

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

**PETITION FOR INTER PARTES REVIEW OF
U.S. PATENT NO. 8,382,327
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.1-.80, 42.100-.123**

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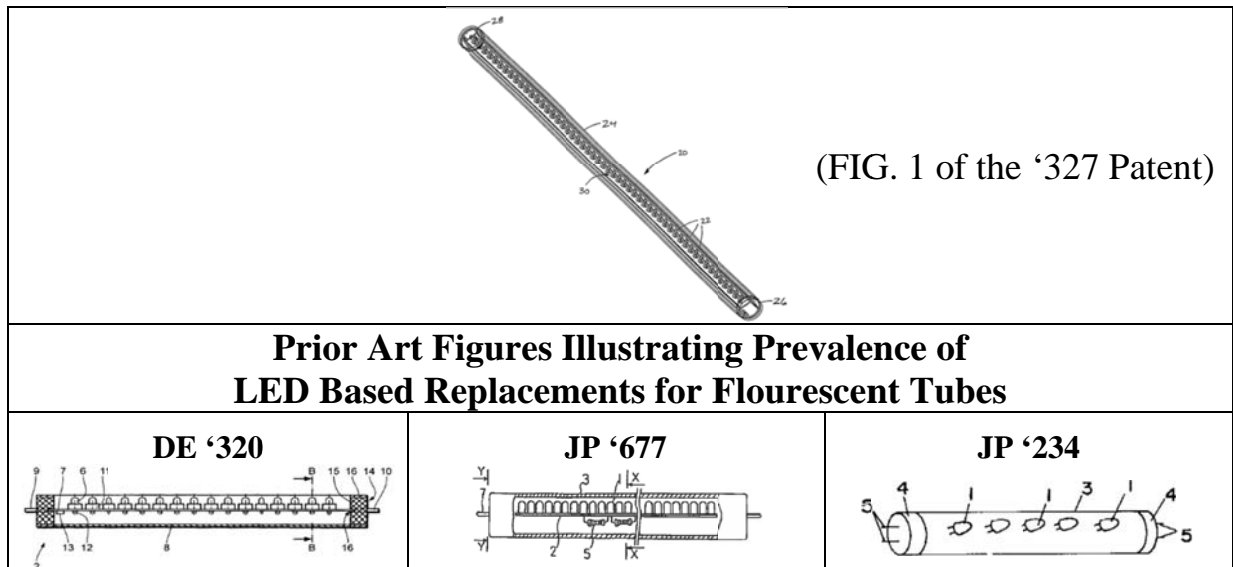
I. INTRODUCTION

Philips Electronics North America Corp. (“Petitioner”) respectfully requests the United States Patent and Trademark Office (“Office”) to (a) grant an *inter partes* review under 35 U.S.C. §§ 311-319 and 37 C.F.R. §§ 42.1-.80 & 42.100-.123, and (b) cancel as unpatentable claims 1-3, 7-9 and 13-16 of U.S. Patent 8,382,327 (“the ‘327 Patent”) (“Ex. 1001”) in light of the prior art set forth herein.

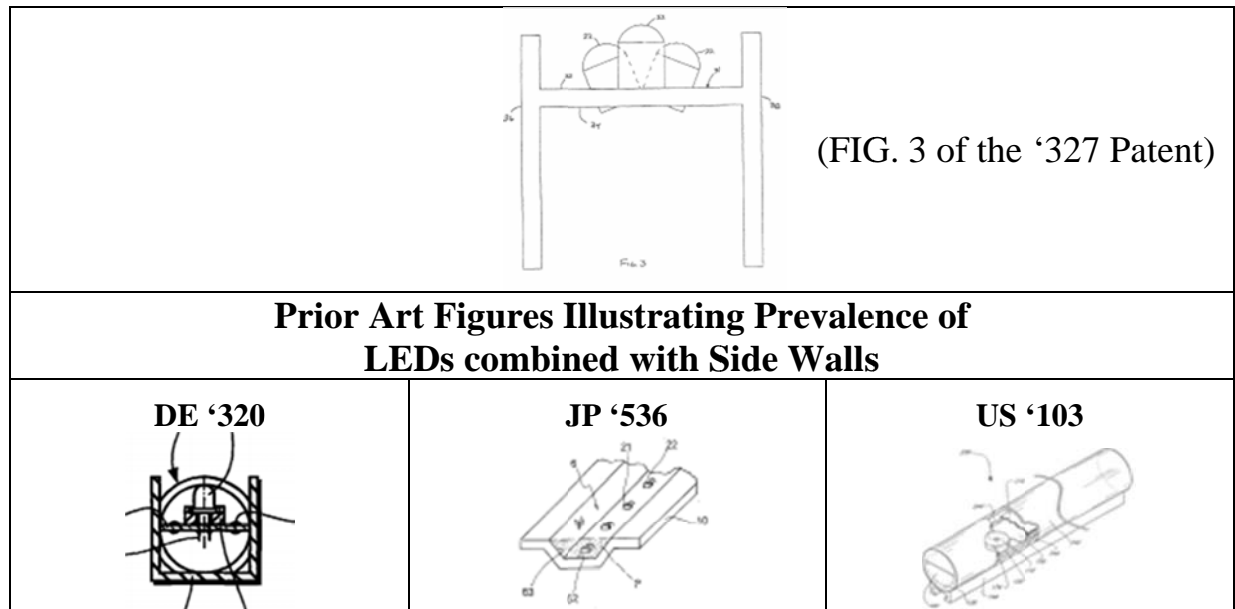
Independent claims 1, 8 and 16 of the ‘327 Patent are generally directed to a replacement fluorescent tube using LEDs including sidewalls around the LEDs.

FIG. 1 of the ‘327 Patent is provided below, along with prior art figures illustrating the well-known prior-art prevalence of replacement fluorescent tubes using LEDs.

FIG. 3 of the ‘327 Patent is also provided below along with prior art figures illustrating the prevalence of LEDs in combination with sidewalls.



As described more fully herein, over three years before the earliest effective filing date of the ‘327 Patent, Japanese Published Patent Application JP08-162677 (“JP ‘677”) (“Ex. 1007” (English translation)) described LED replacements for fluorescent tubes. Nearly a year before said date, LED replacements for fluorescent tubes were also described in German Utility Model DE29900320 (“DE ‘320”) (“Ex. 1003” (English translation)) — and in Japanese Published Patent Application JP11-162234 (“JP ‘234”) (“Ex. 1013” (English translation)).



With respect to the sidewalls, the ‘327 Patent is directed to sidewalls that act to confine light output of the light source to less than about 180°. As described herein, sidewalls that confine light output to less than 180° are prevalent in the prior art. For example, nearly a year before the earliest effective filing date, DE ‘320 described sidewalls that extend above an LED mounting surface in a replacement for a fluorescent tube. Over a year before said date, Japanese

Published Patent Application JP10-308536 (“JP ‘536”) (“Ex. 1010”) described sidewalls that extend above an LED mounting surface in a linear light source. And U.S. Pat. No. 6,582,103 (“US ‘103”) (“Ex. 1015”) described sidewalls (150) that extend above an LED surface in a cylindrical light source. In short, for reasons set forth more fully herein, claims 1-3, 7-9 and 13-16 of the ‘327 Patent should be canceled as unpatentable.

II. MANDATORY NOTICES

A. REAL PARTY-IN-INTEREST

Pursuant to 37 C.F.R. § 42.8(b)(1), Koninklijke Philips N.V. is the real party-in-interest for Petitioner.

B. RELATED MATTERS

Pursuant to 37 C.F.R. § 42.8(b)(2), the ‘327 Patent has been asserted against the Petitioner in the following case which may affect or be affected by a decision in this proceeding: *Illumisys, Inc. d/b/a Toggled v. Philips Electronics North America Corp.*, Civil Action No. 3:13-CV-14961 pending in the United States District Court for the Eastern District of Michigan.

On information and belief, other judicial and administrative matters that could likely affect, or be affected by, a decision in this proceeding include: (1) the pending *inter partes* review request of related Patent No. 8,093,823, filed 2/19/14; (2) the pending *inter partes* review request of related Patent No. 7,510,299, filed 4/30/2014; (3) the patent infringement lawsuit styled *Altair Engineering, Inc. v.*

LEDdynamics, Inc., 07-CV-13150-GCS-SDP (E.D. Mich.), filed 7/27/07, terminated 7/25/11; (4) the patent infringement lawsuit styled *Altair Engineering, Inc. v. LEDS America*, 5:10-CV-13424 (E.D. Mich.), filed 8/26/10, terminated 5/31/11; (5) the interference proceeding styled *Jos Timmermans and Jean C. Raymond Junior Party (Appl. No. 11/085,744) v. Jones J. Robertson and Robert M. Currie Senior Party (U.S. Patent No. 6,860,628)*, 2010 WL 3503767 (Bd. Pat. App. & Interf. 2010); (6) the following pending U.S. Patent Applications, which claim priority to the '327 Patent and/or priority or benefit to an application to which the '327 Patent claims priority or benefit: Ser. No. 13/836,825, filed 3/15/13; Ser. No. 13/777,331, filed 2/26/13; Ser. No. 14/094,455, filed 12/2/13; Ser. No. 14/299,909 filed 6/9/14; Ser. No. 14/299,915 filed 6/9/14; (7) the following issued U.S. Patents, which claim priority or benefit to an application to which the '327 Patent claims priority or benefit: Patent No. 7,049,761 filed 2/12/01 and issued 5/23/06; Patent No. 8,093,823 filed 12/8/04 and issued 1/10/12; Patent No. 8,247,985 filed 3/21/05 and issued 8/21/12; Patent No. 8,482,212 filed 9/30/08 and issued 7/9/13; Patent No. 7,510,299 filed 6/27/11 and issued 5/31/09.

C. NOTICE OF COUNSEL AND SERVICE

Pursuant to 37 C.F.R. § 42.8(b)(3)-(4) and 42.10(a), Petitioner provides the following designation of counsel:

Lead Counsel	Back-Up Counsel
John F. Salazar (Reg. No. 39,353) Email: jfs@middletonlaw.com	Scott W. Higdon (Reg. No. 64,065) Email: swh@middletonlaw.com
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<u>Telephone:</u> 502-584-1135	<u>Facsimile:</u> 502-561-0442

Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition. Service of any documents via hand-delivery or mailed documents may be made at the postal address designated above.

III. PAYMENT OF FEES

Ten claims are being challenged. Pursuant to 37 C.F.R. § 42.103 and 42.15(a)(1)-(4), payment in the amount of **\$23,000.00** is submitted herewith (includes \$9,000 request fee and pre-payment of \$14,000 post-institution fee).

