses and illustrates with reference to Figure 4 the reflecting surface (i.e., multi-faceted side walls) of the reflector can also be designed to be symmetrical through a plane through the vertex.



Ex. 1038, Stopa, Fig. 4



Ex. 1038, Stopa, Fig. 8

FIG. 4 also illustrates the reflector directional axis  $A_d$  bisecting the reflector 10. The reflecting surface of the linear parabolic section is described by projecting a parabola P along the linear focal axis 17. The directional axis  $A_d$  geometrically corresponds to a vertex axis of the parabola P. In other words, the directional axis.  *$A_d$  bisects parabola P through the focus and vertex of the parabola P.*

(Ex. 1038, Stopa at 6:17-24.)

12. A light assembly comprising:

a reflector comprising a concave reflecting surface defining a reflecting cavity, said reflecting surface flaring from an inner vertex to an open outer end, *said reflecting surface being symmetrical to a plane through said vertex;*

at least one light emitting diode having an optical axis and disposed in said reflecting cavity such that said optical axis is generally coincident with said plane; and

a collimating lens mounted within said reflecting cavity,

wherein said collimating lens is configured to collimate substantially all light output from said at least one LED that is not incident upon said reflecting surface without altering the direction of light emitted from said at least one LED reflected by said reflecting surface.

(Ex. 1038, Stopa at 8:65-9:13.)

163. As I discussed with regard to claim 2, Stopa discloses or renders obvious a base member to support both the first and second reflector walls. The side-

walls would have extended from the base member or bottom surface as claimed. The side-walls are therefore disclosed as being symmetrical *about an axis of symmetry that runs through a center of the base member*.

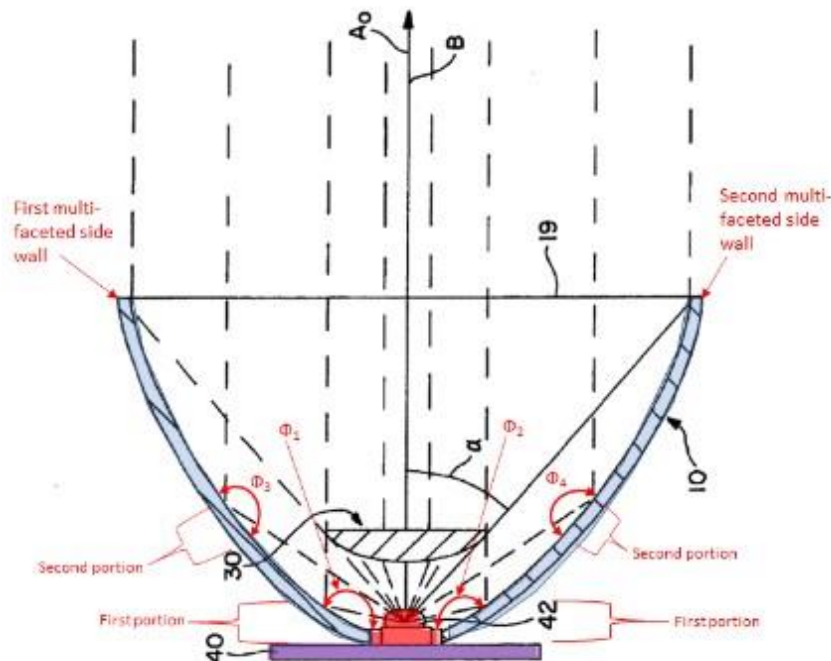
164. Stopa discloses the limitations of claim 6.

## **7. Claim 7**

***[7] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 6, wherein the first and second multi-faceted side walls each comprise a first portion defining a first angle with the base member and a second portion defining a second angle with the first portion.***

165. As shown below, the Stopa's reflector has a *first multi-faceted sidewall* having a first portion (outlined in red) defining a first angle ( $\Phi_1$ ) with the *base member* (as I discussed in claim 3). The *first multi-faceted sidewall* also includes a second portion defining a second angle ( $\Phi_3$ ) with the first portion. Stopa's reflector also includes a *second multi-faceted sidewall* having a first portion defining a first angle ( $\Phi_2$ ) with the base member (copper cladding) and a second portion defining a second angle ( $\Phi_4$ ) with the first portion.





**Ex. 1038, Stopa, Fig. 8**

166. Accordingly, it is my opinion that Stopa discloses claim 7.

## 8. Claim 8

**[8] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 7, wherein the first angle and second angle are different angles.**

167. As I discussed in limitation [1.4a] and [1.4b] above, Stopa discloses a reflector having side walls which are parabolic in shape. The '854 Patent states "multi-faceted," includes side walls having a parabolic shape. The different portions of a parabolic shape would include differing angles. This is known to a POSITA.

Each side wall 185 of reflector assembly 141 includes a first facet or first portion 186 defining a first angle  $\theta$  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187

of LED 111, and a second facet or second portion 188 that defines a second angle  $\Phi$  with first portion 186. The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111. It is contemplated that the multiple facets reflect the light that is output from the LEDs back toward other facets of the walls of reflector 141, thereby amplifying the light. *However, this is not to be construed as limiting as this definition of a multi-faceted reflector may also include reflectors having a parabolic shape.*

(Ex. 1001, '854 Patent at 17:41-54.)

168. As I discussed in claim 7, Stopa's *side walls* have *first/second portions* that define *first/second angles*, e.g.,  $\Phi_1$ ,  $\Phi_2$ ,  $\Phi_3$ , and  $\Phi_4$ . The *side walls* have a *first angle* ( $\Phi_1$ ,  $\Phi_2$ ) and a *second angle* ( $\Phi_3$ ,  $\Phi_4$ ) that would not be the same since the reflector is designed to be parabolic.

169. Accordingly, it is my opinion that Stopa discloses claim 8.

## **9. Claim 9**

***[9] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the first and second multi-faceted side walls comprise multi-angle side walls.***

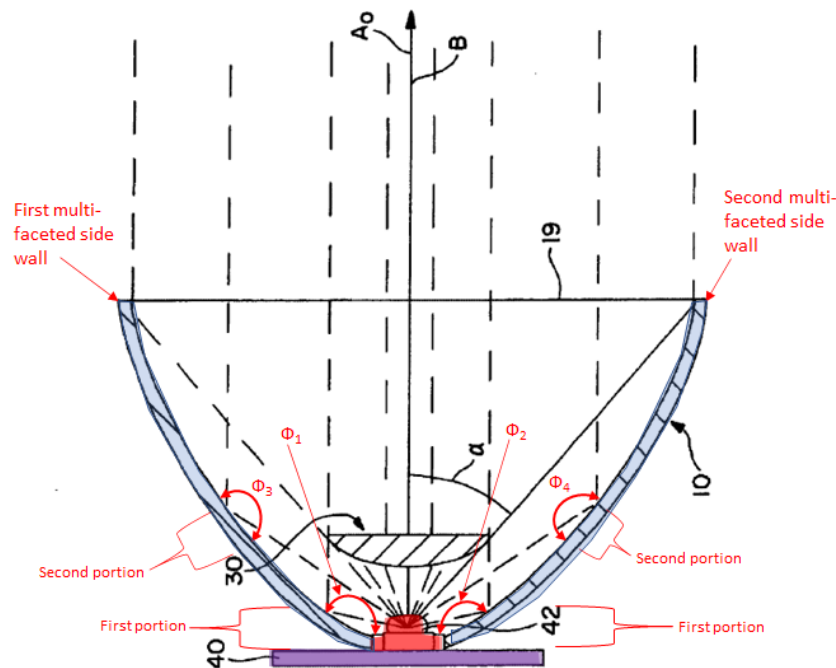
170. As I discussed in limitation [1.4a] and [1.4b] above, Stopa discloses a reflector having side walls which are parabolic in shape. The '854 Patent states "multi-faceted," includes side walls having a parabolic shape. All of the different portions of a parabolic shape have differing angles.

Each side wall 185 of reflector assembly 141 includes a first facet or first portion 186 defining a first angle  $\theta$  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187 of LED 111, and a second facet or second portion 188 that defines a second angle  $\Phi$  with first portion 186. The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111. It is contemplated that the multiple facets reflect the light that is output from the LEDs back toward other facets of the walls of reflector 141, thereby amplifying the light. *However, this is not to be construed as limiting as this definition of a multi-faceted reflector may also include reflectors having a parabolic shape.*

(Ex. 1001, '854 Patent at 17:41-54.)

171. I discussed above in claim 7, every surface portion of the side wall has a different angle. For example, in Fig. 8 below, annotated angles  $\Phi_1$ ,  $\Phi_2$ ,  $\Phi_3$ , and  $\Phi_4$ , can be considered first and second portions that have different angles. Stopa's first sidewall initially extends at a first angle ( $\Phi_1$ ). The curvature of the first sidewall then changes as it increases in height to form a second angle ( $\Phi_2$ ). The first angle ( $\Phi_1$ ) is different than the second angle ( $\Phi_2$ ), and a POSITA would understand that no two angles are the same on the parabolic surface of the reflector. Therefore, the first sidewall comprises multiple angles, i.e., it is a multi-angle sidewall. In addition, Stopa's second side wall initially extends at a first angle ( $\Phi_3$ ). The curvature of the first sidewall then changes as it increases in height to form a second angle ( $\Phi_4$ ). The

first angle ( $\Phi_3$ ) is different than the second angle ( $\Phi_4$ ).



**Ex. 1038, Stopa, Fig. 8**

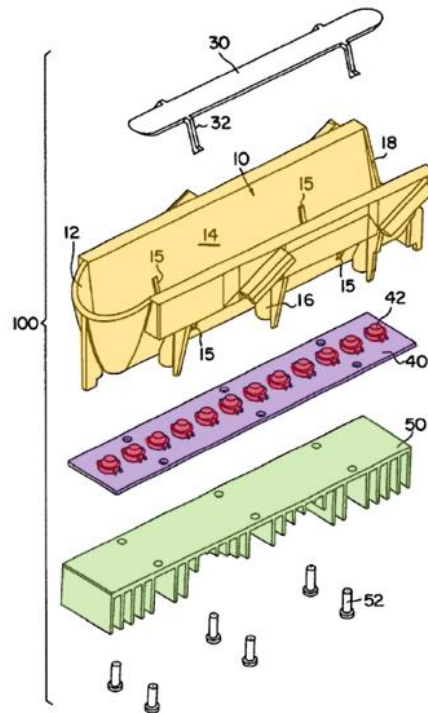
172. Accordingly, it is my opinion that Stopa discloses claim 9.

## 10. Claim 10

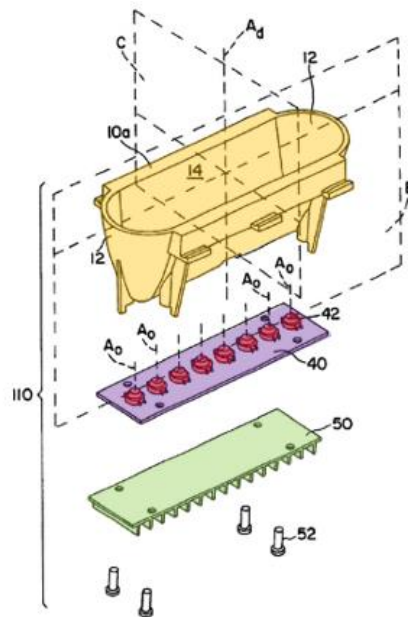
[10] *The LED lighting arrangement of claim 1, wherein the first multi-faceted side wall adjacent the lighting strip extends along the entire length of the lighting strip from a position level with a bottom portion of a light emitting portion of each of the LEDs, and wherein the second multi-faceted side wall adjacent the lighting strip extends along the entire length of the lighting strip on a side opposite the first multi-faceted side wall from a position level with a bottom portion of a light emitting portion of each of the LEDs.*

173. Again, Stopa illustrates and discloses a linear row of high-output LEDs (red) assembled onto a printed circuit board (purple). The printed circuit board with

LEDs satisfies the recited *lighting strip*.



**Ex. 1038, Stopa, Figs. 1**



**FIG. 7**

**Ex. 1038, Stopa, Fig. 7**

In accordance with the present invention, a linear array of high-output LEDs as arranged on a printed circuit board (PC board).

(Ex. 1038, Stopa at 3:24-26.)

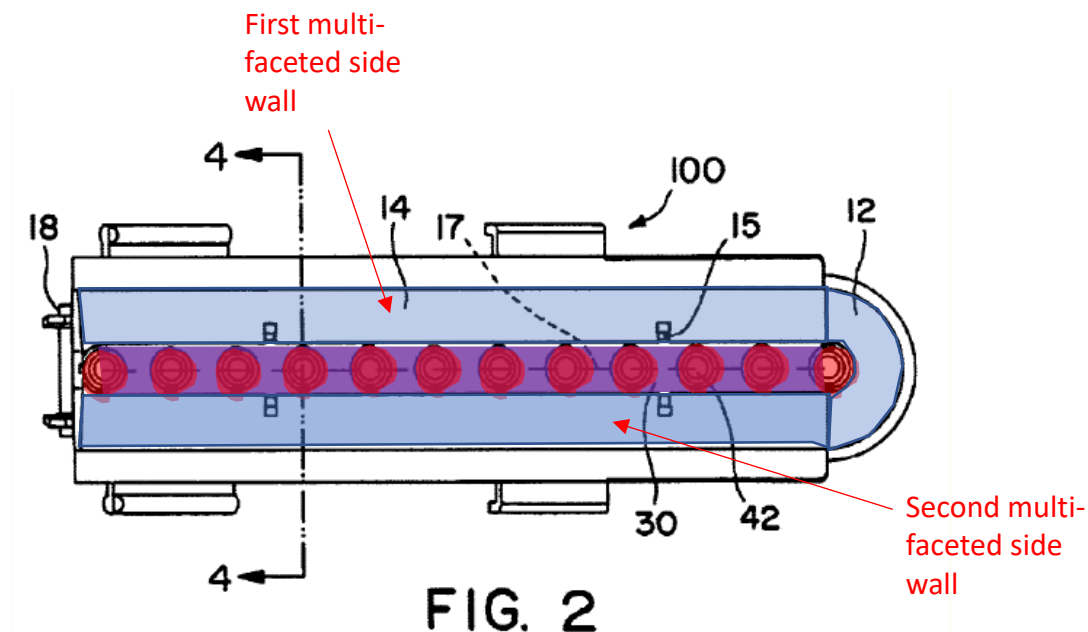
FIG. 1 is an exploded view of an LED light assembly 100 in accordance with the present invention. The LED light assembly 100 includes a reflector 10 having a linear parabolic section 14, a PC board 40 with a plurality of high-output LEDs 42 arranged in a linear array and *a heat sink 50 configured for assembly adjacent the rear side of the PC board.*

(Ex. 1038, Stopa at 4:59-65.)

*FIGS. 1 and 7 illustrate a linear array of LEDs mounted to a PC board* in accordance with the present invention. The LEDs in the illustrated embodiments are mounted approximately 12 mm apart center to center. Center to center spacing of less than approximately 9 mm is difficult in view of the overall size of the chip package.

(Ex. 1038, Stopa at 6:11-17.)

174. Stopa discloses the reflector includes an open slot (as shown by Figure 2 below) for receiving the LEDs. As shown, the open slot extends along the entire length of the lighting strip with regard to both the *first* and *second multi-faceted side walls.*

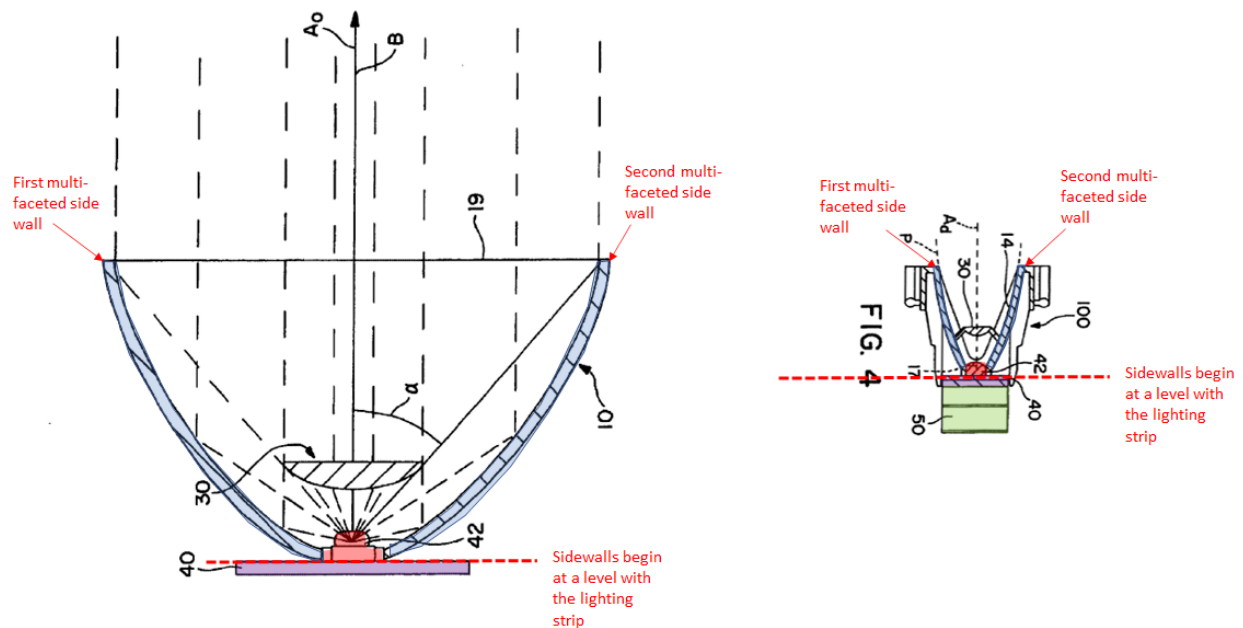


Ex. 1038, Stopa, Fig. 2

The reflector 10 has a linear parabolic section 14 that defines a linear focal axis 17 extending the length of the parabolic section 14. With particular reference to FIGS. 2 and 4, the rear of the reflector 10 (adjacent the focal axis 17) is configured as an open slot to ***receive and align the array of high-output LEDs 42 with the focal axis 17.***

(Ex. 1038, Stopa at 5:5-10.)

175. As shown below, the *first/second side walls* also begin from a position level with a bottom portion of a light emitting portion of each of the LEDs.



### Ex. 1038, Stopa, Figs. 8 and 4

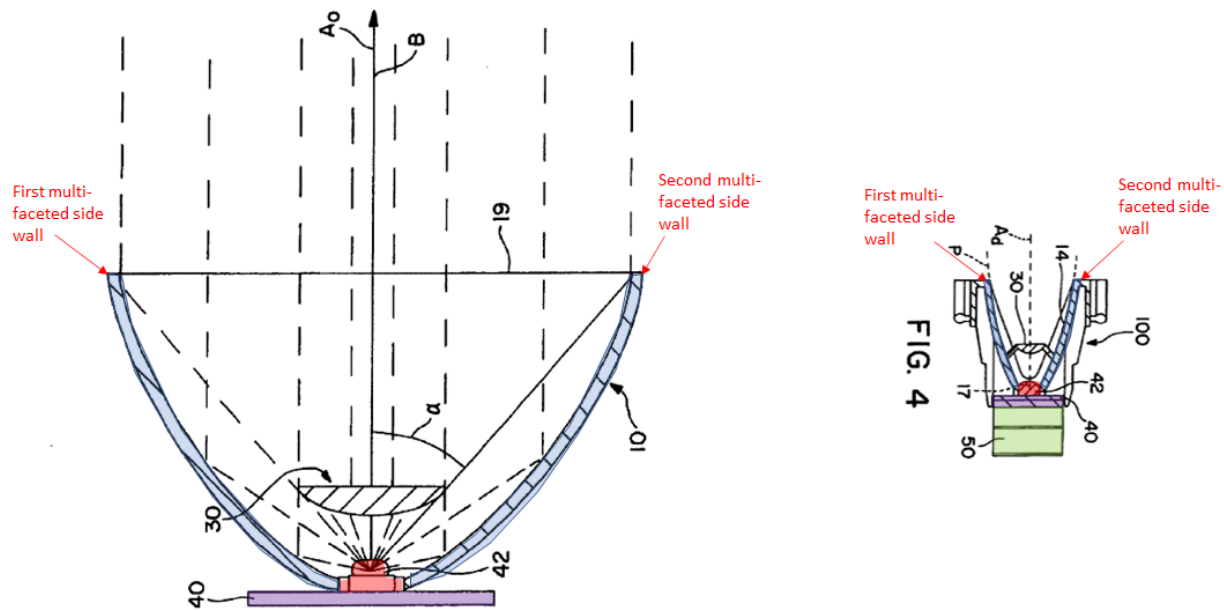
176. Stopa discloses the limitations of claim 10.

#### 11. Claim 11

**[11] The LED lighting arrangement of claim 1, wherein the first multi-faceted side wall and the second multi-faceted side wall are separately coupled to the lighting arrangement.**

177. Again, the '854 Patent discloses the PC Board (*lighting strip*) with linear row of LEDs (*lighting arrangement*) is sandwiched (coupled) between the reflector and the heat sink. As shown below, the first side wall is coupled to a left side of the LED lighting arrangement and the second side wall is coupled to the right side of the LED lighting arrangement.





### Ex. 1038, Stopa, Figs 8 and 4

FIG. 4 clearly illustrates that the *PC board 40 is sandwiched or tightly compressed between the rear end of the reflector 10 and a conventional finned heat sink 50*. This compressed relationship is maintained by fasteners 52 passing through the heat sink 50 and PC board 40 to engage fastener receptacles 16 molded in the reflector 10. A tightly compressed relationship enhances thermal transfer between the PC board 40 and the heat sink 50. Thermal transfer can further be enhanced by copper cladding on both sides of the PC board, copper-clad through holes and/or thermally conductive adhesives or materials disposed between the PC board and the heat sink. The slugs 49 of each LED are mounted to the PC board in such a manner as to enhance heat transfer from the slug to the copper cladding of the PC board. Although a conventional finned heat sink is illustrated, numerous heat absorption and transfer mechanisms are known in the art and may be appropriate

for incorporation into an LED light assembly 100 in accordance with the present invention. Conducting heat away from the high output LEDs is important because overheating interferes with the efficient operation and seriously shortens the life of an LED as is known in the art.

(Ex. 1038, Stopa at 5:56-6:10.)

178. Stopa discloses the limitations of claim 11.

## **12. Claim 12**

***[12] The LED lighting arrangement of claim 1, wherein the first multi-faceted side wall comprises a first reflector sheet bent to form first facets, and wherein the second multi-faceted side wall comprises a second reflector sheet bent to form second facets.***

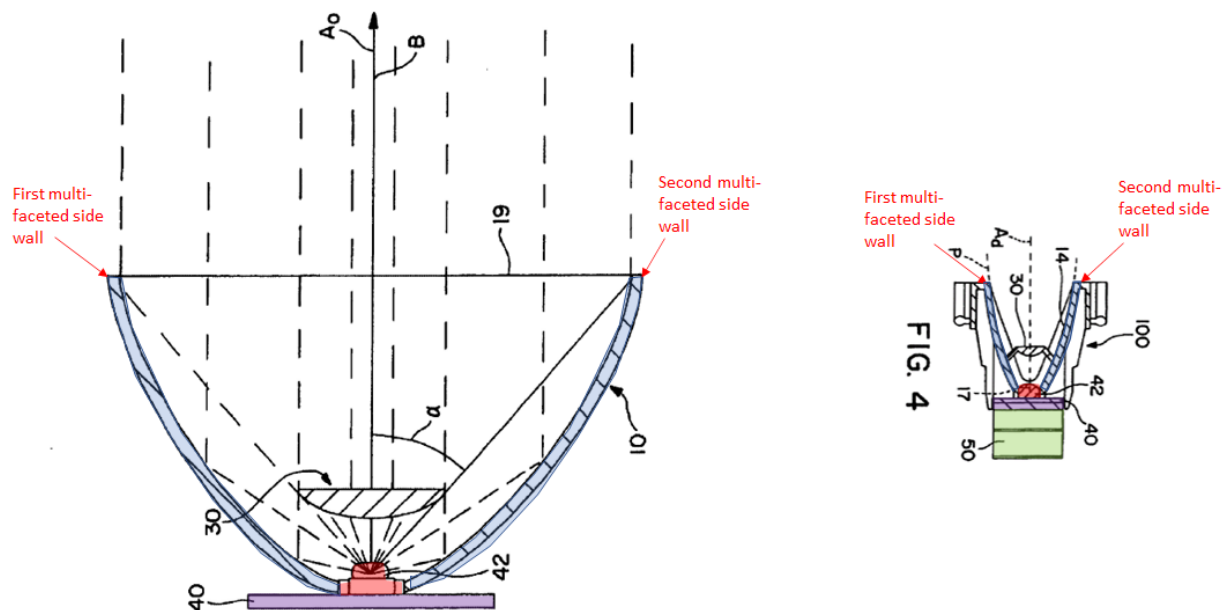
179. Again, the '854 Patent broadly defines "multi-faceted" to include "reflectors having a parabolic shape." (Ex. 1001, '854 Patent at 10:51-60 and 17:41-54.) The '854 Patent also discloses the sidewalls having different angles define different facets.

Each side wall 185 of reflector assembly 141 includes ***a first facet or first portion 186 defining a first angle  $\theta$***  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187 of LED 111, and ***a second facet or second portion 188 that defines a second angle  $\Phi$  with first portion 186.*** The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111. It is contemplated that the multiple facets reflect the light that is output from the LEDs back toward other facets of the walls of reflector 141, thereby

amplifying the light. However, this is not to be construed as limiting as this definition of a multi-faceted reflector may also include reflectors having a parabolic shape.

(Ex. 1001, '854 Patent at 17:41-54.)

180. As explained in limitations [1.4a] and [1.4b] and claim 7 above, Stopa teaches a reflector having a parabolic side walls which are multi-faceted.



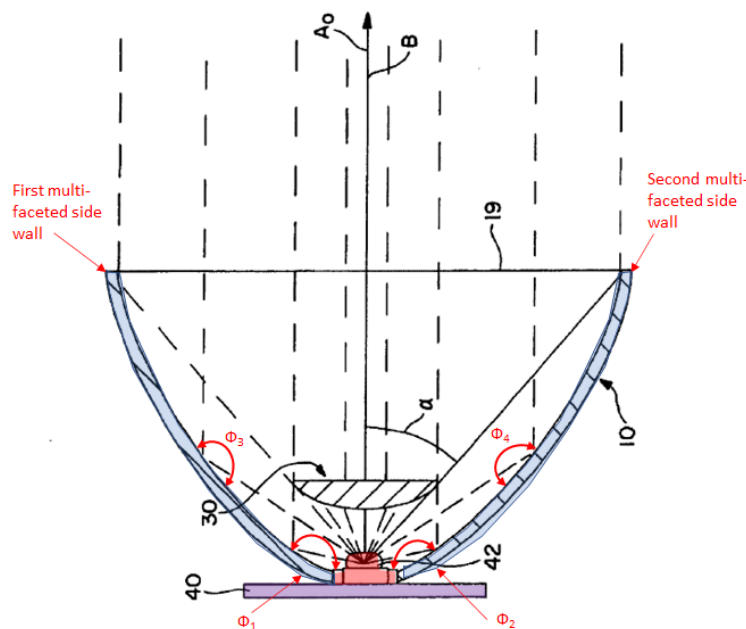
**Ex. 1038, Stopa, Figs 4 and 8**

It should be noted that *a parabolic reflector may be configured to be very narrow, tall and steep or shallow and wide, depending on mathematical definition of the parabola used to define the reflecting surface*. In a steep and narrow parabolic reflector, angle  $\alpha$  will be correspondingly small as the reflector will capture and redirect a greater portion of the light emitted from the LEDs. In a broader, shallower parabola, angle  $\alpha$  will be greater and an associated collimating lens 30

correspondingly wider to achieve the same functionality, i.e., light output in the form of a substantially collimated beam of parallel rays. The depth and configuration of the parabolic reflector will vary in accordance with design constraints and the requirements of the lighting application.

(Ex. 1038, Stopa at 7:54-67.)

181. As shown below, Stopa's parabolic reflector has a *first multi-faceted sidewall* having a first portion (shaded orange) defining a first angle ( $\Phi_1$ ) and a second angle ( $\Phi_2$ ). Stopa's reflector also includes a *second multi-faceted sidewall* having a first angle ( $\Phi_3$ ) and a second angle ( $\Phi_4$ ).

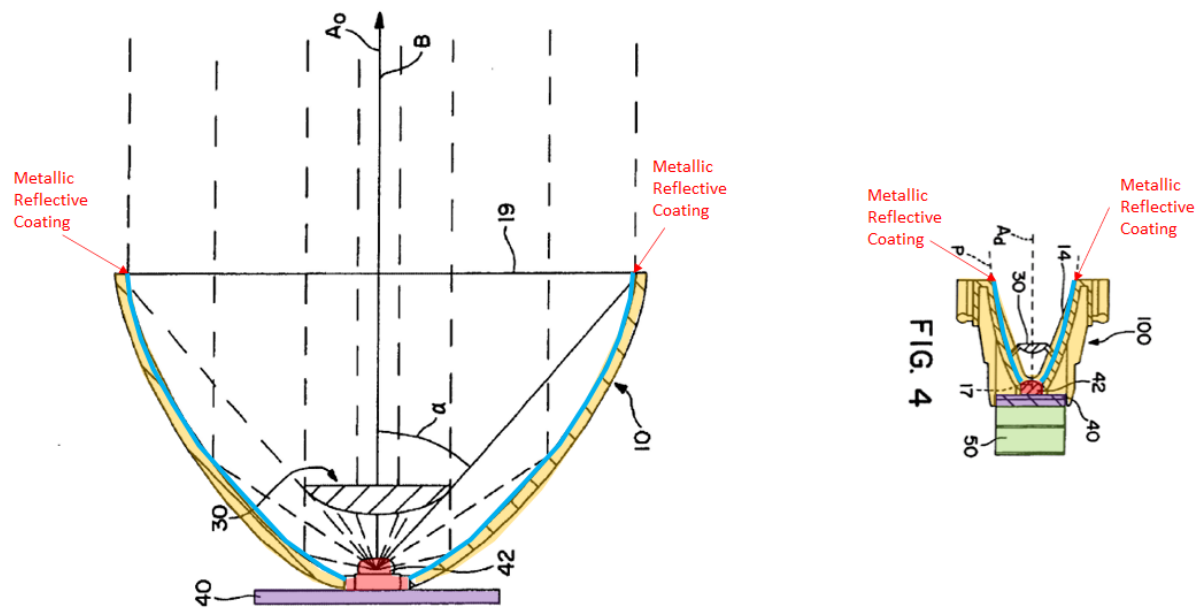


**Ex. 1038, Stopa, Fig. 8**

182. Stopa's reflector includes a first sheet i.e., the first multi-faceted side

wall that is bent to form first facets and a second sheet i.e., the second multi-faceted side wall that is bent to form second facets. A POSITA would have even understood and known that the parabolic design could be changed to include flat walls with multiple facets. This would be nothing more than a design choice to change the output light optics.

183. As I also stated in regard to limitation [1.3], it would have been obvious to add the metallic coating disclosed by Stopa II (Ex. 1045) onto the reflector disclosed by Stopa. This reflective coating could be applied using aluminum. Once applied the metallic coating it takes the shape of the parabolic multi-faceted sidewall and therefore comprises multiple facets. Stopa would include a first sheet of metal i.e., the first multi-faceted side wall that is bent to form first facets and a second sheet of metal i.e., the second multi-faceted side wall that is bent to form second facets.



**Ex. 1038, Stopa, Figs. 8 and 4**

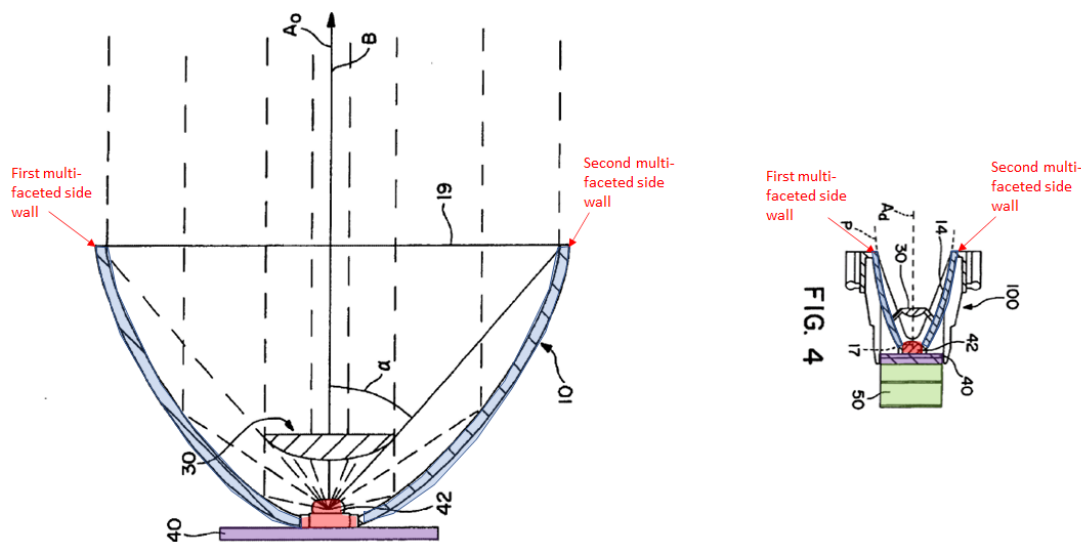
184. Accordingly, it is my opinion that Stopa discloses or renders obvious the limitations of claim 12.

