

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PHILIPS ELECTRONICS NORTH AMERICA CORP.

Petitioner

v.

ILUMISYS, INC.

Case No.: To be Assigned
Patent 8,382,327

**DECLARATION OF THOMAS M. LEMONS
IN SUPPORT OF PETITIONER, PHILIPS ELECTRONICS
NORTH AMERICA CORP.
IN THE INTER PARTES REVIEW OF U.S. PATENT NO. 8,382,327**

Mail Stop **Patent Board**
Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

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I. INTRODUCTION

1. I, Thomas M. Lemons, FIES, PE, have been retained by Middleton Reutlinger on behalf of Petitioner Philips Electronics North America Corp. (“Philips”) as an independent expert in this *inter partes* review by the U.S. Patent and Trademark Office. As part of my engagement, I have been asked to provide an analysis and expert opinions on the following topics: (a) the disclosure of U.S. Patent No. 8,382,327 (“the ‘327 Patent”); and (b) the validity of claims 1-3, 7-9 and 13-16 of the ‘327 Patent. I understand that one or more of these claims have been asserted by Patent Owner Ilumisys, Inc. (“Ilumisys”) against Philips in litigation styled *Ilumisys, Inc. d/b/a Toggled v. Philips Electronics North America Corp.*, Civil Action No. 3:13-CV-14961, which is pending in the United States District Court for the Eastern District of Michigan.

2. It is my opinion that Claims 1-3, 7-9, 13-16 (the “Challenged Claims”) are invalid in view of the prior art discussed later in this Declaration. Specifically, it is my opinion that the prior art constitutes, discloses, teaches, or suggests the inventions claimed in the Challenged Claims, and thus the Challenged Claims are rendered obvious by the prior art, including the knowledge of those skilled in the art. The particular references that invalidate the Challenged Claims, as well as the reasons for my opinion, are set forth in detail below.

3. I am being compensated for my work on this case at my standard consulting rate of \$190 per hour. My compensation is not contingent upon the results of my study, the substance of my testimony, or the outcome of this case.

4. This declaration explains the subject matter and opinions related to this *inter partes* review based on facts and information available to me to date. As such, I am prepared to provide expert testimony regarding opinions formed resulting from my analysis of the issues considered in this declaration if asked about those issues by the Board or by the private parties' attorneys.

5. Additionally, I may discuss my own work, teachings, and knowledge of the state of the art in the relevant time period. I may rely on handbooks, textbooks, technical literature, and the like to demonstrate the state of the art in the relevant period and the evolution of relevant technologies.

6. This declaration describes my opinions in the matter named above. However, I respectfully reserve my right to alter or supplement my analysis in response to any criticisms or alternative opinions offered by Ilumisys or any other matter that might cause me to alter my opinion.

7. It is my understanding that discovery may occur in this proceeding. I reserve the right to modify or supplement my opinions, as well as the basis for my

opinions, in light of any documents, testimony, or other evidence that may emerge during the course of this matter, including depositions that have yet to be taken.

8. Throughout this declaration, I refer to specific pages of patents and other technical documents. The citations are intended to be exemplary and are not intended to convey that the citations are the only source of evidence to support the propositions for which they are cited.

II. BASIS FOR OPINIONS

(a) Qualifications

9. I am an independent consultant. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience related to, *inter alia*, optics, light emitting diodes, pulse width modulation, the lighting field in general, and on the documents and information referenced in this declaration. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I have attached to this declaration a copy of my current curriculum vitae (Ex. 1018), which details my education, experience, and publications, and a list of all other cases in which, during the previous four years, I testified as an expert at trial or by deposition. The following thus provides

only a brief overview of some of my experience that is relevant to the matters set forth in this declaration.

10. I have been a lighting consultant since 1970. As a lighting consultant, I have, *inter alia*, designed lighting installations such as a Boston Red Sox batting cage using LED luminaires, provided optical designs for manufacturers including a patented LED product, and provided expert witness services. My lighting consulting work from 1970 until 2013 was with TLA-Lighting Consultants, Inc. I founded and served as President of TLA-Lighting Consultants, Inc. TLA-Lighting Consultants, Inc. was dissolved in 2013 and I have since been performing lighting consulting work independently under the name TLA-Lighting Consultants.

11. A short list of project credits as a lighting consultant includes major sports lighting projects such as: Boston's Fenway Park; New York's Yankee Stadium; and Philadelphia's Spectrum Arena. The list also includes office lighting designs for: Haworth Center in Holland, Michigan; PG&E Diablo Canyon Power Plant in California; and Clark Equipment Company in South Bend, Indiana. The list further includes: exhibit lighting designs for several Haworth Showrooms; the MSPCA Macomber Farm in Framingham, Massachusetts; and the Museum of Fine Arts in Portland, Maine.

12. As a lighting consultant, I also performed optical design work for many companies, including: Lam Lighting; The 3M Company; Haworth, Inc.; the Macbeth Division of Kollmorgen Corporation; Black and Decker; Brasscorp Limited; and Altman Stage Lighting Company. The Brasscorp Limited optical design activity used an array of LEDs in an inspection luminaire, which is covered by U.S. Patent No. 7,204,606.

13. From 1979 to 2001, I was co-founder and President of ARC Sales, Inc. ARC Sales, Inc. designed and manufactured highly efficient luminaires for the gaming and architectural lighting industries.

14. From 1956 to 1970, I was an Applications and Development Engineer at Sylvania Lighting Products. At Sylvania, I developed new products and discovered new uses for existing products. My work at Sylvania included pioneering the application of tungsten halogen light sources in the theater, television, and film industries. One of my first major projects at Sylvania was to design luminaires using fluorescent lamps to produce a controlled beam of light from standard T12 fluorescent lamps as well as aperture fluorescent lamps. Three of these products were used to illuminate the Gaillard Cut of the Panama Canal, the touch down zone of the main runway at Washington National Airport, and the New Jersey Turnpike at the Newark Airport.

15. I received my BS degree in Electrical Engineering from Purdue University in 1956, with emphasis on illumination and optics. I am also a Registered Professional Engineer in the Commonwealth of Massachusetts

16. I am active in many lighting organizations, such as the Illuminating Engineering Society of North America (IESNA), International Commission on Illumination (CIE) and United States Institute for Theatre Technology (USITT). I am a Fellow of the IESNA and USITT. I previously served as the IESNA Regional Vice President and the Vice President of Administration and Operation. I also previously served as the Secretary, and then President, of the United States National Committee of the CIE. I am currently the United States' Member of Division 5 (Outdoor and Specialty Lighting) of the CIE.

17. I have chaired many IESNA and CIE technical committees including: the Light Control and Luminaire Design committee; the Sports Lighting committee; the Institutions Lighting committee; the Theatre, TV and Film Lighting committee; and the Library Lighting committee. I have assisted in the preparation of energy standards for new buildings (ASHRAE 90-75) and for existing places of public assembly (ASHRAE/IES 100.6-1981). I also assisted in writing a manual of accepted practice for ASHRAE 90-75. I also served on the Technical Review Committee (TRC) for IESNA on multiple occasions. My duties on the TRC

included technical review of the 10th Edition of the IESNA Lighting Handbook and Chairman of the Handbook Committee for the Handbook's 8th Edition.

18. I have presented and published over eighty technical papers and have conducted seminars on reflector design and light sources. I have also taught various illumination subjects, including a course on Light Sources for students in the Masters in Lighting Design at the New School in New York, New York and a course on Lighting Design at Chamberlain Junior College in Boston, Massachusetts.

19. I have been awarded over 20 U.S. and foreign patents in the general field of optics and illumination. These patents are identified in my curriculum vitae (Ex. 1018).

20. I have previously served as an expert witness in patent litigation involving lighting technology, including the following: Genlyte Thomas Group, LLC v. Architectural Lighting Systems; Kenall Manufacturing Co. v. Genlyte Thomas Group, LLC; and Sportlite, Inc. v. Genlyte Thomas Group, LLC.

21. In the last four years, I have testified as an expert by deposition or at trial in three cases related to lighting. These cases are identified in my curriculum vitae (Ex. 1018).

(b) Preparation for this Declaration

22. All of the opinions stated in this declaration are based on my own personal knowledge and professional judgment; if called as a witness during any proceeding in this matter I am prepared to testify competently about them.

23. In forming my opinions, I have considered, in addition to my own knowledge and experience, (a) my review of the '327 Patent, its file history, and various prior art references; and (b) any other references referred to or cited in this declaration.

(c) Level of Ordinary Skill in the Art

24. I believe that a person of ordinary skill in the art relating to the '327 Patent would have a Bachelor's degree in Electrical Engineering, an equivalent discipline, or two or more years of work experience in lighting design.

25. I meet these criteria and consider myself a person with at least ordinary skill in the art pertaining to the '327 Patent. I would have been such a person by at least the time of the filing of the earliest application on which the '327 Patent is based (February 11, 2000).

III. LEGAL UNDERSTANDINGS

26. In this section I describe my understanding of certain legal standards that I have relied upon in forming my opinions set forth in this declaration. I have been informed of these legal standards by Philips' attorneys. I am not an attorney and I have not researched the law on patent invalidity. I am relying only on instructions from Philips' attorneys for these legal standards

(a) A Person of Ordinary Skill in the Art

27. I understand that a person having ordinary skill in the art is a hypothetical person who is used to analyze the prior art without the benefit of hindsight. A person of ordinary skill in the art is presumed to be one who thinks along the lines of conventional wisdom in the art and is not one who undertakes to innovate, whether by extraordinary insights or by patient and often expensive systematic research.

28. I understand that the hypothetical person of ordinary skill is presumed to have knowledge of all references that are sufficiently related to one another and to the pertinent art, and to have knowledge of all arts reasonably pertinent to the particular problem that the claimed invention addresses.

(b) Legal Standard for Prior Art

29. I understand that a patent or other publication, must first qualify as prior art before it can be used to invalidate a patent claim.

30. I understand that a U.S. or foreign patent qualifies as prior art to a patent claim if the date of application and/or issuance of the prior art patent is prior to the purported date of invention of the patent claim.

31. I further understand that a printed publication, such as an article published in a magazine or trade publication, qualifies as prior art to a patent claim if the date of publication is prior to the purported date of invention of the patent claim.

32. I understand that a U.S. or foreign patent or patent application qualifies as prior art to a patent claim if the date of issuance or publication of the prior art patent or application is more than one year before the earliest asserted priority date of the patent claim.

33. I further understand that a printed publication, such as an article published in a magazine or trade publication, qualifies as prior art to a patent claim if the date of publication occurs more than one year before the filing date of the patent claim.

34. I understand that a U.S. patent qualifies as prior art to a patent claim if the application for the prior art patent was filed in the United States before the purported date of invention of the patent claim.

(c) Legal Standard for Anticipation

35. I understand that, once the claims of a patent have been properly construed, the second step in determining anticipation of a patent claim requires a comparison of the properly construed claim language to the prior art on a limitation-by-limitation basis.

36. I understand that a prior art reference “anticipates” a claim, and thus renders the claim invalid, if all elements of the claim are disclosed in that prior art reference, either explicitly or inherently (*i.e.*, necessarily present or implied).

37. Under Section 102 of the Patent Act, claims may be invalidated for lack of novelty or loss of rights. I have been informed by counsel that a claimed invention is invalid for anticipation or lack of novelty when all of the limitations of the claim as construed by the Court are present in a single prior art reference. I understand, however, that all limitations of the claim need not be shown directly so long as all limitations are necessarily present in the single prior art reference and thus are inherent.

(d) Legal Standard for Obviousness

38. I have been instructed by counsel on the law regarding obviousness, and understand that even if a patent is not anticipated, it is still invalid if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in the pertinent art.

39. I understand that a person of ordinary skill in the art provides a reference point from which the prior art and claimed invention should be viewed. This reference point prevents one from using their own insight or hindsight in deciding whether a claim is obvious.

40. I also understand that an obviousness determination includes the consideration of various factors such as (1) the scope and content of the prior art, (2) the differences between the prior art and the Challenged Claims, (3) the level of ordinary skill in the pertinent art, and (4) the existence of secondary indicia of non-obviousness.

41. I am informed that secondary indicia of non-obviousness may include (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success or lack of commercial success of processes covered by the patent; (3) unexpected results achieved by the invention and praise

of the invention by others skilled in the art; (4) taking of licenses under the patent by others; and (5) deliberate copying of the invention. I also understand that there must be a relationship between any such secondary indicia and the invention. I further understand that contemporaneous and independent invention by others is a secondary consideration supporting an obviousness determination.

42. I understand that a proper obviousness analysis generally requires a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements of multiple items of prior art in the way the claimed invention does. I understand that the items of prior art themselves may provide a suggestion, motivation, or reason to combine, but other times the nexus linking two or more prior art references is simple common sense. I further understand that an obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that a motivation to combine references may be supplied by the direction of the marketplace.

43. I understand that if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using such a technique is obvious unless its actual application is beyond the practitioner's skill.

44. I also understand that practical and common sense considerations should guide a proper obviousness analysis, because familiar items may have

obvious uses beyond their primary purposes. I further understand that a person of ordinary skill in the art looking to overcome a problem will often be able to fit the teachings of multiple prior art publications and/or the components or processes carried out by or included in various prior art systems together like pieces of a puzzle. I understand that an obviousness analysis therefore takes into account the inferences and creative steps that a person of ordinary skill in the art would employ under the circumstances.

45. I understand that a particular combination may be proven obvious merely by showing that it was obvious to try the combination. For example, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp because the result is likely the product not of innovation but of ordinary skill and common sense.

46. I understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. I understand that if a person of ordinary skill can implement a predictable variation, 35 U.S.C. §103 likely bars its patentability.

47. It is further my understanding that a proper obviousness analysis focuses on what was known or obvious to a person of ordinary skill in the art, not just the patentee. Accordingly, I understand that any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

48. I understand that a patent claim can be obvious in light of a single item of prior art, without the need to combine multiple items of prior art, even if one or more of the elements of that claim that are not found explicitly or inherently in the item of prior art, but could have been supplied by the common sense of one of skill in the art at the time of the purported invention.

49. I understand that even if a claimed invention involves more than substitution of one known element for another or the application of a known technique to a piece of prior art ready for improvement, the invention may still be obvious. I also understand that in such circumstances courts may need to look to interrelated teachings of multiple patents, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art to determine if the claimed invention is obvious.

50. In sum, my understanding is that items of prior art and the teachings therein are properly combined where a person of ordinary skill in the art having the

understanding and knowledge reflected in the prior art and motivated by the general problem facing the inventor, would have been led to make the combination of elements recited in the claims. Under this analysis, the items of prior art themselves, or any need or problem known in the field of endeavor at the time of the invention, can provide a reason for combining the elements of multiple items of prior art in the claimed manner.

51. I have been informed and understand that the obviousness analysis requires a comparison of the properly construed claim language to the prior art on a limitation-by-limitation basis.

(e) Claim Construction

52. I have been instructed by counsel on the law regarding claim construction and patent claims, and understand that a patent may include two types of claims, independent claims and dependent claims. An independent claim stands alone and includes only the limitations it recites. A dependent claim can depend from an independent claim or another dependent claim. I understand that a dependent claim includes all the limitations that it recites in addition to all of the limitations recited in the claim from which it depends.

53. I have been instructed by counsel that claim construction is a matter of law for the arbiter of law to decide. Further, I have been instructed by counsel that

for the purposes of an *inter partes* review, claim terms should be given their broadest reasonable construction consistent with the patent in which the terms are used.

54. I also understand under a broadest reasonable interpretation, the words of the claim must be given their plain meaning, unless the inventor, acting as a lexicographer, has set forth special meaning to certain terms.

IV. TECHNOLOGY BACKGROUND

55. Below I have included information that provides a technical background and a state of the art around and before 2000 that can be helpful in understanding technical matters of my analyses and provides an overview of the technology at issue in this case. This overview also provides what I believe to have been the general understanding of a person of ordinary skill in the art around and before 2000, when the earliest application on which the '327 Patent is based was filed.

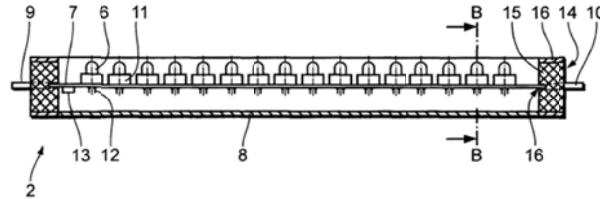
(a) LED Replacements for Fluorescent Tubes

56. It was understood by one of ordinary skill in the art around and before 2000 that LEDs may be utilized in light sources that replace conventional light sources. For example, prior art patent applications were filed and published throughout the 1990s that describe light sources that incorporate LEDs and replace

conventional fluorescent tubes. The prior art patent applications mention many of the benefits obtained by utilization of LEDs in replacement light sources for fluorescent tubes, such as increased life of the light sources, increased durability, reduced energy consumption, and reduced servicing costs. Examples of some of the prior art patent applications that describe LED replacement light sources for fluorescent tubes are described in the following paragraph.

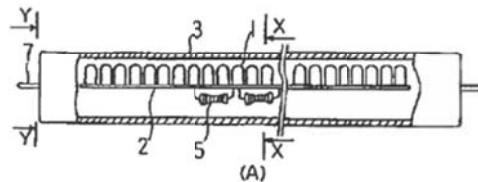
57. LED replacements for fluorescent tubes designed to fit in a conventional fluorescent light fixture were described in multiple prior art references such as: German Utility Model DE29900320 (“DE ‘320”) filed January 4, 1999 and published May 12, 1999 (Ex. 1003); Japanese Published Patent Application JP08-162677 (“JP ‘677”) filed December 5, 1994 and published June 21, 1996 (Ex. 1007); and Japanese Published Patent Application JP11-162234 (“JP ‘234”) filed November 25, 1997 and published June 18, 1999 (Ex. 1013). An example figure of each is reproduced below. Each figure illustrates an LED light source that replaces a conventional fluorescent tube and has a form factor that conforms to a conventional fluorescent tube. Each light source includes opposed end caps with bi-pin connectors. Each light source further includes LEDs that are provided along the length of the light source and that illuminate in response to power provided via the bi-pin connectors. Additional description of these prior art

references is provided below in Section VII in the “Analysis of the Challenged Claims Against the Prior Art”.



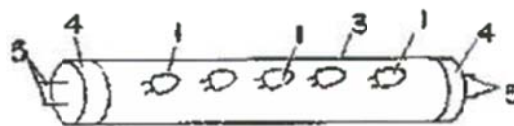
Ex. 1003 (DE '320), FIG. 2

【図1】



Ex. 1007 (JP '677), FIG. 1(A)

【図5】



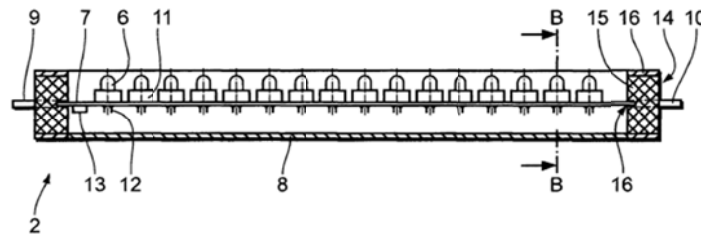
Ex. 1013 (JP '234), FIG. 5

(b) Mounting of LEDs

58. It was also understood by one of ordinary skill in the art around and before 2000 that LEDs may be arranged along the length of an elongate LED surface in an elongate light source. For example, prior art patent applications were filed and/or published throughout the 1990s that describe elongate light sources

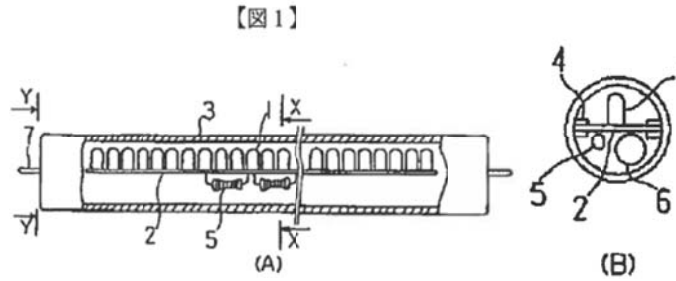
that generally conform to the form factor of a fluorescent tube, and that include LEDs arranged along an elongate circuit board or other surface. Examples of some of the prior art references are described in the following paragraphs.