IV. REQUIREMENTS FOR *INTER PARTES* REVIEW

As set forth below and pursuant to 37 C.F.R. § 42.104, each requirement for *inter partes* review of the ‘327 Patent is satisfied.

A. GROUNDS FOR STANDING

Petitioner hereby certifies that the ‘327 Patent is available for *inter partes* review and that the Petitioner is not barred or estopped from requesting *inter partes* review. Specifically, Petitioner certifies that: (1) Petitioner is not the owner of the ‘327 Patent; (2) Petitioner has not filed a civil action challenging the validity of any claim of the ‘327 Patent; (3) this petition is filed less than one year from December 6, 2013, the date on which Petitioner was served with a complaint

alleging infringement of the ‘327 Patent; (4) the estoppel provisions of 35 U.S.C. §315(e)(1) do not prohibit this *inter partes* review; and (5) this Petition is being filed after the date that is the later of: (a) nine months after the date of the grant of the ‘327 Patent or (b) the date of termination of any post-grant review thereof.

B. IDENTIFICATION OF CHALLENGE AND RELIEF REQUESTED

1. Claims for Which *Inter Partes* Review is Requested

Pursuant to 37 C.F.R. § 42.104(b), the precise relief requested is that *inter partes* review be granted and each of claims 1-3, 7-9 and 13-16 be canceled as invalid under 35 U.S.C. § 103, as set forth in more detail herein.

2. Prior Art on Which Challenge is Based

The ‘327 Patent claims benefit of a provisional filed 2/11/00. Therefore, assuming adequate support, the earliest effective filing date for the ‘327 Patent is 2/11/00. *Inter partes* review is requested based on the following references¹:

Ex.	Reference	Pub.	Filed	Abbr.
1002/1003 ²	German Utility Model DE29900320	5/12/99	1/4/99	DE ‘320

¹ General references herein to each prior art reference will be to the abbreviations therefor. Citations herein will be to the Exhibit number occupied by said reference, in the form “Ex. 10[--] at [pinpoint citation]”.

² English Translation, which is cited herein.

1005	US Pat. App. Pub. No. 2003/0076281	4/24/03	6/15/99	US ‘281
1006/1007 ²	Jap. Pub. Patent App. JP08-162677	6/21/96	12/5/94	JP ‘677
1009/1010 ²	Jap. Pub. Patent App. JP10-308536	11/17/98	5/6/97	JP ‘536
1012/1013 ²	Japanese Pub. Pat. App. JP11-162234	6/18/99	11/25/97	JP ‘234
1015	US Pat. No. 6,582,103	6/24/03	7/20/00 ³	US ‘103

DE ‘320 and JP ‘234 qualify as prior art under at least 35 U.S.C. § 102(a).

US ‘281 and US ‘103 qualify as prior art under at least 35 U.S.C. § 102(e). The other references qualify as prior art under at least 35 U.S.C. § 102(b).

3. Statutory Grounds for Challenge

The grounds under 35 U.S.C. § 103 on which each challenge is based is set forth in summary fashion in the table below:

Grd	Claims	Obvious under §103(a) over
A	1-2,7-8,13-16	JP ‘677 in view of JP ‘536
B	3, 9	JP ‘677 in view of JP ‘536, and further in view of JP ‘234
C	1-3,7-9,13-16	JP ‘234 in view of US ‘103
D	1-3,7-9,13-16	JP ‘234 in view of JP ‘536
E	1-2,7-8,13, 14, 16	DE ‘320 in view of US ‘281

³ US ‘103 claims benefit of and is fully supported by Prov. No. 60/144,920, filed 7/21/99 – attached as Ex. 1016.

F	3, 9	DE '320 in view of US '281 and further in view of JP '234
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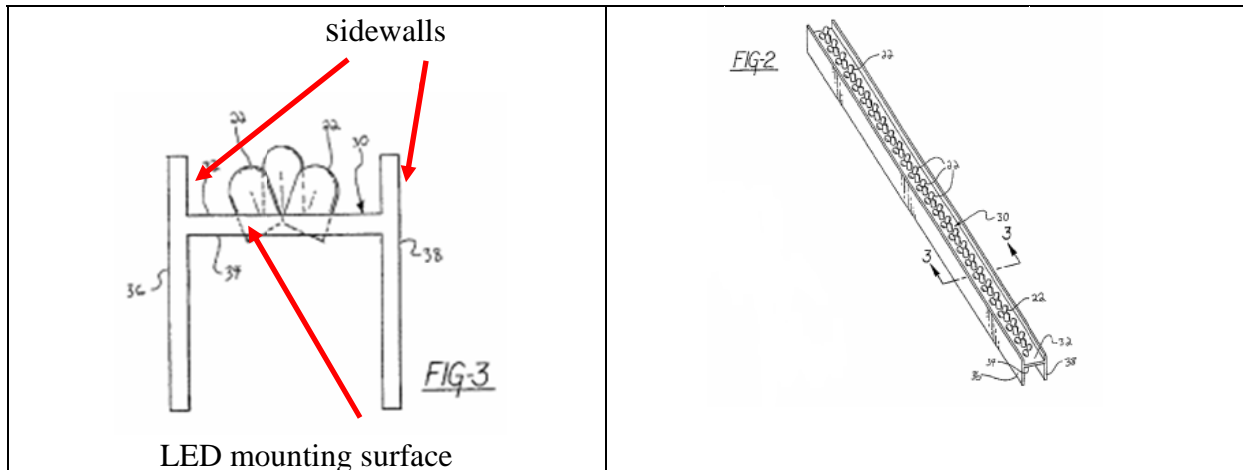
V. OVERVIEW OF THE '327 PATENT

A. DISCLOSURE OF THE '327 PATENT

The '327 Patent issued on 2/26/13 from an application filed 12/10/10, which was a continuation of an application filed on 3/21/05 (now U.S. Pat. No. 8,247,985), which was a continuation of an application filed on 2/12/01 (now U.S. Pat. No. 7,049,761). The '327 Patent further claims benefit of U.S. Prov. App. No. 60/181,744, filed 2/11/00. *See* Ex. 1001 at p. 1.

The '327 Patent discloses an LED based light source that replaces a conventional fluorescent tube and that uses sidewalls on either side of the LEDs. Ex. 1001 at 2:22-36, 61-63. The light source includes a bulb portion 24 with end caps 26, 28 disposed at opposite ends thereof. *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 2:32-34 and 3:7-11. LEDs 22 are arranged to emit light through the bulb portion 24. *Id.* at 2:51-53.

The claims of the '327 Patent include various recitations related to light being confined to an included angle by sidewalls extending to a height above the LED mounting surface. *Id.* at claims 1, 8 and 16. Some claims recite that the sidewalls extend between the first and second end caps, as allegedly illustrated by FIGS. 2-3 of the '327 Patent (reproduced below). *Id.*



B. SUMMARY OF THE PROSECUTION HISTORY OF THE ‘327 PATENT

The ‘327 Patent issued on 2/26/13 with sixteen (16) claims.

In the Statement of Reasons for Patentability, the examiner found as related to claim 1 that the prior art fails to disclose or fairly suggest an LED based fluorescent bulb wherein “the arrangement of the circuit board and the bulb portion is such that substantially the entire light output the light device ... is confined to the included angle by sidewalls extending to a height above the one surface on opposing sides” of the LEDs. Ex. 1019 at p. 27. Similarly, as related to independent claim 8, the examiner found that the prior art failed to disclose or fairly suggest such replacement tube having “opaque side walls extending above the one side of the circuit board...to confine an entirety of light emitted from the replacement light tube to an included angle of less than about 180°”. *Id.* at pp. 27-28. Further, as to independent claim 16, the examiner found that the prior art fails to disclose or fairly suggest such device wherein “substantially the entire light

output of said lighting unit ... is confined to the included angle by sidewalls extending to a height above said surface...”. *Id.* at p. 28.

VI. CLAIM CONSTRUCTION

A claim subject to *inter partes* review is to receive the “broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b). Under that standard, “[w]ords in a claim are to be given their ordinary and accustomed meaning unless the inventor chooses to be his own lexicographer in the specification.” *See In re Bass*, 314 F.3d 575, 577 (Fed. Cir. 2002). The following claim construction is provided to aid the Board. All claim terms not specifically addressed in this section have been accorded their broadest reasonable construction in light of the patent specification.

A. SUPPORT STRUCTURE (CLAIM 16)

Claim 16 includes the term “support structure,” which does not appear in the ‘327 Patent specification. Petitioner submits that the broadest 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; Ex. 1017 at ¶ 86.

VII. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the ‘327 Patent’s field around and before 2000 (“POSITA”) would have good knowledge of lighting design in general, including knowledge of LEDs and related technology for driving LEDs, mounting LEDs, and influencing illumination from LEDs. This person would have gained this

knowledge through an undergraduate degree in Electrical Engineering, an equivalent discipline, or two or more years of work experience in lighting design. *See* Ex. 1017 at ¶ 24.

Moreover, it is noted the level of ordinary skill in the art is evidenced by the references. *See In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). The prior art applied herein demonstrates that a POSITA was aware of problems that linear fluorescent lamps have, including a relatively short life span and relatively high energy consumption, resulting in relatively high operating and maintenance costs. Ex. 1003 at p. 2, ll. 21-26; Ex. 1007 at ¶¶ 0004, 0009, 0016. It was known that light sources that incorporate LEDs and replace linear fluorescent lamps provided many benefits over linear fluorescent lamps. Ex. 1003 at p. 4, l. 22 – p. 5, l. 7; Ex. 1007 at ¶¶ 0005, 0009, 0016; Ex. 1013 at ¶¶ 0005, 0006, 0037, 0043; Ex. 1017 at ¶ 56. It was known LEDs had the capability to be used in light sources having identical form and connectors as linear fluorescent lamps. Ex. 1003 at p. 4, ll. 3-10; Ex. 1007 at ¶¶ [Structure], 0005, 0006, 0009; Ex. 1013 at ¶ 0025; Ex. 1017 at ¶ 56. It was also known to use reflectors on opposed sides of LEDs to direct light output from the LEDs to a desired illumination area. Ex. 1003 at p. 8, ll. 28-31; Ex. 1010 at Abstract; Ex. 1015 at 4:3-15; Ex. 1017 at ¶ 63.