### 13. Claim 13

**[13.0] The LED lighting arrangement of claim 1, wherein the first side wall and second side wall each are formed by a single reflector sheet.**

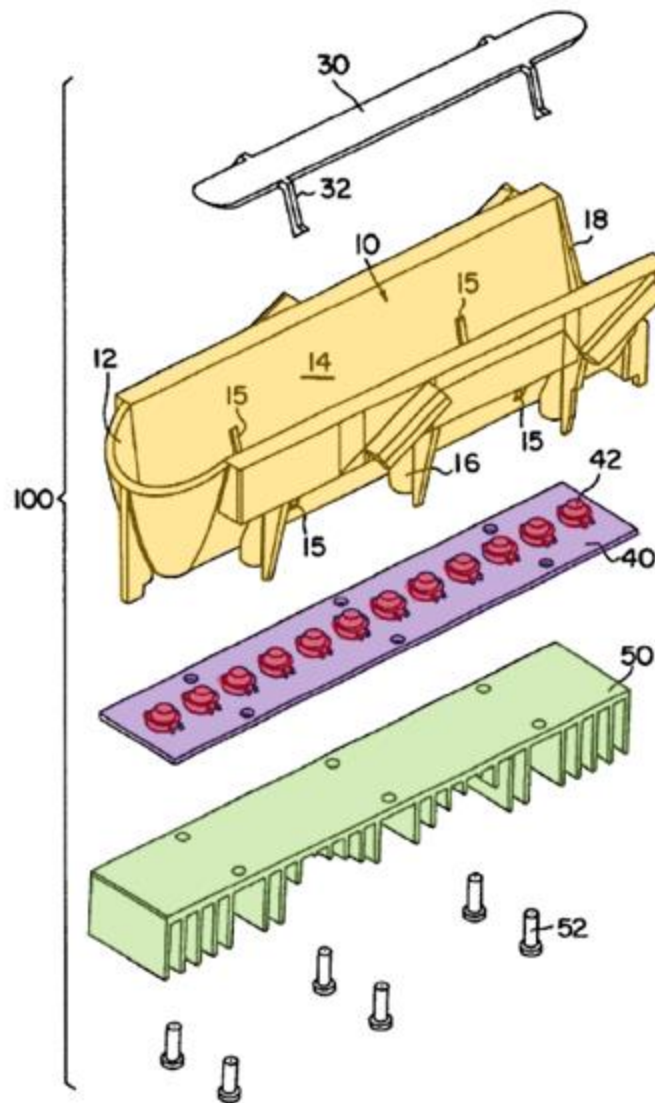
185. As I have discussed in claims [1.3] and 12 above, Stopa discloses a reflector that forms a parabolic inner first wall and second wall. These walls are formed by a single reflector sheet. Stopa states the parabolic shape is used to “define the reflecting surface.” *Id.* Stopa’s inner wall reflecting surface (as shown below)

redirects the light output from the LEDs.<sup>9</sup> (Ex. 1038, 7:54-67; 6:18-21; Claim 12.) Stopa's reflector is a one piece design – as shown by Figure 1 below. The inner reflecting surface of Stopa's walls would therefore be understood as being constructed as a singular highly reflective material and would be a *single reflector sheet*.



**Ex. 1038, Stopa, Figs 8 and 4**

<sup>9</sup> Stopa states “parabolic section 14” or inner surface “redirects ‘wide angle’ light from LEDs.” (Ex. 1038, 6:33-39.)

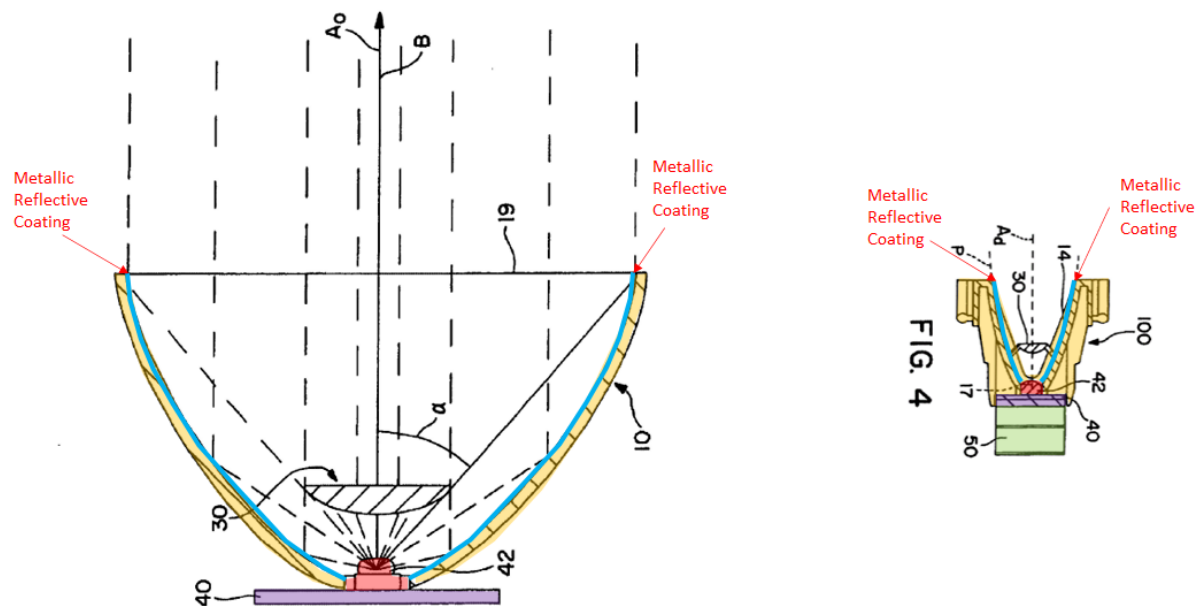


**Ex. 1038, Stopa, Fig. 1**

186. As I also stated in regard to limitation [1.3], it would have been obvious to a POSITA to add the metallic coating disclosed by Stopa II (Ex. 1045) onto the reflector disclosed by Stopa. This reflective coating could be applied using aluminum as disclosed by Stopa II. Once applied, the metallic coating takes the shape of the both the first parabolic multi-faceted sidewall and the second parabolic



multi-faceted sidewall. The metallic coating would provide a reflector that is formed from a single reflector sheet of metal.



**Ex. 1038, Stopa, Figs. 8 and 4**

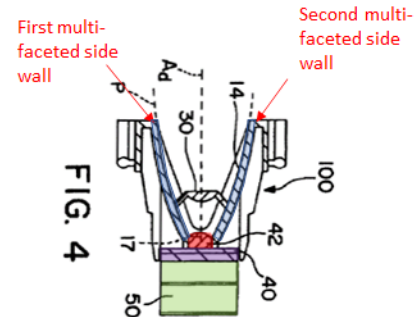
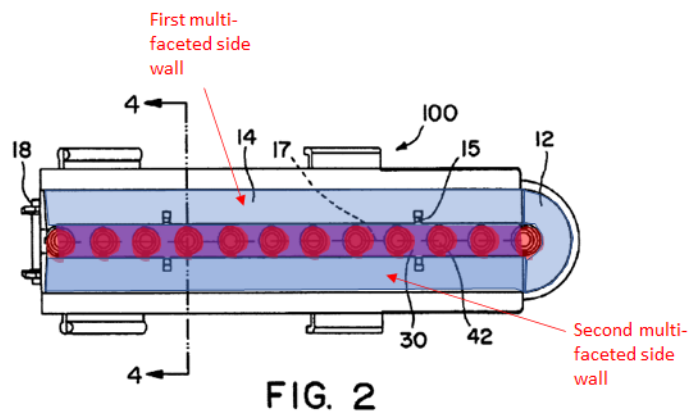
187. Accordingly, it is my opinion that Stopa discloses or renders obvious claim 12.

## 14. Claim 14

***[14] The LED lighting arrangement of claim 1, wherein the first and second multi-faceted side walls begin at a level of the lighting strip and extend away from the lighting strip.***

188. Stopa discloses the reflector includes an open slot (as shown by Figure 2 below) between both *side walls* for receiving the linear row of LEDs on a PC board

– i.e., *lighting strip*.



### Ex. 1038, Stopa, Figs. 2 and 4

The reflector 10 has a linear parabolic section 14 that defines a linear focal axis 17 extending the length of the parabolic section 14. With particular reference to FIGS. 2 and 4, the rear of the reflector 10 (adjacent the focal axis 17) is configured as an open slot to *receive and align the array of high-output LEDs 42 with the focal axis 17*.

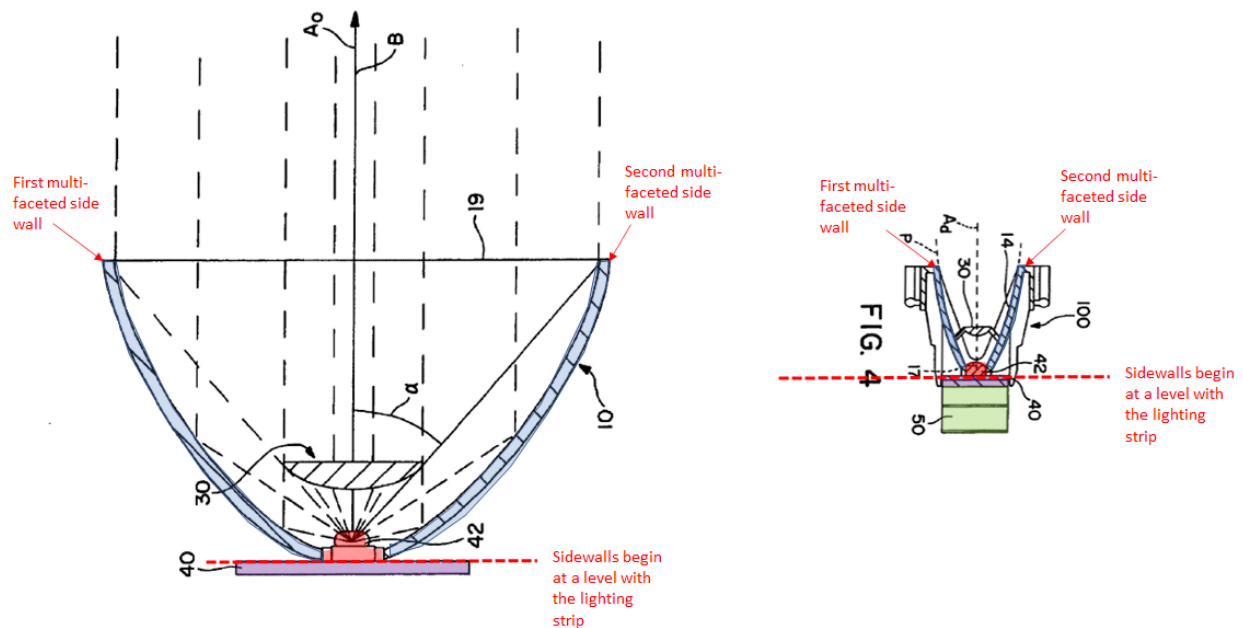
(Ex. 1038, Stopa at 5:5-10.)

FIG. 4 clearly illustrates that the *PC board 40 is sandwiched or tightly compressed between the rear end of the reflector 10 and a conventional finned heat sink 50*. This compressed relationship is maintained by fasteners 52 passing through the heat sink 50 and PC board 40 to engage fastener receptacles 16 molded in the reflector 10. A tightly compressed relationship enhances thermal transfer between the PC board 40 and the heat sink 50. Thermal transfer can further be enhanced by copper cladding on both sides of the PC board, copper-clad through holes and/or thermally conductive adhesives or materials disposed between the PC board and the heat sink. The slugs 49 of each

LED are mounted to the PC board in such a manner as to enhance heat transfer from the slug to the copper cladding of the PC board. Although a conventional finned heat sink is illustrated, numerous heat absorption and transfer mechanisms are known in the art and may be appropriate for incorporation into an LED light assembly 100 in accordance with the present invention. Conducting heat away from the high output LEDs is important because overheating interferes with the efficient operation and seriously shortens the life of an LED as is known in the art.

(Ex. 1038, Stopa at 5:56-6:10.)

189. As indicated, the PC board and LEDs (i.e., *lighting strip*) is sandwiched or compressed between the heat sink (green) and reflector (orange). The top of the PC board therefore begins at the lower level of the reflector wall. As shown below, the *first/second side walls* begin at a level with a top side of the PC board and LEDs (i.e., lighting strip). The *first/second side walls* then extend away from the top portion of the PC board and LEDs (i.e., *lighting strip*).



**Ex. 1038, Stopa, Figs. 8 and 4**

190. Accordingly, it is my opinion that Stopa renders obvious claim 14.

### 15. Claim 15

**[15.0] A light emitting diode (LED) lighting fixture, comprising:**

191. See claim [1.0] above.

**[15.1] a base plate having a front side and a rear side;**

192. See claim [1.1] above.

**[15.2] a plurality of lighting strips mounted on the front side of the base plate, each of the lighting strips comprising a plurality of light emitting diodes (LEDs) arranged along a length of the lighting strip; and**

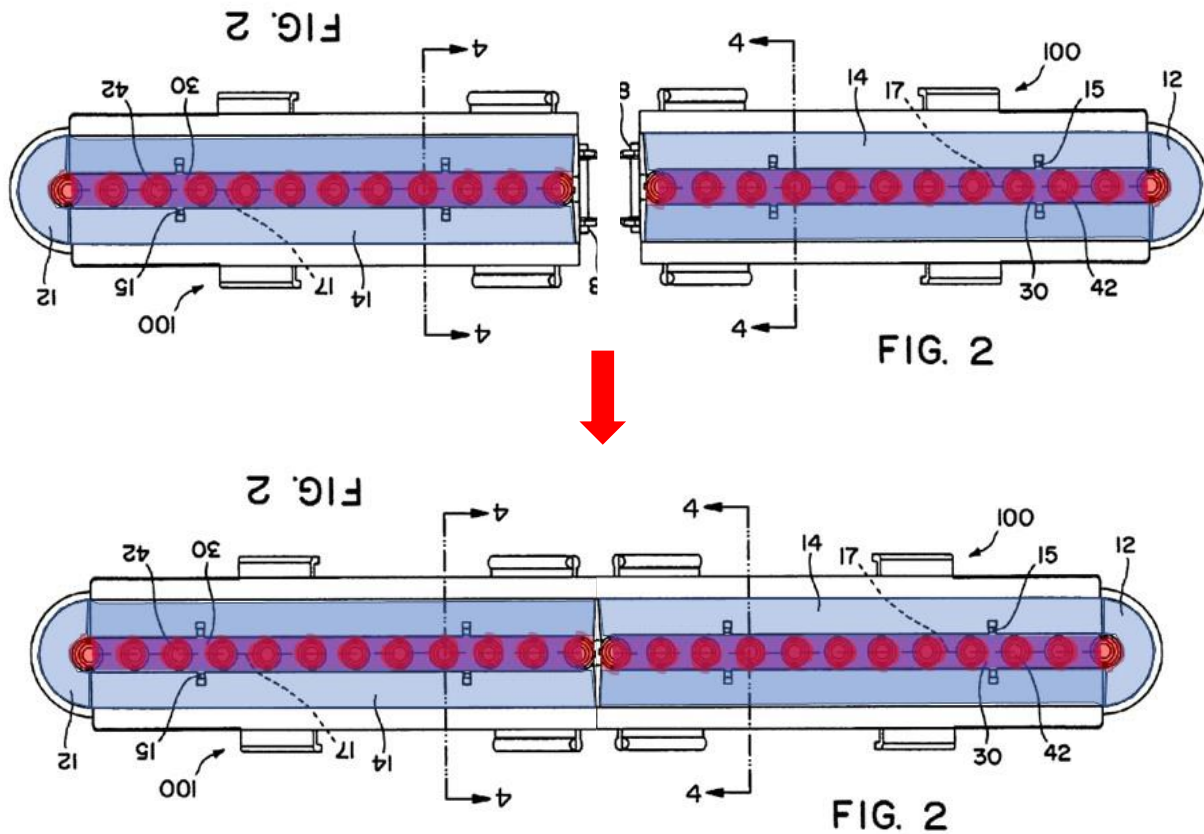
193. Stopa expressly discloses coupling two of the LED lighting units

together to form one combined lighting unit.

An opposite end 18 of the reflector is open. *The open end 18 may be aligned and fixed to the open end of additional LED light assemblies to form an extended length light assembly.* Alternatively, the open end 18 may remain open to provide improved wide-angle visibility from the LED light assembly by permitting light to escape without being redirected. Such wide-angle visibility is particularly useful in certain signaling and/or warning light applications.

(Ex. 1038, Stopa at 5:20-28.)

194. As I have illustrated below, a POSITA reading Stopa would have understood the LED lighting unit illustrated by Figure 2 could be combined with a similar LED lighting unit to form one combined unit. A POSITA would have understood the combined lighting unit would include at least two PC boards mounted with LEDs – *plurality of lighting strips* each having a *plurality of LEDs*. As shown, these LEDs would be linearly arranged as I discussed limitation [1.2] above. Both of PC boards would also be mounted to the front side of the heat sink (*base plate*) as I also have discussed in limitation [1.1] above.



**Ex. 1038, Stopa at Fig. 2**

195. To the extent the Patent Owner argues that the recited *base plate* must be a singular device – which I understand is not required – it is my opinion that a POSITA would have found it obvious to modify Stopa’s heat sink to be one continuous heat sink that spans both PC boards or *lighting strips*. Such a modification would have been simple substitution of two heat sinks for one combined heat sink that would provide the same heat removal properties. A POSITA would have known that one heat sink would be using an already known technique (i.e., separate heat sinks) for a similar device in the same way. A POSITA would have also known that one heat sink – as opposed to separate heat sinks – could

provide improved overall heat dissipation properties than separate heat sinks and such a modification would have also been obvious to try.

196. It is therefore my opinion that Brown discloses or renders obvious the limitations recited by [15.2].

***[15.3] driver circuitry and control circuitry electrically coupled to the plurality of light emitting diodes (LEDs) for providing power to the light emitting diodes (LEDs),***

197. This claim simply recites driver circuitry and control circuitry for providing power to the LEDs. Stopa does not provide details regarding the circuitry providing power to the LEDs. But by 2007 driver and control circuitry were commonly known and used for powering LEDs. Indeed, Stopa necessarily included driver and control circuitry otherwise the LED lighting unit would not be powered and would not work. Regardless, this limitation would have been obvious to a POSITA.

198. For instance, Stopa discusses commercially available LumiLED LEDs being used. Stopa also discloses that the thermal transfer capability of the heat sink allows the drive current to be increased to provide greater light output by the LEDs. A POSITA would have understood this to be *driver circuitry* for providing power to the LEDs.

FIG. 9A illustrates a new technology high flux LED, manufactured by LumiLeds Inc. This LED assembly is known in the art as a Luxeon<sup>TM</sup>

emitter. The LED die 46 is mounted on an integrated reflector cup and thermally conductive slug 49, and the anode and cathode connections are attached to the die 45 via bonded lead wires. Opto coupling silicon gel 47 is used to isolate the LED die 45 and lead wires from the optical epoxy wide angle lens 46. This new LED light source allows the heat produced from the die to be efficiently conducted out of the LED assembly through the slug 49. Efficient thermal transfer *allows drive currents through the LED die 45 to be increased which result in greater light output.*

(Ex. 1038, Stopa at 5:43-55.)

199. A POSITA would have also understood that to allow drive currents to be increased, there must be related *control circuitry* in the form of a microprocessor or digital circuitry that adjusts or provides increased or decreased drive currents to increase or decrease the light output. For instance, Stopa II discloses “control circuitry” for maintaining the LED energization current to provide the desired output light flux – i.e., light output. Stopa II discloses this control circuitry may even take the form of a microprocessor with associated circuitry – e.g., pulse width modulator or step-down switching regulator. A POSITA would have found it obvious that Stopa’s LED lighting unit would have included similar control circuitry to provide the increased or decreased light flux or output.

The present invention further encompasses control circuitry which achieves and maintains a preselected average LED energization



current, less than the rated peak current of the diodes, commensurate with a desired output light flux. This average energizing current is selected to take into account the characteristic light output versus time curve of the LED. A controller in accordance with the present invention also, in a preferred embodiment, compensates for variations in input, i.e., supply voltage. In one reduction to practice of the invention, the controller comprised a microprocessor operating as a current controlled pulse width modulator. In a preferred second embodiment, the controller was a step-down switching regulator. ...In accordance with a third control circuit embodiment, which may be employed as an enhancement to the other embodiments, the controller varied the voltage applied to the LED's as a function of the temperature of the reflector.

(Ex. 1045, Stopa II at 2:29-46.)

As noted above, the light output of the LED's is a function of energizing current. The power management circuit 70 sets the energizing current to achieve the desired light output by maintaining a constant voltage across the cluster of LED's 60 independent of input voltage. The LED current is derived by subtracting the voltage drop of the LED's from the output voltage of circuit 70, divided by the effective resistance of the resistors 62 and 63. Thus, an LED current of 250 mA can be regulated with an output voltage of 8.6 volts, using a pair of ten (10) ohm limiting resistors. This constant output voltage is achieved by causing controller 76 to function as a pulse width modulator. Diode D25 and capacitor C4 are charge pump components for the gate of the internal switch of controller 76, diode D35 is the output reset diode, capacitor C6 is the

output filter, and resistors R20 and R21 set the output voltage for 8.6 volts.

(Ex. 1045, Stopa II at 6:28-43.)

200. Brown renders obvious limitation [15.3].

*[15.4] wherein each of the lighting strips includes at least one reflector sheet comprising:*

*[15.5a] a first multi-faceted side wall of the at least one reflector sheet extending at an angle from a first side of the lighting strip along an entire length of the lighting strip, the first side wall comprising a sheet bent to form the angle,*

*[15.5b] a second multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement adjacent a second, opposite side of the lighting strip along an entire length of the lighting strip, and*

201. This limitation is met by my analysis with regard to [1.3], [1.4a], and [1.4b] above.

*[15.6] wherein the first and second multi-faceted side walls extend away from the lighting strip at an angle and are configured to cause light produced by the plurality of light emitting diodes (LEDs) to be amplified and formed into a uniform beam, and*

202. See limitation [1.5] above.

*[15.7] wherein contact between the lighting strips and the base plate provides heat transfer between the lighting strips and the base plate*

*such that heat produced by the plurality of LEDs comprised in the lighting strip is conducted to the base plate for transfer to the ambient environment.*

203. See limitation [1.6] above.

**16. Claim 18**

*[18] The light emitting diode (LED) lighting fixture as claimed in claim 15, wherein each light emitting diode (LED) of each lighting strip is electrically connected in series, and each lighting strip is electrically connected to the driver circuitry in parallel.*

204. As discussed above, Stopa discloses a or renders obvious *driver circuit*.

A POSITA would have also understood electrical circuits are connected either in series or in parallel. A POSITA would have known Stopa's linearly arranged row of LEDs would have likely been connected in series as this would be the most common and efficient way to provide power. For instance, a POSITA would have understood connecting the LEDs in a series circuit would be the most efficient way to run high power LEDs with a constant current LED driver. A POSITA would have also recognized that connecting the LEDs in series aids in providing the same amount of current to each LED. By being provided the same amount of current, each LED would provide the same light intensity or brightness and connecting in series will help ensure a single LED does not consume more current than another.

205. A POSITA would have also understood that the driver would have been

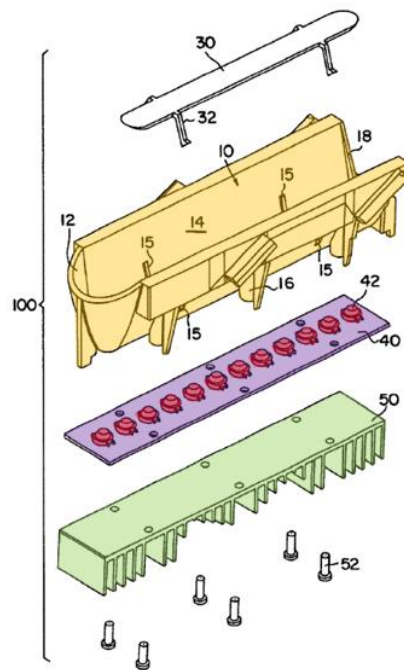
connected in parallel with respect to the LEDs connected in series. This would be the most efficient connection as there would only need to be a positive and negative voltage connection needed at both ends of the PC board to power and drive the LEDs. If the driver circuitry was connected in parallel, each LED would have to be connected individually. Such a design would be inefficient and impractical as it would require multiple separate connections. A POSITA would have understood common practice would be to connect the power being supplied from the driver circuit in parallel with all the series-connected LEDs.

206. It is my opinion Stopa discloses or renders obvious the limitations of claim 18.

**17. Claim 19**

*[19] The light emitting diode (LED) lighting fixture as claimed in claim 15, wherein each plurality of lighting strips is individually removably mounted to the base plate, so as to permit individual replacement of each lighting strip irrespective of the other lighting strips.*

207. Stopa illustrates a PC board that is mounted to a heat sink using a series of screws.



**Ex. 1038, Stopa, Fig. 1**

FIG. 4 clearly illustrates that the PC board 40 is sandwiched or tightly compressed between the rear end of the reflector 10 and a conventional finned heat sink 50. This *compressed relationship is maintained by fasteners 52 passing through the heat sink 50 and PC board 40 to engage fastener receptacles 16 molded in the reflector 10*. A tightly compressed relationship enhances thermal transfer between the PC board 40 and the heat sink 50. Thermal transfer can further be enhanced by copper cladding on both sides of the PC board, copper-clad through holes and/or thermally conductive adhesives or materials disposed between the PC board and the heat sink. The slugs 49 of each LED are mounted to the PC board in such a manner as to enhance heat transfer from the slug to the copper cladding of the PC board. Although a conventional finned heat sink is illustrated, numerous heat absorption and transfer mechanisms are known in the art and may be appropriate

for incorporation into an LED light assembly 100 in accordance with the present invention. Conducting heat away from the high output LEDs is important because overheating interferes with the efficient operation and seriously shortens the life of an LED as is known in the art.

(Ex. 1038, Stopa at 5:56-6:10.)

208. A POSITA would have recognized the design of Stopa allows the PC board or *lighting strip* to be disassembled from the reflector cup and heat sink. If one or more of the LEDs on the PC board were to fail, or the PC board itself were to fail, it would have been obvious to a POSITA that the LED light assembly could be disassembled *via* the screws and the PC board could be replaced. This is contemplated to a POSITA by the design of Stopa and well within the skill of a POSITA.

209. Furthermore, even if multiple LED light assemblies are combined together – as Stopa discloses and I discuss in limitation [15.2] – a POSITA would have still been capable and understood one PC board could be replaced.

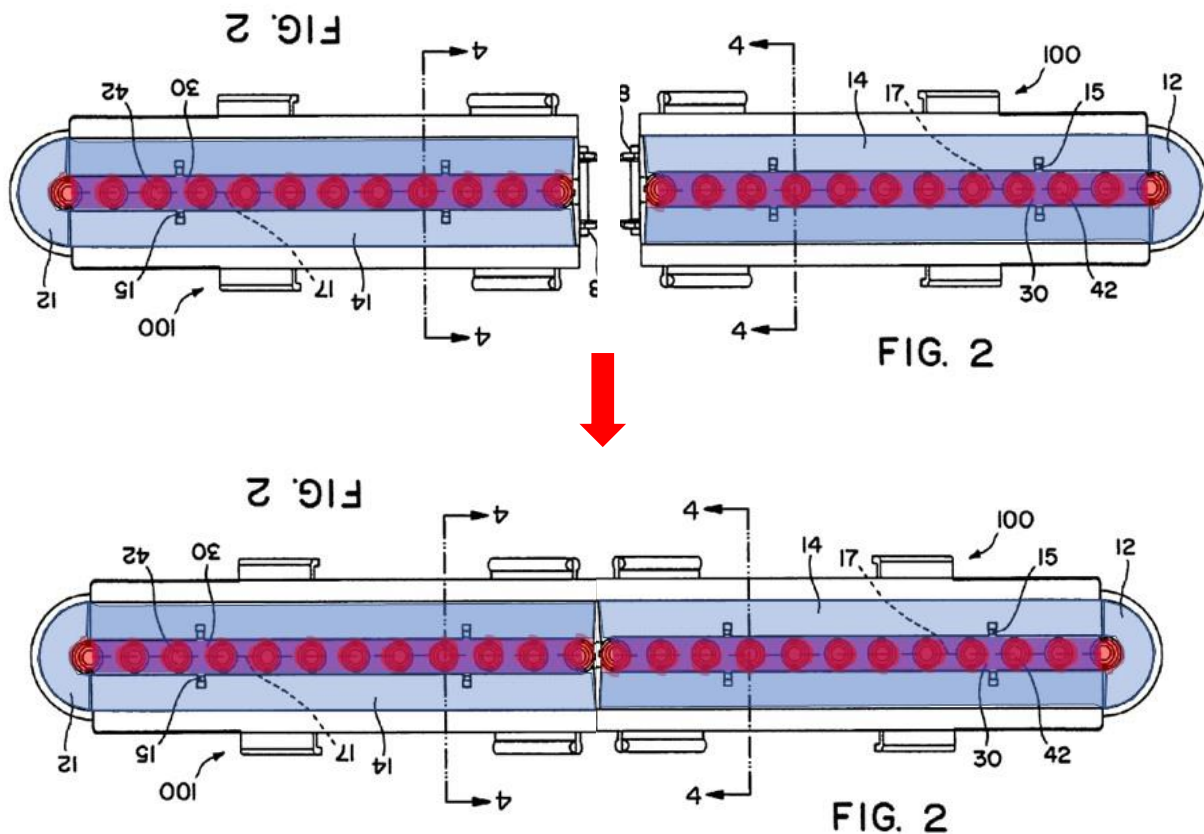
210. The limitations of claim 19 were therefore obvious in view of Stopa.

#### **18. Claim 20**

***[20] The light emitting diode (LED) lighting fixture as claimed in claim 15, wherein the light emitting diodes (LEDs) in each of the lighting strips are arranged in a linear row along the length of the lighting strip.***

211. As discussed in limitation [1.2], Stopa discloses a PC Board with a

linearly arranged row of LEDs. As discussed in limitation [15.2], Stopa discloses connecting multiple lighting strips together in a row. As illustrated below, the LEDs (red) would be arranged in a linear row the entire length of both PC Boards (*lighting strips*) upon which they are mounted.



**Ex. 1038, Stopa at Fig. 2**

212. Stopa discloses or renders obvious claim 20.

### **B. Reasons or Motivation to Combine Stopa and Stopa II**

213. As background information, Stopa (Ex. 1038) discloses prior patents which are commonly assigned. Stopa then provides a detailed disclosure of the prior patents including Stopa II (Ex. 1045).

*U.S. Pat. No. 6,318,886*, assigned to the assignee of the present invention, the entire contents of ***which are hereby incorporated by reference into this specification***, describes a high-flux LED assembly in which an array of LEDs are provided with a reflector surrounding each LED. A conical reflecting surface collects and redirects light escaping from the LED at a large angle relative to the LED optical axis. The conical reflectors redirect such “wide angle” light out the face of the assembly, increasing the effective light contribution of each LED. The high-flux LED assembly also discloses connecting the conical reflectors with grooves to improve the wide-angle visibility desirable in a warning or signaling light application. By concentrating a number of high-output LEDs in a relatively small area and reflecting the light produced in a desired pattern, a very efficient and effective signaling and/or warning light is provided.

*U.S. Pat. No. 6,318,886 mentioned above discloses an approach using conical reflectors.* While the high-flux LED assembly described in the '886 patent has proved successful for its desired application, further efficiencies are possible. ***The conical reflectors disclosed in the '886 patent redirect light incident upon them out the face of the light assembly over a range of angles where the angle of the escaping light depends on the angular relationship between incident light and the reflecting surface.*** Such an arrangement, while desirably redirecting light out the front face of the assembly, undesirably does so over a range of angles. Some of the reflected light reinforces light output of the LED. Other light is reflected at random angles that fail to reinforce the light output of the LED and is effectively lost by being dispersed. The light



pattern produced is essentially a series of bright points of light having somewhat improved wide-angle visibility due to the grooves connecting the conical reflectors.

