

Ex-1003 – Declaration of Dr. Michael S. Lebby Regarding U.S. Patent No. 9,640,733

**UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE
PATENT TRIAL AND APPEAL BOARD**

IKEA Supply AG

Petitioner

v.

Everlight Electronics Co., Ltd.,

Patent Owner

U.S. Patent No. 9,640,733 to Hsieh *et al.* IPR Case No.: IPR2024-00972

**Declaration of Dr. Michael S. Lebby
Regarding U.S. Patent No. 9,640,733**

**Ex-1003 – Declaration of Dr. Michael S. Lebby Regarding U.S. Patent No.
9,640,733**

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1. Introduction and Summary of Opinions

1. My name is Michael S. Lebby. I have been retained as an expert witness by counsel for Petitioners IKEA Supply AG (“IKEA”) in the above captioned proceeding. I have been asked to provide my opinion regarding the validity or invalidity of the U.S. Patent No. 9,640,733 (“the ’733 patent”) purportedly assigned to Patent Owner Everlight Electronics Co., Ltd. (“Everlight”). My analysis in this report relates to claims 1-5 and 7 of the ’733 patent (collectively, the “Challenged Claims”).

2. It is my opinion that claims 1-5 of the ’733 patent are anticipated by U.S. Patent No. 7,771,093 (“Kishikawa”) (Ex-1004).

3. It is my opinion that claims 1-5 of the ’733 patent are anticipated by U.S. Patent No. 7,462,870 (“Nakashima”) (Ex-1005).

4. It is my opinion that claims 1-5 and 7 of the ’733 patent are obvious over Japanese Patent Publication No. 2014-41966 (“Umeda”) (Ex-1006 and Ex-1007 (Translation)) in view of U.S. Patent No. 7,719,024 (“Bando”) (Ex-1009) and/or the level of ordinary skill in the art.

5. It is my opinion that claims 1-5 and 7 of the ’733 patent are anticipated by U.S. Patent Publication No. 2014/0124812 (“Kuramoto”) (Ex-1008).

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6. It is my opinion that claim 7 of the '733 patent is obvious over each of (i) Kishikawa; (ii) Nakashima; or (iii) Kuramoto in view of Bando and/or the level of ordinary skill in the art.

7. It is my opinion that claims 1-5 are obvious over any of Kishikawa, Nakashima, or Kuramoto in view of a POSITA's common knowledge to the extent that any of the references are considered not to anticipate.

8. This report contains a statement of the opinions that I have formed regarding the validity/invalidity of the Challenged Claims to date and provides the bases and reasons for my opinions. I have provided my opinion as to the level of skill of a person of ordinary skill in the art (POSITA) and a POSITA's common general knowledge at the time of the alleged invention, which I understand to be 2014 based on the priority claim of the '733 patent. I may offer additional opinions based on further review of materials in this proceeding, including opinions and/or testimony of other experts, including those of Everlight.

9. I am being compensated for my time in connection with this matter at my standard hourly rate of \$450/hour. My compensation is not affected by my opinions or the outcome of this proceeding. I do not have any financial interest in the outcome of this proceeding.

10. I reserve the right to amend and/or supplement my opinions to respond to any declarations, reports, or testimony from any of Everlight's expert(s) or

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witnesses; any briefs or pleadings that Everlight may file; any other filings relating to validity/invalidity of the Challenged Claims, any proposals regarding the level of skill of a POSITA, and/or the interpretation of claim terms that are proposed by Everlight or the Patent Trial and Appeal Board (“the Board”). I also reserve the right to prepare and rely on demonstrative exhibits concerning the opinions and their bases as an aid for trial or to assist the Board in connection with this proceeding.

2. Summary of My Qualifications

2.1 Education, Employment, and Research

11. I am currently the CEO of Lightwave Logic, a company engaged in developing optical polymer modulators for the fiber optic communications industry (including both data communications and telecommunications). I am also the CEO and CTO of GenusTechnik Inc., where I perform expert witness consulting concerning photonics, optoelectronics, semiconductors, and fiber optic equipment technology. I am also currently a technical expert for the Information Technology (IT) Unit of the European Commission, where I participate in organizing workshops and lectures, evaluating photonics, electronics and packaging proposals, and advising the European Commission on new technology projects. I was voted the Photonic Integrated Circuits Conference Entrepreneur and Business Leader of the Year in March 2018.

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12. A copy of my curriculum vitae (CV) is attached as Exhibit 1023. As set forth more fully in my CV, over the course of my 40-year career in optoelectronics, I have worked in nearly every aspect of optoelectronics, including light-emitting diodes (“LEDs”), LED packaging, and LED fabrication. Accordingly, I have experience and expertise relating to epitaxial wafer growth, LED/device fabrication, implementation of LEDs/devices into packages, and packaging materials such as plastics, metallic-based, semiconductor-based, and ceramic-based. I have also designed LED/device packages (e.g., through-pin, surface mount, flip-chip and various combinations thereof) for printed circuit board mounting. Many of the designed packages were implemented in modules and sub-system/luminaire applications, i.e., fixtures in which LED packages are incorporated. The modules have been fiber-optic, display, lighting, and sensing-based. For example, I have designed optoelectronic devices such as LEDs, laser diodes, photodiodes, and solar cells, with a focus on efficient optical device design that maximizes LED/device performance for both lighting and illumination applications.

13. I am a chartered engineer in the United Kingdom, which is a status equivalent to a United States professional engineer. I started my career in 1977 at the Ministry of Defense (United Kingdom) in the Royal Electrical and Mechanical Engineer division as a telecommunications apprentice. At the Ministry of Defense, I also studied material and characterization issues of Gallium Arsenide (GaAs) and

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Indium Phosphide (InP) optoelectronic devices as well as semiconductor device design, fabrication, and characterization, and particularly with materials using III-V semiconductors. I also worked on ceramic-based radiofrequency (RF) electronic packaging that included low-temperature co-fired ceramic.

14. I attended the University of Bradford, where I obtained a Bachelor degree of Engineering (Electrical Engineering), with honors, in 1984, an M.B.A. in 1985, and a Ph.D. (Electrical Engineering) in 1987. My Ph.D. thesis related to the characterization and fabrication of both optoelectronic and electronic semiconductor devices. In 2004, I was awarded a Doctor of Engineering (a Doctorate degree higher than a Ph.D.) from the University of Bradford for my “Technical Contributions to Optoelectronics.” This was only the second time in the University of Bradford’s history that a Doctor of Engineering was granted based on industry experience.

15. At the same time, I attended the University of Bradford and afterward from 1985 to 1989, I worked as a researcher in the Photonics Research Department of AT&T Bell Labs (“Bell Labs”). At Bell Labs, I focused my research on novel device designs using III-V semiconductor material systems that included FETs, bipolar transistors, LEDs, laser diodes, and photodetectors. My research at Bell Labs became the subject of my Ph.D. thesis.

16. After I completed my Ph.D. at the University of Bradford and my work at Bell Labs, I became a Research and Development Manager (“R&D Manager”) in

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the photonics division of Motorola's Corporate R&D Labs from 1989 to 1998. My responsibilities at Motorola included research and development of optical interconnects, displays, LEDs, and laser devices, as well as the packaging and reliability of mobile product prototypes. While at Motorola, I was the inventor or co-inventor of over 150 utility patents. In 1998, I received a special award from the Chairman of Motorola for exemplary patent accomplishments. At that time, I had the highest number of issued utility patents in the history of Motorola.

17. LEDs, LED packaging, and LED fabrication were an integral part of my work at Motorola. In the early 1990s, full-color LED displays were not viable. Mature LED technologies at the time included Phosphide (Gallium Arsenide Phosphide (GaAsP) and/or Aluminum Indium Gallium Phosphide (AlInGaP)) and Aluminum Gallium Arsenide (AlGaAs)-based LEDs that produced visible red and orange colors with good emission properties. Gallium Phosphide (GaP)-based LEDs that produced a green color had low emission output. Blue-wavelength emission LEDs were only available using pure Silicon Carbide (SiC) on Silicon Carbide (SiC) substrate wafers, with extremely low emission output. I worked closely with Motorola's mobile divisions on new and novel display prototypes to research and develop how best to innovate with full color red, green, and blue displays. In the early 1990s, single (red wavelength) and dual (orange and red wavelength) color displays were designed and made into LED packaged prototypes. After consumer

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testing, it was found that full-color LED displays were more attractive and then a number of alternative technologies were evaluated, such as Liquid Crystal Displays (LCDs), organic LEDs (OLEDs), and, in the late 1990s, Gallium Nitride (GaN) and Indium Gallium Nitride (InGaN) materials grown onto Sapphire. I designed packages for these devices, which included standard Transistor Output (TO) cans, over-molded plastic dual in-line (DIL) solutions, and ceramic and semiconductor-based technology.

18. As an R&D Manager at Motorola, I worked on a number of other projects, with a particular interest in miniature displays using technologies such as LEDs, organic LEDs, lasers, and LCDs, as well as technological problems related to package lenses and molding unique and innovative shapes. One of the devices I worked on at Motorola was the Vertical-Cavity Surface-Emitting Laser (“VCSEL”). This device design required special attention to optical efficiency and distributed Bragg reflectors (“DBR”), as well as transparent packaging similar to the approach in LED packaging. I also initiated Motorola’s work in optical interconnect (Optobus™) technology, and I was involved in research and development of the IC chip designs that this parallel interconnect module utilized. In this project, transparent plastics were developed and process over-molded onto standard metallic lead frames for both light-emitting devices (e.g., LEDs, VCSELs) as well as

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photodetectors, which collect light and convert it into an electronic signal. These transparent lead frame packages were developed in volume production at Motorola.

19. I also worked on GaAs-based LED opto-couplers, which are optoelectronic packages that optically isolate the LED from a photodetector in a plastic package. These optoelectronic packages are usually designed with either a glass transparent plate or transparent organic polymer positioned between the LED and the photodetector. My work at Motorola also addressed full color display and display electronics composed of red, green, and blue LEDs, and specifically how to package these technologies to allow for high electrical, optical, and thermal performance. I also worked with displays that included large arrays of visible LEDs (i.e., 10,000 LEDs on a chip) and phosphor technology. I also worked on photonics prototypes, which were subject to optimized optical device design and optical/transparent packaging, and consumer products that utilized LEDs in opto-coupler, display, and imager platforms that were all driven using standard electronic ICs and electronic signaling, as well as packages that included transparent plastic packaging varieties where the transparent plastic material was molded to a variety of conventional stamped metallic lead frames and flexible tape automated bonding (TAB) using materials such as Kapton®.

20. In 1998, I left Motorola to join TE Connectivity (previously Tyco Electronics) as Director of Technology and Business Development, where I helped

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develop technology strategy for optical communications products for the Global Optoelectronics Division. My work included designing and characterizing LED- and laser-based packages and modules for customer qualification specifications.

21. In 1999, I joined Intel Capital (“Intel”) as Director of Business Development, and also as a corporate investor. My work at Intel included sourcing, negotiating, and closing private placement equity deals in the optical networking, component, and semiconductor industries. My work at Intel also included investigating the investment in photonic devices, packaging, and modules, as well as LEDs, lasers, and displays. I also was one of the founders of Intel’s silicon photonics division, which worked to establish a fabrication facility in South San Jose to investigate the integration of silicon FET electronics with optoelectronics into the same silicon semiconductor wafer.

22. From 2005 to 2010, I became the Executive Director, President, and CEO of the 32wOptoelectronic Industry Development Association (OIDA), a trade association that represented photonics manufacturers in the fields of fiber optics, display, sensing, defense, aerospace, LED lighting, and motor vehicles. I was responsible for organizing technical conferences, workshops, and forecasts using industry roadmaps that featured LEDs, fiber optics, optics, fiber, optical sensors, displays, and their associated packaging.

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23. In 2010, I became the General Manager and CTO of Translucent, Inc., a start-up company that developed and manufactured silicon and rare earth oxide-based epitaxial semiconductor wafers. Part of my work there was to help develop novel platforms for the growth of GaN and InGaN onto silicon and the growth of single crystal layers of GaN/InGaN/AlN onto single crystal rare earth oxides for LED fabrication. I also researched various epitaxial semiconductor layer structures for improved LED performance during my time at Translucent.

24. I joined Glyndŵr University from 2013 to 2015 as a Professor of Optoelectronics, where I focused on the design, simulation, and testing of 100G/400G photonic integrated circuits, optoelectronic integrated circuits, laser diodes, optics, and solar cells.

25. From 2013 to 2015, I was also the President and CEO of OneChip Photonics Corporation, where I served as an elected independent board member focusing on the technical and business operational strategy for communications based on InP photonic integrated circuits and optoelectronic integrated circuits.

26. Over the course of my career, I have also given a number of peer-reviewed presentations, speeches, and talks at workshops and conferences, including on optoelectronic devices, optoelectronic components, and packaging technology.

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2.2 Patents

27. I am a named inventor of over 200 issued patents or published patent applications, as set forth more fully in my CV. I am a named inventor of the following exemplary patents relating to LEDs, LED packaging, and LED fabrication:

- U.S. Patent No. 5,416,870, entitled Optoelectronic interface device and method with reflective surface, issued May 16, 1995;
- U.S. Patent No. 5,708,280, entitled Integrated electro-optical package and method of fabrication, issued January 13, 1998;
- U.S. Patent No. 5,358,880, entitled Method of manufacturing closed cavity LED, issued October 25, 1994;
- U.S. Patent No. 5,563,900, entitled Broad spectrum surface emitting LED, issued October 8, 1996;
- U.S. Patent No. 5,699,073, entitled Integrated electro-optical package with carrier ring and method of fabrication, issued December 16, 1997;
- U.S. Patent No. 5,741,724, entitled Method of growing gallium nitride on a spinel substrate, issued April 12, 1998;
- U.S. Patent No. 5,739,800, entitled Integrated electro-optical package with LED display chip and substrate with drivers and central opening, issued April 14, 1998;

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- U.S. Patent No. 5,818,404, entitled Integrated electro-optical package, issued October 6, 1998; and
- U.S. Patent No. 7,605,531, entitled Full color display including LEDs with rare earth active areas and different, issued October 20, 2009.

2.3. Publications

28. I have authored or co-authored numerous publications, which are set forth fully in my CV. I am an author or co-author of the below exemplary publications relating to LEDs, LED packaging, and LED fabrication:

- F. Erdem Arkun, Rytis Dargis, Andrew Clark, Robin S. Smith, Michael S. Lebby, Jeffrey M. Leathersich and F. Shahedipour-Sandvik, *Growth of GaN by MOCVD on Rare Earth Oxide on Si(111)*, ECS Transactions, Oct. 31, 2013.
- Rytis Dargis, Andrew Clark, Erdem Arkun, Radek Roucka, David Williams, Robin S. Smith, and Michael S. Lebby, *Epitaxial Si and Gd₂O₃ Heterostructures – Distributed Bragg Reflectors with Stress Management Function for GaN on Si Light Emitting Devices*, ECS Transactions, 2013.

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- F. Erdem Arkun, Rytis Dargis, Robin Smith, David Williams, Andrew Clark, Michael S. Lebby, *Integrated High Reflectivity Silicon Substrates for GaN LEDs*, Physica Status Solidi, Jan. 13, 2012.
- David Williams, Andrew Clark, Erdem Arkun, Aleta Jamora, Gary Vosters, Michael S. Lebby, *Silicon Light Emitting Device Based on Rare Earth Oxide Superlattice*, 7th IEEE International Conference on Group IV Photonics, Beijing, China, Sep. 2010.
- Wenbin Jiang, Michael S. Lebby, *Packaging of Optical Components and Systems*, Wiley Encyclopedia of Electrical Electronics and Engineering, 27 Dec., 1999.
- Wenbin Jiang, Michael S. Lebby, *Semiconductor Laser and Light Emitting Diode Fabrication*, Handbook of Fiber Optic Data Communication, February 2002.

2.4. Prior Testimony

29. I have previously served as a testifying expert witness in patent cases as set forth more fully in my CV. I have been recognized as an expert in the LED field including LED packaging in numerous jurisdictions and by the USPTO in invalidity proceedings including :

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- *Jiaxing Super Lighting Electric Appliance Co., LTD and Obert Inc. v. Current Lighting Solutions, LLC d/b/a GE Current.*, No. 6-22-CV-00534-ADA (W.D. Tx Filed 16th Sep 2022);
- *LG Electronics Inc., v. TCL Electronics Holdings Ltd. (f/k/a TCL § Multimedia Technology Holdings, Ltd.) et al.*, No. 2-22-CV-0122-JRG (W.D. Tx. Filed 14th Oct 2022);
- *Amazon.com Inc., v. Epistar Corp.*, No. 6-22-CV-00526-ADA (W.D. Tx. Filed 24th May 2022)
- *Certain integrated circuits, and electronic devices and products containing the same*, No. 337-TA-1287 (ITC Filed 1st Dec 2021);
- *LedComm LLC., v. IKEA US Retail LLC et al.*, No. 6-22-CV-00302-ADA (W.D. Tx. Filed 21st Mar 2022);
- *Jiaxing Super Lighting Electric Appliance Co., LTD and Obert Inc. v. Maxlite Inc.*, No. 19-CV-04047 (C.D. Cal. Filed 8th May 2019); and
- *Cree Lighting, Wolfspeed, Ideal Industries Lighting, v. CAO Lighting*, No. IPR2022-00848 (PTAB Filed 8th April 2022).

2.5. Expertise

30. Based on my education and experience, I consider myself to be an expert in the fields of LED and LED packaging related to the technologies described and claimed in the '733 patent.

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3. Person of Ordinary Skill in the Art (POSITA)

31. I understand that validity/invalidity are determined from the perspective of a person of ordinary skill in the art, or POSITA, at the time of the alleged invention. I understand the alleged invention date to be the earliest effective filing date of the application that issued as the '733 patent, which I understand to be May 23, 2014.

32. In determining the appropriate level of ordinary skill for a POSITA, my understanding is that the following factors can be considered: the inventor's educational background and experience, the types of problems encountered in the art, prior art solutions to those problems, the rapidity with which innovations are made in the art, the sophistication of the technology, the educational background and experience of those working in the art, and the like.

33. After a review of the '733 patent, I am of the opinion that a POSITA at the relevant time of the alleged invention of the '733 patent would have had (1) a Bachelor's degree in electrical engineering, physics, or a comparable field of study, and (2) at least three years of professional experience with semiconductor optoelectronic devices and packaging. This description is approximate, and a higher level of education or skill might make up for less experience, and additional experience could make up for a lower education level (for example, an M.S. in any

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of the above fields and two years of practical experience would qualify one as a POSITA).

34. I consider myself to be at least a person of ordinary skill in the art for the '733 patent. I started industrial employment in 1977 with the British Government, and was involved in electronic engineering and semiconductor design, testing, and characterization. As of 1988, I have had a Bachelor's degree in electrical engineering and at least three years of professional experience with semiconductor optoelectronics devices and packaging, including LED design, characterization, and testing. I received a Bachelor's degree in electrical engineering in 1984 and by no later than 1988, had at least three years of professional experience with semiconductor optoelectronics devices and packaging through my Ph.D. and post-doctoral research performed at Bell Labs (thesis related to the characterization and fabrication of optoelectronic and electronic semiconductor devices).

4. Materials Considered

35. I have considered information from various sources in forming my opinions. Besides drawing from more than forty-year career in optoelectronics, I have also reviewed the '733 patent, its file history, IKEA's Petition for *inter partes* review ("Petition"), each exhibit attached to the Petition, and any other documents or references discussed in this declaration.

5. Legal Standards Applied in the Report

36. I am not an attorney and will not offer opinions on the law. I was asked to apply the following legal standards in forming my opinions.

37. I understand that for an invention claimed in a patent to be found patentable, it must be, among other things, new and not obvious from what was known before the invention was made. My understanding of the legal standards for anticipation and obviousness are set forth below.

38. I was instructed that IKEA has the burden of proving that the Challenged Claims of the '733 patent are anticipated by or obvious in view of the prior art by a preponderance of the evidence in this proceeding. I was instructed that “a preponderance of the evidence” is evidence sufficient to show that a fact is more likely true than it is not.

39. I was instructed to evaluate whether an invention is new and not obvious in view of the legal standards below and what is referred to as “prior art.” I understand that “prior art” generally includes patents and printed publications (e.g., books, journal publications, articles on websites, product manuals, etc.) that existed before the earliest filing date (the “effective filing date”) of the claims in the '733 patent. I understand that whether a printed document qualifies as prior art to the '733 patent is a legal conclusion, so I was asked to assume for my analysis that the documents applied in my report are prior art to the Challenged Claims.

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40. I was instructed that in my anticipation and obvious analysis, I should compare the Challenged Claims to the prior art. I was instructed that in this analysis, the '733 patent claims must be interpreted in accordance with certain standards of claim construction. I was instructed that claim construction is a question of law for the Court to decide. The claim construction I was asked to use is provided below.

5.1. Anticipation

41. I was instructed that the following standards govern the determination of whether a patent claim is “anticipated” by the prior art. I have applied these standards in my evaluation of whether the claims of the patent would have been anticipated by the prior art.

42. I was instructed that, for a patent claim to be “anticipated” by the prior art, each and every limitation of a claim must be found, expressly or inherently, in a single prior art reference as recited in the claim. I understand that a prior art reference inherently discloses a claim limitation if the claim limitation is “inherent” if the claim limitation is necessarily present or the natural result of the combination of elements explicitly disclosed in the prior art reference. I understand that the inherency inquiry is distinct from the question of obviousness.

43. I was instructed that if a reference incorporates other documents by reference, the incorporating reference and the incorporated reference(s) should be treated as a single prior art reference for purposes of analyzing anticipation.

5.2 Obviousness

44. I was instructed that a claimed invention is not patentable if it would have been obvious to a POSITA at the time the invention was made.

45. I was instructed that a patent may not be obtained even though the invention is not identically disclosed or anticipated by the prior art, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA to which said subject matter pertains.

46. I understand that the following standards govern the determination of whether a claim in a patent is obvious. I have applied these standards in my evaluation of whether the asserted claims of the patent at issue here would have been considered obvious as of the relevant priority date. I have been asked to assume that the priority date for the claims at issue here is May 23, 2014.

47. I understand that to find a claim in a patent obvious, one must consider certain factual questions regarding the claimed invention and the prior art. Specifically, I understand that the question of whether an alleged invention is obvious requires consideration of four factors (although not necessarily in the following order):

- The scope and content of the prior art;
- The differences between the prior art and the claims at issue;

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- The knowledge of a POSITA; and
- Whatever objective factors indicating obviousness or non-obviousness may be present in any particular case (commonly referred to as “secondary considerations of non-obviousness”).

48. In addition, I understand that the obviousness inquiry should not be done based on hindsight, but must be done using the perspective of a POSITA as of the priority date of the patent claim.

49. I was instructed that the secondary considerations of non-obviousness may include: commercial success of products covered by the patent claims; a long-felt need for the invention; failed attempts by others to make the invention; copying of the invention by others in the field; unexpected results achieved by the invention; praise of the invention by those in the field; the taking of licenses under the patent by others; expressions of surprise by experts and those skilled in the art at the making of the invention; and the patentee proceeded contrary to the accepted wisdom of the prior art. I also understand that any of this evidence must be specifically connected to the invention rather than being associated with the prior art or with marketing or other efforts to promote an invention. I am not presently aware of any evidence of “objective factors” suggesting the claimed subject matter is not obvious, and reserve my right to address any such evidence if it is identified in the future. I understand that objective factors of obviousness include near simultaneous invention by another.

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50. I understand that an indication of obviousness is the combination of familiar elements according to known techniques to yields predictable results. I also understand that an example of a solution in one field of endeavor may make that solution obvious in another related field. I also understand that market demands or design considerations may prompt variations of a prior art system or process, either in the same field or a different one, and that these variations will ordinarily be considered obvious variations of what has been described in the prior art. When there is such a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within their technical grasp. If this leads to the anticipated success, it is likely the product, not of innovation, but of ordinary skill and common sense

51. I also understand that if a POSITA can implement a predictable variation, that variation may be considered obvious. I understand that for similar reasons, if a technique has been used to improve one device, and a POSITA would recognize that it would improve similar devices in the same way, using that technique to improve the other device is an indication that the technique would have been obvious unless its actual application yields unexpected results or challenges in implementation.

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52. I understand that the obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, but instead can consider the “ordinary innovation” and experimentation that yields predictable results, which include inferences and creative steps that a POSITA would employ.

53. I understand that, to make an obviousness determination, it will sometimes be necessary to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art. I understand that all these issues may be considered to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. It is my understanding that motivation to combine prior art to form the claimed invention includes motivation or suggestions in a reference, common sense, the level of ordinary skill, and motivation derived from the nature of the problem to be solved.

54. I understand that an invention that might be considered an obvious variation or modification of the prior art may be considered non-obvious if one or more prior art references discourages or lead away from the line of inquiry disclosed in the reference(s). A reference does not “teach away” from an invention simply because the reference suggests that another embodiment of the invention is better or preferred. My understanding of the doctrine of teaching away requires a clear

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indication that the combination should not be attempted (*e.g.*, because it would not work or explicit statements saying the combination should not be made).

5.3. Claim Construction

55. I understand that the claim construction is for the USPTO. I understand that a claim construction order was recently issued in the Walmart-Everlight Litigation (Ex-1016). I have applied those constructions here (Ex-1016). For instance, when defining electrode and/or housing cross sections below, the Court defined the cross sections as “plane surfaces formed by cutting a solid” (Ex-1016 at 2-3). I note that the claim 1 element “the housing cross section and the electrode portion cross section are not level with one another” was found indefinite (Ex-1016 at 3). To the extent that the claim is definite, I apply the plain and ordinary meaning of the claims to a POSITA. The prior art is so close to the claims that that whatever the “not level” limitation means, the prior art references satisfy the claim regardless of whether a Court has determined that the claim is indefinite.

6. Technical Background

56. In this section, I describe engineering that was well-known to a POSITA prior to 2014.

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6.1. Light Emitting Diodes (LEDs)

57. A light-emitting diode (LED) is a semiconductor die that emits light when electric current flows through it. LEDs are well-known semiconductors dating back to as early as 1907.

58. LEDs can be made from a variety of semiconductor materials to emit different colors of visible light. For example, red LEDs, which were first introduced in the 1970s, can be made from Gallium Arsenide Phosphide (GaAsP), Gallium Phosphide (GaP), and Aluminum Gallium Arsenide (AlGaAs). Yellow LEDs, also demonstrated as early as 1972, can be made from GaAsP, GaP, and Aluminum Indium Gallium Phosphide (AlInGaP). And blue LEDs were made commercially available in 1989.

59. As the '733 patent recognizes, LEDs are known to have several advantages including, “a long service life, a small volume, high resistance to shock, low heat generation and low power consumption,” and as such “have been widely used as indicators or light sources in household appliances” (Ex-1001, '733 patent, 1:26-30).

60. LED chips are typically small and fragile. Thus, “[t]o impart the LEDs with good reliability, most of the LEDs are subjected to a packaging process to form durable light emitting devices” (Ex-1001, '733 patent, 1:36-39).

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61. LED packaging serves several purposes. For example, LED packaging provides electrically connection between the LED and a larger circuit; protects the device from environmental contaminants that would harm the semiconductor device (e.g., via encapsulation); provides an effective path for heat dissipation and thermal sinking to protect the chip from thermal degradation; permits effective transmission of light; and allows for optical manipulation of the output light, for example with lenses. This was all well-known to a POSITA well before 2014.

62. Most LEDs are mounted within a package. The package includes several subcomponents, namely the LED, a surface or place where the LED is mounted (or as the '733 patent describes, a “carrier” or “housing”), and two electrical leads (or “electrodes” in the '733 patent’s parlance). The package is then encapsulated in a material that both protects the LED and allows the light emitted by the LED to escape the package. The two leads provide electricity to the LED, with the positive electrode being the anode and the negative electrode being the cathode. This was all well-known to a POSITA well before 2014.

63. As the '733 patent describes, “[i]n recent years, a dicing-type carrier leadframe has been developed by manufacturers,” whereby a “plastic body is molded on a metal sheet material, then a die bonding process, a wire bonding process and an encapsulation process are performed, and then the metal sheet material and the

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plastic body are diced away simultaneously to form individual light emitting devices that are separate from each other” (Ex-1001, ’733 patent, 1:40-47).

64. The type of LED package manufacturing described in the ’733 patent was well-known and widely used prior to 2014.

6.2. LEDs Carried in a Carrier Housing were Well-Known Prior to 2014

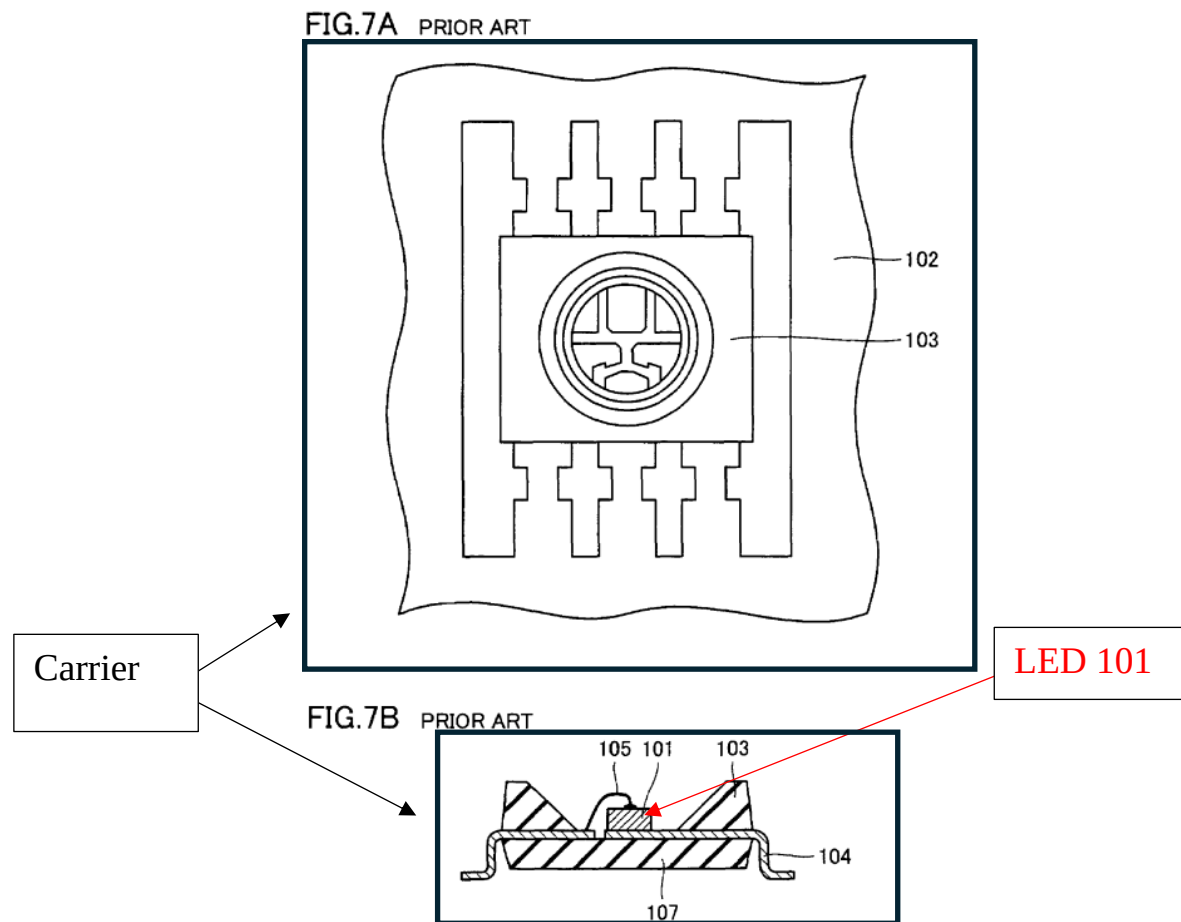
65. Prior to 2014, LEDs were commonly contained in a carrier housing. For example, in its “Background” section the ’733 patent describes that prior to the ’733 patent LEDs were die bonded to “a plastic body” (*i.e.*, a “carrier” or “carrier housing”) (See Ex-1001, ’733 patent, 1:40-44).