VIII. SUPPORTING EVIDENCE AND MATERIAL FACTS

A. SUPPORTING EVIDENCE

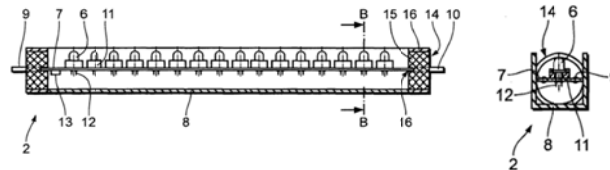
Pursuant to 37 C.F.R. § 42.105(b)(5), the exhibit numbers of the supporting evidence, including identifying specific portions of the evidence that support the challenge, are provided in Section IX below. An Exhibit Appendix is attached.

Pursuant to 37 C.F.R. § 42.63(b), Exhibits 1004, 1008, 1011, and 1014 are affidavits attesting to the accuracy of the English translations of Exhibits 1003, 1007, 1010, and 1013 (translations are cited herein). The technical information and grounds for rejection explained in this petition are further supported by the Declaration of Thomas M. Lemons (“TML”) attached as Ex. 1017.

B. STATEMENT OF MATERIAL FACTS

Pursuant to 37 C.F.R. § 42.22, Petitioner submits the following statement of material facts:

DE ‘320 (Ex. 1003)



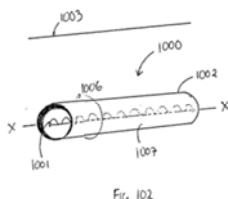
1. DE ‘320 discloses an LED light source that is “a replacement for an existing fluorescent lamp.” Ex. 1003 at p. 3, ll. 11-15; FIGS. 1-7.
2. DE ‘320 discloses the LED light source “...substantially corresponds, with regard to the external dimensions as well as the layout and the size or geometry of the electrical terminals for the illumination means, to a conventional fluorescent lamp...” *Id.* at p. 4, ll. 3-8.

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

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

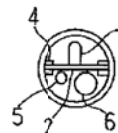
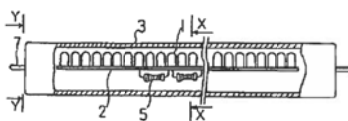
5. DE '320 discloses a reflector 8 that is provided on opposed sides of, and extends above, the LEDs 6 and the circuit board 7. The reflector 8 has “a polished surface in order to enhance the reflection of light emitted by the light-emitting diodes.” *Id.* at p. 9, ll. 28-30; FIGS. 1-8b.

6. DE '320 discloses a power supply and electrical circuit that supplies current to its LEDs 6. *Id.* at p. 11, lines 1-16; p. 5, line 27 – p. 6, line 1.



US '281 (Ex. 1005)

1. US '281 discloses a translucent member 1002 that may be implemented in a cylindrical housing 1007 provided around LEDs 1001 to provide uniformity of light distribution at an object 1003. Ex. 1005 at ¶¶ 261, 262; FIGS. 101A-102.



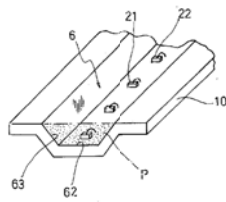
JP ‘677 (Ex. 1007)

1. 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.

2. 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.

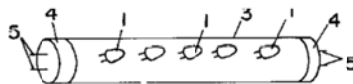
3. JP ‘677 discloses LEDs 1 arranged on a linear printed circuit board 2; *Id.* at ¶ 0006; FIGS. 1(A) & 1(B); and discloses a power supply and electrical circuit that receives current and includes a “full wave rectifying and smoothing circuit”, a “starting circuit”, a “voltage smoothing circuit” and “a current that has been limited”. *Id.* at ¶ 0013.

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



JP ‘536 (Ex. 1010)

1. JP ‘536 discloses reflective surfaces 61, 63 provided on opposed sides of a surface supporting a linear array of LEDs 21, 22. Ex. 1010 at Abstract, FIGS. 3-5.

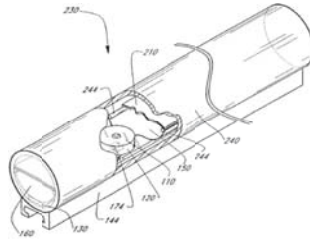


JP ‘234 (Ex. 1013)

1. JP ‘234 discloses a LED light source having a number of light emitting diode elements 1 arranged in a cylindrical tube 3 that has the same form and dimensions as a ready-made fluorescent lamp. Ex. 1013 at ¶ 0025; FIG. 5.

2. The LED light source of JP ‘234 contains bases 4 at each end of the tube that can be attached and detached in a standard fluorescent light socket. *Id.*

3. The bases 4 each include a pair of terminal pins 5. *Id.*
4. JP ‘234 discloses a power supply and electrical circuit including a “rectifying circuit”, “driving circuit”, “power factor correction circuit”, and a “current limiting element”. *Id.* at ¶¶ 0027, 0028; FIGS. 6 & 7.



US ‘103 (Ex. 1015)

1. US ‘103 discloses “a cylindrically shaped housing 240 that functions both as a housing and a protective outer cover”. Ex. 1015 at 5:33-35, FIGS. 3 & 4.
2. US ‘103 discloses a reflective surface 150 that extends above and is provided on opposed sides of linearly arranged LEDs 174 within the cylindrically shaped housing 240. *Id.* at FIGS. 3 & 4.

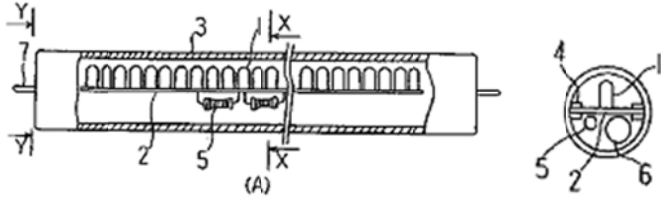
IX. IDENTIFICATION OF HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE

Pursuant to 37 C.F.R. § 42.104(b)(4)-(5), the following analysis demonstrates that the challenged claims are unpatentable. Succinctly, obviousness rejections under 35 U.S.C. § 103(a) are discussed with regard to each challenged claim.

A. CLAIMS 1, 2, 7-8, 13-16 OBVIOUS OVER JP ‘677 IN VIEW OF JP ‘536

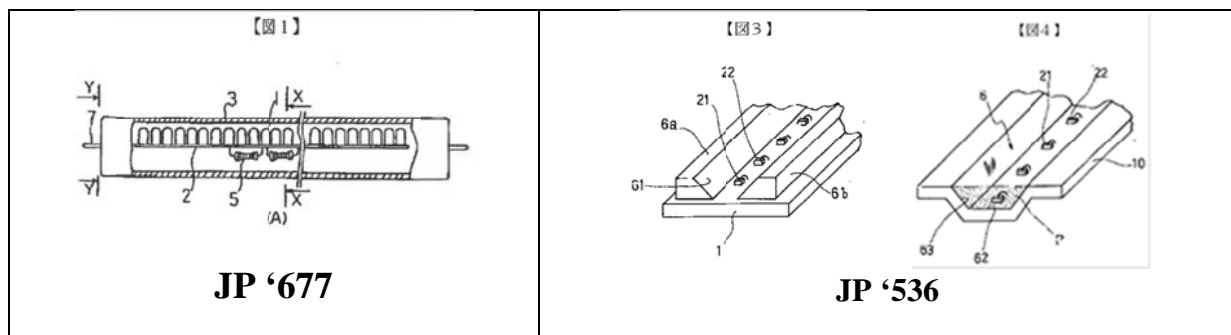
As provided by the following analysis and claim charts, as well as the declaration of TML, claims 1, 2, 7-9, and 13-16 are obvious over JP ‘677 in view of JP ‘536.

1. Claim 1 obvious over JP ‘677 in view of JP ‘536

Claim 1	JP ‘677 Disclosure
A light device for illumination by a power supply circuit comprising:	<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> 
a bulb portion,	<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.” <i>Id.</i> at ¶ 0013; FIGS. 1(A) and 1(B).</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	<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</p>

Claim 1	JP ‘677 Disclosure
cap, wherein the bulb portion and the pair of end caps are dimensioned to be mounted in a fluorescent light tube socket; and	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).
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;	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).
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	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).
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	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 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.	JP ‘677 does not explicitly disclose the sidewalls of this limitation.

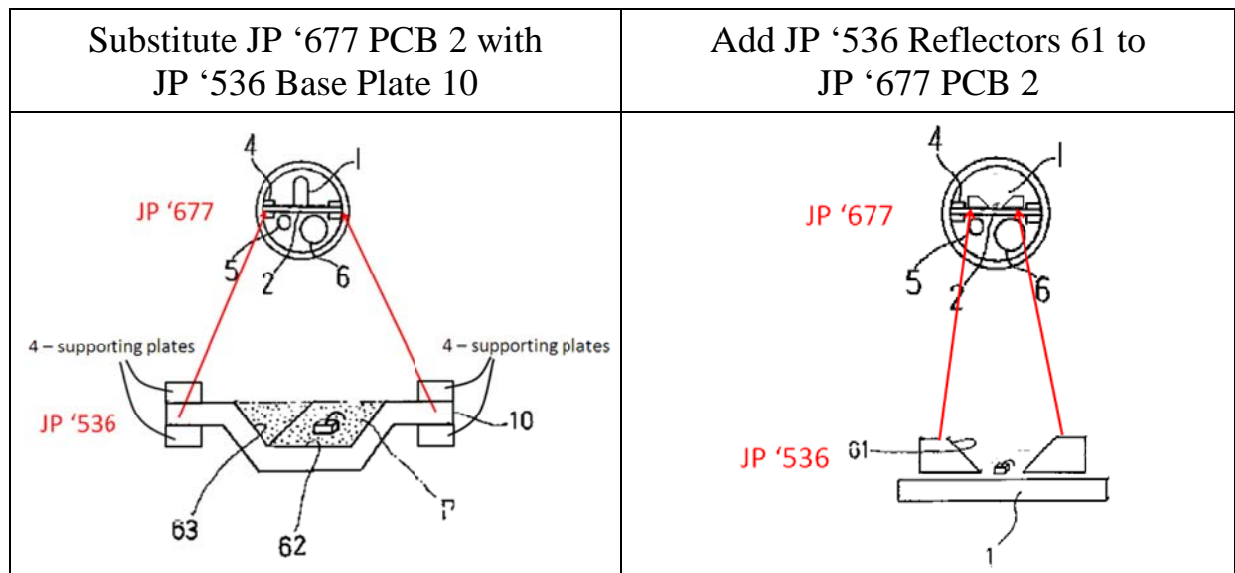
As described in the above claim chart, JP ‘677 does not explicitly disclose that the light output is “confined to an included angle by sidewalls extending to a height above the one surface on opposing sides of the plurality light emitting diodes between the first end cap and the second end cap” of claim 1. However, this deficiency is overcome by JP ‘536, which 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 FIG. 3; 63 in FIG. 4). The reflective surfaces extend on opposing sides of the LEDs, above a surface along which the LEDs are arranged, and confine the entirety of the light output of the device to an included angle of less than 180° . Ex. 1017 at ¶ 98.