It is known in the art to use parabolic reflectors to collimate the light output from prior art light sources such as halogen bulbs or xenon flash tubes. U.S. Pat. Nos. 4,792,717 and 4,886,329, both directed to a wide-angle warning light and both assigned to the assignee of the present invention, disclose the use of a parabolic reflector comprised of a linear parabolic section including parabolic dish ends. The reflector is configured with a reflector having a linear focal axis similar in configuration to the extended length of the xenon flash tube light source.

As exemplified by the '886, '717 and '329 patents discussed above, reflectors for light assemblies are typically configured to complement the form of the light source, e.g., point light sources are provided with reflectors having axial symmetry and linear light sources are provided with reflectors having linear symmetry. The conventional approach generally involved matching the reflector to the light source to produce maximum light output from a light assembly.

(Ex. 1038, Stopa at 2:20-3:3.)

214. As emphasized above, Stopa expressly incorporates by reference the disclosure of Stopa II. Regardless of the legal meaning, a POSITA would have understood Stopa's teachings and incorporation language as a suggestion that would have motivated and led a POSITA to modify Stopa or to combine Stopa with the

teachings of Stopa II.

215. In reviewing Stopa II, a POSITA would have understood it teaches another type of reflector similar to the reflector being disclosed by Stopa. A POSITA would have understood that combining the two references would have been nothing more than applying the known techniques of Stopa II to Stopa's reflector which would yield predictable results. As such a POSITA would have been motivated to apply the metallic coating technique to Stopa's reflector to improve its reflective properties.

**C. Ground 2 – Claims 1-2, 6-9, 13, 15, and 18-20 are Obvious Over US Pub. 2008/0089069 (Ex. 1022, Medendorp) in View of US Patent 6,257,735 (Ex. 1037, Baar) and the Knowledge of a POSITA**

**1. Claim 1**

***[1.0] A light emitting diode (LED) lighting arrangement for a lighting fixture, comprising:***

216. It is my understanding that a preamble is not limiting where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention. While it is my understanding the preamble may not be limiting, Medendorp discloses this limitation.

217. For instance, Medendorp discloses an LED lighting system that may be used to retrofit pre-existing fluorescent lighting fixtures.

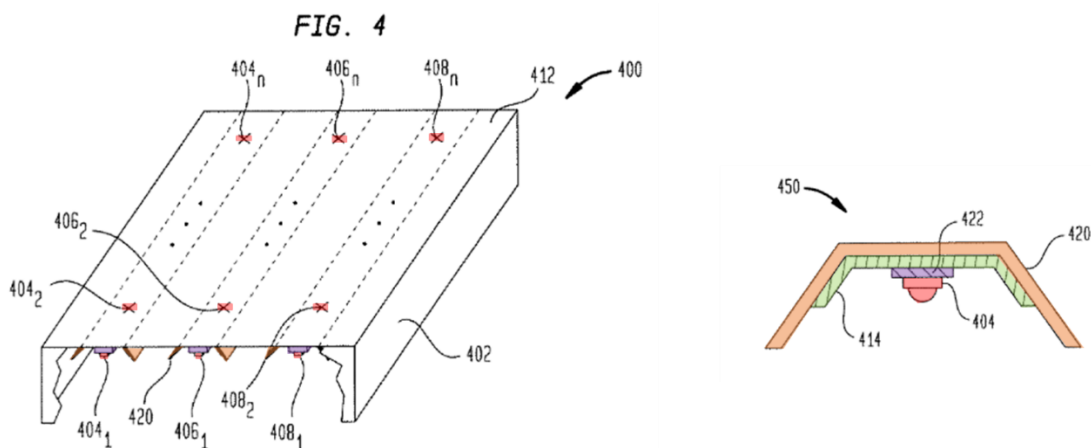
The present invention relates generally to improvements to solid state based lighting methods and apparatus suitable for use in both *retrofitting and replacing existing fluorescent lighting systems* and the like. More particularly, it relates to advantageous methods and apparatus for improved heat spreading and heat management in light emitting diode (LED) lighting systems.

(Ex. 1022, Medendorp at ¶0001.)

Among its several aspects, the present invention recognizes that a more cost effective, lower weight, and lower physical profile approach to heat dissipation is highly desirable for solid state fixtures, such as *LED-based lighting fixtures intended to replace standard fluorescent lighting fixtures. . . .*

(Ex. 1022, Medendorp at ¶0008.)

218. Medendorp discloses that a linear array of LEDs (shown with red) may be placed in the prior reflector assembly (orange) of the fluorescent light fixture.

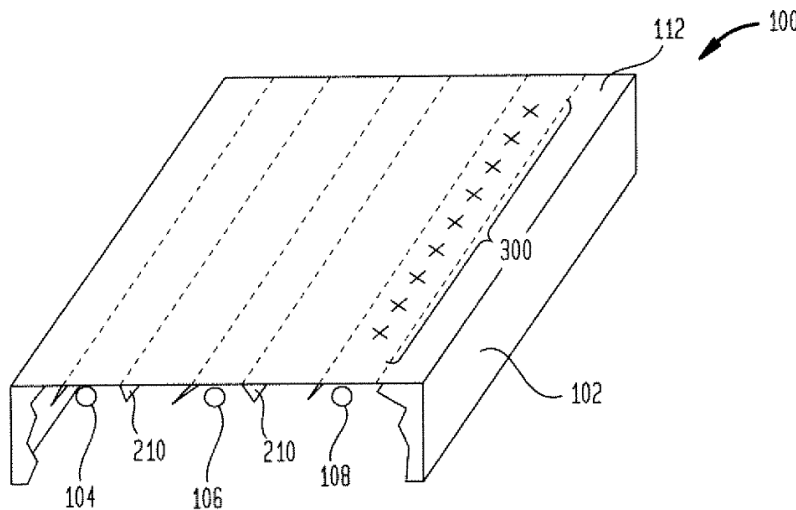


Ex. 1022, Medendorp, Figs. 4 and 5

FIG. 4 shows a side view of a first embodiment of an LED based light fixture 400 in accordance with the present invention. As shown in FIG. 4, each of the three fluorescent bulbs 104, 106, 108 of FIG. 1 is replaced by a number,  $n$ , of LEDs  $404_1, 404_2, \dots 404_n$  (collectively 404),  $406_1, 406_2, \dots 406_n$  (collectively 406), and  $408_1, 408_2, \dots 408_n$  (collectively 408), respectively. While it is presently preferred that high power LEDs, such as XLamp™ series LEDs from Cree, Incorporated, having a current of 125 mA or higher be employed, it will be recognized that lower power LEDs may also be employed. . . .

(Ex. 1022, Medendorp at ¶0023.)

219. Medendorp even illustrates the linear row of LEDs along the pre-existing reflector of the fluorescent light when explaining Figure 1.



**Ex. 1022, Medendorp, Fig. 1**

One common fluorescent lighting fixture is a luminaire fixture 100 shown illustratively in FIG. 1. Fixture 100 may suitably comprise a 2' by 4' metal box or compartment 102 having a plurality of fluorescent

bulbs 104, 106 and 108. While a 2' by 4' fluorescent fixture is discussed here as exemplary, it will be recognized that many other sizes of fluorescent fixture and various incandescent fixtures are also common. Each fluorescent bulb, such as bulb 108, is inserted in an electrical socket, and located within a reflective subassembly 210 as seen in greater detail in FIG. 2. The compartment 102 also has a reflective back surface, such as a white painted interior surface and a plastic cover mounted in a hinged door (not shown) which swings open to allow the bulbs to be easily accessed and changed. Such a fixture with its electrical ballasts may weigh about 40 pounds. A typical office may have several such fixtures mounted to the ceiling of each room to provide room lighting.

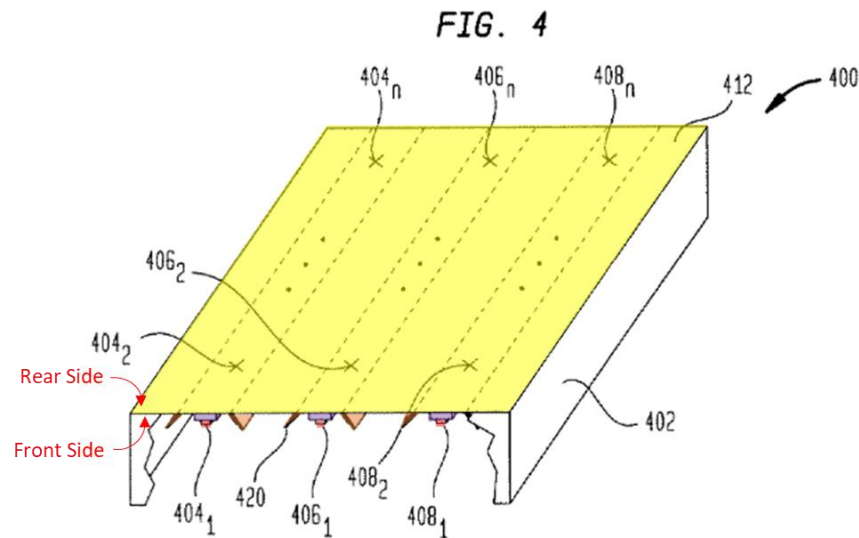
A ceiling mounted fluorescent bulb, such as the bulbs 104, 106 and 108, is only about 50-60% efficient in directing its light downwards to the room below. As illustrated by FIG. 2, if a single ceiling mounted fluorescent bulb 108 *in a typically reflective luminaire or reflector 210* is considered to emit light from four quadrants A, B, C, and D, for example, about 30% of the light emitted from quadrant A reaches a room below, about 55% from quadrants B and C is directed downwards and almost 95% from quadrant D is directed downwards so that the end result is approximately 50-60% efficiency. ***By contrast, a plurality of LEDs 300 mounted in a similar reflective fixture 310 direct most of their light downward to the room below.***

(Ex. 1022, Medendorp at ¶¶0003-0004.)

220. Therefore, Medendorp discloses limitation [1.0].

**[1.1] a base plate;**

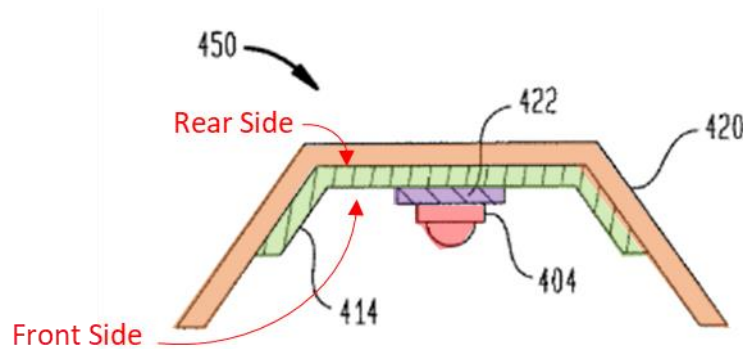
221. As shown below, Medendorp discloses a pre-existing fluorescent or luminaire fixture 400 having a top surface<sup>10</sup> (shaded yellow) that has been retrofitted with a linear row of LEDs. *See* Ex. 1022, Medendorp at ¶¶003 and 0023. A POSITA would have understood top surface of the fluorescent fixture as being the recited *base plate* which would include a front side and a rear side.



**Ex. 1022, Medendorp, Fig. 4**

<sup>10</sup> Medendorp discloses with reference to Figure 1, that reference “112” which corresponds to “412” is the top surface of the fluorescent or luminaire light fixture. (Ex. 1022, Medendorp at ¶0006.) Medendorp also discloses reference “102” which corresponds to “402” is the fluorescent fixture box. *Id.*

222. Alternatively, Medendorp discloses “a sheet of anisotropic heat spreading material 414” which also satisfies the recited *base plate*. As shown, the heat spreading material or *base plate* also has a front side and opposing rear side.



**Ex. 1022, Medendorp, Fig. 5**

In FIGS. 5 and 6, a *plurality of LEDs 404 are mounted on a metal core or FR4 board 422 in thermal contact with a sheet of anisotropic heat spreading material 414 which is attached by an adhesive backing, such as a thermal adhesive, glued or otherwise attached to a luminaire or other reflector 420*. The combination of LEDs 404, metal core or FR4 board 412, anisotropic heat spreading material 414 and luminaire 420 forms a subassembly 450. An anisotropic heat spreading material is one which preferentially directs heat in one direction. Some exemplary material thermal conductivities are shown in the table below.

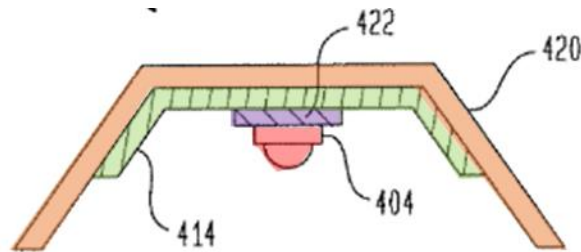
(Ex. 1022, Medendorp at ¶0024.)

223. Medendorp discloses or renders obvious limitation [1.1].

*[1.2] a lighting strip coupled to the base plate, the lighting strip comprising a plurality of light emitting diodes (LEDs) arranged along*

***a substantially planar surface of the lighting strip;***

224. Medendorp discloses a plurality of LEDs (red) arranged or “mounted” along the flat planar surface of a “metal core or FR4<sup>11</sup>” printed circuit board (shown in purple below) – which I collectively refer to as a substrate material. The combination of LEDs and the substrate material would satisfy the recited *lighting strip*.



**Ex. 1022, Medendorp, Fig. 5**

In FIGS. 5 and 6, ***a plurality of LEDs 404 are mounted on a metal core or FR4 board 422*** in thermal contact with a sheet of anisotropic heat spreading material 414 which is attached by an adhesive backing, such

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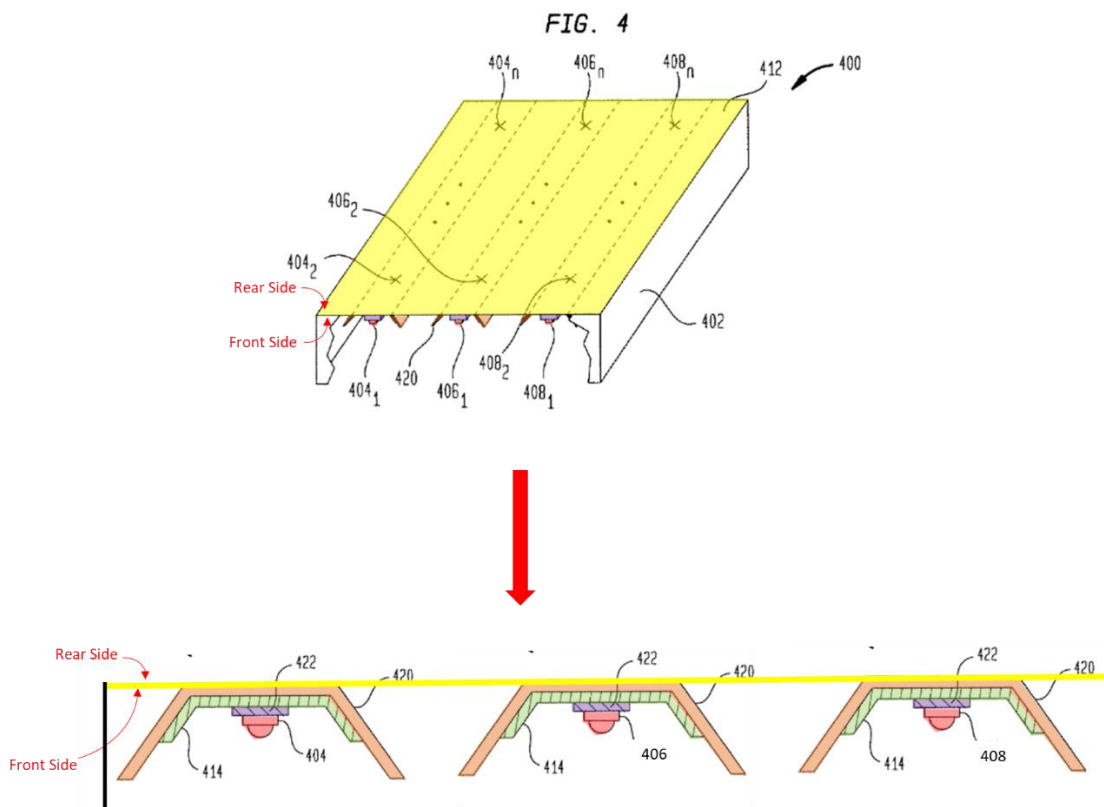
<sup>11</sup> A POSITA would have understood “FR4” is a class of printed circuit board base material made from a flame retardant epoxy resin and glass fabric composite. A POSITA would have understood FR4 printed circuit boards that included a metal core such as aluminum was common practice in order to reduce the operating temperature of the LEDs. A POSITA would have known that metal core-FR4 light engines were commonly used for use in LED lighting applications.



as a thermal adhesive, glued or otherwise attached to a luminaire or other reflector 420. The combination of LEDs 404, metal core or FR4 . . . board 412, anisotropic heat spreading material 414 and luminaire 420 forms a subassembly 450. An anisotropic heat spreading material is one which preferentially directs heat in one direction. Some exemplary material thermal conductivities are shown in the table below.

(Ex. 1022, Medendorp ¶0024.)

225. Medendorp's *lighting strip* is coupled to the top surface (*i.e.*, *base plate*) of the fluorescent fixture through the reflector (orange) and "heat spreading material 414." I note the '854 Patent expressly states a *lighting strip* can be "mounted either directly or indirectly to [the] base plate 103 in a manner permitting effective and efficient heat transfer between the LEDs 111[.]" (Ex. 1001, 854 at 8:11-15.) The '854 Patent also includes an embodiment where the *base plate* is indirectly coupled through a separate mounting member or base member. (*See* Ex. 1001, '854 Patent at 13:6-25; Figs. 1 & 10B.) Medendorp's *lighting strip* is therefore *coupled* to the *base plate* (yellow). Medendorp's coupling between the *lighting strip* and *base plate* provides a heat transfer path for the heat generated by the LEDs to be dissipated.



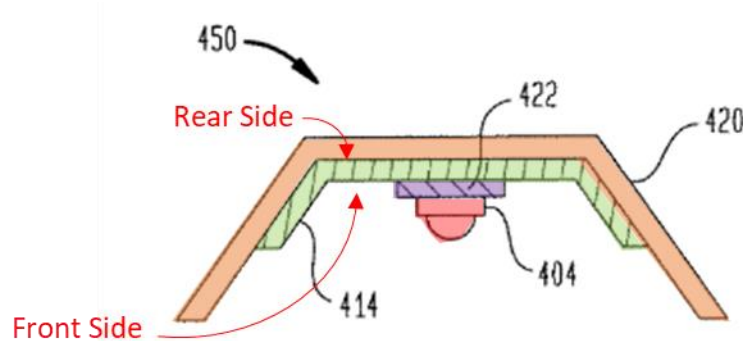
**Ex. 1022, Medendorp, Figs. 4 and 5 (modified & annotated)**

FIG. 4 shows a side view of a first embodiment of an LED based light fixture 400 in accordance with the present invention. As shown in FIG. 4, each of the three fluorescent bulbs 104, 106, 108 of FIG. 1 is replaced by a number,  $n$ , of LEDs  $404_1, 404_2, \dots, 404_n$  (collectively 404),  $406_1, 406_2, \dots, 406_n$  (collectively 406), and  $408_1, 408_2, \dots, 408_n$  (collectively 408), respectively. While it is presently preferred that high power LEDs, such as XLamp™ series LEDs from Cree, Incorporated, having a current of 125 mA or higher be employed, it will be recognized that lower power LEDs may also be employed. Further exemplary details of suitable mounting details of the LEDs 404, 406 and 408 are shown in FIGS. 5, 6, 9A and 9B. While single LEDs are shown, multiple color LEDs, such as red, blue and green may be grouped together in arrays

for applications where it is desired to be able to vary the color of light delivered by the fixture.

(Ex. 1022, Medendorp at ¶0023.)

226. Alternatively, as I discussed with regard to limitation [1.1], the “a sheet of anisotropic heat spreading material 414” also satisfies the recited *base plate*. As shown, *lighting strip* (i.e., the substrate and plurality of LEDs) are therefore directly coupled to the *base plate*.

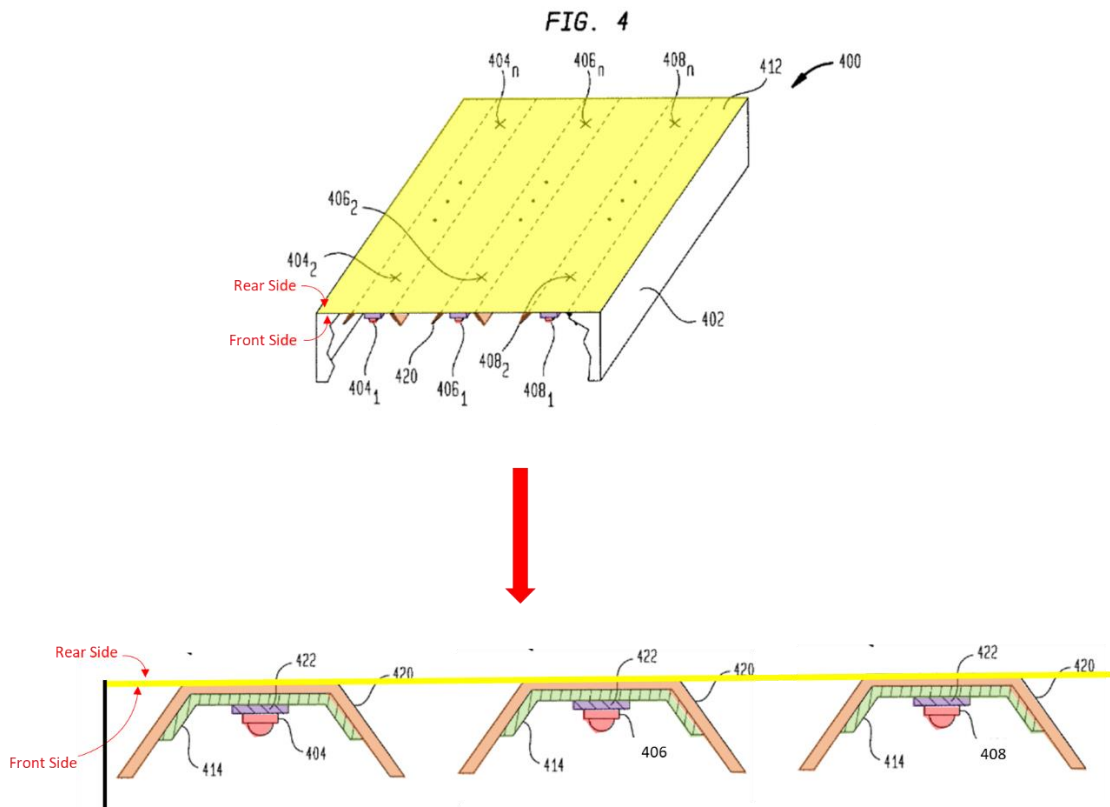


**Ex. 1022, Medendorp, Fig. 5**

227. Therefore, Medendorp discloses or renders obvious limitation [1.2].

**[1.3] at least one reflector sheet comprising**

228. As shown below Medendorp discloses a plurality of reflectors 420 (shaded orange) that are meant to house a linear row of LEDs 404, 406, and 408 (shaded red).



**Ex. 1022, Medendorp, Figs. 4 & 5 (modified and annotated)**

In FIGS. 5 and 6, a plurality of LEDs 404 are mounted on a metal core or FR4 board 422 in thermal contact with a sheet of anisotropic heat spreading material 414 which is attached by adhesive backing, such as a thermal adhesive, glued or otherwise attached to a luminaire or other **reflector 420**. . . .

(Ex. 1022, Medendorp at ¶0024.)

229. A POSITA would have understood that fluorescent or luminaire fixtures were commonly constructed of a metal material like aluminum or steel. Medendorp even states the exemplary fluorescent fixture includes a 2' by 4' metal structure. (Ex. 1022, Medendorp at ¶0003.) Medendorp further states: “the present

invention addresses techniques for more efficiently transferring heat away from LEDs to the surrounding metal or other materials of a mounting fixture, such as the reflective metal of a luminaire fixture.” (Ex. 1022, Medendorp at ¶0008.) A POSITA would have understood Medendorp as teaching fluorescent fixtures – including the reflector – as being assembled out of metal. Such an understanding is reinforced by Medendorp’s statement of a “reflective metal” i.e., the reflector material. A POSITA would have also known it was common for fluorescent fixtures to include one or more reflectors formed from a single sheet of metal.

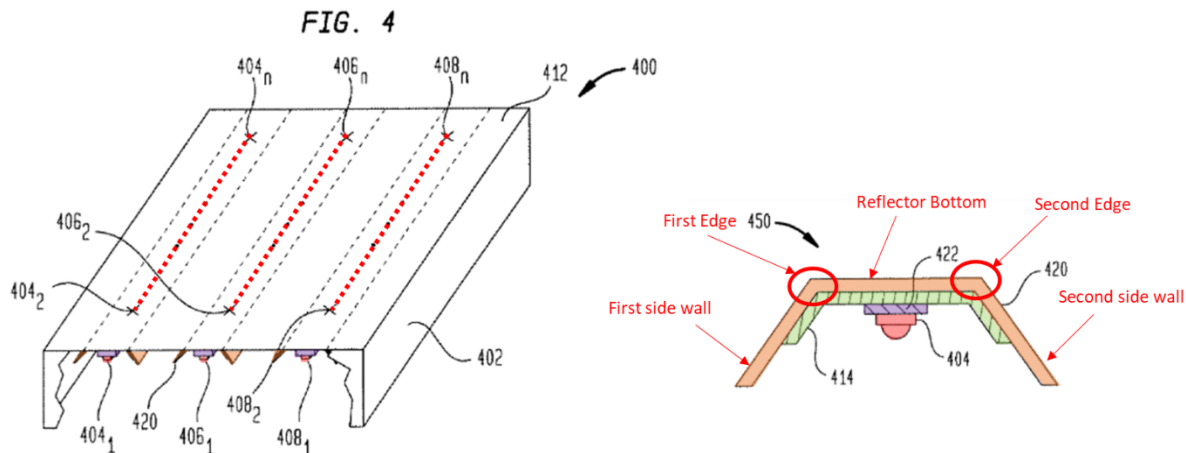
230. Medendorp discloses or renders obvious this limitation.

*[1.4a] a first multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip with a first edge adjacent a first side of the lighting strip and extending at an angle along an entire length of the lighting strip; and*

*[1.4b] a second multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip, the second side wall having a first edge adjacent a second, opposite side of the lighting strip at an angle that extends along an entire length of the lighting strip,*

231. As annotated below, Medendorp’s reflector includes a *first sidewall* and a *second sidewall*. The *first* and *second sidewalls* are connected to the reflector’s bottom at a *first edge* and a *second edge*. As I explained in limitation [1.3] it would

have been obvious to construct the *first sidewall*, *second sidewall*, and reflector bottom from one reflector sheet.

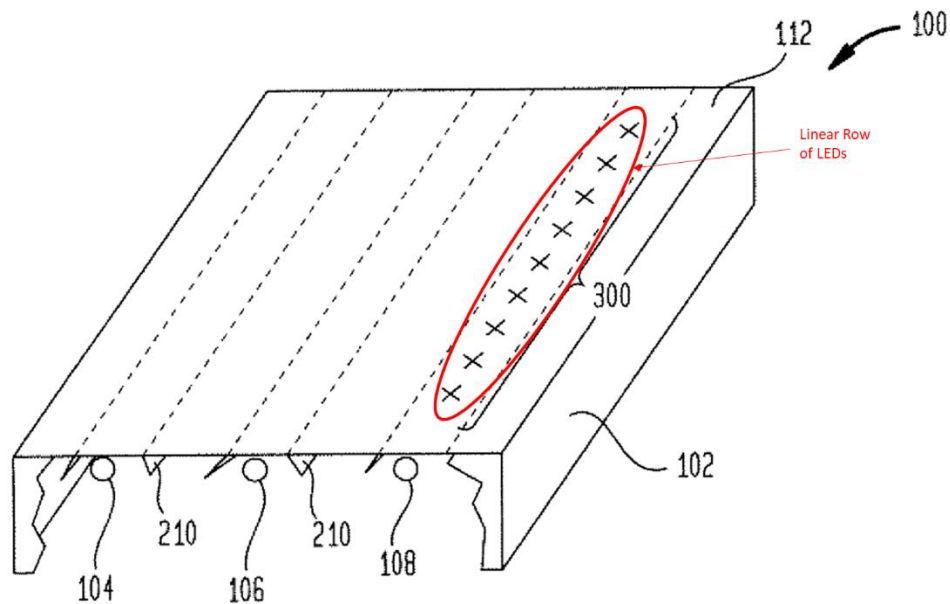


**Ex. 1022, Medendorp, Figs. 4 & 5**

232. A POSITA would have understood Medendorp discloses the *first/second side walls* of the reflectors extend the entire length of the *lighting strip* as shown by the dashed line above left. This is specifically shown where reflector 420 extends continuously across the entire length of the LED fixture 400 as shown by the sets of dashed hidden lines. The reflector 420 extends parallel with the linear arrangement of LEDs 404, which are centered on the base of the reflector 420. Since the reflector extends along the entire length of the light fixture 400, it also extends the entire length of the lighting strip.

233. Medendorp additionally confirms how the *lighting strip* extends the entire length of a reflector when describing how a fluorescent light may be retrofitted. With reference to Figure 1, Medendorp states a series of high-power

LEDs (represented by “X” in figure below) can be inserted in the same location previously occupied by the fluorescent light bulb. As I discussed above, since discrete LEDs have an output of about 80-100 lumens, the use of LED lighting strips with multiple LEDs was an obvious way of increasing the total output of a luminaire. As shown below, the LEDs would be located within the “reflector 210.”



**Ex. 1022, Medendorp, Fig. 1**

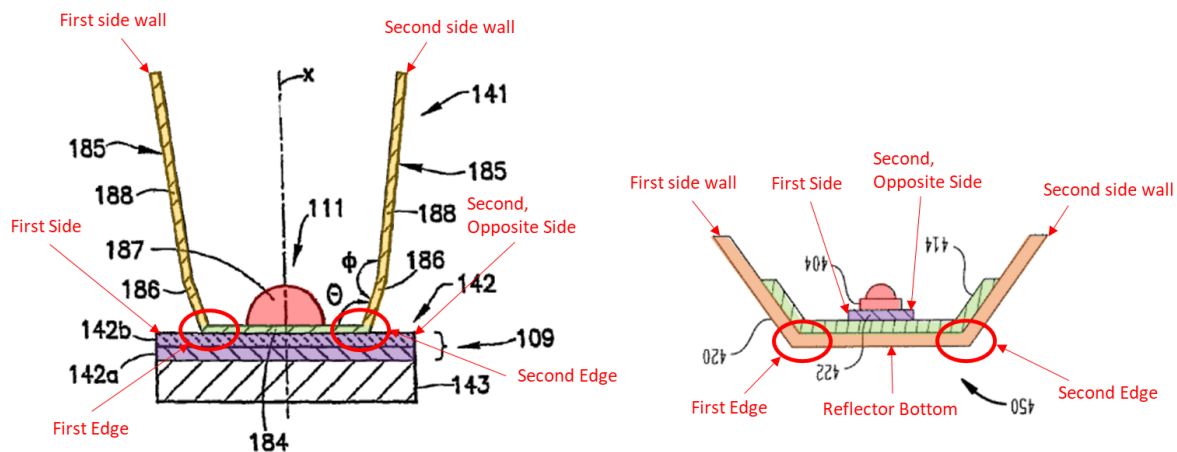
With respect to heat dissipation, the fluorescent bulbs 102, 106 and 108 extend the length of box 102 as indicated by the dashed lines for their subassemblies in FIG. 1. With their large surface areas, they very effectively transfer their heat to the surrounding air and subassemblies so that heat dissipation is not a problem for fluorescent lighting fixtures of this kind. *By contrast, when a fluorescent bulb is replaced by a series of high power LEDs, such as the LEDs 300 of FIG. 3, as represented by xs in FIG. 1, heat dissipation becomes an issue. In this example, high power means an LED having a current of 125 mA or*

higher. In most cases, power LEDs for lighting applications will be mounted on metal core printed circuit boards (MCPCB), which will be thermally connected to an isotropic heat sink. Heat flows through the MCPCB to the heat sink by way of conduction. The heat sink diffuses heat to the ambient surroundings by convection. There are three common varieties of heat sinks: flat plates, dip-cast finned heat sinks, and extruded finned heat sinks. A material often used for heat sink construction is aluminum, although copper may be advantageously used for flat-sheet heat sinks.