6.2.1. Chikugawa

66. U.S. Patent No. 7,161,190 to Chikugawa (“Chikugawa”) (Ex-1017) issued on January 9, 2007 and matured from a patent application filed on August 1, 2005. Because Chikugawa issued on January 9, 2007 and matured from an application filed on August 1, 2005, I was instructed that Chikugawa is prior art to the ’733 patent.

67. The below annotated version of “prior art” Chikugawa FIGs. 7A and 7B illustrate an LED 101 that is carried in a housing.

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6.2.2. Carey

68. Likewise, U.S. Patent No. 6,274,924 to Carey et al. (“Carey”) (Ex-1018), which issued on August 14, 2001 and matured from an application filed on November 5, 1998, illustrates an LED carried in a carrier housing. Because Carey issued on August 14, 2001, I was instructed that Carey is prior art to the ’733 patent.

69. For example, the below annotated version of Carey FIG. 2 shows a package or “carrier” with an LED die 16 mounted in a heat-sinking slug 10 in an “insert-molded leadframe 12” that “is a filled plastic material molded around a metal frame” (i.e., an LED in a housing) (see Ex-1018, Carey, 2:20-58). Carey’s

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package/carrier also has electrodes protruding from the side of the lead frame 12, and an optical lens 20 that “may be added by mounting a pre-molded thermoplastic lens and an encapsulant (not shown) or by casting epoxy to cover the LED or by a cast epoxy lens over the encapsulant (not shown)” (Ex-1018, Carey, 2:31-34).

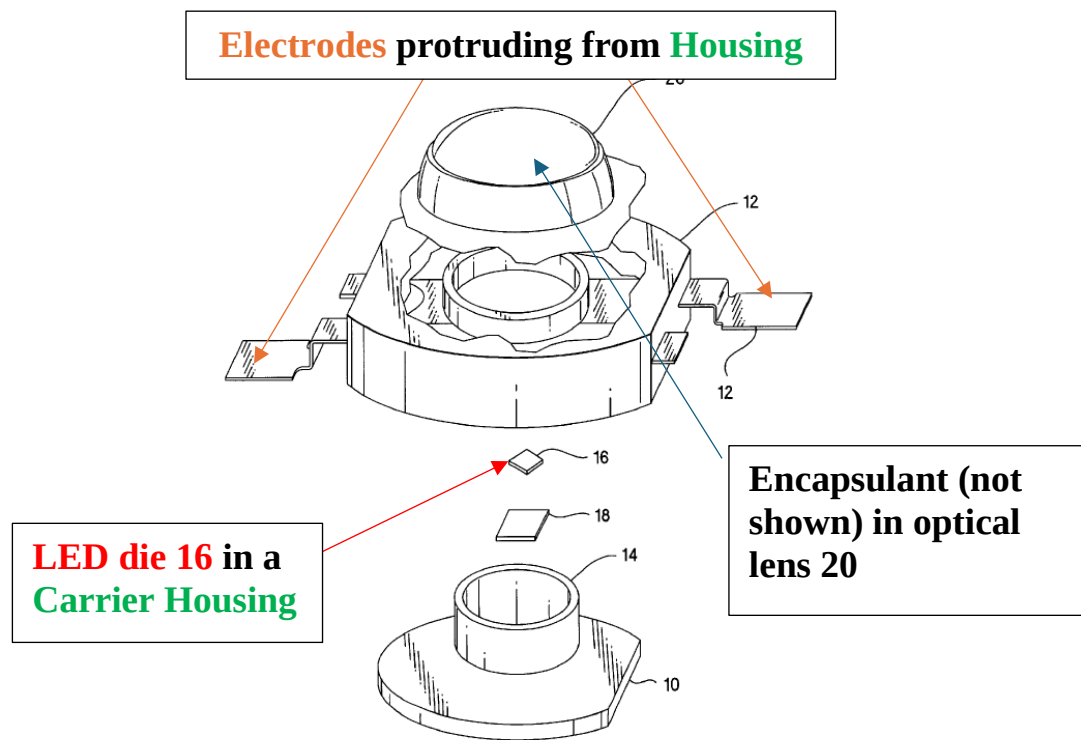


Figure 2

Figure 2 of Carey (Annotated)

6.2.3. Bogner

70. U.S. Patent No. 8,097,937 to Bogner et al. (“Bogner”) (Ex-1019), which issued on January 17, 2012 and matured from a patent application filed on October 10, 2003, also illustrates a similar configuration. Because Bogner issued on

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January 17, 2012 and matured from an application filed in October 2003, I was instructed that Bogner is prior art to the '733 patent.

71. As shown in the below annotated version of Bogner FIG. 4, a radiation-emitting chip 5 (i.e., an LED) is mounted on a mounting area 11 of a thermal connecting part 4 in the housing base body 1 (Ex-1019, Bogner, 8:6-67). The Bogner package/carrier also includes electrical connecting parts 12a, 12b (i.e., electrodes) that protrude from the housing body 1.

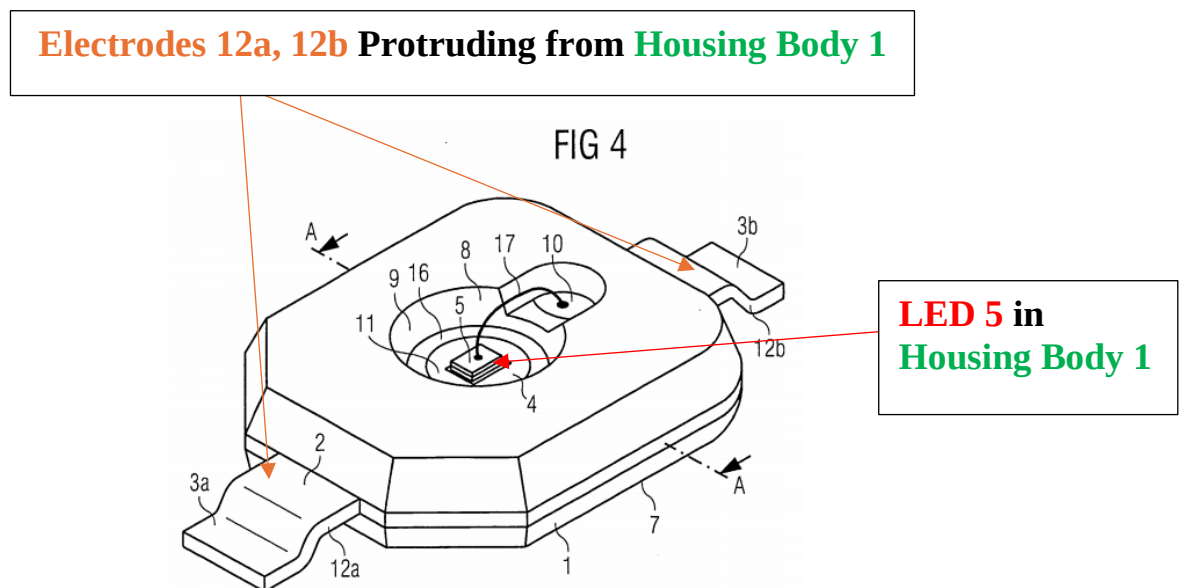


Figure 4 of Bogner (Annotated)

72. While not explicitly called out in the Figures, Bogner also teaches that the LED 5 “The chip is, preferably, at least partially sheathed by an encapsulation compound, preferably, a plastic compound, in particular, a casting resin or a molding compound” (Ex-1019, Bogner, 5:31-34).

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73. Chikugawa, Carey, and Bogner each exemplify that LED packages/carriers with LEDs mounted in housings that were commonplace and widely used before 2014.

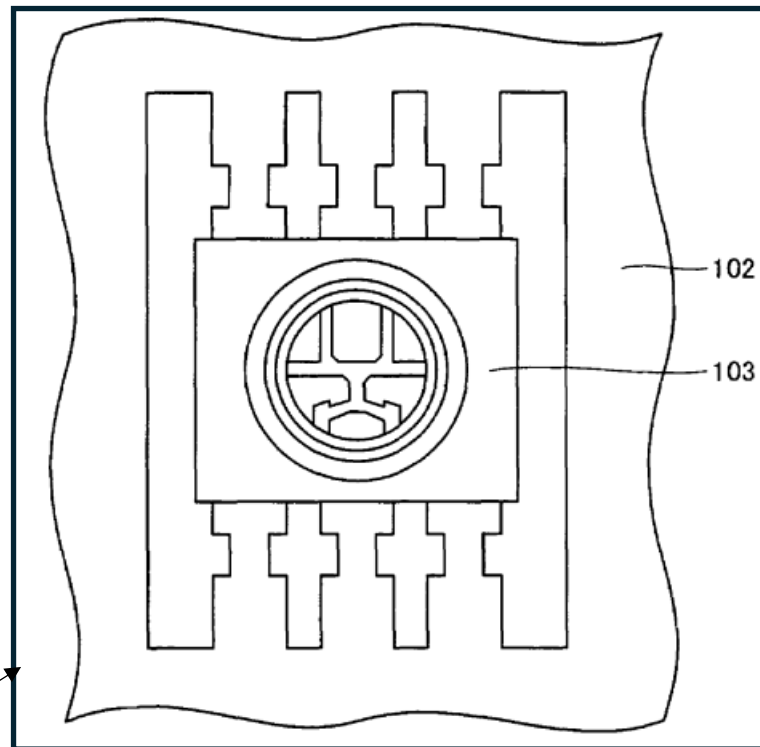
6.3. LEDs Carried in a Carriers with Electrodes were Well-Known Prior to 2014

74. Prior to 2014, a POSITA knew that LEDs were commonly carried in packages/carriers that included electrodes. Based on my experience in the field, LED were packaged to include electrodes in the 1970's, which decades before the earliest filing date of the '733 patent and was well within the ordinary level of skill in the art.

6.3.1. Chikugawa

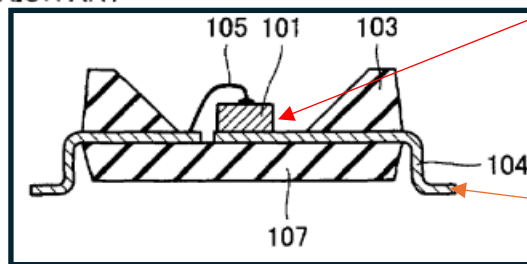
75. For example, the below annotated version of “prior art” Chikugawa FIGs. 7A and 7B illustrate an LED 101 that is carried in a housing. And Chikugawa further describes that the LED 101 is mounted on a “[l]ead frame 102 ... [that] has a lead terminal portion 104,” which are electrodes (Ex-1017, Chikugawa, 1:37-38).

FIG.7A PRIOR ART



Carrier

FIG.7B PRIOR ART



LED 101

**lead terminal
portion/electrode
104**

Figures 7A and 7B of Carey (Annotated)

6.3.2. Carey

76. Similarly, the below annotated version of Carey FIG. 2 shows a package or “carrier” with an LED die 16 mounted in a heat-sinking slug 10 in an “insert-molded leadframe 12” that “is a filled plastic material molded around a metal frame” (i.e., an LED in a housing) (*See Ex-1018, Carey, 2:20-58*). Carey’s package/carrier

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also has electrodes protruding from the side of the lead frame 12, and an optical lens 20 that “may be added by mounting a pre-molded thermoplastic lens and an encapsulant (not shown) or by casting epoxy to cover the LED or by a cast epoxy lens over the encapsulant (not shown)” (Ex-1018, Carey, 2:31-34).

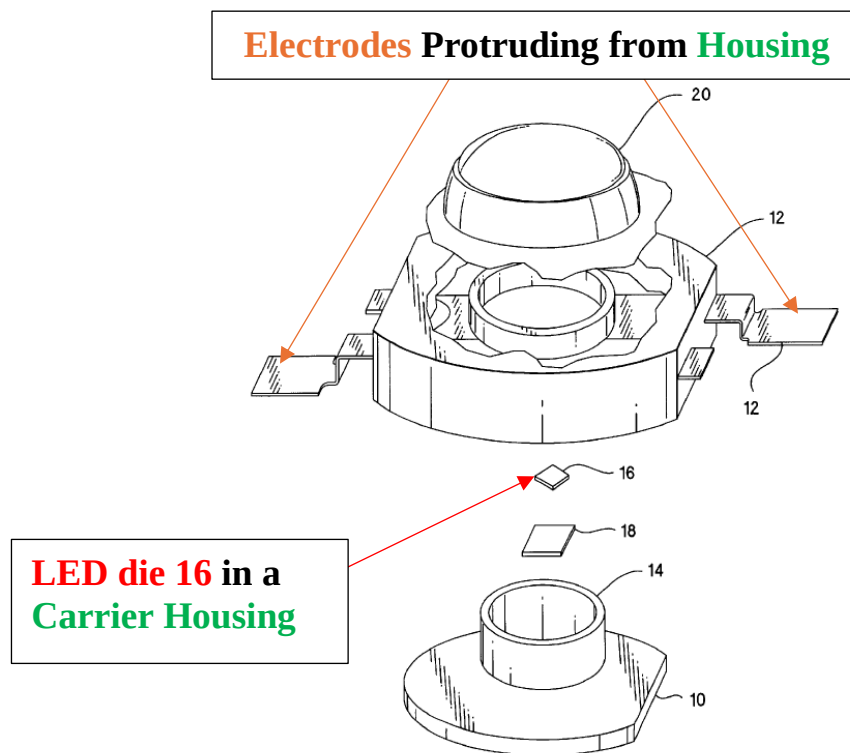


Figure 2

Figure 2 of Carey (Annotated)

6.3.3. Bogner

77. As shown in the below annotated version of Bogner FIG. 4, a radiation-emitting chip 5 (i.e., an LED) is mounted on a mounting area 11 of a thermal connecting part 4 in the housing base body 1 (*See* Ex-1019, Bogner, 8:6-67). The

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Bogner package/carrier also includes electrical connecting parts 12a, 12b (i.e., electrodes) that protrude from the housing body 1.

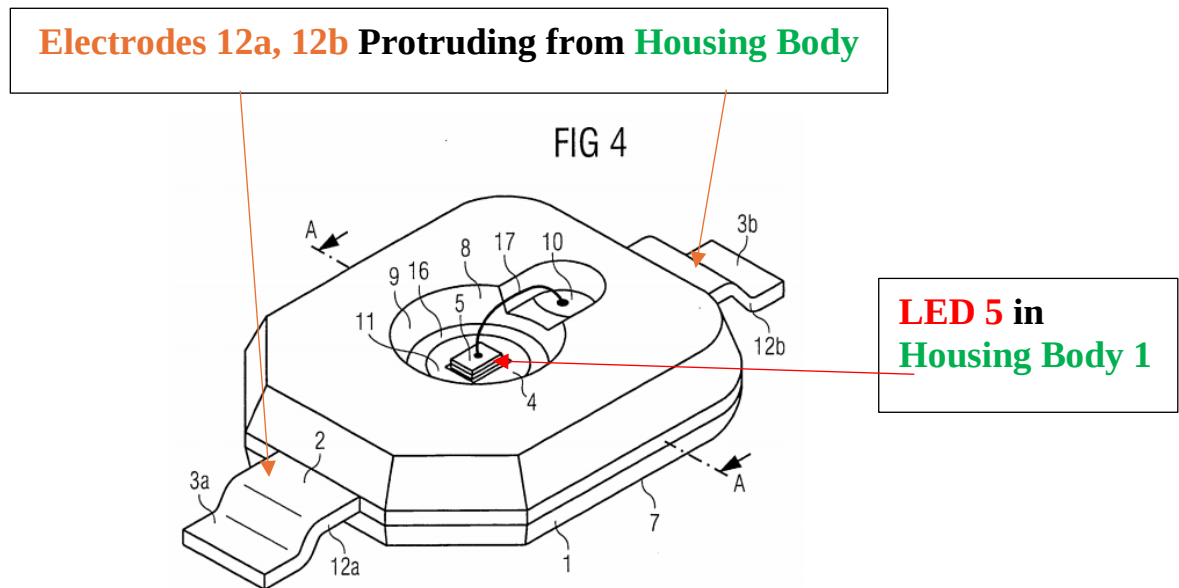


Figure 4 of Bogner (Annotated)

78. While not explicitly called out in the Figures, Bogner also teaches that the LED 5 “The chip is, preferably, at least partially sheathed by an encapsulation compound, preferably, a plastic compound, in particular, a casting resin or a molding compound” (Ex-1019, Bogner, 5:31-34).

79. Chikugawa, Carey, and Bogner each exemplify that LED packages/carriers with LEDs mounted in housings were commonplace and widely in use before 2014.

6.4. Encapsulants Covering an LED Chip were Well-Known to a POSITA

80. As I introduced above, LED packages that include an encapsulant that cover the LED chip were widely known before 2014. For example, based on my experience, encapsulants have been used in LED packaging since the 1970s and thus was well with the ordinary level of skill in the art prior to the '733 patent.

81. The encapsulants in such packages have several purposes, including protecting the chip and the delicate wiring that electrically connects the chip, changing the color of the light emitted by the LED, and providing an optical medium to maximize light extraction from the LED package.

6.4.1. Carey

82. Carey discloses a package/carrier that includes an encapsulant in the optical lens 20. Carey further describes that the “encapsulant is preferably a soft material that provides low stress or cushioning to the LED die” (Ex-1018, 2:35-36). And “[b]ecause the LED die is thermally coupled to the heatsinking slug, the die can be maintained at a junction temperature lower than conventional packages,” which “maintains reliability and performance under high-power conditions because the die is not subject to high thermal stress” (Ex-1018, 2:36-41).

83. Carey further describes that the encapsulant “is a soft optically transparent material having a refractive index >1.3 , e.g. silicone, liquid or gelatinous

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optical compound, and fills the optical path between an LED die 16 and the optical lens 20,” and “protects the LED die 16” (Ex-1018, 3:11-15).

84. Carey therefore illustrates that the use of encapsulants to protect and reduce the stress on LEDs was well-known and widely used prior to 2014.

6.4.2. Bogner

85. While not explicitly shown in the Figures, Bogner discloses that its LED chip 5 is “preferably, at least partially sheathed by an encapsulation compound, preferably, a plastic compound, in particular, a casting resin or a molding compound” (Ex-1019, 5:31-33). Bogner also describes that a “fluorescent substances can be added to the encapsulation compound, which convert the radiation that is produced by the chip to a different wavelength band,” and that “[s]uch an embodiment is suitable particularly for a component that emits mixed colors or white light” (Ex-1019, Bogner, 5:40-45).

6.4.3. Tanda

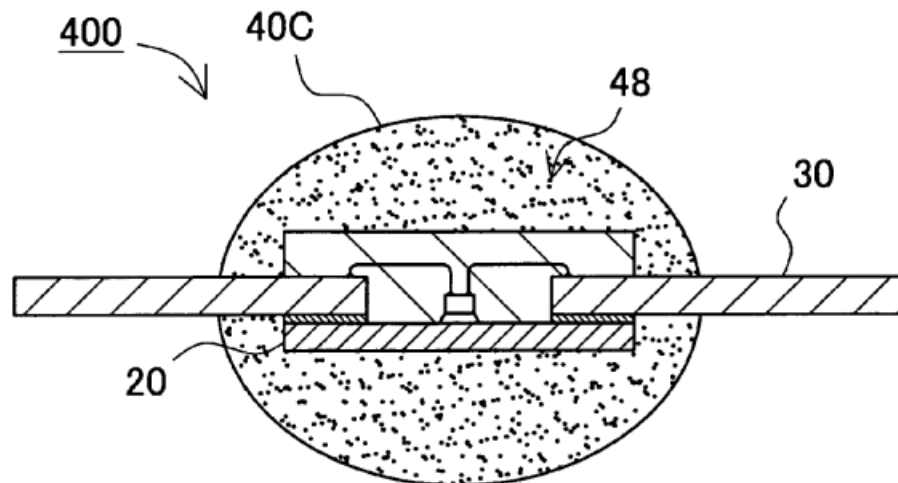
86. U.S. Patent Application Publication No. 2007/0139949 to Tanda et al. (“Tanda”) (Ex-1020), which published on June 21, 2007, also shows the use of LED encapsulants. Because Tanda published on June 21, 2007, I was instructed that Tanda is prior art to the ’733 patent.

87. For example, the below annotated version of Tanda FIG. 6 illustrates a transparent member 40 that encapsulates an LED chip. Tanda describes that the

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transparent member 40 can “can additionally serve as the wavelength conversion member” (Ex-1020, Tanda, ¶ [0047]). Tanda teaches that phosphors 48 “can be mixed into an epoxy resin” that forms the transparent member 40 (Ex-1020, Tanda, ¶ [0047]). The wavelength conversion member “can be disposed around the periphery of the light emitting element 10,” and using the phosphors 48, “[t]he wavelength conversion member 50 can absorb light emitted by the light emitting element 10 and convert its wavelength so as to emit luminescent radiation with different wavelength” (Ex-1020, Tanda, ¶ [0046]).

FIG.6



88. Thus, Tanda shows the use of encapsulants, for example, made of epoxy and including phosphors, that protect LEDs and convert the color of the light emitted by the LED prior to 2014.

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6.4.4. Bando

89. U.S. Patent No. 7,719,024 to Bando (“Bando”) (Ex-1009) issued on May 18, 2010 and matured from a U.S. Patent Application filed on December 27, 2006. Because Bando issued in May, 2010 and matured from an application filed on December 2006, I was instructed that Bando is prior art to the ’733 patent.

90. Bando discloses an encapsulant covering an LED chip. Bando discloses that after its light emitting elements 10 (which are semiconductor light emitting elements i.e., LED chips (Ex-1009 at 8:35-49) are secured in package 2, sealing resin 4 is filled within the molding member of the package (Ex-1009 at 14:41-45). Bando discloses that the sealing resin 4 encapsulating the light emitting element has the beneficial effect of “prevent[ing] short circuit of the wire lines 3, and the p-pad and n-pad electrodes of the light emitting elements 10” (Ex-1009 at 14:45-47). Further, it has the beneficial effect of being “formed in a desired shape on the light emission side to provide a lens effect” in order to focus the light from the light emitting element 10 in a desired direction (Ex-1009 at 14:65-15:10). It can also “improve adhesion between the light emitting element 10 and the lead middle region 101” (Ex-1009 at 15:11-14). Finally, if “sealing resin 4 is mixed with a wavelength conversion member such as phosphor material that is excited by light from the light emitting elements 10 and emits luminescent radiation, the light from the light emitting elements 10 is converted to light with different wavelength, thus,

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it is possible to emit mixture light of the light from the light emitting elements 10 and the light with wavelength converted by the wavelength conversion member” (Ex-1009 at 15:22-29).

91. Carey, Bogner, Tanda, and Bando together exemplify that the use of encapsulants to cover LED chips was commonplace and widely in use before 2014.

6.5. LED Electrodes Comprising Antioxidant Layers were Well-known to a POSITA

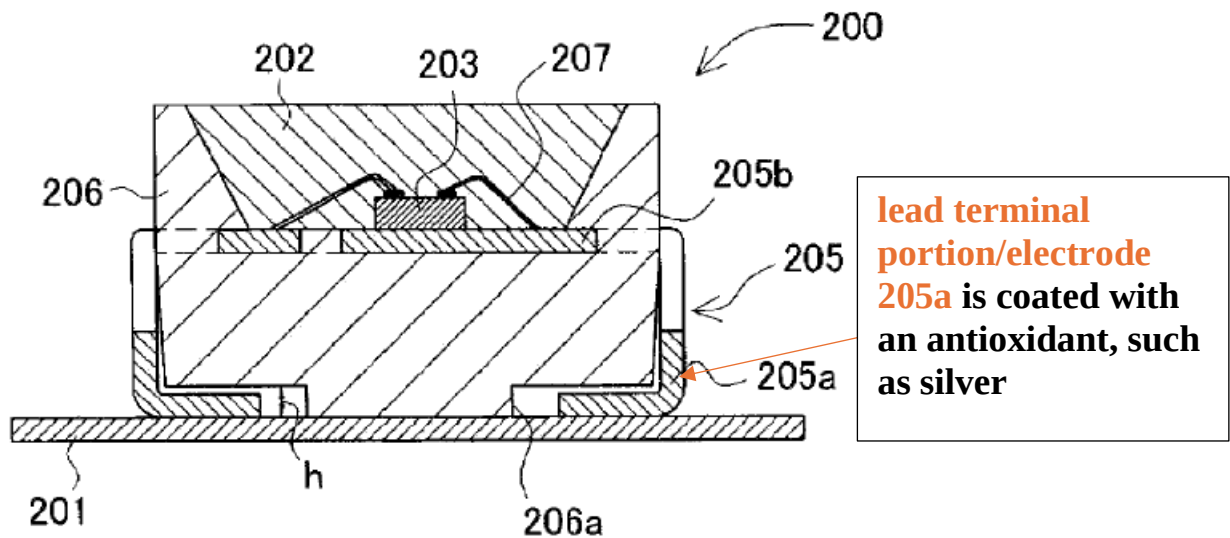
92. LED electrodes comprising antioxidant layers were well-known to a POSITA prior to 2014.

6.5.1. Bando

93. In its “Background” section, Bando illustrates a “conventional” LED package/carrier 200. Bando’s “conventional” LED carrier 200 includes an “LED chip 203 [that] is mounted on the lead middle portion 205b” (Ex-1009, Bando, 1:55-56). Bando further describes that the lead terminal portion 205a, which are electrodes, protrude from the carrier (See Ex-1009, Bando, 1:19-26). Bando further describes that because the lead 205a “is made of a conductive material such as copper and iron, silver or the like is plated to prevent oxidation (Ex-1009, Bando, 2:4-6). Oxidation can cause metals to deteriorate. This deterioration can lead to electrical and mechanical failures. Therefore, coating a metal electrode to prevent oxidation was routine to a POSITA.

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94. Thus, as shown in the below annotated version of FIG. 18, Band discloses electrodes 205 that are coated with “silver or the like is plated to prevent oxidation” (i.e., an antioxidant).



6.6 Manufacturing of LED’s Packaging by Dicing Lead Frames was Known

95. Mass producing lead frames and dicing lead frames was known to a POISTA and widely used before 2014.

6.6.1. Takada

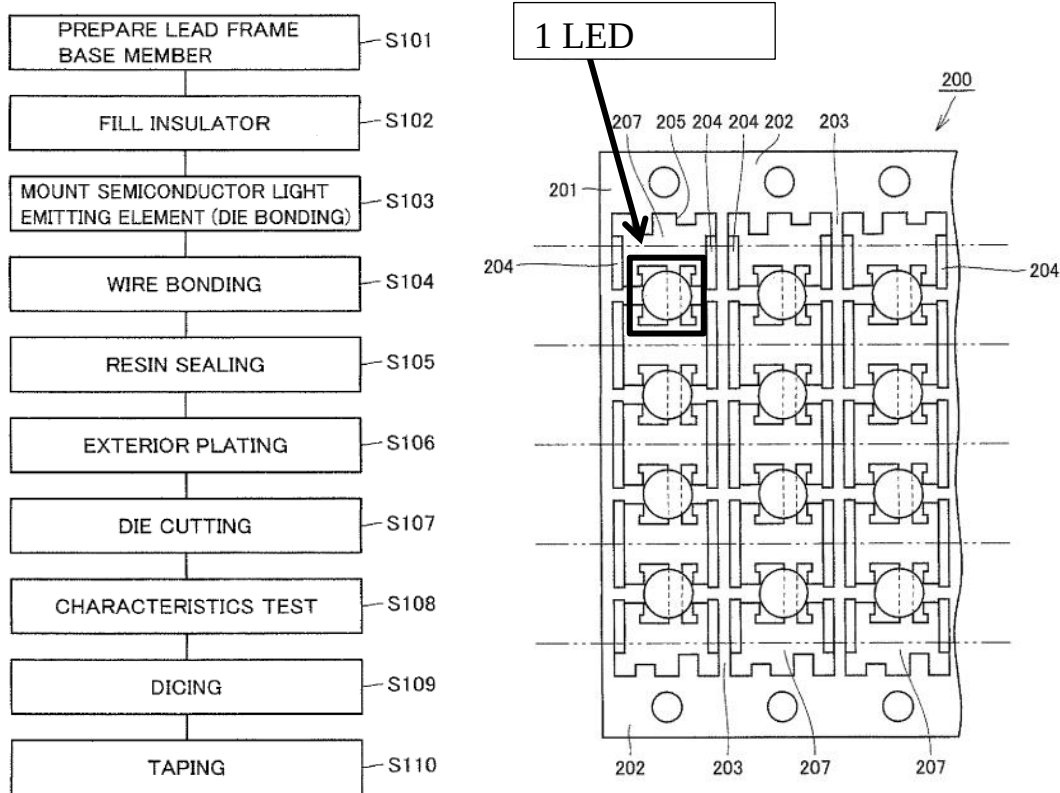
96. U.S. Patent No. 8,415,681 to Takada (“Takada”) (Ex-1012) issued on April 9, 2013 and matured from a patent application filed on March 12, 2008. Because Takada issued on April 9, 2013 and matured from a patent application filed on March 12, 2008, I was instructed that Takada is prior art to the ’733 patent.

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97. Takada, for example, illustrates a dicing a lead frame in FIG. 4, which is reproduced below. With respect to dicing lead frames, Takada describes that “a dicing apparatus is used to cut multiple lead frame 200 along the outer shape of the semiconductor light emitting devices arranged in a matrix (i.e., along the alternate long and two short dashes line in FIG. 4)” (Ex-1012, 11:3-6). With such a lead frame design, “the singulation is performed, where the plurality of semiconductor light emitting devices are cut from multiple lead frame 200, each being separated into a single semiconductor light emitting device having single lead frame 1 and resin portion 2 surrounding lead frame 1” (Ex-1012, Takada, 11:7-12).