59. As one example, prior art reference DE '320 discloses an LED light source 2 that is a replacement for a conventional fluorescent tube. Ex. 1003 at p. 3, ll. 11-15. An example figure is reproduced below that illustrates LEDs 6 arranged along the length of a circuit board 7. The circuit board 7 is elongate and extends substantially the length of the light source 2.



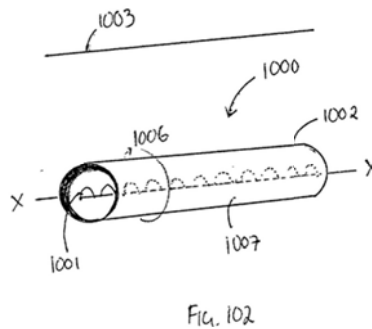
Ex. 1003, FIG. 2

60. As another example, prior art reference JP '677 also discloses an LED light source that may be used as a retrofit for a conventional fluorescent tube. Ex. 1007 at ¶¶ [Aim], [Structure]. Two example figures are reproduced below that illustrate the replacement light source with LEDs 1 arranged along the length of an elongate circuit board 2.



Ex. 1007, FIGS. 1(A) and 1(B)

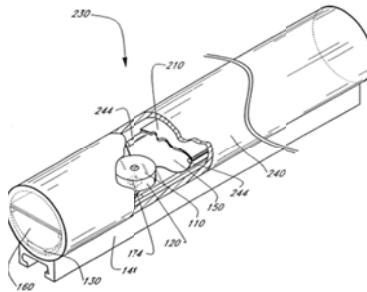
61. As another example, prior art U.S. Pat. App. Pub. No. 2003/0076281 (“US ‘281”) published April 24, 2003 and filed June 15, 1999 (Ex. 1005), describes LEDs 1001 may be arranged along a mounting panel within a cylindrical housing 1007. Ex. 1005 at ¶¶ 262 and 276. An example figure is reproduced below.



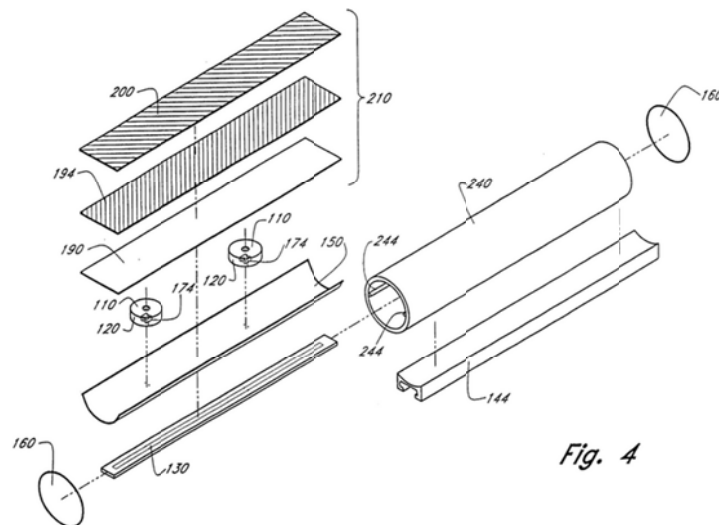
Ex. 1005, FIG. 102

62. As yet another example, prior art U.S. Pat. No. 6,582,103 (“US ‘103”) published June 24, 2003 and filed July 20, 2000 (Ex. 1015) (claims priority to, *inter alia*, Prov. App. No. 60/144,920, filed July 21, 1999 (Ex. 1016)), describes LEDs 174 linearly arranged along a surface within a cylindrically shaped housing

240. Ex. 1015 at 5:16-22; Ex. 1016 at p. 7, ll. 17-21. Two example figures are reproduced below.



Ex. 1015, FIG. 3



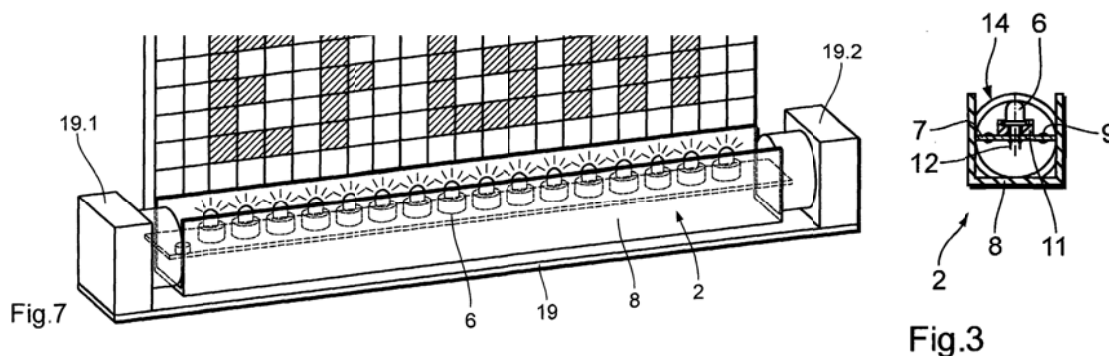
Ex. 1015, FIG. 4

(c) Confining Light Output of LEDs

63. It was also understood by one of ordinary skill in the art around and before 2000 that light output from linear light sources incorporating LEDs may be confined in an included angle of less than about 180°. For example, prior art patent applications were filed and/or published throughout the 1990s that describe

elongate light sources that include LEDs and that are configured such that light output from the light source is confined to an included angle of less than about 180°. Examples of some of the prior art references are described in the following paragraphs.

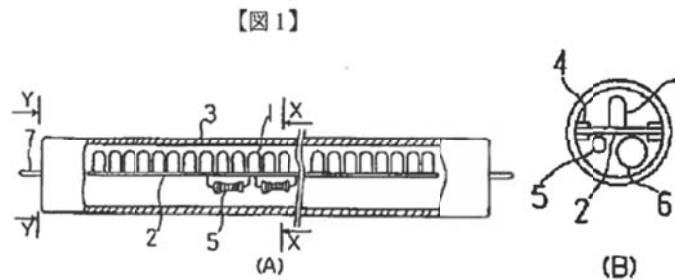
64. As one example, prior art reference DE '320 discloses a reflector 8 that is provided on opposed sides of, and extends above, LEDs 6 and a circuit board 7 in a light source that is a replacement for a conventional fluorescent tube. Ex. 1003 at p. 8, ll. 28-31. The reflector 8 has a polished surface to enhance the reflection of light emitted by the light-emitting diodes. *Id.* at p. 9, ll. 28-30. The reflector 8 confines the entirety of the light output from the light source to an included angle of less than 180°. Two example Figures are reproduced below.



Ex. 1003, FIGS. 7 and 3

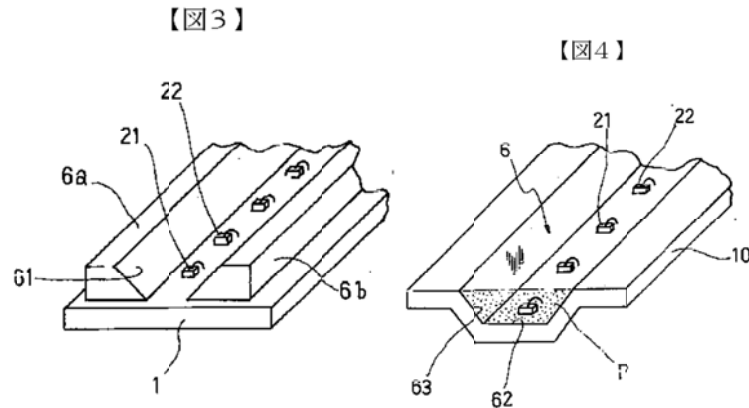
65. As another example, prior art reference JP '677 also describes a LED light source that may be used as a retrofit for a conventional fluorescent tube. Ex.

1007 at ¶¶ [Aim], [Structure]. Two example figures are reproduced below that illustrate the elongate circuit board 2 and cylindrical tube 3 are arranged such that substantially the entire light output of the device is emitted away from the circuit board 2 and confined to an included angle of less than about 180°.



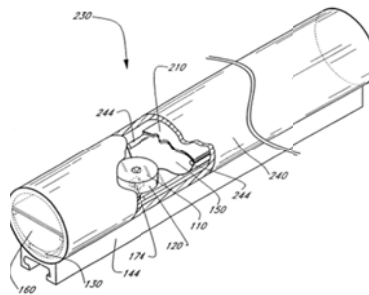
Ex. 1007, FIGS. 1(A) and 1(B)

66. As another example, Japanese Published Patent App. JP10-308536 (“JP ‘536”), published Nov. 17, 1998 and filed May 6, 1997 (Ex. 1010), discloses reflective surfaces that are provided on opposed sides of a surface supporting a linear array of LEDs 21, 22. Ex. 1010 at Abstract. Two example figures are provided below that illustrate the reflective surfaces (61 in the embodiment of FIG. 3; 63 in the embodiment of FIG. 4). The reflective surfaces confine light output of the device to an included angle of less than 180°. JP ‘536 discloses that the reflective surfaces bring forward light reflected from the side of each LED, and thereby limit drops in light output immediately above places where no LED is present. *Id.* JP ‘536 discloses that such arrangement provides a LED linear light source with low variability in optical output. *Id.* at ¶ 0021.

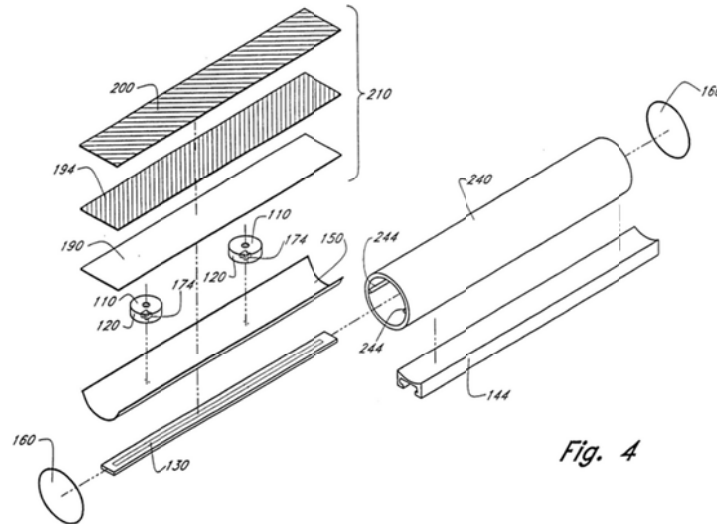


Ex. 1010, FIGS. 3 and 4

67. As yet another example, US '103 discloses a reflective surface 150 that extends above and is provided on opposed sides of linearly arranged LEDs 174 within a cylindrically shaped housing 240. Ex. 1015 at 3:50-51, 4:3-5, and 4:13-15; Ex. 1016 at p. 5, ll. 10-12, 24-27; p. 6, ll. 1-3. The reflective surface 150 confines light output of the device to an included angle of less than 180°. Two example figures are reproduced below that illustrate the reflective surface 150.



Ex. 1015, FIG. 3



Ex. 1015, FIG. 4

(d)Power Supply Circuits for LEDs

68. It was also understood by one of ordinary skill in the art around and before 2000 that LEDs of light sources that incorporate LEDs and are utilized as a replacement for a fluorescent tube illuminate in response to current provided by a power supply circuit or an electrical circuit. Moreover, it was also understood that the LEDs of such light sources illuminate in response to current to be received from a fluorescent light fixture in which the light sources are installable. Multiple prior art references that describe LED replacement light sources for fluorescent tubes describe receiving current from a fluorescent light fixture and describe methods to supply current to the LEDs using an electrical circuit or power supply circuit. Description is provided below of receiving current from a fluorescent light

fixture and some of the various methods for supplying current to LEDs as is set forth in some of the prior art references.

69. As one example, prior art reference DE '320 discloses a power supply/electrical circuit that supplies current to the LEDs and that may include: “a diode 13 forming the reverse pole protection means” and connected together with the LEDs 6 on the circuit board 2; *Id.* at p. 11, lines 1-6; a “vehicle battery” that supplies power to the LED light source via the fluorescent lamp mounting 19; *Id.* at p. 11, lines, 11-16; and/or “switching means in order to switch the light-emitting diodes ... on or off either individually, in pairs or in groups ... to adapt the light level of the illumination device ...” *Id.* at p. 5, line 27 – p. 6, line 1. A person of ordinary skill in the art around and before 2000 would understand the “reverse pole protection means”, the “voltage source”, and/or the “switching means” of DE '320 as a power supply/electrical circuit that supplies current to LEDs to illuminate the LEDs. Moreover, the LEDs of the light source of DE '320 are illuminated by the power supply/electrical circuit in response to current received from sockets of the fluorescent lamp mounting that receive the contact pins of the light source. *Id.* at p. 11, lines 11-16.

70. As another example, JP '677 discloses a power supply/electrical circuit that provides current to its LEDs and includes a “full wave rectifying and

smoothing circuit”, a “starting circuit”, a “voltage smoothing circuit” and “a current that has been limited”. Ex. 1007 at ¶ 0013. Moreover, the LEDs of JP ‘677 are illuminated by the power supply/electrical circuit in response to current received from a fluorescent light fixture. For example, JP ‘677 describes “... electric connectors 7 with the same dimensions as electric connectors of fluorescent lamps ...”, Ex. 1007 at ¶ [Aim], and “[t]o electric connection fittings 7, an alternating current source from the stabiliser that is used in the fluorescent lamp is applied ...” *Id.* at ¶ 0014.

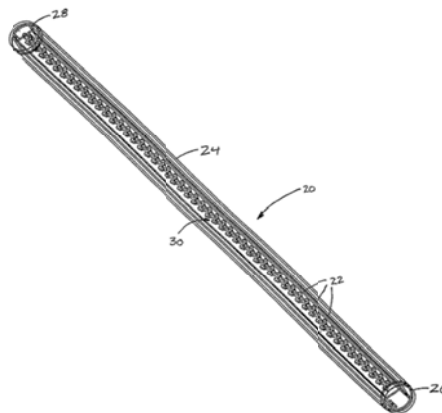
71. As another example, JP ‘234 discloses a power supply/electrical circuit in a replacement light source that incorporates LEDs. The power supply/electrical circuit of JP ‘234 includes, *inter alia*, a “rectifying circuit”, “driving circuit”, “power factor correction circuit”, and a “current limiting element”. *Id.* at ¶¶ 0027, 0028; FIGS. 6 and 7. Moreover, the LEDs of JP ‘234 are illuminated by the power supply/electrical circuit in response to current received from a fluorescent light fixture. For example, JP ‘234 describes “[i]n both end parts of tube 3, bases 4 that can be attached and detached in a socket for fluorescent lamps, are established.” *Id.* at ¶ 0025; FIG. 5.

V. THE '327 PATENT

(a) The '327 Patent Overview

72. The '327 Patent, entitled "Light Tube and Power Supply Circuit" issued on February 26, 2013, from an application filed on December 10, 2010, which was a continuation of an application filed on March 21, 2005 (now U.S. Patent No. 8,247,985), which was a continuation of an application filed on February 12, 2001 (now U.S. Patent No. 7,049,761). The '327 Patent further claims the benefit of provisional application 60/181,744, filed on February 11, 2000. The named inventors of the '327 Patent are: Jos Timmermans; Jean C. Raymond; and John Ivey.

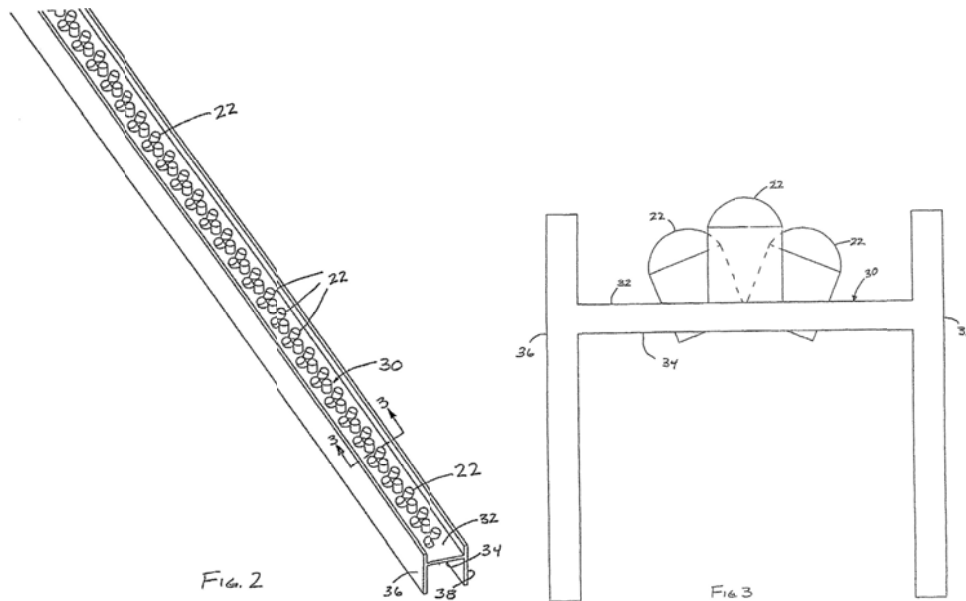
73. The '327 Patent discloses a light source that incorporates LEDs and replaces fluorescent tubes. Ex. 1001 at Abstract. FIG. 1 of the '327 Patent is reproduced below.



Ex. 1001, FIG. 1

74. All claimed embodiments described in the '327 Patent are directed to a light source that replaces a conventional fluorescent tube. Disposed at opposite ends of the housing 24 are end caps 26, 28. *Id.* at 2:25-27. The end caps 26, 28 include connectors 44 compatible with a standard double-ended bi-pin socket designed for fluorescent lamps. *Id.* at 2:31-34.

75. The embodiments use LEDs 22 arranged to emit light through a bulb portion 24 of the light source. *Id.* at 2:51-54. The LEDs 22 are described in the specification as mounted to one surface 32 of a circuit board 30. *Id.* at 2:49-51. The specification further describes that the total radiation pattern of light from the light tube 20 is affected by (1) the mounting angle of the LEDs 22 and (2) the radiation pattern of light from each LED. *Id.* at 2:66-3:1. FIGS. 2 and 3 of the '327 Patent are reproduced below and show the circuit board 30 and the LEDs 22 mounted on the circuit board 30.



Ex. 1001, FIGS. 2 and 3

76. The claims also include various recitations related to light emitted from the replacement light source being confined to an included angle. For example, some claims recite sidewalls that extend above a surface along which LEDs are arranged to confine light emitted from the light source, as allegedly illustrated by FIG. 3 of the ‘327 Patent (see above).