(Ex. 1022, Medendorp at ¶0005.)

234. A POSITA would understand the term “adjacent” is a relative term that tends to mean next to or near something. The embodiments of the ‘854 Patent are similar in design to Medendorp. For instance, both Medendorp and the ‘854 Patent show the *first/second sides walls* being joined to the sides of the reflector bottom having the LEDs (red) centered in the middle of the reflector. Both Medendorp and the ‘854 Patent illustrate a *first/second edge* adjacent a *first/second side* of the *lighting strip*.



**FIG.16**

**ON LEFT: Ex. 1001, '854 Patent, Fig. 16**

**ON RIGHT: Ex. 1022, Medendorp, Fig. 5 (annotated and inverted)**

235. As shown above, both the '854 Patent and Medendorp illustrate a *lighting strip* (purple) with a *first side/second side* that are adjacent – or near to – the *first edge/second edge*. The only visible differences is that the '854 Patent *lighting strip* extends beyond the reflector, whereas Medendorp illustrates a narrower lighting strip. However, a POSITA would have understood the size of Medendorp's lighting strip could be designed to extend the entire length of the reflector bottom. This is simply a design choice and a POSITA would have known how to increase the size of the substrate board the LEDs are assembled on.

236. Regarding the recited *multi-facet*, the '854 Patent defines facets “broadly in connection with this disclosure as a formation(s) in the body of

reflector 141 that amplify<sup>12</sup> the light output of the LEDs 111 and direct the amplified and desirably uniform light outward from the light fixture 101 for any desirable application.” (Ex. 1001, ’854 Patent at 10:56-60 (footnote added).)

237. While Medendorp does not detail the construction of the first and second reflector side walls, the illustrated sidewalls of the reflector 420 meet this definition of facet. The figures show the sidewalls of the reflectors as being straight sides wall. In my opinion the reflector 420 can be considered to have single faceted sidewalls.

In the present embodiment, reflector 141 defines multiple facets formed therein that amplify the light provided by LEDs 111 as will be discussed in greater detail hereinafter. Such facts may be angled formations in the body of the reflector 141 but reflector 141 is not intended to be limited to such facets. *Facets should be read broadly in connection with this disclosure as a formation(s) in the body of reflector 141 that amplify the light output of the LEDs 111 and direct the amplified and desirably uniform light outward from the light fixture 101 for any desirable application.*

(Ex. 1001, ’854 Patent at 10:51-60.)

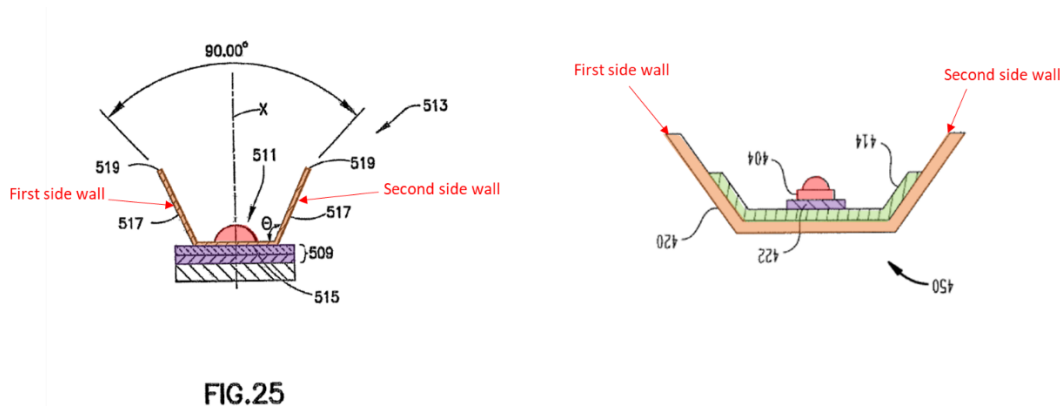
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<sup>12</sup> As I explained above, reflectors cannot amplify the light. I will again read amplified as focused.

Each side wall 185 of reflector assembly 141 includes a first facet or first portion 186 defining a first angle  $\theta$  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187 of LED 111, and a second facet or second portion 188 that defines a second angle  $\Phi$  with first portion 186. The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111. It is contemplated that the multiple facets reflect the light that is output from the LEDs back toward other facets of the walls of reflector 141, thereby amplifying the light. *However, this is not to be construed as limiting as this definition of a multi-faceted reflector may also include reflectors having a parabolic shape.*

(Ex. 1001, '854 Patent at 17:41-54.)

238. Indeed the design of Medendorp is nearly identical to Figure 25 of the '854 Patent.



ON LEFT: Ex. 1001, '854 Patent, Fig. 25

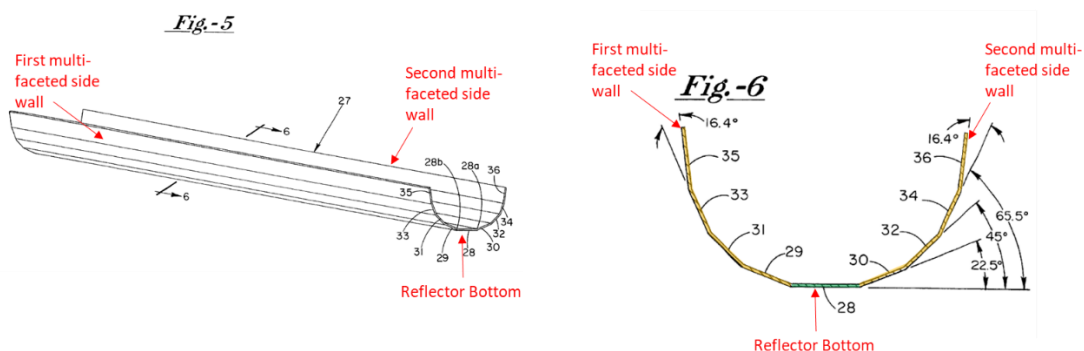
ON RIGHT: Ex. 1022, Medendorp, Fig. 5 (annotated and inverted)

239. While Medendorp discloses *side walls* similar to Figure 25 of the '854

Patent, it does not expressly disclose a reflector wall that includes *multi-faceted side walls*.

240. But a POSITA reading Medendorp would have known that the reflectors illustrated are merely exemplary and fluorescent/luminaire fixtures may include many varying types and reflector shapes. Indeed, a POSITA would have recognized that fluorescent/luminaire fixtures were known to include reflectors having all types of shapes including multi-faceted side wall designs.

241. For instance, Baar discloses a fluorescent light reflector design that was known as early as 2000. As shown below, Baar discloses a “U-shaped” reflector that includes a flat bottom surface and a *first/second multi-faceted side wall*. Baar also discloses the reflector is constructed from a single piece of aluminum – like Medendorp.



**Ex. 1037, Baar, Figs. 5 & 6**

FIG. 5 shows a perspective view of one of my reflectors and FIG. 6 shows a cross-sectional view thereof, taken along line 6-6 of FIG. 5. As

shown, it is comprised of an elongated *channel member 27 which is of generally U-shape in cross-sectional configuration and is made of a light metal such as aluminum*. As shown, it is comprised of an elongated flat panel 28 at the base of the U-shaped channel which extends thereat through its length.

(Ex. 1037, Baar at 3:46-53.)

242. Baar's *first and second multi-faceted sidewalls* extend from the edges of the reflector bottom (i.e., "flat panel 28"). Baar's *first/second multi-faceted sidewalls* are composed of a plurality of reflective panels (facets) arranged at different angles to form the entire reflector.

Extending parallel to the side edges 28a and 28b of the panel 28 and connected thereto as a continuation of panel 28, **is a pair of flat parallel elongated reflective panels 29 and 30**, each of which extends at an angle of 22-32 degrees (preferably 22.5°) to the plane of panel 28. The reflective surfaces of each of the panels 29 and 30 face downwardly and outwardly and cooperate with the reflective surface of panel 28.

**Connected and extending parallel to the side edges of the panels 29 and 30 is a second pair of flat, parallel elongated reflective panels 31 and 32**, each of which has a reflective surface facing downwardly and extending outwardly from panels 29 and 30, respectively at an angle of 22-32 degrees (preferably 22.50°).

**Connected and extending parallel to the side edges of panels 21 and 32 is a third pair of flat, elongated parallel reflector panels 33 and 34**, each of which also has a reflective surface facing

downwardly and extending outwardly from the side edges of flat panels, 31 and 32, respectively at an angle of 22-32 degrees (preferably 22.50).

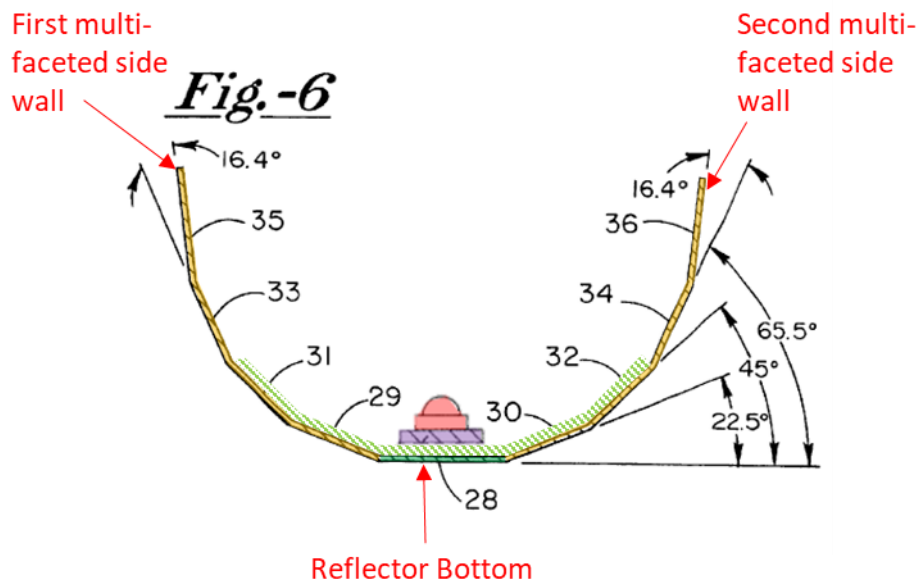
**Connected and extending at their side edges to the side edges of the panels 33 and 34 is a fourth pair of flat parallel elongated panels 35 and 36**, each of which also has a reflective surface facing downwardly and outwardly from the side edges of panels 33 and 34, respectively, at an angle of approximately 13-20° (preferably 16°).

Each of the panels 29-34 are preferably {fraction (11/16)} of an inch wide, while the panels 35-36 may be slightly wider, preferably at {fraction (13/16)} of an inch.

(Ex. 1037, Baar 3:58-4:19.)

243. Again, Medendorp discloses “improvements to solid state based lighting methods and apparatus suitable for use in both retrofitting and replacing existing fluorescent lighting systems.” A POSITA would have known it was obvious to employ the retrofit teachings of Medendorp within the fluorescent fixture disclosed by Baar. It would have been obvious to a POSITA that as is taught by Medendorp, a string of LEDs on a strip the same length as a fluorescent bulb could be used to replace it inside a luminaire that had reflectors with multiple facets, such as Figs. 5 and 6 from Baar. Once employed, a POSITA would have known Medendorp discloses all elements of limitation [1.4] including *first/second multi-faceted sidewalls* as I have illustrated below. As shown, POSITA would have

understood Medendorp's "anisotropic heat spreading material" (green hatched shading) would be applied to the surface of Baar's multi-faceted reflector. Also, the lighting strip would then be positioned onto the heat spreading material along the reflector bottom, like it is disclosed by Medendorp. The *first side wall* extends away from the *lighting strip* at a *first edge* which is located where the bottom surface "28" and the first facet "29" meet – i.e., angle 22.5. Likewise, *second side wall* extends away from the *lighting strip* at a *second edge* which is located where the bottom surface "28" and the first facet "30" meet – i.e., angle 22.5



**Ex. 1037, Baar, Fig. 6**

244. Lastly, I understand the Patent Owner disagrees that claim 1 requires the *first/second multi-faceted sidewalls* need to extend from the reflector bottom at the same angle. Instead, Patent Owner contends the angles between the two sidewalls

can be different. Regardless of the construction, Medendorp and Baar satisfy this limitation.

245. For instance, as shown above, Baar illustrates both the *first/second multi-faceted side walls* extend from the reflector bottom at an angle of 22.5 degrees, i.e., the same angle. While Medendorp doesn't provide the exact angles, the figures visually illustrate both the *first/second side walls* extend from the reflector bottom at the same angle. With sidewalls extending at the same angle, the combination of Medendorp and Baar meet the recited claim language.

246. Accordingly, the combination of Medendorp and Baar discloses limitations [14a] and [1.4b].

***[1.5] wherein the first and second multi-faceted side walls extend away from the lighting strip at an angle and are configured to cause light produced by the plurality of light emitting diodes (LEDs) to be amplified and formed into a uniform beam,***

247. As discussed above, Medendorp discloses that the reflector sidewalls extend from the reflector base at an angle. I further explained above that Baar also discloses that the reflector sidewalls extend from reflector bottom at an angle. Baar also teaches that the reflector is configured to cause light to be focused and formed into a uniform beam.

248. Again, the '854 Patent states that a uniform beam may be a focused beam or a diffused beam:



Additional embodiments are directed to amplifying reflectors that may be associated with the lighting strips so that light produced by the plurality of light emitting diodes (LEDs) may be amplified and formed into a *uniform beam which may be* a focused beam useful, for example, as a spotlight, or *a diffused beam useful, for example, as an overhead streetlight or possibly as an overhead office light.*

(Ex. 1001, '854 Patent at 5:61-6:1.)

249. First, Medendorp expressly discloses its retrofit application can be used for any standard fluorescent lighting fixtures in use prior to 2006 (the filing date) which includes “street lights, low bay lights, desk lamps” as examples. (Ex. 1022, Medendorp, at ¶0035.) Medendorp therefore contemplates a retrofit kit used in fixtures having reflectors that will provide uniform beams that are diffused (e.g., street lights) or focused (desk lamps). Baar also discusses focused lighting for large areas such as “warehouses, sports arenas, supermarkets, etc.” (Ex. 1037, Baar at 1:17-18.) The lighting of streets and sports arenas have similar lighting requirements such as providing uniform illumination over a wide area. Baar explains:

The primary feature of my invention is the interior reflective surface of the inverted U-shaped channel member which is characterized by the use of a series of elongated flat reflective panels extending lengthwise of the channel member in parallel side by side relation, and at a prescribed angle thereto. These panels have a reflective inner surface, facing downwardly and outwardly, and extend at an angle of about 22°-32° relative to each other. They function to spread the light which they

reflect downwardly so as to overlap each other's reflections markedly, and thereby *diffuse the light and spread it to make it more uniform and avoid the formation of shadows and hot spots*, while improving the visibility and producing a higher ratio of vertical to horizontal illuminance.

(Ex. 1037, Baar at 1:42-55.)

Another object of my invention is to provide a light reflector configured and positioned to produce *a more uniform light distribution*.

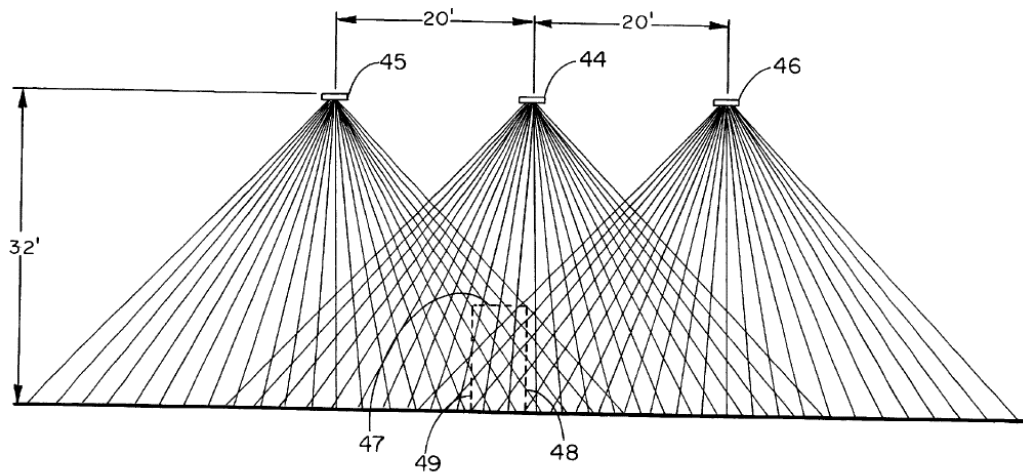
(Ex. 1037, Baar at 2:34-36.)

FIG. 11 illustrates the benefits derived from the use of my reflectors which are described above. *The angled panels spread out the light generated by each of the bulbs mounted in each reflector of the various banks of lamps*, each bank being comprised of five (5) reflectors and five (5) lamps or bulbs. These banks are spaced from each other by a distance of about twenty (20) feet, center to center, and are each disposed at an elevation of approximately 32 feet. **As shown in FIG. 11, there is substantial spread** and, as a consequence, there is substantial overlap of the lighting from each adjacent bank of lights. As shown, each bank such as centrally located bank 44 overlaps in excess of 50% of the area lighted by each adjacent bank, such as banks 45 and 46. Thus, bank 44 overlaps over 50% of the lighted areas of four (4) adjacent banks when we install the banks in a horizontal square design, spaced twenty (20) feet, center to center at an elevation of thirty-two (32) feet. *This provides great lumen overlap and much more uniform light distribution* and precludes any problem of spots and shadows,

while greatly diminishing the required wattage, as hereinafter described.

(Ex. 1037, Baar at 4:30-49.)

***Fig. -11***



**Ex. 1037, Baar, Fig. 11**

250. As I discussed in Ground 1 limitation [1.5], it is not possible for a reflector to amplify light. The '854 Patent however states that amplification is done by a reflector having multiple angles. As I discussed above, “amplified” seems to indicate increased “focus” of the light output. The reflectors of both Medendorp and Baar collect LED light output at different angles, redirects and focuses the light produced by the LEDs in order to increase the light level where it is required on the roadway or other surfaces, as I discussed above.

251. Once retrofitted with the LED lighting system of Medendorp, a POSITA would have known that Baar’s reflector structure would cause the LED

light to be a uniform and amplified (i.e., focused) beam. Therefore, Medendorp in combination with Baar and the knowledge of a POSITA disclose limitation [1.5].

*[1.6] and wherein the coupling between the lighting strips and the base plate provides heat transfer between the lighting strips and the base plate such that heat produced by the plurality of LEDs comprised in the lighting strip is conducted to the base plate for transfer to the ambient environment.*

252. Medendorp discloses a fluorescent light fixture having a metal housing that would allow the heat generated by the LEDs to be transferred to the metallic housing and dissipated to the ambient environment.

Among its several aspects, the present invention recognizes that a more cost effective, lower weight, and lower physical profile approach to **heat dissipation** is highly desirable for solid state fixtures, such as LED-based lighting fixtures intended to replace standard fluorescent lighting fixtures. Important factors in selecting heat sinks include the surface area and weight of the heat sink. *An aspect of the present invention balances such important design constraints with the physical constraints of existing lighting fixtures, such as their weight, footprint, profile and the like. Further, the present invention addresses techniques for more efficiently transferring heat away from LEDs to the surrounding metal or other materials of a mounting fixture, such as the reflective metal of a luminaire fixture.* By utilizing such materials to dissipate heat more effectively, advantages such as lower overall weight fixtures may be achieved. Further, more effective

heat spreading can result in longer LED lifetime and more consistent LED performance. To such ends, an aspect of the present invention seeks to utilize an existing isotropic conductive heat sink or frame of a standard or design fixture thereby allowing more cost effective retrofitting of such devices. Another aspect addresses a better design approach to new design fixtures.

(Ex. 1022, Medendorp at ¶0008.)

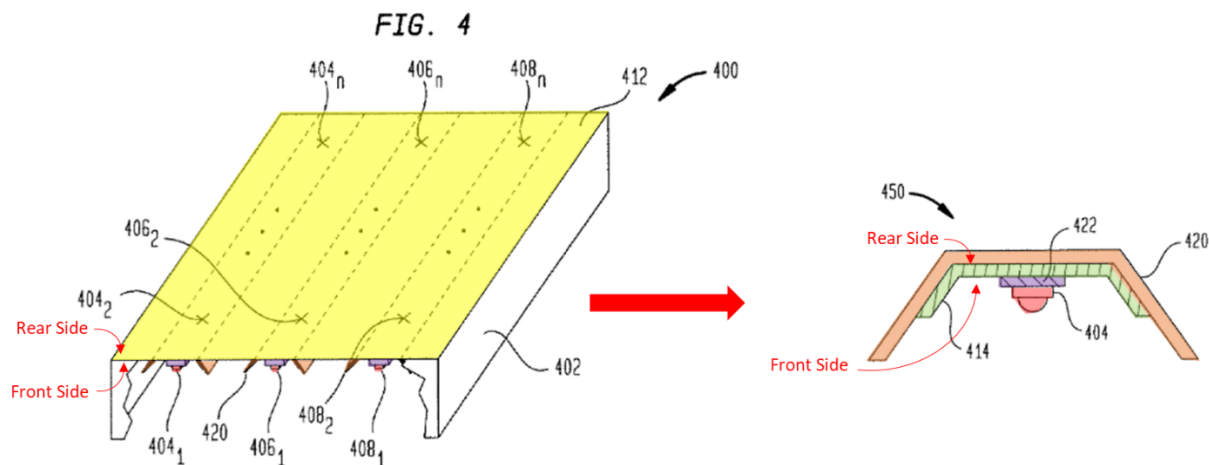
253. Medendorp also discloses a “heat spreading material 414” that is applied to the reflector to dissipate heat generated by the *lighting strip* (i.e., the FR4/PCB substrate with LEDs).

In FIGS. 5 and 6, a plurality of **LEDs 404** are mounted on a metal core or FR4 board 422 in thermal contact with a sheet of **anisotropic heat spreading material 414** which is attached by an adhesive backing, such as a thermal adhesive, glued or otherwise attached to a luminaire or other reflector 420. **The combination of LEDs 404, metal core or FR4 board 412, anisotropic heat spreading material 414 and luminaire 420 forms a subassembly 450.** . . . As discussed further below, **heat from the LEDs 404 is thermally coupled by metal core, FR4, or fiberglass board 422 to the anisotropic heat spreading material 414.** In this embodiment and in other embodiments, the x-y plane is along the plane or surface of the luminaire or reflector 420 and the z direction is downwards into the luminaire. Depending on the embodiment, as would be understood by one of skill in the art, the anisotropic material can include isotropic material which is configured to provide anisotropic heat spreading. As

seen in FIG. 5, x and y are in the plane of the page and z is into or out of the page. *Thus, the heat spreading material 414 transfers the spread heat over a wider area of the luminaire 420 which in turn transfers heat to the ambient air.*

(Ex. 1022, Medendorp at ¶10024.)

254. Medendorp teaches a POSITA the heat generated by the *lighting strip* would dissipate from the “heat spreading material 414” through the metal reflector to the luminaire fixture itself. The heat would therefore be dissipated through the rear side of the luminaire’s top surface (highlighted yellow below) out to the ambient environment. Or the heat could be dissipated from the heat spreading material itself to the ambient environment.



**Ex. 1022, Medendorp, Figs. 4 & 5**

255. Whether the luminaire’s top surface, or the “heat spreading material 414” is considered *the base plate*, both effectively couple with the *lighting strip* to provide a heat transfer path for heat generated by the *lighting strips* to be dissipated

to the *ambient environment*.

256. My opinion would be the same using Medendorp's retrofitting application within the fluorescent fixture (and reflectors) disclosed by Baar. Indeed, Medendorp teaches how to retrofit preexisting fluorescent fixtures like Baar's with LED lighting. Medendorp's solution also teaches how to dissipate the heat generated by LEDs. When applied to Baar's fixture, Medendorp's lighting and heat dissipating solution would apply in the same or very similar fashion. Specifically, Baar teaches a fluorescent fixture that is designed using a "rectangular metal frame" – like that disclosed by Medendorp. (Ex. 1037, Barr at 3:31-34; 5:1-7.) Barr also teaches designs of a metallic reflector that can be designed using aluminum. (Ex. 1037, Barr at 3:49-52.) A POSITA would understand when applying Medendorp's solution, the heat generated by the LEDs would be transferred through the metallic structure to the metal frame and out to the ambient environment.

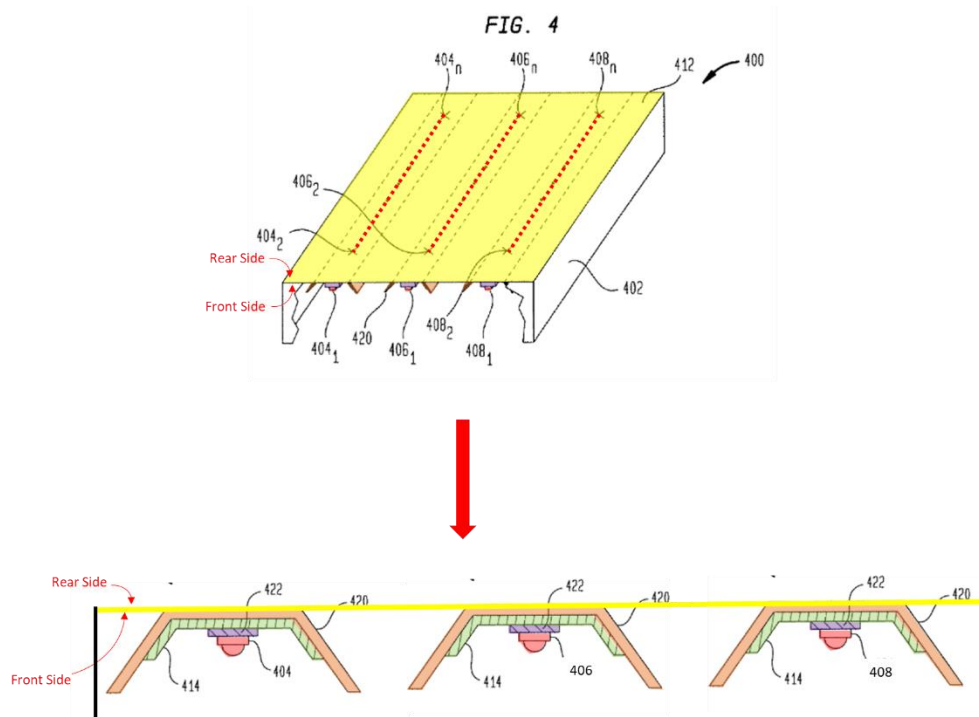
257. Medendorp discloses or renders obvious this limitation.

## **2. Claim 2**

***[2] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the light emitting diodes (LEDs) are arranged in a linear row along the length of the lighting strip.***

258. As I discussed above in limitation [1.2], Medendorp discloses a lighting strip having a number of LEDs (red dashed line; identified as 404/406/408). The

LEDs are coupled to the front side of the base plate in linear arrays or strips, such as the three strips shown in Figure 4.



**Ex. 1022, Medendorp, Figs. 4 and 5 (modified & annotated)**

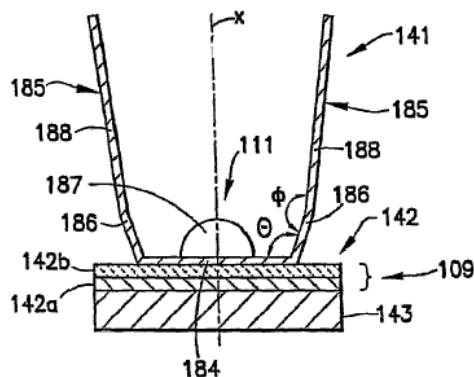
259. Therefore, Medendorp discloses the limitations of claim 2.

### 3. Claim 6

*[6] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the first and second multi-faceted side walls extend away from a base member and are symmetrical about an axis of symmetry that runs through a center of the base member.*



260. As I explained in claim 3 of Ground I above, the '854 Patent describes the recited *base member* a bottom portion of the reflector from which both side walls extend.



**FIG. 16**

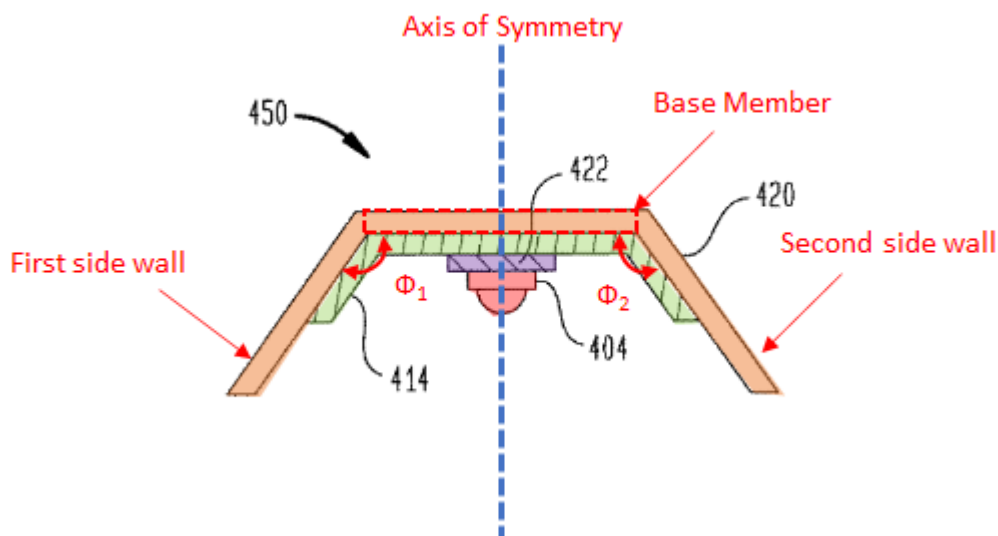
**Ex. 1001, '854 Patent, Fig. 16**

With reference to FIG. 16, a cross-sectional view of an exemplary lighting strip 109 having LEDs 111 mounted thereon and a reflector assembly 141 extending therefrom is illustrated. *In this exemplary embodiment, the reflector assembly includes a base member 184 and a pair of desirably integral side walls 185 extend from opposite sides of the base member 184 at an angle.* Each LED 111 includes a light emitting portion 187. Reflector assembly 141 is mounted to lighting strip 109 such that a bottom edge of each side wall 185 extends from a bottom portion of light emitting portion 187 of LED 111. Each side wall 185 of reflector assembly 141 includes a first facet or first portion 186 defining a first angle  $\theta$  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187 of LED 111, and a second facet or second portion 188 that defines a second angle  $\Phi$

with first portion 186. The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111.

(Ex. 1001, '854 Patent at 17:31-53.)

261. Medendorp discloses a bottom surface or *base member* (outlined in red below). The *first/second sidewalls* extend away from Medendorp's *base member* (red). The *first/second sidewalls* are also symmetrical about axis of symmetry that runs through a center of the *base member*.<sup>13</sup> In other words, Medendorp illustrates symmetrical *side-walls* extending away from the *base member*.

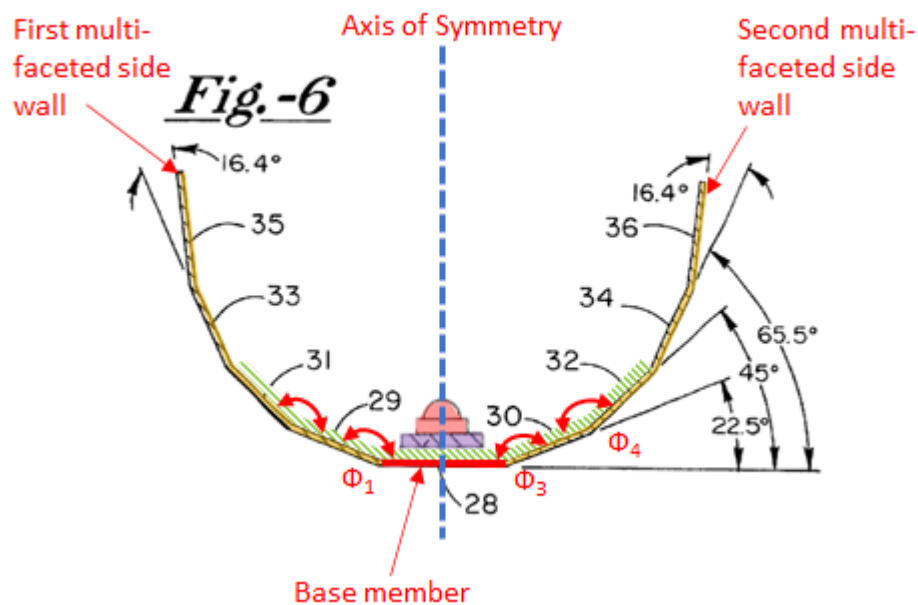


**Ex. 1022, Medendorp, Fig. 5**

262. As I explained above, Medendorp is disclosed as being a retrofit

<sup>13</sup> As I previously discussed, Medendorp's disclosure is very similar to the reflector unit shown and disclosed as FIG. 25 of the '854 Patent (Ex. 1001).

solution for fluorescent/luminaire fixtures. I have also explained it would be obvious to POSITA to apply Medendorp's retrofit solution to Baar's fluorescent fixture. When retrofitted with Medendorp's LED solution, Baar's *first/second multi-faceted sidewalls* are also symmetrical about an axis of symmetry that runs through a center of the bottom surface or *base member* of Baar's reflector. In other words, Baar's reflector (with Medendorp's LED lighting solution) also illustrates symmetrical *first/second multi-faceted side-walls* extending away from the *base member*.