98. In the well-known LED package manufacturing process described in Takada, multiple LED packages are formed by, for example, stamping a metal sheet to form metal frames, depositing a resin over at least part of the metal, and dicing the sheet to form individual LED packages (Ex-1012, Takada, 11:3-12; FIGs. 11-16). Takada FIG. 11 is one example of an LED manufacturing process, and Takada FIG. 12 illustrates LED packages singulation into individual packages.

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99. Takada further describes that “while each semiconductor light emitting device is connected to support frame (cradle) 202 by resin base member 207, the devices are electrically independent. Accordingly, in the subsequent step (S108), it is possible to perform a semiconductor light emitting device characteristics test for each multiple lead frame” (Ex-1012, Takada, 14:48-53). As shown in the above Takada Fig. 11, the “CHARCTERISTIC TEST” at S108 is preformed prior to “DICING” at S108.

6.6.2. Abe

100. U.S. Patent No. 8,035,125 to Abe (“Abe”) (Ex-1020) issued on October 11, 2011 and matured from an application filed on April 12, 2007. Because Abe

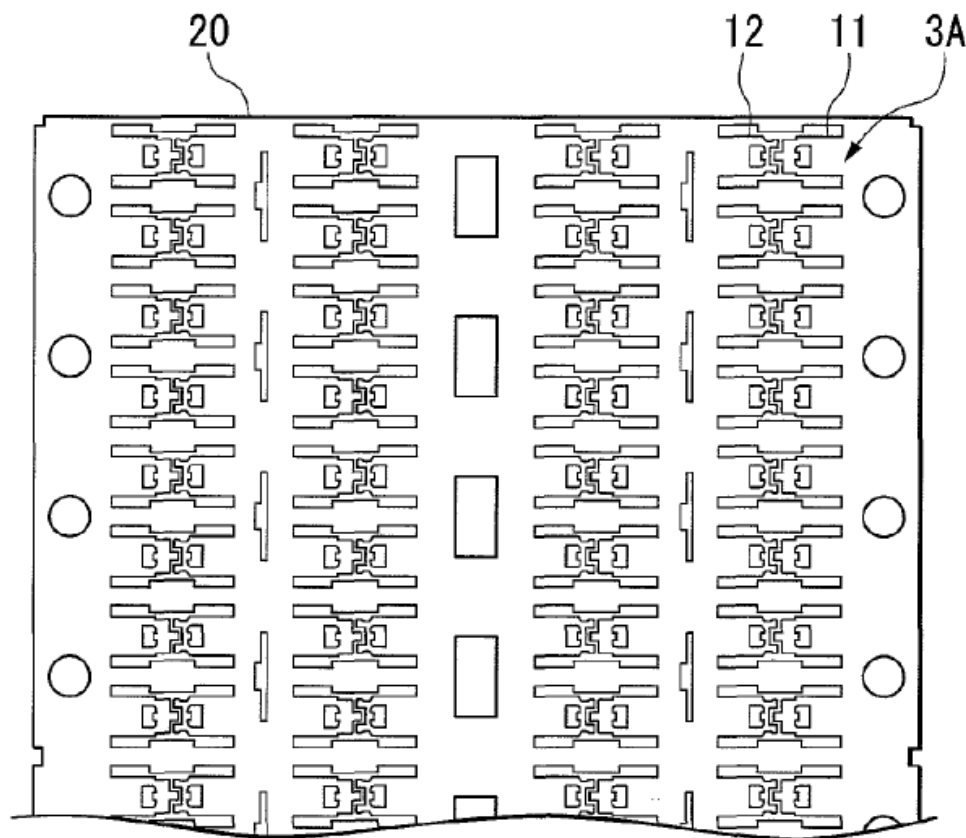
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issued on October 11, 2011 and matured from an application filed on April 12, 2007,

I was instructed that Abe is prior art to the '733 patent.

101. As shown below, Abe FIG. 4 shows frame plate 20, which is a leadframe. Abe further describes that lead frame 20 has “a plurality of portions 3A corresponding to the lead frames 3 arranged in a matrix thereon,” and that the “plurality of portions 3A corresponding to the lead frames 3 in which portions corresponding to the first electrode leads 11 and the second electrode leads 12 are punched out are arranged in a matrix” (Ex-1021, Abe, 8:40-47).

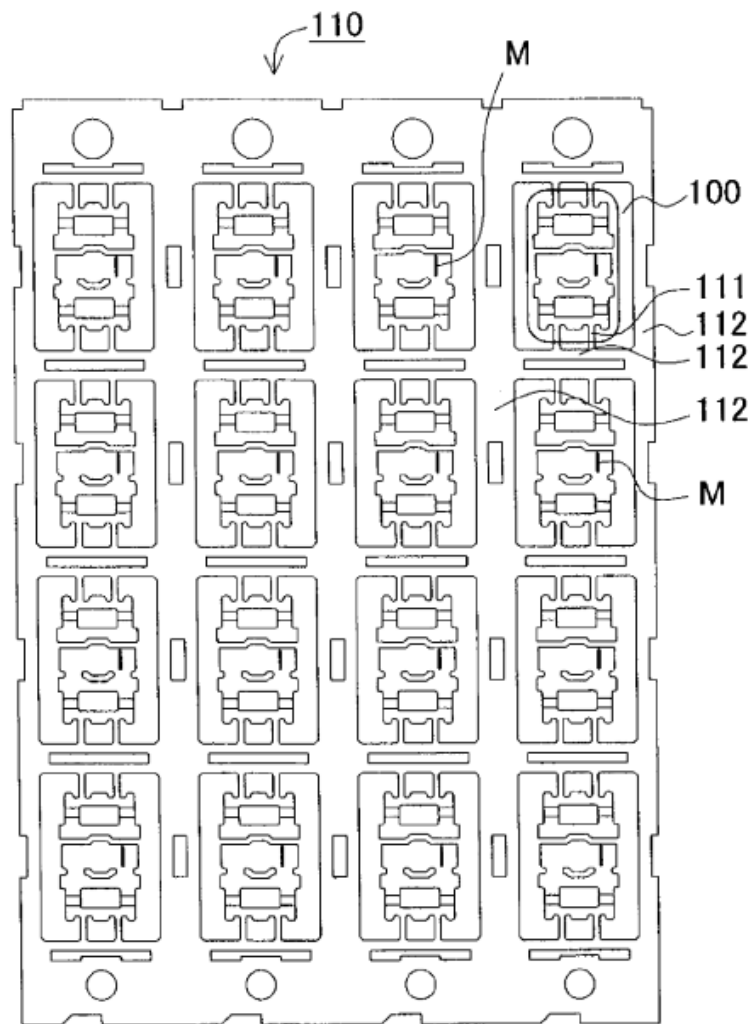
FIG. 4



6.6.3. Bando

102. Bando also shows a lead frame 110 in FIG. 4. Bando further describes such dicing-type lead frames as being used in the “conventional production of [] light emitting device[s]” where “a plurality of patterns for light emitting devices are formed in a lead frame 110 made of a sheet of conductive material (Ex-1009, 1:43-47). “Subsequently, the lead frame is subjected to production processes,” and “is cut and separated into individual patterns,” resulting in “a plurality of light emitting devices [being] produced at a time” (Ex-1009, 1:47-53).

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6.6.4. Bierhuizen

103. World Intellectual Property Organization (“WIPO”) Publication No. WO2013118072A2 to Bierhuizen (“Bierhuizen”) (Ex-1022) published on August 15, 2013. Because Bierhuizen published on August 15, 2013 and matured from an application filed on February 10, 2012, I was instructed that Bierhuizen is prior art to the ’733 patent.

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104. Bierhuizen also illustrates a well-known LED package manufacturing process. Bierhuizen describes an LED package manufacturing process that includes testing the LED prior to dicing or singulation, as shown in the below Bierhuizen Figure 2.

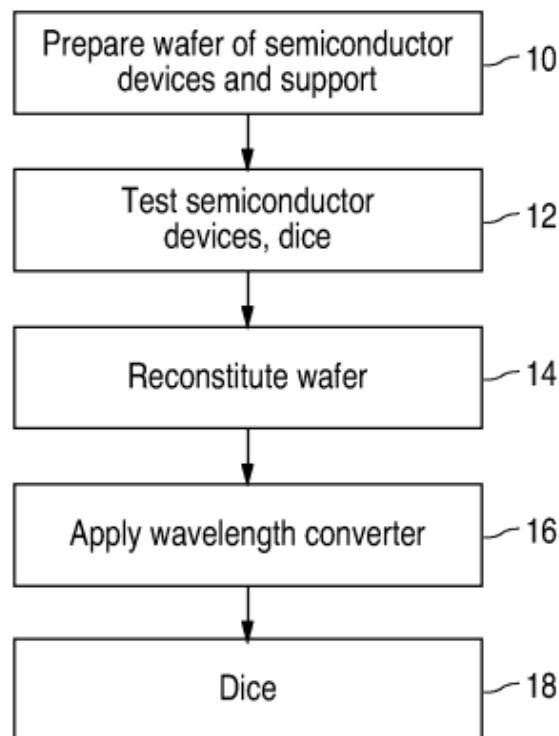


FIG. 2

Bierhuizen Figure 2

105. Bierhuizen’s process allows “individual semiconductor devices on the wafer ... to identify good devices, and optionally to identify characteristics of each device, such as the peak emission wavelength, brightness, etc.” (Ex-1022, ¶ [0019]). Bierhuizen further describes that “[s]ince device testing is done before wavelength

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converting material is applied in stage 16 and only good devices are used, no wavelength converting material [i.e., encapsulant] is wasted on bad devices (i.e. nonfunctional or non-light-emitting devices), which may reduce cost” (Ex-1022, ¶ [0020]). Bierhuizen also states that “based on the test described above in reference to stage 12, only devices that emit light within the same peak wavelength range are connected to substrate 28 in the reconstituted wafer, such that the wavelength converting material can be matched to the peak emission wavelength of the devices, which may improve yield” (Ex-1022, ¶ [0020]).

106. Takada, Abe, Bando, and Bierhuizen each exemplify that manufacturing and/or packaging LEDs by dicing leadframes was well-known before 2014.

7. The '733 Patent

107. The '733 patent issued on May 2, 2017 and matured from U.S. Patent Application No. 14/720,230 filed on May 22, 2015. The '733 patent also claims priority to a foreign patent application filed May 23, 2014.

7.1. The Relevant Technical Field

108. The '733 patent includes twelve claims, one of which is independent. Claim 1, the sole independent claim, is directed to a “light emitting device” that includes five structural components: (1) a carrier that comprises (2) an electrode

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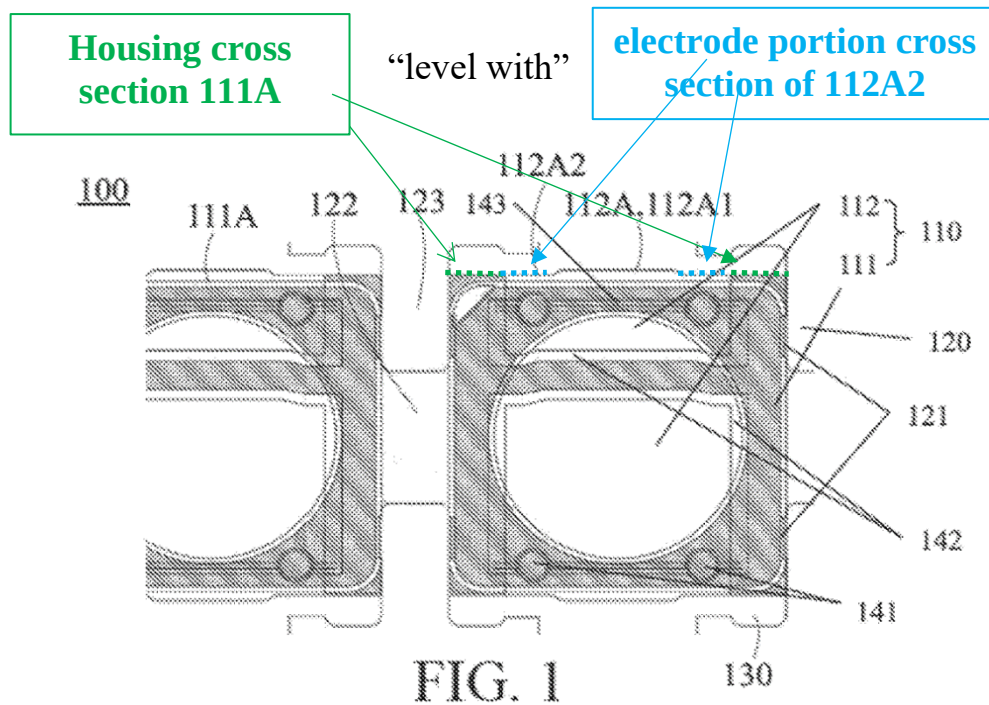
portion and (3) a housing; (4) an LED chip carried within the carrier; and (5) an encapsulant covering the LED chip (Ex-1001, '733 patent, 14:6-20).

109. As I explain in Section 7 above, each of the five structural components claims in the '733 patent was well-known and widely used before 2014.

7.2. The '733 Patent's LED Package

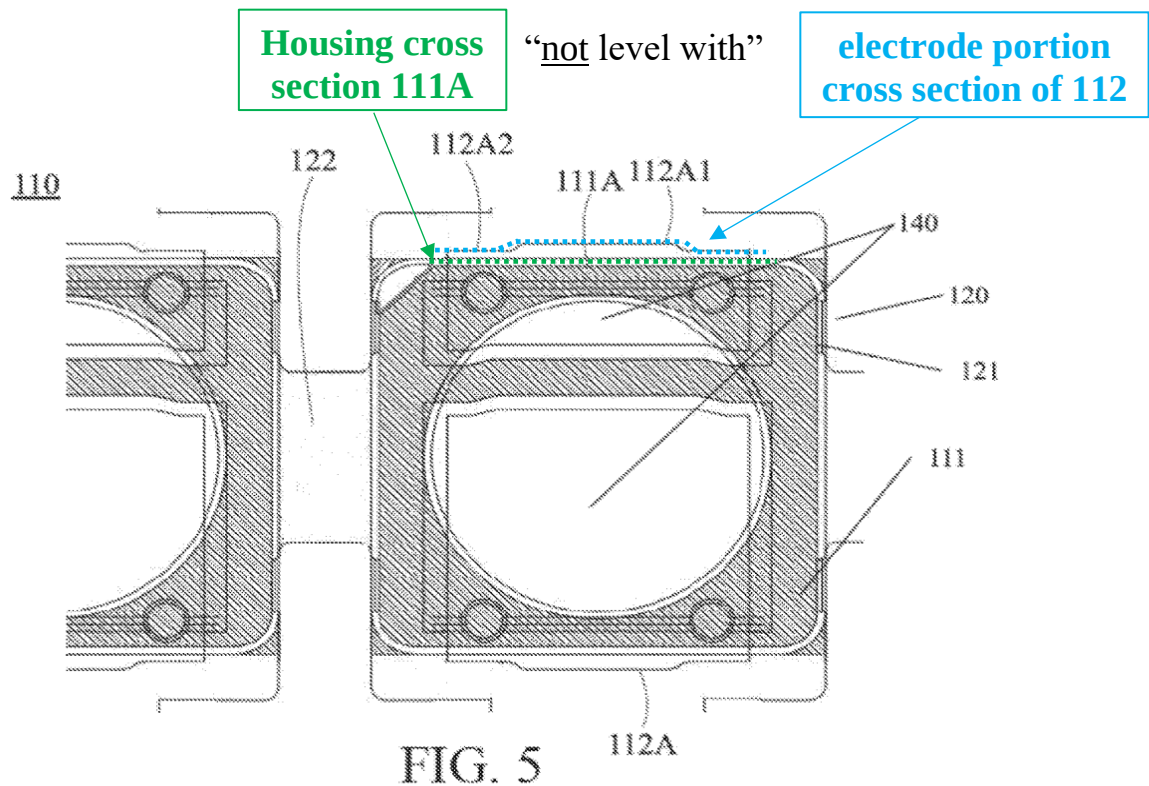
110. The '733 patent describes LED packages with conventional LED components, such as an LED, electrodes, a housing, and an encapsulant (*see* Ex-1001 at 1:43-45). The '733 patent describes different configurations of the claimed “electrode portion” relative to the “housing” (Ex-1001 at 14:6-49).

111. The '733 patent describes that a “carrier includes a housing and at least one electrode portion” (Ex-1001 at 3:9-10). The carrier 110 of FIG. 1 comprises a housing 111 and two electrode portions 112 having wing portions 112A, which each have a central protruding area 112A1 and two outer edge areas 112A1, 112A2 (Ex-1001 at 3:26-29; 6:40-44). In FIG. 1, “each of the edge areas 112A2 comprises an electrode portion cross section, and the electrode portion cross sections are level with a part of the housing cross section 111A of the housing 111” (Ex-1001 at 6:44-47).



The '733 Patent FIG. 1 (Annotated)

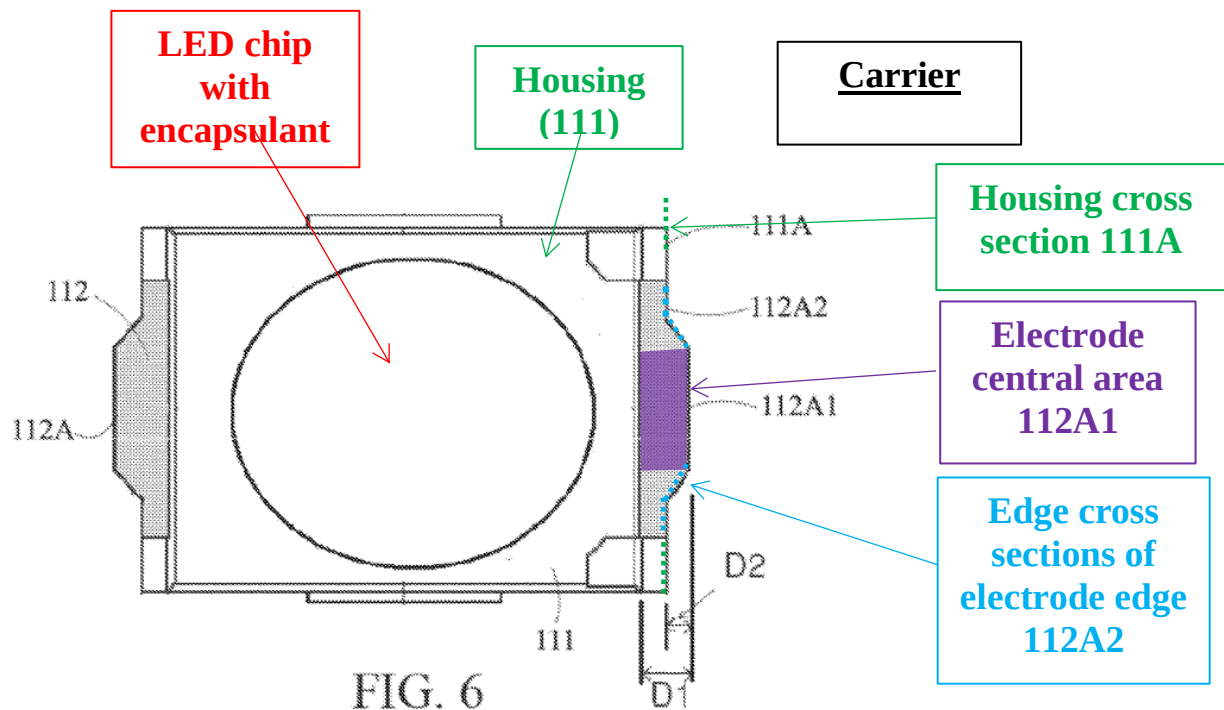
112. In another example in FIG. 5, “the wing portion 112A of the electrode portion 112 comprises a central protruding area 112A1 and two outer edge areas 112A2” (Ex-1001 at 6:49-53). In FIG. 5, the “electrode portion cross section of the electrode portion 112 is not level with the housing cross section 111A of the housing 111” (Ex-1001 at 6:49-53). The “additional lateral area” of the “not level” electrode and housing cross sections allegedly “increase the binding force with the solder, so as to increase the component bonding strength of the light emitting devices” (Ex-1001 at 6:54-58).



The '733 Patent FIG. 5 (Annotated)

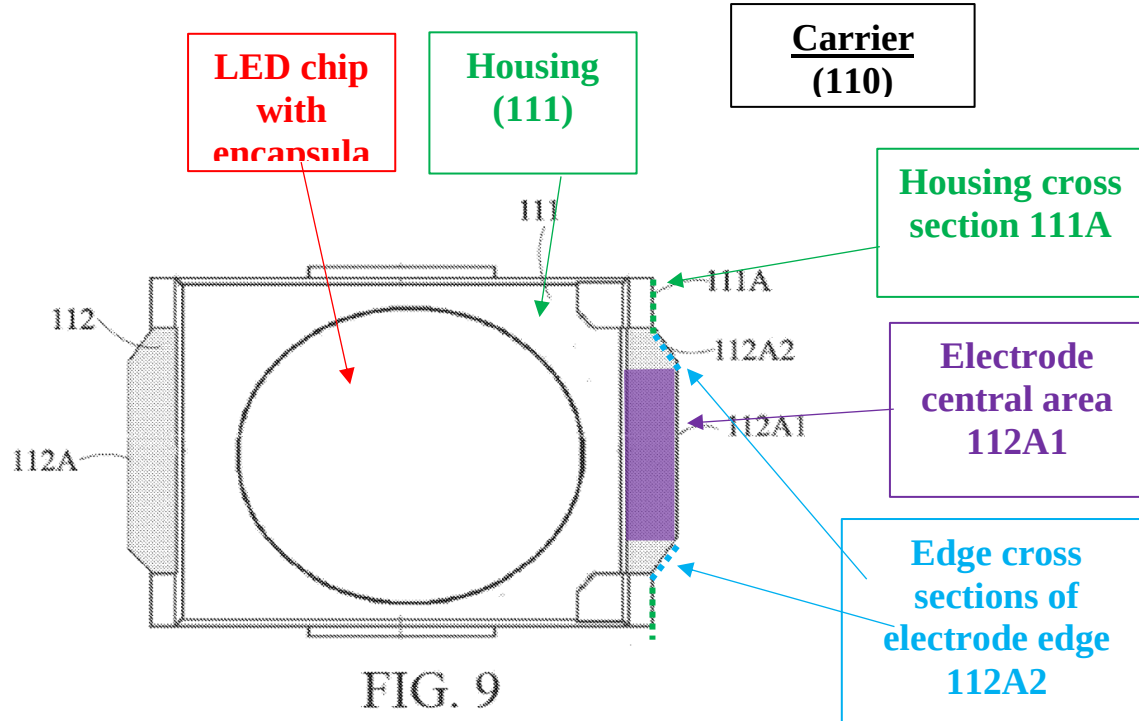
113. FIG. 6 illustrates another configuration of a carrier 110 having housing 111 and an electrode portion 112 (Ex-1001 at 2:43-44; 8:51-60). Although not identified in FIG. 6 (or any figure), the '733 patent describes that an LED chip is carried within the carrier and covered by an encapsulant, such as epoxy resin (Ex-1001 at 6:17-20). FIG. 6 has been annotated to show where the LED chip and encapsulant would be found. The FIG. 6 configuration has an electrode portion 112 having a central area 112A1 and wing portions 112A that protrude from the housing 111 (Ex-1001 at 8:53-60). FIG. 6's embodiment has a housing cross section 111A (green). Cross sections can be drawn through the electrode edge area (blue).

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The '733 Patent FIG. 6 (Annotated)

114. FIG. 9 of the '733 patent describes another example in which the edge cross sections of electrode edge 112A2 are described as “sloping surfaces” and the wing portion 112A is described as not being coplanar with the cross section 111A of housing 111 (Ex-1001 at 8:43-48).



115. While other housing/electrode configurations are discussed, none are described as novel or advantageous. As the '733 patent admits, LED packages having a plastic body molded on a metal sheet, an LED that is die bonded to the package, wire bonds for electrically connecting the LED to the electrode, and an encapsulant for encapsulating the LED were all well-known.

116. The '733 patent discusses manufacturing process. A stated manufacturing problem identified by the '733 patent is that "a large amount of plastic and metal dusts tend to be produced . . . which seriously pollute the surfaces of the final products" when dicing LED packages (Ex-1001 at 1:47-49). Another stated problem was that prior art manufacturing processes did allow for a "light-on test

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prior to the encapsulation process” which requires the “use of additional instruments and is time consuming” (Ex-1001 at 1:51-58).

117. In view of these stated problems, the ’733 patent discusses an LED packaging manufacturing process that uses a conductive sheet 160 shown in Figure 2, on which a plastic body 150 is formed as shown in Figure 3 (Ex-1001 at FIG. 2-3; 4:36-5:23).

118. The ’733 patent also describes removing unneeded parts of the metal and plastic, dicing/stamping the conductive sheet and plastic, and cleaning the package (Ex-1001 at 5:24-6:25). The ’733 patent describes benefits associated with removing plastic and metal non-simultaneously because nonuniform stresses are created by cutting different materials simultaneously (Ex-1001 at 6:3-25) and electronic measurements can be performed prior to singulation since the electrodes for each package are isolated (Ex-1001 at 10:57-65). However, based on my experience, the ability test LEDs (e.g., perform electronic measurements) was well-known and being used by those having ordinary skill in the art since the 1960s.

119. While the ’733 patent discusses manufacturing, the patent claims are directed to devices, not manufacturing processes.

7.3. The Prosecution History

120. In preparing my report, I have reviewed the file history of the ’733 patent (“’733 patent file history”) (Ex-1002). I discuss only portions of the file

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history herein, but I reserve the right to rely on any other portion of the file history for my opinions as this matter proceeds.

121. The '733 patent matured from U.S. Patent Application No. 14/720,230, which was filed on May 22, 2015 (“’230 application”). The ’230 application claims priority to two foreign patent applications: Taiwanese Application No. 104103527 filed on February 3, 2015; and Taiwanese Application No. 103118060 filed on May 23, 2014.

122. The originally-filed ’230 application contained 10 claims, all of which were apparatus claims (Ex-1002, ’733 patent file history, p. 35-36). Claims 1 and 6 were independent (Ex-1002, ’733 patent file history, p. 35-36).

123. In the first office action, the examiner issued a restriction requirement, alleging that the “application contains claims directed to the following patentably distinct species I (Fig. 1), and species II (Fig. 5), species III (Fig. 6), species IV (Fig. 7), Species 5 (Fig. 8), Species 6 (Fig. 9), Species 7 (Fig. 10), Species 8 (Fig. 11), Species 9 (Fig. 12A-D), Species 10 (Figure 13A-16), Species 11 (Fig. 17A-D), Species 12 (Fig. 18A-22)” (Ex-1002, ’733 patent file history, p. 262). The examiner further required the Applicant to elect “a species to be examined” and identify “the claims encompassing the elected species or grouping of patentably indistinct species” (Ex-1002, ’733 patent file history, p. 263).

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124. In response to the restriction requirement, Applicant cancelled application claims 1-10, and added new application claims 11-25 (Ex-1002,'733 patent file history, p. 267-270). Application claims 11-25 were all apparatus claims, with claim 11 being the sole independent claim (Ex-1002,'733 patent file history, p. 267-269). Applicant further elected "Species II (Fig. 5) for further examination and prosecution" (Ex-1002,'733 patent file history, p. 271).

125. Claim 11 as originally-filed is reproduced below:

11. A light emitting device, comprising:
a carrier;
a light emitting diode (LED) chip carried within the carrier; and
an encapsulant covering the LED chip,
wherein the carrier comprises:
at least one electrode portion, each of the at least one electrode portion comprising at least an electrode portion cross section; and
a housing comprising a housing cross section, the housing at least partially covering the at least one electrode portion,
wherein the housing cross section and the electrode portion cross section are not level with one another.

126. No further office actions were issued. But in a notice of allowance dated March 8, 2017, the examiner cancelled application claims 12-14 and amended application claim 11 to incorporate the subject matter originally recited in claims 12-14. Claim 11 as amended by the examiner read:

11. A light emitting device, comprising:
a carrier;
a light emitting diode (LED) chip carried within the carrier; and

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an encapsulant covering the LED chip,
wherein the carrier comprises:

at least one electrode portion, each of the at least one electrode portion comprising at least an electrode portion cross section; and

a housing comprising a housing cross section, the housing at least partially covering the at least one electrode portion,
wherein the housing cross section and the electrode portion cross section are not level with one another; wherein each of the at least one electrode portion further comprises a central area and two edge areas, and wherein the electrode portion cross section is located on at least one of the two edge areas; wherein the central area and the two edge areas protrude from the housing cross section; wherein the central area protrudes from the two edge areas.

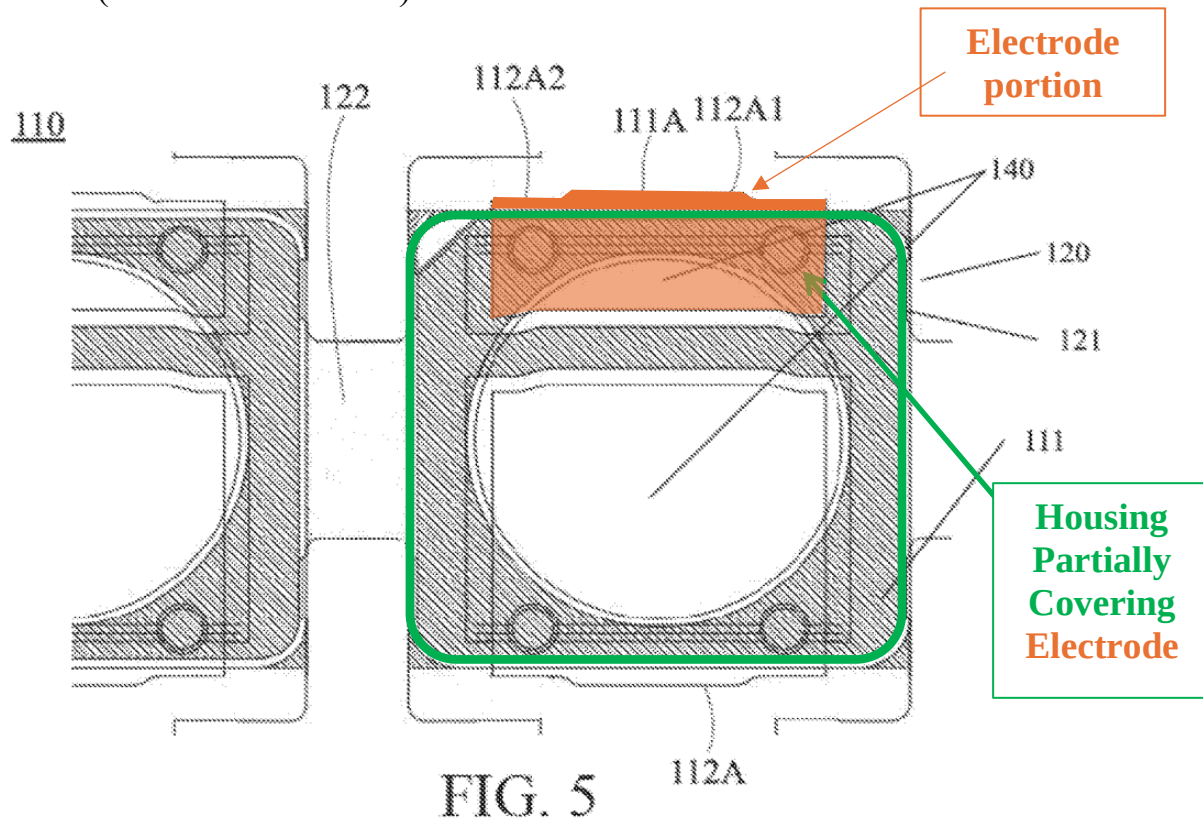
127. No further claim amendments were entered. Application claims 11 and 15-25 subsequently issued as claims 1-12 in the '733 patent.