77. The ‘327 Patent issued on February 26, 2013 with sixteen claims (1-16).

78. I have analyzed claims 1, 8, and 16, which are independent claims. They are reproduced below.¹

1. A light device for illumination by a power supply circuit comprising:

- (a) a bulb portion,
- (b) a pair of end caps disposed at opposite ends of the bulb portion, the pair of end caps including a first end cap disposed at one end of the bulb portion, and a second end cap disposed at an end of bulb portion opposite the first end cap,
- (c) wherein the bulb portion and the pair of end caps are dimensioned to be mounted in a fluorescent light tube socket; and
- (d) a plurality of light emitting diodes disposed inside the bulb portion along one surface of a circuit board extending between the first end cap and the second end cap for illuminating in response to electrical current to be received from the power supply circuit;
- (e) wherein each of the plurality of light emitting diodes is mounted with respect to surface of the circuit board to establish a radiation pattern of light emitted from the bulb portion; and

¹ I have added alpha designators for clarity.

(f) wherein the arrangement of the circuit board and the bulb portion is such that substantially the entire light output of the light device is emitted away from the one surface and is confined to an included angle by sidewalls extending to a height above the one surface on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap.

8. In a replacement light tube for a fluorescent light fixture having a light tube socket, the improvement comprising:

(a) a plurality of light emitting diodes disposed along a length of a bulb portion between a first end cap and a second end cap mounted on opposite ends of the bulb portion,

(b) wherein the plurality of light emitting diodes is mounted on only one side of a circuit board in a light emitting direction;

(c) an electrical circuit for illuminating in response to electrical current to be received from the fluorescent light fixture; and

(d) opaque side walls extending above the one side of the circuit board in the light emitting direction on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap to confine an entirety of light emitted from the replacement light tube to an included angle of less than about 180°.

16. An LED lighting unit for replacing a conventional fluorescent tube between the opposed electrical receptacles of a conventional fluorescent lighting fixture comprising:

(a) a rigid, substantially cylindrical structure having a first end and a second end opposite said first end, the cylindrical structure including a support structure and a bulb portion;

(b) a first end cap disposed upon said first end of said cylindrical structure and a second end cap disposed upon said second end of said cylindrical structure;

(c) a pair of parallel, fluorescent light fixture receptacle connectors extending from each said end cap and configured for installing within the opposed electrical receptacles of the lighting fixture; and

(d) a plurality of LEDs disposed along a surface of said support structure in electrical contact with one another and with at least one pair of said pair of connectors extending from said end caps,

(e) whereby light is divergently emitted along the length of said lighting unit in an included angle of less than about 180°;

(f) wherein the combination of said support structure and said bulb portion is such that substantially the entire light output of said lighting unit device is emitted

away from said surface and is confined to the included angle by sidewalls extending to a height above said surface on opposing sides of said plurality of LEDs between the first end and the second end.

79. I have also analyzed: claims 2-3 and 7, which depend from claim 1; and claims 9 and 13-15, which depend from claim 8. These dependent claims are reproduced below.

2. The light tube of claim 1 wherein each of the pair of end caps includes an electrical bi-pin connector.

3. The light device of claim 1 wherein each of the plurality of light emitting diodes is a white light emitting diode.

7. The light device of claim 1 wherein the plurality of light emitting diodes is arranged substantially continuously between the opposite ends of the bulb portion.

9. The improvement of claim 8 wherein each of the plurality of light emitting diodes is a white light emitting diode.

13. The improvement of claim 8 wherein the radiation pattern of light from each of the plurality of light emitting diodes is centered at a 90° angle relative to the circuit board.

14. The improvement of claim 8 wherein the plurality of light emitting diodes is arranged substantially continuously along the length of the bulb portion.

15. The improvement of claim 8 wherein the electrical circuit includes at least a rectifier and a current-limiting circuit.

VI. PRIOR ART CONSIDERED

80. I include in this declaration six prior art references with exemplary citations identifying the relevant features related to the claim language of claims 1-3, 7-9, and 13-16 of the '327 Patent. I have also described combinations of these prior art references that when combined render claims 1-3, 7-9, and 13-16 of the '327 Patent invalid.

81. Four of the prior art references are foreign language prior art references. In reviewing the four foreign language prior art references, I relied upon translations of those references. The translations I relied upon are included as Exhibits (Ex. 1003, Ex. 1007, Ex. 1010, and Ex. 1013).

82. The citations presented in the body of this declaration correspond to the teachings disclosed in exemplary items of prior art that identify (1) the problem(s) confronted by one of ordinary skill in the art, (2) an express suggestion

to make one or more of the combinations, (3) an implicit suggestion to make one or more of the combinations, and/or (4) the knowledge of those skilled in the art as to the applicable field of technology.

83. It is my opinion that claims 1-3, 7-9, and 13-16 of the '327 Patent are rendered obvious in light of the prior art specifically discussed in this declaration. Below I describe six references related to the features described in these claims.

(a) Identification of the Primary Prior Art References

84. I have personally reviewed the references cited in this declaration. It is my opinion that a person of ordinary skill in the art would consider at least the prior art references identified below:

Patent/Publication No.	Filing Date	Publication Date
German Utility Model DE29900320, entitled "Kit for a lighting device" (DE '320) (Ex. 1002) (English Translation is Ex. 1003 and is cited herein).	Jan. 4, 1999	May 12, 1999
US Pat. App. Pub. No. 2003/0076281, entitled "Diffuse Illumination Systems and Methods" (US '281) (Ex. 1005).	June 15, 1999	April 24, 2003
Japanese Published Patent App. JP08-162677, entitled "Slender light source wherein light emitting diodes have been used" (JP '677) (Ex. 1006) (English Translation is Ex. 1007 and is cited herein).	Dec. 5, 1994	June 21, 1996
Japanese Published Patent App. JP10-308536, entitled "LED line light source" (JP '536) (Ex. 1009) (English Translation is Ex.	May 6, 1997	Nov. 17, 1998

Patent/Publication No.	Filing Date	Publication Date
1010 and is cited herein).		
Japanese Published Patent App. JP11-162234, entitled “Light source wherein light emitting diodes have been used” (JP ‘234) (Ex. 1012) (English Translation is Ex. 1013 and is cited herein).	Nov. 25, 1997	June 18, 1999
US Pat. No. 6,582,103, entitled “Lighting Apparatus” (US ‘103) (Ex. 1015) (claims priority to, <i>inter alia</i> , Prov. App. No. 60/144,920, filed July 21, 1999 – attached as Ex. 1016).	July 20, 2000	June 24, 2003

Other knowledge described earlier in this declaration is relevant to show the state of the art, i.e., what a person of ordinary skill in the art would have known when using the references identified above, or to use in various combinations with the references identified above to render claims 1-3, 7-9, and 13-16 invalid.

VII. ANALYSIS OF THE CHALLENGED CLAIMS AGAINST THE PRIOR ART

(a) Claim Construction

85. As explained above, it is my understanding that in an *inter partes* review, a claim is given its broadest reasonable interpretation in light of the specification of the patent. I agree that the Petitioner’s proffered construction of the term set forth below is reasonable.

86. The term “support structure” appears in claim 16 of the ‘327 Patent. A reasonable construction of this term is “a structure that may support LEDs and/or other components.” See, e.g., Ex. 1001 at 2:37-63; FIGS. 2 & 3.

(b) Application of the Prior Art to the Claims

87. Based on my review of the prior art, and particularly the references cited in detail in this Declaration, it is my opinion that the subject matter of each of the Challenged Claims would have been obvious to one of ordinary skill in the art in view of the known prior art.

88. I understand that each of the prior art references analyzed in this declaration meets the legal requirements for prior art to the ‘327 Patent, and I have performed my analysis with that understanding.

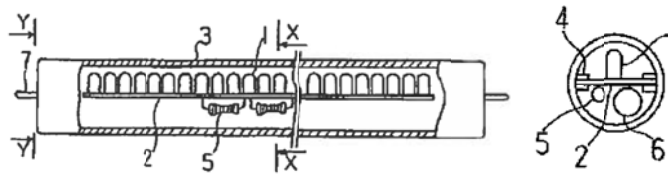
89. Based on my analysis, I conclude that the Challenged Claims of the ‘327 Patent are anticipated and/or rendered obvious by the following prior art:

Claims	Proposed Statutory Rejections for the ‘327 Patent
1-2, 7-8, 13-16	Obvious under §103(a) over JP ‘677 in view of JP ‘536
3, 9	Obvious under §103(a) over JP ‘677 in view of JP ‘536, and further in view of JP ‘234
1-3,7-9,13-16	Obvious under §103(a) over JP ‘234 in view of US ‘103
1-3,7-9,13-16	Obvious under §103(a) over JP ‘234 in view of JP ‘536
1-2,7-8,13, 14, 16	Obvious under §103(a) over DE ‘320 in view of US ‘281
3, 9	Obvious under §103(a) over DE ‘320 in view of US ‘281 and

90. I have analyzed each of these references on a claim element by claim element basis in the accompanying claim charts found below.

a. Obviousness of Claims 1, 2, 7-8, 13-16 over JP '677 in view of JP '536

91. JP '677 discloses an LED light source that is compatible with existing fluorescent lamps. Ex. 1007 at ¶¶ [Aim], 0005, and 0006; FIGS. 1(A)-(C) & 3. Accordingly, the LED light source of JP '677 is a replacement for conventional fluorescent tubes as described in the '327 Patent.



Ex. 1007, FIGS. 1(A) and 1(B)

92. JP '677 discloses a light transmissive circular tube 3 with the same dimensions as a linear fluorescent lamp. *Id.* at [Claim 1]; FIGS. 1(A)-(C) & 3.

93. JP '677 discloses LEDs 1 arranged on a linear printed circuit board 2. *Id.* at ¶ 0006; FIGS. 1(A) & 1(B).

94. JP ‘677 discloses a power supply/electrical circuit that provides current to LEDs 1 and includes a “full wave rectifying and smoothing circuit”, a “starting circuit”, a “voltage smoothing circuit” and “a current that has been limited”. *Id.* at ¶ 0013.

95. The electrical connectors of JP ‘677 are male bi-pin connectors with the same dimensions as connectors of fluorescent lamps. *Id.* at ¶¶ [Structure], 0005, and 0006; FIGS. 1(A)-(C) & 3.

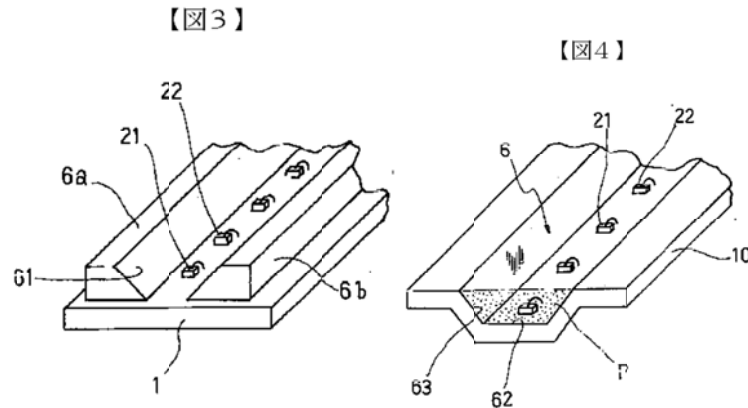
96. The LEDs 1 of JP ‘677 are illuminated in response to current received from a fluorescent light fixture. *Id.* at ¶¶ [Aim], 0014.

97. Additional detail on the disclosure of JP ‘677 is provided in the claim charts below. As described in more detail in the claim charts, JP ‘677 discloses all elements of claims 1, 2, 7-8, and 13-16, but does not explicitly disclose the following “sidewalls” related language of independent claims 1, 8, and 16:

- substantially the entire light output “is confined to an included angle by sidewalls extending to a height above the one surface on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap” of claim 1;

- the “opaque side walls extending above the one side of the circuit board in the light emitting direction on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap to confine an entirety of light emitted from the replacement light tube to an included angle of less than about 180°” of claim 8; or
- substantially the entire light output “is confined to the included angle by sidewalls extending to a height above said surface on opposing sides of said plurality of LEDs between the first end and the second end” of claim 16.

98. However, JP ‘536 discloses such structure. JP ‘536 discloses LEDs 21, 22 positioned between opposing sidewalls 61 or 63 that act as reflective surfaces. Ex. 1010 at Abstract. Two example figures are provided below that illustrate the reflective surfaces (61 in the embodiment of FIG. 3; 63 in the embodiment of FIG. 4). The reflective surfaces of JP ‘536 extend above a surface along which the LEDs 21, 22 are arranged, on opposing sides of the LEDs 21, 22, and confine the entirety of the light output of the device to an included angle of less than 180°.



Ex. 1010, FIGS. 3 and 4

99. JP ‘536 discloses that the reflective surfaces bring forward light reflected from the side of each LED, and thereby limit drops in light output immediately above places where no LED is present. *Id.* at Abstract. JP ‘536 discloses that such arrangement provides optical output such that: “output between parts directly above a lighted LED and other parts has virtually disappeared, and thus it was confirmed that by means of the present invention it is possible to provide a LED linear light source with low variability in optical output.” *Id.* at ¶ 0021. This improvement in light output from the reflective surfaces of JP ‘536 is illustrated in graphical form in Figures 2 and 6 of JP ‘536 (reproduced below). Figure 2 shows distribution of light output in a LED linear light source according to prior art of JP ‘536. As illustrated in Figure 2, light output tends to be high in areas immediately above LEDs, but low in areas where LEDs are not present. Figure 6 shows distribution of light output in a preferred embodiment of JP ‘536.

As illustrated in Figure 6, light output variations between areas above LEDs and areas where LEDs are not present is virtually eliminated.

Figure 2

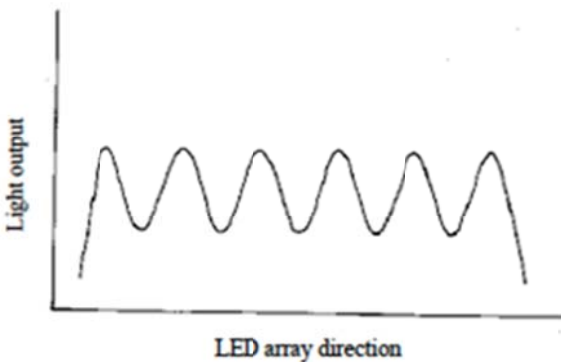
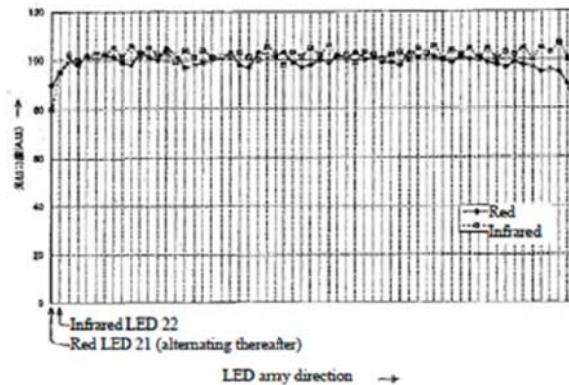
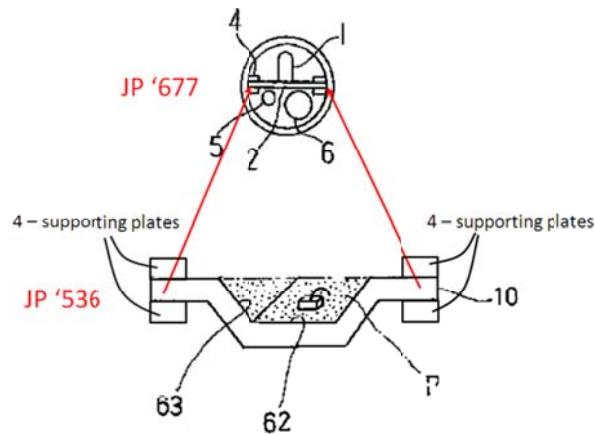


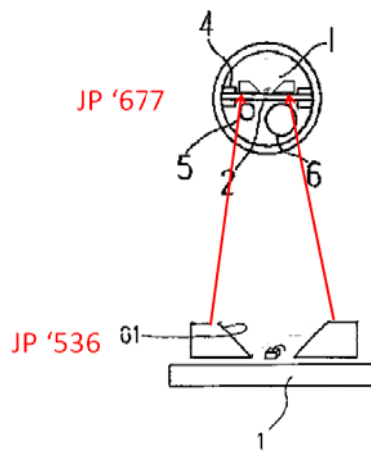
Figure 6



100. In my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate reflectors that extend above a mounting surface for LEDs in JP '677 on opposite sides of the LEDs, such as the reflectors 61 or 63 described by JP '536. For example, the base plate 10 (FIG. 4 of JP '536) with reflectors 63 could be substituted for the PCB 2 of JP '677 and captured between plates 4 of JP '677 in a similar manner as the PCB 2 of JP '677 is captured between plates 4. An example of such a substitution is illustrated below.



Also, for example, reflectors 61 (FIG. 3 of JP '536) may be incorporated on the PCB 2 of JP '677 in a manner such as that shown in FIG. 3 of JP '536. An example of such a substitution is illustrated below.



101. One would have been motivated to incorporate reflectors in JP '677 to achieve low variability in light output from the light source of JP '677 as taught by JP '536. JP '677 discloses a desire for uniform brightness from the light source (Ex. 1007 at ¶¶ 0011, 0013) and one would be motivated to incorporate reflectors

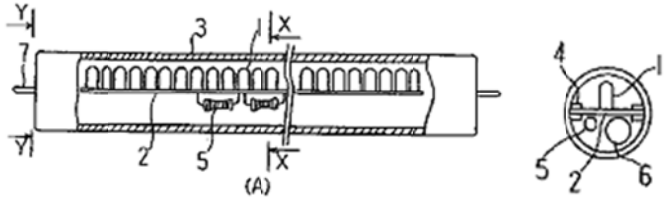
of JP ‘536 to achieve the expected result of improved uniformity of the brightness of the light source of JP ‘677.

102. In my opinion, incorporation of reflectors, such as the reflectors of JP ‘536, in the light source of JP ‘677 renders obvious the “sidewalls” related language of claims 1, 8, and 16. In particular, the incorporated reflectors would confine substantially the entire light output of the light device to an included angle and would extend to a height above the surface on which the LEDs are disposed, on opposing sides of the LEDs between the end caps, as provided by claim 1. Also, the reflectors are opaque and would be on opposing sides of the LEDs between the end caps to confine an entirety of light emitted by the light source to an included angle of less than about 180° as provided by claim 8. Also, substantially the entire light output of the light source would be confined to an included angle less than 180° by the reflectors that extend to a height above the surface on opposing sides of the LEDs between the first end and the second end of the device as provided by claim 16.

103. Accordingly, in my opinion, JP ‘677 in view of JP ‘536 renders obvious claims 1, 2, 7-8, and 13-16.

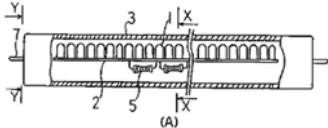
104. The claim charts below illustrate the disclosure of elements of claims 1, 2, 7-8, and 13-16. The claim charts also include, in summary fashion, the

disclosure of JP ‘536 that teaches any elements not explicitly disclosed in JP ‘677 – along with a brief summary of why incorporation of such elements in JP ‘677 would have been obvious to a person of ordinary skill in the art around and before 2000.