**Ex. 1037, Baar, Fig. 6**

263. The combination of Medendorp and Baar render obvious the limitations of claim 6.

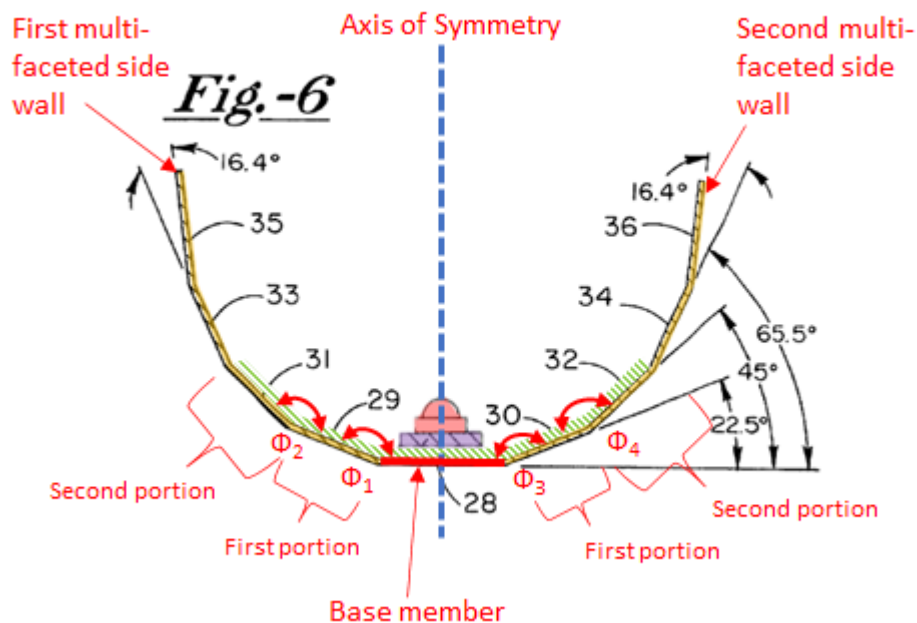
#### 4. Claim 7

[7] *The light emitting diode (LED) lighting arrangement for a*

*lighting fixture as claimed in claim 6, wherein the first and second multi-faceted side walls each comprise a first portion defining a first angle with the base member and a second portion defining a second angle with the first portion.*

264. As discussed above with regard to claim limitations [1.3] and [1.4], Baar discloses that the first and second multi-faceted sidewalls are composed of a plurality of reflective panels arranged at different angles. I have also described how it would have been obvious to employ Medendorp's retrofit LED lighting solution into Baar's fluorescent fixture.

265. As shown below, Baar's reflector has a *first multi-faceted sidewall* having a *first portion* defining a first angle ( $\Phi_1$ ) with the *base member* (red). The *first multi-faceted sidewall* also includes a *second portion* defining a second angle ( $\Phi_2$ ) with the first portion. Baar's reflector also includes a *second multi-faceted sidewall* having a *first portion* defining a first angle ( $\Phi_3$ ) with the *base member* (red) and a second portion defining a second angle ( $\Phi_4$ ) with the *first portion*.



**Ex, 1037, Baar, Fig. 6**

266. Specifically, the reflective “panel 29” (*first portion* of the *first multi-faceted sidewall*) is angled at  $22.5^\circ$  relative to the base panel 28 (*base member*) and the reflective “panel 31” (*second portion* of the *first sidewall sidewall*) is angled at  $45^\circ$  relative to the *base member* and  $22.5^\circ$  relative to the *first portion*. Also, the reflective “panel 30” (*first portion* of the *second multi-faceted sidewall*) is angled at  $22.5^\circ$  relative to the base panel 28 (*base member*) and the reflective panel 32 (*second portion* of the *second sidewall sidewall*) is angled at  $45^\circ$  relative to the *base member* and  $22.5^\circ$  relative to the *first portion*.

267. The combination of Medendorp and Baar render obvious the limitations of claim 7.

## 5. Claim 8

***[8] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 7, wherein the first angle and second angle are different angles.***

268. As I explained and illustrated in claim 7 above, the reflective “panel 29” (*first portion of the first multi-faceted sidewall*) is angled at 22.5° relative to the base panel 28 (*base member*) and the reflective “panel 31” (*second portion of the first sidewall sidewall*) is angled at 45° relative to the *base member*.

269. Also, the reflective “panel 30” (*first portion of the second multi-faceted sidewall*) is angled at 22.5° relative to the base panel 28 (*base member*) and the reflective panel 32 (*second portion of the second sidewall sidewall*) is angled at 45° relative to the *base member* and 22.5° relative to the *first portion*.

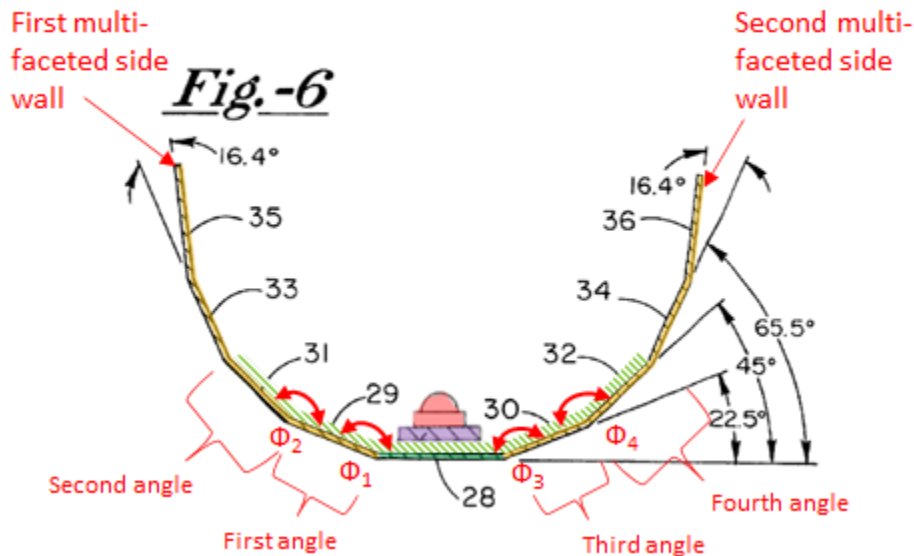
270. The combination of Medendorp and Baar therefore discloses *first/second angles* which are *different angles*.

271. Medendorp and Baar render obvious the limitations of claim 7.

## 6. Claim 9

***[9] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the first and second multi-faceted side walls comprise multi-angle side walls.***

272. Again, Baar's reflector when modified to include Medendorp's LED lighting solution includes *first/second multi-faceted sidewalls* are *multi-angle side walls*.



Ex. 1037, Baar, Fig. 6

273. Medendorp and Baar render obvious the limitations of claim 9.

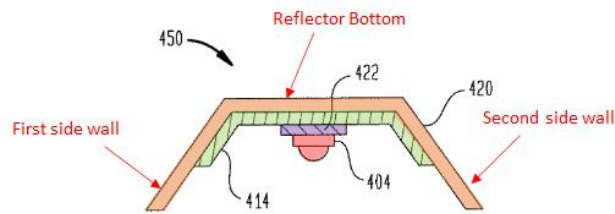
## 7. Claim 13

**[13] The LED lighting arrangement of claim 1, wherein the first side wall and second side wall each are formed by a single reflector sheet.**

274. Medendorp illustrates an LED retrofit lighting solution that is installed on a reflector for a fluorescent fixture. The reflector shown is a *single reflector sheet*. Medendorp discloses a *first/second side wall*<sup>14</sup> that are *formed by a single reflector*

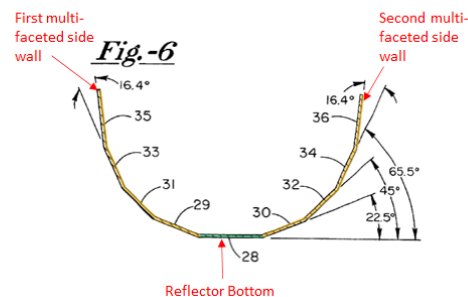
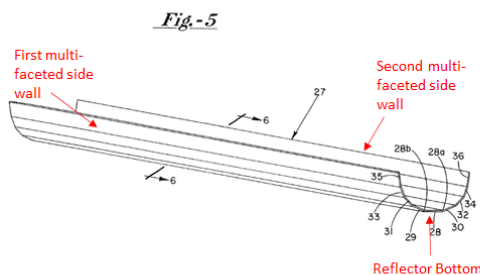
<sup>14</sup> I note claim 13 does not recite “multi-faceted side walls” but just side walls.

sheet.



**Ex. 1022, Medendorp, Fig. 5 (annotated and inverted)**

275. Likewise, Baar discloses a reflector that is formed from a single sheet of light metal (e.g., aluminum) that is “preferably about 1 inch in width.” Once modified to include the LED lighting solution of Medendorp, Baar’s reflector discloses a *first second multi-faceted side wall* which are formed from a *single reflector sheet* of metal.



**Ex. 1037, Baar, Figs. 5 and 6**

FIG. 5 shows a perspective view of one of my reflectors and FIG. 6 shows a cross-sectional view thereof, taken along line 6-6 of FIG. 5. As shown, it is comprised of an elongated channel member 27 which is of generally U-shape in cross-sectional configuration and is made of a light metal such as aluminum. As shown, it is comprised of an elongated flat panel 28 at the base of the U-shaped channel which



extends thereat through its length. It is preferably about 1 inch in width and, when in use, is fixedly secured to the frame 55 and has a reflective surface extending in a downwardly facing position.

(Ex. 1037, Baar at 3:46-57.)

276. To the extent it is argued Medendorp and Baar do not disclose a reflector formed from a single bent sheet such a solution was obvious to a POSITA by 2007. A POSITA would have known single sheet reflectors existed and were commonly used in fluorescent lighting fixtures. A POSITA would have further known that multi-facets in the reflectors could be advantageous for certain light distributions desired from the LED light fixture and that a metal press machine could easily produce the shapes of reflectors.

## **8. Claim 15**

***[15.0] A light emitting diode (LED) lighting fixture, comprising:***

277. See limitation [1.0] above.

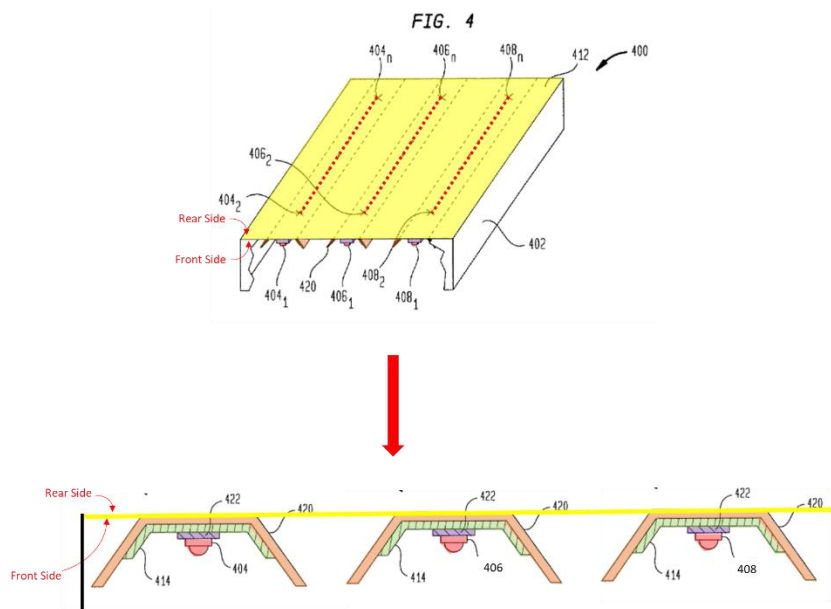
***[15.1] a base plate having a front side and a rear side;***

278. See limitation [1.1] above.

***[15.2] a plurality of lighting strips mounted on the front side of the base plate, each of the lighting strips comprising a plurality of light emitting diodes (LEDs) arranged along a length of the lighting strip; and***

279. As I discussed with regard to claim 1, Medendorp discloses a plurality

of *lighting strips* (purple below) each including a linear row of LEDs (dotted red line below). The first array includes the LEDs 404, second array includes the LEDs 406, and the third array includes the LEDs 408. The first, second, and third arrays are mounted on the front side of the base plate.



**Ex. 1022, Medendorp, Figs. 4 and 5 (annotated and inverted)**

FIG. 4 shows a side view of a first embodiment of an LED based light fixture 400 in accordance with the present invention. As shown in FIG. 4, each of the three fluorescent bulbs 104, 106, 108 of FIG. 1 is replaced by a number,  $n$ , of LEDs 404<sub>1</sub>, 404<sub>2</sub>, . . . 404 <sub>$n$</sub>  (collectively 404), 406<sub>1</sub>, 406<sub>2</sub>, . . . 406 <sub>$n$</sub>  (collectively 406), and 408<sub>1</sub>, 408<sub>2</sub>, . . . 408 <sub>$n$</sub>  (collectively 408), respectively. While it is presently preferred that high power LEDs, such as XLamp™ series LEDs from Cree, Incorporated, having a current of 125 mA or higher be employed, it will be recognized that lower power LEDs may also be employed. Further exemplary details of suitable mounting details of the LEDs 404, 406 and 408 are shown

in FIGS. 5, 6, 9A and 9B. While single LEDs are shown, multiple color LEDs, such as red, blue and green may be grouped together in arrays for applications where it is desired to be able to vary the color of light delivered by the fixture.

(Ex. 1022, Medendorp at ¶0023.)

280. Therefore, Medendorp discloses a *plurality of lighting strips* coupled to the front side of the base plate and that each lighting strip includes a *plurality of LEDs*.

281. When Baar is modified to include the LED lighting solution disclosed by Medendorp it would have been obvious to POSITA that a plurality of lighting strips would likewise be included. For instance, Baar discloses a fluorescent fixture with multiple fluorescent bulbs each having a reflector unit. (Ex. 1037, Baar at 3:31-46.) As I discussed, Baar's fluorescent fixture is constructed of a metallic housing and the reflectors are also constructed of metal – preferably aluminum. The metallic housing would be understood as being the *base plate*. A POSITA would know that a typical T8 fluorescent bulb has an output of approximately 2500 lumens. As I discussed above, since a discrete LED has an output of approximately 80-100 lumens, it would be obvious to a POSITA that in order to replace the fluorescent bulb, a plurality of LEDs on a strip, or strips would be required for LEDs as a light source to replace fluorescent light sources. A POSITA would have understood the multiple fluorescent bulbs when replaced by at Medendorp's LED lighting strips

would therefore constitute a plurality of LED *lighting strips* each including their own LEDs. When retrofitted, Baar's fixture would include *LED lighting strips* coupled to the *base plate*.

282. Therefore, Medendorp alone and in combination with Baar discloses or renders obvious limitation [15.2].

***[15.3] driver circuitry and control circuitry electrically coupled to the plurality of light emitting diodes (LEDs) for providing power to the light emitting diodes (LEDs),***

283. A POSITA would have known by 2007 that lighting strips (i.e., circuit boards with LEDs) would require a DC current and voltage that is provided by a power supply. Therefore, LED lighting fixtures have a power supply (including an AC/DC converter) and driver circuitry as common practice. Otherwise, the lighting fixture would not be able to function. LED lighting fixtures also require control circuitry for controlling the illumination of the LEDs, such as brightness.

284. A POSITA would have understood in 2007, however, ***fluorescent*** lighting fixtures are powered by AC power. A POSITA would have known and understand that Medendorp must include driver circuitry and control circuitry to convert the AC power previously used for a fluorescent fixture to an AC to DC converter power supply that would provide DC current and power for the LED lights.

285. Medendorp does not ***expressly*** disclose such drive and control circuitry

as a POSITA would understand its disclosure focuses on retrofitting techniques and thermal management rather than the well-known driver and control circuitry, which are required components of a functioning LED lighting fixture. However, Medendorp does disclose electrically connecting the LEDs of each lighting strip in series. Medendorp further discloses the LEDs are to be powered at a drive current of “125mA.” (Ex. 1022, Medendorp at Claim 3.) A POSITA would understand Medendorp as disclosing *driver circuitry* that is intended to drive the LEDs at a specified current of 125mA. Medendorp also discloses that it is known to a POSITA that “LEDs are ... superior to traditional lighting solutions ... because they ... can be **controlled** to deliver virtually any color light.” (Ex. 1022, Medendorp at ¶0002.) A POSITA understood that *control circuitry* was used to change the light color or even light intensity (e.g., dimming) of the LED lights. It is therefore obvious that Medendorp discloses *driver and control circuitry*.

LED lighting systems are becoming more prevalent as replacements for existing lighting systems. LEDs are an example of solid state lighting and are superior to traditional lighting Solutions such as incandescent and fluorescent lighting because they use far less energy, are far more durable, operate longer, can be combined in red-blue green arrays that can be controlled to deliver virtually any color light, and contain no lead or mercury.

(Ex. 1022, Medendorp at ¶0001.)

By contrast, when a fluorescent bulb is replaced by a series of high power LEDs, such as the LEDs 300 of FIG. 3, as represented by Xs in FIG. 1, heat dissipation becomes an issue. In this example, high power means an LED having a current of 125 mA or higher.

(Ex. 1022, Medendorp at ¶0005.)

While it is presently preferred that high power LEDs, such as XLamp™ series LEDs from Cree, Incorporated, having a current of 125 mA or higher be employed, it will be recognized that lower power LEDs may also be employed. Further exemplary details of suitable mounting details of the LEDs 404, 406 and 408 are shown in FIGS. 5, 6, 9A and 9B. While single LEDs are shown, multiple color LEDs, such as red, blue and green may be grouped together in arrays for applications where it is desired to be able to vary the color of light delivered by the fixture.

(Ex. 1022, Medendorp at ¶0023.)

286. However, Medendorp does incorporate by reference in its entirety US Application No. 11/379,709, which is now USPN 7,648,257 (Ex. 1044, “Villard”).<sup>15</sup> While Villard is also directed to alternative heat dissipation techniques, it also describes the well-known *driver and control circuitry* a POSITA could and would

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<sup>15</sup> Villard was filed April 21, 2006 and the patent issued Jan. 1, 2010. Therefore, it is my understanding that Villard alone qualifies as prior art to the ‘854 Patent under 35 U.S.C. § 102.

have used within the Medendorp's retrofit LED lighting solutions.

. . . for example, U.S. patent application Ser. Nos. **11/379,709** and **11/379,726**, entitled "Light Emitting Diode Packages" and "Light Emitting Diode Lighting Package with Improved Heat Sink", respectively, both filed Apr. 21, 2006, describe additional packages and backing structures and are *incorporated by reference herein in their entirety*.

(Ex. 1022, Medendorp at ¶0033.)

287. For instance, Villard discloses well known LED solutions for applying power (i.e., *driver circuitry*), as well as *control circuits* that allow for variations in lighting intensity and wireless communication with the LEDs.

[C]ontrol system 800 may be suitably employed to selectively *apply power* to one or more of six LED lighting packages and to simultaneously *vary the brightness of one or more of the six LED lighting packages*. During brightness adjustment, the activated LED lighting packages are adjusted together so as to output the same brightness level.

(Ex. 1044, Villard at 8:29-35.)

*Control system 800 includes six direct current (DC) power supplies 810A-810F*, a potentiometer 820, and an Ethernet control relay switch. *Each power supply supplies power to a corresponding LED lighting package* such as lighting packages 200, 240, 300, 400, and 410.

(Ex. 1044, Villard at 8:36-40.)

***Power supplies 810A-810F receive input from an alternating current (AC) power source (not shown).*** The AC power source may provide 120 volts (V) at 20 amps (A) or a range of 220 V-240V at 20A. The input AC power runs between 50 and 60 hertz (Hz). ***Referring to LED lighting packages 400 and 410, the output power of power supplies 810A-810F matches the DC operating conditions of at most six columns of 20 serially connected LEDs*** where each column is electrically connected in parallel. Typically, the designed operating range for an LED such as LED 10 is to receive constant current around 350 mA. Consequently, for each power supply to power an LED lighting package such lighting packages 400 and 410, each power supply outputs 36V at 4.2 Amps.

(Ex. 1044, Villard at 9:6-18.)

In operation, the Ethernet control relay switch 830 is controlled by a laptop through its Ethernet port 835 to connect one or more power supplies 810A-810F to their corresponding LED lighting packages. The potentiometer is manually controlled or controlled by laptop 850 to, in turn, ***vary the output voltage of power supplies 810A-810F simultaneously to the connected LED lighting packages. The combination of relay control and brightness control of the LED lighting packages provides a two dimensional adjustment.*** With control system 800, Laptop 850 may alternatively employ music to control both the potentiometer 820 and Ethernet control relay switch 830 so that the LED lighting packages emit lighting patterns corresponding to the beat of the music.



(Ex. 1044, Villard at 9:19-31.)

288. It would have been obvious to a POSITA in 2007 that Villard describes well-known *control and driver circuitry* that a POSITA would have understood and known how to incorporate into the LED retrofit lighting solution disclosed by Medendorp. For instance, this would have been nothing more than taking a known solution already applied in the same field that would likely achieve the same results when applied to Medendorp's LED solution. This is also nothing more than combining known (and contemplated by the incorporation by reference) elements to Medendorp's LED lighting fixture to yield a predictable result. Lastly, it would have been obvious for a POSITA to try the Villard control solutions to Medendorp given the express incorporation to read and review that reference. It would have, therefore, been obvious to include such known *control and driver circuits* (like those disclosed by Villard) into the retrofit LED lighting solutions disclosed by Medendorp.

289. Medendorp renders obvious limitation [15.2].

***[15.4] wherein each of the lighting strips includes at least one reflector sheet comprising:***

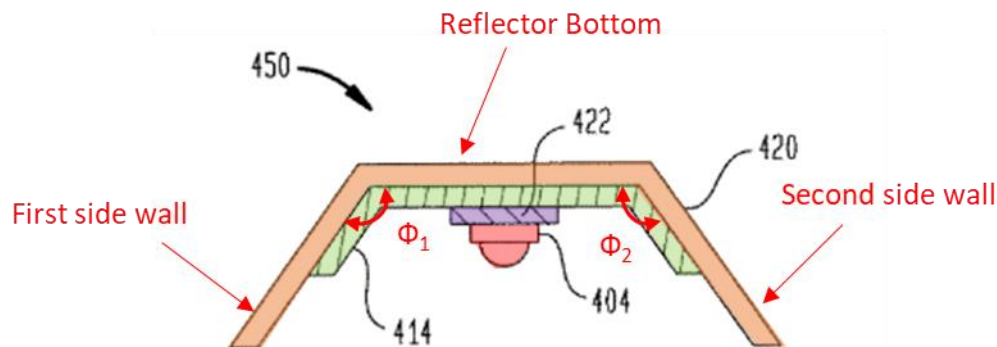
290. See limitation [1.2] and [1.3] above.

***[15.5a] a first multi-faceted side wall of the at least one reflector sheet extending at an angle from a first side of the lighting strip along an entire length of the lighting strip, the first side wall comprising a sheet bent to form the angle;***

***[15.5b] a second multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement adjacent a second, opposite side of the lighting strip along an entire length of the lighting strip, and***

291. See limitations [1.4a] and [1.4b] above.

292. In addition, Medendorp discloses a reflector 420, which is shown as a single sheet that a POSITA would have understood includes *a first side wall* that is bent to form an angle.<sup>16</sup> As I have illustrated, Medendorp discloses a reflector that has a bottom surface and a *first/second side wall*. Each *side wall* is bent at an angle with respect to the reflector bottom surface.

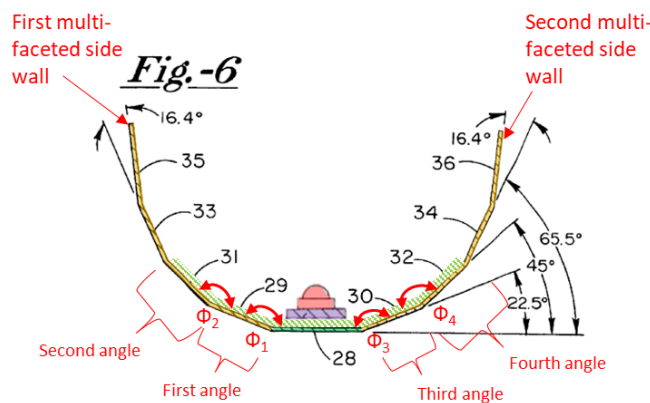


**Ex. 1022, Medendorp, Fig. 5**

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<sup>16</sup> I note, the language “first side wall comprising a sheet bent to form the angle” is not included within limitation [15.5b] regarding the second side wall. Regardless, Medendorp likewise discloses the reflector being bent from the bottom surface so that the second side wall is bent to form another angle.

293. My analysis is likewise the same with respect to Baar as it would be modified using Medendorp's retrofit LED lighting solution. Baar discloses a reflector that has a bottom surface and a *first/second multi-faceted side walls*. Each *multi-faceted side wall* is bent at multiple angles with respect to the reflector bottom surface.



**Ex. 1037, Baar, Fig. 6**

294. Medendorp and Baar render obvious limitation [15.5a] and [15.5b].

*[15.6] wherein the first and second multi-faceted side walls extend away from the lighting strip at an angle and are configured to cause light produced by the plurality of light emitting diodes (LEDs) to be amplified and formed into a uniform beam, and*

295. See limitation [1.5] above.

*[15.7] wherein contact between the lighting strips and the base plate provides heat transfer between the lighting strips and the base plate such that heat produced by the plurality of LEDs comprised in the lighting strip is conducted to the base plate for transfer to the ambient*

*environment.*

296. See limitation [1.6] above.

## 9. Claim 18

*[18.0] The light emitting diode (LED) lighting fixture as claimed in claim 15, wherein each light emitting diode (LED) of each lighting strip is electrically connected in series, and each lighting strip is electrically connected to the driver circuitry in parallel.*

297. Medendorp discloses to electrically connect the LEDs of each lighting strip in series:

Also, it is recognized that other thermally conductive materials such as ceramics, plastics, and the like may be utilized. Aluminum is presently preferable because of its abundance and relatively low cost. The LED lighting package 1100 includes columns of LEDs mounted on printed circuit boards (PCBs) such as PCB 1120A and 1120B. *Each PCB has five LEDs such as LED 1102 mounted thereon and these LEDs are electrically connected in series with each other.* Each PCB includes a positive voltage terminal and a negative voltage terminal (not shown). *The negative voltage terminal of PCB 1120A is electrically connected to the positive voltage terminal of PCB 1120B so that the ten LEDs defining a column are electrically serially connected.*

(Ex. 1022, Medendorp at ¶0034.)

298. Medendorp discloses to electrically connect the lighting strips in parallel.

The columns of *ten LEDs are electrically connected in parallel* to its adjacent column by wires 1130A-D, respectively.

(Ex. 1022, Medendorp at ¶0034.)

299. As discussed in limitation [15.3] above, a POSITA would know that LED devices require DC current to operate and would have known Medendorp would include *driver circuitry* for providing DC power to the LED circuits. But a POSITA would have also known it was obvious that LED lighting solutions like Medendorp would include such circuitry and the only two ways to connect power supplies with LED circuits is either in series or parallel, or combinations of parallel and series.

300. A POSITA would have understood that Medendorp's *lighting strips* would be connected in parallel to a *driver circuit* (i.e., power supply). Specifically, a POSITA would have understood that the positive and negative terminals of a DC-power supply would be connected to the positive and negative terminals of each string or strip of LEDs that are in series, and that those strings would in turn be connected in parallel.

#### **10. Claim 19**

*[19.0] The light emitting diode (LED) lighting fixture as claimed in claim 15, wherein each plurality of lighting strips is individually removably mounted to the base plate, so as to permit individual replacement of each lighting strip irrespective of the other lighting*

*strips.*

301. Medendorp discloses methods and apparatus for *retrofitting* fluorescent light fixtures with LEDs. For example, one or more LED subassemblies 450 may replace the one or more existing fluorescent light bulb assemblies in the original light fixture.

The present invention relates generally to improvements to solid state based lighting methods and apparatus suitable for use in both retrofitting and replacing existing fluorescent lighting systems and the like. More particularly, it relates to advantageous methods and apparatus for improved heat spreading and heat management in light emitting diode (LED) lighting systems.

(Ex. 1022, Medendorp at ¶0001.)

302. In retrofit applications, Medendorp discloses to remove the existing fluorescent bulb fixtures from the housing and replace it with LED lighting. The replacement LEDs may be in the form of LED subassemblies 450, which are installed in the original housing that is reused for the retrofit application.

FIG. 10 shows details of a process 1000 of making a lighting fixture employing anisotropic heat spreading in accordance with the present invention. Process 1000 is an exemplary process of manufacturing a *retrofit lighting fixture employing high power lighting LEDs to replace an existing fluorescent bulb fixture with a unit having a similar profile and footprint*. In step 1002, a standard luminaire fixture without ballasts of fluorescent bulb sockets has an adhesive back strip

of anisotropic heat spreading material pressed in place as shown in FIGS. 5 and 6, for example. Alternatively strips, such as strips 614<sub>1</sub>, 614<sub>2</sub>, 614<sub>3</sub> and 614<sub>4</sub> of FIG. 7 may be applied or material 714 may be applied as discussed above in connection with FIG. 8. As a further alternative and while not presently preferred, the surface of an aluminum or other fixture may be suitably prepared and the anisotropic graphite or another anisotropic material may be directly applied on that surface.

(Ex. 1022, Medendorp at ¶0030.)

In step 1004, *a plurality of LEDs are mounted* on the anisotropic material so that good thermal contact is made and heat is efficiently transferred from the LEDs to the anisotropic material. *The LEDs may be individually mounted or may be mounted as part of a subassembly of plural LEDs.*

(Ex. 1022, Medendorp at ¶0031.)

303. As I have discussed with regard to limitation [1.1] above, the recited *base plate* could be the metallic top surface of the fluorescent fixture or the “sheet of anisotropic heat spreading material 414.” A POSITA would have understood that if an LED *lighting strip* were to fail, a replacement *lighting strip* could be removed and replaced without having to remove the other *lighting strips*.

304. Considering Medendorp is focused on a retrofit assembly, it would require nothing more than disconnecting and removing the *lighting strip* that needs to be replaced. A new *lighting strip* could then be inserted into the reflector as a

replacement. A POSITA would have the tools and knowledge on how to replace the *lighting strip* similar to how the one being replaced was inserted during the retrofit conversion.

305. Medendorp renders obvious the limitations of claim 20.

#### **11. Claim 20**

*[20.0] The light emitting diode (LED) lighting fixture as claimed in claim 15, wherein the light emitting diodes (LEDs) in each of the lighting strips are arranged in a linear row along the length of the lighting strip.*

306. As I discuss above in element [15.2], Medendorp discloses that the LEDs are arranged in a linear row along the length of the lighting strip.

#### **D. Reasons or motivation to combine Medendorp and Baar**

307. Medendorp provides explicit motivation for combining LED subassemblies with traditional lighting, such as the fluorescent lighting of Baar. Medendorp provides instructions for removing the fluorescent bulb fixture and replacing it with an LED subassembly, such as subassembly 450, as I explained above.

As LEDs replace the typical fluorescent light fixtures found in many workplaces, the present invention recognizes that it is important to cost effectively dissipate the heat generated by the LEDs used in these systems *while enabling relatively simple physical retrofitting or replacement of existing lighting hardware.*



(Ex.1022, Medendorp at ¶0002.)

FIG. 10 shows details of a process 1000 of making a lighting fixture employing anisotropic heat spreading in accordance with the present invention. *Process 1000 is an exemplary process of manufacturing a retrofit lighting fixture employing high power lighting LEDs to replace an existing fluorescent bulb fixture* with a unit having a similar profile and footprint.

(Ex. 1022, Medendorp at ¶0030.)

*While the above discussion has focused primarily upon the application of the present invention to the retrofitting, of existing lighting fixtures, such as standard fluorescent luminaire fixtures, and the like, by replacing fluorescent bulbs and their associated hardware with LEDs* and utilizing efficient heat spreading techniques as taught herein, it will be recognized that the present invention is also applicable in a wide variety of other contexts in which it is desired to provide an LED based lighting fixture with improved heat dissipation characteristics.