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. Ex. 1010 at Abstract. JP ‘536 discloses such arrangement providing optical output such that: “output between parts

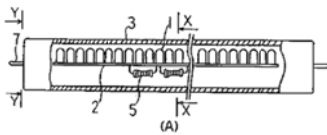
directly above a lighted LED and other parts has virtually disappeared ... to provide a LED linear light source with low variability in optical output.” *Id.* at ¶10021. This improvement in light output from the reflective surfaces of JP ‘536 is illustrated in graphical form in Figures 2 and 6 of JP ‘536.

It would have been obvious to a POSITA to incorporate into JP ‘677 reflectors that extend above a mounting surface for LEDs on opposite sides of the LEDs, such as the reflectors 61 or 63 described by JP ‘536. Ex. 1017 at ¶ 100. For example, the PCB of JP ‘677 could be substituted with the base plate 10 (Fig. 4 of JP ‘536), which could be secured between plates 4 of JP ‘677 in a similar manner as the PCB 2 of JP ‘677 is secured between plates 4. *Id.* Alternatively, 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 JP ‘536. *Id.*



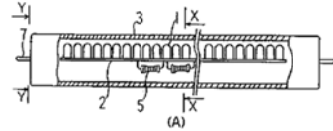
A POSITA would have been motivated to incorporate reflectors, as taught by JP ‘536, into JP ‘677 to achieve low variability in light output from the light source of JP ‘677. *Id.* at ¶ 101. JP ‘677 discloses a desire for uniform brightness from its LED-based linear light source (Ex. 1007 at ¶¶ 0011, 0013) and a POSITA would be motivated to incorporate the reflectors of JP ‘536 which also pertains to LED-based linear light sources, to improve uniformity of the brightness. Ex. 1017 at ¶ 101.

2. Claim 2 obvious over JP ‘677 in view of JP ‘536

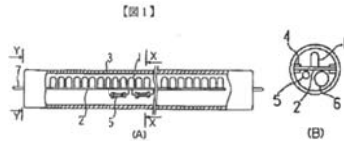
Claim 2	JP ‘677
“each of the pair of end caps includes an electrical bi-pin connector.”	<p>JP ‘677 discloses end caps with male bi-pin connectors 7 that are compatible with fluorescent lamp sockets: “Electric connection fittings 7 are established in both ends of circular tube 3, and outer diameter and length of circular tube 3 and electric connection fittings 7 have the same dimensions and arrangement as the linear fluorescent lamp...” Ex. 1007 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> 

3. Claim 7 obvious over JP ‘677 in view of JP ‘536

Claim 7	JP ‘677
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 ‘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 LEDs in JP ‘677 are disposed continuously along the length of the bulb portion.

Claim 7	JP ‘677
	

4. Claim 8 obvious over ‘JP ‘677 in view of JP ‘536

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	<p>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).</p> 
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).
between a first end cap and a second end cap mounted on opposite ends of the bulb	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

Claim 8	JP ‘677 Disclosure	
portion, wherein the plurality of light emitting diodes is mounted on only one side of a circuit board in a light emitting direction;		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).
an electrical circuit for illuminating in response to electrical current to be received from the flourescent light fixture; and	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.	
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°.	JP ‘677 does not explicitly disclose this limitation.	

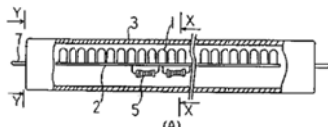
As described in the above claim chart, JP ‘677 does not explicitly disclose the “opaque sidewalls” limitation of claim 8. However, this deficiency is overcome by JP ‘536, which discloses LEDs 21, 22 positioned between opposing opaque sidewalls 61 or 63 that act as reflective surfaces. Ex. 1010 at Abstract. As described above in Section IX.A.1, it would have been obvious to a POSITA to incorporate into JP ‘677 the reflectors of JP ‘536 which extend above a mounting surface for LEDs on opposite sides of the LEDs, and would confine the entirety of

light emitted from the LEDs of JP ‘677 to an included angle of less than 180°. Ex. 1017 at ¶¶ 100-101.

5. Claim 13 obvious over JP ‘677 in view of JP ‘536

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”. Ex. 1007 at ¶ 0006. Further, JP ‘536 indicates “...optical output is high directly above a lighted LED...” Ex. 1010 at ¶ 0021.

6. Claim 14 obvious over JP ‘677 in view of JP ‘536

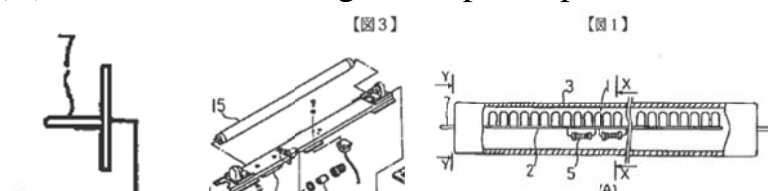
Claim 14	JP ‘677 Disclosure
The improvement of claim 8 wherein the plurality of light emitting diodes is arranged substantially continuously along the length of the bulb portion.	JP ‘677 describes that “light emitting diodes are arranged in printed circuit board 2 in a linear form...” Ex. 1007 at [Aim].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

7. Claim 15 obvious over JP ‘677 in view of JP ‘536

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.

8. Claim 16 obvious over JP ‘677 in view of JP ‘536

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. 

Claim 16	JP '677 Disclosure
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	JP '677 discloses connection pins 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 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).
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>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="548 890 1317 1079" data-label="Diagram"> </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>
whereby light is divergently emitted along the length of said lighting unit in an included angle of less than about 180°;	<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="591 1677 951 1829" 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 2. “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.	JP ‘677 does not explicitly disclose this limitation.	

As described in the above claim chart, JP ‘677 does not explicitly disclose the last limitation of claim 16 (“is confined to the included angle by sidewalls ...”). However, this deficiency is overcome by JP ‘536 which discloses LEDs 21,22 positioned between opposing sidewalls 61 or 63 that act as reflective surfaces. Ex. 1010 at Abstract. As described above in Section IX.A.1, it would have been obvious to a POSITA to incorporate into JP ‘677 the reflectors of JP ‘536 which extend above a mounting surface for LEDs on opposite sides of the LEDs and would confine the light emitted from the light source of JP ‘677 to an included angle of less than 180°. Ex. 1017 at ¶¶ 100-101. Moreover, if the Board finds JP ‘677 does not explicitly disclose “whereby light is divergently emitted along the length of said unit in an included angle of less than about 180°” as provided in

claim 16, incorporation of reflectors in JP ‘677 as proposed would meet this limitation. *Id.* at ¶ 102.

B. CLAIMS 3 AND 9 OBVIOUS OVER JP ‘677 IN VIEW OF JP ‘536 AND FURTHER IN VIEW OF JP ‘234

1. Claim 3 is obvious over JP ‘677 in view of JP ‘536 and further in view of JP ‘234

JP ‘677 in view of JP ‘536 and further in view of JP ‘234 also renders obvious claim 3. Claim 3 depends from claim 1 and merely adds that the plurality of LEDs “are white light emitting diode[s].” JP ‘234, in the same technology (LED lighting) and same field of endeavour (LED-based replacements for fluorescent lamps) as JP ‘677, 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. In view of white LEDs being a known option for inclusion in LED light sources in and around 2000, it would have been obvious to a POSITA to substitute the LEDs of JP ‘677 with white LEDs, such as the white LEDs taught by JP ‘234. Ex. 1017 at ¶ 107. 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. *Id.* 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. *Id.* 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; Ex. 1017 at ¶ 107. Such teachings would motivate a POSITA 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. Ex. 1017 at ¶ 107. Thus, the addition of JP ‘234 renders obvious claim 3.

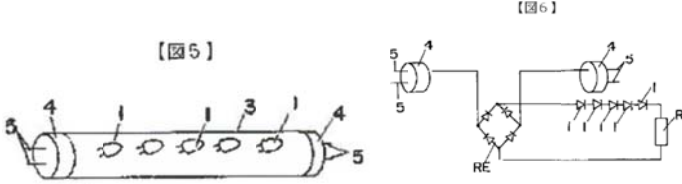
2. Claim 9 is obvious over JP ‘677 in view of JP ‘536 and further in view of JP ‘234

JP ‘677 in view of JP ‘536 and further in view of JP ‘234 also renders obvious claim 9. Claim 9 depends from claim 8 and merely adds that the plurality of LEDs are “white light emitting diode[s].” For the same reasons given above with respect to claim 3, the addition of JP ‘234 also renders obvious claim 9.

C. CLAIMS 1-3, 7-9, 13-16 OBVIOUS OVER JP ‘234 IN VIEW OF US ‘103

As provided by the following analysis and claim charts, as well as the declaration of TML, claims 1-3, 7-9, and 13-16 are obvious over JP ‘234 in view of US ‘103.

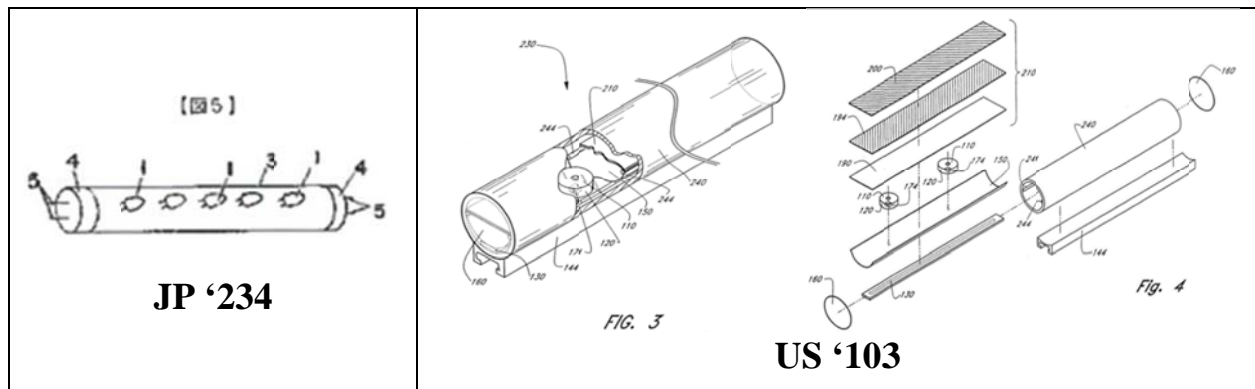
1. Claim 1 obvious over JP ‘234 in view of US ‘103

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 and 7.</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 fluorescent 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="673 336 1380 535"> <p>Figure 6 is a circuit diagram showing a bulb portion (5) connected to a resistor (R) and a switch (S). Figure 5 is a cross-sectional view of a cylindrical tube (3) containing LEDs (1) mounted on a surface (4).</p> </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> at 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 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>

As described in the above claim chart, JP ‘234 does not explicitly disclose “substantially the entire light output ... is confined to an included angle by *sidewalls* extending to a height above the one surface...” of claim 1. However,

this deficiency is overcome by US '103, which discloses LEDs 174 positioned between opposing sidewalls 150 in a linear cylindrical illumination apparatus. Ex. 1015 at Abstract; FIGS. 3 & 4. The reflective surface 150 confines light output from the illumination apparatus to an included angle of less than 180°. Ex. 1017 at ¶ 115.