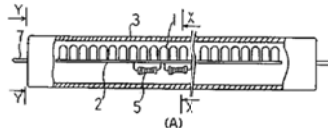
Claim 1	JP ‘677 Disclosure
<p>A light device for illumination by a power supply circuit comprising:</p>	<p>JP ‘677 discloses a “slender light source with a long lifespan that is compatible with existing fluorescent lamps. Light emitting diodes 1 are arranged in printed circuit board 2 in a linear form, this is established inside circular tube 3 with the same dimensions as a standard linear fluorescent lamp, and in both ends of circular tube 3, electric connectors 7 with the same dimensions as electric connectors of fluorescent lamps are established.” Ex. 1007 at ¶¶ [Aim], [Structure]; FIGS. 1(A), 1(B).</p> 
<p>a bulb portion,</p>	<p>JP ‘677 discloses a circular tube that transmits light from the LEDs 1 away from the printed circuit board 2. JP ‘677 states “[a]s circular tube 3, a colourless transmissive one of an acryl material is used. In order to improve the uniformity of brightness in the longitudinal direction, however, it may also be a milky white non-transmissive body... in addition to acryl material, a plastic material such as polycarbonate may be used for circular tube 3, but also the same glass as in the fluorescent lamp may be used.” Id. at ¶ 0013; FIGS. 1(A) and 1(B).</p>

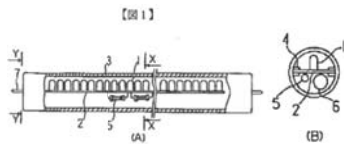
Claim 1	JP ‘677 Disclosure
<p>a pair of end caps disposed at opposite ends of the bulb portion, the pair of end caps including a first end cap disposed at one end of the bulb portion, and a second end cap disposed at an end of bulb portion opposite the first end cap, wherein the bulb portion and the pair of end caps are dimensioned to be mounted in a flourescent light tube socket; and</p>	<p>JP ‘677 discloses end caps that are compatible with fluorescent lamp sockets: “Electric connection fittings 7 are established in both ends of circular tube 3, and outer diameter and length of circular tube 3 and electric connection fittings 7 have the same dimensions and arrangement as the linear fluorescent lamp of JIS C7601, that is used in existing detectors, and have the same dimensions as the base of G13 or R17d of JIS C 7709.” <i>Id.</i> at ¶ 0012; FIGS. 1(A) and 1(B).</p>
<p>a plurality of light emitting diodes disposed inside the bulb portion along one surface of a circuit board extending between the first end cap and the second end cap for illuminating in response to electrical current to be received from the power supply circuit;</p>	<p>FIGS. 1(A) and 1(B) of JP ‘677 show LEDs 1 arranged along the length of the printed circuit board 2. JP ‘677 discloses “[l]ight emitting diodes 1 are arranged on printed circuit board 2,” <i>Id.</i> at ¶ 0012, and “[p]rinted circuit board 2 consists of a standard circuit board with standard dimensions, and in one standard circuit board, 33 light emitting diodes have been established.” JP ‘677 discloses “an alternating current source” is applied and a “full wave rectifying circuit” is used so that a current “flows in a large number of light emitting diodes” <i>Id.</i> at ¶ 0014; FIGS. 1(A) and 1(B).</p>
<p>wherein each of the plurality of light emitting diodes is mounted with respect to surface of the circuit board to establish a radiation pattern of light emitted from the bulb portion; and</p>	<p>JP ‘677 discloses the LEDs are mounted on the surface of the printed circuit board within the circular tube that transmits light from the LEDs 1 away from the printed circuit board 2. JP ‘677 states “Light emitting diodes 1 are arranged on a printed circuit board 2 with the mutual distance of one row as the density” <i>Id.</i> at ¶ 0013; FIGS. 1(A) and 1(B).</p>
<p>wherein the arrangement of the circuit board and the bulb portion is such that substantially the entire light output of the light device is emitted away from the one surface and</p>	<p>JP ‘677 discloses the LEDs are mounted on the printed circuit board that is arranged with the cover such that substantially the entire light output of the light source is emitted</p>

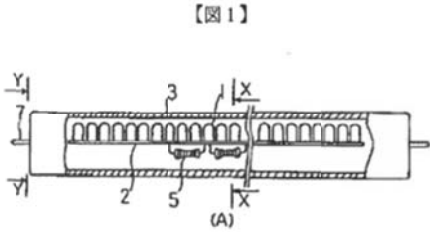
Claim 1	JP ‘677 Disclosure
	away from the surface of the printed circuit board. <i>Id.</i> at FIGS. 1(A) and 1(B).
is confined to an included angle by sidewalls extending to a height above the one surface on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap.	<p>JP ‘677 does not explicitly disclose the sidewalls of this limitation.</p> <p>However, as described above (¶¶ 98, 99), JP ‘536 describes LEDs 21, 22 positioned between opposing sidewalls 61, 63 that act as reflective surfaces. Ex. 1010 at Abstract. As also described above (¶¶ 100, 101), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate reflectors that extend above a mounting surface for LEDs in JP ‘677 on opposite sides of the LEDs, such as the reflectors 61 or 63 described by JP ‘536.</p>

Claim 2	JP ‘677
“each of the pair of end caps includes an electrical bi-pin connector.”	<p>JP ‘677 discloses end caps with male bi-pin connectors 7 that are compatible with fluorescent lamp sockets: “Electric connection fittings 7 are established in both ends of circular tube 3, and outer diameter and length of circular tube 3 and electric connection fittings 7 have the same dimensions and arrangement as the linear fluorescent lamp...” <i>Id.</i> at ¶ 0012; FIGS. 1(A) and 1(B). Accordingly, use of the bi-pin connectors of JP ‘677 would also render obvious claim 2</p> 

Claim 7	JP ‘677
The light device of claim 1 wherein the plurality of light emitting diodes is arranged	JP ‘677 describes that “light emitting diodes are arranged in printed circuit board 2 in a linear form...” <i>Id.</i> at [Aim]. As shown in Fig. 1(A), the

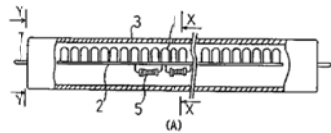
Claim 7	JP '677
substantially continuously between the opposite ends of the bulb portion.	LEDs in JP '677 are disposed continuously along the length of the bulb portion. <i>Id.</i> 

Claim 8	JP '677 Disclosure
In a replacement light tube for a fluorescent light fixture having a light tube socket, the improvement comprising:	JP '677 discloses a “slender light source with a long lifespan that is compatible with existing fluorescent lamps. Light emitting diodes 1 are arranged in printed circuit board 2 in a linear form, this is established inside circular tube 3 with the same dimensions as a standard linear fluorescent lamp, and in both ends of circular tube 3, electric connectors 7 with the same dimensions as electric connectors of fluorescent lamps are established.” Ex. 1007 at ¶¶ [Aim], [Structure]; FIGS. 1(A), 1(B).
a plurality of light emitting diodes disposed along a length of	In FIGS. 1(A) and 1(B) of JP '677 the LEDs 1 are arranged along the length of the printed circuit board 2. <i>Id.</i> at FIG. 1(A). JP '677 discloses “[l]ight emitting diodes 1 are arranged on printed circuit board 2;” <i>Id.</i> at ¶ 0012 and “[p]rinted circuit board 2 consists of a standard circuit board with standard dimensions...” <i>Id.</i> at ¶ 0013; FIGS. 1(A) and 1(B). 
a bulb portion	JP '677 discloses a circular tube that transmits light from the LEDs 1. JP '677 states “[a]s circular tube 3, a colourless transmissive one of an acryl material is used. In order to improve the uniformity of brightness in the longitudinal direction, however, it may also be a milky white non-transmissive body... in addition to acryl material, a plastic material such as polycarbonate may be used for circular tube 3, but also the same glass as in the fluorescent lamp may be used. <i>Id.</i> at ¶ 0013; FIGS. 1(A) and 1(B).

Claim 8	JP '677 Disclosure
<p>between a first end cap and a second end cap mounted on opposite ends of the bulb portion, wherein the plurality of light emitting diodes is mounted on only one side of a circuit board in a light emitting direction;</p>	<p>JP '677 discloses connection pins 7 that are compatible with fluorescent sockets and extend from end caps of the circular tube 3. <i>Id.</i> at FIGS. 1(A), 2, 3. Further, “[l]ight emitting diodes1 are arranged on printed circuit board 2 with the mutual distance of one row as the density.” <i>Id.</i> at ¶ 0012; FIGS. 1(A) and 1(B).</p>  <p style="text-align: center;">【図 1】</p>
<p>an electrical circuit for illuminating in response to electrical current to be received from the flourescent light fixture; and</p>	<p>Figure 2 of JP '677 illustrates “a block diagram of the starting circuit To electric connection fittings 7, an alternating current source from the stabiliser that is used in the fluorescent lamp is applied, and by the full wave rectifying circuit of full wave rectifying and smoothing circuit 8, full wave rectification is carried out, and via a voltage smoothing circuit, a current that has been limited inside the regular current flows in a large number of light emitting diodes 1 that have been serially connected, and the situation arrives that the respective light emitting diodes start in an equal brightness.” <i>Id.</i> at ¶ 0014.</p>
<p>opaque side walls extending above the one side of the circuit board in the light emitting direction on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap to confine an entirety of light emitted from the replacement light tube to an included angle of less than about 180°.</p>	<p>JP '677 does not explicitly disclose this limitation.</p> <p>However, as described above (¶¶ 98, 99), JP '536 describes LEDs 21, 22 positioned between opposing sidewalls 61, 63 that act as reflective surfaces. Ex. 1010 at Abstract. As also described above (¶¶ 100, 101), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate reflectors that extend above a mounting surface for LEDs in JP '677 on opposite sides of the LEDs, such as the reflectors 61 or 63 described by JP '536. Such reflectors incorporated in JP '677 would confine an entirety of light emitted from the light source of JP '677 to an included angle</p>

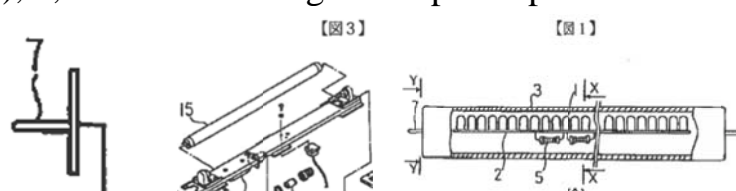
Claim 8	JP '677 Disclosure
	of less than about 180°.

Claim 13	JP '677 Disclosure
The improvement of claim 8 wherein the radiation pattern of light from each of the plurality of light emitting diodes is centered at a 90° angle relative to the circuit board.	The LEDs are aligned down the center and along the length of the printed circuit board of the JP '677 LED fluorescent replacement tube device, which centers their light output at a 90° angle relative to the circuit board. “In order to achieve the above mentioned aim...it is...equipped with a printed circuit board wherein light emitting diodes have been lined up in a linear form”. <i>Id.</i> at ¶ 0006. Further, JP '536 indicates “...optical output is high directly above a lighted LED...” Ex. 1010 at ¶ 0021.

Claim 14	JP '677 Disclosure
The improvement of claim 8 wherein the plurality of light emitting diodes is arranged substantially continuously along the length of the bulb portion.	JP '677 describes that “light emitting diodes are arranged in printed circuit board 2 in a linear form...” Ex. 1007 at [Aim]. As shown in Fig. 1(A), the LEDs in JP '677 are disposed continuously along the length of the bulb portion. <i>Id.</i> 

Claim 15	JP '677 Disclosure
The improvement of claim 8 wherein the electrical circuit includes at least a rectifier and a current-limiting	Figure 2 of JP '677 illustrates “a block diagram of the starting circuit...To electric connection fittings 7, an alternating current source from the stabiliser that is used in the fluorescent lamp is applied, and by the full wave rectifying circuit of full wave rectifying and smoothing circuit 8, full wave rectification is carried out, and via a

Claim 15	JP ‘677 Disclosure
circuit.	voltage smoothing circuit, a current that has been limited inside the regular current flows in a large number of light emitting diodes 1 that have been serially connected, and the situation arrives that the respective light emitting diodes start in an equal brightness.” <i>Id.</i> at ¶ 0014.

Claim 16	JP ‘677 Disclosure
An LED lighting unit for replacing a conventional fluorescent tube between the opposed electrical receptacles of a conventional fluorescent lighting fixture comprising:	JP ‘677 discloses a “slender light source with a long lifespan that is compatible with existing fluorescent lamps. Light emitting diodes 1 are arranged in printed circuit board 2 in a linear form, this is established inside circular tube 3 with the same dimensions as a standard linear fluorescent lamp, and in both ends of circular tube 3, electric connectors 7 with the same dimensions as electric connectors of fluorescent lamps are established.” Ex. 1007 at ¶¶ [Aim], [Structure]; FIGS. 1(A), 1(B).
a rigid, substantially cylindrical structure having a first end and a second end opposite said first end, the cylindrical structure including a support structure and a bulb portion;	JP ‘677 discloses a rigid circular tube 3 and printed circuit board 2. JP ‘677 discloses “[a]s circular tube 3, a colourless transmissive one of an acryl material is used. In order to improve the uniformity of brightness in the longitudinal direction, however, it may also be a milky white non-transmissive body... in addition to acryl material, a plastic material such as polycarbonate may be used for circular tube 3, but also the same glass as in the fluorescent lamp may be used.” <i>Id.</i> at ¶ 0013; FIGS. 1(A) and 1(B). JP ‘677 further discloses the LEDs 1 “are arranged on printed circuit board 2 ... Printed circuit board 2 is arranged on the diameter of circular tube 3 ... <i>Id.</i> at ¶ 0012; FIGS. 1(A) and 1(B).
a first end cap disposed upon said first end of said cylindrical structure and a second end cap disposed upon said second end of said cylindrical structure;	Connection pins 7 extend from respective end caps on opposed ends of the circular tube 3. Portions of FIGS. 1(A), 2, and 3 illustrating end caps are provided below. 
a pair of parallel,	JP ‘677 discloses connection pins 7 that are compatible

Claim 16	JP '677 Disclosure
<p>fluorescent light fixture receptacle connectors extending from each said end cap and configured for installing within the opposed electrical receptacles of the lighting fixture; and</p>	<p>with fluorescent lamp sockets: “Electric connection fittings 7 are established in both ends of circular tube 3, and outer diameter and length of circular tube 3 and electric connection fittings 7 have the same dimensions and arrangement as the linear fluorescent lamp of JIS C7601, that is used in existing detectors, and have the same dimensions as the base of G13 or R17d of JIS C7709.” <i>Id.</i> at ¶ 0012; FIGS. 1(A) and 1(B).</p>
<p>a plurality of LEDs disposed along a surface of said support structure in electrical contact with one another and with at least one pair of said pair of connectors extending from said end caps,</p>	<p>In FIGS. 1(A) and 1(B) of JP '677 the LEDs 1 are arranged along the length of the PCB 2. <i>Id.</i> at FIGS. 1(A) and 1(B). JP '677 discloses “[l]ight emitting diodes 1 are arranged on printed circuit board 2”, JP '677 at ¶ 0012, and “[p]rinted circuit board 2 consists of a standard circuit board with standard dimensions...” <i>Id.</i> at ¶ 0013; FIGS. 1(A) and 1(B).</p> <div data-bbox="548 842 1317 1035" data-label="Image"> </div> <p>Figure 2 of JP '677 illustrates “a block diagram of the starting circuit...To electric connection fittings 7, an alternating current source from the stabiliser that is used in the fluorescent lamp is applied, and by the full wave rectifying circuit of full wave rectifying and smoothing circuit 8, full wave rectification is carried out, and via a voltage smoothing circuit, a current that has been limited inside the regular current flows in a large number of light emitting diodes 1 that have been serially connected, and the situation arrives that the respective light emitting diodes start in an equal brightness.” <i>Id.</i> at ¶ 0014.</p>
<p>whereby light is divergently emitted along the length of said lighting unit in an included angle of less than about 180°;</p>	<p>As illustrated by FIGS. 1(A) and 1(B), light from the LEDs 1 of JP '677 will be divergently emitted along the length of the light source in an included angle of less than about 180°.</p> <div data-bbox="589 1633 951 1787" data-label="Image"> </div> <p>“...it is equipped with a printed circuit board wherein light emitting diodes have been lined up in a linear</p>

Claim 16	JP ‘677 Disclosure
	form.” <i>Id.</i> at ¶ 0006.
wherein the combination of said support structure and said bulb portion is such that substantially the entire light output of said lighting unit device is emitted away from said surface and	JP ‘677 discloses light from LEDs 1 will be emitted along the length of the light source away from the printed circuit board. “Printed circuit board 2 consists of a standard circuit board with standard dimensions, an in one standard circuit board, 33 light emitting diodes have been established.” <i>Id.</i> at ¶ 0013.
is confined to the included angle by sidewalls extending to a height above said surface on opposing sides of said plurality of LEDs between the first end and the second end.	<p>JP ‘677 does not explicitly disclose this limitation.</p> <p>However, as described above (¶¶ 98, 99), JP ‘536 describes LEDs 21, 22 positioned between opposing sidewalls 61, 63 that act as reflective surfaces. Ex. 1010 at Abstract. As also described above (¶¶ 100, 101), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate reflectors that extend above a mounting surface for LEDs in JP ‘677 on opposite sides of the LEDs, such as the reflectors 61 or 63 described by JP ‘536. Such reflectors incorporated in JP ‘677 would confine substantially the entire light output emitted from the light source of JP ‘677 to an included angle.</p>

**b. Obviousness of Claims 3 and 9 over JP ‘677 in view of JP ‘536,
and further in view of JP ‘234**

105. As described above in Section VII.(b)a, JP ‘677 in view of JP ‘536 renders obvious independent claims 1 and 8. In my opinion, JP ‘677 in view of JP ‘536, and further in view of JP ‘234 renders obvious claims 3 and 9. Claim 3 depends from claim 1 and merely adds that the plurality of light emitting diodes “are white light emitting diode[s].” Claim 9 depends from claim 8 and likewise merely adds that the plurality of LEDs are “white light emitting diode[s].”

106. JP ‘677 does not explicitly disclose “white light emitting diodes.” However, JP ‘234 is in the same technology (LED lighting) and in the same field of endeavour (LED-based replacements for fluorescent lamps) as JP ‘677, and discloses the well-known usage of white light emitting diodes in LED light sources. JP ‘234 discloses that “it is preferred that a white emission colour is obtained ... by using white light emitting diodes (that radiate white light by shining blue light to a fluorescent substance with yellow light emission).” Ex. 1013 at ¶ 0029.

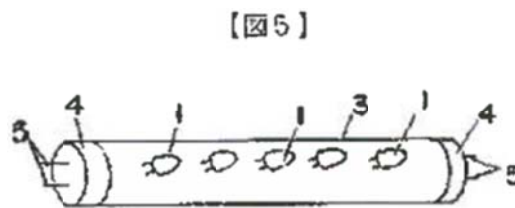
107. In my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to substitute the LEDs of JP ‘677 with white LEDs, such as the white LEDs taught by JP ‘234. As illustrated by JP ‘234, white

LEDs were a known option for inclusion in LED light sources in and around 2000. One would have been motivated to substitute the LEDs of JP ‘677 with white LEDs to enable the replacement light source of JP ‘677 to be adapted to other lighting applications beyond the lighting applications discussed in JP ‘677. For example, common sense would motivate the substitution, as one would recognize that adaptation of JP ‘677 to general lighting applications would advantageously incorporate white LEDs. One would be motivated to adapt the replacement fluorescent light source of JP ‘677 to other lighting applications at least due to market forces and/or the teachings of JP ‘677, such as teachings that indicate the replacement fluorescent light source is “compatible with existing fluorescent lamps,” Ex. 1007 at [Aim], and has a “long lifespan.” *Id.* at ¶ 0005. Such teachings would motivate a person of ordinary skill in the art around and before 2000 to adapt the replacement light source of JP ‘677 to other lighting applications where white LEDs are desirable and where the use of LEDs will achieve advantages taught by JP ‘677.