(Ex. 1022, Medendorp at ¶0033.)

308. Medendorp is not restricted to a single fluorescent/luminaire fixture for installing the retrofit LED lighting solution. Instead, Medendorp is directed to a general LED lighting solution for retrofitting any pre-existing fluorescent/luminaire fixture. The LED lighting solution discloses how to install a heat spreading material and lighting strip (with linear row of LEDs) into the reflector of a fluorescent fixture.

Medendorp therefore provides an express teaching, suggestion, and motivation to a POSITA to replace pre-existing fluorescent fixtures (like Baar) with the LED lighting solution disclosed by Medendorp.

309. As I explained in Section V.E. above, by 2007 it had become well known and common to replace fluorescent light bulbs with LEDs because of their increased energy efficiency. Again, it was known retrofitting can be much less expensive than replacing the entire fluorescent fixture with a new LED fixture because the retrofit kits tend to be less expensive than new fixtures, and the time and labor needed to install a retrofit kit is typically much less than the time to remove and replace an old fixture with a brand new one.

310. Baar discloses a pre-existing fluorescent fixture having multiple reflectors. A POSITA would have understood how to retrofit Baar's pre-existing fluorescent bulbs with the LED lighting solution of Medendorp.

311. A POSITA would have understood modifying Baar would be nothing more than using the known technology of Medendorp to retrofit Baar's pre-existing fluorescent lighting fixture in the way disclosed by Medendorp. Once retrofitted, Baar would provide a more energy efficient LED system which will not require as much maintenance due to burnt out fluorescent light bulbs or failing fluorescent ballasts.

**E. Ground 3 – Claims 1-2, 6-15, 18, and 20 are Obvious Over U.S. Patent Publication No. 2007/0121343 (Brown) in View of US Patent No. 6,641,284 (Stopa) and the Knowledge of a POSITA**

**1. Claim 1**

*[1.0] A light emitting diode (LED) lighting arrangement for a lighting fixture, comprising:*

312. It is my understanding that a preamble is not limiting where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention. While it is my understanding the preamble may not be limiting, Brown does disclose this limitation.

313. For instance, Brown discloses an illumination device having an arrangement of LEDs:

The present invention provides an illumination device for *illuminating one or more users* in front of a multimedia communication terminal comprising a gutter-shaped housing with a generally angular or U-shaped cross section consisting of a light reflecting material, *a LED array including a number of light emitting diodes attached to the bottom of said gutter-shaped housing*, and a diffuser sheet consisting of light diffusing, partly transparent material mounted on top of said gutter-shaped housing.

(Ex. 1036, Brown at ¶0016, emphasis added.)

314. As reproduced below, Figure 1 of Brown illustrates a reflector that includes a linear array of LEDs within a reflector.

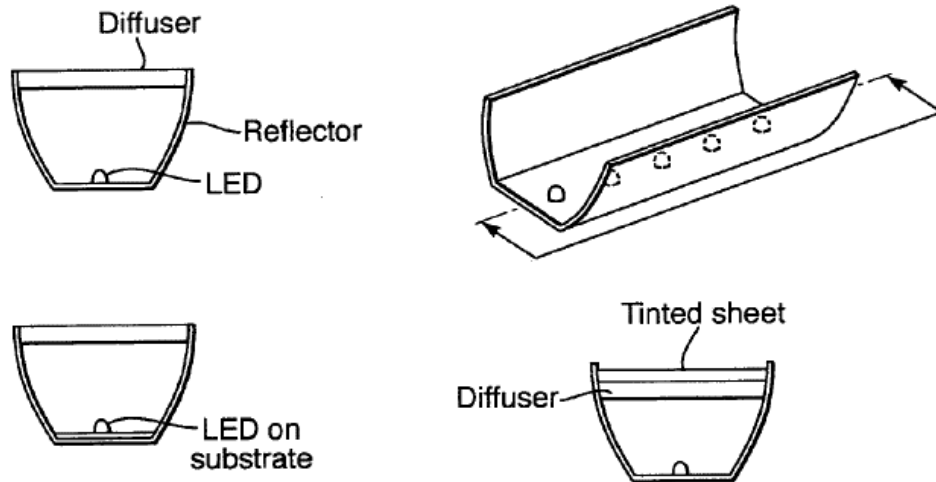
**Fig.1.****Ex. 1036, Brown, Fig. 1**

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom. The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings. The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)

315. Brown further discusses that when a user is participating within a video conference, the overhead fluorescent lighting may interfere and create shadows on the user's face. Brown recognizes that bad lighting can spoil expressions made

during face-to-face meetings.

A common bad lighting situation in a video conference appears when the participants are using personal desktop video conferencing endpoints in office environments. In these cases, the camera is typically localized relatively closed (sic) to the user's face, normally on top of the desktop endpoint. In office environments, strong fluorescent lighting from above typically creates shadows in the user's face making a distorted and blurred face image.

A general advantages of video conferencing compared to audio conferencing is that it allows for exchange of expressions just as in real face-to-face communication. This advantage could be completely spoiled when the face lighting is bad.

(Ex. 1036, Brown, ¶¶0009-0010.)

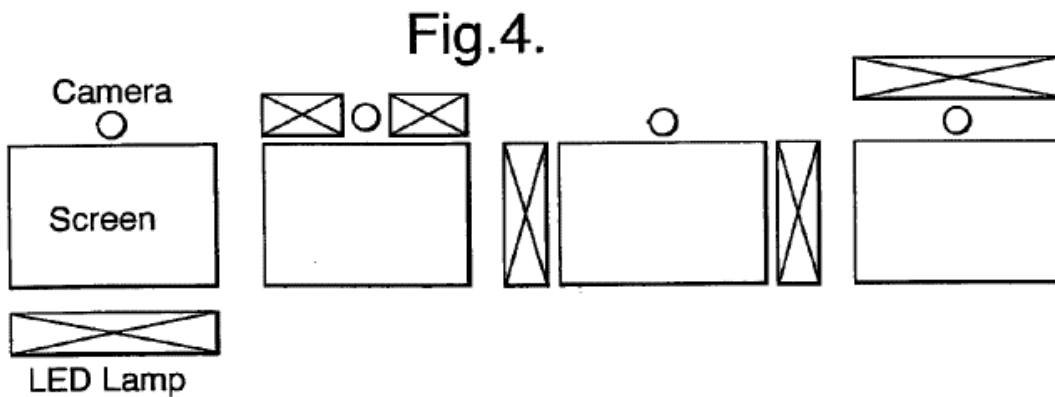
316. Brown therefore discusses the LED array and reflector may be placed within a larger "LED lamp assembly" which may then be located in various locations around a video-conferencing screen (e.g., a wall-mounted screen or computer monitor). The LED lamp assembly is placed near the screen and directed toward a user to "illuminate the users face."

. . . In FIG. 4, various placing of the LED lamp assembly is shown. The LED lamp is placed over, under or on each side of the screen. In all cases the lightening will according to the intention due to the fact that the user will be looking into the screen during the video conference,

and therefore a LED lamp placed in the vicinity of the screen and directed towards the user will illuminate the users face.

However, the most preferred placement of the LED lamp should be above the screen and either on each side of the camera or above the camera. Placement underneath the screen will result in an illusion for the user that the screen has become darker, since the user's natural eye direction is from the horizontal and downwards.

(Ex. 1036, Brown at ¶¶0032-0033.)



**Ex. 1036, Brown, Fig. 4**

317. Brown even recognizes the fully integrated LED lamp assembly can also be placed away from the screen. For instance, Brown discloses it could be placed in a table pointing outwards or it could be “ceiling mounted directed to the users face” or it can be “wall mounted or floor standing.”

In addition to a fully integrated LED lamp assembly it is also possible to design the lamp such that it becomes a separate unit from the actual video conference system. A separate lamp unit may be applicable for large systems in large rooms, whereby the lamps could become

satellites placed in the room to ensure even lighting to all video conference users. *The position of the satellite units could be in the middle of a table pointing outwards, ceiling mounted directed to the users face, wall mounted or floor standing.*

(Ex. 1036, Brown at ¶0034.)

318. Brown therefore discloses an LED lamp assembly (i.e., a lighting fixture) that includes a reflector having an array of LEDs (i.e., LED arrangement). Brown discloses limitation [1.0].

*[1.1] a base plate;*

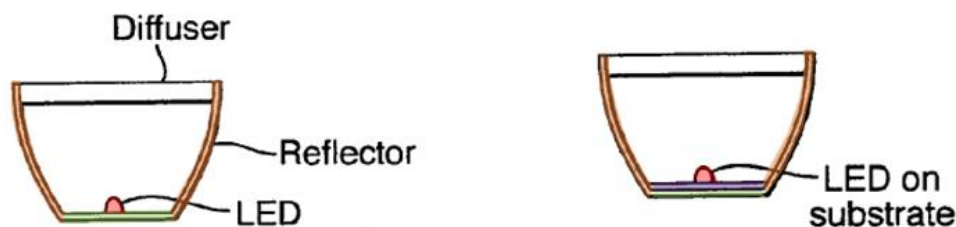
319. Again, Brown discloses an “LED lamp” that includes, among other things, a reflector and a linear array of LEDs.

The present invention provides an illumination device for illuminating one or more users in front of a multimedia communication terminal comprising a gutter-shaped housing with a *generally angular or U-shaped cross section consisting of a light reflecting material*, a *LED array including a number of light emitting diodes attached to the bottom of said gutter-shaped housing*, and a diffuser sheet consisting of light diffusing, partly transparent material mounted on top of said gutter-shaped housing.

(Ex. 1036, Brown at ¶0016.)

320. As I have shown below, Brown discloses the reflector includes “a back panel” (shaded green) and “two reflector wings” (shaded orange). Brown also discloses (below right) the LEDs (shaded red) may be assembled on an LED

substrate” that may be coupled to the back panel. Lastly, Brown recognizes the entire reflector (i.e., back panel and wings) may be manufactured from one sheet of metal.



**Ex. 1036, Brown, Fig. 1**

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. *A linear array of LEDs protected by a LED substrate is mounted on a back panel.* A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom. *The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings.* The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)

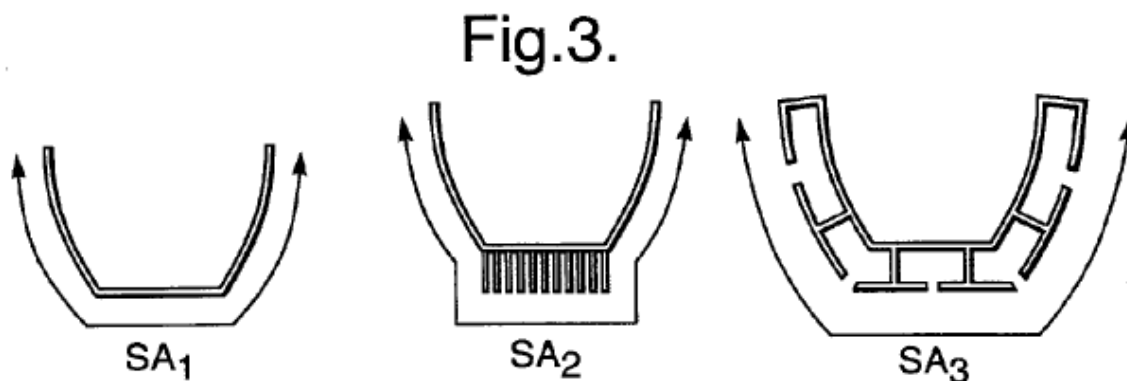
321. Brown further discloses (with respect Fig. 3) that heat produced by LEDs can be managed by forming components from metal so that the whole assembly can act as a heat sink for thermally managing the LEDs. Brown discusses “narrow ribs on the rear of the unit” (i.e., cooling fins) (i.e., “SA<sub>2</sub>” as shown in Fig.



3) being attached to the back panel.

For providing best possible reflection, the LED lamp assembly should preferably be made of a metal such as steel or aluminium [*sic*]. Thus, the surface area of the LED lamp assembly is crucial because the whole assembly will act as a heat sink for the high power LEDs. The LEDs demand a certain surface area (SA) per LED and the reflector can be designed such that this surface area is available per module length of the LED array. If required special features can be included in the design of the reflector to increase the surface area within a compact size. *As indicated in FIG. 3, these features can include narrow ribs on the rear of the unit, i.e. [that] face away from the light source.*

(Ex. 1036, Brown at ¶0028.)



**Ex. 1036, Brown, Fig. 3**

322. Brown does not discuss or provide details on how the “ribs” shown in Fig. 3 are added to the back panel of reflector. A POSITA would have understood, however, in 2007 that several methods existed for constructing the reflector unit with ribs shown. The ribs would be part of a heat sink that is then attached to the reflector,

or the ribs and reflector are one integral piece.

323. In reviewing Brown, my opinion is a POSITA would have known the heat sink “ribs” and reflector would be two different components. My opinion is supported by claim 3 which states the “narrow ribs are *attached on the backside of the illumination device* for cooling down LED array generated heat.” (Ex. 1036, Brown at claim 3.) In other words, claim 3 confirms the heat sink ribs can be a separate unit that is *attached* to the backside of the reflector.

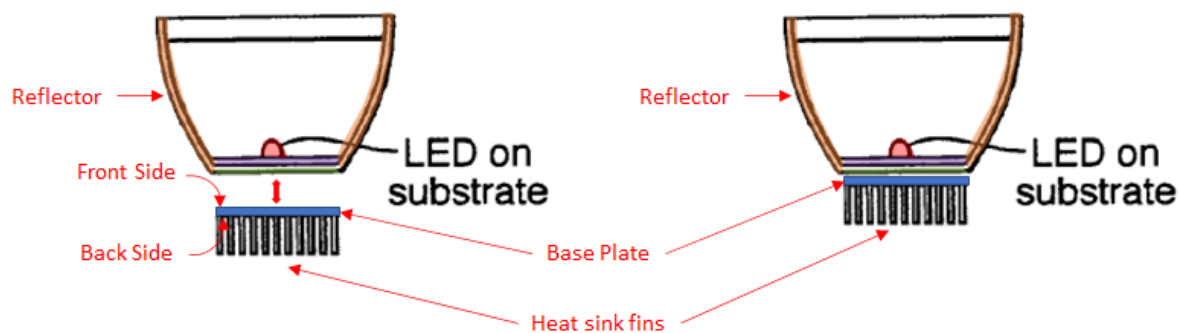
3. An illumination device according to one of the preceding claims, characterized in that *narrow ribs are attached on the backside of the illumination device* for cooling down LED array generated heat.  
(Ex. 1036, Brown at claim 3.)

324. My opinion is also supported by the fact a POSITA would have known that the embodiments shown as “SA<sub>2</sub>” in Figure 3 could only be manufactured using a molding process where the entire reflector plus fin structure is constructed as one piece. But a POSITA would have understood that this would be difficult – if not impossible – to construct from the “same sheet” or single sheet of metal as Brown teaches. (Ex. 1036, Brown at ¶0026.)

325. Instead, a POSITA would have understood it would be more cost-efficient and simpler in design to construct the reflector and heat sink fins as separate units. A POSITA would have also known it was common for the heat sink “ribs”

and reflector to be constructed as two separate components and then attach the two items (as recited by claim 3) using well-known solutions. For example, a POSITA would have known the heat sink fins could be attached to the reflector using screws or thermal adhesives.

326. Even if it was argued by Patent Owner that the fins and reflector cup were indeed one assembly, a POSITA would have understood how to construct them as separate units. For instance, a POSITA would have known by 2007 that a typical fin unit could include a support plate and associated fins that were constructed as a single piece. As I have shown below, the support plate (highlighted blue below) would attach to the reflector's back panel (highlighted green).



**Ex. 1036, Brown, Fig. 1 modified to include heat sink “fins” of Fig. 3**

327. Stopa confirms and illustrates my understanding of Brown's heat sink being a separate unit. For instance, Stopa discloses a heat sink (green) having an upper side plate and bottom side with fins. As shown below, Stopa discusses a reflector (orange) and linear LED array (red) like Brown. Stopa also discusses a

“heat sink 50” being attached to the LED PC board (purple) and the reflector using screws – i.e., “fasteners 52.”

The LED light assembly 100 includes a reflector 10 having a linear parabolic section 14, a PC board 40 with a plurality of high-output LEDs 42 arranged in a linear array and a heat sink 50 configured for assembly adjacent the rear side of the PC board.

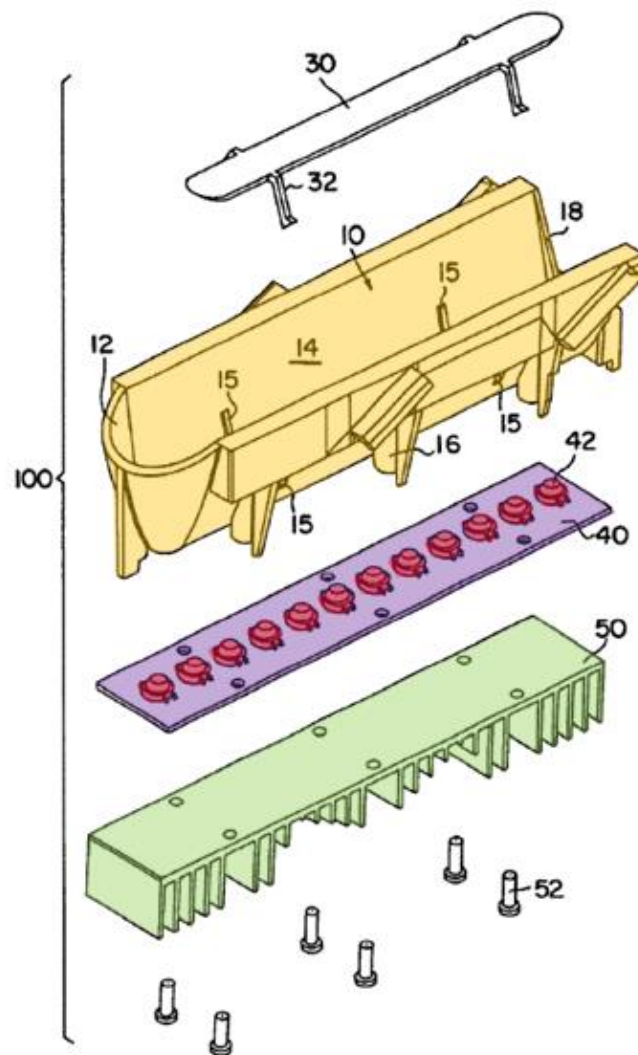
(Ex. 1038, Stopa at 4:60-65.)

The LED light assembly 100 includes a reflector 10 having a linear parabolic section 14, a PC board 40 with a plurality of high-output LEDs 42 arranged in a linear array and a heat sink 50 configured for assembly adjacent the rear side of the PC board. *Fasteners 52 pass through the heat sink 50 and PC board 40 to engage fastener receptacles 16 molded in the reflector 10.*

(Ex. 1038, Stopa at 4:60-67.)

FIG. 4 clearly illustrates that the PC board 40 is sandwiched or tightly compressed between the rear end of the reflector 10 and a *conventional finned heat sink 50*.

(Ex. 1038, Stopa at 5:56-58.)



**Ex. 1038, Stopa, Fig. 1**

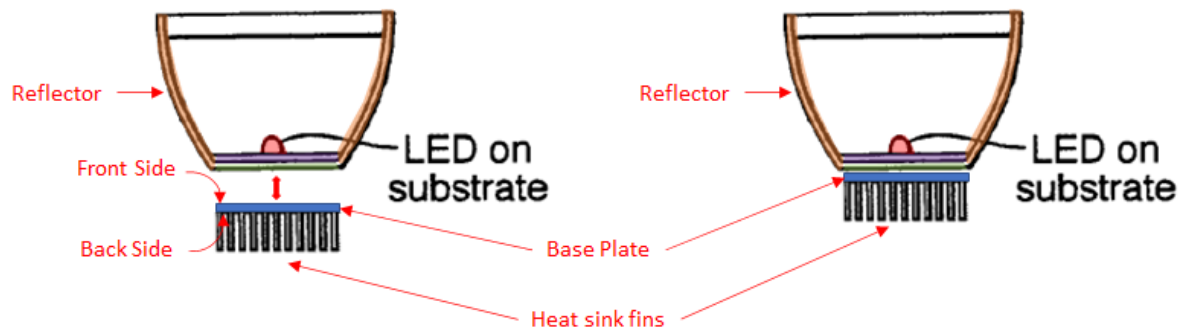
328. Therefore, to the extent Brown doesn't teach a heat sink constructed separately from the reflector, it would have been obvious to modify Brown in view of Stopa such that the reflector and heat sink were constructed as two separate components. Again, this would make for a simpler construction and more cost-efficient from a manufacturing standpoint. It would have also been within the skill of a POSITA to use known prior art elements (like separate heat sink and reflector

components) and techniques of assembling the heat sink and reflector to yield a predictable result.

329. As I also mentioned above, based on the teachings of Brown there were essentially a finite number of methods to construct the reflector and fin assembly disclosed by Brown. The heat sink unit (with fins) could have been manufactured separately from the reflector – which I believe is the correct interpretation based on claim 3 of Brown, or the heat sink fins and reflector were cast from a single piece – which is more expensive. Brown teaches that the reflector is made and bent from the same sheet.

330. With two separate components, a POSITA would have known screws or other fastener would be used to attach the support plate of the heat sink fin to the reflector bottom surface (i.e., back plate). Indeed, a POSITA would have understood that attaching fins was a commonly used practice in many different applications like heat sinks being attached to a CPU within a computer. When attaching such a separate heat sink (with fins) a thermal adhesive may be applied to the back panel or support plate to help improve heat transfer.

331. As I have shown below, a POSITA would have therefore understood Brown as having a heat sink (i.e., a *base plate*) with a front side for attaching to the backside of Brown's reflector.



**Brown, Fig. 1 modified to include heat sink “fins” of Fig. 3**

332. Alternatively, a POSITA would have also understood that Brown’s reflector cup is intended to be installed onto additional surface – e.g., a wall, ceiling, a personal computer or portable communication device. For instance, Fig. 4 illustrates and discloses the reflector unit is to be installed over, under or on each side of a wall that is located around a screen. Brown discusses the LED lamp could be a satellite unit placed in various places around the room to be illuminated like a table or ceiling mount. Lastly, Brown states the reflector unit can be attached to a “PC, a portable communication device, etc.” (Ex. 1036, Brown at ¶0039.)

In FIG. 4, various placing of the LED lamp assembly is shown. The LED lamp is placed over, under or on each side of the screen. In all cases the lightening will according to the intention due to the fact that the user will be looking into the screen during the video conference, and therefore a LED lamp placed in the vicinity of the screen and directed towards the user will illuminate the users face.

(Ex. 1036, Brown at ¶0032.)

In addition to *a fully integrated LED lamp assembly it is also possible to design the lamp such that it becomes a separate unit from the actual video conference system*. A separate lamp unit may be applicable for large systems in large rooms, whereby the lamps could become satellites placed in the room to ensure even lighting to all video conference users. *The position of the satellite units could be in the middle of a table pointing outwards, ceiling mounted directed to the users face, wall mounted or floor standing*.

(Ex. 1036, Brown at ¶0034.)

Note that even if the present invention is described in connection with conventional videoconferencing, it is applicable to any visual communication with a image capturing device is involved, i.e. the LED lamp assembly described herein could be *connected to any multimedia communication terminal like a PC, a portable communication device, etc.*

(Ex. 1036, Brown at ¶0039.)

333. Claims 1 and 2, Brown also discloses the reflector unit is attached to a “retaining device” allowing it to be positioned in the various locations discussed in Figure 4. The “retaining device” is also disclosed as providing adjustability with regard to the angle and position of the reflector.

1. An illumination device for illuminating one or more users in front of a multimedia communication terminal,  
  
characterized in a gutter-shaped housing with a generally angular or U-shaped cross section consisting of a light reflecting material, a LED



array including a number of light emitting diodes attached to the bottom of said gutter-shaped housing, and a diffuser sheet consisting of light diffusing, partly transparent material mounted on top of said gutter-shaped housing,

*said illumination device is attached under, above or on the side of the multimedia communication terminal by means of one or more retaining device(s), and*

said LED array is electrically coupled to the multimedia communication terminal.

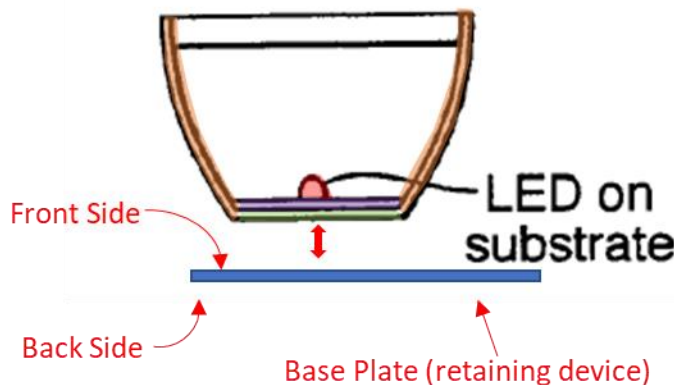
2. An illumination device according to claim 1, characterized in that said *retaining device(s) is configured to make the illumination device adjustable in terms of position and angle* relative to the multimedia communication terminal.

(Ex. 1036, Brown at Claims 1 and 2.)

334. A POSITA would have therefore understood, the retaining device could be a bracket designed to be attached to the back panel (i.e., bottom surface) of Brown's reflector. Such brackets or "retaining devices" are well-known for attaching and hanging light sources to walls or ceilings. A POSITA would have understood the retaining device would include a flat planar material allowing for attachment to the reflector. The most common attachment mechanism would include securing the retaining device to the wall (typically using screws) and then securing the reflector to the retaining device. A POSITA would have known screwing the reflector to the

retaining device would provide the most secure and stable connection.

335. As I have illustrated below, a POSITA would have understood the retaining device could (and likely would) include a flat surface or *base plate* (blue rectangle) having a front side and rear side. The flat surface of the retaining device (*base plate*) would then be secured to the reflector using some type of securing mechanism (e.g., screws). The retaining device could then be secured to a wall or ceiling and provide the adjustability of position and angle as recited by claim 2 of Brown.



**Ex. 1036, Brown, Fig. 1**

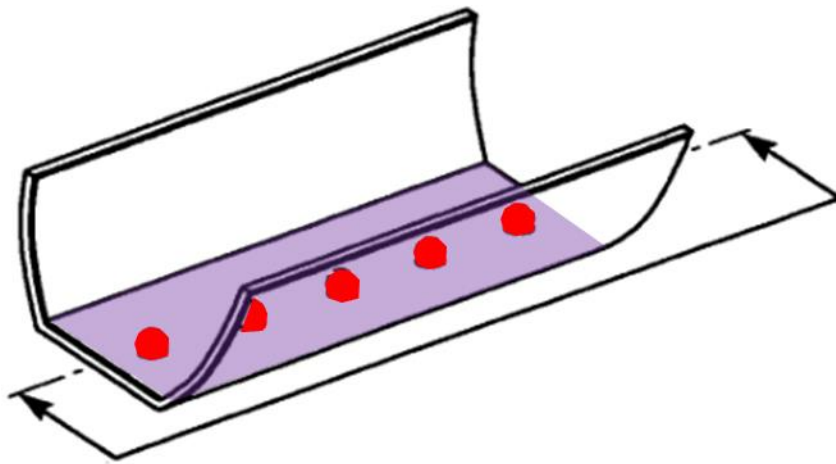
336. A POSITA would have understood by reading Brown that the reflector (including the LED and substrate) could be attached to the retaining device (i.e., *base plate*) as I have illustrated.

337. Brown and/or Stopa therefore disclose limitation [1.1].

*[1.2] a lighting strip coupled to the base plate, the lighting strip*

***comprising a plurality of light emitting diodes (LEDs) arranged along a substantially planar surface of the lighting strip;***

338. First, Brown discloses a lighting strip (purple) that may be a substrate, which a POSITA would have understand could be a printed circuit board (PCB) or metal printed circuit board (MPCB). As illustrated below, a linear row of LEDs (red) is arranged along the planar (rectangular) surface of the lighting strip.



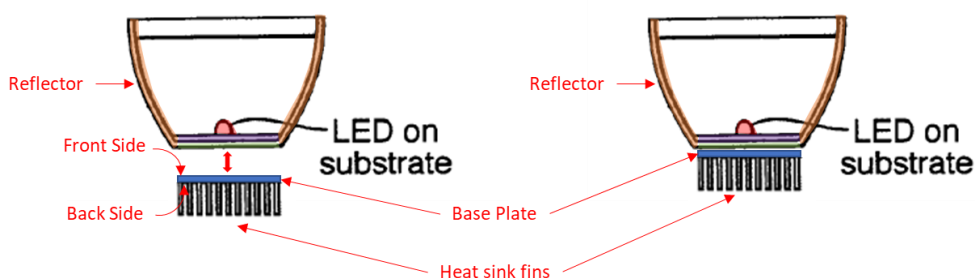
**Ex. 1036, Brown, Fig. 1**

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. ***A linear array of LEDs protected by a LED substrate is mounted on a back panel.*** A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom. The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings. The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)

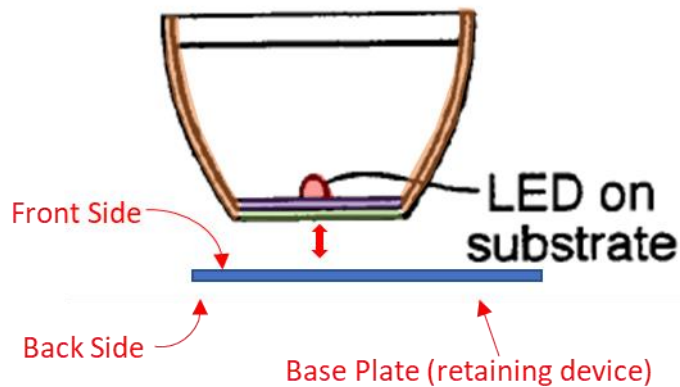
339. As I discussed in the prior limitation, Brown teaches a POSITA would have understood several different components satisfy the claimed *base plate*. As I also discussed in Ground 2, limitation [1.2] the '854 Patent states the lighting strip can be directly or indirectly coupled to the base plate. (Ex. 1001, 854 at 8:11-15.)

340. First, Brown discloses a heat sink (with fins) having a *base plate* (blue) that attaches to the back plate (green) of the reflector. The lighting strip or substrate (purple) and LEDs (red) and substrate are coupled to the base plate (blue) when the heat sink is attached. When coupled, the *base plate* allows the heat generated by the LEDs to be dissipated to the ambient environment.



**Brown, Fig. 1 modified to include heat sink “fins” of Fig. 3**

341. Alternatively, Brown discloses a retaining device which is the *base plate*. Again, the backside of the reflector attaches to the front side of the base plate. The *lighting strip* is coupled to the *base plate*. A POSITA would recognize that the retaining device would also serve as a path for allowing the heat generated by the LEDs to be dissipated to the ambient environment.

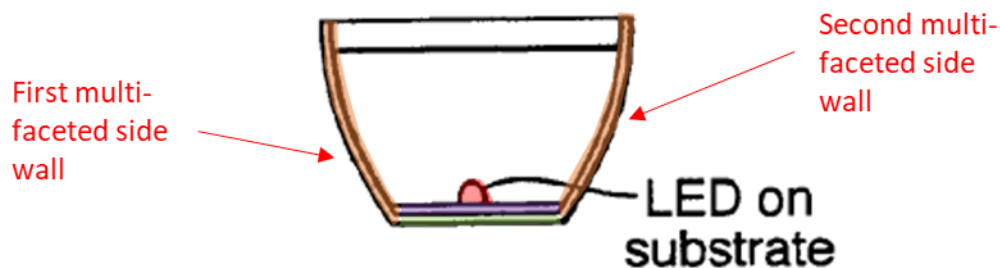


**Ex. 1036, Brown, Fig. 1**

342. Brown renders obvious this limitation.

**[1.3] at least one reflector sheet comprising**

343. Again, Brown discloses that to provide the best reflection, the LED light assembly (i.e., the reflector) “should preferably be made of a metal such as steel or aluminium [*sic*].” (Ex. 1036, Brown at ¶0028.) By using a metallic material, Brown discloses the reflector can be assembled from the “*same sheet* folded along two lines to create two reflector wings.” (Ex. 1036, Brown at ¶0026.) As shown below, this *same sheet* reflector unit includes a back panel (green) along the bottom and at a pair of reflector wings (orange).