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 3:50-53. “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% ...” *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. 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.

It would have been obvious to a POSITA to incorporate a reflecting sheet, such as reflecting sheet 150 of US ‘103, in combination with the LEDs of JP ‘234. Ex. 1017 at ¶ 117. For example, the circuit board 130, LEDs 174 (optionally in combination with the optical diverters 110), and reflecting sheet 150 of US ‘103 can 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. *Id.* A POSITA would have been motivated to incorporate into JP ‘234 the reflective sheet 150 of US ‘103 to achieve the predictable result of reflecting light emitted from LEDs toward a desired illumination area. *Id.* Moreover, US ‘103 discloses positioning of the circuit board 130, LEDs 174, and reflecting sheet 150 in a cylindrically and linearly shaped housing 240 – and incorporating such components in the similar cylindrical and linear tube 3 of JP ‘234 would be obvious to a POSITA. *Id.* Moreover, if the Board finds that JP ‘234 does not explicitly disclose that the LEDs are disposed along one surface of a circuit board and mounted with respect to such

surface, incorporation of the circuit board 130, LEDs 174, and reflecting sheet 150 in the light source of JP ‘234 would likewise overcome such deficiency. *Id.* at ¶ 118.

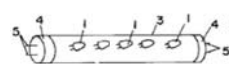
2. Claim 2 obvious over JP ‘234 in view of US ‘103

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.” Ex. 1013 at ¶ 0025; FIG. 5.

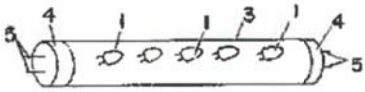
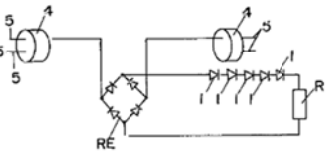
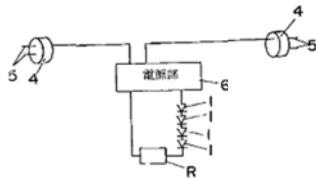
3. Claim 3 obvious over JP ‘234 in view of US ‘103

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.

4. Claim 7 obvious over JP ‘234 in view of US ‘103

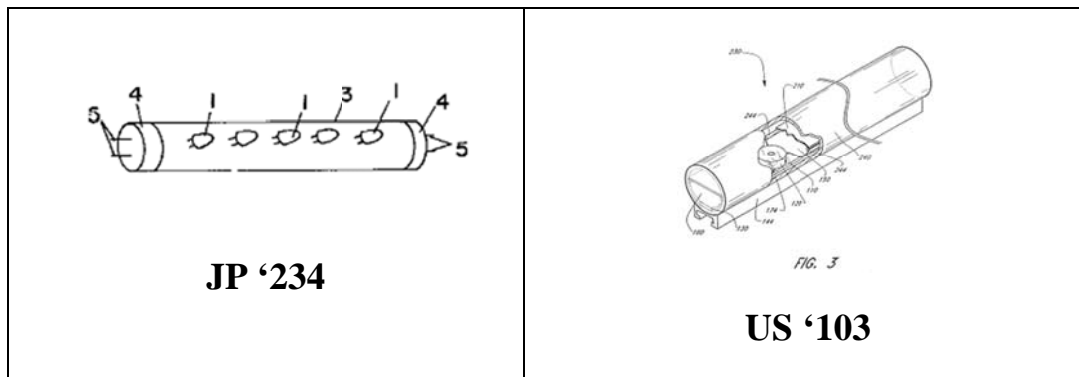
Claim 7	JP ‘234 Disclosure
The light device of claim 1 wherein the plurality of light emitting diodes is arranged substantially continuously between the opposite ends of the bulb portion.	JP ‘234 discloses that LEDs 1 can be mounted on a plane surface, describing that a number of light emitting diode 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. 

5. Claim 8 obvious over JP '234 in view of US '103

Claim 8	JP '234 Disclosure
In a replacement light tube for a fluorescent light fixture having a light tube socket, the improvement 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.</p> <p style="text-align: center;">【図5】</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>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>
an electrical circuit for illuminating in response to electrical current to be received from the fluorescent light fixture; and	<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>
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	<p>JP '234 discloses emission toward a target surface, but does not explicitly disclose that the light output is confined to an included angle by sidewalls</p>

Claim 8	JP ‘234 Disclosure
emitted from the replacement light tube to an included angle of less than about 180°.	extending above the one side of the circuit board.

As described in the above claim chart, JP ‘234 does not explicitly disclose the “opaque side walls” limitation of claim 8. However, this deficiency is overcome by US ‘103 which discloses LEDs 174 positioned between opposing opaque sidewalls 150 that act as reflective surfaces. Ex. 1015 at Abst.; FIGS. 3, 4.



As described above in Section IX.C.1, it would have been obvious to incorporate into JP ‘234 the reflecting sheet 150 of US ‘103, which extends above a mounting surface for LEDs on opposite sides of the LEDs and would confine the light emitted from the LEDs of JP ‘234 to an included angle of less than 180°. Ex. 1017 at ¶¶ 115, 117. Moreover, if the Board finds that JP ‘234 does not explicitly disclose the circuit board or the plurality of LEDs mounted on only one side of the circuit board, incorporation of the circuit board 130, LEDs 174, and sheet 150 of US ‘103 in the light source of JP ‘234 would likewise overcome such deficiency. *Id.* at ¶ 118.

6. Claim 9 obvious over JP ‘234 in view of US ‘103

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).” Ex. 1013 at ¶ 0029.

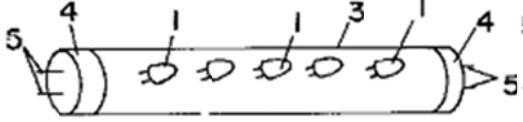
7. Claim 13 obvious over JP ‘234 in view of US ‘103

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.	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.

If the board finds that ‘JP 234 fails to disclose LEDs that emit light centered at a 90 degree angle relative to the circuit board, US ‘103 discloses such. US ‘103 discloses: “The plural LEDs are coupled to each other electrically by a printed circuit board 130.” Ex. 1015 at 3:50-51. FIG. 11 of US ‘103 depicts LED package 430 centered at 90° from the circuit board. It would have been obvious to a POSITA to incorporate LEDs, such as LEDs 174 of US ‘103, in combination with the structure of JP ‘234. Ex. 1017 at ¶ 119. For example, the circuit board 130, LEDs 174 and reflecting sheet 150 of US ‘103 can 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. *Id.* A POSITA would have been motivated to

incorporate into JP ‘234 the LED output of US ‘103 to achieve the predictable result of directing light emitted from LEDs toward a desired illumination area. *Id.*

8. Claim 14 obvious over JP ‘234 in view of US ‘103

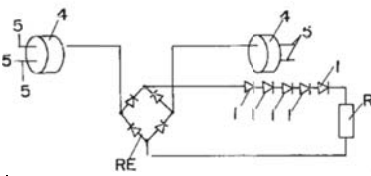
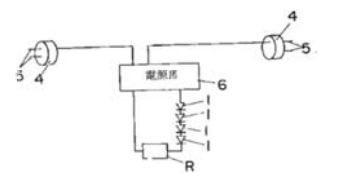
Claim 14	JP ‘234
The improvement of claim 8 wherein the plurality of light emitting diodes is arranged substantially continuously along the length of the bulb portion.	<p>JP ‘234 discloses that LEDs 1 can be mounted on a plane surface, describing that “a number of light emitting diode elements ... have been grouped on a plane.” Ex. 1013 at ¶ 0018. Fig. 5 of JP ‘234 discloses that the LEDs 1 are arranged substantially continuously along the length of the bulb portion.</p> 

9. Claim 15 obvious over JP ‘234 in view of US ‘103

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>

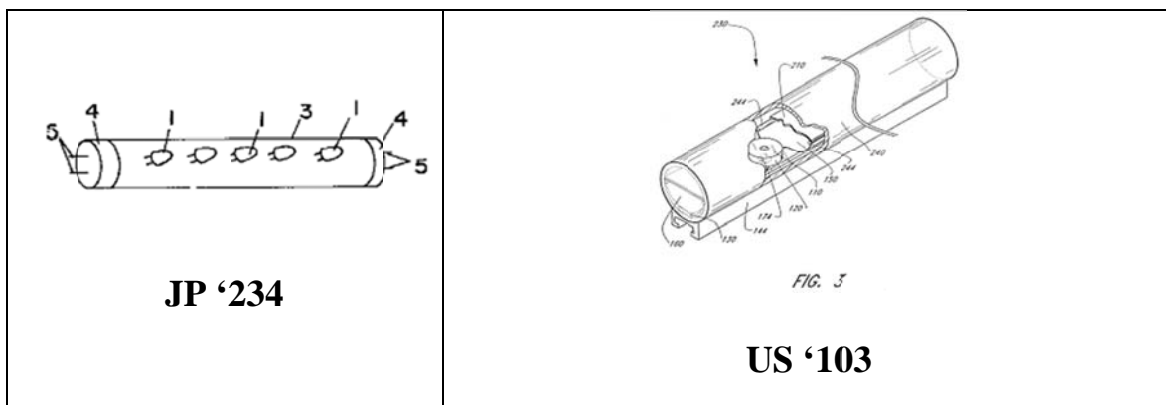
10. Claim 16 obvious over JP ‘234 in view of US ‘103

Claim 16	JP ‘234 Disclosure
An LED lighting unit for replacing a conventional fluorescent tube between the opposed electrical	<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</p>

Claim 16	JP ‘234 Disclosure
receptacles of a conventional fluorescent lighting fixture comprising:	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.
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,	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. <div style="text-align: center;">   </div>
whereby light is divergently emitted along the length of	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.