108. Accordingly, in my opinion, JP ‘677 in view of JP ‘536, and further in view of JP ‘234 renders obvious claims 3 and 9.

c. Obviousness of Claims 1-3, 7-9, and 13-16 over JP ‘234 in view of
US ‘103

109. JP ‘234 discloses a LED light source having a number of light emitting diode elements arranged in a cylindrical tube that has the same form and dimensions as a ready-made fluorescent lamp. Ex. 1013, at ¶ 0025, FIG. 5. Accordingly, the LED light source of JP ‘234 is a replacement for conventional fluorescent tubes as described in the ‘327 Patent.



Ex. 1013, FIG. 5

110. The LED light source of JP ‘234 contains bases at each end of the tube that can be attached and detached in a standard fluorescent light socket. *Id.*

111. The LED light source of JP ‘234 has a pair of terminal pins at the bases of each end of the tube. *Id.*

112. JP ‘234 discloses a power supply/electrical circuit including a “rectifying circuit”, “driving circuit”, “power factor correction circuit”, and a “current limiting element”. *Id.* at ¶¶ 0027, 0028; FIGS. 6 and 7.

113. The LEDs of JP ‘234 are illuminated in response to current received from a fluorescent light fixture. *Id.* at ¶ 0025; FIGS. 5, 6, 7.

114. Additional detail on the disclosure of JP ‘234 is provided in the claim charts below. As described in more detail in the claim charts, JP ‘234 discloses all elements of claims 1-3, 7-9, and 13-16, but does not explicitly disclose the following “sidewalls” related language of independent claims 1, 8, and 16:

- substantially the entire light output “is confined to an included angle by sidewalls extending to a height above the one surface on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap” of claim 1;
- the “opaque side walls extending above the one side of the circuit board in the light emitting direction on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap to confine an entirety of light emitted from the replacement light tube to an included angle of less than about 180°” of claim 8; or
- substantially the entire light output “is confined to the included angle by sidewalls extending to a height above said surface on opposing sides of said plurality of LEDs between the first end and the second end” of claim 16.

115. However, US ‘103 discloses such structure. US ‘103 discloses a cylindrical illumination apparatus that includes LEDs 174. Ex. 1015 at Abstract; Ex. 1016 at p. 24. The apparatus of US ‘103 also includes a reflective surface 150 that is provided on opposed sides of the LEDs 174. Ex. 1015 and Ex. 1016 at FIGS. 3 & 4. The reflective surface 150 of US ‘103 confines light output from the illumination apparatus to an included angle of less than 180°.

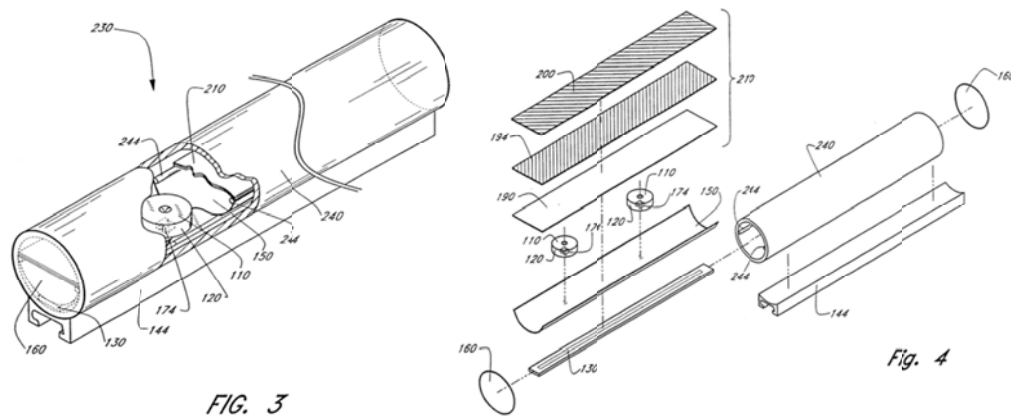


FIG. 3

Fig. 4

Ex. 1015, FIGS. 3 and 4

116. US ‘103 discloses: “[l]ight from the LED 174 is received by the optical diverter 110 which redirects the light laterally and downwardly. The plural LEDs are coupled to each other electrically by a printed circuit board 130.” Ex. 1015 at 3:50-51. “The light that exits the diverters 110 is reflected by the diffusely reflecting sheet 150, located between the optical diverters 110 and the circuit board 130...” *Id.* at 4:3-5. The “surfaces of the diffusely reflecting sheet 150 and the diffusely reflecting end caps 160 are preferably matte white, with diffuse

reflectivity over 90%, preferably 96% or more. ... ” *Id.* at 4:13-15. “The housing 140 includes lips or flanges 220 for holding the diffusely reflecting sheet 150 in place. The sheet 150 (and the LEDs 174 and the printed circuit board 130 to which the sheet 150 is attached) is advantageously flexible so that it may be slid underneath the lips 220, permitting the sheet 150 to naturally assume a shape which is typically parabolic in cross section.” *Id.* at 5:22-28. “The flanges 244 may also function the same as the lips 220 of FIG. 2, for holding the reflecting sheet 150 in place.” *Id.* at 5:37-39. US ‘103 further discloses “... a cylindrically shaped housing 240 that functions both as a housing and a protective outer cover”, *Id.* at 5:33-35, and encloses, *inter alia*: the LEDs 174; the circuit board 130, and the reflective surface 150. *Id.* at FIGS. 3 and 4. *See also*, Ex. 1016 at p. 5, l. 10 – p. 7, l. 30, FIGS. 3 and 4.

117. In my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate a reflecting sheet, such as reflecting sheet 150, in combination with the light source of JP ‘234. For example, the circuit board 130, LEDs 174 (optionally in combination with the optical diverters 110), and reflecting sheet 150 of US ‘103 may be incorporated in the cylindrical tube 3 of JP ‘234 in a similar manner as they are incorporated in the cylindrical housing 240 of US ‘103. One would have been motivated to incorporate the reflective sheet 150 to achieve the predictable result of reflecting

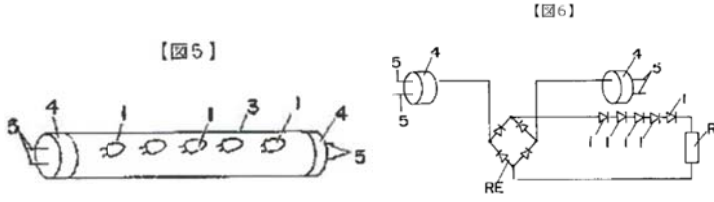
light emitted from LEDs toward a desired illumination area. Moreover, US ‘103 discloses positioning of the circuit board 130, LEDs 174, and reflecting sheet 150 in a cylindrically shaped housing 240 – and incorporating such components in the similar cylindrical tube 3 of JP ‘234 would be obvious to, and within the skill of, a person of ordinary skill in the art around and before 2000.

118. Moreover, if it is found that JP ‘234 does not explicitly disclose: the plurality of light emitting diodes being disposed along one surface of a circuit board of claim 1; the plurality of lighting emitting diodes being mounted on only one side of a circuit board of claim 8; or the plurality of LEDs disposed along a surface of a support structure of claim 16, in my opinion incorporation of the circuit board 130, LEDs 174, and reflecting sheet 150 of US ‘103 in the light source of JP ‘234 would likewise overcome such deficiency. For example, the incorporated circuit board 130 would constitute the “circuit board” or “surface of a support structure” and the LEDs 174 would be disposed along or mounted on the incorporated circuit board 130.

119. Moreover, if it is found that JP ‘234 does not explicitly disclose “the radiation pattern of light from each of the plurality of light emitting diodes is centered at a 90° angle relative to the circuit board” as provided in claim 13, in my opinion incorporation of the circuit board 130, LEDs 174, and reflecting sheet 150

of US ‘103 in the light source of JP ‘234 would likewise overcome such deficiency. For example, the LEDs may be mounted on the incorporated circuit board 130 as shown in US ‘103 such that the radiation pattern of light from each of the light emitting diodes is centered at a 90° angle relative to the circuit board. US ‘103 discloses “[t]he plural LEDs are coupled to each other electrically by a printed circuit board 130.” Ex 1015 at 3:50-51. FIG. 11 and other figures of US ‘103 depict the radiation pattern of light from LED package 430 is centered at 90° from the circuit board. In my opinion, a person of ordinary skill in the art in and around 2000 would have been motivated to incorporate into JP ‘234 the LED light output relative to the circuit board as disclosed in US ‘103 to achieve the predictable result of directing light emitted from LEDs toward a desired illumination area.

120. The claim charts below illustrate the disclosure of elements of claims 1-3, 7-9, and 13-16 in JP ‘234. The claim chart also includes, in summary fashion, the disclosure of US ‘103 that teaches any elements not explicitly disclosed in JP ‘234 – along with a brief summary of why incorporation of such elements in JP ‘234 would have been obvious to a person of ordinary skill in the art around and before 2000.

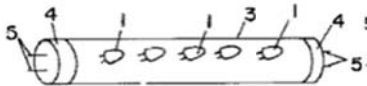
Claim 1	JP '234 Disclosure
A light device for illumination by a power supply circuit comprising:	<p>JP '234 discloses “a light source wherein light emitting diodes have been used, that is suited for illumination and for display.” Ex. 1013 at ¶ 0001. The light source includes a power supply circuit as illustrated in FIGS 6,7. <i>Id.</i></p> 
a bulb portion,	<p>JP '234 discloses “light emitting diode elements 1 have been accommodated in a cylindrical tube 3 that has been formed with the same form and same dimensions as a ready-made fluorescent lamp. ...In short, for the external observation, it is formed in the same way as a ready-made fluorescent lamp.” <i>Id.</i> at ¶ 0025.</p>
a pair of end caps disposed at opposite ends of the bulb portion, the pair of end caps including a first end cap disposed at one end of the bulb portion, and a second end cap disposed at an end of bulb portion opposite the first end cap, wherein the bulb portion and the pair of end caps are dimensioned to be mounted in a flourescent light tube socket; and	<p>JP '234 discloses end caps or bases 4 with terminal bi-pins 5 that are compatible with fluorescent lamp sockets: “In both end parts of tube 3, bases 4 that can be attached and detached in a socket for fluorescent lamps, are established. In short, for the external observation, it is formed in the same way as a ready-made fluorescent lamp. ” <i>Id.</i> at ¶ 0025; FIG. 5.</p>
a plurality of light emitting diodes disposed inside the bulb portion along one surface of a circuit board extending between the first end cap and the second end cap for illuminating in response to electrical current to be received from the power supply circuit;	<p>The longitudinally extending LEDs 1 are disposed inside the cylindrical tube 3 extending between the end caps 4. <i>Id.</i> at FIG. 5. JP '234 discloses that LEDs 1 can be mounted on a plane surface, describing that “a number of light emitting diode elements ... have been grouped on a plane.” <i>Id.</i> at ¶ 0018. Figures 6 and 7 of JP '234 illustrate two examples of power supply circuits. In both power supply circuits the LEDs are electrically connected between the bi-pin connectors 5 to be illuminated in response to electrical current received from the power supply</p>

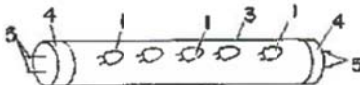
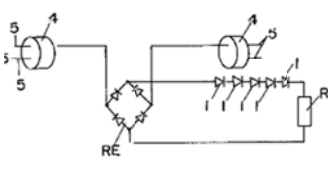
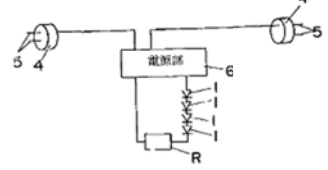
Claim 1	JP ‘234 Disclosure
	<p>circuit.</p> <div data-bbox="670 331 1377 531" data-label="Diagram"> </div>
<p>wherein each of the plurality of light emitting diodes is mounted with respect to surface of the circuit board to establish a radiation pattern of light emitted from the bulb portion; and</p>	<p>The longitudinally extending LEDs 1 are disposed inside the cylindrical tube 3. <i>Id.</i> at FIG. 5. JP ‘234 discloses that LEDs 1 are mounted with respect to a surface to establish a radiation pattern of light emitted from the bulb portion. <i>Id.</i> at ¶ [Means of a Solution] (“A number of light emitting diode elements 1 are grouped with an arrangement density that corresponds with the <i>light distribution</i> design. By the grouping of a number of light emitting diode elements 1, a surface light source can be obtained in a simple way.”).</p>
<p>wherein the arrangement of the circuit board and the bulb portion is such that substantially the entire light output of the light device is emitted away from the one surface and</p>	<p>JP ‘234 discloses that LEDs 1 can be mounted on a plane surface: “as is shown in figure 1, a number of light emitting diode elements... have been grouped on a plane. ...Figure 2 shows in the horizontal axis the distance up to shining surface that is parallel to the surface wherein light emitting diode elements 1 have been grouped” <i>Id.</i> at ¶ 0018. The LEDs 1 are arranged so that light emitted therefrom will be substantially directed away from the plane surface. <i>Id.</i>; FIG. 5.</p>
<p>is confined to an included angle by sidewalls extending to a height above the one surface on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap.</p>	<p>JP ‘234 does not explicitly disclose this limitation.</p> <p>However, as described above (¶¶ 115, 116), US ‘103 discloses a cylindrical illumination apparatus that includes LEDs 174, Ex. 1015 at Abstract, and includes a reflective surface 150 that is provided on opposed sides of the LEDs 174. <i>Id.</i> at FIGS. 3 and 4. As also described above (¶117), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate a reflecting sheet, such as reflecting sheet 150, in combination with the</p>

Claim 1	JP ‘234 Disclosure
	light source of JP ‘234. The light output of the light device would be confined to an included angle by the incorporated reflecting sheet.

Claim 2	JP ‘234 Disclosure
The light tube of claim 1 wherein each of the pair of end caps includes an electrical bi-pin connector.	JP ‘234 discloses bases 4 that include terminal bi-pins 5 that are compatible with fluorescent lamp sockets: “In both end parts of tube 3, bases 4 that can be attached and detached in a socket for fluorescent lamps, are established. In short, for the external observation, it is formed in the same way as a ready-made fluorescent lamp. ...The alternating current input terminals of rectifying circuit RE are respectively connected to respectively 1 terminal pin 5 of base 4 that has been established in the respective ends of tube 3.” <i>Id.</i> at ¶ 0025; FIG. 5.

Claim 3	JP ‘234 Disclosure
The light device of claim 1 wherein each of the plurality of light emitting diodes is a white light emitting diode.	JP ‘234 discloses that “it is preferred that a white emission colour is obtained ...by using white light emitting diodes (that radiate white light by shining blue light to a fluorescent substance with yellow light emission). <i>Id.</i> at ¶ 0029.

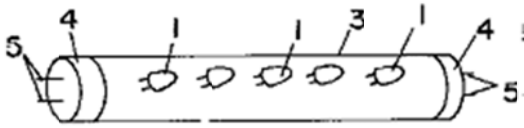
Claim 7	JP ‘234 Disclosure
The light device of claim 1 wherein the plurality of light emitting diodes is arranged substantially continuously between the opposite ends of the bulb portion.	JP ‘234 discloses that LEDs 1 can be mounted on a plane surface, describing that a number of light emitting diode elements... have been grouped on a plane. As shown in Fig. 5, the LEDs 1 in JP ‘234 are disposed substantially continuously between the opposite ends of the bulb portion. 

Claim 8	JP ‘234 Disclosure
<p>In a replacement light tube for a fluorescent light fixture having a light tube socket, the improvement comprising:</p>	<p>JP ‘234 discloses “a light source wherein light emitting diodes have been used, that is suited for illumination and for display.” Ex. 1013 at ¶ 0001.</p> <p style="text-align: center;">【図5】</p> 
<p>a plurality of light emitting diodes disposed along a length of a bulb portion between a first end cap and a second end cap mounted on opposite ends of the bulb portion, wherein the plurality of light emitting diodes is mounted on only one side of a circuit board in a light emitting direction;</p>	<p>JP ‘234 discloses “light emitting diode elements 1 have been accommodated in a cylindrical tube 3 that has been formed with the same form and same dimensions as a ready-made fluorescent lamp. ... In short, for the external observation, it is formed in the same way as a ready-made fluorescent lamp.” <i>Id.</i> at ¶ 0025. The longitudinally extending LEDs 1 are disposed inside the cylindrical tube 3 extending between two ends caps 4. <i>Id.</i> at FIG. 5. JP ‘234 discloses that LEDs 1 can be mounted on only one side of a plane surface, describing that “a number of light emitting diode elements ... have been grouped on a plane.” <i>Id.</i> at ¶ 0018.</p>
<p>an electrical circuit for illuminating in response to electrical current to be received from the fluorescent light fixture; and</p>	<p>Figures 6 and 7 of JP ‘234 illustrate two examples of electrical circuits. In both electrical circuits the LEDs are electrically connected between the bi-pin connectors 5 to be illuminated by power received from a socket for fluorescent lamps. <i>Id.</i> at ¶ 0025.</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p>【図6】</p>  </div> <div style="text-align: center;"> <p>【図7】</p>  </div> </div>
<p>opaque side walls extending above the one side of the circuit board in the light emitting direction on opposing sides of the</p>	<p>JP ‘234 does not explicitly disclose this limitation.</p> <p>However, as described above (¶¶ 115, 116), US ‘103 discloses a cylindrical illumination apparatus that includes LEDs 174, Ex. 1015 at Abstract, and includes a reflective surface 150 that is provided on opposed sides of</p>

Claim 8	JP ‘234 Disclosure
plurality of light emitting diodes between the first end cap and the second end cap to confine an entirety of light emitted from the replacement light tube to an included angle of less than about 180°.	the LEDs 174. <i>Id.</i> at FIGS. 3 and 4. As also described above (¶117), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate a reflecting sheet, such as reflecting sheet 150, in combination with the light source of JP ‘234. The reflecting sheet is opaque and would confine the entirety of light emitted from the light device to an included angle of less than about 180°.

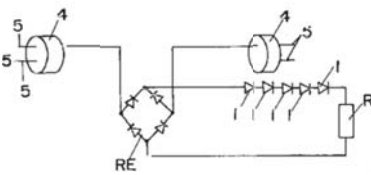
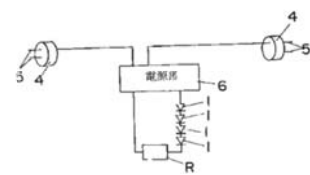
Claim 9	JP ‘234
The improvement of claim 8 wherein each of the plurality of light emitting diodes is a white light emitting diode.	JP ‘234 discloses that “it is preferred that a white emission colour is obtained ... by using white light emitting diodes (that radiate white light by shining blue light to a fluorescent substance with yellow light emission).” <i>Id.</i> at ¶ 0029.