**Ex. 1036, Brown, Fig. 1**

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom. *The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings.* The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

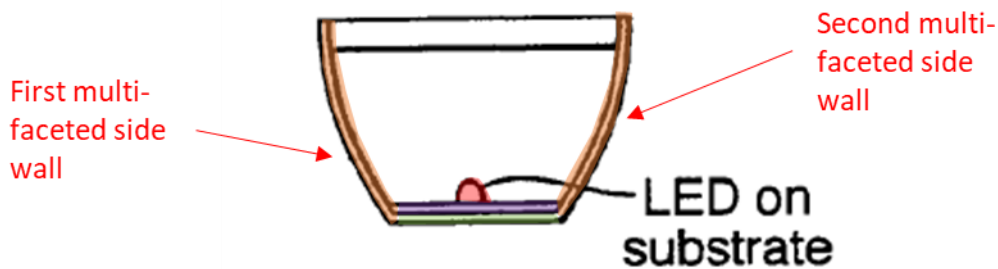
(Ex. 1036, Brown at ¶0026.)

344. Brown therefore discloses the *at least one reflector sheet* as recited by limitation [1.3].

*[1.4a] a first multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip with a first edge adjacent a first side of the lighting strip and extending at an angle along an entire length of the lighting strip; and*

***[1.4b] a second multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip, the second side wall having a first edge adjacent a second, opposite side of the lighting strip at an angle that extends along an entire length of the lighting strip,***

345. As I discussed in limitation [1.3] above, Brown discloses a reflector unit formed from a single sheet of metal to have a back plate (annotated green) and “two reflector wings.” (Ex. 1036, Brown at ¶0026.) As I have annotated below, a POSITA would have understood that one of the reflector wings would satisfy the recited *first multi-faceted side wall* and the other reflector wing would satisfy the *second multi-faceted side wall*.



**Ex. 1036, Brown, Fig. 1**

346. I note the '854 Patent states the multiple facets are intended to simply

amplify light<sup>17</sup> but the design and construction is not limited to a given shape. For instance, the '854 Patent discloses “multi-faceted,” as including multi-angle sidewalls as well as parabolic sidewalls:

In the present embodiment, reflector 141 defines multiple facets formed therein that amplify the light provided by LEDs 111 as will be discussed in greater detail hereinafter. Such facets may be angled formations in the body of the reflector 141 but reflector 141 is not intended to be limited to such facets. *Facets should be read broadly in connection with this disclosure as a formation(s) in the body of reflector 141 that amplify the light output of the LEDs 111 and direct the amplified and desirably uniform light outward from the light fixture 101 for any desirable application.*

(Ex. 1001, '854 Patent at 10:51-60.)

Each side wall 185 of reflector assembly 141 includes a first facet or first portion 186 defining a first angle  $\theta$  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187 of LED 111, and a second facet or second portion 188 that defines a second angle  $\Phi$  with first portion 186. The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111. It is

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<sup>17</sup> I find this an odd term since a reflector cannot “amplify” light. Amplification can only be done by increasing the power being supplied by, for example, the AC/DC driver.



contemplated that the multiple facets reflect the light that is output from the LEDs back toward other facets of the walls of reflector 141, thereby amplifying the light. ***However, this is not to be construed as limiting as this definition of a multi-faceted reflector may also include reflectors having a parabolic shape.***

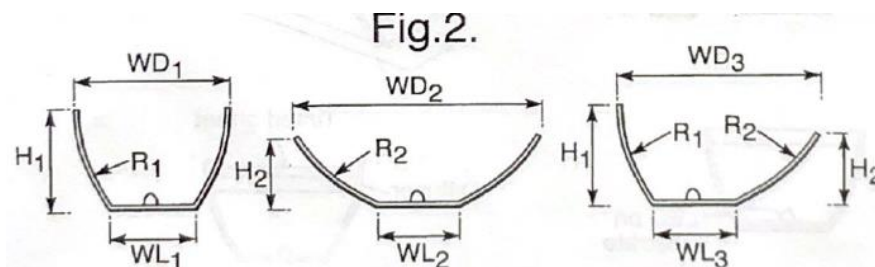
(Ex. 1001, '854 Patent at 17:41-54.)

347. As shown above, it is visible that Brown's reflector includes "reflector wings" having a parabolic shape (i.e., multi-faceted). Each of Brown's reflector wings therefore discloses the recited a *first and second multi-faceted side wall*.

348. To the extent it is argued the shape illustrated by Figure 1 is not parabolic, Brown explains that the shape of the reflector wings can be varied to satisfy a given application. Again, Brown discloses with regard to Figure 2 modifying: (1) the width of the back plate, (2) the height of the reflector wings, (3) the width of the reflector wings, or (4) the angle of each reflector wing.

As already mentioned, the LED lamp assembly may have various designs. Key parameters in the design of the assembly are height from LED to diffuser (H), width of diffuser (WD), width of LED base (WL) and radius of reflector sides (R). As depicted in FIG. 2, the LED lamp assembly does not have to be symmetric, and can have different radii (R) and height (H) from side to side. ***The radii of the sides do not have to be of constant curvature.***

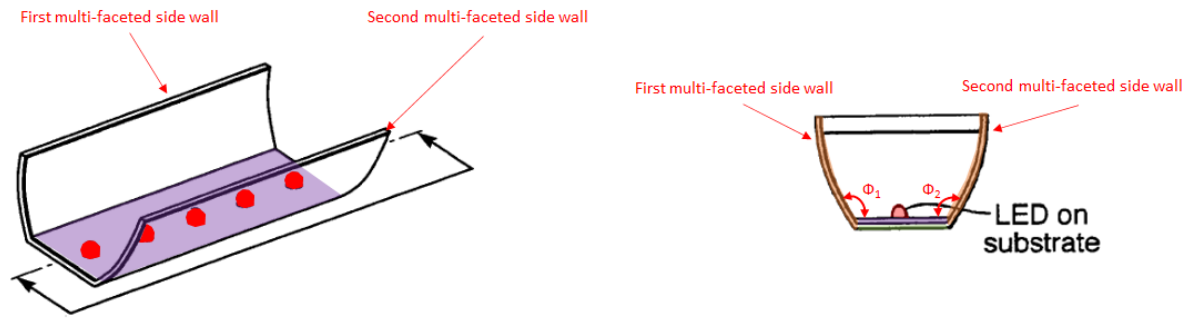
(Ex. 1036, Brown at ¶0027.)



**Ex. 1036, Brown, Fig. 2**

349. Brown even emphasizes that the reflector wings *do not have to be symmetric*, and they can have a different radii that is *not* a constant curvature. In other words, Brown teaches a POSITA the reflector wings could be designed to have curvatures that are parabolic, elliptical – i.e., not constant curvature. Brown’s teaching therefore further confirms the reflector wings satisfy the recited a *first and second multi-faceted side wall*.

350. As I have also annotated below, Brown discloses a reflector having a pair of reflector wings (i.e., *first/second multi-faceted side walls*). These side walls are disclosed (and illustrated) as extending the entire length of both: (1) the LEDs (red) – i.e., *LED lighting arrangement*; and (2) the PCB substrate (purple) with LEDs– i.e., *lighting strip*. Therefore, as I have labeled below, it would be understood that each of Brown’s reflector wings would satisfy the recited *first/second multi-faceted side walls of the at least one reflector sheet extending along the lighting arrangement along an entire length of the lighting strip*.



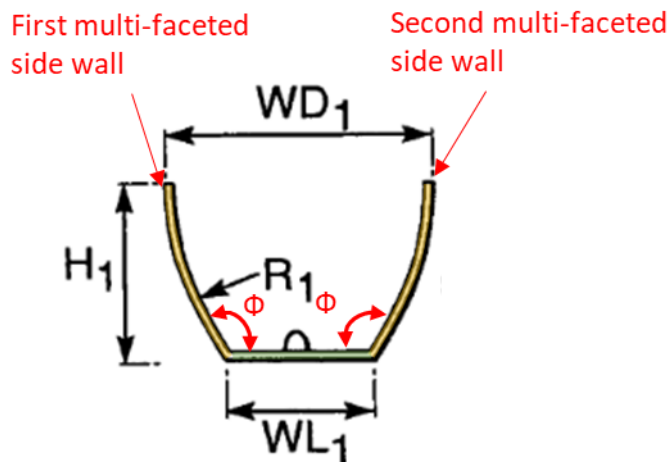
**Ex. 1036, Brown, Fig. 1**

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. *A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom.* The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings. The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)

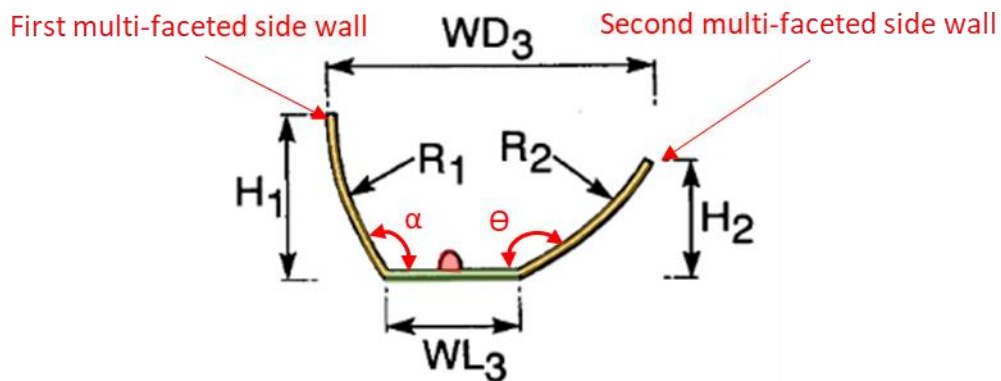
351. I understand there is a dispute as to what is meant by the recited “an angle.” I understand Petitioner contends “*an angle*” requires the angle to be the same for the *first/second side walls*, while Patent Owner contends “*an angle*” can mean the angle between the *first/second side walls* can be different. While I agree Petitioner’s proposal seems correct with regard to the disclosure of the ‘854 Patent, I also note Brown satisfies both constructions.

352. First, each of Brown's reflector wings (orange) join the back panel (green) at a *first/second side edge*. These side edges include *an angle* (which I have labeled as  $\Phi_1$  and  $\Phi_2$  below). As shown, the angle between the back panel and the reflector wings (*first/second multi-faceted side walls*) extends the entire length of the lighting strip. Figure 1 therefore illustrates that the angle ( $\Phi_1$  and  $\Phi_2$ ) between the back panel (green) and each reflector wing is the same – and therefore the reflector unit is symmetrical.



**Ex. 1036, Brown, Fig. 1**

353. However, as I have explained, Brown also discloses the reflector unit does not have to be symmetrical and the radii of each reflector wing can vary. (Ex. 1036, Brown, ¶0028.) As I have annotated below, Figure 2 illustrates an embodiment where the *first-multi faceted side wall* includes a *first angle* (i.e.,  $\alpha$ ) and *second-multi faceted side wall* includes a *second angle* (i.e.,  $\Theta$ ). As Brown discloses, the angles, height, radii, etc. can be modified so the reflector is not symmetrical.

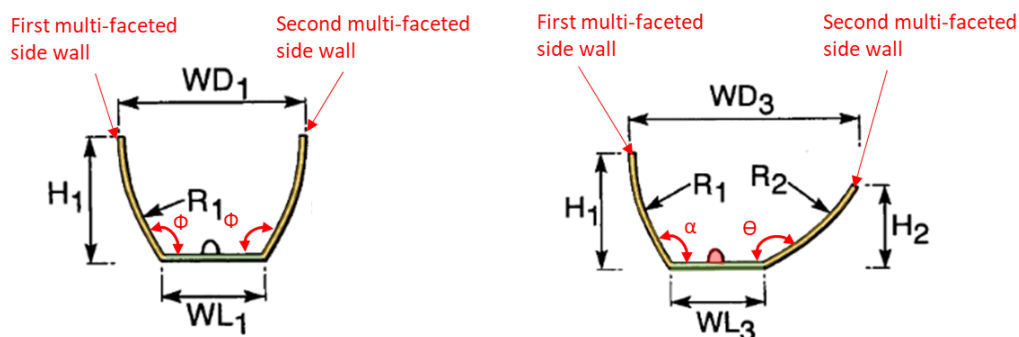


Ex. 1036, Brown, Fig. 2

354. Therefore, Brown discloses limitation [1.4a] and [1.4b].

*[1.5] wherein the first and second multi-faceted side walls extend away from the lighting strip at an angle and are configured to cause light produced by the plurality of light emitting diodes (LEDs) to be amplified and formed into a uniform beam,*

355. As I discussed with regard to limitations [1.4a] and [1.4b], Brown discloses a first and second reflector sidewall extending from a first and second side edge of the back panel. The side walls can extend away from the back panel (green) at the same angle (below left) or at different angles (below right).



Ex. 1036, Brown, Fig. 2

356. I note the '854 Patent states that a “uniform beam” may be a focused beam (e.g., spotlight) or a diffused beam (office light/street lamp).

Additional embodiments are directed to amplifying reflectors that may be associated with the lighting strips so that light produced by the plurality of light emitting diodes (LEDs) may be amplified and formed into a *uniform beam* which may be a *focused beam* useful, for example, as a spotlight, *or a diffused beam* useful, for example, as an overhead streetlight or possibly as an overhead office light.

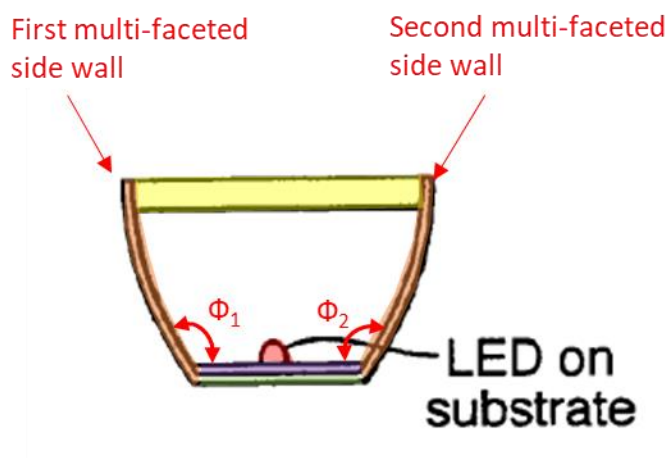
(Ex. 1001, '854 Patent at 5:61-6:1.)

357. Again, Brown is designed to be a spotlight used for illuminating users during a teleconference. Brown discloses the reflector can be designed to provide a “focused beam of light” or a reflector that can “spread the light over a wide area” (i.e., diffused). Brown therefore discloses both types of “uniform beam” disclosed by the '854 Patent.

According to the present invention, the function of the LEDs is to provide a high intensity white light source, which at the same time consumes low power in relation to the intensity of the light. The intensity and spreading of the light from a LED requires the use of a reflector to collect and direct the light rays. The *design of the reflector may be adjusted to suit the application the light will be used for*, and can for example be such that a *focused beam of light can be projected* a certain distance, *alternatively the reflector can spread the light over a wide area if required for short distance lighting*.

(Ex. 1036, Brown at ¶0025.)

358. In addition, each of Brown's reflector side walls are configured to direct the light to a diffuser (shaded yellow). As Brown discloses, the diffuser can be further used in conjunction with the side walls to provide either a projected or diffused beam of light.



**Ex. 1036, Brown, Fig. 1**

According to the present invention, *the purpose of the diffuser is to gather the individual light rays from the reflectors and homogenise them into a large area constant intensity light.* This allows the user to be directly spotlighted by the LED lamp without feeling any substantial discomfort. Without a diffuser the light rays will provide discomfort to the user, and potential short term focused spots in the eye. Viewing without a diffuser can be compared to looking directly into a power flashlight or into the main lights of a car.

(Ex. 1036, Brown at ¶0029.)

One of the main advantages of the present invention is that the design of the reflectors can be shaped and adjusted in the parameters of height from LED (H), width of diffuser opening (WD) and radius of sides (R) such *that the beam collation and projection can be tailored to each specific application.* The reflector can be made of a metal such that it will function as a heat sink and therefore allow prolonged use of high power LEDs.

(Ex. 1036, Brown at ¶0037.)

Further, the design and shape of the reflectors can be made such that the surface area (SA) required per length of LED is included within the design. The LED lamp is not directly linked to the camera, and can therefore be positioned in a variety of positions around the screen on a fully integrated system, or can be placed in a variety of positions around a meeting room. *The diffuser homogenises the point light source such that discomfort from glare is avoided whilst still allowing a high percentage of light transmission.*

(Ex. 1036, Brown at ¶0038.)

359. Therefore, Brown discloses that the reflectors cause the light produced by the plurality of light emitting diodes (LEDs) to be focused and formed into a uniform beam.

360. Claim limitation [1.5] also recites the side walls “are configured to cause light produced by the plurality of light emitting diodes (LEDs) **to be amplified.**” With regard to this limitation, the ’854 Patent states the angles of the



reflector walls creates facets which amplify the light provided by the LEDs.

*The combination of these angles creates facets in side walls 303 of reflector 300 which amplify the light provided by LEDs 11 or LEDs 111.* In addition, side walls 303 of reflector 300 direct the light from each of the plurality of lighting strips 9 of LEDs 11 or strips 109 of LEDs 111 and focus the light into what outwardly appears to be a uniform beam of light. Reflector assemblies 300 are constructed from silver-coated aluminum with a protective polymer coating as described previously.

(Ex. 1001, '854 Patent at 19:4-12.)

With reference to FIGS. 20 and 21, yet another possible configuration for a reflector is shown and is denoted generally as reference numeral 400. This reflector 400 includes a base portion or member 401 with a pair of integral side walls 403 extending from opposite sides thereof at an angle. Each side wall 403 of reflector 400 has several angles therein as shown in FIG. 20. Each side wall 403 of reflector 400 includes a first portion 405 that extends from base member 401 at a first angle  $\theta$  of, for example, about  $110^\circ$  to about  $120^\circ$ , such as about  $115^\circ$ . Side walls 403 further include a second portion 407 that defines a second angle  $\Phi$  with the first portion 405; this angle is, for example, about  $170^\circ$  to about  $180^\circ$ , such as about  $177^\circ$ . *The combination of the foregoing angles creates facets in the reflector 400 that amplify the light provided by LEDs 11 or LEDs 111.* In addition, side walls 403 of reflector assemblies 400 direct the light from each of the plurality of lighting strips 9 of LEDs 11 or strips 109 of LEDs 111 and focus the light into

what outwardly appears to be a uniform beam of light. Reflector assemblies 400 are also constructed from silver-coated aluminum with a protective polymer coating in like manner to previous embodiments.

(Ex. 1001, '854 Patent at 19:13-34.)

The combination of reflectors *for amplifying or intensifying* the light and the heat dissipation provided through the thermal radiation properties of the housing provides for a lighting fixture adapted to provide effective light output for use as a street light, while not overheating and reducing the life span or safety of the street light.

(Ex. 1001, '854 Patent at 6:1-7.)

361. However, a POSITA would understand amplification of light by a reflector is physically impossible. In this context, a POSITA would understand amplitude likely refers to the intensity or output of the LEDs, which is typically expressed in lumens. With regard to the word amplify in claim 1.5, a POSITA would understand that a reflector can collect the lumen output radiated at different angles from the LED and redirect or focus it so that a specific area on a surface being illuminated by the LED luminaire produces more light on that area than it would without the reflector.

**Lumen** – the unit of luminous flux, equal to the luminous flux emitted within a unit solid angle (1 steradian) from a point source having a uniform intensity of 1 candela...

(Ex. 1039, McGraw-Hill Dictionary of Scientific and Technical Terms.)

362. As illustrated by the above definition, a reflector – regardless of the number of angles included – cannot increase the integrated total lumens output of an LED light source. Even the most reflective materials absorb some portion of the light energy. To amplify, the reflector would have to reflect more energy (i.e., energy from the LED) than it receives which is simply not possible.

363. A POSITA reading the '854 Patent would understand the intent of the wording “amplification” to mean the more angles used can provide a more “focused” light beam. A focused beam directs more of the total LED light produced to a particular targeted area. In contrast, a non-focused beam spreads the total LED light produced a crossed a larger area. The focused beam may appear brighter than the non-focused beam, but the total LED light produced is not more; it its simply focused to where lighting is desired.

364. As I discuss above, the reflector of Brown focuses the light produced by the LEDs. Brown discloses not only modifying the radii of the side walls to provide a more focused light, Brown also discloses the use of a diffuser (i.e., lens) *and* a coating (e.g., silver coating) being placed on the walls of the reflector.

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom.

The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings. *The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.*

(Ex. 1036, Brown at ¶0026.)

According to the present invention, *the purpose of the diffuser is to gather the individual light rays from the reflectors and homogenise them into a large area constant intensity light.* This allows the user to be directly spotlighted by the LED lamp without feeling any substantial discomfort. Without a diffuser the light rays will provide discomfort to the user, and potential short term focused spots in the eye. Viewing without a diffuser can be compared to looking directly into a power flashlight or into the main lights of a car.

(Ex. 1036, Brown at ¶0029.)

365. A POSITA would have understood the silver coating would assist in ensuring more of the light generated by the LED is not absorbed by the reflector but is instead reflected and outputted from the LED lamp. The diffuser also works together with the light being reflected by the side walls (i.e., reflector wings) to provide a constant intensity of light.

366. It is therefore my opinion, Brown discloses *first/second side walls* are *multi-faceted* and extend at *from the lighting strip at an angle* (either the same or

different) to increase the focal intensity (*amplify*) of the light beam produced by the LEDs.

367. Brown discloses limitation [1.5].

*[1.6] and wherein the coupling between the lighting strips and the base plate provides heat transfer between the lighting strips and the base plate such that heat produced by the plurality of LEDs comprised in the lighting strip is conducted to the base plate for transfer to the ambient environment.*

368. Brown discloses that heat produced by LEDs can be managed by forming components from metal so that the whole assembly can act as a heat sink for thermally managing the LEDs:

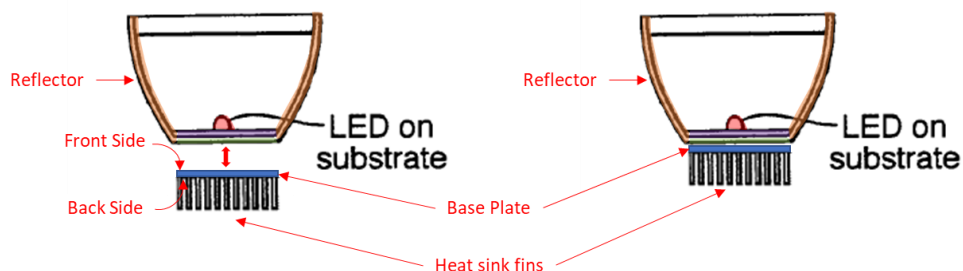
For providing best possible reflection, *the LED lamp assembly should preferably be made of a metal such as steel or aluminum*. Thus, the surface area of the LED lamp assembly is crucial because *the whole assembly will act as a heat sink for the high power LEDs*. The LEDs demand a certain surface area (SA) per LED and the reflector can be designed such that this surface area is available per module length of the LED array. If required special features can be included in the design of the reflector to increase the surface area within a compact size. As indicated in FIG. 3, these features can include *narrow ribs on the rear of the unit*, i.e. the face away from the light source.

(Ex. 1036, Brown at ¶0028.)

One of the main advantages of the present invention is that the design of the reflectors can be shaped and adjusted in the parameters of height from LED (H), width of diffuser opening (WD) and radius of sides (R) such that the beam collation and projection can be tailored to each specific application. *The reflector can be made of a metal such that it will function as a heat sink and therefore allow prolonged use of high power LEDs.*

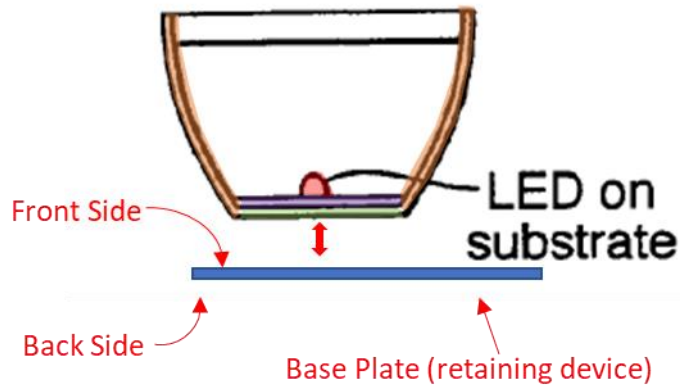
(Ex. 1036, Brown at ¶0037.)

369. Again, the '854 Patent discusses the base plate is a mechanism for transferring and dissipating heat away from the LEDs. As I discussed above, Brown's back panel (green) can be connected to a separate heat sink which would include the recited *base plate* (shaded blue below). The substrate and LED array (purple and red) would transfer heat to the reflector back panel (green) which would in turn transfer heat to Brown's heat sink (i.e., the base plate and fins). A POSITA would have understood the fins are a common aspect of a heat sink for transferring heat to the ambient environment. *See* Ex. 1036, Brown at ¶0028.



**Ex. 1036, Brown, Fig. 1 (annotated and modified)**

370. As I also discussed above, a POSITA would have understood Brown discloses a retaining plate (e.g., Ex. 1036, Brown at Claims 1 and 2) for attaching to the reflector. The retaining device allows the reflector unit to be attached in various locations and allows the reflector angle and position to be adjusted. A POSITA would have understood this would require the reflector to be attached to some flat portion of the retaining plate. A POSITA would have understood that any mechanism – like a retaining device – once attached to the reflector would receive any of the heat being generated by the LEDs. A POSITA would have understood the heat generated by the LEDs would be transferred from the substrate to the reflector and then to the retaining plate. Any heat received by the retaining plate would then be dissipated to the ambient environment. A POSITA would have further understood it would be desirable to even construct the retaining device from a metal (e.g., aluminum) that has good heat dissipating properties. A POSITA would have understood to ensure longer life expectancy for the LEDs any additional heat transfer mechanisms would be used.



**Ex. 1036, Brown, Fig. 1**

371. Accordingly, it is my opinion that Brown either discloses or renders obvious limitation [1.6].

## **2. Claim 2**

*[2] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the light emitting diodes (LEDs) are arranged in a linear row along the length of the lighting strip.*

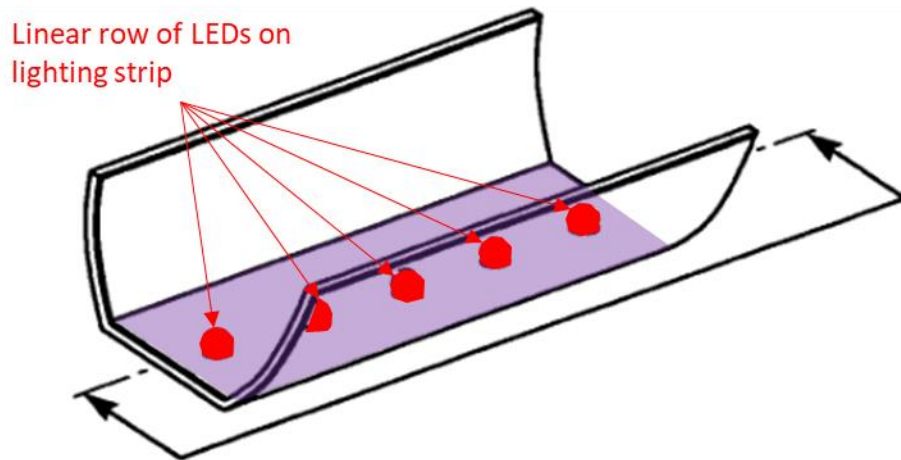
372. As I discussed above in limitation [1.2], Brown discloses an LED array (i.e., plurality of LEDs) that are assembled in a linear row that extends along a substrate material (purple below), which is the recited *lighting strip*.

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. **A linear array of LEDs** protected by a LED substrate is mounted on a back panel. A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the



bottom. The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings. The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)



**Ex. 1036, Brown, Fig. 1**

373. Accordingly, Brown discloses or renders obvious claim 2.

### **3. Claim 6**

*[6] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the first and second multi-faceted side walls extend away from a base member and are symmetrical about an axis of symmetry that runs through a center of the base member.*

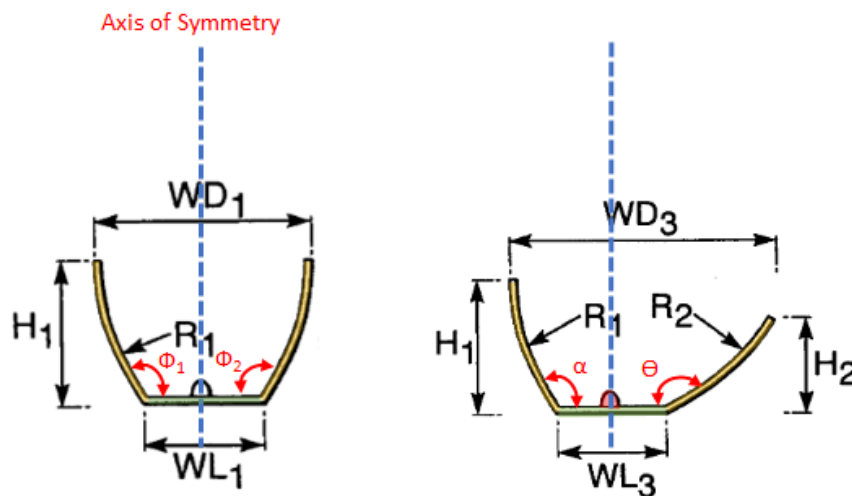
374. Again, Brown discloses (with reference to Figure 2) that the reflector design can be constructed any number of ways where the side walls height or radii

can be modified. Or the back panel width and length can be modified.

As already mentioned, the LED lamp assembly may have various designs. Key parameters in the design of the assembly are height from LED to diffuser (H), width of diffuser (WD), width of LED base (WL) and radius of reflector sides (R). *As depicted in FIG. 2, the LED lamp assembly does not have to be symmetric*, and can have different radii (R) and height (H) from side to side. The radii of the sides do not have to be of constant curvature.

(Ex. 1036, Brown at ¶0027.)

375. As annotated below left, the *first/second side walls* can extend from the base member (Brown's "back panel" shaded green") at the same angle (which I have annotated  $\Phi_1$  and  $\Phi_2$ ). As I have annotated the two halves of the reflector illustrated in Figure 2 are symmetrical *about an axis of symmetry that runs through a center of the base member*. A POSITA would have understood the design to be symmetrical since the width "WD1" between the sidewalls is the same, the radii of the sidewalls ( $R_1$ ) is depicted as being the same, and the height of the sidewalls ( $H_1$ ) is depicted as being the same.



**Ex. 1036, Brown, Fig. 2**

376. A POSITA would have understood the reflector shown above right would not be symmetrical considering the side walls have two different heights ( $H_1$  and  $H_2$ ) and two different radii ( $R_1$  and  $R_2$ ).

377. Brown discloses the limitations of claim 6.

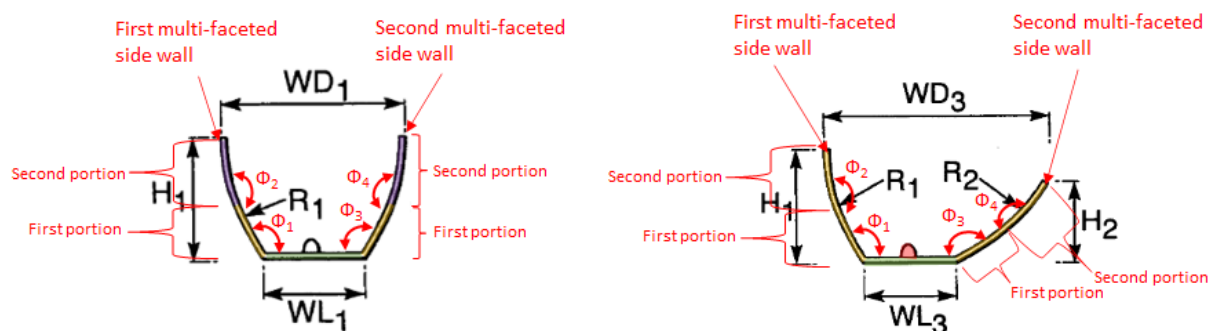
#### **4. Claim 7**

*[7] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 6, wherein the first and second multi-faceted side walls each comprise a first portion defining a first angle with the base member and a second portion defining a second angle with the first portion.*

378. As explained above, inventor of the '854 Patent broadly defined "multi-faceted" to include "reflectors having a parabolic shape." (Ex. 1001, '854 Patent at 10:51-60 and 17:41-54.) Again, Brown teaches a reflector that can be shaped such that the "sides do not have to be of constant curvature" – i.e., they can be parabolic

or even ellipsoids. (Ex. 1036, Brown at ¶0027.)

379. As shown below, the reflector of Brown has a *first multi-faceted sidewall* having a first portion (shaded orange) defining a first angle ( $\Phi_1$ ) with the base member (shaded green).<sup>18</sup> The *first multi-faceted sidewall* also includes a second portion (shaded purple) defining a second angle ( $\Phi_2$ ) with the first portion. Brown's reflector also includes a *second multi-faceted sidewall* having a first portion (shaded orange) defining a first angle ( $\Phi_3$ ) with the base member (green) and a second portion (shaded purple) defining a second angle ( $\Phi_4$ ) with the first portion.