7.4. The Claims of the '733 Patent

128. Claim 1 of the '733 patent is directed to a “light emitting device,” and has just five structural elements, an “LED chip,” an “encapsulant,” and a “carrier” comprising “at least one electrode portion” and a “housing” (Exhibit 1001 at 14:6-13). Most of claim 1’s limitations relate to the configuration of the claimed “electrode portion” relative to the “housing” and can be described referencing FIG. 5 (Exhibit 1001 at 14:12-20). Because Applicant elected the embodiment of FIG. 5 during prosecution, I describe the claims with respect to FIG. 5 of the '733 patent

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129. The carrier comprises at least one electrode portion (Ex-1001 at 14:8-11) and a housing, the housing at least partially covering the at least one electrode portion (Ex-1001 at 14:8-13).

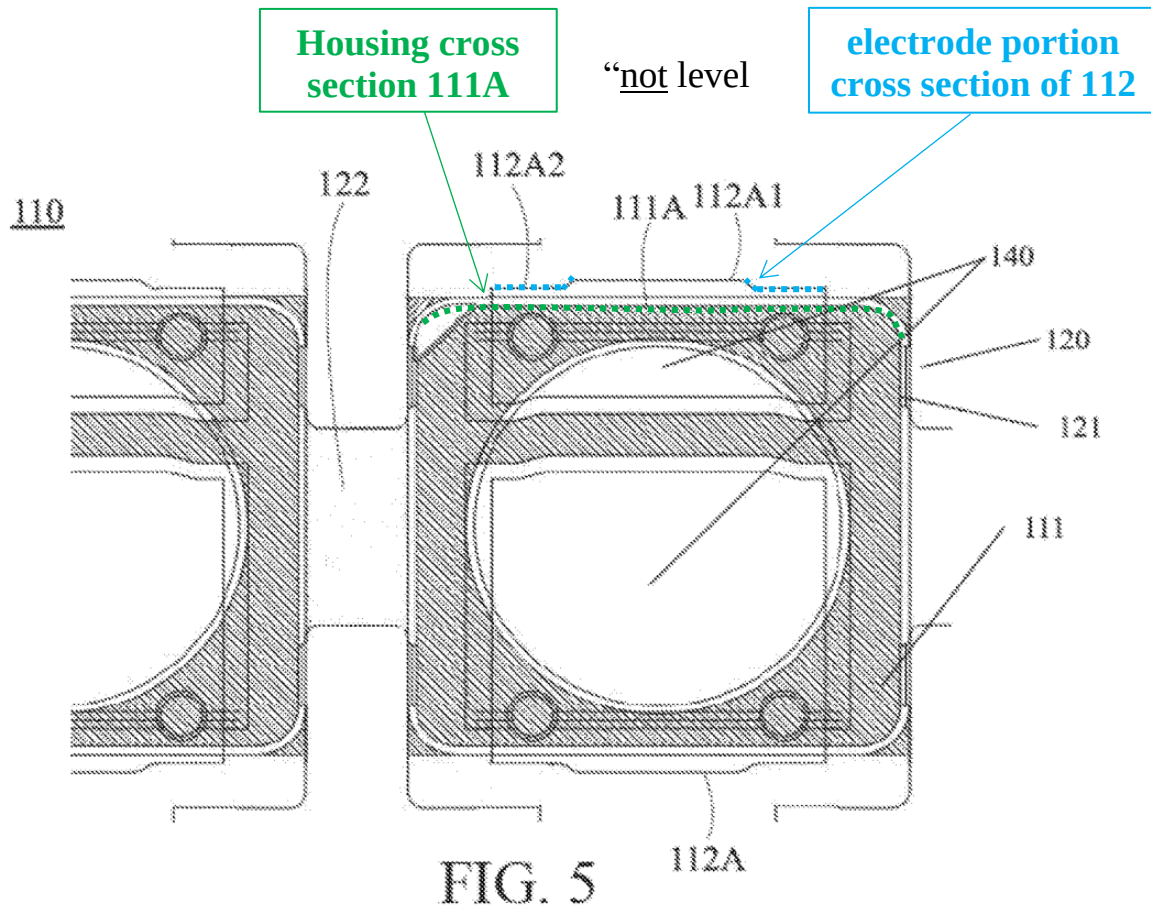


The '733 Patent FIG. 5 (Annotated)

130. Claim 1 also requires that: (1) the “at least one electrode portion further comprises a central area and two edge areas,” (2) the central area and the two edge areas “protrude from a housing cross section,” and (3) the central area “protrudes from the two edge areas” (Ex-1001 at 14:15-16; 18-20). This configuration is shown with reference to FIG. 5 below. I note, however, that the '733 patent does not purport

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with one another” (Ex-1001 at 14:13-15). This is shown in the below annotated version of FIG. 5.



The '733 Patent FIG. 5 (Annotated)

132. Dependent claims 2-3 provide further limitations regarding the electrode portion shape and positioning of its cross section(s), while claims 4-6 are directed to the housing cross section shape and positioning (Ex-1001 at 14:21-36). Claim 7 relates to an antioxidant layer (Ex-1001 at 14:21-36). These minor variations are neither new nor inventive.

8. Overview of the Prior Art

8.1. Kishikawa

133. U.S. Patent No. 7,771,093 (“Kishikawa”) (Ex-1004) entitled “LIGHT EMITTING DEVICE” issued on August 10, 2010 and matured from U.S. Patent Application No. 11/834,146, which was filed on August 6, 2007. I was instructed that Kishikawa is prior art to the ’733 because it issued in August 2010.

134. Kishikawa generally discloses an LED that is mounted on a “metal member” and packaged in a housing. The “metal member” is “electrically connected to the light emitting element and, optionally, a protective element, and generally has the function of a lead electrode. It is also used to mount the light emitting element and, optionally, a protective element. Since part of the metal member is usually embedded in the package, the portion that functions as a lead electrode and a platform for mounting the light emitting element, etc., is also called an internal terminal, and the portion that extends outside the package and has the function of making an electrical connection with an outside is also called an external terminal” (Ex-1004, 3:16-26).

135. Kishikawa describes that the “package may be formed from any material as long as it can integrally embed part of the above-mentioned metal member and seal it in the form of a block, and can ensure insulation of the light emitting elements and the metal member” (Ex-1004, 8:13-17). Kishikawa provides

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example materials for the “package,” including “polyphthalamide (PPA), polycarbonate resin, polyphenylene sulfide (PPS), liquid crystal polymer (LCP), ABS resin, epoxy resin, phenol resin, acrylic resin, PBT resin, and other such resins, and ceramics” (Ex-1004, 8:17-21).

136. The structure of the Kishikawa device is illustrated in Figures 1 and 2a. To aid in the explanation, I provide annotated versions of the Kishikawa figures below.

Fig.1

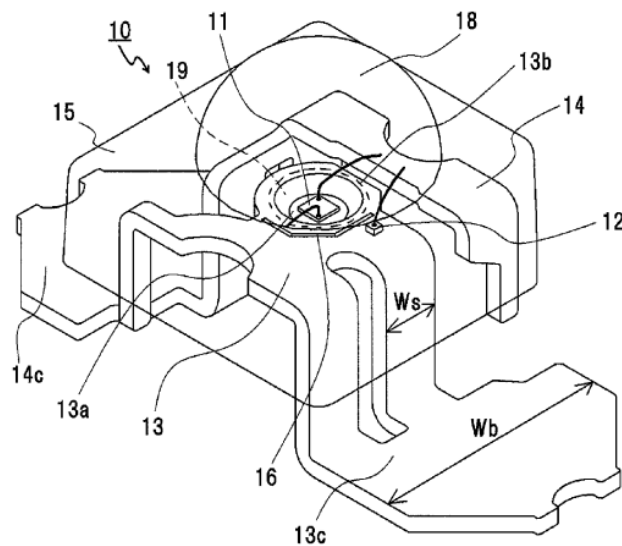


FIG. 1 of Kishikawa (Annotated)

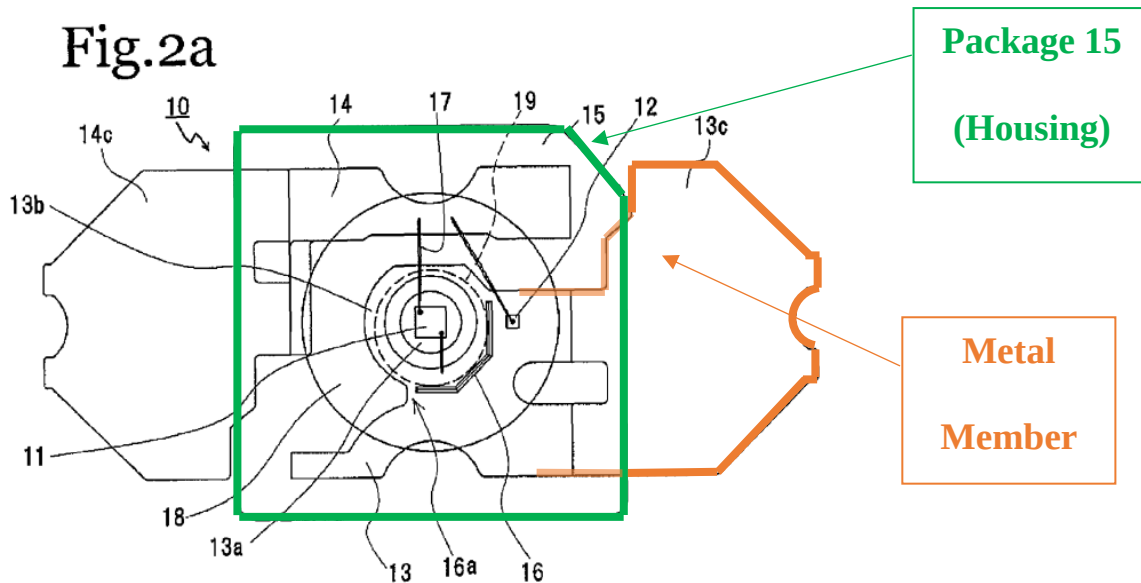


FIG. 2a of Kishikawa (Annotated)

137. As shown in annotated Figure 2a above, the LED carrier of Kishikawa includes package 15 with first and second metal members 13 and 14 such that package 15 at least partially covers the first and second metal members (Ex-1004, 9:14-19). Kishikawa further describes that the “the first and second metal members 13 and 14 are bent at approximately 90° within the package so that their ends protrude from the bottom face of the package 15, and are then further bent approximately 90° to the outside of the light emitting device, so that they function as external terminals” (Ex-1004, 9:36-41).

138. As shown below in annotated version of FIG. 2a, the metal members of Kishikawa further comprise a central area and two edge areas (See Ex-1004 at 9:36-46; FIG. 1, 2a, and 2b). The central area and the two edge areas of the first and

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second metal members protrude from a housing cross section of the package and the central area protrudes from the two edge areas (Ex-___ at FIG. 1, 2a, and 2b).

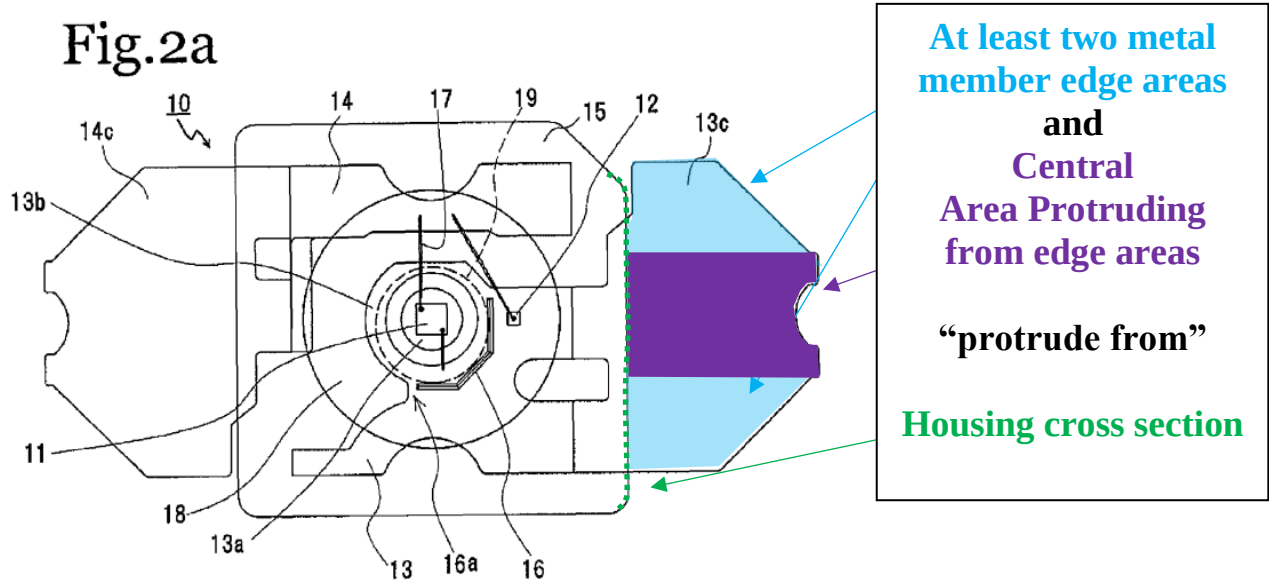


FIG. 2a of Kishikawa (Annotated)

8.2 Nakashima

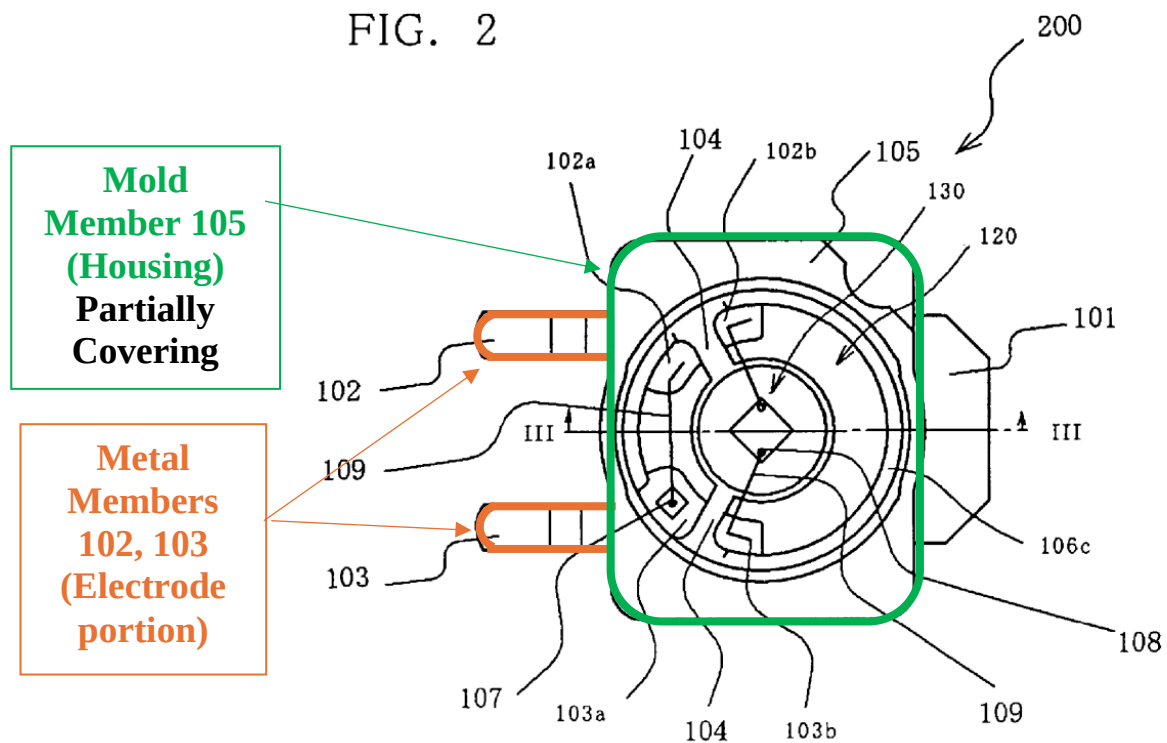
139. Nakashima is a U.S. patent titled “MOLDED PACKAGE AND SEMICONDUCTOR DEVICE USING MOLDED PACKAGE” that was filed March 3, 2006 and published December 9, 2008 (Ex-1005 at Cover). I was instructed that Nakashima is prior art to the '733 patent because it published in December 2008.

140. Nakashima discloses a package (carrier) comprising a metal member, such as a lead electrode (electrode), which supplies electric power to a semiconductor element incorporated into the mold member (housing) (Ex-1005 at Abstract; 9:2-8; 9:52-57). Nakashima’s package is shown in FIGs. 1 and 2 (Ex-1005

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at 9:2-3). “[M]etal member 102 is the positive electrode,” and “metal member 103 is the negative electrode” (Ex-1005 at 9:3-5). The metal members 102, 103 are inserted into and protrude from the sides of mold member 105, which is a housing for light emitting element/LED chip 108 (Ex-1005 at 9:6-7; 31:28-30). “[T]he light emitting element 108 is mounted in the recess and enclosed by a first encapsulating member 111” (Ex-1005 at 10:5-7). The first encapsulating member “enclose[es] the semiconductor components housed in the molded package” in a transparent resin and may include fluorescent material and/or a diffusing agents (Ex-1005 at 16:16-26).

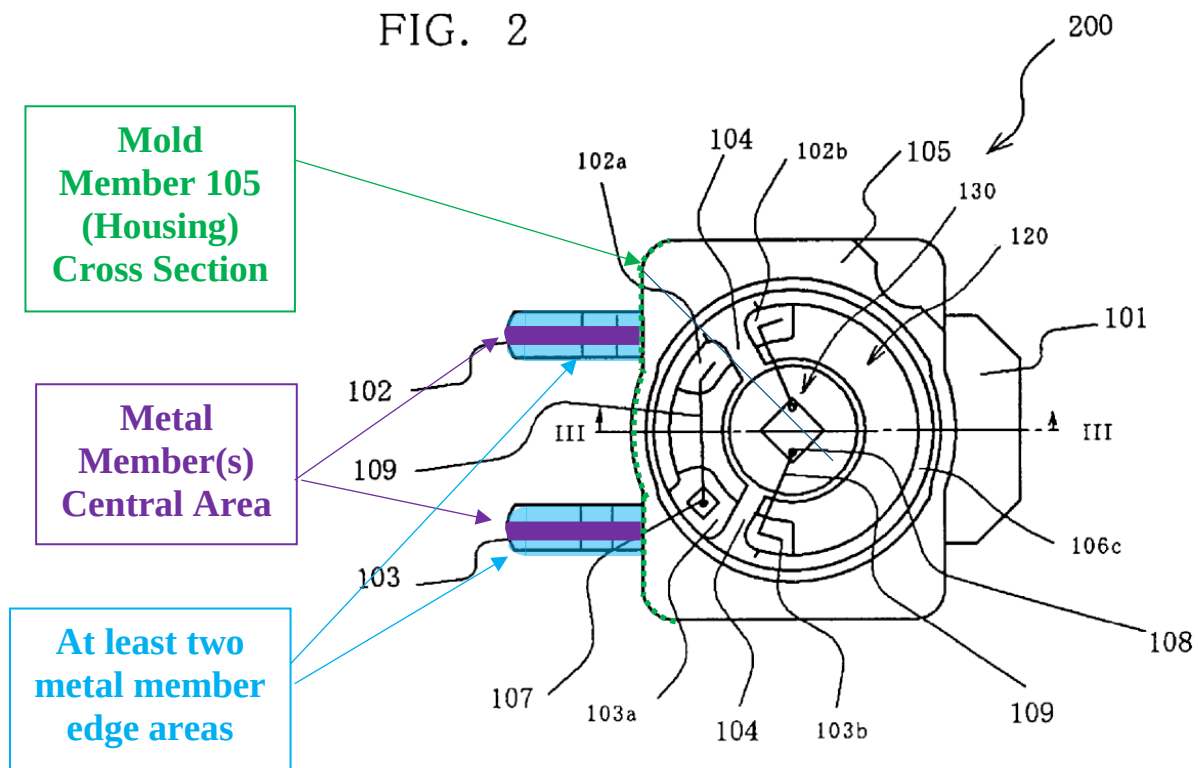
141. As shown in the below annotated Figure 2, Nakashima’s molded package 100 (or carrier) includes a mold member 105 (i.e., housing) that partially covers its electrodes 102, 103 (Ex-1005 at 6:62-65; 7:3-4).



Nakashima FIG. 2 (Annotated)

142. Nakashima's metal member electrodes 102, 103 each further comprise a central area and two edge areas (*See* Ex-1005 at 11:33-41; FIG. 1-4). As shown in the below annotated Nakashima Figure 2, metal member/electrodes 102, 103 protrude from mold member 105 (housing with housing cross section) and include at least two edge areas and a central area protruding from the edge areas.

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8.3 Umeda

143. Umeda is a Japanese patent application publication entitled “PACKAGE FOR LIGHT EMITTING DEVICE AND LIGHT EMITTING DEVICE,” and a certified English translation of Umeda is found at Ex-1007. Umeda was filed on August 23, 2012 and published on March 6, 2014 (Ex-1007 at Cover). I was instructed that Umeda is prior art to the '733 patent because it published in March 2014.

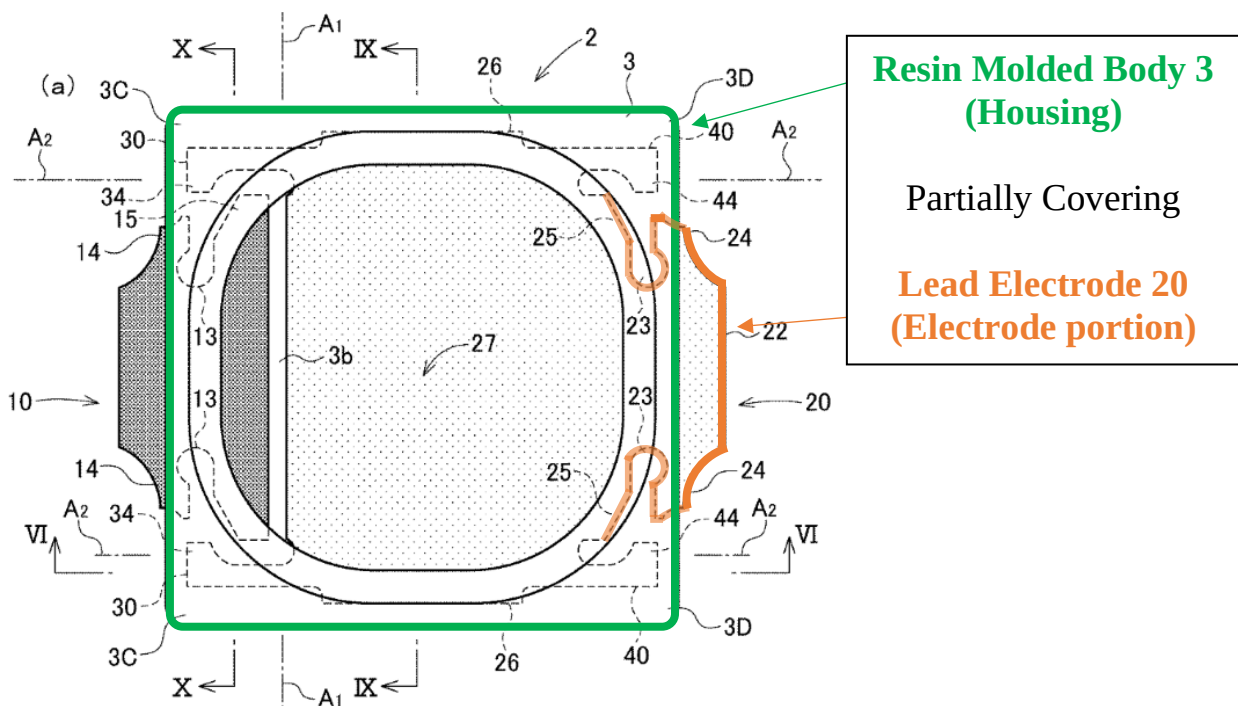
144. Umeda discloses a package for a light emitting device (Ex-1007 at [0015]). The package is a carrier that includes a resin molded body (housing) that

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is integrated with a pair of lead electrodes (Ex-1007 at [0015]). The resin molded body houses the light emitting element in a central “cup portion” (Ex-1007 at [0015]), and the light emitting element is an “LED element” (Ex-1007 at [0001]).

145. As shown in the below annotated Umeda Figure 5a, Umeda’s package is a carrier that includes a resin molded body 3 (or housing) that partially covers the first and second lead electrodes 10 and 20 such that “a front edge 22” of the electrode 20 “protrude[s] from the resin molded body 3” (Ex-1007 at [0039]) while “recessed portions” 13 and 23 of the electrodes are covered by resin molded body 3 (Ex-1007 at [0040], [0042]).

[FIG. 5]

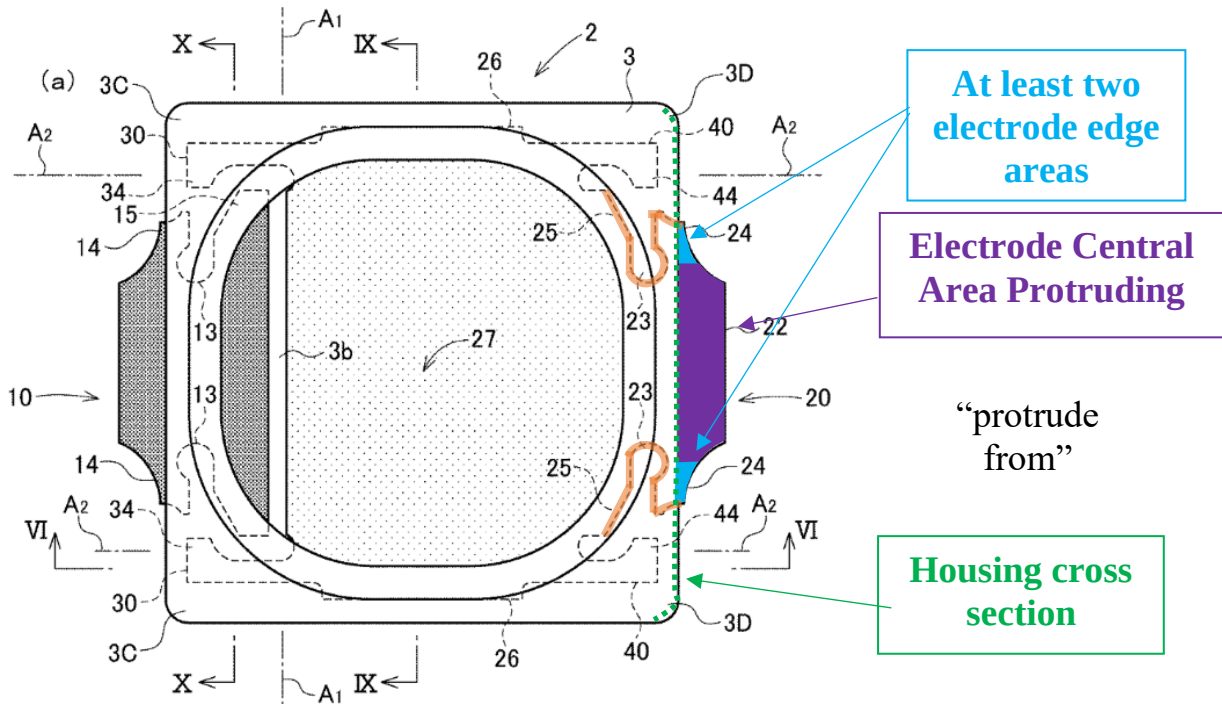


Umeda FIG. 5a (Annotated)

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146. Umeda's lead electrodes 110, 20 also each comprise a central area (e.g., front edges 12, 22) and two edge areas (e.g., first side edges 14, 24) (Ex-1007 at [0041]-[0042]; FIGs. 5a & 5b). The front edges 12, 22 (central area) and the first side edges 14, 24 (two edge areas) of lead electrodes 10, 20 protrude from the resin molded body 3 housing, and front edges 12, 22 protrude from the first side edges 14, 24 (Ex-1007 at [0039]-[0043]; FIGs. 5a & 5b).

[FIG. 5]



Umeda FIG. 5a (Annotated)

8.4. Kuramoto

147. “Kuramoto” refers to U.S. Patent Application Publication No. 2014/0124812 entitled “LIGHT EMITTING DEVICE AND METHOD FOR MANUFACTURING THE SAME,” which is the national phase application of

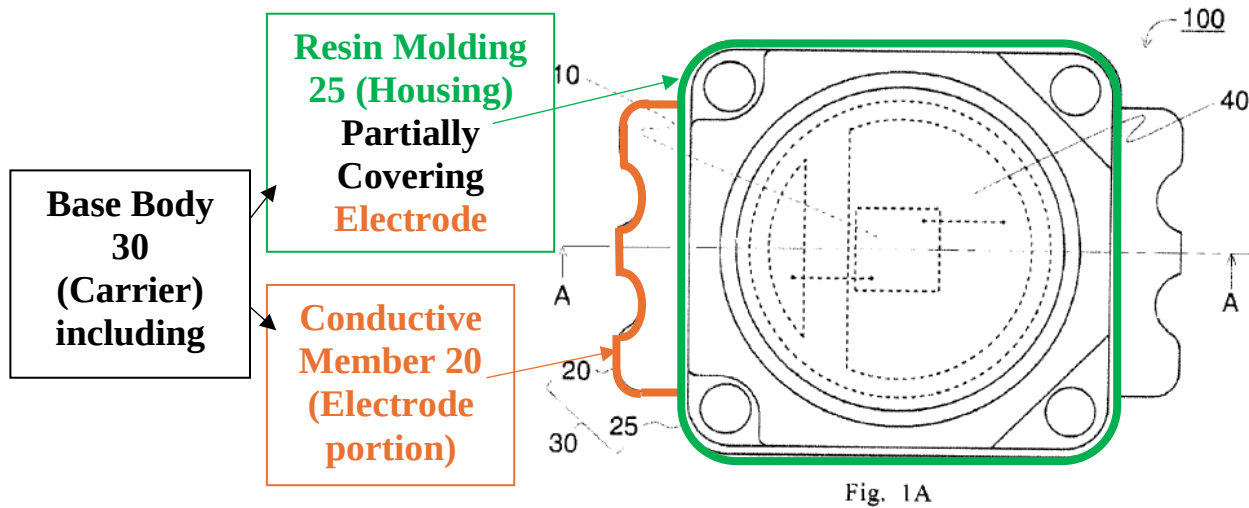
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PCT/JP2012/062418 with an international filing date of May 15, 2012, and claims priority to Japanese Patent Applications 2011-109134 and 2011-163510 on May 16, 2011 and July 26, 2011, respectively (Ex-1008 at Cover). Kuramoto published on May 8, 2014. I was instructed that Kuramoto is prior art because it published on May 8, 2014.