Claim 13	JP ‘234
The improvement of claim 8 wherein the radiation pattern of light from each of the plurality of light emitting diodes is centered at a 90° angle relative to the circuit board.	<p>Fig. 5 of JP ‘234 illustrates that the LEDs 1 are aligned down the center and along the length of the surface of the LED fluorescent replacement tube, which centers their light output at a 90° angle relative to the surface.</p> <p>Moreover, as described above (¶ 119), US ‘103 discloses the radiation pattern of light from LED package 430 is centered at 90° from the circuit board. Ex 1015 at 3:50-51; FIG. 11. As also described above (¶ 119), in my opinion, a person of ordinary skill in the art in and around 2000 would have been motivated to incorporate into JP ‘234 the LED light output relative to the circuit board as disclosed in US ‘103 to achieve the predictable result of directing light emitted from LEDs toward a desired illumination area.</p>

Claim 14	JP ‘234
The improvement of claim 8 wherein the plurality of light emitting diodes is arranged substantially continuously along the length of the bulb portion.	<p>JP ‘234 discloses that LEDs 1 can be mounted on a plane surface, describing that “a number of light emitting diode elements ... have been grouped on a plane.” <i>Id.</i> at ¶ 0018. Fig. 5 of JP ‘234 discloses that the LEDs 1 are arranged substantially continuously along the length of the bulb portion.</p> 

Claim 15	JP ‘234
The improvement of claim 8 wherein the electrical circuit includes at least a rectifier and a current-limiting circuit.	<p>JP ‘234 discloses that the power supply includes “rectifying circuit RE that consists of a diode bridge ... [and] a serial circuit of resistance R as a current limiting element...” <i>Id.</i> at ¶ 0025.</p>

Claim 16	JP ‘234 Disclosure
An LED lighting unit for replacing a conventional fluorescent tube between the opposed electrical receptacles of a conventional fluorescent lighting fixture comprising:	<p>JP ‘234 discloses “a light source wherein light emitting diodes have been used, that is suited for illumination and for display.” Ex. 1013 at ¶ 0001. “[A] number of light emitting diode elements 1 have been accommodated in cylindrical tube 3 that has been formed with the same form and same dimensions as a ready-made fluorescent lamp. In both end parts of tube 3, bases 4 that can be attached and detached in a socket for fluorescent lamps, are established. In short, for the external observation, it is formed in the same way as a ready-made fluorescent lamp.” <i>Id.</i> at ¶ 0025.</p>

Claim 16	JP ‘234 Disclosure
a rigid, substantially cylindrical structure having a first end and a second end opposite said first end, the cylindrical structure including a support structure and a bulb portion;	JP ‘234 discloses “light emitting diode elements 1 have been accommodated in a cylindrical tube 3 that has been formed with the same form and same dimensions as a ready-made fluorescent lamp. ...In short, for the external observation, it is formed in the same way as a ready-made fluorescent lamp.” <i>Id.</i> JP ‘234 discloses that LEDs 1 can be mounted on a plane surface, describing that “a number of light emitting diode elements ... have been grouped on a plane.” <i>Id.</i> at ¶ 0018.
a first end cap disposed upon said first end of said cylindrical structure and a second end cap disposed upon said second end of said cylindrical structure;	JP ‘234 discloses bases 4 that include bi-pins 5 compatible with fluorescent lamp sockets: “In both end parts of tube 3, bases 4 that can be attached and detached in a socket for fluorescent lamps, are established” <i>Id.</i> at ¶ 0025; FIG. 5.
a pair of parallel, fluorescent light fixture receptacle connectors extending from each said end cap and configured for installing within the opposed electrical receptacles of the lighting fixture; and	“The alternating current input terminals of rectifying circuit RE are respectively connected to respectively 1 terminal pin 5 of base 4 that has been established in the respective ends of tube 3.” <i>Id.</i> at ¶ 0025; FIG. 6.
a plurality of LEDs disposed along a surface of said support structure in electrical contact with one another and with at least one pair of said pair of connectors extending from said end caps,	<p>JP ‘234 discloses a plane surface on which the LEDs 1 are mounted. <i>Id.</i> at ¶ 0018; FIG. 5. Figures 6 and 7 of JP ‘234 illustrate two examples of power supply circuits. In both power supply circuits the LEDs are in electrical contact with one another and electrically connected with the bi-pin connectors 5.</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p>【図6】</p>  </div> <div style="text-align: center;"> <p>【図7】</p>  </div> </div>
whereby light is divergently emitted along the length of said lighting unit in an included angle of less than about	JP ‘234 discloses that LEDs 1 can be mounted on a plane surface, describing that “a number of light emitting diode elements ... have been grouped on a plane.” <i>Id.</i> at ¶ 0018. The LEDs 1 are arranged so that light emitted therefrom will be substantially directed away from the plane surface and divergently emitted in an included angle of less than

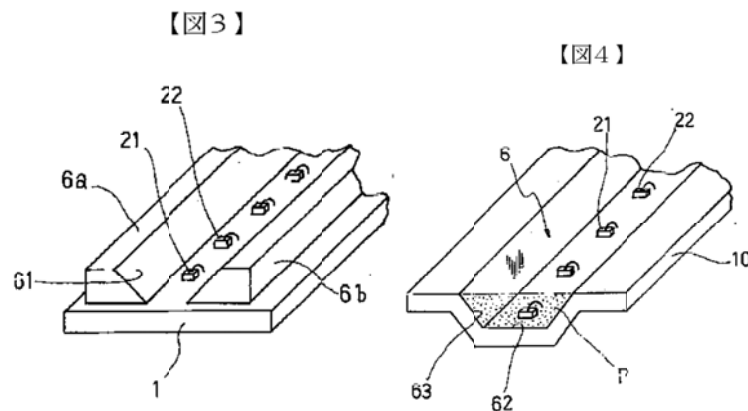
Claim 16	JP ‘234 Disclosure
180°;	about 180° as illustrated in FIGS. 1, 2 and 16. <i>Id.</i>
wherein the combination of said support structure and said bulb portion is such that substantially the entire light output of said lighting unit device is emitted away from said surface and	JP ‘234 discloses that LEDs 1 can be mounted on a plane surface: “as is shown in figure 1, a number of light emitting diode elements ... have been grouped on a plane. ... Figure 2 shows in the horizontal axis the distance up to shining surface that is parallel to the surface wherein light emitting diode elements 1 have been grouped.” <i>Id.</i> at ¶ 0018. The LEDs 1 are arranged so that light emitted therefrom will be substantially directed away from the plane surface. <i>Id.</i> at FIG. 5.
is confined to the included angle by sidewalls extending to a height above said surface on opposing sides of said plurality of LEDs between the first end and the second end.	<p>JP ‘234 discloses light emission toward a target surface, but does not explicitly disclose that the light output is confined to an included angle by sidewalls extending above the one surface.</p> <p>However, as described above (¶¶ 115, 116), US ‘103 discloses a cylindrical illumination apparatus that includes LEDs 174, Ex. 1015 at Abstract, and includes a reflective surface 150 that is provided on opposed sides of the LEDs 174. <i>Id.</i> at FIGS. 3 and 4. As also described above (¶117), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate a reflecting sheet, such as reflecting sheet 150, in combination with the light source of JP ‘234. Incorporation of such reflecting sheet in JP ‘234 would confine substantially the entire light output from the light source to an included angle of less than about 180°. Moreover, the incorporated reflecting sheet would extend to a height above a surface along which the LEDs are disposed on opposing sides of the LEDs between the first end and the second end of the light source.</p>

d. Obviousness of Claims 1-3, 7-9, and 13-16 over JP ‘234 in view of JP ‘536

121. As described in the discussion and claim charts above in Section VII.(b)c, JP ‘234 discloses all elements of claims 1-3, 7-9, and 13-16, but does not explicitly disclose the following “sidewalls” related language of independent claims 1, 8, and 16:

- substantially the entire light output “is confined to an included angle by sidewalls extending to a height above the one surface on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap” of claim 1;
- the “opaque side walls extending above the one side of the circuit board in the light emitting direction on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap to confine an entirety of light emitted from the replacement light tube to an included angle of less than about 180°” of claim 8; or
- substantially the entire light output “is confined to the included angle by sidewalls extending to a height above said surface on opposing sides of said plurality of LEDs between the first end and the second end” of claim 16.

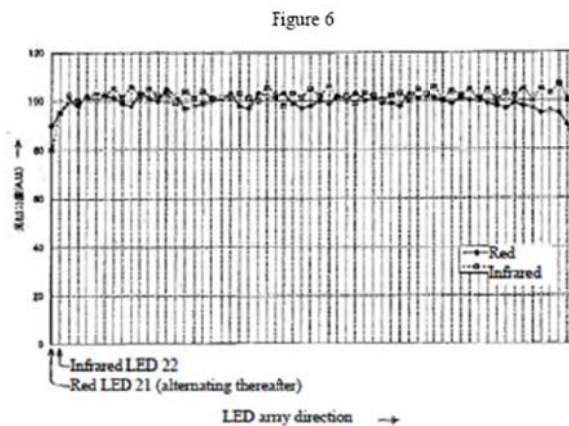
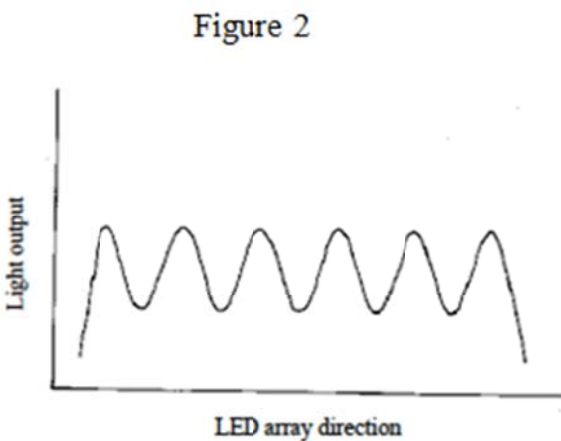
122. However, JP ‘536 includes such structure. JP ‘536 discloses LEDs 21, 22 positioned between opposing sidewalls 61 or 63 that act as reflective surfaces. Ex. 1010 at Abstract. Two example figures are provided below that illustrate the reflective surfaces (61 in the embodiment of FIG. 3; 63 in the embodiment of FIG. 4). The reflective surfaces of JP ‘536 extend above a surface along which the LEDs 21, 22 are arranged, on opposing sides of the LEDs 21, 22, and confine the entirety of the light output of the device to an included angle of less than 180°.



Ex. 1010, FIGS. 3 and 4

123. JP ‘536 discloses that the reflective surfaces bring forward light reflected from the side of each LED, and thereby limit drops in light output immediately above places where no LED is present. *Id.* at Abstract. JP ‘536 discloses that such arrangement provides optical output such that: “output between parts directly above a lighted LED and other parts has virtually disappeared, and thus it was confirmed that by means of the present invention it is possible to

provide a LED linear light source with low variability in optical output.” *Id.* at ¶ 0021. This improvement in light output from the reflective surfaces of JP ‘536 is illustrated in graphical form in Figures 2 and 6 of JP ‘536 (reproduced below). Figure 2 shows distribution of light output in a LED linear light source according to prior art of JP ‘536. As illustrated in Figure 2, light output tends to be high in areas immediately above LEDs, but low in areas where LEDs are not present. Figure 6 shows distribution of light output in a preferred embodiment of JP ‘536. As illustrated in Figure 6, light output variations between areas above LEDs and areas where LEDs are not present is virtually eliminated.



124. In my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate reflectors that extend above a mounting surface for LEDs on opposite sides of the LEDs in JP ‘234, such as the reflectors 61 or 63 described by JP ‘536. For example, the base plate 10 (FIG. 4 of

JP ‘536) with reflectors 63 or the base plate 1 with reflectors 61 (FIG. 3 of JP ‘536) could be readily incorporated in the cylindrical tube 3 of JP ‘234. For instance, the base plate 10 could extend between and be supported by bases 4 and/or supported by the interior of cylindrical tube 3. One would have been motivated to incorporate reflectors to achieve the predictable results of reflecting light emitted from the LEDs toward the desired illumination area and low variability in light output from the light source of JP ‘234 as taught by JP ‘536. JP ‘234 discloses a desire for uniformity of brightness from the light source (*e.g.*, Ex. 1013 at ¶ 0020) and one would be motivated to incorporate reflectors of JP ‘536 as an alternative and/or additional means to improve uniformity of the brightness of the light source of JP ‘234.

125. In my opinion, incorporation of reflectors, such as the reflectors of JP ‘536, in the light source of JP ‘234 renders obvious the “sidewalls” related language of claims 1, 8, and 16. In particular, the reflectors would confine substantially the entire light output of the light device to an included angle and would extend to a height above the surface on which the LEDs are disposed, on opposing sides of the LEDs between the end caps, as provided by claim 1. Also, the reflectors are opaque and would be on opposing sides of the LEDs between the end caps to confine an entirety of light emitted by the light source to an included angle of less than about 180° as provided by claim 8. Also, substantially the entire

light output of the light source would be confined to an included angle less than about 180° by the reflectors that extend to a height above the surface on opposing sides of the LEDs between the first end and the second end of the device as provided by claim 16.

126. Moreover, if it is found that JP ‘234 does not explicitly disclose: the plurality of light emitting diodes being disposed along one surface of a circuit board of claim 1; the plurality of lighting emitting diodes being mounted on only one side of a circuit board of claim 8; or the plurality of LEDs disposed along a surface of a support structure of claim 16, in my opinion incorporation in the light source of JP ‘234 of the wiring base plate 1 or base plate 10 of JP ‘536 in combination with the reflectors 61 or 63 would likewise overcome such deficiency. For example, the incorporated base plate 1 or 10 would constitute the “circuit board” or “surface of a support structure” and the LEDs 21, 22 (or LEDs 1 of JP ‘234) would be disposed along or mounted on the incorporated plate 1 or 10.

127. Moreover, if it is found that JP ‘234 does not explicitly disclose “the radiation pattern of light from each of the plurality of light emitting diodes is centered at a 90° angle relative to the circuit board” as provided in claim 13, in my opinion incorporation in the light source of JP ‘234 of the wiring base plate 1 or base plate 10 of JP ‘536 in combination with the reflectors 61 or 63 would likewise

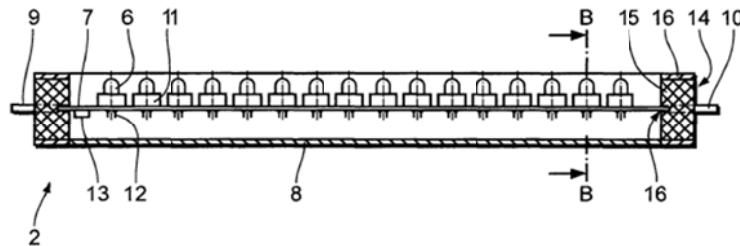
overcome such deficiency. JP ‘536 discloses the radiation pattern of light emitted from each of LEDs 21, 22 is centered at a 90° angle relative to the base plates 1, 10. For example, JP ‘536 discloses “LED 21, 22 ... are placed alternatively along a single line on the surface of wiring base plate 1” such that: “...optical output is high directly above a lighted LED however optical output becomes lower in other parts.” *Id.* at ¶¶ 0011, 0021; *see also* FIGS. 1-7. In my opinion, incorporation in the light source of JP ‘234 of the wiring base plate 1 or base plate 10 of JP ‘536 in combination with the reflectors 61 or 63 would likewise overcome such deficiency. For example, the LEDs 21, 22 (or LEDs 1 of JP ‘234) would be mounted on the incorporated base plate 1 or 10 as disclosed by JP ‘536 such that the radiation pattern of light emitted from each of LEDs 21, 22 is centered at a 90° angle relative to the base plate 1 or 10.

128. Accordingly, in my opinion, JP ‘234 in view of JP ‘536 renders obvious claims 1-3, 7-9, and 13-16.

e. Obviousness of Claims 1-2, 7-8, 13, 14, and 16 over DE ‘320 in view of US ‘281

129. DE ‘320 discloses an LED light source 2 that is “a replacement for an existing fluorescent lamp.” Ex. 1003 at p. 3, ll. 11-15; FIGS. 1-7. Accordingly,

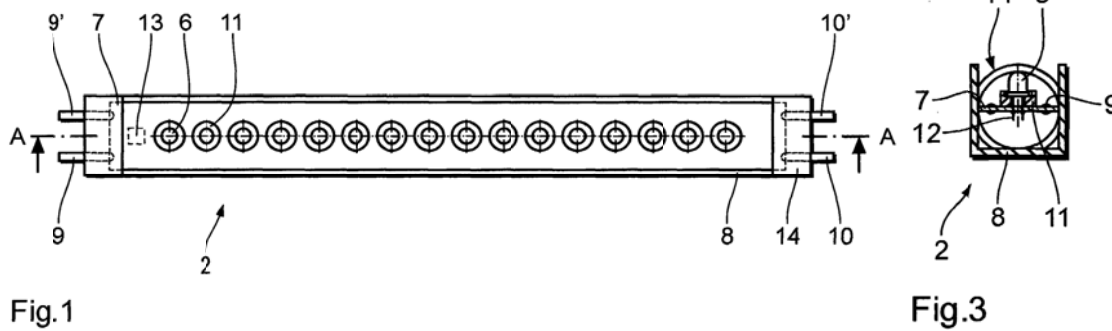
the LED light source of DE '320 is a replacement for conventional fluorescent tubes as described in the '327 Patent.



Ex. 1003, FIG. 2

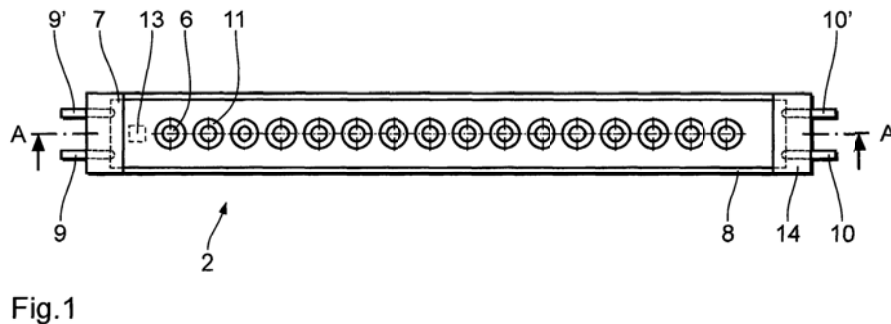
130. DE '320 discloses the LED light source 2 “...substantially corresponds, with regard to the external dimensions as well as the layout and the size or geometry of the electrical terminals for the illumination means, to a conventional fluorescent lamp...” *Id.* at p. 4, ll. 3-8.

131. DE '320 discloses LEDs 6 arranged along the length of a circuit board 7 that extends substantially the length of the LED light source 2. *Id.* at p. 8, ll. 26-31, p. 6, ll. 8-11; p. 9, ll. 13-17; FIGS. 1-3.