**Ex. 1036, Brown, Fig. 2**

380. Again, this is just one example, and based on the teaching of Brown, a POSITA would understand these changes in radii (which do not have to be constant curvature) can vary even more dramatically or include more portions with additional angles. And as shown above right, the angles can be different when the reflector is

<sup>18</sup> As I have previously explained, the *base member* would constitute the substrate upon which the LEDs are mounted which is not clearly shown by Figure 2.

not symmetrical. (Ex. 1036, Brown at ¶0027.)

381. Accordingly, it is my opinion that Brown discloses the limitations of claim 7.

## 5. Claim 8

*[8] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 7, wherein the first angle and second angle are different angles.*

382. As I annotated in claim 7 above, Brown's reflector could include *side walls* having *first/second portions* that define *first/second angles*, e.g.,  $\Phi_1$ ,  $\Phi_2$ ,  $\Phi_3$ , and  $\Phi_4$ . As clearly shown by the non-symmetrical design (above in claim 7 to right) the *first portion* has a *first angle* ( $\Phi_3$ ) that would clearly be different than the second portion's *second angle* ( $\Phi_4$ ). The angles  $\Phi_1$ ,  $\Phi_2$  and  $\Phi_3$ ,  $\Phi_4$  are different due to the parabolic shape or non-symmetric shape of the sidewalls. Again, this is because a POSITA would understand Brown's reflector side walls could be parabolic (or even elliptical) as Brown teaches the "sides do not have to be of constant curvature." (Ex. 1036, Brown at ¶0027.)

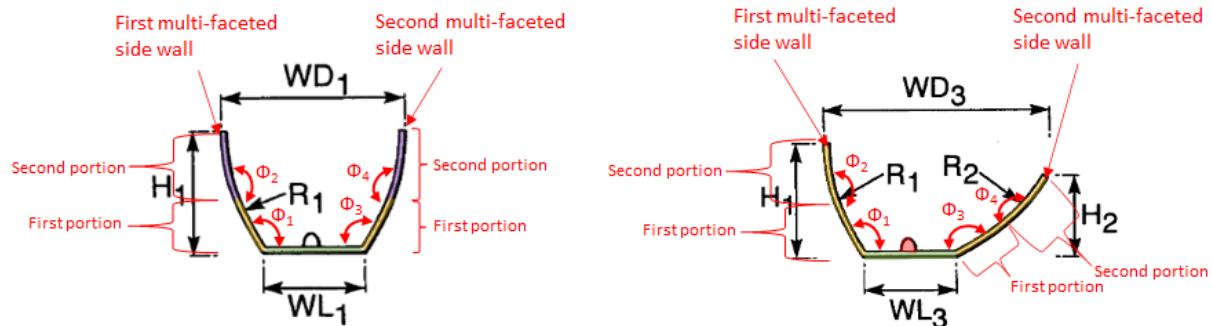
383. Accordingly, it is my opinion that Brown discloses or renders obvious the limitations of claim 8.

## 6. Claim 9

*[9] The light emitting diode (LED) lighting arrangement for a lighting fixture as claimed in claim 1, wherein the first and second*

***multi-faceted side walls comprise multi-angle side walls.***

384. I discussed above in claim 7, each side wall includes first and second portions that have different angles, e.g.,  $\Phi_1$ ,  $\Phi_2$ ,  $\Phi_3$ , and  $\Phi_4$ . Referring to annotated Figure 2, replicated below, the first sidewall initially extends from the back panel at a first angle ( $\Phi_1$ ). The curvature of the first sidewall then changes as it increases in height to form a second angle ( $\Phi_2$ ) between a second portion of the first sidewall and the back panel. The first angle ( $\Phi_1$ ) is different than the second angle ( $\Phi_2$ ). Therefore, the first sidewall comprises multiple angles, i.e., it is a multi-angle sidewall. In annotated Figure 2, the second sidewall is symmetrical with the first sidewall and is a multi-angle sidewall for the same reasons as the first sidewall. But the same analysis would also apply to the non-symmetrical shape as well.



**Ex. 1036, Brown, Fig. 2**

385. While Brown discusses reflectors having different angles due to parabolic sidewalls – as opposed to multiple straight segments – I believe claim 9 includes such designs. The language of claim 9 does not specify that the first and second side walls require straight segments. My opinion here is additionally

confirmed by the patentee's instructions for interpreting claim limitations related to the reflectors. For example, the inventor of the '854 Patent states:

In the present embodiment, reflector 141 defines multiple facets formed therein that amplify the light provided by LEDs 111 as will be discussed in greater detail hereinafter. Such facets may be angled formations in the body of the reflector 141 but reflector 141 is not intended to be limited to such facets. *Facets should be read broadly in connection with this disclosure as a formation(s) in the body of reflector 141 that amplify the light output of the LEDs 111 and direct the amplified and desirably uniform light outward from the light fixture 101 for any desirable application.*

(Ex. 1001, '854 Patent at 10:51-60.)

Each side wall 185 of reflector assembly 141 includes a first facet or first portion 186 defining a first angle  $\theta$  with the base portion 184 of reflector 141 adjacent the bottom portion of light emitting portion 187 of LED 111, and a second facet or second portion 188 that defines a second angle  $\Phi$  with first portion 186. The combination of these angles creates facets in side walls 185, thereby creating a multi-faceted side wall which amplifies the light provided by LEDs 111. It is contemplated that the multiple facets reflect the light that is output from the LEDs back toward other facets of the walls of reflector 141, thereby amplifying the light. *However, this is not to be construed as limiting as this definition of a multi-faceted reflector may also include reflectors having a parabolic shape.*

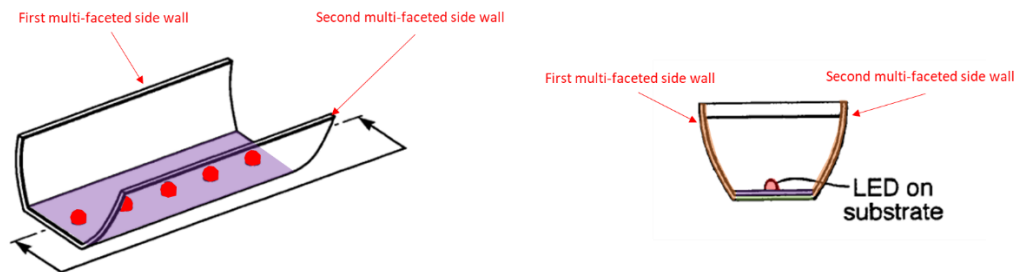
(Ex. 1001, '854 Patent at 17:41-54.)

386. Accordingly, it is my opinion that Brown discloses or renders obvious the limitations of claim 9.

## 7. Claim 10

*[10] The LED lighting arrangement of claim 1, wherein the first multi-faceted side wall adjacent the lighting strip extends along the entire length of the lighting strip from a position level with a bottom portion of a light emitting portion of each of the LEDs, and wherein the second multi-faceted side wall adjacent the lighting strip extends along the entire length of the lighting strip on a side opposite the first multi-faceted side wall from a position level with a bottom portion of a light emitting portion of each of the LEDs.*

387. As I show below, Brown discloses the *first and second side walls* are adjacent (i.e., next to) and extend along the entire length of the lighting strip (purple).



**Ex. 1036, Brown, Fig. 1**

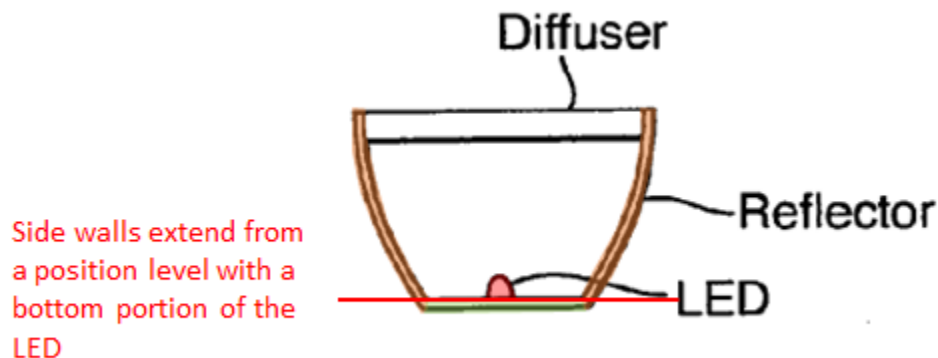
FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. *A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the*



**bottom.** The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings. The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)

388. Brown discloses a reflector made from one sheet of metal that includes a “back panel” (*bottom portion* highlighted in green) and reflector wings (*side walls*). (Ex. 1036, Brown at ¶0026.) As shown below, Brown visually disclose the first/second sidewalls of the reflector extend from a positions that is level with a *bottom portion* of a light emitting portion of each LED.



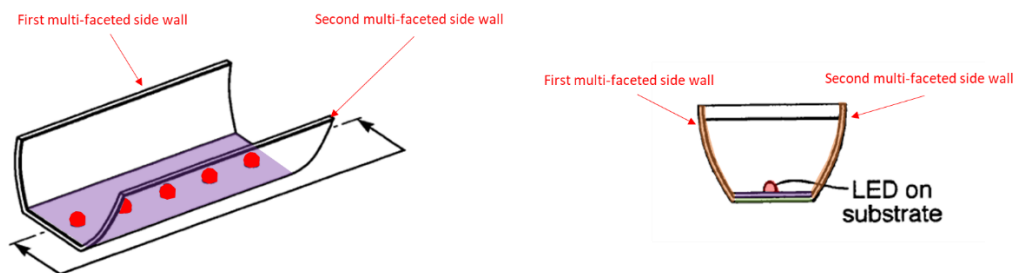
**Ex. 1036, Brown, Fig. 1**

389. Therefore, the combination of Brown and Stopa discloses the limitations of claim 10.

## 8. Claim 11

**[11] The LED lighting arrangement of claim 1, wherein the first multi-faceted side wall and the second multi-faceted side wall are separately coupled to the lighting arrangement.**

390. Brown discloses multiple embodiments for the reflectors. In one embodiment, the reflectors could be separate components that are attached to the back plane. In another embodiment, as discussed above, the back plane can be integrally formed from the “same sheet” of metal to create the two reflector wings – which I have discussed as being the recited *side walls*. As shown below the *first side wall* and *second side wall* are separately coupled to opposite sides of the *lighting strip* substrate which includes the linear array of LEDs (*lighting arrangement*).



**Ex. 1036, Brown, Fig. 1**

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. *A reflector is mounted edge to edge with the back plane* on each side of the LED array in a gutter-like shape with the LED array in the bottom. *The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector*

**wings.** The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)

391. Brown discloses or renders obvious the limitations of claim 11.

## **9. Claim 12**

***[12] The LED lighting arrangement of claim 1, wherein the first multi-faceted side wall comprises a first reflector sheet bent to form first facets, and wherein the second multi-faceted side wall comprises a second reflector sheet bent to form second facets.***

392. As previously discussed, the '854 Patent broadly defines facets as any angle or formation in the body of the *sidewall* that aids in directing the light output of the LEDs.

In the present embodiment, reflector 141 defines multiple facets formed therein that amplify the light provided by LEDs 111 as will be discussed in greater detail hereinafter. Such *facts [sic "facets"] may be angled formations in the body of the reflector 141 but reflector 141 is not intended to be limited to such facets. Facets should be read broadly in connection with this disclosure as a formation(s) in the body of reflector 141* that amplify the light output of the LEDs 111 and direct the amplified and desirably uniform light outward from the light fixture 101 for any desirable application.

(Ex. 1001, '854 Patent at 10:51-60.)

393. As I discuss above in regard to claim 11, Brown discloses that each reflector may be formed separately and then coupled to the back panel. The text of Brown does not explicitly state that the separately formed reflectors are sheets; however, the figures of Brown show the reflectors as being sheets and the text teaches to a POSITA that the separately formed reflectors are sheets.

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. *A reflector is mounted edge to edge with the back plane* on each side of the LED array in a gutter-like shape with the LED array in the bottom. *The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings.* The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

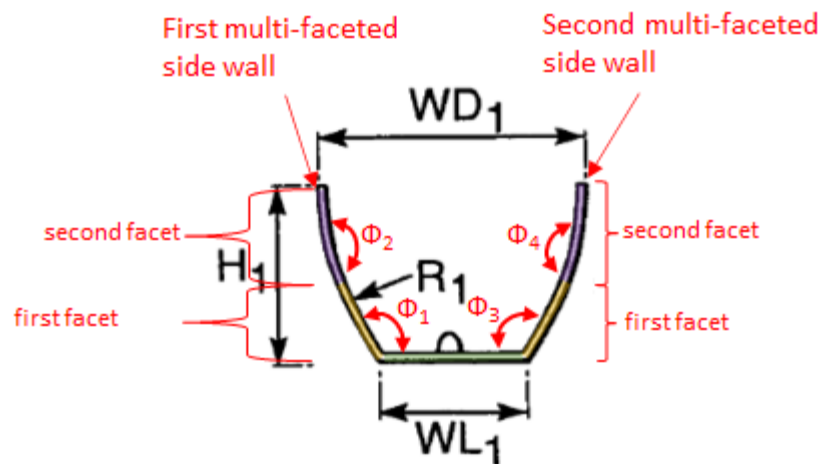
(Ex. 1036, Brown at ¶0026.)

394. Therefore, I understand Brown as disclosing *a first sidewall* comprising *a first reflector sheet* and *a second sidewall* comprising *a second reflector sheet* in the embodiment where the reflectors are assembled edge to edge with the back panel. As I have previously discussed, Brown discloses the height, width and radii of the sidewalls may be varied such that the reflectors are bent to form facets that may be symmetrical or non-symmetrical.

As already mentioned, the LED lamp assembly may have various designs. ***Key parameters in the design of the assembly are height from LED to diffuser (H), width of diffuser (WD), width of LED base (WL) and radius of reflector sides (R).*** As depicted in FIG. 2, the LED lamp assembly does not have to be symmetric, and can have different radii (R) and height (H) from side to side. ***The radii of the sides do not have to be of constant curvature.***

(Ex. 1036, Brown at ¶0027.)

395. As shown below, Brown's reflectors can be bent to have varying angles between the *first* and *second multi-faceted sidewalls*. If not constant curvature, Brown's reflector has a *first multi-faceted side wall* that is bent to form *first/second facets* (shown by angles  $\Phi_1$ ,  $\Phi_2$ ) and a *second multi-faceted side wall* bent to form *first/second facets* (shown by angles  $\Phi_3$ ,  $\Phi_4$ )



Ex. 1036, Brown, Fig. 2

396. Accordingly, it is my opinion that Brown discloses or renders obvious the limitations of claim 12.

#### **10. Claim 13**

***[13.0] The LED lighting arrangement of claim 1, wherein the first side wall and second side wall each are formed by a single reflector sheet.***

397. As I have discussed above, Brown discloses an embodiment where the reflector is formed from a single sheet of metal and folded to create the two reflector wings – *i.e.* the recited *side walls*.

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. A linear array of LEDs protected by a LED substrate is mounted on a back panel. A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom. ***The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings.*** The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

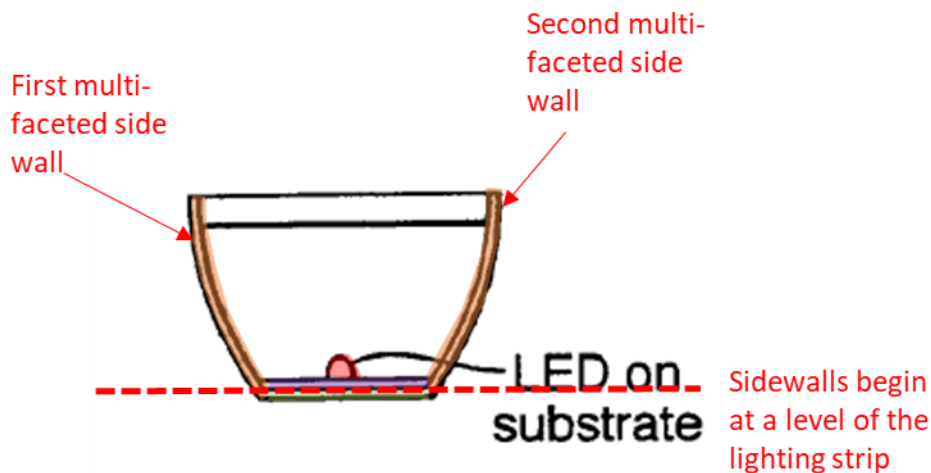
(Ex. 1036, Brown at ¶0026.)

398. Accordingly, it is my opinion that Brown discloses or renders obvious claim 12.

## 11. Claim 14

**[14] The LED lighting arrangement of claim 1, wherein the first and second multi-faceted side walls begin at a level of the lighting strip and extend away from the lighting strip.**

399. A POSITA would have understood Brown discloses and illustrates the substrate (purple) with *lighting strip* substrate (purple) seated onto the back panel (green). As shown below, the *first/second sidewalls* would still begin *at a level of the lighting strip*. Again, Brown disclose the reflector includes a back panel that is bent to include reflector wings – *i.e. first/second multi-faceted side walls*. Brown teaches and illustrates the *side walls* as *extending way from the lighting strip*.



**Ex. 1036, Brown, Fig. 1**

400. Accordingly, it is my opinion that Brown renders obvious claim 14.

## 12. Claim 15

**[15.0] A light emitting diode (LED) lighting fixture, comprising:**

401. See claim [1.0] above.

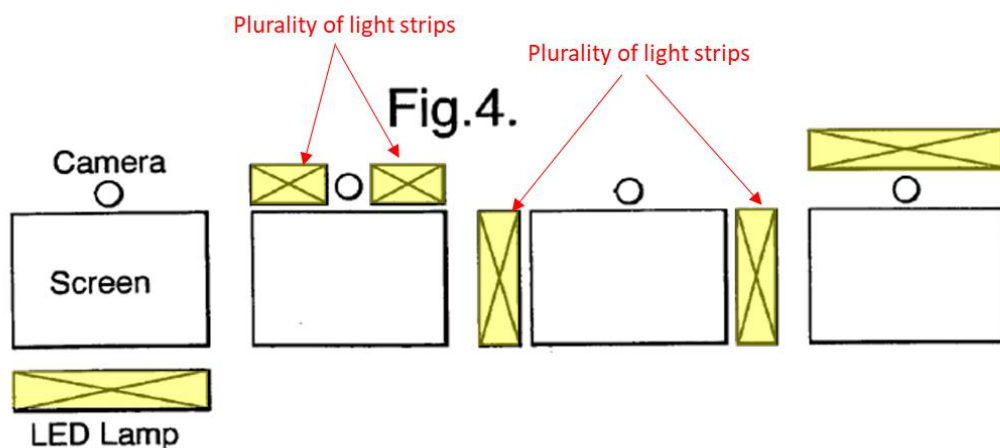
***[15.1] a base plate having a front side and a rear side;***

402. See claim [1.1] above.

***[15.2] a plurality of lighting strips mounted on the front side of the base plate, each of the lighting strips comprising a plurality of light emitting diodes (LEDs) arranged along a length of the lighting strip; and***

403. A POSITA would understand that discrete LEDs have an output of approximately 80-100 lumens. Therefore, in order to increase the overall output of an LED lamp, additional LED lamps could be used to increase light output from using just a single LED lamp.

404. As shown below, Brown discloses *a plurality of light strips* by including additional LED lamps (highlighted yellow) at various locations around the screen. (Ex. 1036, Brown at ¶¶0032-0033.)



**Ex. 1036, Brown, Fig. 4**



405. A POSITA would have understood that each of the LED lamps would have included at least one reflector and linear LED arrays assembled on a substrate. However, a POSITA would have also understood the two center illustrations would include two LED lamps *having at least two lighting strips* – i.e., at least one in each lamp.

406. Combining multiple LED strips into one LED lamp would have been nothing more than applying a known technique of using multiple lighting strips originally in two separate LED lamps into the same LED lamp that would provide predictable results. For instance, a POSITA would have understood the plurality of lighting strips combined into a single LED lamp could provide a greater intensity of focused light onto a user.

407. Combining the lighting strips into one LED lamp would also be nothing more than using a known technique to improve an LED lamp in the same way that the disclosed multiple LED lamps with multiple lighting strips would have provided.

408. Moreover, increasing the overall output would have been known by simply increasing the total number of LEDs. Therefore, a POSITA would have known that multiple lighting strips were a known technique. And a POSITA would have known and been capable of improving Brown in the same way.

409. As explained in limitation [1.2] above, each of the plurality of *lighting strips* would be coupled on the front side of a *base plate*.

410. It is therefore my opinion that Brown discloses or renders obvious the limitations recited by [15.2].

***[15.3] driver circuitry and control circuitry electrically coupled to the plurality of light emitting diodes (LEDs) for providing power to the light emitting diodes (LEDs),***

411. Brown discloses the array of LEDs are connected to a power source. The power source can the LEDs on/off or can be commanded to provide dimming of the LEDs. Brown discloses that the user can control and adjust the light intensity of the LEDs remotely (i.e., from the other end of the video call) or from within the same room.

The ***LED array can be connected to a power source controlled by the video conference system.*** This is applicable both in the case of a fully integrated system but also in the case of a satellite system. Connection to a controlled power source means that the lamp can be made to only be active when the video conference system itself is in use. This differentiates the LED illumination from the ambient illumination in the room or area. Furthermore, connection to a video conference controlled ***power source gives the opportunity to control the lighting from the far-end,*** i.e. from the users at the opposite end of the video call. The ***far-end users may wish to switch on/off or alter the dimming (i.e. the power output) of the LED lamp.***

In one embodiment of the present invention, ***the light intensity and direction is adjustable for allowing the users to achieve the most***

*optimal illumination in the user's environment.* The LED lamp assembly angle relative to the video conference system, and the LED lamp assembly itself, will then have to be adjustable in both vertical and horizontal direction, either manually or automatically by a motor drive controlled in the same way as for control of the camera direction in conventional video conference endpoints. *The light intensity will be adjusted by varying the power supply of the LED lamp assembly.* This *could be done from a user interface like a remote control or via a user menu.* This will allow a user at the near-end to adjust the illumination of the face of the user at the near-end by changing the light intensity, position or angle of the LED lamp assembly with a remote control or a user interface.

(Ex. 1036, Brown at ¶¶0035-0036.)

4. An illumination device according to one of the preceding claims, characterized in that the *light intensity of said light emitting diodes are adjustable through a user interface.*

(Ex. 1036, Brown at Claim 4.)

5. An illumination device according to claim 2, characterized in that said *position and angle are adjustable through a user interface.*

(Ex. 1036, Brown at Claim 5.)

412. A POSITA would have understood Brown as disclosing the recited *driver circuitry and control circuitry.* Again, the *control circuitry* would be the ability of a user to control the position and angle of the reflector lamp or by turning any one of the LED lamps on/off.

413. The *driver circuitry* would be understood by a POSITA as a device that provides DC current that could be varied to change the intensity of the LEDs or to provide the dimming function.

414. Brown renders obvious limitation [15.3].

*[15.4] wherein each of the lighting strips includes at least one reflector sheet comprising:*

*[15.5a] a first multi-faceted side wall of the at least one reflector sheet extending at an angle from a first side of the lighting strip along an entire length of the lighting strip, the first side wall comprising a sheet bent to form the angle,*

*[15.5b] a second multi-faceted side wall of the at least one reflector sheet extending along the lighting arrangement adjacent a second, opposite side of the lighting strip along an entire length of the lighting strip, and*

415. This limitation requires *at least one reflector sheet*. Therefore, it is my understanding each of the *plurality of lighting strips* recited by limitation [15.2] do not require the recited reflector. This limitation is therefore met by my analysis with regard to [1.3], [1.4a], and [1.4b] above.

416. To the extent it is argued that multiple reflectors are required, it would have been obvious to a POSITA that Brown teaches the construction of a reflector with a given *lighting strip* – i.e., substrate and linear array of LEDs. But it would have been obvious that multiple arrays of LEDs and multiple reflectors could be

used for a given application.

*[15.6] wherein the first and second multi-faceted side walls extend away from the lighting strip at an angle and are configured to cause light produced by the plurality of light emitting diodes (LEDs) to be amplified and formed into a uniform beam, and*

417. See limitation [1.5] above.

*[15.7] wherein contact between the lighting strips and the base plate provides heat transfer between the lighting strips and the base plate such that heat produced by the plurality of LEDs comprised in the lighting strip is conducted to the base plate for transfer to the ambient environment.*

418. See limitation [1.6] above.

### **13. Claim 18**

*[18] The light emitting diode (LED) lighting fixture as claimed in claim 15, wherein each light emitting diode (LED) of each lighting strip is electrically connected in series, and each lighting strip is electrically connected to the driver circuitry in parallel.*

419. Brown discloses both a *driver circuit* and *control circuit* as discussed in limitation [15.3].

420. It is also noted that there are only two ways to electrically connect components – i.e., in series or in parallel. It would have been obvious to POSITA that Brown's linear LED array could have been connected in either series or parallel. For instance, U.S. Patent 7,847,486 (Ex. 1043) even confirms as background or what

was known around 2004, that LEDs are typically connected in both (or either) series and parallel arrangement.

In arrangements that use super-bright LEDs as the light source, *many LEDs are typically connected in both a series and parallel arrangement*. Because the LEDs are usually packed together to form a single LED lighting system in a confined space, heat dissipation is limited. To optimize the performance of the LED light system, while still operating the LEDs in their safe operating regions, a substantially constant LED energy transfer is needed, that is, the energy from the power source into the LEDs should be maximized and maintained at a relatively constant level, while energy wasted as heat in the peripheral circuit components should be minimized; at the same time, variations of input voltage, peripheral component parameters, and LED forward voltage must be addressed. Without this optimization, LED lighting systems either under-perform, that is, they do not produce the lumens-per-watt they could, or are under-designed, that is, they must operate outside their safe operating regions.

(Ex. 1043, USPN 7,847,486 at 2:1-18.)

421. Stated differently, it would have been obvious Brown's *lighting strip* (i.e., LEDs attached on a substrate) would be electrically connected in series. This would have been the most common way of creating wire traces on the substrate for connecting each of the LEDs. A POSITA would understand that since an LED needs DC current and voltage, the most common and obvious way to connect a series of

LEDs in a luminaire is to connect them in series so that the same DC current runs through all of them. A POSITA would have known that separate strings or strips of LEDs could be connected in parallel to a power supply, which was commonly practiced as a way to keep all the LEDs from turning off when one LED in one string becomes inoperative and an electrical open circuit. A POSITA would understand that if strings or strips of LEDs were connected in parallel, if one strip went 'dark' due to a malfunctioning LED, the other strings connected in parallel would continue to radiate normally. Again, this would have been using obvious and known that LED strips could be connected in series and that those strips could in turn be connected in parallel.

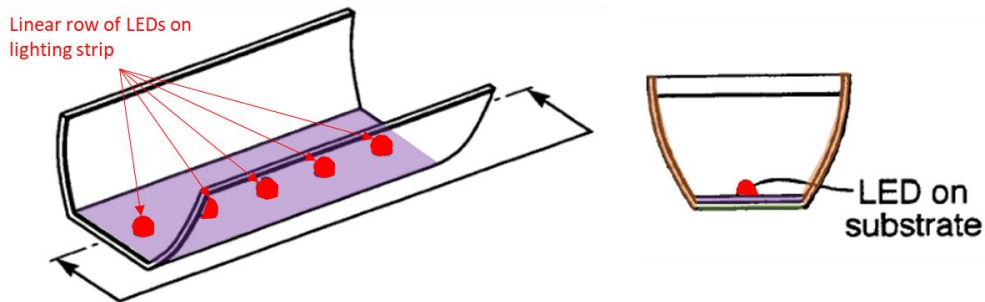
422. It would have also been known that Brown's *driver circuitry* could be connected to LED strips in series and that the strips could be connected to the power supply driver in parallel. By connecting in parallel, the *driver circuitry* would be operable to control all the LEDs (e.g., for dimming) at the same time. This would be more efficient and economical than providing separate *driver circuits* for each LED itself.

423. It is my opinion Brown discloses or renders obvious the limitations of claim 18.

#### 14. Claim 20

**[20] The light emitting diode (LED) lighting fixture as claimed in claim 15, wherein the light emitting diodes (LEDs) in each of the lighting strips are arranged in a linear row along the length of the lighting strip.**

424. As I discussed above, Brown discloses a substrate having a linear array of LEDs attached (i.e., the *lighting strip*).



**Ex. 1036, Brown, Fig. 1**

FIG. 1 shows an overall picture of an assembly of LEDs, reflector and diffuser according to one embodiment of the present invention. ***A linear array of LEDs protected by a LED substrate is mounted on a back panel.*** A reflector is mounted edge to edge with the back plane on each side of the LED array in a gutter-like shape with the LED array in the bottom. The back plane and the reflector could of course also be made out of a same sheet folded along two lines to create two reflector wings. The reflector is preferably painted or coated on the internal surface with a white or silver colour. A diffuser is mounted on top of the gutter, together forming an oblong housing of the LED array.

(Ex. 1036, Brown at ¶0026.)



425. As I discussed in limitation 15.2 it would have been obvious based on the teaching of Brown to include an LED lamp with multiple LED *lighting strips*. It would have also been obvious that the *plurality of lighting strips* would all include a substrate with a linear row of LEDs as taught by Brown. As I discussed above, a POSITA would have understood that since discrete LEDs have an output of 80-100 lumens, while the specification for LED luminaires is significantly higher than that, i.e., typically 1000 or more lumens, it is obvious that more than one LED is needed in design of the luminaire, and that multiple LEDs on a light engine PCB with a strip design would serve to increase the total overall output from the luminaire.

426. Brown discloses or renders obvious claim 20.

**F. Reasons or Motivation to Combine Brown and Stopa**

427. It is my opinion that it would have been obvious to modify Brown to include the teachings of Stopa. First, Brown and Stopa are all arise from the same field of endeavor of LED lighting solutions using reflectors and heat sinks.

428. Although I understand a motivation to combine is not necessary to prove obviousness, one of skill in the art would have been motivated to combine Brown and Stopa as both relate to LED lighting and utilize parabolic reflectors to focus the light into a uniform beam. The only differences between these references is (1) the possible construction of the reflectors; and/or (2) placement of the LED lighting strips (i.e., substrates with LEDs) with respect to the reflector and heat sink.

429. In one embodiment, Brown teaches to assemble the LED *lighting strip* on top of the reflector base, whereas Stopa teaches to assemble the *lighting strip* under the reflector base thereby allowing the LEDs to extend into an opening in the reflector. But these references simply disclose two common designs for assembling an LED substrate strip with a reflector. The choice of placing the substrate onto the reflector pack panel (i.e., bottom surface) or underneath the back panel makes no significant change to the optical performance of the LEDs relative to the reflectors. Nor does the placement of the LED substrate dictate the construction of the reflectors, beyond providing openings in the case of LEDs positioned through the bottom surface of the reflector. As such, reflectors for both designs are interchangeable with minimal modification e.g., providing openings for the LEDs.

430. LEDs produce heat that must be properly managed to ensure satisfactory operation of the lighting device. Both Brown and Stopa teach heat sinks with fins. Stopa simply teaches a removable heat sink (with fins) that can be attached to the substrate and reflector using a well-known technique – i.e., screws or adhesive. Brown teaches “attaching” the heatsink to the back of the reflector. A POSITA would have known and found it obvious that Brown’s heatsink fins would have been attached using similar attachment techniques.

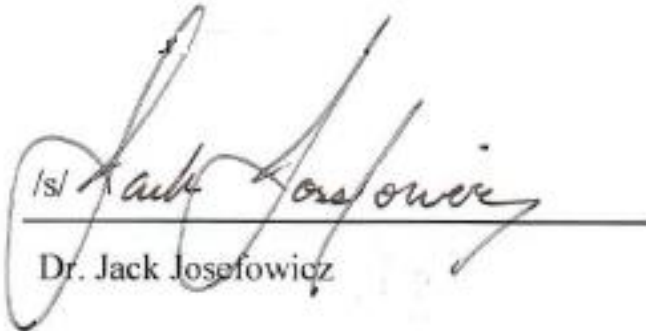
## **IX. Conclusion**

431. In my opinion, all the elements of the challenged claim limitations are disclosed by the references discussed above and that the claims are unpatentable in view of these prior art references.

432. I reserve the right to supplement my opinions to address any information obtained, or positions taken, based on any new information that comes to light throughout this proceeding.

I declare under penalty of perjury that the foregoing is true and accurate to the best of my ability.

Dated: October 28, 2022

/s/   
Dr. Jack Josefowicz