148. Kuramoto discloses a light emitting device having a base body 30 (i.e., a carrier) that “is a package including the conductive member 20 that is composed of a pair of positive and negative lead frames” and a “resin molding 25 that [] integrally holds the conductive member” (Ex-1008 at [0044]). The light emitting element 10 “is an LED chip that is pasted on the bottom surface of the recess 31 of the base body ... and is connected to the conductive member 20 by wires” (Ex-1008 at [0044]). A sealing member 40, or encapsulant, “is provided to cover the light emitting element 10 inside the recess 31 of the base body” and “may contain a phosphor or a diffuser” (Ex-1008 at [0044]).

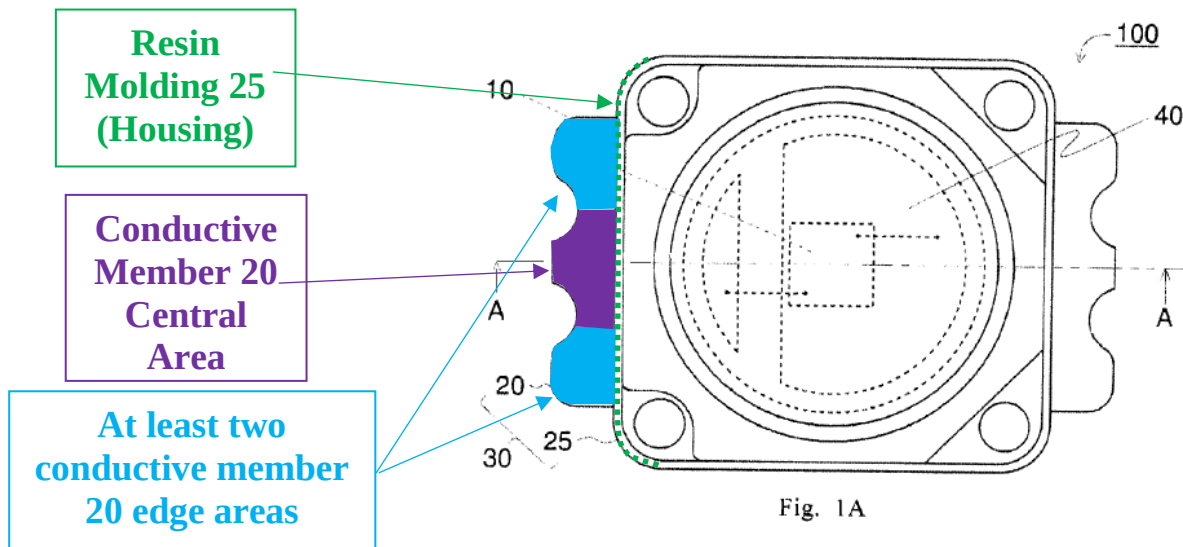
149. The Kuramoto package is illustrated in the below annotated Figure 1A, which is a top view of the light emitting device (Ex-1008 at [0029]). The base body 30 is a package (i.e., carrier) including a resin molding 25 (i.e., housing) with integrally formed conductive member 20 (i.e., electrodes) that protrudes from each end of the resin molding (Ex-1008 at [0043]).

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Kuramoto FIG. 1A (Annotated)

150. Kuramoto's conductive member 20 also comprises a central area and two edge area, as shown below. Kuramoto discloses several examples of shapes for the protruding portions of the conductive member 20, but they each include a central area and two edges areas (*See, e.g., Ex-1008 at 1A, 4A, 6A*).



Kuramoto FIG. 1 (Annotated)

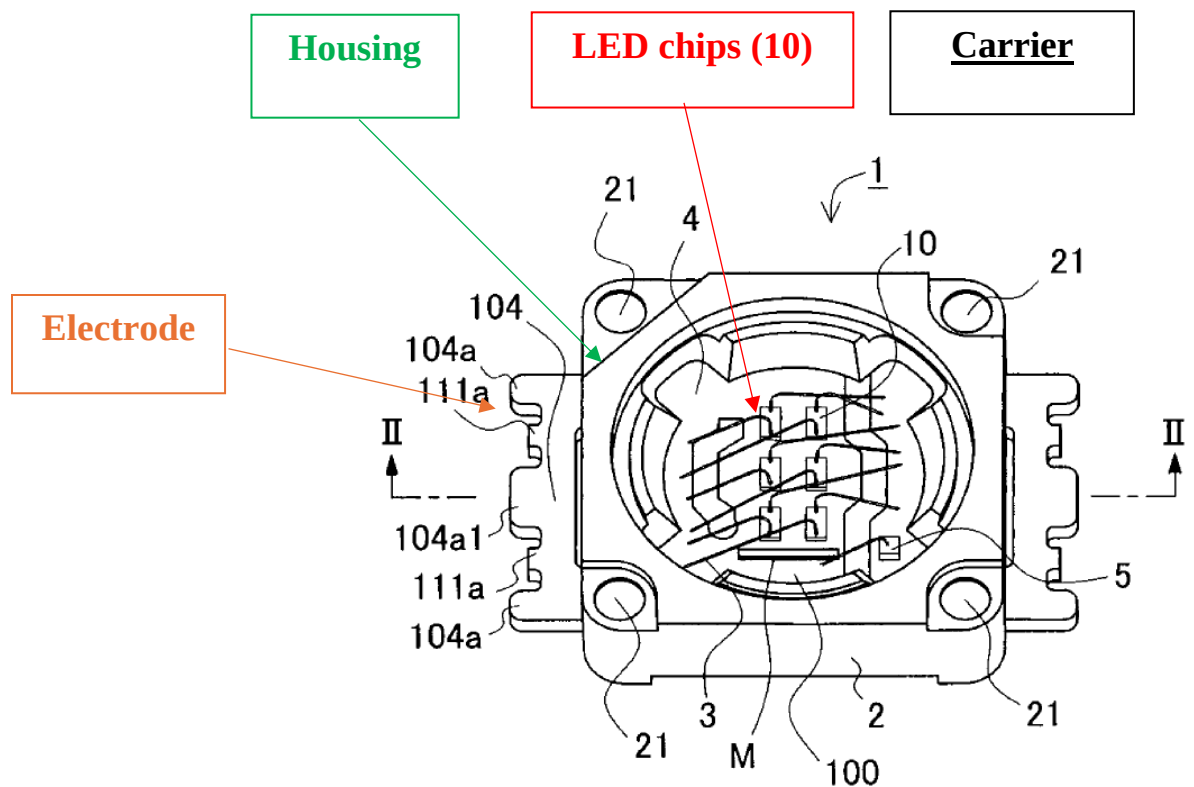
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8.5. Bando

151. “Bando” refers to U.S. Patent No. 7,719,024 entitled “SEMICONDUCTOR LIGHT EMITTING DEVICE AND METHOD FOR PRODUCING THE SAME,” filed on December 27, 2006 and issued on May 18, 2010 (Ex-1009 at Cover). I was instructed that Bando is prior art to the ’733 patent because it issued in May 2010.

152. Bando discloses a light emitting device 1 with package 2 (i.e., housing) with lead arrangement 100 (i.e., electrodes) that includes a plurality of mounted light emitting elements 10 (i.e., LED chips) encapsulated by a sealing resin 4 (encapsulant) (Ex-1009 at 8:17-24). The light emitting device 1 is illustrated in the below annotated Bando Figure 1:

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Bando FIG. 1 (Annotated)

153. Bando teaches that “in order to prevent corrosion of metal ... a noble metal such as silver, gold, palladium and rhodium is plated on the other parts of the lead arrangement” (Ex-1009 at 10:44-46). The plated the electrode 100 “is less prone to be oxidized by air, and thus is prevented from corrosion of metal” and “has good wettability, and thus can provide electrical adhesiveness between the lead arrangement 100 and a separate mount body with solder” (Ex-1009 at 19:3-8). “After silver is plated, the lead connection portions 111 are cut off. As a result, silver

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is not plated on the lead cut surfaces 111 b as cut surfaces of the lead connection portions 111” (Ex-1009 at 8-11).

8.6. Seo

154. “Seo” refers to U.S. Patent No. 7,964,943 entitled “LIGHT EMITTING DEVICE,” filed on December 19, 2008 and issued on June 21, 2011 (Ex-1011 at Cover). I was instructed that Seo is prior art to the ’733 patent because it issued in June 2011. Seo discloses that lead frame electrodes for an LED package can have a convex shape or a rectangular plate shape (Ex-1011 at 2:60-3:4).

9. The Challenged Claims are Unpatentable

9.1. Claims 1-5 are Anticipated by Kishikawa

155. It is my opinion that Kishikawa discloses each and every limitation of claims 1-5 of the ’733 patent.

9.1.1. Independent Claim 1

156. It is my opinion Kishikawa anticipates claim 1 of the ’733 patent for at least the following reasons.

9.1.1.1. Claim 1: “A light emitting device, comprising”

157. Kishikawa discloses “[a] light emitting device, comprising a carrier; a light emitting diode (LED) chip carried within the carrier; and an encapsulant covering the LED chip,” recited in claim 1 of the ’733 patent.

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158. Kishikawa is entitled “LIGHT EMITTING DEVICE” (Ex-1004 at Cover), and FIG. 1 illustrates “an oblique view of an embodiment of the light emitting device” (Ex-1004, 2:13-14). Likewise, FIGS. 2a and 2b “are a plan view and a side view of the embodiment of the light emitting device of FIG. 1” (Ex-1004 at 2:15-16). For example, “lighting emitting device 10” of Kishikawa is the claimed light emitting device (Ex-1004 at 9:14-15).

9.1.1.2. Claim 1: A carrier comprising “at least one electrode portion” and a “housing”

159. It is my opinion that Kishikawa discloses a carrier that comprises “at least one electrode portion” and “a housing,” as recited in claim 1 of the ’733 patent. For example, portions of the lighting emitting device 10 used to carry and support light emitting element 11 — including at least package 15 and first and second metal members 13, 14 — are the claimed carrier (Ex-1004 at 9:14-19). These portions of the light emitting device 10 are illustrated in the below annotated version of FIG. 2B.

160. Kishikawa discloses that “[a]s shown in FIG. 1 and FIGS. 2A and 2B, the light emitting device 10 in this Example is a snap mounting-type light emitting device, in which a light emitting element 11, a protective element 12, and parts of a first metal member 13 and a second metal member 14 are integrally sealed in a package 15 made of an epoxy resin” (Ex-1004 at 9:14-19).

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161. The package 15 portion of the claimed carrier supports lighting emitting element 11, for example by forming “a lens 18 for converging the light from the light emitting element 11 ... above the concave portion 13a and in the middle of the top face of the package 15” (Ex-1004 at 9:65-67). Kishikawa’s carrier includes at least one metal member “embedded in the package, ... that functions as a lead electrode and a platform for mounting the light emitting element” (Ex-1004 at 3:20-23).

162. While Kishikawa does not use the term “carrier” that is used in the ’733 patent, its package 15 and metal portions 13 and 14 are structurally the same as the “at least one electrode portion” and “housing” of the carrier claimed in the ’733 patent. For instance, as shown in FIG. 1 of the ’733 patent, the carrier 110 is described and shown as the combination of housing 111 and electrode portions 112 (Ex-1004 at 3:28-29), which is consistent with claim 1 of the ’733 patent.

163. As shown in the below annotated versions of Kishikawa’s FIGS. 2a and 2b, the carrier of light emitting device 10 comprises a package 15 (i.e., the claimed “housing”) and metal members 13 and 14 (i.e., the claimed “at least one electrode”) that provide support for the light emitting element 11.

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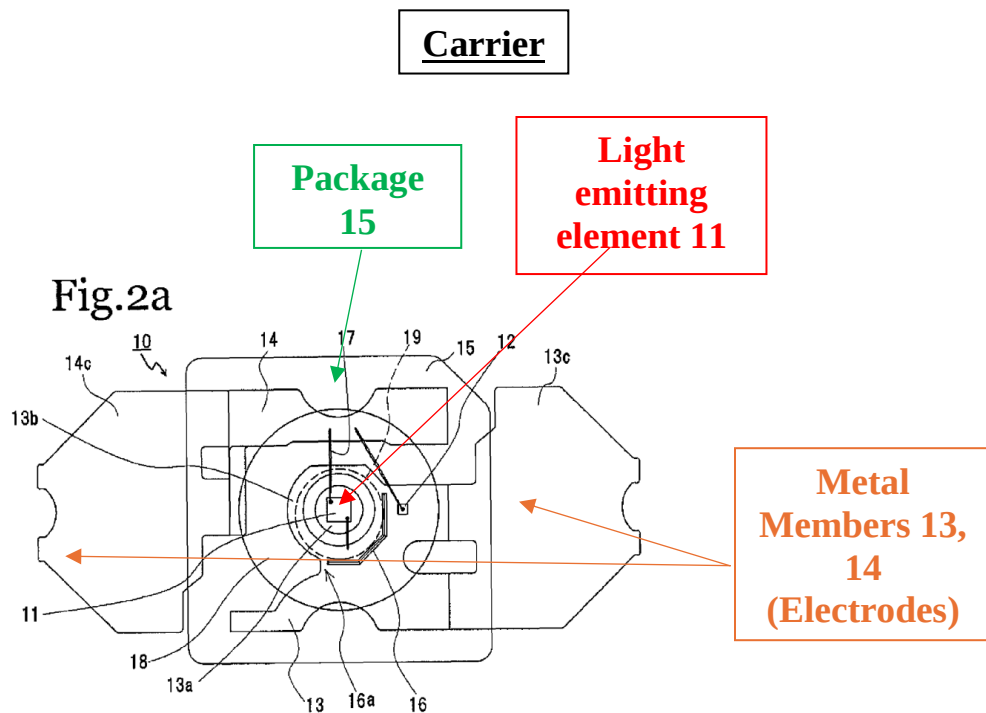


FIG. 2a of Kishikawa (Annotated)

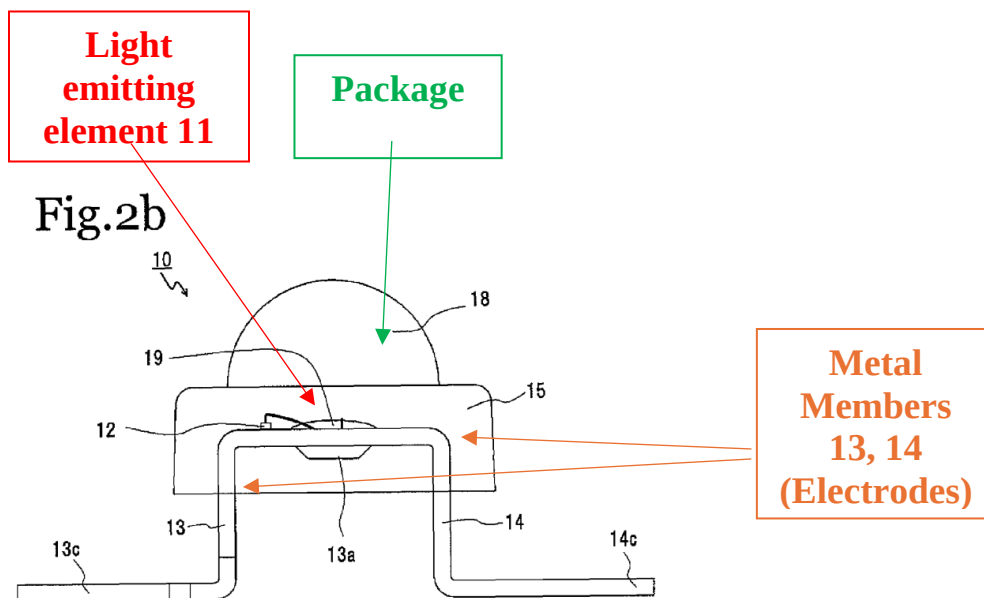


FIG. 2b of Kishikawa (Annotated)

9.1.1.3 Claim 1: A light emitting diode (LED) chip carried within the carrier”

164. It is my opinion that Kishikawa’s light emitting element 11 is the claimed “LED chip carried within the carrier.” For example, Kishikawa discloses light emitting elements, including the light emitting element 11, that “are generally semiconductor light emitting elements,” and may also “called light emitting diodes” (Ex-1004, 2:34-36). Kishikawa further describes that the light emitting element 11 is a semiconductor with “an active layer on a substrate” (e.g., InN, AlN, GaN, InGaN, AlGaIn, and InGaAlN) (Ex-1004 at 2:33-41), which is an LED chip.

165. Just as the ’733 patent describes how “an LED chip is ... die bonded and wire bonded into the reflection concave cup of the carrier” (Ex-1001 at 7:33-35), Kishikawa describes how a “silver paste or an epoxy resin is used for the die bonding of the light emitting element 11. The electrodes (not shown) provided to the light emitting element 11 and the first metal member 13 is connected by wires composed of gold” (Ex-1004 at 9:30-34). Further, Kishikawa describes how “the light emitting element is mounted at an internal terminal of the first metal member” that may be “flat” or “concave” (Ex-1004 at 3:48-51) and that “the light emitting element 11 is provided above the concave portion 13a and in the middle of the top face of the package 15” (Ex-1004 at 9:65-67). Thus, as shown in the below annotated version of FIG. 2a, the light emitting element 11 (i.e., the claimed “LED

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chip”) is carried within the package 15 and portions of the metal members 13, 14 forming the claimed “carrier”:

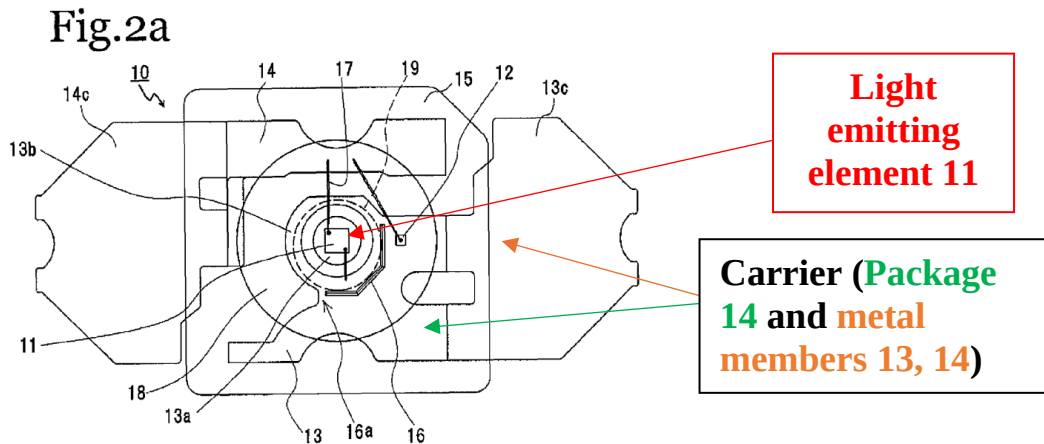


FIG. 2a of Kishikawa (Annotated)

9.1.1.4. Claim 1: An encapsulant covering the LED chip

166. It is my opinion that Kishikawa’s “translucent covering material” is the claimed “encapsulant covering the LED chip.” For example, Kishikawa discloses that a “translucent covering material” (*i.e.*, the claimed “encapsulant”) that “is embedded in the concave portion of the first metal member after the light emitting element has been placed in the concave portion of the first metal member” such that “[t]he translucent covering material protects the light emitting element against external force, moisture, and so forth, and also protects the wiring” (Ex-1004 at 7:6-17). Thus, it is my opinion that Kishikawa’s disclosure of “a translucent covering material that covers at least the light emitting element” (Ex-1004 at 1:54-56) corresponds to the claimed “encapsulant covering the LED.”

9.1.1.5. Claim 1: A carrier comprising “at least one electrode portion”

167. It is my opinion that Kishikawa discloses a “carrier” that comprises “at least one electrode portion,” as recited in claim 1 of the ’733 patent. As described in Section 9.1.1.2 above, the portions of the lighting emitting device 10 used to carry and support light emitting element 11 (i.e., the claimed “LED chip”) — including at least package 15 and first and second metal members 13, 14 — are the claimed “carrier.” Kishikawa further describes that the metal members are “embedded in the package,” and “function[] as a lead electrode and a platform for mounting the light emitting element” (Ex-1004 at 3:20-23).

168. As shown in the below annotated versions of FIGS. 2a and 2b, Kishikawa discloses a “carrier” that includes metal members 13 and 14 that are each electrode portions for the light emitting element 11.

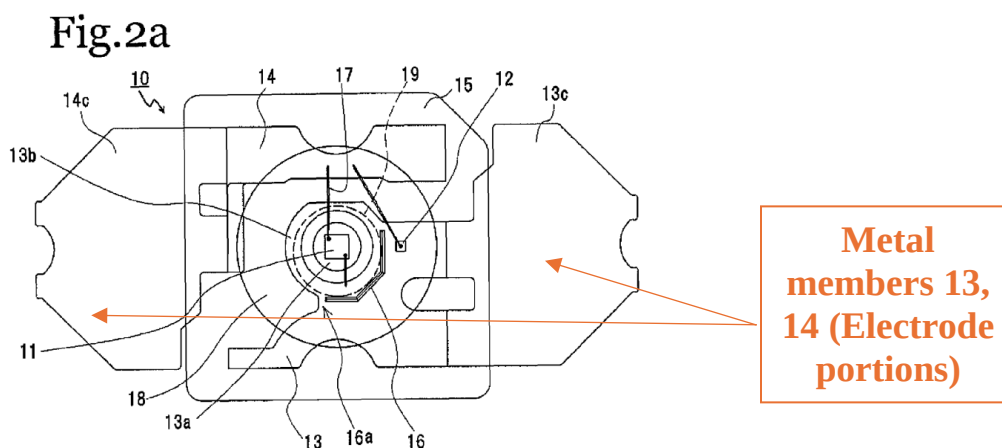


FIG. 2a of Kishikawa (Annotated)

Fig.2b

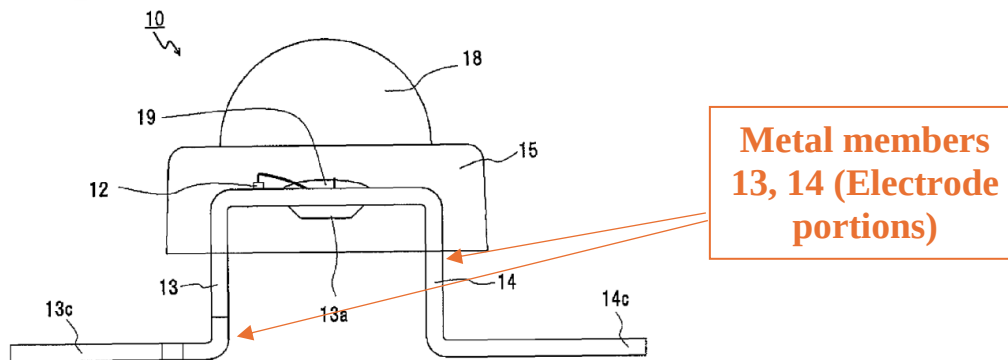


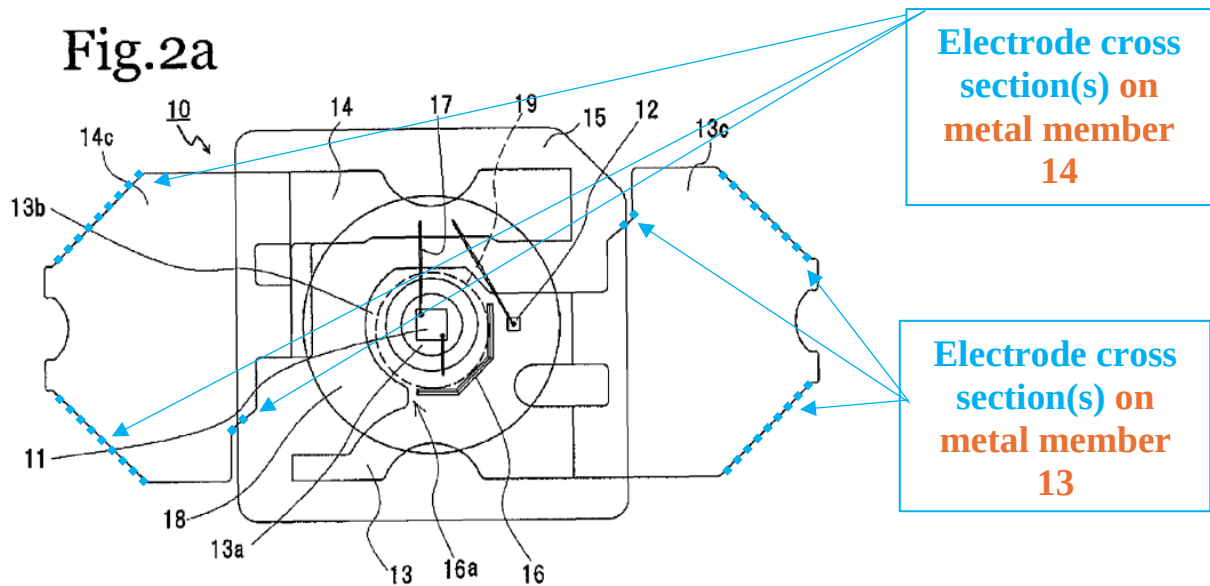
FIG. 2b of Kishikawa (Annotated)

169. Thus, Kishikawa discloses a carrier (package 15 and first and second metal members 13, 14) that includes at least one electrode portion (first and second metal members 13, 14).

9.1.1.6. Claim 1: Each of the at least one electrode portion comprising at least an electrode portion cross section

170. It is my opinion that Kishikawa discloses that “each of the at least one electrode portion comprising at least an electrode portion cross section,” as claimed in the ’733 patent. Although Kishikawa does not describe its light emitting device structure in terms of “cross sections,” the structural arrangement of Kishikawa is the same as that claimed in the ’733 patent. For example, FIG. 2 of Kishikawa is reproduced below in annotated form to identify examples of the claimed “electrode portion cross sections” on each of metal members 13, 14 (i.e., the claimed “electrode portions”).

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Kishikawa FIG. 2a (Annotated)

171. While may analysis is based on comparing the claims to the prior art, it is worth noting that these electrode portion cross-sections in Kishikawa are the same as the electrode portion cross sections described in the '733 patent, as illustrated in the annotated version of FIG. 6 of the '733 patent reproduced below:

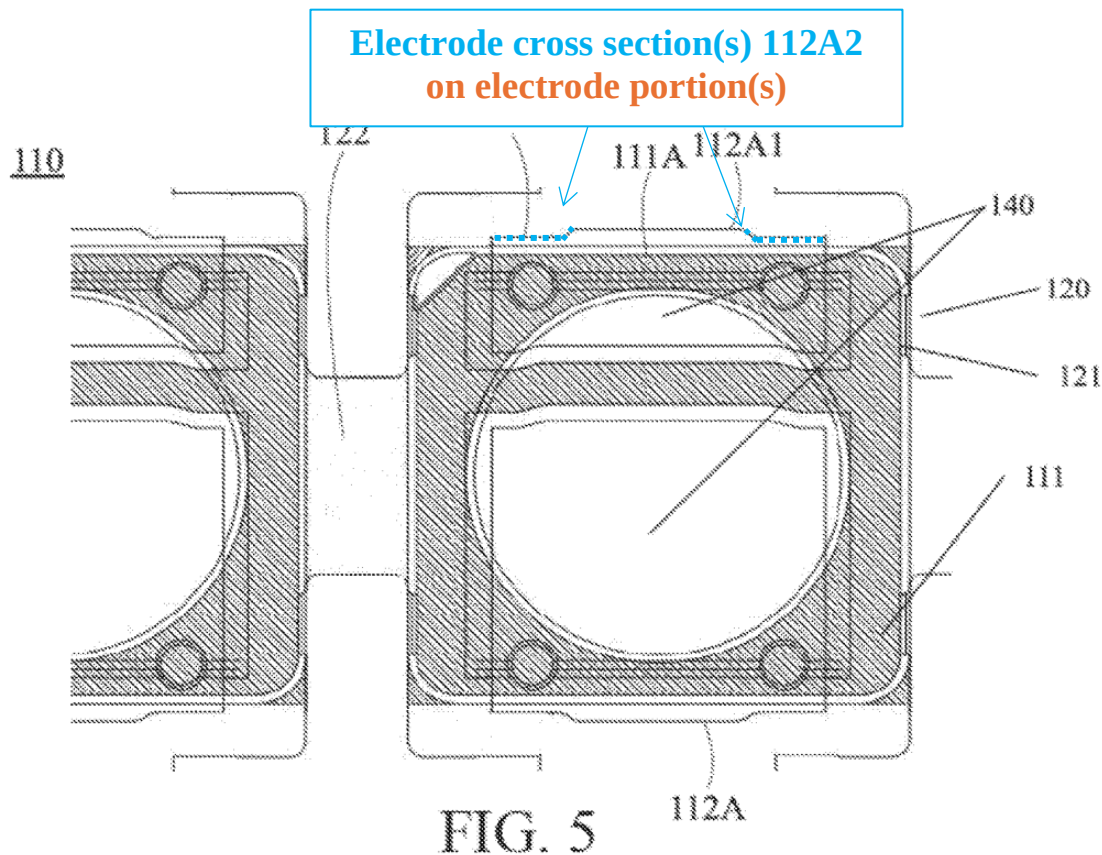


FIG. 5 of the '733 Patent (Annotated)

9.1.1.7. Claim 1: A housing comprising a housing cross section

172. It is my opinion that Kishikawa discloses a carrier comprising “a housing comprising a housing cross section.” As described in Section 9.1.1.2 above, the portions of the lighting emitting device 10 used to carry and support light emitting element 11 (i.e., the claimed “LED chip”) — including at least package 15 and first and second metal members 13, 14 — are the claimed “carrier.” It is my opinion that package 15 of Kishikawa’s carrier is the claimed “housing.”

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173. As Kishikawa describes, a package, such as the package 15, “may be formed from any material as long as it can integrally embed part of the above-mentioned metal member and seal it in the form of a block, and can ensure insulation of the light emitting elements and the metal member” (Ex-1004, 8:13-17).

174. Further, although Kishikawa does not use the “cross section” language of the ’733 patent, the below annotated version of Kishikawa’s FIG 2a shows that a cross section can be taken through the edges of package 15. The housing cross-section extends through the rounded corners of the housing. Many cross-sections can be drawn through the housing.