Claim 16	JP ‘234 Disclosure
said lighting unit in an included angle of less than about 180°;	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 about 180° as illustrated in FIGS. 1, 2 and 16.
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.	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.

As described in the above claim chart, JP ‘234 does not explicitly disclose “the entire light output ... is confined to the included angle by sidewalls extending to a height above said surface ...” of claim 16. However, this deficiency is overcome by US ‘103 which discloses LEDs 174 positioned between opposing opaque sidewalls 150 that act as surfaces. Ex. 1015 at Abstract; FIGS. 3 and 4.



As described above in Section IX.C.1, it would have been obvious to incorporate into JP ‘234 the reflecting sheet 150 of US ‘103, which extends above a mounting surface for LEDs on opposite sides of the LEDs and would confine the light emitted from the LEDs of JP ‘234 to an included angle of less than 180°. Ex. 1017 at ¶¶ 115, 117. Moreover, if the Board finds that JP ‘234 does not explicitly disclose the surface or the plurality of LEDs disposed along the surface, incorporation of the circuit board 130, LEDs 174, and sheet 150 in the light source of JP ‘234 would likewise overcome such deficiency. *Id.* at ¶ 118.

D. CLAIMS 1-3, 7-9, 13-16 OBVIOUS OVER JP ‘234 IN VIEW OF JP ‘536

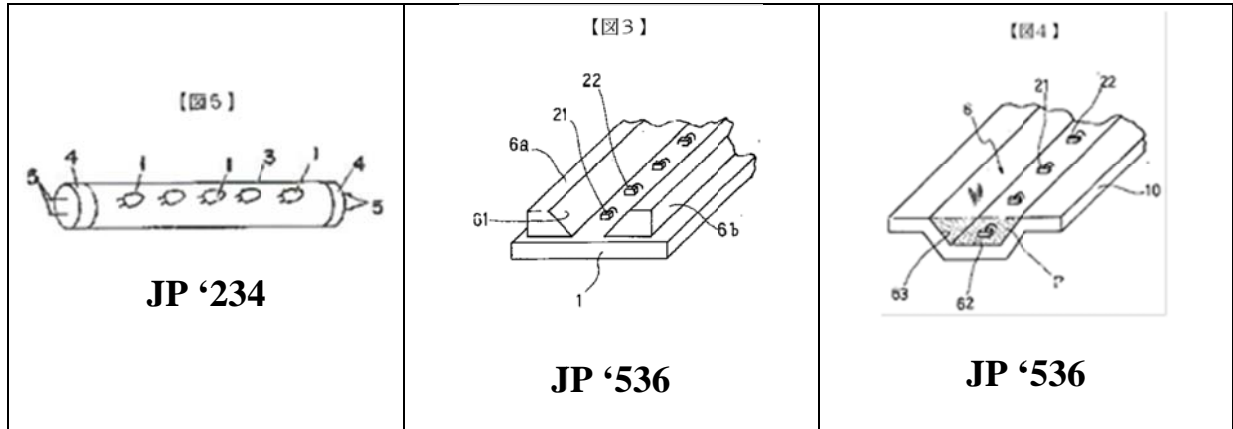
As provided by the following analysis and claim charts, as well as the declaration of TML, claims 1-3, 7-9, and 13-16 are obvious over JP ‘234 in view of JP ‘536.

1. Claim 1 obvious over JP ‘234 in view of JP ‘536

As described in Section IX.C.1 herein, JP ‘234 discloses all elements of claim 1 but does not explicitly disclose sidewalls extending to a height above the one surface on opposing sides of the LEDs so that “substantially the entire light output ... is emitted away...and confined to an included angle by sidewalls” as set out in claim 1. However, this deficiency is overcome by JP ‘536, which 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 FIG. 3; 63 in FIG. 4).

The reflective surfaces extend on opposing sides of the LEDs, above a surface along which the LEDs are arranged, and confine the entirety of the light output of the device to an included angle of less than 180° . Ex. 1017 at ¶ 122.



JP '536 discloses 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. Ex. 1010 at Abstract. JP '536 discloses such arrangement provides optical output such that: “output between parts directly above a lighted LED and other parts has virtually disappeared ... 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.

It would have been obvious to a POSITA to incorporate reflective surfaces, such as the reflective side wall surfaces 61 or 63 of JP '536 which are on opposite sides of the LEDs, in combination with the light source of JP '234. Ex. 1017 at ¶

124. For example, the base plate 10 (FIG. 4 of JP ‘536) with reflectors 63 may be readily incorporated in the cylindrical tube 3 of JP ‘234 to improve uniform brightness. *Id.* One would have been motivated to incorporate the reflective sidewall surfaces 61 or 63 to achieve the predictable result of reflecting light emitted from the LEDs toward the desired illumination area. *Id.* Moreover, JP ‘536 discloses wiring base plate 1 and metal base plate 10 for mounting of the LEDs and incorporating such components in a tube 3 of JP ‘234 would be obvious to a POSITA. *Id.* Moreover, if the Board finds that JP ‘234 does not explicitly disclose the LEDs disposed along one surface of a circuit board and mounted with respect to such surface, incorporation of the wiring base plate 1 or 10, LEDs 21, 22, and reflectors 61 or 63 from JP ‘536 in the light source of JP ‘234 would likewise overcome such deficiency. *Id.* at ¶ 126.

2. Claim 2, 3 and 7 obvious over JP ‘234 in view of JP ‘536

As described above in Section IX.D.1, JP ‘234 in view of JP ‘536 sets forth all elements of claim 1. JP ‘234 further discloses those features of claims 2, 3 and 7 as is set forth in Section IX.C.2-4. As such, JP ‘234 with JP ‘536 renders such claims obvious for the basis and reasons stated therein.

3. Claim 8 obvious over JP ‘234 in view of JP ‘536

As described in Section IX.C.5 herein, JP ‘234 discloses all elements of claim 8 but does not explicitly disclose “opaque side walls” of claim 8. However,

this deficiency is overcome by JP ‘536, which discloses reflective surfaces that are provided on opposed sides of a surface supporting a linear array of LEDs 21, 22. Ex. 1010 at Abstract. As described above in Section IX.D.1 it would have been obvious to a POSITA to incorporate reflective sidewall surfaces, such as the reflective side wall surfaces 61 or 63 of JP ‘536 which are on opposite sides of the LEDs, in combination with the light sources of JP ‘234. For example, the wiring base plate 1 (FIG. 1 of JP ‘536) and sidewalls 61 could be substituted for the elongate mounting plane of JP ‘234. A POSITA would have been motivated to incorporate reflectors to achieve low variability in light output from the light source of JP ‘234 as taught by JP ‘536. Ex. 1017 at ¶ 124. JP ‘234 discloses a desire for uniform brightness from the light source (*e.g.*, Ex. 1013 at ¶ 0020) and a POSITA would be motivated to incorporate side wall reflectors of JP ‘536 to improve uniformity of the brightness. Ex. 1017 at ¶ 124. Moreover, if the Board finds that JP ‘234 does not explicitly disclose the LEDs being mounted on only one side of a circuit board, incorporation of the wiring base plate 1 or 10, LEDs 21, 22, and reflectors 61 or 63 from JP ‘536 in the light source of JP ‘234 would likewise overcome such deficiency. *Id.* at ¶ 126.

4. Claims 9, 13, 14 and 15 obvious over JP‘234 in view of JP ‘536

As described above in Section IX.D.3, JP ‘234 in view of JP ‘536 discloses all elements of claim 8. JP ‘234 further discloses those features of claims 9, 13-15

as is set forth in Section IX.C.6-9. As such, the combination renders such claims obvious for the basis and reasons stated therein.

If the Board finds that ‘JP 234 does not explicitly disclose “the radiation pattern of light ...is centered at a 90° angle relative to the circuit board” of claim 13, 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. Incorporation of the wiring base plate and LEDs of JP ‘536 in JP ‘234 (as described above) would render claim 13 obvious. Ex. 1017 at ¶ 127.

5. Claim 16 obvious over JP ‘234 in view of JP ‘536

As described in Section IX.C.10 herein, JP ‘234 discloses all elements of claim 16 but does not explicitly disclose the last limitation of claim 16 (“wherein the combination of said ...”). However, this deficiency is overcome by JP ‘536. JP ‘536 describes reflectors provided on opposite sides of a surface supporting a linear array of LEDs. Ex. 1010 at Abstract. As described above in Section IX.D.1, it would have been obvious to a POSITA to incorporate reflectors that extend above a mounting surface for LEDs in JP ‘234 on opposite sides of the LEDs and such incorporated reflectors would confine the light emitted from the light source of JP ‘234 to an included angle of less than 180°. Ex. 1017 at ¶¶ 124, 125.

Moreover, if the Board finds JP ‘234 does not explicitly disclose “whereby light is

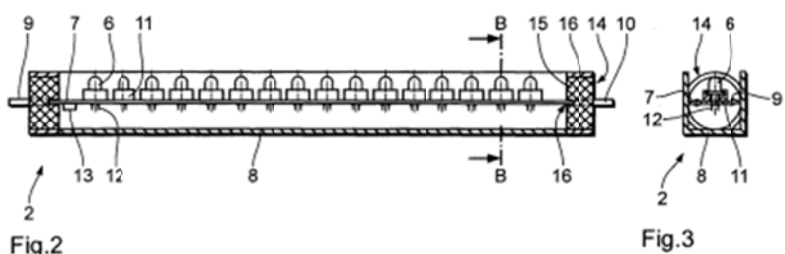
divergently emitted along the length of said unit in an included angle of less than about 180°” as provided in claim 16, incorporation of side wall reflectors in JP ‘536 as proposed would meet this limitation. *Id.* Moreover, if the Board finds that JP ‘234 does not explicitly disclose the LEDs disposed along a surface of a support structure, incorporation of the wiring base plate 1 or 10, LEDs 21, 22, and reflectors 61 or 63 from JP ‘536 in the light source of JP ‘234 would likewise overcome such deficiency. *Id.* at ¶ 126.