Ex. 1003, FIGS. 1 and 3

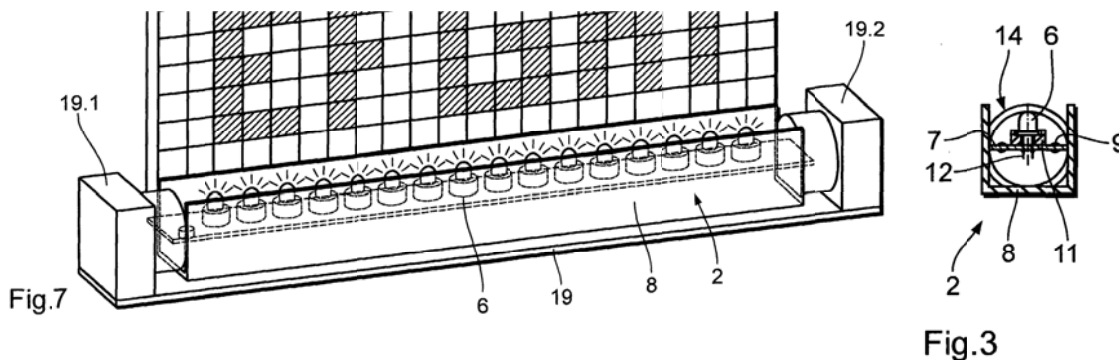
132. DE '320 discloses male bi-pin connectors 9, 9', 10, and 10' with the same dimensions as connectors of fluorescent lamps. *Id.* at p. 10, ll. 19-30; FIGS. 1-6.



Ex. 1003, FIG. 1

133. DE '320 discloses a reflector 8 that is provided on opposed sides of, and extends above, the LEDs 6 and the circuit board 7. The reflector 8 has “a polished surface in order to enhance the reflection of light emitted by the light-emitting diodes.” *Id.* at p. 9, ll. 28-30; FIGS. 1-8b. The reflector 8 constitutes

“sidewalls” and confines light output from the LED light source 2 to an included angle of less than 180° as evidenced, for example, by Figures 3 and 7.



Ex. 1003, FIGS. 7 and 3

134. DE ‘320 discloses a power supply/electrical circuit that supplies current to its LEDs 6 that may include: “a diode 13 forming the reverse pole protection means” and connected together with the LEDs 6 on the circuit board 2; *Id.* at p. 11, lines 1-6; a “vehicle battery” that supplies power to the LED light source via the fluorescent lamp mounting 19; *Id.* at p. 11, lines, 11-16; and/or “switching means in order to switch the light-emitting diodes ... on or off either individually, in pairs or in groups to adapt the light level of the illumination device...” *Id.* at p. 5, line 27 – p. 6, line 1.

135. The LEDs of the light source of DE ‘320 are illuminated in response to current received from sockets of the fluorescent lamp mounting that receive the contact pins of the light source. *Id.* at p. 11, lines 11-16.

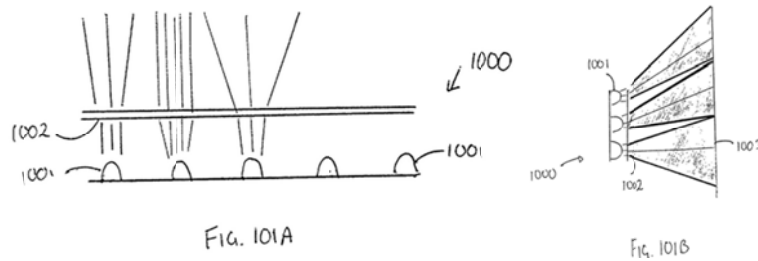
136. Additional detail on the disclosure of DE '320 is provided in the claim charts below. As described in more detail in the claim charts, DE '320 discloses all elements of claims 1-2, 7-8, and 13-16, but does not explicitly disclose:

- the “bulb portion” of claims 1 and 8;
- the bulb portion and that the structure is substantially cylindrical as provided in claim 16;

137. However, US '281 discloses such structure and, as described below, it would have been obvious to one of ordinary skill in the art around and before 2000 to incorporate such structure in the device of DE '320. With respect to the “bulb portion” of claims 1, 8, and 16, US '281 describes a translucent member may be placed over LEDs to provide uniform light distribution. US '281 describes:

... the association of the translucent member 1002 to the LEDs 1001 is so that the diffusion angle of light emitted from the LEDs 1001 may be altered such that the emitted light may substantially uniformly illuminate a surface 1003. In particular, by placing between the LEDs 1001 and the surface 1003 a translucent member 1002 ... the diffusion angle of light emitted from each LED 1001, or group of LEDs 1001, can be made to increase or decrease accordingly as the light travels across the translucent member 1002, as illustrated in FIG. 101B, to permit illumination of the entire surface 1003 with uniformity,

including substantially the same degree of brightness or intensity. Ex. 1005 at ¶ 261.



138. US '281 further describes the translucent member 1002 may be implemented in a substantially cylindrical housing 1007 provided around LEDs 1001 to provide uniformity of light distribution on a surface 1003. US '281 describes:

Looking now at FIG. 102, the translucent member 1002, in an embodiment, may include a substantially cylindrical housing 1007 such that the translucent member is implemented as an elongate translucent member. The housing 1007, as shown, can be shaped so as to permit an array of LEDs 1001 to be situated therein. To permit light from the LEDs 1001 to be substantially uniformly distributed against the surface 1003, the material from which the housing 1007 may be formed can be, but not limited to, glass, plastic (e.g., polycarbonate, acrylic, vinyl), quartz, and composites, which material may be designed to provide, for instance, a particular index of dispersion to vary the angle of diffusion of light being transmitted from the LEDs 1001. Ex. 1005 at ¶ 262.

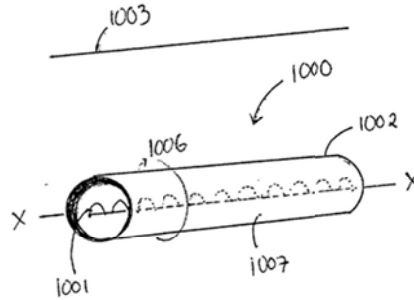


Fig. 102

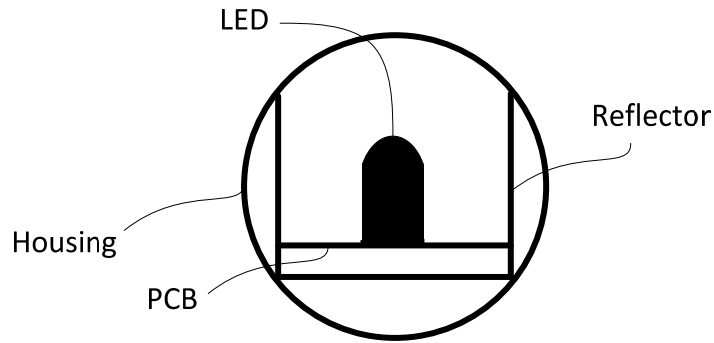
139. In my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate a substantially cylindrical housing around the circuit board 7, LEDs 6, and reflector 8 of the illumination device of DE ‘320, such as the substantially cylindrical housing 1007 described by US ‘281. One would have been motivated to incorporate the substantially cylindrical housing to achieve the predictable result of uniform illumination from the DE ‘320 illumination device as described by US ‘281. *Id.* Moreover, the description of DE ‘320 provides motivation for incorporating the substantially cylindrical housing as it describes that the light source “substantially corresponds, with regard to the external dimensions ... to the external dimensions of a conventional fluorescent lamp...” Ex. 1003 at p. 4, ll. 4-8. One would be motivated by such teachings to incorporate a cylindrical housing to have the light source further correspond to a conventional fluorescent lamp. As further motivation, one use for the illumination device as described by DE ‘320 is for illuminating an information display. *Id.* at p. 12, ll. 9-12. A person of ordinary

skill in the art around and before 2000 would be motivated to provide uniform illumination (as described by US '281) for an information display to ensure even illumination of the display while minimizing any bright spots.

140. There are multiple options for incorporating a substantially cylindrical housing around the circuit board 7, LEDs 6, and reflector 8 of the illumination device of DE '320 and, in my opinion, all would have been within the skill of a person of ordinary skill in the art around and before 2000. For example, one option is to incorporate the cylindrical housing by increasing the diameter of the end caps 14 of DE '320 and sizing the cylindrical housing such that it substantially conforms in diameter to the end caps and surrounds the circuit board 7, LEDs 6, and reflector 8. In my opinion, such a modification would have been obvious as the end caps and cylindrical housing could be sized to achieve the predictable result of a larger diameter tube such as, for example, a standard T8 or T12 tube. It is noted that the standard fluorescent bi-pin end cap is used on both the standard T8 and T12 fluorescent tubes. As understood by a person of ordinary skill in the art around and before 2000, fluorescent tubes were available in many different diameter sizes such as T5 (5/8" diameter), T8 (1" diameter), and T12 (1.5" diameter). To achieve a larger diameter lamp size such as a T8 or T12, one could size the cylindrical housing and end caps in conformity with such size, while maintaining the dimensions of the circuit board 7, LEDs 6, and reflector 8. The

cylindrical housing could be sized to abut the end caps 14 of DE '320 or could be sized to surround the end caps 14, and could be cemented or otherwise affixed to the end caps 14.

141. Also, for example, another option is to make minor modifications to the size and/or placement of the circuit board 7 and/or reflector 8 to incorporate the substantially cylindrical housing in a tube size that substantially conforms to the end caps 14 as illustrated in DE '320. For example, the sides of the reflector 8 may be moved “inward”, the bottom of the reflector 8 may be moved “upward”, and/or the circuit board 7 (and LEDs 6) may be moved “downward”, while maintaining the size of the end caps 14 and incorporating a cylindrical housing that substantially conforms in diameter to the end caps 14. Such modifications would likewise be obvious to one of ordinary skill in the art and would achieve predictable results. For example, the reflector 8 could still function to achieve the predictable results of enhancing the reflection of the LEDs 6 and/or supporting the circuit board 7 as described in DE '320. The cylindrical housing could be sized to abut the end caps 14 of DE '320, or could be sized to surround the end caps 14, and could be cemented or otherwise affixed to the end caps 14. An example figure schematically showing one example of such modifications is illustrated below.



142. In my opinion, incorporation of a substantially cylindrical housing around the circuit board 7, LEDs 6, and reflector 8 of the illumination device of DE '320 renders obvious the “bulb portion” of claims 1, 8, and 16. With respect to claim 16 (“substantially cylindrical structure”), it is noted that incorporation of a substantially cylindrical housing in DE '320 as proposed would result in a structure that is substantially cylindrical (the “bulb portion” of the structure would be substantially cylindrical).

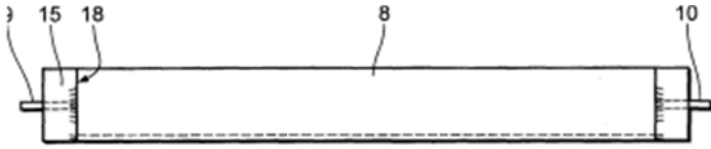
143. Accordingly, for at least the reasons set forth herein, in my opinion, DE '320 in view of US '281 renders obvious 1-2, 7-8, 13, 14, and 16.

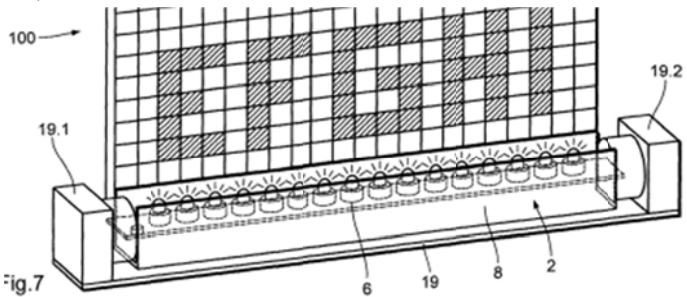
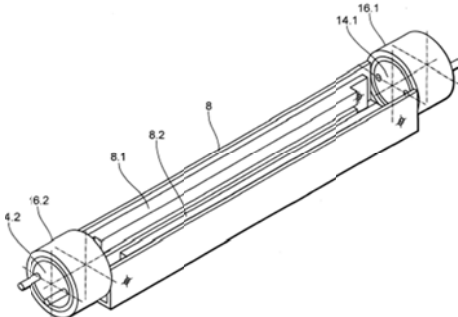
144. The claim charts below illustrate the disclosure of elements of claims 1-2, 7-8, 13, 14, and 16 in DE '320. The claim charts also include, in summary fashion, the disclosure of US '281 that teaches any elements not explicitly disclosed in DE '320 – along with a brief summary of why incorporation of such

elements in DE ‘320 would have been obvious to a person of ordinary skill in the art around and before 2000.

Claim 1	DE ‘320 Disclosure
<p>A light device for illumination by a power supply circuit comprising:</p>	<p>“...the invention is based on the object of providing a replacement kit for an illumination device of the kind mentioned above, which can be installed as a replacement for an existing fluorescent lamp ...” Ex. 1003 at p. 3, ll. 11-15. “According to the invention, the replacement kit comprises an LED lamp designed as a plug-in device and for replacing existing fluorescent lamps ...” <i>Id.</i> at p. 3, ll. 27-29. “The plug-in device includes a source of light formed from electric illumination means and substantially corresponds, with regard to the external dimensions as well as the layout and the size or geometry of the electrical terminals for the illumination means, to a conventional fluorescent lamp and can therefore readily be used in the mountings of an existing and conventional small fluorescent lamp, which has the electrical terminals.” <i>Id.</i> at p. 4, ll. 3-10.</p> <div data-bbox="487 1087 1258 1339"> </div> <p>The device includes a power supply circuit to supply power to the LEDs: “The reverse pole protection means for the light emitting diodes 6, which is disposed on the circuit board 7, is identified with 13. On each end face of the reflector 8, an end piece 14 is fastened through which the contact pins 9, 10 for the electrical connection of the light-emitting diodes 6 disposed on the circuit board 7 are guided with a voltage source as well as the unused contacts 9’, 10’.” <i>Id.</i> at p. 9, ll. 23-28. “The flexible cables 4 and 5 of the cable set are respectively connected in the plug-in blocks 19.1 and 19.2 of the fluorescent lamp mounting 19 in sockets receiving the contact pins and are connected – whilst electrically bridging the ballasts of the replaced</p>

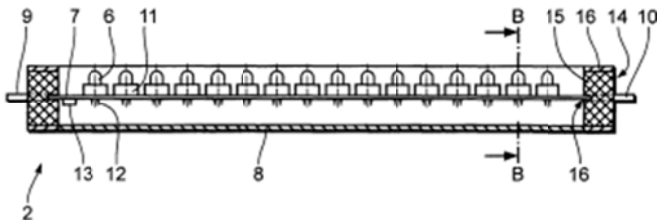
Claim 1	DE ‘320 Disclosure
	<p>fluorescent lamp - with their free ends to the poles of the vehicle battery.” <i>Id.</i> at p. 11, lines, 11-16. “According to one variant of the invention, the illumination device includes switching means in order to switch the light-emitting diodes arranged in one or several rows on or off either individually, in pairs or in groups” <i>Id.</i> at p. 5, lines 27 – 30.</p>
a bulb portion,	<p>DE ‘320 does not explicitly disclose this limitation.</p> <p>However, as described above (¶¶ 137,138), US ‘281 describes a translucent member 1002 may be implemented in a substantially cylindrical housing 1007 provided around LEDs 1001 to provide uniformity of light distribution. Ex. 1005 at ¶¶ 261, 262. As also described above (¶¶ 139-141), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate a cylindrical housing around the circuit board 7, LEDs 6, and reflector 8 of the illumination device of DE ‘320, such as the substantially cylindrical housing 1007 described by US ‘281.</p>
a pair of end caps disposed at opposite ends of the bulb portion, the pair of end caps including a first end cap disposed at one end of the bulb portion, and a second end cap disposed at an end of bulb portion opposite the first end cap, wherein the bulb portion and the pair of end caps are dimensioned to be mounted in a flourescent light tube socket; and	<p>End pieces 14 are provided on opposite ends of the lamp 2 and include pins 9, 9’, 10, and 10’ for installing the lamp 2 in a fluorescent fixture. “... two contact pins which are preferably cylindrically formed are provided on each end piece ...” Ex. 1003 at p. 6, ll. 20-21. “The contact pins 9, 10 and the corresponding, equally sized unused contacts 9’ and 10’ in the end pieces 13 are - as shown in the end view of lamp 2 according to Fig. 5 - arranged with regard to the implementation of the lamp 2 in a form conforming to a fluorescent lamp and lie respectively on the same diameter and extend in the same plane. This plane extends transversely to the light emergence plane of the lamp 2, so that this may be plugged into the pre-existing fluorescent lamp mounting when installing it as a replacement for a fluorescent lamp (compare position 19 in Fig. 6) and may be locked by rotating it about 90°.” <i>Id.</i> at p. 10, ll. 19-30.</p>

Claim 1	DE '320 Disclosure
	
<p>a plurality of light emitting diodes disposed inside the bulb portion along one surface of a circuit board extending between the first end cap and the second end cap for illuminating in response to electrical current to be received from the power supply circuit;</p>	<p>LEDs 6 are arranged along the length of the circuit board 7 and illuminate in response to electrical current received from a power supply circuit. “The light-emitting diodes 6 are arranged in rows on a circuit board 7...” <i>Id.</i> at p. 8, ll. 28-29, see also FIGS. 1-3, 7. “The reverse pole protection means for the light emitting diodes 6, which is disposed on the circuit board 7, is identified with 13. On each end face of the reflector 8, an end piece 14 is fastened through which the contact pins 9, 10 for the electrical connection of the light-emitting diodes 6 disposed on the circuit board 7 are guided with a voltage source as well as the unused contacts 9’, 10’.” <i>Id.</i> at p. 9, ll. 23-28. “The flexible cables 4 and 5 of the cable set are respectively connected in the plug-in blocks 19.1 and 19.2 of the fluorescent lamp mounting 19 in sockets receiving the contact pins and are connected – whilst electrically bridging the ballasts of the replaced fluorescent lamp - with their free ends to the poles of the vehicle battery.” <i>Id.</i> at p. 11, lines, 11-16. “According to one variant of the invention, the illumination device includes switching means in order to switch the light-emitting diodes arranged in one or several rows on or off either individually, in pairs or in groups” <i>Id.</i> at p. 5, lines 27 – 30.</p>
<p>wherein each of the plurality of light emitting diodes is mounted with respect to surface of the circuit board to establish a radiation pattern of light emitted</p>	<p>The elongate support structure of DE '320 includes a reflector 8 and circuit board 7. The circuit board 7 provides a substantially continuous LED mounting surface and extends substantially the length of the lamp 2. “The light-emitting diodes 6 are arranged in rows on a circuit board 7, which is arranged in a reflector 8 made from sheet metal, which has a U-shaped cross-sectional profile.” <i>Id.</i> at p. 8, ll. 28-31. “The board is formed as a printed circuit board and is retained within the space encircled by the illumination carrier by fixing in a clamped manner between the end pieces.” <i>Id.</i> at p.</p>

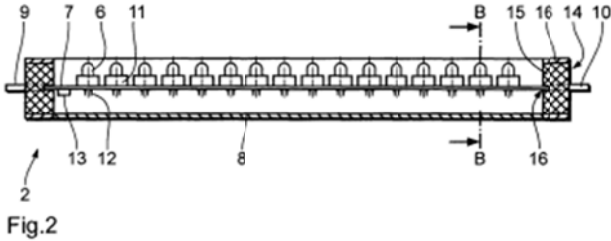
Claim 1	DE '320 Disclosure
<p>from the bulb portion; and</p>	<p>6, ll. 8-11.</p>  <p>fig. 7</p>
<p>wherein the arrangement of the circuit board and the bulb portion is such that substantially the entire light output of the light device is emitted away from the one surface and is confined to an included angle by sidewalls extending to a height above the one surface on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap.</p>	<p>The support structure includes reflector 8, which provides on opposite sides of the circuit board 7 walls that extend above the circuit board 7 in the light emitting direction to confine the entirety of light emitted from the lamp 2 in an included angle of less than about 180°. The reflector 8 may be made from an opaque material such as sheet metal. “The light-emitting diodes 6 are arranged in rows on a circuit board 7, which is arranged in a reflector 8 made from sheet metal, which has a U-shaped cross-sectional profile.” <i>Id.</i> at p. 8, ll. 28-31. “The reflector 8 is provided on the inside thereof with a polished surface in order to enhance the reflection of the light emitted by the light-emitting diodes.” <i>Id.</i> at p. 9, ll. 28-30.</p> 

Claim 2	DE '320 Disclosure
<p>“wherein each of the pair of end caps includes an electrical</p>	<p>DE '320 describes that end pieces 14 are provided on opposite ends of the lamp 2 and include pins 9, 9', 10, and 10' for installing the lamp 2 in a fluorescent fixture. “...</p>

Claim 2	DE ‘320 Disclosure
bi-pin connector.”	two contact pins which are preferably cylindrically formed are provided on each end piece ...” Ex.1005 at p. 6, ll. 20-21.