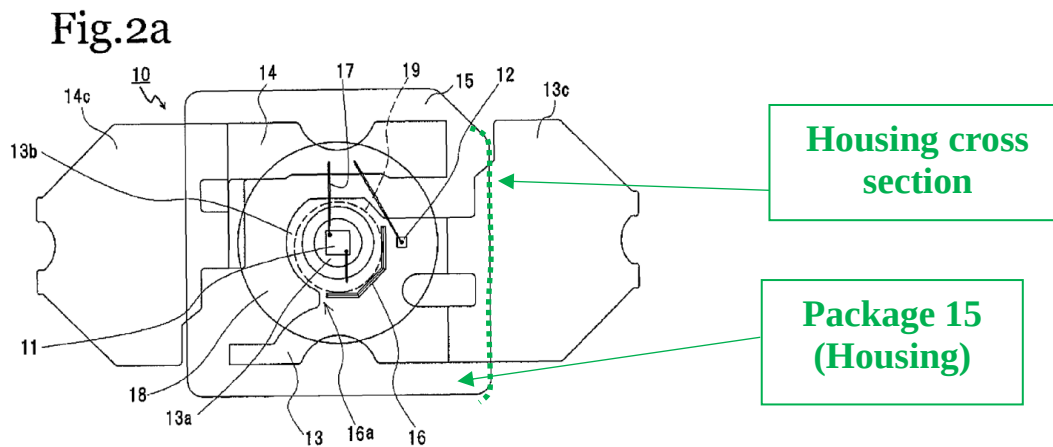


FIG. 2a of Kishikawa (Annotated)

175. While may analysis is based on comparing the claims to the prior art, it is worth noting that like the electrode portion cross sections described in Section 9.1.1.5 above, the housing cross section in Kishikawa is the same as and consistent

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with the housing cross section described in the '733 patent, as shown in the below annotated version of FIG. 6 of the '733 patent:

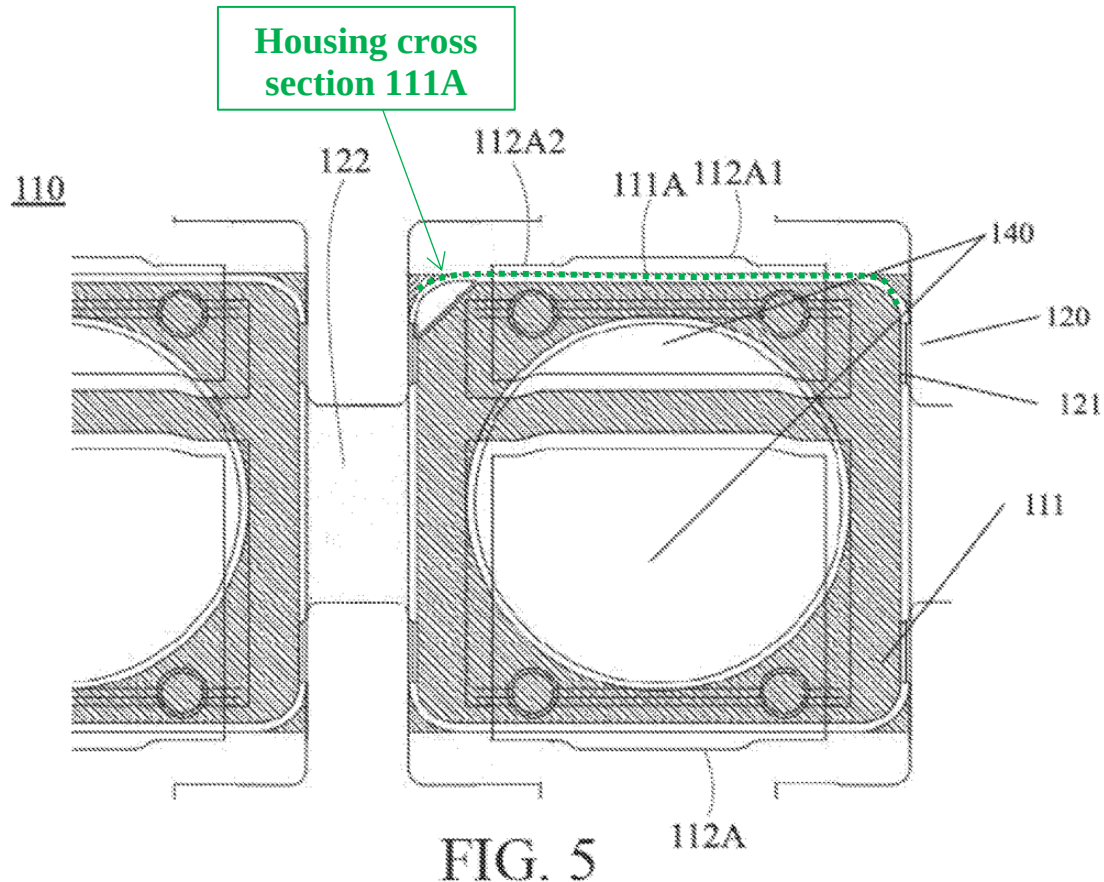


FIG. 5 of the '733 Patent (Annotated)

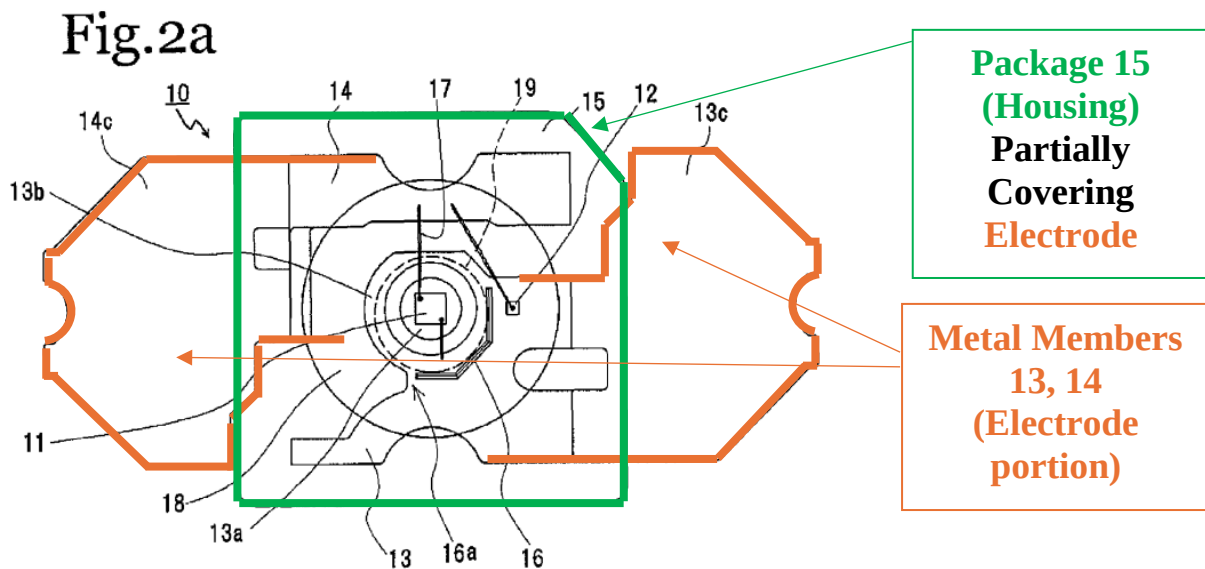
9.1.1.8. Claim 1: The housing at least partially covering the at least one electrode portion

176. It is my opinion that Kishikawa discloses the claimed “housing at least partially covering the at least one electrode portion.”

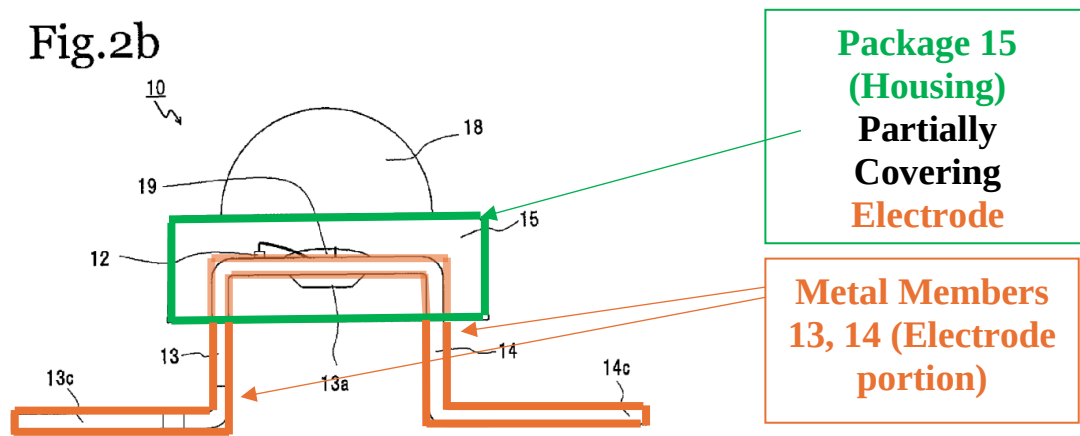
177. As described in Sections 9.1.1.2 and 9.1.1.5 above, Kishikawa’s package 15 is the claimed “housing” and its metal members 13, 14 are the claimed

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“at least one electrode portion.” Kishikawa discloses that its package 15 (*i.e.*, housing) “may be formed from any material as long as it can integrally embed part of the above-mentioned metal member [i.e., at least one electrode portion] and seal it in the form of a block, and can ensure insulation of the light emitting elements and the metal member” (Ex-1004, 8:13-17). Kishikawa’s arrangement of the package 15 (the claimed “housing”) at least partially covering metal members 13, 14 (*i.e.*, the claimed “the at least one electrode portion”) is illustrated in the below annotated versions of Kishikawa FIG. 2a and 2b.



Kishikawa FIG. 2a (Annotated)



Kishikawa FIG. 2b (Annotated)

178. Thus, as FIGs 2a and 2b illustrate, Kishikawa discloses the claimed housing (i.e., package 15) at least partially covers the at least one electrode portion (i.e., metal members 13, 14).

9.1.1.9. Claim 1: Wherein the Housing Cross Section and the Electrode Portion Cross Section are not Level with one Another

179. For the below reasons, it is my opinion that Kishikawa discloses the claimed “wherein the housing cross section and the electrode portion cross section are not level with one another.”

180. As explained in Sections 9.1.1.6 and 9.1.1.7 above, Kishikawa discloses a housing cross section on the edge of package 15 and an electrode portion cross section on the outer edges of metal members 13, 14. And as shown in FIG. 2a of Kishikawa, the housing cross section on the edge of package 15 and an electrode

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portion cross section on outer edges of metal members 13, 14 are not level with one another.

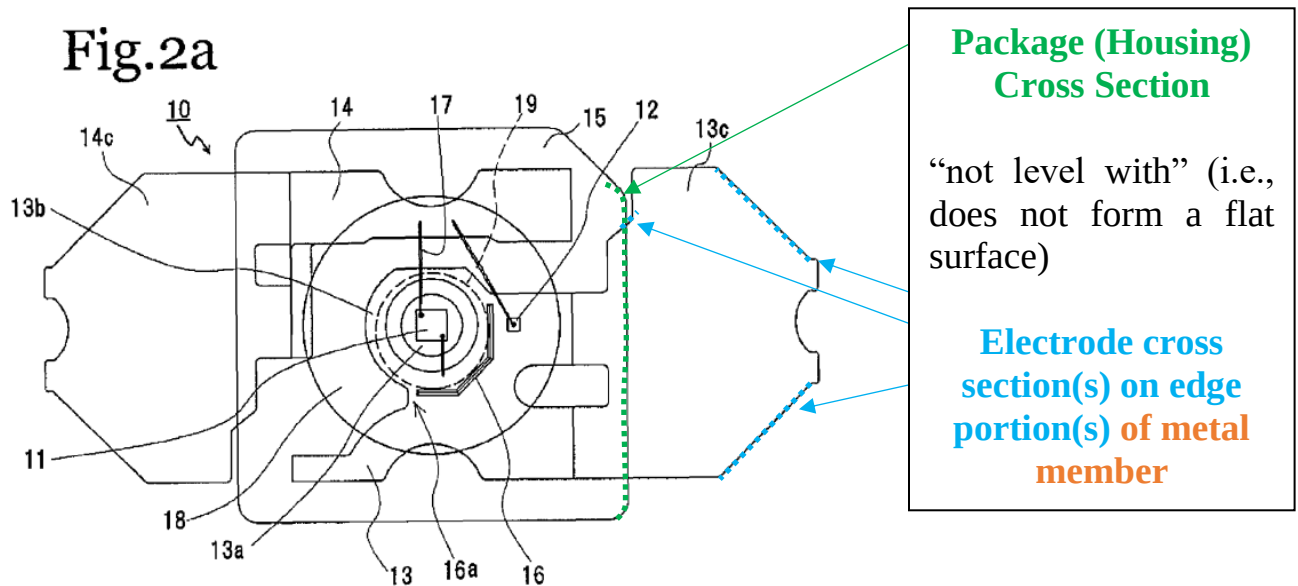


FIG. 2a of Kishikawa (Annotated)

181. This is consistent with the '733 patent's description. The '733 patent describes the electrode portion cross section and the housing cross section “as not forming a flat surface” (Ex-1001 at 6:34-39). In Kishikawa, the electrode cross section and the housing cross section if extended would intersect and do not form a flat surface.

182. Thus, Kishikawa discloses a housing cross section on the edge of package 15 and an electrode portion cross section on outer edges of metal members 13, 14 that are not level.

9.1.1.10. Claim 1: Wherein each of the at least one electrode portion further comprises a central area and two edge areas

183. For the reasons below, it is my opinion that Kishikawa discloses the claimed “wherein each of the at least one electrode portion further comprises a central area and two edge areas.”

184. Kishikawa discloses each of the at least one electrode portion (metal members 13, 14) further comprises a central area and two edge areas. For example, as shown in the below annotated version of Kishikawa FIG. 2a, each of metal members 13, 14 (i.e., electrode portions) comprises a central area and two edge areas (not only shown for metal member 13 in the annotated FIG. 2a, below).

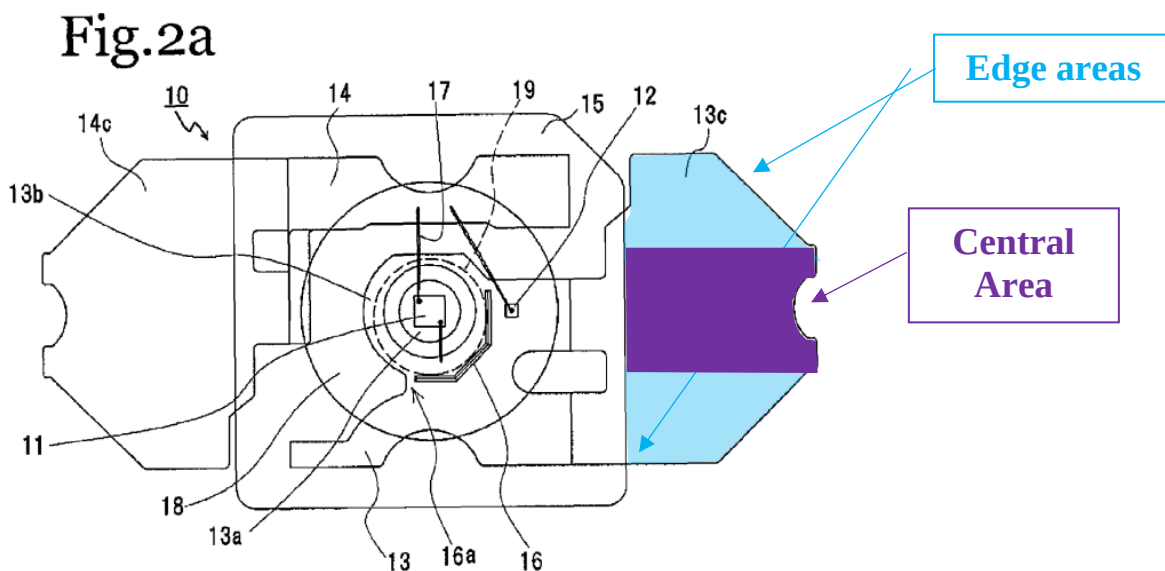


FIG. 2a of Kishikawa (Annotated)

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185. Thus, Kishikawa discloses each of the at least one electrode portion (each of metal members 13, 14) further comprises a central area and two edge areas.

9.1.1.11. Claim 1: wherein the electrode portion cross section is located on at least one of the two edge areas

186. For the reasons below, it is my opinion that Kishikawa discloses the claimed “wherein the electrode portion cross section is located on at least one of the two edge areas.”

187. As I explain in Section 9.1.1.6 above, the electrode portion cross section is located on the edge of metal members 13, 14, which are electrodes. As shown in the below annotated version of Kishikawa FIG. 2a, the electrode portion cross sections are located on at least one of the two edge areas of metal members 13, 14.

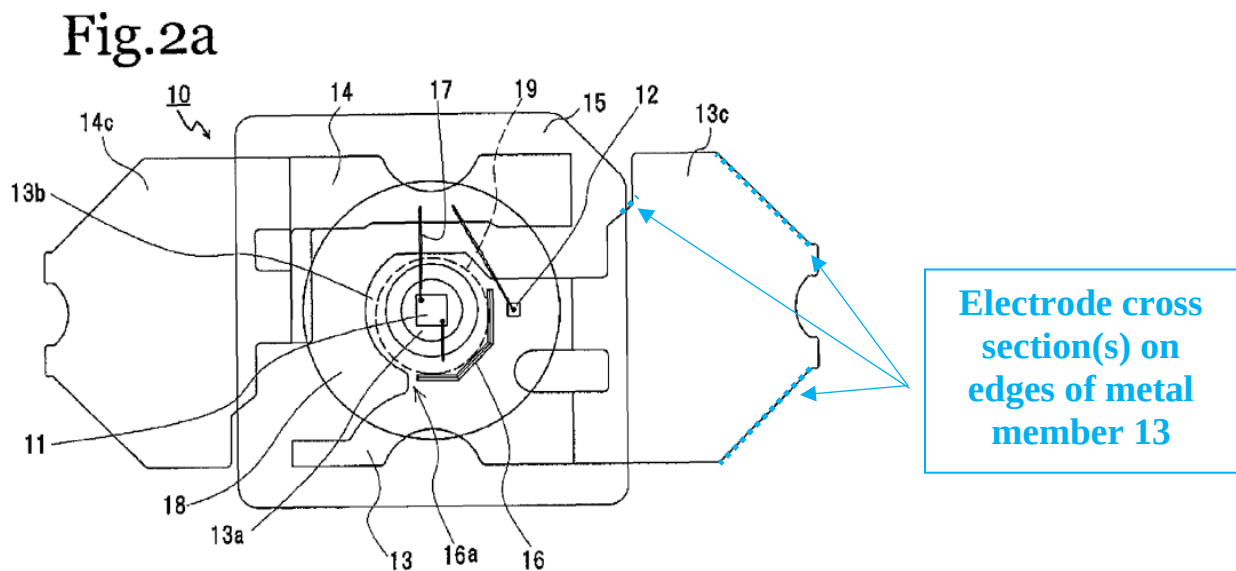


FIG. 2a of Kishikawa (Annotated)

9.1.1.12. Claim 1: wherein the central area and the two edge areas protrude from the housing cross section

188. For the below reasons, it is my opinion that Kishikawa discloses the claimed “wherein the central area and the two edge areas protrude from the housing cross section.”

189. As I describe in Section 9.1.1.12 above, the central area and two edge areas of metal members 13, 14 protrude from the housing cross-section. An annotated version of FIG. 2a of Kishikawa further illustrates the structural relationship whereby the central area and two edge areas of the electrode portion “protrude from” the housing cross section:

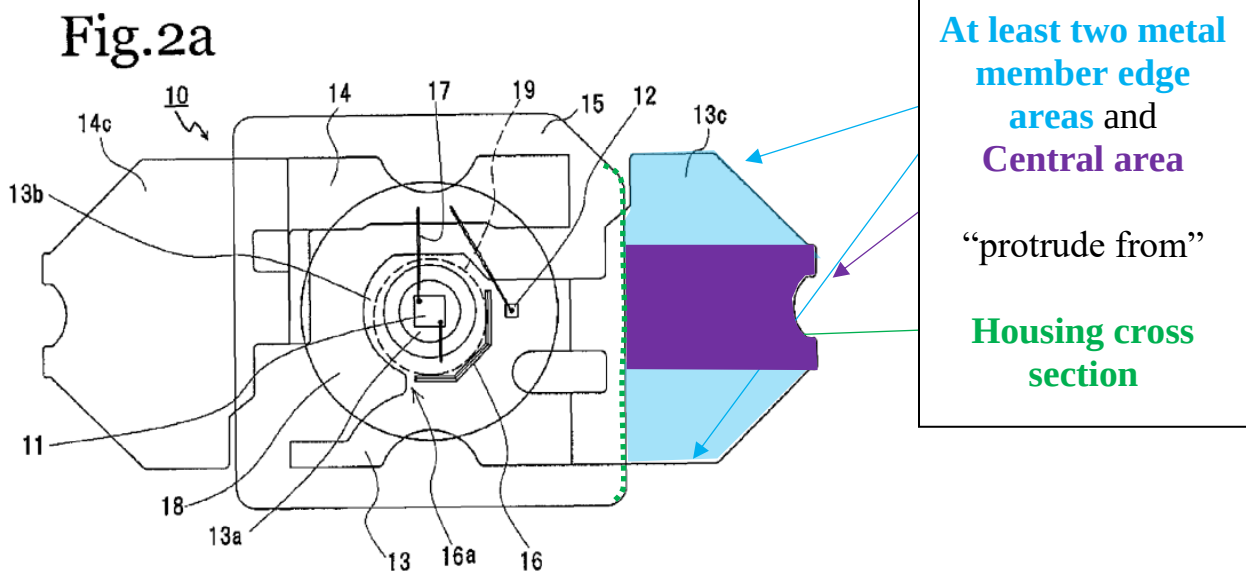


FIG. 2a of Kishikawa (Annotated)

9.1.1.13. Claim 1: wherein the central area protrudes from the two edge areas

190. For the below reasons, it is my opinion that Kishikawa discloses the claimed “wherein the central area protrudes from the two edge areas.”

191. For example, as illustrated by the below annotated version of Kishikawa FIG. 2A, the central area of metal members 13, 14 “protrudes from” the two edge areas of metal members 13, 14, respectively:

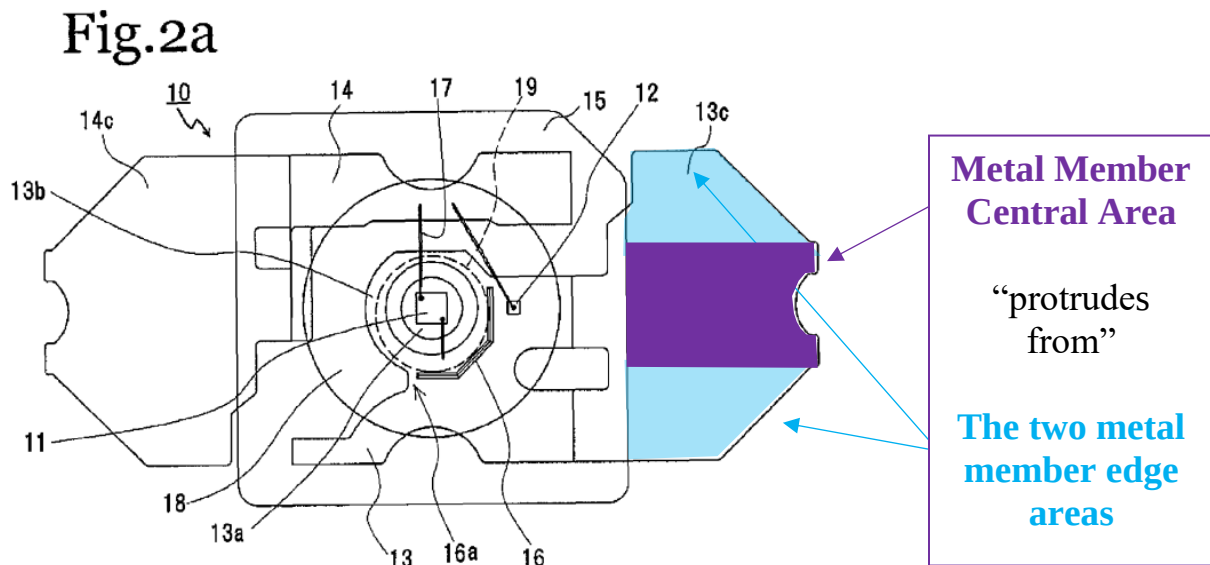


FIG. 2a of Kishikawa (Annotated)

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9.1.2. Dependent Claim 2: The light emitting device of claim 1, wherein the electrode portion cross section comprises a sloping surface

192. For the below reasons, it is my opinion that Kishikawa discloses a light emitting device “wherein the electrode portion cross section comprises a sloping surface,” as recited in claim 2 of the ’733 patent.

193. While I compared the claims to the prior art, I note that the ’733 patent describes “two edge areas 112A2” as comprising a “sloping surfaces” with respect to FIG. 8 (Ex-1001 at 8:26-27). An annotated version of FIG. 9 of the ’733 patent is shown below, highlighting “sloping surfaces” associated with “two edge areas 112A2” (Ex-1001 at 8:43-44).

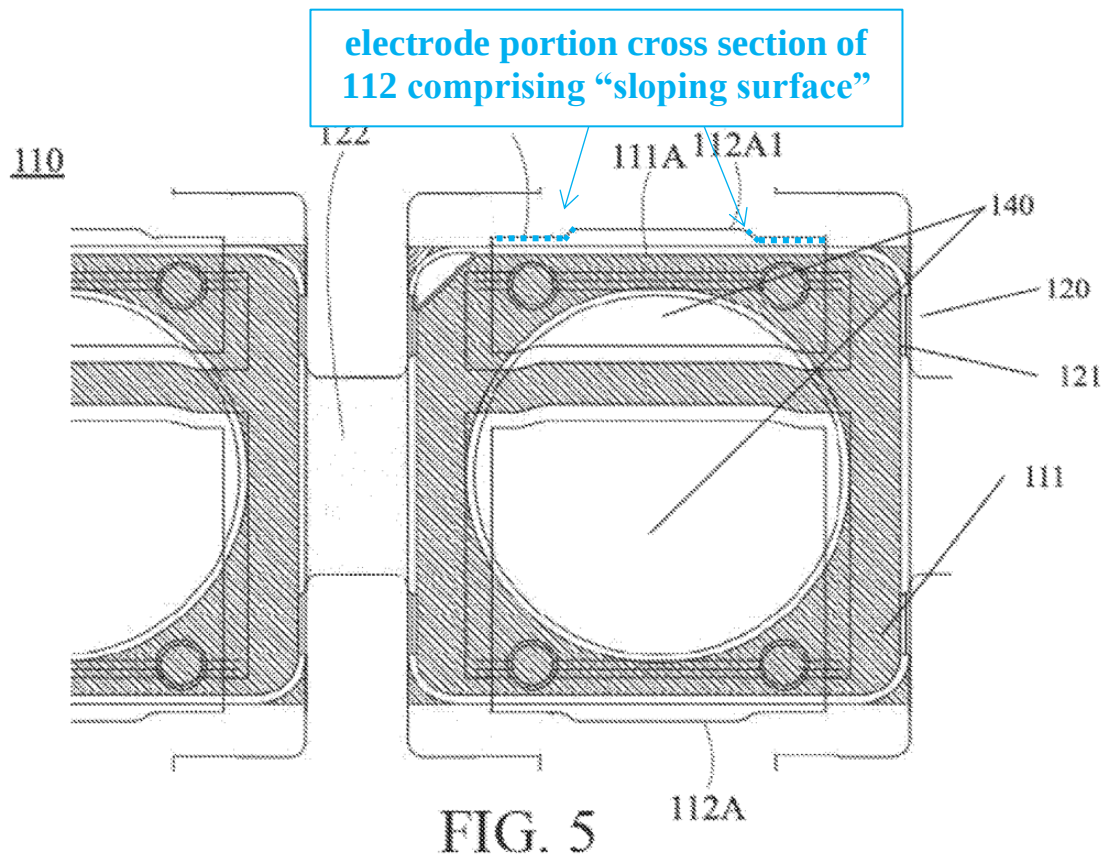


FIG. 5 of the '733 Patent (Annotated)

194. The cross sections of Kishikawa's metal members 13, 14 (i.e., the claimed electrode portion cross section) comprises "a sloping surface." For example, as illustrated by the below annotated version of Kishikawa FIG. 2a, numerous sections of the cross section of metal members 13, 14 have sloping surfaces (e.g., with respect to the housing cross section of package 15):

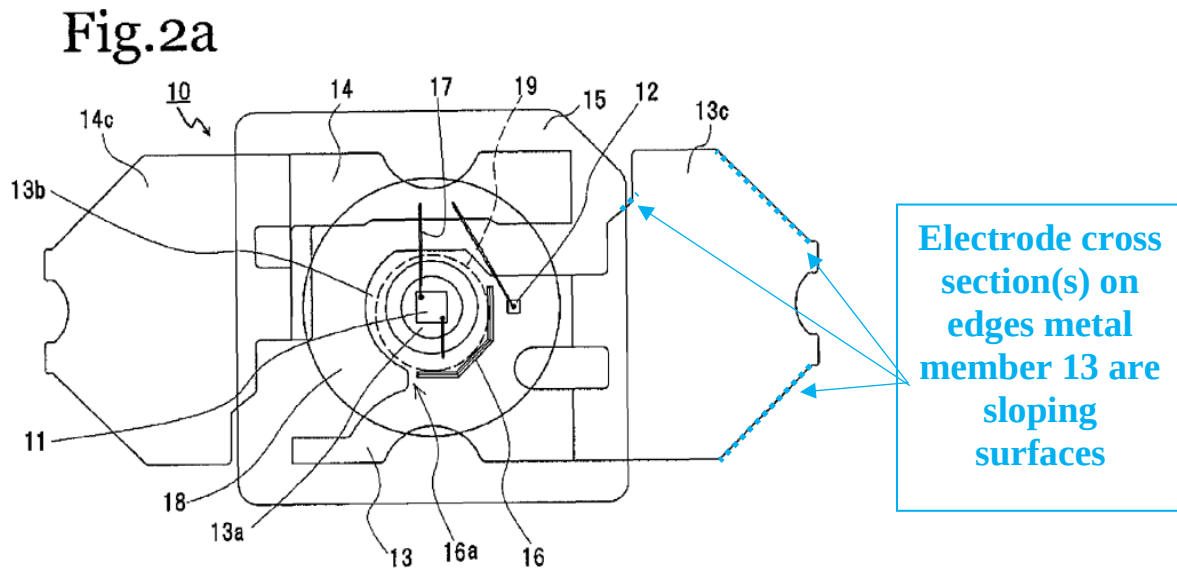


FIG. 2a of Kishikawa (Annotated)

195. Thus, as FIG. 2a illustrated, Kishikawa discloses the electrode portion (i.e., metal members 13, 14) cross section comprises a sloping surface.