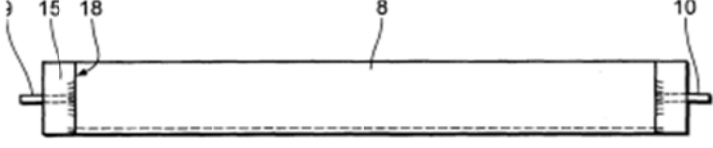
E. CLAIMS 1-2, 7-8, 13-14, 16 OBVIOUS OVER DE ‘320 IN VIEW OF US ‘281

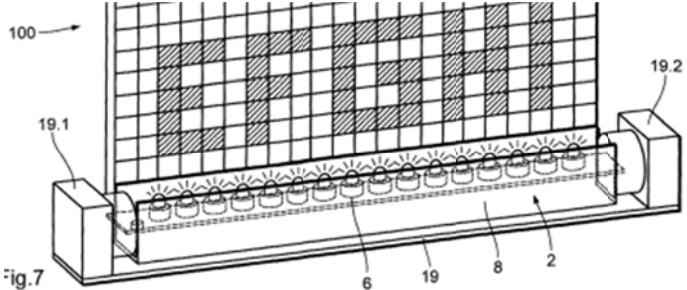
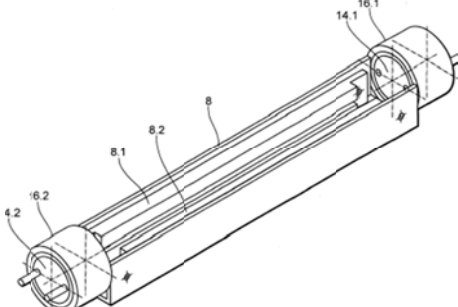
As provided by the following analysis and claim charts, as well as the declaration of TML, claims 1-2, 7-8, 13-14, and 16 are obvious over DE ‘320 in view of US ‘281.

1. Claim 1 obvious over DE ‘320 in view of US ‘281

Claim 1	DE ‘320 Disclosure
A light device for illumination by a power supply circuit 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 ...” 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.

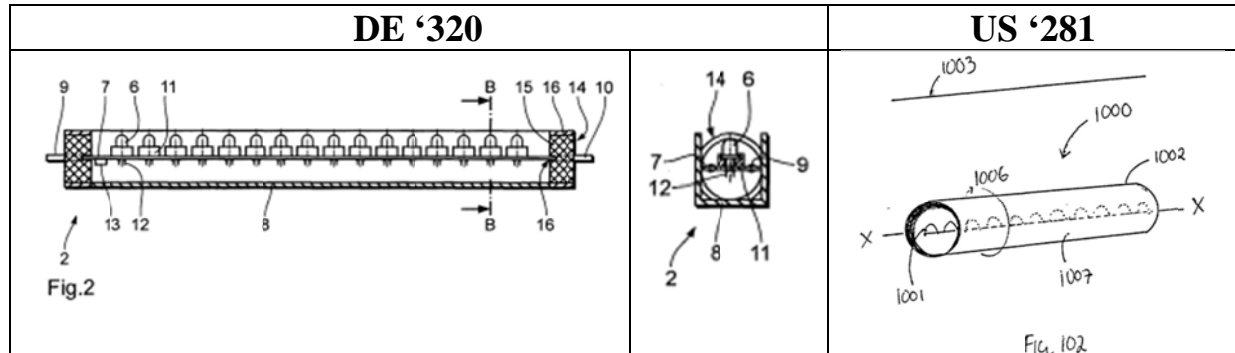
Claim 1	DE '320 Disclosure
	 <p>The device includes a power supply circuit to supply power to the LEDs: “The reverse pole protection means for the light emitting diodes 6, which is disposed on the circuit board 7, is identified with 13. On each end face of the reflector 8, an end piece 14 is fastened 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 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,	DE '320 does not explicitly disclose this limitation.
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	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 ...” <i>Id.</i> 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

Claim 1	DE '320 Disclosure
<p>of end caps are dimensioned to be mounted in a fluorescent light tube socket; and</p>	<p>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> 
<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</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</p>

Claim 1	DE '320 Disclosure
<p>radiation pattern of light emitted from the bulb portion; and</p>	<p>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>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> 

As described in the above claim chart, DE '320 does not explicitly disclose the “a bulb portion” of claim 1. However, this deficiency is overcome by US '281,

which describes a translucent member may be placed over LEDs to provide uniform light distribution.

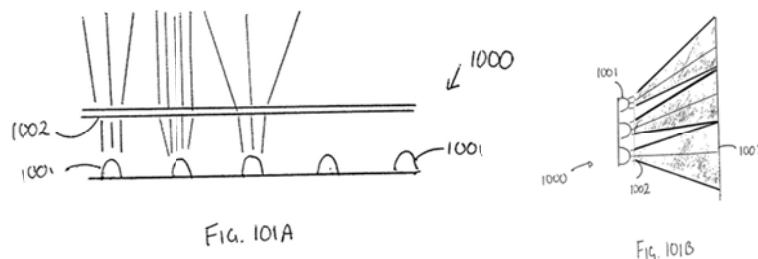


US '281 describes the translucent member 1002 may be implemented in a *substantially cylindrical housing* 1007 provided around LEDs 1001 to provide uniformity of light distribution. US '281 describes:

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.

US '281 further states "... 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.



It would have been obvious to a POSITA to incorporate a cylindrical bulb around the circuit board 7, LEDs 6, and reflector 8 of the illumination device of DE '320, such as the translucent bulb 1007 described by US '281. Ex. 1017 at ¶ 139. One would have been motivated to incorporate the translucent bulb 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 bulb 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-

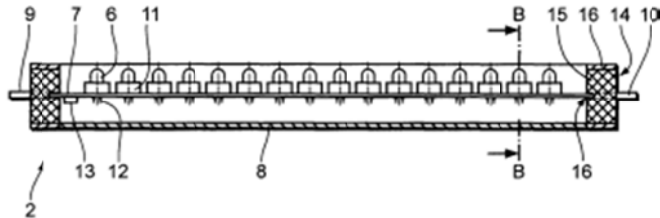
8; Ex. 1017 at ¶ 139. A POSITA would be motivated by such teachings to incorporate a cylindrical bulb to have the light source further correspond to a conventional fluorescent lamp. Ex. 1017 at ¶ 139. As further motivation, one use for the illumination device as described by DE ‘320 is for illuminating an information display. *Id.* at p. 12, ll. 9-12. A POSITA 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. Ex. 1017 at ¶ 139.

As described in the declaration of TML, the cylindrical housing may be incorporated, for example, 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. *Id.* at ¶ 140. Such a modification would be obvious to a POSITA as the end caps and cylindrical housing could be sized to achieve the predictable result of a diameter tube such as, for example, a standard T8 or T12 tube. *Id.* The cylindrical housing may alternatively be implemented by making 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. *Id.* at ¶ 141. Such modifications would likewise be obvious to a POSITA and would achieve predictable results. *Id.*

2. Claim 2 obvious over DE '320 in view of US '281

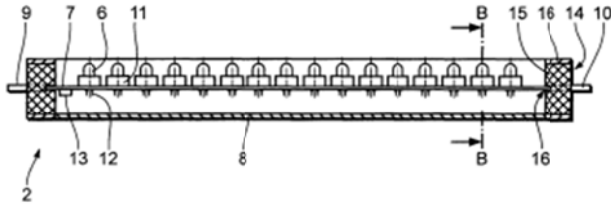
Claim 2	DE '320 Disclosure
“wherein each of the pair of end caps includes an electrical bi-pin connector.”	DE '320 describes that end pieces 14 are provided on opposite ends of the lamp 2 and include pins 9, 9', 10, and 10' for installing the lamp 2 in a fluorescent fixture. “... two contact pins which are preferably cylindrically formed are provided on each end piece ...” Ex.1003 at p. 6, ll. 20-21. Accordingly, such disclosure would also render obvious claim 2.

3. Claim 7 obvious over DE '320 in view of US '281

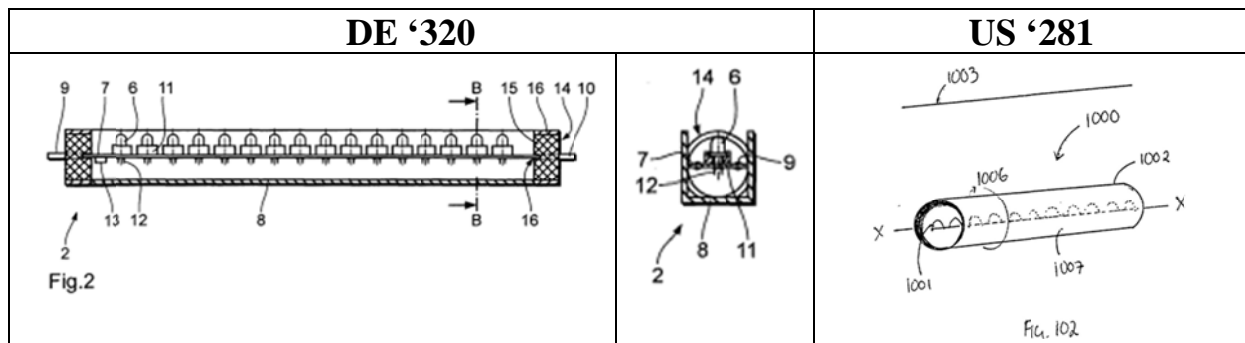
Claim 7	DE '320 Disclosure
“wherein the plurality of light emitting diodes is arranged substantially continuously between the opposite ends of the bulb portion.”	DE '320 discloses LEDs 6 are arranged along the length of the circuit board 7 to emit light from the lamp 2. “The light-emitting diodes 6 are 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. 