Claim 7	DE ‘320 Disclosure
“wherein the plurality of light emitting diodes is arranged substantially continuously between the opposite ends of the bulb portion.”	<p>DE ‘320 discloses LEDs 6 are arranged along the length of the circuit board 7 to emit light from the lamp 2. “The light-emitting diodes 6 are arranged in rows on a circuit board 7...” <i>Id.</i> at p. 8, ll. 28-29, <i>see also</i> FIGS. 1-3, 7.</p> 

Claim 8	DE ‘320 Disclosure
In a replacement light tube for a fluorescent light fixture having a light tube socket, the improvement comprising:	<p>“...the invention is based on the object of providing a replacement kit for an illumination device of the kind mentioned above, which can be installed as a replacement for an existing fluorescent lamp ...” Ex. 1003 at p. 3, ll. 11-15. “According to the invention, the replacement kit comprises an LED lamp designed as a plug-in device and for replacing existing fluorescent lamps ...” <i>Id.</i> at p. 3, ll. 27-29. “The plug-in device includes a source of light formed from electric illumination means and substantially corresponds, with regard to the external dimensions as well as the layout and the size or geometry of the electrical terminals for the illumination means, to a conventional fluorescent lamp and can therefore readily be used in the mountings of an existing and conventional small fluorescent lamp, which has the electrical terminals.” <i>Id.</i> at p. 4, ll. 3-10.</p>

Claim 8	DE '320 Disclosure
	 <p>Fig.2</p>
<p>a plurality of light emitting diodes disposed along a length of a bulb portion between a first end cap and a second end cap mounted on opposite ends of the bulb portion, wherein the plurality of light emitting diodes is mounted on only one side of a circuit board in a light emitting direction;</p>	<p>The elongate support structure of DE '320 includes a reflector 8 and circuit board 7. The circuit board 7 provides a substantially continuous LED mounting surface and extends substantially the length of the lamp 2. "The light-emitting diodes 6 are arranged in rows on a circuit board 7, which is arranged in a reflector 8 made from sheet metal, which has a U-shaped cross-sectional profile." <i>Id.</i> at p. 8, ll. 28-31. "The board is formed as a printed circuit board and is retained within the space encircled by the illumination carrier by fixing in a clamped manner between the end pieces." <i>Id.</i> at p. 6, ll. 8-11.</p> <p>DE '320 fails to disclose a bulb portion.</p> <p>However, as described above (¶¶ 137,138), US '281 describes a translucent member 1002 may be implemented in a substantially cylindrical housing 1007 provided around LEDs 1001 to provide uniformity of light distribution. Ex. 1005 at ¶¶ 261, 262. As also described above (¶¶ 139-141), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate a cylindrical housing around the circuit board 7, LEDs 6, and reflector 8 of the illumination device of DE '320, such as the substantially cylindrical housing 1007 described by US '281.</p>
<p>an electrical circuit for illuminating in response to electrical current to be received</p>	<p>The LEDs 6 are connected to and between the contact pins 9 and 10 to be illuminated by power received via the socket of a fluorescent fixture. "The reverse pole protection means for the light emitting diodes 6, which is disposed on the circuit board 7, is identified with 13. On each end face of the reflector 8, an end piece 14 is fastened through which the contact pins 9, 10 for the electrical connection of the light-emitting diodes 6 disposed on the circuit board 7 are</p>

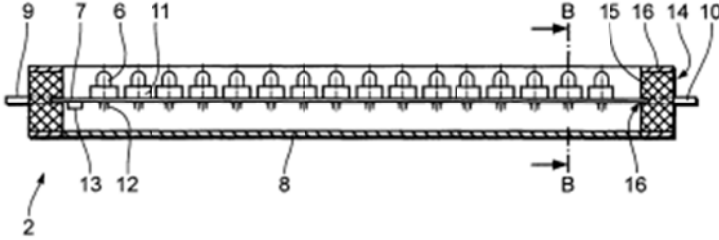
Claim 8	DE '320 Disclosure
from the fluorescent light fixture; and	guided with a voltage source as well as the unused contacts 9', 10'." Ex. 1003 at p. 9, ll. 23-28. "According to the invention, the replacement kit comprises an LED lamp designed as a plug-in device and for replacing existing fluorescent lamps, as well as a set of cables or another device for bridging or bypassing the pre-existing ballast, so that the plug-in socket may be immediately connected to the on-board DC voltage." <i>Id.</i> at p. 3, l. 27 – p. 4, l. 2. "The light-emitting diodes 6 are - as shown in Fig. 6 - electrically connected in series on the circuit board 7 ... The line sections of the circuit board 7 are identified with 7.1 and 7.2 and are connected to the contact terminal 9 or 10 of the lamp 2." <i>Id.</i> at p. 11, ll. 4-6. "The flexible cables 4 and 5 of the cable set are respectively connected in the plug-in blocks 19.1 and 19.2 of the fluorescent lamp mounting 19 in sockets receiving the contact pins and are connected – whilst electrically bridging the ballasts of the replaced fluorescent lamp - with their free ends to the poles of the vehicle battery." <i>Id.</i> at p. 11, ll. 11-16.
opaque side walls extending above the one side of the circuit board in the light emitting direction on opposing sides of the plurality of light emitting diodes between the first end cap and the second end cap to confine an entirety of light emitted from the replacement light tube to an included angle of less than about 180°.	The walls of reflector 8 extend above the circuit board 7 on opposing sides of the LEDs 6 and confine the light output to an included angle of less than 180°. "The light-emitting diodes 6 are arranged in rows on a circuit board 7, which is arranged in a reflector 8 made from sheet metal, which has a shaped cross-sectional profile." Ex. 1003 at p. 8, ll. 28-31. "The reflector 8 is provided on the inside thereof with a polished surface in order to enhance the reflection of the light emitted by the light-emitting diodes." <i>Id.</i> at p. 9, ll. 28-30.

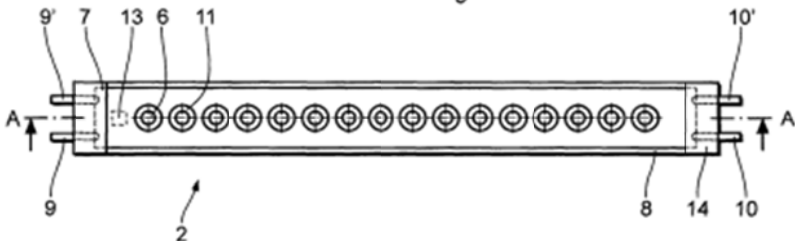
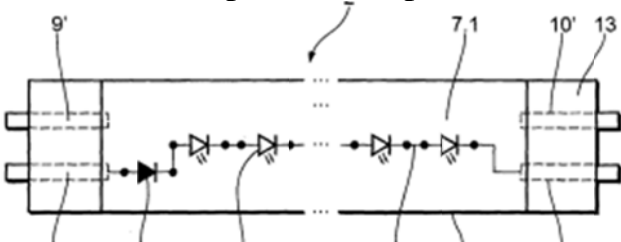
Claim 13	DE '320 Disclosure
"wherein the radiation pattern of light from each of the plurality of light emitting diodes is	DE '320 discloses LEDs which are arranged in at least one row on a board. The LEDs are utilized to illuminate display board 30 extending upward about 90 degrees from the LED circuit board. <i>Id.</i> at page 8, lines 14-17; FIG 7. The device and LEDs thus produce a radiation pattern

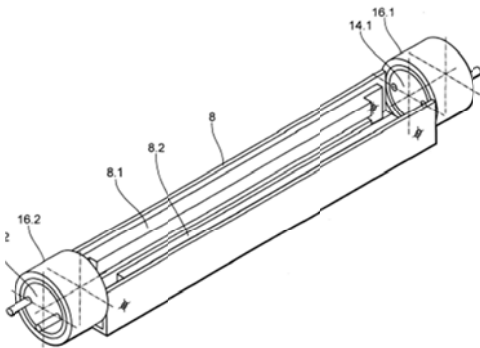
Claim 13	DE ‘320 Disclosure
centered at a 90° angle relative to the circuit board.”	centered at 90° relative to the circuit board as shown in the figures. Thus, DE ‘320 discloses a radiation pattern of light from each of the LEDs centered at a 90° angle relative to the circuit board mounting position.

Claim 14	DE ‘320 Disclosure
wherein the plurality of light emitting diodes is arranged substantially continuously along the length of the bulb portion.	DE ‘320 discloses that LEDs 6 are “arranged in at least one row on a board which extends essentially parallel to the longitudinal axis of the lamp.” <i>Id.</i> at page 4, lines 19-21. Thus, DE ‘320 discloses such substantial continuous arrangement along the length of the bulb portion.

Claim 16	DE ‘320 Disclosure
An LED lighting unit for replacing a conventional fluorescent tube between the opposed electrical receptacles of a conventional fluorescent lighting fixture comprising:	“...the invention is based on the object of providing a replacement kit for an illumination device of the kind mentioned above, which can be installed as a replacement for an existing fluorescent lamp ...” <i>Id.</i> at p. 3, ll. 11-15. “According to the invention, the replacement kit comprises an LED lamp designed as a plug-in device and for replacing existing fluorescent lamps, ...” <i>Id.</i> at p. 3, ll. 27-29. “The plug-in device includes a source of light formed from electric illumination means and substantially corresponds, with regard to the external dimensions as well as the layout and the size or geometry of the electrical terminals for the illumination means, to a conventional fluorescent lamp and can therefore readily be used in the mountings of an existing and conventional small fluorescent lamp, which has the electrical terminals.” <i>Id.</i> at p. 4, ll. 3-10.
a rigid, substantially cylindrical structure having a first end and a	The structure of DE ‘320 includes a rigid reflector 8 and circuit board 7. “In the lamp 2 that may be plugged into the fluorescent lamp mounting, sixteen light-emitting diodes 6 are provided as sources of light. The light-emitting diodes 6 are arranged in rows on a circuit board 7, which is arranged in a reflector 8 made from sheet metal, which has a U-shaped cross-sectional profile.” <i>Id.</i> at

Claim 16	DE '320 Disclosure
<p>second end opposite said first end, the cylindrical structure including a support structure and a bulb portion;</p>	<p>p. 8, ll. 26-31. "The board is formed as a printed circuit board and is retained within the space encircled by the illumination carrier by fixing in a clamped manner between the end pieces." <i>Id.</i> at p. 6, ll. 8-11.</p>  <p>DE '320 does not explicitly disclose a bulb portion and does not explicitly disclose that the structure is substantially cylindrical.</p> <p>However, as described above (§§ 137,138), US '281 describes a translucent member 1002 may be implemented in a substantially cylindrical housing 1007 provided around LEDs 1001 to provide uniformity of light distribution. Ex. 1005 at §§ 261, 262. As also described above (§§ 139-141), in my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to incorporate a cylindrical housing around the circuit board 7, LEDs 6, and reflector 8 of the illumination device of DE '320, such as the substantially cylindrical housing 1007 described by US '281. Incorporation of such a cylindrical housing would result in a structure that is substantially cylindrical.</p>
<p>a first end cap disposed upon said first end of said cylindrical structure and a second end cap disposed upon said second end of said cylindrical structure;</p>	<p>End pieces 14 are provided on opposite ends of the reflector 8. "On each end face of the reflector 8, an end piece 14 is fastened through which the contact pins 9, 10 for the electrical connection of the light-emitting diodes 6 disposed on the circuit board 7 are guided with a voltage source as well as the unused contacts 9', 10'." Ex. 1003 at p. 9, ll. 23-28.</p>
<p>a pair of parallel, fluorescent light fixture</p>	<p>The end pieces 14 include connector pins 9, 9', 10, and 10' for installing within opposed receptacles of a fluorescent fixture. "The contact pins 9, 10 and the corresponding, equally sized unused contacts 9' and 10' in the end pieces 13 are - as shown in</p>

Claim 16	DE '320 Disclosure
receptacle connectors extending from each said end cap and configured for installing within the opposed electrical receptacles of the lighting fixture; and	<p>the end view of lamp 2 according to Fig. 5 - arranged with regard to the implementation of the lamp 2 in a form conforming to a fluorescent lamp and lie respectively on the same diameter and extend in the same plane. This plane extends transversely to the light emergence plane of the lamp 2, so that this may be plugged into the pre-existing fluorescent lamp mounting when installing it as a replacement for a fluorescent lamp (compare position 19 in Fig. 6) and may be locked by rotating it about 90°.” <i>Id.</i> at p. 10, ll. 19-30.</p> 
a plurality of LEDs disposed along a surface of said support structure in electrical contact with one another and with at least one pair of said pair of connectors extending from said end caps,	<p>The LEDs 6 are disposed along the circuit board 7 and are in electrical contact with one another and with the pins 9 and 10. “The light-emitting diodes 6 are arranged in rows on a circuit board 7...” <i>Id.</i> at p. 8, ll. 28-29. “The light-emitting diodes 6 are - as shown in Fig. 6 - electrically connected in series on the circuit board 7 together with a diode 13 forming the reverse pole protection means. The line sections of the circuit board 7 are identified with 7.1 and 7.2 and are connected to the contact terminal 9 or 10 of the lamp 2.” <i>Id.</i> at p. 11, ll. 1-6.</p> 
whereby light is divergently emitted along the length of said lighting unit in an included angle	<p>Light output from the LEDs 6 is divergently emitted along the length of the lamp 2 and reflector 8 confines the light emitted from the lamp 2 in an included angle of less than about 180°. “The light-emitting diodes 6 are arranged in rows on a circuit board 7, which is arranged in a reflector 8 made from sheet metal, which has a U-shaped cross-sectional profile.” <i>Id.</i> at p. 8, ll. 28-31. “The reflector 8 is provided on the inside thereof with</p>

Claim 16	DE ‘320 Disclosure
of less than about 180°;	a polished surface in order to enhance the reflection of the light emitted by the light-emitting diodes.” <i>Id.</i> at p. 9, ll. 28-30.
wherein the combination of said support structure and said bulb portion is such that substantially the entire light output of said lighting unit device is emitted away from said surface and is confined to the included angle by sidewalls extending to a height above said surface on opposing sides of said plurality of LEDs between the first end and the second end.	<p>The support structure includes reflector 8, which provides on opposite sides of the circuit board 7 walls that extend above the circuit board 7 to confine the entirety of light emitted from the lamp 2 in an included angle of less than 180°. “The light-emitting diodes 6 are arranged in rows on a circuit board 7, which is arranged in a reflector 8 made from sheet metal, which has a U-shaped cross-sectional profile.” <i>Id.</i> at p. 8, ll. 28-31. “The reflector 8 is provided on the inside thereof with a polished surface in order to enhance the reflection of the light emitted by the light-emitting diodes.” <i>Id.</i> at p. 9, ll. 28-30.</p> 

f. Obviousness of Claims 3 and 9 over DE ‘320 in view of US ‘281, and further in view of JP ‘234

145. As described above in Section VII.(b)e, DE ‘320 in view of US ‘281 renders obvious independent claims 1 and 8. In my opinion, DE ‘320 in view of US ‘281, and further in view of JP ‘234 renders obvious claims 3 and 9. Claim 3 depends from claim 1 and merely adds that the plurality of light emitting diodes

“are white light emitting diode[s].” Claim 9 depends from claim 8 and likewise merely adds that the plurality of LEDs are “white light emitting diode[s].”

146. DE '320 does not explicitly disclose “white light emitting diodes.” However, JP '234 is in the same technology (LED lighting) and in the same field of endeavour (LED-based replacements for fluorescent lamps) as DE '320, and discloses the well-known usage of white light emitting diodes in LED light sources. JP '234 discloses that “it is preferred that a white emission colour is obtained ... by using white light emitting diodes (that radiate white light by shining blue light to a fluorescent substance with yellow light emission).” Ex. 1013 at ¶ 0029.

147. In my opinion, it would have been obvious to a person of ordinary skill in the art around and before 2000 to utilize white LEDs, such as the white LEDs taught by JP '234, as the LEDs of DE '320. As illustrated by JP '234, white LEDs were a known option for inclusion in LED light sources in and around 2000. One would have been motivated to incorporate white LEDs in DE '320 to enable the replacement light source of DE '320 to have the replacement light source emit a color similar to the color emitted from the fluorescent light DE '320 is designed to replace. For example, common sense would motivate the substitution, as one

would recognize that a replacement for a fluorescent light as taught by DE '320 would advantageously incorporate white LEDs.

148. Accordingly, in my opinion, JP '677 in view of JP '536, and further in view of JP '234 renders obvious claims 3 and 9.

VIII. SECONDARY CONSIDERATIONS

149. I understand that Ilumisys has not provided any evidence regarding secondary considerations of non-obviousness. To the extent Ilumisys is permitted to provide any evidence of such secondary considerations later in this case or in any contentions expressed by Ilumisys or its experts attempting to rebut my opinions as expressed in this declaration, I reserve the right to supplement and/or amend this declaration or submit a reply declaration to consider the alleged secondary considerations of non-obviousness.

IX. RIGHT TO SUPPLEMENT

150. I reserve the right to supplement this declaration, if appropriate, should additional information come to light that bears on my opinions contained in this declaration. I also reserve the right to consider and comment on additional evidence, such as objective evidence of non-obviousness, that may be presented by experts for Ilumisys.

151. At any trial or hearing in which I testify in this matter, I may provide demonstrative aids, such as computer animations, excerpts and figures from the relevant exhibits and prior art references, and physical examples to assist in explaining the subject matter discussed in this report.

152. I expect to continue my study and evaluation of relevant prior art as this litigation proceeds, at least up until the end of the period prescribed for discovery. In the event further issues arise which concern the subject matter of this declaration, I expressly reserve the right to supplement, modify, or amend the opinions stated in this declaration as well as the bases supporting my opinions. I further reserve the right to supplement and/or amend this declaration or submit a reply declaration based on any information or contentions expressed by Illumisys or its experts attempting to rebut my opinions as expressed in this declaration. Additionally, I reserve the right to use demonstratives or other exhibits at trial in support of my opinions in any of my expert declarations or supplements thereto.

X. CONCLUSION

153. For the reasons set forth above, it is my opinion that the Challenged Claims of the '327 Patent are invalid.

154. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are

believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on July 3, 2014 in Peabody, Massachusetts

By:

A handwritten signature in cursive script, appearing to read "Thomas M. Lemons", written over a horizontal line.

THOMAS M. LEMONS