9.1.3. Dependent Claim 3: The light emitting device of claim 1, wherein the electrode portion cross section and the central area are not coplanar

196. For the below reasons, it is my opinion that Kishikawa discloses a light emitting device, wherein the electrode portion cross section and the central area are not coplanar,” as recited in claim 3 of the ’733 patent.

197. For example, as shown in the below annotated version of Kishikawa FIG. 2a, the central portion of metal member 13 is irregularly shaped and is not coplanar with the electrode portion cross-section.

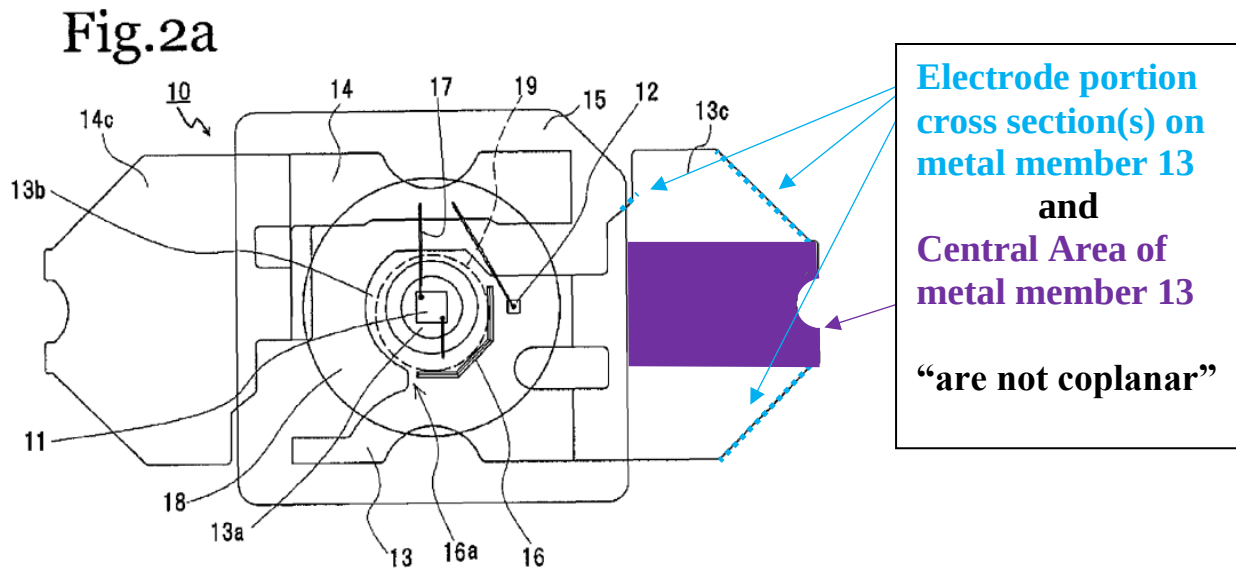


FIG. 2a of Kishikawa (Annotated)

198. Thus, as illustrated in FIG. 2a, Kishikawa discloses that the electrode portion cross-section and the central area of the electrode portion (i.e., metal member 13) are not coplanar.

9.1.4. Dependent Client 4: The light emitting device of claim 1, wherein the housing cross section or the electrode portion cross section comprises a curved surface.

199. For the below reasons, it is my opinion that Kishikawa discloses a light emitting device “wherein the housing cross section or the electrode portion cross section comprises a curved surface,” as recited in claim 4 of the ’733 patent.

200. Kishikawa discloses that each of package 15 (i.e., the claimed “housing”) on which the housing cross section is located and metal member 13 (i.e., the claimed “at least one electrode portion”) on which the electrode cross section is

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located comprises a curved surface. This is illustrated in the below annotated version of Kishikawa FIG. 2a:

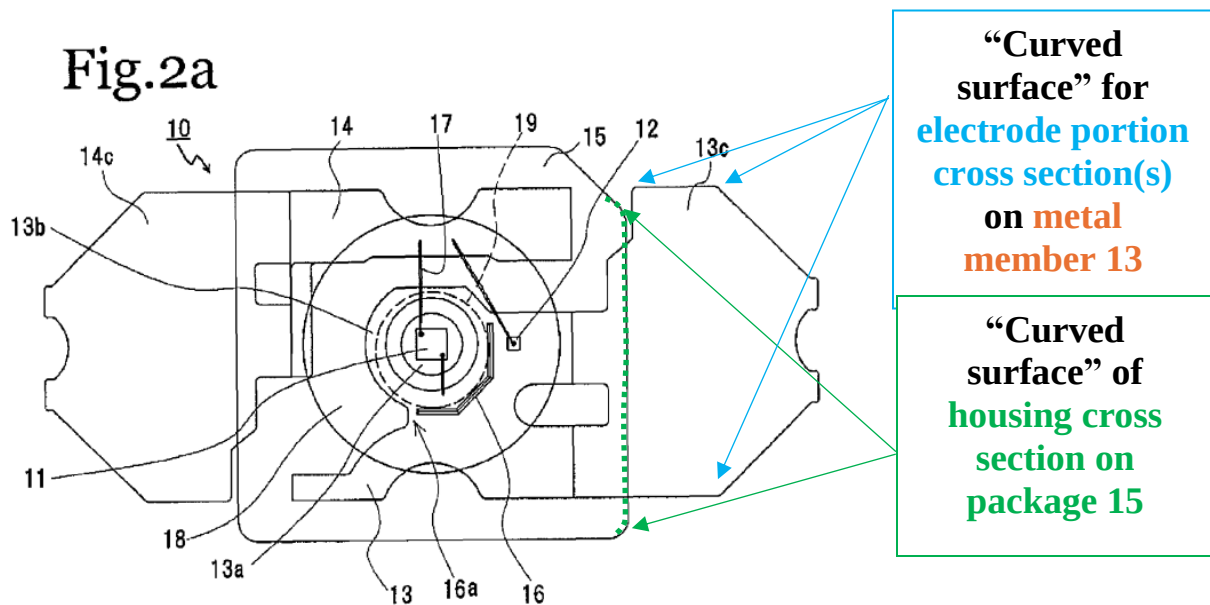


FIG. 2a of Kishikawa (Annotated)

201. Thus, as illustrated in FIG. 2a, Kishikawa discloses that the housing cross section or the electrode portion cross section comprises a curved surface, as recited in claim 4 of the '733 patent.

9.1.5. Dependent Claim 5: The light emitting device of claim 1, wherein the housing cross section comprises a rounded corner

202. For the below reasons, it is my opinion that Kishikawa discloses a light emitting device “wherein the housing cross section comprises a rounded corner,” as recited in claim 5 of the '733 patent.

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203. The below annotated version of Kishikawa FIG. 2a illustrates that package 15 (i.e., the claimed “housing”) on which the housing cross section exists comprises a “rounded corner.” The housing cross-section extends through the rounded corners of the housing.

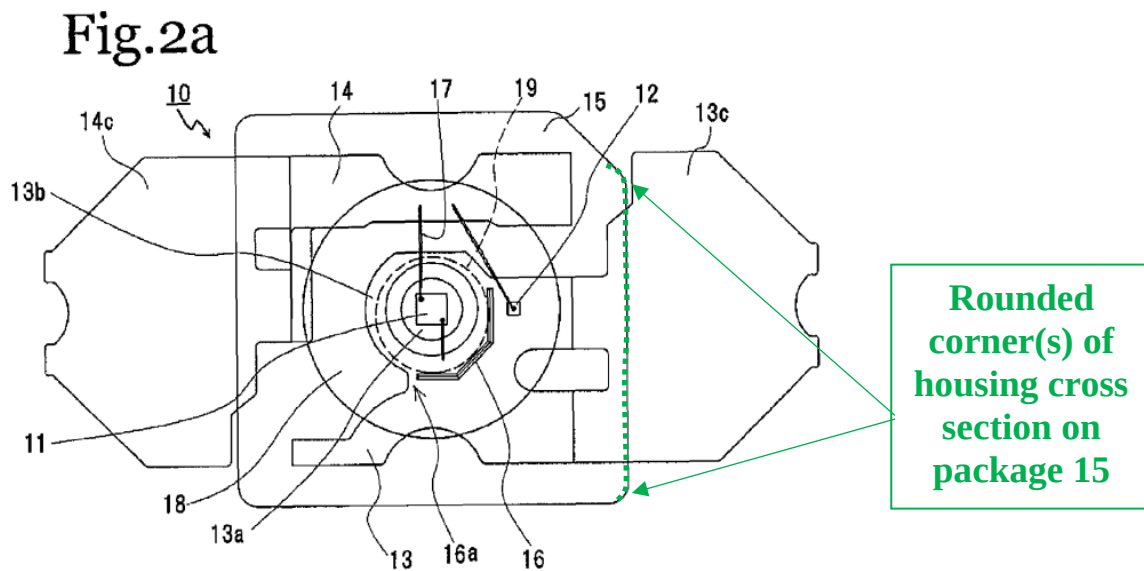


FIG. 2a of Kishikawa (Annotated)

204. Thus, as FIG. 2a illustrates, Kishikawa discloses that the housing cross section comprises a rounded corner, as recited in claim 5 of the '733 patent.

9.2. Claims 1-5 are Anticipated by Nakashima

205. It is my opinion that Nakashima discloses each and every limitation of claims 1-6 of the '733 patent.

9.2.1. Independent Claim 1

206. It is my opinion Nakashima anticipates claim 1 of the '733 patent for at least the following reasons.

9.2.1.1. Claim 1: “A light emitting device, comprising ...”

207. To the extent that the preamble is a limitation, it is my opinion that Nakashima discloses a “a light emitting device, comprising ...” For example, Nakashima describes how its “present invention relates to a light emitting device” (Ex-___ at 2:51). Likewise, FIGs. 1-4 illustrate various views of the “molded package” included in the “light emitting device” (Ex-1005 at 2:51-3:15; 5:20-29). Nakashima therefore discloses the claimed “light emitting device.”

9.2.1.2. Claim 1: A carrier comprising “at least one electrode portion” and a “housing”

208. It is my opinion that Nakashima discloses a carrier that comprises “at least one electrode portion and a housing,” as recited in claim 1. For example, Nakashima discloses “molded package 100,” which is the claimed carrier. As illustrated in the below annotated version of FIG. 1, Nakashima discloses that the molded package 100 includes second metal member 102 and a third metal member 103 (i.e., the claimed “at least one electrode portion”) and mold member 105 (the claimed “housing”):

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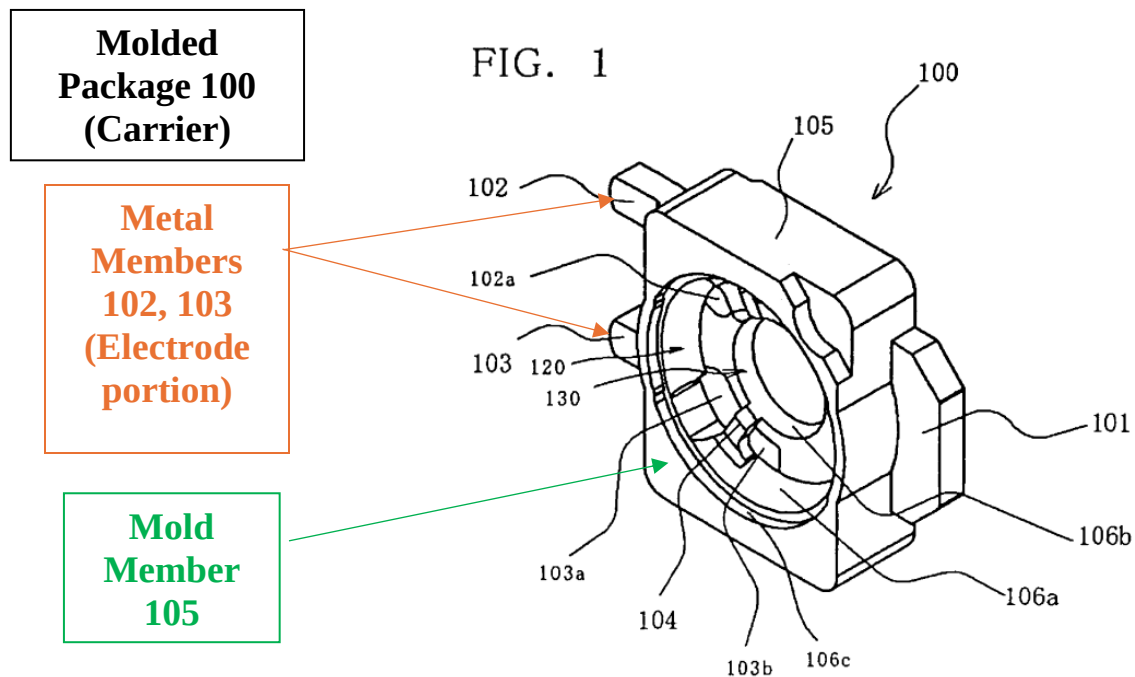


FIG. 1 of Nakashima (Annotated)

209. As shown in the above annotated FIG. 1, Nakashima discloses a carrier “molded package 100” comprising at least one electrode portion (second metal member 102 and a third metal member 103) and a housing (mold member 105).

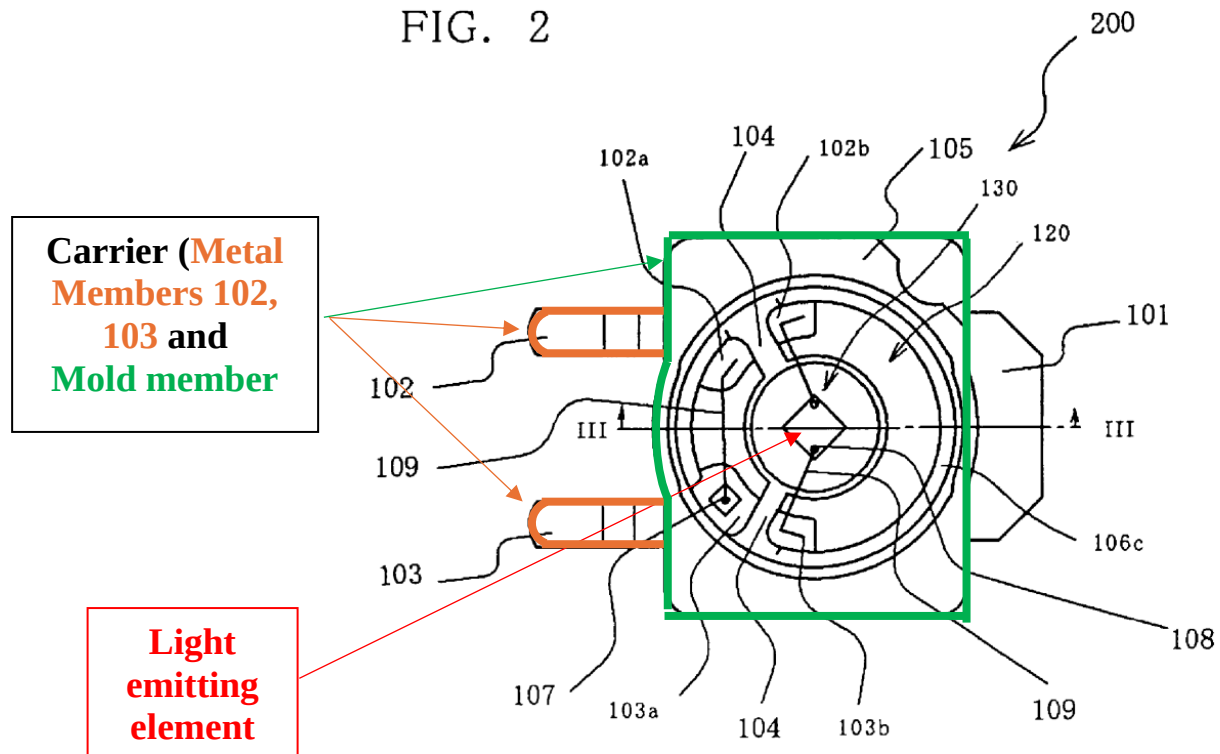
210. Nakashima further describes that “the molded package is formed by way of integral molding so that ... one end of the second metal base 102, and one end of the third metal base 103 are inserted in the mold member 105 and respective other ends are protruded from the outer surface of the mold member 105.” (Ex-1005 at 6:5-15). “The second metal member 102 is the positive electrode,” and “the third metal member 103 is the negative electrode” (Ex-1005 at 9:3-5). And a “recess” in the mold member is designed for “housing the light emitting element 108” (Ex-1005 at 9:43-46).

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211. Thus, it is my opinion that Nakashima discloses the claimed carrier via its mold member 105 and its metal members 102, 103.

9.2.1.3. Claim 1: A light emitting diode (LED) chip carried within the carrier

212. It is my opinion that Nakashima discloses an “LED chip carried with the carrier,” as recited in claim 1 of the ’733 patent. The light emitting element 108 is an LED chip throughout the disclosure of Nakashima (*E.g.*, Ex-1005 at 12:65-13:1; 13:57-59; 18:21-25; 19:56) and thus corresponds to the claimed “LED chip.” Nakashima further describes that the “light emitting element 108 [is] mounted on the bottom surface of the second recess 130” of the molded package 100 (carrier) (Ex-1005 at 7:12-14). And as shown in the below annotated Nakashima FIG 2, the lighting emitting element 108 is carried within the mold member 105, which along with metal members 102, 103 make up the claimed carrier:



Nakashima FIG. 2 (Annotated)

213. For these reasons, I am of the opinion that Nakashima discloses the claimed LED chip carried within the carrier.

9.2.1.4. Claim 1: An encapsulant covering the LED chip

214. It is my opinion that Nakashima discloses the claimed “encapsulant covering the LED chip.” For example, Nakashima discloses a “encapsulating member 111, 112 covering the semiconductor component,” which corresponds to the claimed “encapsulate covering the LED chip” (Ex-1005 at 9:32-33). Nakashima also discloses that the encapsulating member “covers the light emitting element 108” for example with a “rubber-like flexible resin” that can include “fluorescent material” or “diffusing agent” (Ex-1005, 16:15-51). Thus, it is my opinion that

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Nakashima discloses an encapsulant covering the LED chip via its encapsulating member 111, 112 covering its light emitting element 108.

9.2.1.5. Claim 1: A carrier comprising “at least one electrode portion”

215. It is my opinion that Nakashima discloses a carrier comprising “at least one electrode,” as recited in claim 1 of the ’733 patent.

216. As explained in Section 9.2.1.2 above, Nakashima’s metal members 102, 103 and mold member 105 are the claimed carrier. Nakashima’s carrier comprises at least one electrode portion in the form of metal members 102, 103. For example, Nakashima describes that the molded package carrier includes second metal member 102, which is the positive electrode, and “the third metal member 103 is the negative electrode” (Ex-1005 at 9:3-5).

217. As shown in the below annotated version of Nakashima FIG. 1, the carrier/molded package 100 of Nakashima comprises metal members 102, 103 that are each electrode portions.

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electrode portion cross sections extend into the curved part of the metal members 102, 103.

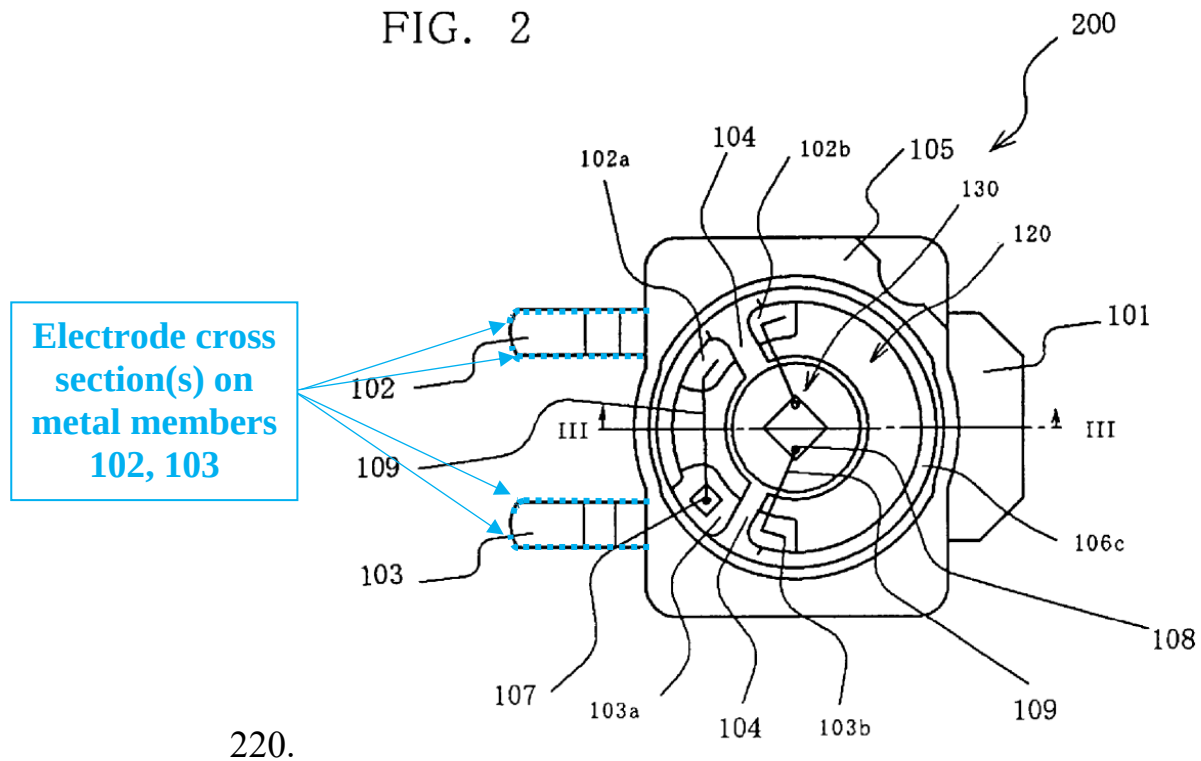


FIG. 2 of Nakashima (Annotated)

221. Nakashima's above electrode portion cross-sections are consistent with the electrode portion cross sections described in the '733 patent, as shown in the below annotated version of FIG. 5 of the '733 patent:

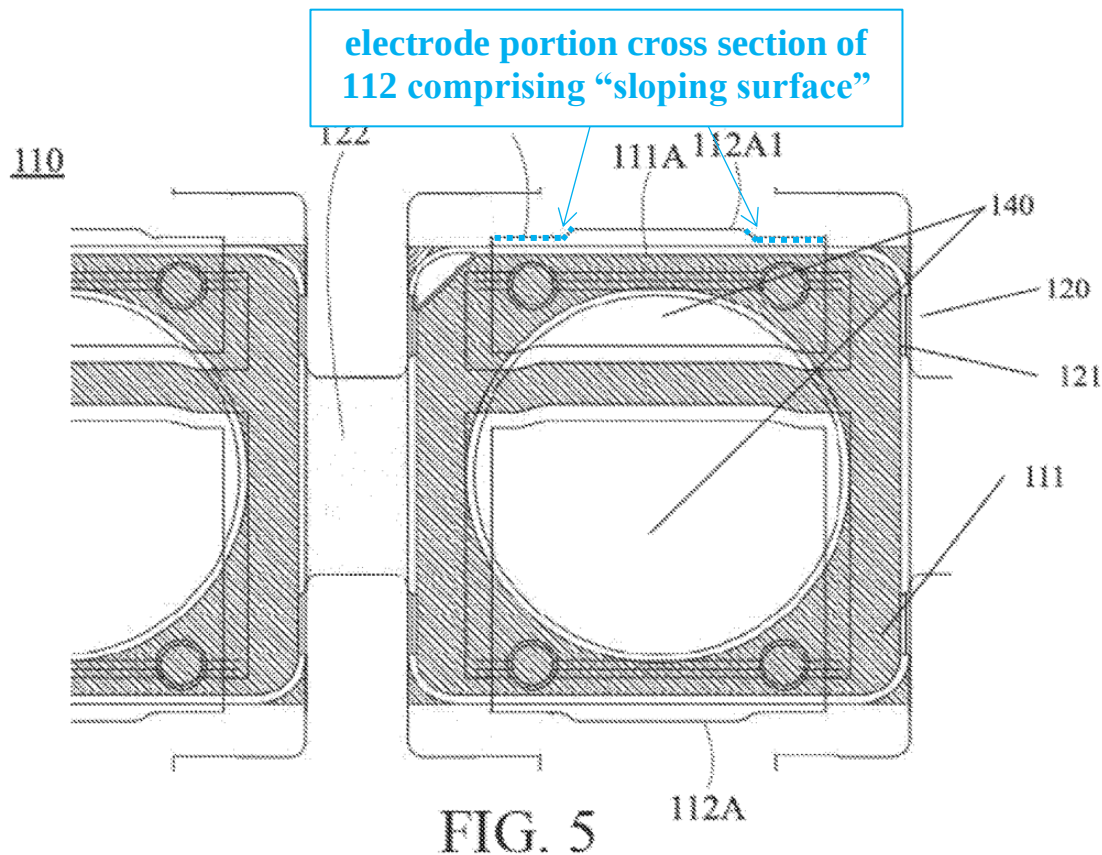


FIG. 5 of the '733 Patent (Annotated)

222. For these reasons, I am of the opinion that Nakashima discloses the claimed “each of the at least one electrode portion comprising at least an electrode portion cross section” of claim 1.

9.2.1.7. Claim 1: a housing comprising a housing cross section

223. It is my opinion that Nakashima discloses the “housing comprising a housing cross section” limitation recited in claim 1 of the '733 patent.

224. As I explain in Section 9.2.1.2 above, the carrier of Nakashima includes a housing in the form of mold member 105. Nakashima further describes that “a

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recess (first recess 120) is formed by the internal surface 106 a in the main surface side of the molded package so as to house the semiconductor component.” Thus, Nakashima discloses that the mold member 105 (i.e., the claimed “housing”) includes a recess for housing the semiconductor component/light emitting element/LED chip (Ex-1005, 6:16-29).

225. Further, as shown in the below annotated version of Nakashima FIG. 2, mold member 105 includes a side that is in operable contact with the electrodes (metal members 102, 103). And although Nakashima does not use the “cross section” language of the ’733 patent, it is my opinion that the edges of mold member 105 form the claimed housing cross section. The cross section extends into Nakashima’s housing’s rounded corners show below.

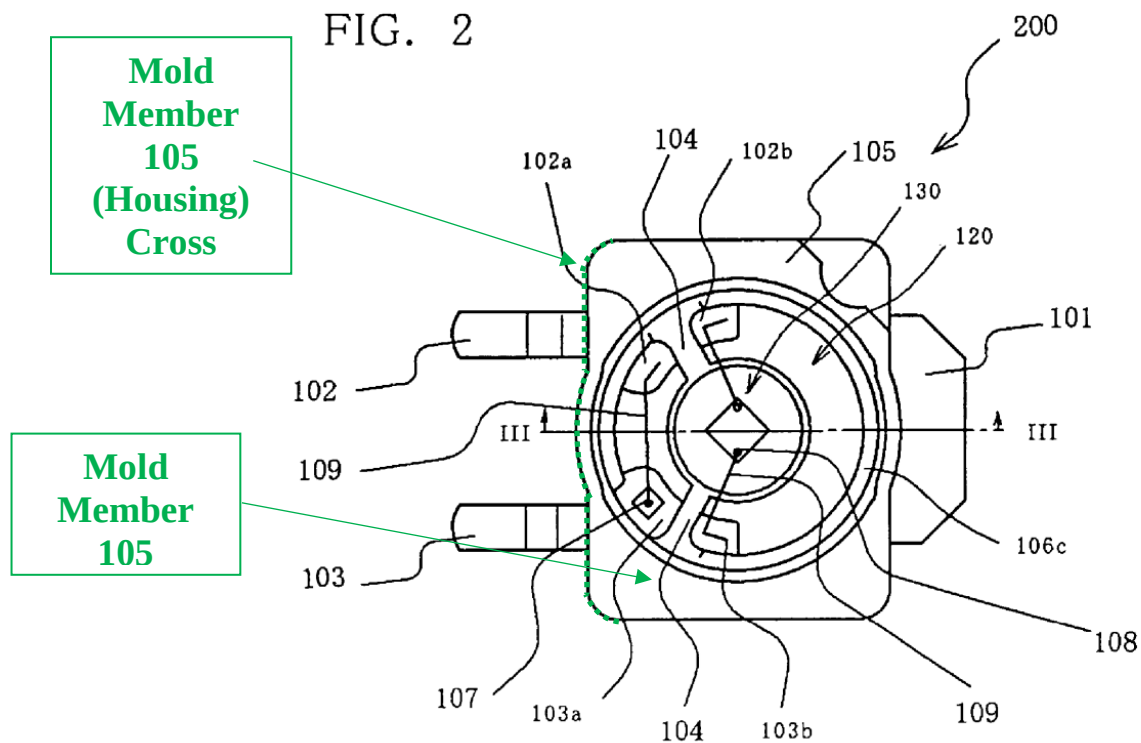


FIG. 2 of Nakashima (Annotated)

226. For these reasons, it is my opinion that Nakashima discloses the claimed housing comprising a housing cross section.

9.2.1.8. Claim 1: the housing at least partially covering the at least one electrode portion

227. It is my opinion that Nakashima discloses the “housing at least partially covering the at least one electrode portion” limitation recited in claim 1 of the ’733 patent.

228. Nakashima discloses that the second and third metal members 102, 103 (i.e., the claimed “electrode portions”) are inserted into a protrude from the sides of

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mold member 105, which is the claimed “housing” for light emitting element/LED chip 108 (Ex-1005 at 9:6-7; 31:28-30).

229. Further, the below annotated version of Nakashima FIG. 2 illustrates that the housing/mold member 105 partially covers the metal member 102, 103 electrode portions. That the mold member 105 covers the metal members 102,103 is also confirmed by Nakashima’s disclosure that “bonding regions of 102a, 102b, 103a, and 103b” are within the interior of mold member 105 and isolated by wall portion 104.

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232. As I explain in Sections 9.2.1.6 and 9.2.1.7 above, Nakashima discloses a housing cross section on the edge of mold member 105 and an electrode portion cross section on outer edges of metal members 102, 103. And as I explain in Section 9.1.1.9 above, the '733 patent informs us that when the “the housing cross section and the electrode portion cross section are not level with one another,” they “do not form a flat surface” (Ex-1001 at 6:34-39).

233. The below annotated version of Nakashima FIG. 2 illustrates that the housing cross section on the edge of mold member 105 and the electrode portion cross sections on outer edges of metal members 102, 103 are not level with one another.