4. Claim 8 obvious over DE '320 in view of US '281

Claim 8	DE '320 Disclosure
In a replacement light tube for a fluorescent light fixture having a light tube socket, the improvement 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 ...” 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

Claim 8	DE '320 Disclosure
	<p>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>  <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. DE '320 fails to disclose a bulb portion.</p>
<p>an electrical circuit for illuminating in response to electrical current to be received from the fluorescent light fixture; and</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 guided with a voltage source as well as the unused contacts 9', 10'.” <i>Id.</i> 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</p>

Claim 8	DE '320 Disclosure
	<p>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.</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>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.” <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>



As described in the above claim chart, DE '320 does not explicitly disclose the “a bulb portion” of claim 8. However, this deficiency is overcome by US '281,

which describes a translucent member may be placed over LEDs to provide uniform light distribution. Ex. 1005 at ¶¶ 261,262. US ‘281 describes the translucent member 1002 may be implemented in a *substantially cylindrical housing* 1007 provided around LEDs 1001 to provide uniformity of light distribution. *Id.* As set forth above in Section IX.E.1., it would have been obvious to a POSITA to incorporate a cylindrical bulb around the circuit board 7, LEDs 6, and reflector 8 of the illumination device of DE ‘320, such as the translucent bulb 1007 described by US ‘281. Ex. 1017 at ¶ 139. One would have been motivated to incorporate the translucent bulb, for example, to achieve the predictable result of uniform illumination from the DE ‘320 illumination device as described by US ‘281. *Id.*

5. Claim 13 obvious over DE ‘320 in view of US ‘281

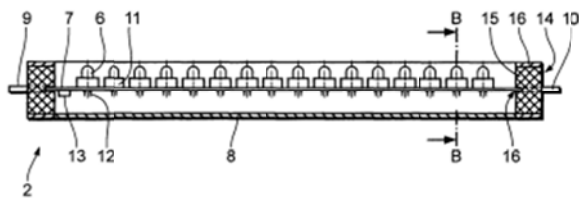
Claim 13	DE ‘320 Disclosure
“wherein the radiation pattern of light from each of the plurality of light emitting diodes is centered at a 90° angle relative to the circuit board.”	DE ‘320 discloses LEDs which are arranged in at least one row on a board. The LEDs are utilized to illuminate display board 30 extending upward about 90 degrees from the LED circuit board. Ex. 1003 at p. 2, ll. 14-17; FIG 7. The device and LEDs thus produce a radiation pattern 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.

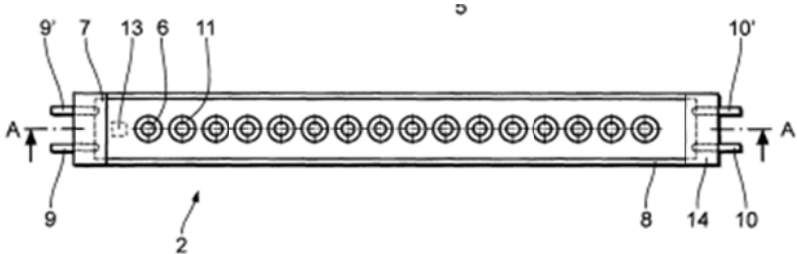
6. Claim 14 obvious over DE ‘320 in view of US ‘281

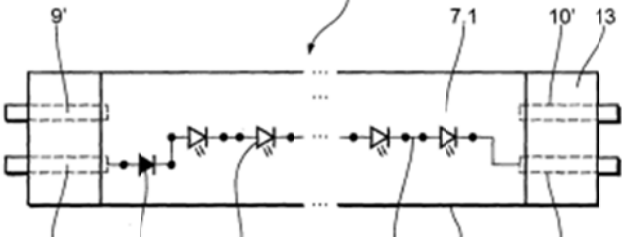
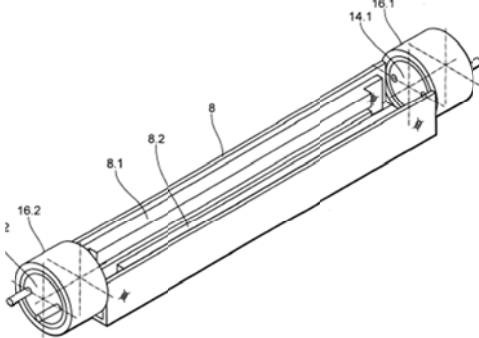
Claim 14	DE ‘320 Disclosure
wherein the plurality of light emitting	DE ‘320 discloses that LEDs 6 are “arranged in at least one row on a board which extends essentially parallel to

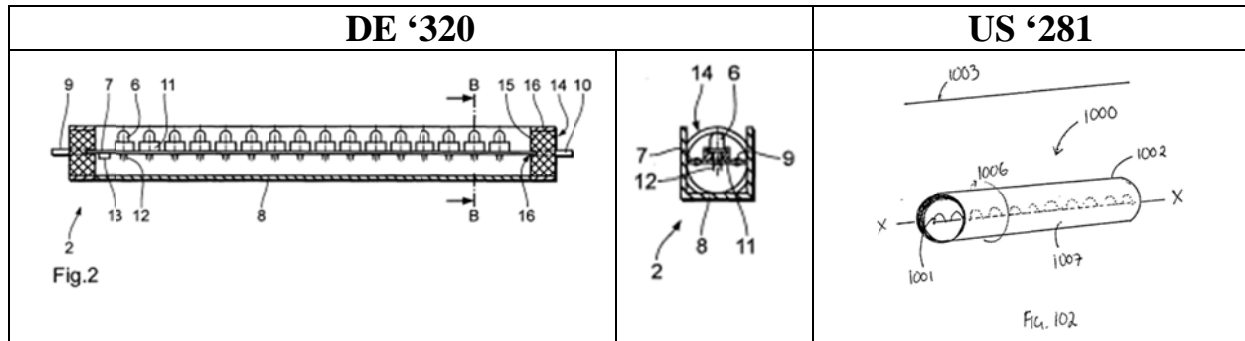
Claim 14	DE ‘320 Disclosure
diodes is arranged substantially continuously along the length of the bulb portion.	the longitudinal axis of the lamp.” <i>Id.</i> at page 4, lines 19-21. Thus, DE ‘320 discloses such substantial continuous arrangement along the length of the bulb portion.

7. Claim 16 obvious over DE ‘320 in view of US ‘281

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 second end opposite said first end, the cylindrical structure including a support structure and a bulb portion;	<p>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 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> 

Claim 16	DE '320 Disclosure
	DE '320 does not explicitly disclose a bulb portion and does not explicitly disclose that the structure is substantially cylindrical.
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;	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'." <i>Id.</i> at p. 9, ll. 23-28.
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	<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 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	<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>

Claim 16	DE '320 Disclosure
<p>of said pair of connectors extending from said end caps,</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>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 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>
<p>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>	<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> 



As described in the above claim chart, DE '320 does not explicitly disclose the bulb portion and does not explicitly disclose that the structure is substantially cylindrical. However, this deficiency is overcome by US '281, which describes a translucent member 1002 may be implemented in a rigid substantially cylindrical housing 1007 provided around LEDs 1001 to provide uniformity of light distribution. Ex. 1005 at ¶ 261, 262. As described above in Section IX.A.1, it would have been obvious to a POSITA to incorporate a substantially cylindrical housing in the illumination device of DE '320, such as the substantially cylindrical housing 1007 described by US '281. Ex. 1017 at ¶ 139.

F. CLAIMS 3 AND 9 OBVIOUS OVER DE '320 IN VIEW OF US '281 AND FURTHER IN VIEW OF JP '234

1. Claim 3 is obvious over DE '320 in view of US '281 and further in view of JP '234

DE '320 in view of US '281 and further in view of JP '234 also renders obvious claim 3. Claim 3 depends from claim 1 and adds that each of the plurality of LEDs “is a white light emitting diode.” JP '234, in the same field of endeavour and for the same technology, 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. In view of white LEDs being a known option for inclusion in LED light sources in and around 2000, it would have been obvious to a POSITA to incorporate white LEDs in DE ‘320, such as the white LEDs taught by JP ‘234. Ex. 1017 at ¶ 147. One would have been motivated to incorporate white LEDs in DE ‘320 to have the illumination device of DE ‘320 emit a color similar to the color emitted from the fluorescent light DE ‘320 is designed to replace. Ex. 1003, p. 6, lines 1-5; Ex. 1017 at ¶ 147. Thus, the addition of JP ‘234 renders obvious claim 3.

2. Claim 9 is obvious over DE ‘320 in view of US ‘281 and further in view of JP ‘234

DE ‘320 in view of US ‘281 and further in view of JP ‘234 also renders obvious claim 9. Claim 9 depends from claim 8 and merely adds that the plurality of LEDs are each “a white light emitting diode.” For the reasons noted immediately above, the inclusion of JP ‘234 renders obvious claim 9.

X. CONCLUSION

For the foregoing reasons, Petitioner asks that *inter partes* review of the ‘327 Patent be granted and that claims 1-3, 7-9, 13-16 be canceled as unpatentable.

Date: July 3, 2014

/John F. Salazar/

John F. Salazar, Reg. No. 39,353

EXHIBIT APPENDIX

Exhibit	Description	Statement of Relevance
1001	U.S. Patent No. 8,382,327 (“the ‘327 Patent”)	The patent for which <i>inter partes</i> review is requested herein.
1002	DE29900320 (“DE ‘320”)	Invalidating prior art to the challenged claims
1003	DE ‘320 (English Translation)	English translation of invalidating prior art to the challenged claims
1004	Affidavit of W. Mark Headley	Affidavit of W. Mark Headley attesting to the accuracy of the German to English translation of Ex. 1003
1005	U.S. Pub. No. 2003/0076281 (“US ‘281”)	Invalidating prior art to the challenged claims
1006	JP08-162677 (“JP ‘677”)	Invalidating prior art to the challenged claims
1007	JP ‘677 (English Translation)	English translation of invalidating prior art to the challenged claims
1008	Affidavit of M. Tan-Maas	Affidavit of M. Tan-Maas attesting to the accuracy of the Japanese to English translation of Ex. 1007
1009	JP10-308536 (“JP ‘536”)	Invalidating prior art to the challenged claims
1010	JP ‘536 (English Translation)	English translation of invalidating prior art to the challenged claims
1011	Affidavit of Clinton D. Morrison	Affidavit of Clinton D. Morrison attesting to the accuracy of the Japanese to English translation of Ex. 1010
1012	JP11-162234 (“JP ‘234”)	Invalidating prior art to the challenged claims
1013	JP ‘234 (English Translation)	English translation of invalidating prior art to the challenged claims
1014	Affidavit of M. Tan-Maas	Affidavit of M. Tan-Maas attesting to the accuracy of the Japanese to English translation of Ex. 1013

1015	U.S. Patent No. 6,582,103 (“US ‘103”)	Invalidating prior art to the challenged claims
1016	Provisional Application No. 60/144,920	Provisional Application to which Ex. 1015 claims benefit
1017	Declaration	Declaration of Thomas M. Lemons Related to unpatentability of claims 1-3, 7-9, and 13-16 of the ‘327 Patent
1018	CV of Thomas M. Lemons	Curriculum Vitae of Declarant Thomas M. Lemons
1019	Prosecution History	Prosecution History of the ‘327 Patent

CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b) that on July 3, 2014, I caused a true and correct copy of the foregoing PETITION FOR *INTER PARTES* REVIEW to be served via Federal Express, postage prepaid, on the following:

Young Basile
3001 West Big Beaver Road
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Troy, Michigan 48084

Date: July 3, 2014

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