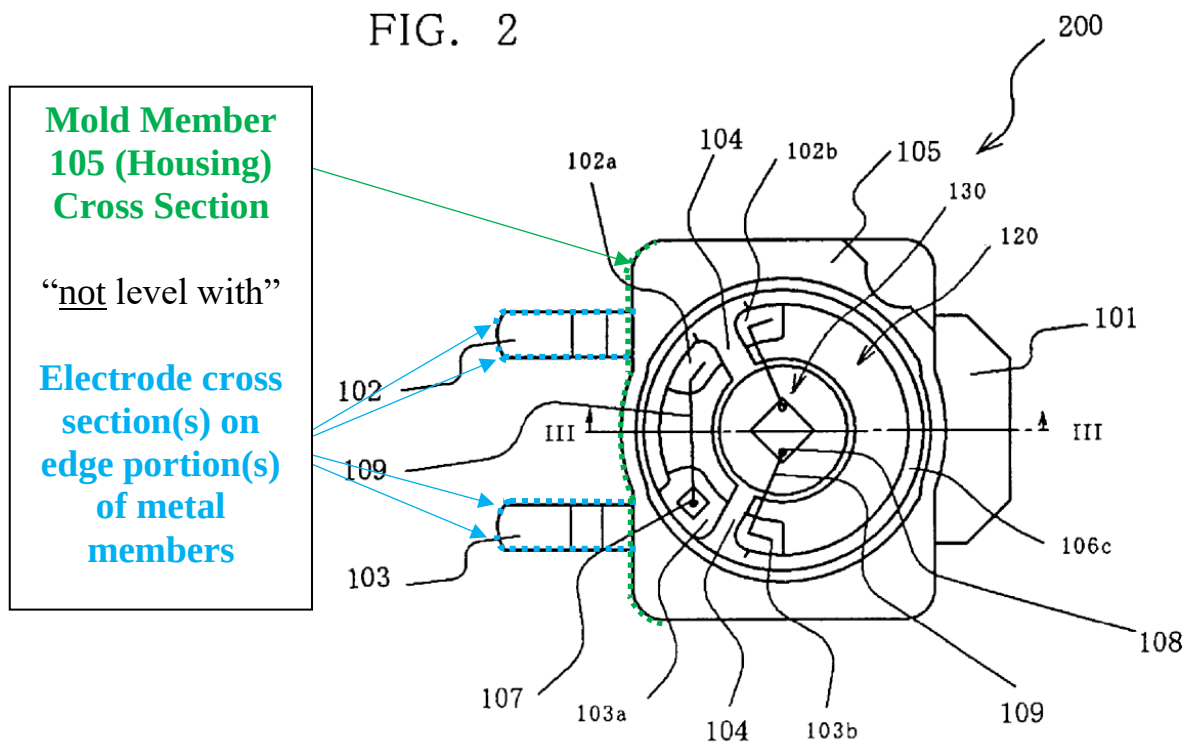


FIG. 2 of Nakashima (Annotated)

234. Thus, Nakashima discloses a housing cross section on the edge of mold member 105 and an electrode portion cross section on outer edges of metal members 102, 103 that are not level.

9.2.1.10. Claim 1: wherein each of the at least one electrode portion further comprises a central area and two edge areas

235. It is my opinion that Nakashima discloses the “wherein each of the at least one electrode portion further comprises a central area and two edge areas” limitation of claim 1 of the ’733 patent.

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236. For example, as the below annotated version of FIG. 2, each of metal members 102, 103 (i.e., electrode portions) comprises a central area and two edge areas.

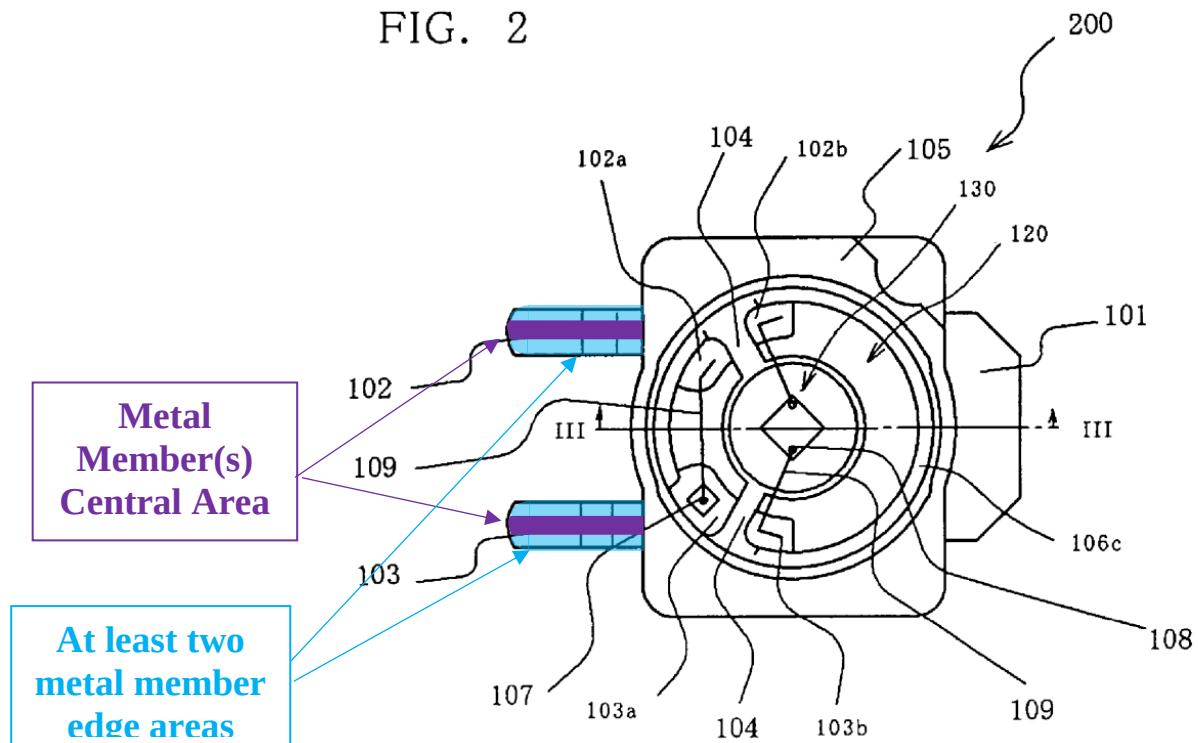


FIG. 2 of Nakashima (Annotated)

237. For these reasons, I am of the opinion that Nakashima discloses the “each of the at least one electrode portion further comprises a central area and two edge areas” limitation recited in claim 1 of the ’733 patent.

9.2.1.11. Claim 1: wherein the electrode portion cross section is located on at least one of the two edge areas

238. It is my opinion that Nakashima discloses the claimed “wherein the electrode portion cross section is located on at least one of the two edge areas” limitation of claim 1.

239. As I explain in Sections 9.2.1.6 and 9.2.1.7 above, the electrode portion cross section is located on the edge of metal members 102, 103, which are electrodes. And as shown in the below annotated version of Nakashima FIG. 2, the electrode portion cross sections are located on at least one of the two edge areas of metal members 102, 103:

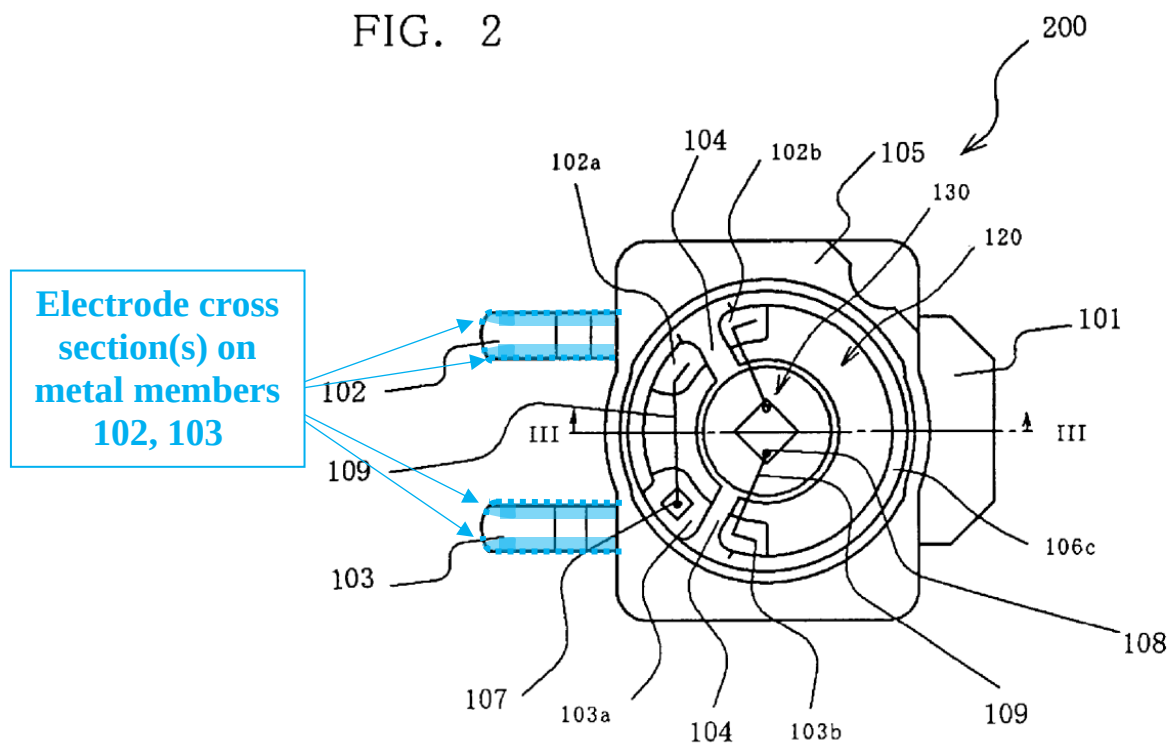


FIG. 2 of Nakashima (Annotated)

240. Thus, Nakashima discloses the electrode portion cross section is located on at least one of the two edge areas, as recited in claim 1 of the '733 patent.

9.2.1.12. Claim 1: wherein the central area and the two edge areas protrude from the housing cross section

241. It is my opinion that Nakashima discloses the “wherein the central area and the two edge areas protrude from the housing cross section” limitation of claim 1.

242. For example, as shown in the below annotated version of Nakashima FIG. 2, the “central area” and “two edge areas” of the metal members 102, 103 (i.e., the claimed “at least one electrode portion”) “protrude from” the “housing cross section” of the mold member 105 (i.e., the claimed “housing”):

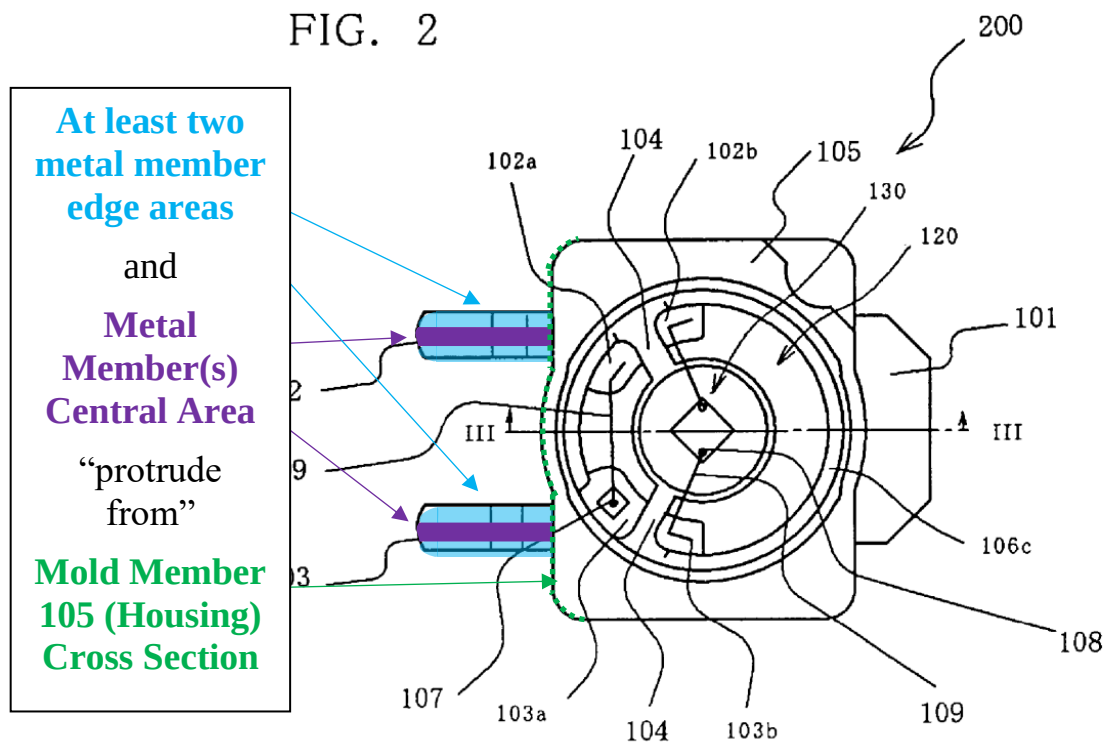


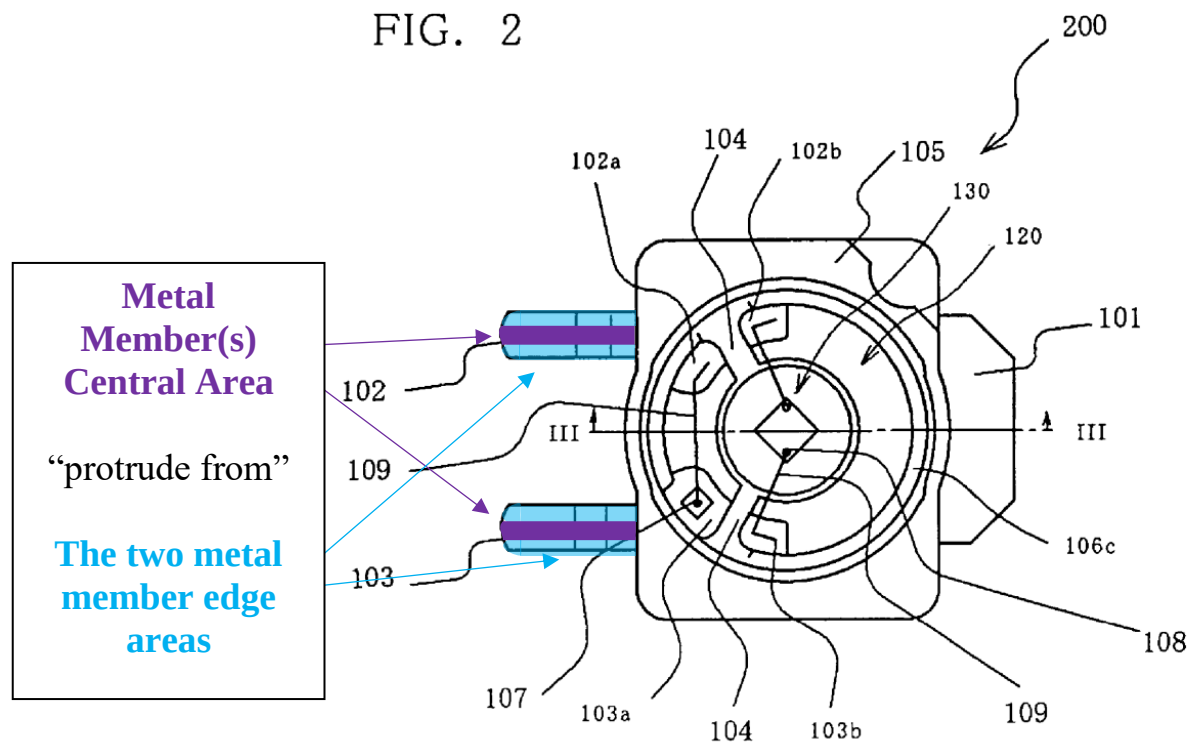
FIG. 2 of Nakashima (Annotated)

243. Thus, as FIG. 2 illustrates, Nakashima discloses that the central area and the two edge areas protrude from the housing cross section, as claimed.

9.2.1.13. Claim 1: wherein the central area protrudes from the two edge areas

244. It is my opinion that Nakashima discloses the “wherein the central area protrudes from the two edge areas” limitation recited in claim 1 of the ’733 patent.

For example, as shown in the below annotated version of Nakashima FIG. 2, the central area of metal members 102, 103 protrudes from the two edge areas of metal members 102, 103, respectively:



245. Thus, as FIG. 2 illustrates, Nakashima discloses that the central area protrudes from the two edge areas, as claimed.

9.2.2. Claim 2: The light emitting device of claim 1, wherein the electrode portion cross section comprises a sloping surface

246. It is my opinion that Nakashima discloses that the semiconductor device 200 (i.e., the claimed “light emitting device”), “wherein the electrode portion cross section comprises a sloping surface,” as recited in ’733 patent, claim 2. For example, as shown in the below annotated version of Nakashima FIG. 2, the

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edge area cross section is sloped at the top of the electrode portion cross section.

This is illustrated for the edges of metal members 102, 103 below.

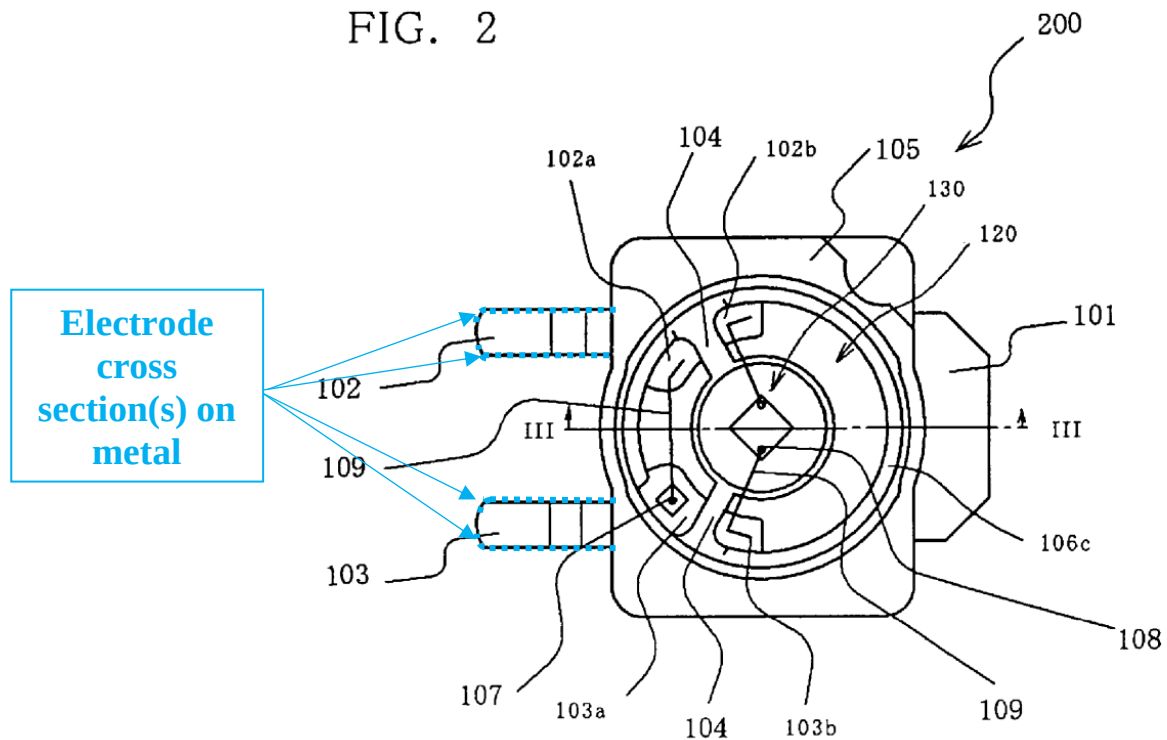


FIG. 2 of Nakashima (Annotated)

247. Thus, as FIG. 2 illustrates, Nakashima discloses the electrode portion cross section comprises a sloping surface.

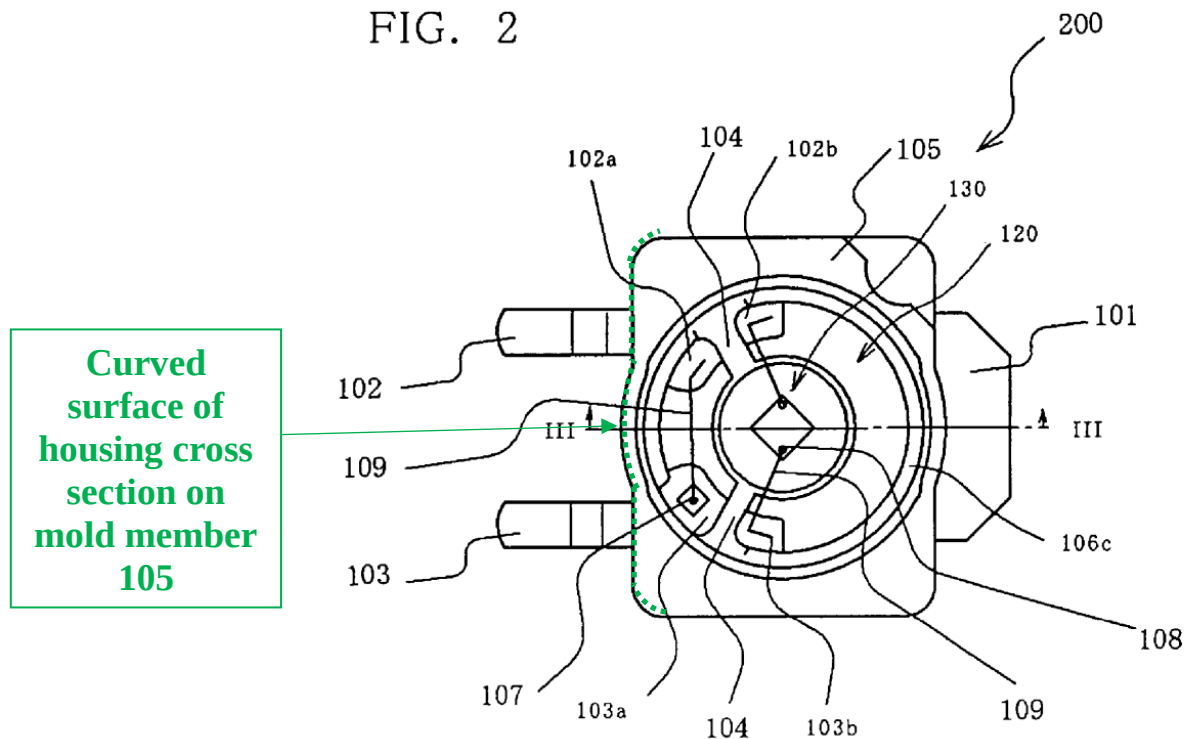
9.2.3. Claim 3: The light emitting device of claim 1, wherein the electrode portion cross section and the central area are not coplanar

248. It is my opinion that Nakashima discloses the “wherein the electrode portion cross section and the central area are not coplanar” limitation recited in claim 3 of the ’733 patent.

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limitation of claim 4. For example, the mold member 105 (i.e., the claimed “housing”) on which the housing cross section is located comprises a curved surface.

This is illustrated in the below annotated version of Nakashima FIG. 2.



252. As FIG. 2 illustrates, Nakashima discloses that the housing cross section of mold member 105 (i.e., the claimed “housing”) comprises a curved surface.

9.2.5. Claim 5: The light emitting device of claim 1, wherein the housing cross section comprises a rounded corner

253. It is my opinion that that Nakashima discloses the “wherein the housing cross section comprises a rounded corner” limitation of claim 5. For example, as

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with Bando and/or a POSITA's level of skill renders claims 1-5 of the '733 patent obvious.

9.3.1. Independent Claim 1

256. It is my opinion combination of Umeda with either Bando and/or a POSITA's level of skill renders claim 1 of the '733 patent obvious for at least the following reasons.

257. As I detail below, Umeda discloses all of claim 1's limitations except for the "encapsulant." However, it would have been obvious to include an "encapsulant" covering the LED chip disclosed in Bando. Bando discloses a sealing resin 4 that encapsulates Bando's light emitting element has the beneficial effect of "prevent[ing] short circuit of the wire lines 3, and the p-pad and n-pad electrodes of the light emitting elements 10" (Ex-1009 at 14:45-47) and can be "formed in a desired shape on the light emission side to provide a lens effect" in order to focus the light from the light emitting element 10 in a desired direction (Ex-1009 at 14:65-15:10). Additionally, Bando's "sealing resin 4 [can be] mixed with a wavelength conversion member such as phosphor material that is excited by light from the light emitting elements 10 and emits luminescent radiation, the light from the light emitting elements 10 is converted to light with different wavelength, thus, it is possible to emit mixture light of the light from the light emitting elements 10 and

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the light with wavelength converted by the wavelength conversion member” (Ex-1009 at 15:22-29).

258. Additionally, the use of encapsulants to protect LED chips was widely known and used well before 2014 (the earliest priority date of the challenged claims), as I describe in Section 6.4 above.

259. As further evidence of the level of skill, Kishikawa teaches using a “translucent covering material [that] protects the light emitting element against external force, moisture, and so forth, and also protects the wiring,” as described in Section [XX] above (Ex-1004 at 7:6-17). Thus, a POSITA knew how to and did in fact encapsulate LED’s containing in a housing that had electrodes extending from them (see *supra* background art). Carey, Bogner, Tanda, and Bando also describe the level of skill in the art regarding the claimed “encapsulant.”

260. In fact, it was common place for a POSITA to do so and routine within the level of skill in the art.

261. Accordingly, it is my opinion that it would have been obvious to modify Umeda in view of Bando and/or the level of skill in the art to modify Umeda to include the claimed “encapsulant.” The use, application, and benefits of the claimed encapsulant are described in Bando and were known to a POSITA. Further, the use, application, and benefits of the claimed encapsulant are described in Bando and as known by a POSITA were predictable and in fact ordinary.

9.3.1.1. Claim 1: “A light emitting device, comprising ...”

262. To the extent that claim 1’s preamble is limiting, it is my opinion that Umeda discloses the claimed “light emitting device, comprising ...”

263. Umeda is entitled “PACKAGE FOR LIGHT EMITTING DEVICE AND LIGHT EMITTING DEVICE” (Ex-1007 at Cover). FIG. 1 Umeda “is a plan view of the light emitting device,” and FIG. 5a “is a plan view of a package configuring the light emitting device in FIG. 1” (Ex-1007 at [0031]). For example, it is my opinion that Umeda’s “light emitting device 1” is a “light emitting device” (Ex-1007 at [0033]).

9.3.1.2. Claim 1: “A carrier ... comprises at least one electrode portion ... and a housing”

264. It is my opinion that Umeda discloses a “carrier” that comprises “at least one electrode portion” and a “housing.” It is my opinion that Umeda’s package 2 is the claimed carrier, lead electrodes 10, 20 are the claimed “at least one electrode,” and the resin molded body 3 is the claimed “housing.”

265. Umeda discloses a carrier (i.e., package 2) that is “made up of a first lead electrode 10, a second lead electrode 20, and a resin molded body 3 molded to be integrated with the lead electrodes 10 and 20” (Ex-1007 at [0033]). Umeda further discloses that a portion of “each of the lead electrodes 10 and 20 is exposed at the bottom of the cup portion 3a” of the resin molded body, and that “[t]he outer

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ends of the lead electrodes 10 and 20 extend outward from the outer periphery of the resin molded body 3” (Ex-1007 at [0034]).

266. While Umeda does not use the term “carrier,” it is my opinion that the package 2 is the same as the claimed carrier because it includes lead electrodes (i.e., the claimed “at least one electrode portion”) and resin molded body (i.e., the claimed “housing”), as illustrated by the below annotated version of Umeda FIG. 1:

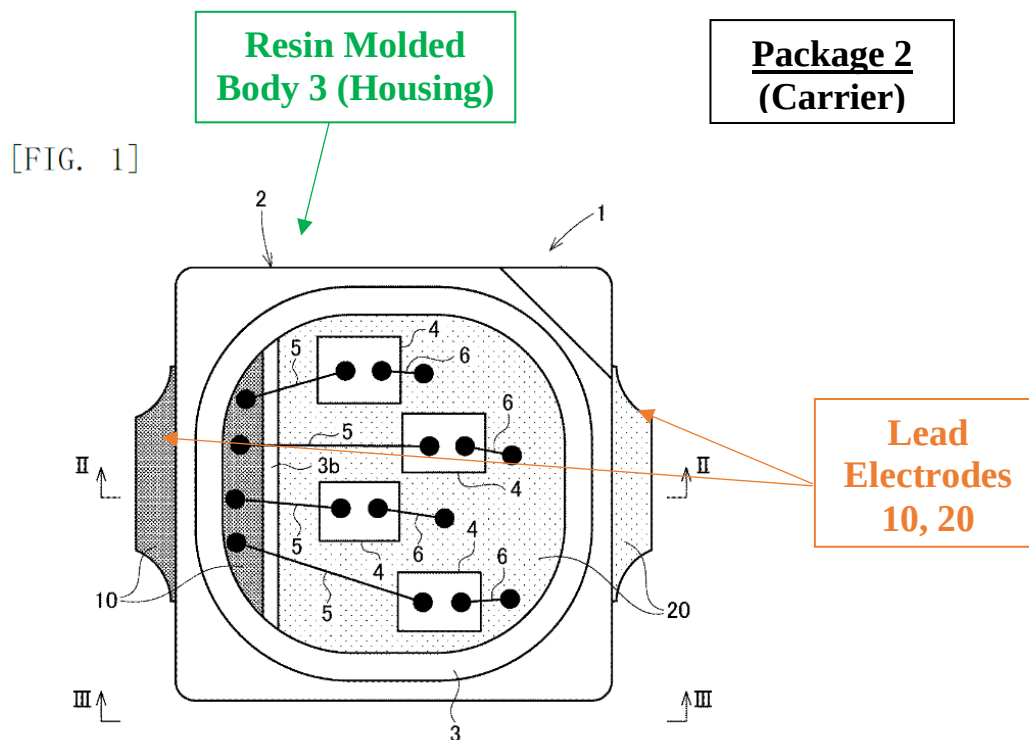


FIG. 1 of Umeda (Annotated)

267. Thus, it is my opinion that Umeda discloses the claimed “carrier ... [that] comprises: at least one electrode portion ... and a housing,” as recited in claim 1 of the '733 patent.

9.3.1.3. Claim 1: A light emitting diode (LED) chip carried within the carrier

268. It is my opinion that Umeda discloses an “LED chip carried with the carrier,” as recited in claim 1 of the ’733 patent. It is my opinion that Umeda’s light emitting element 4 is the claimed “LED chip carried within a carrier.” The package 2, or carrier, of Umeda is described as “for a light emitting device in which a light emitting element such as an LED element is mounted” (Ex-1007 at [0001]). Umeda also discloses that “a light emitting element 4 such as an LED is fixed on the lead electrode 20” (i.e., the claimed “at least one electrode”) via “the cup portion 3a” of the package 2’s (i.e., the claimed “carrier”) resin molded body 3 (i.e., the claimed “housing”). This arrangement is illustrated in the below annotated version of Umeda

FIG. 1:

[FIG. 1]

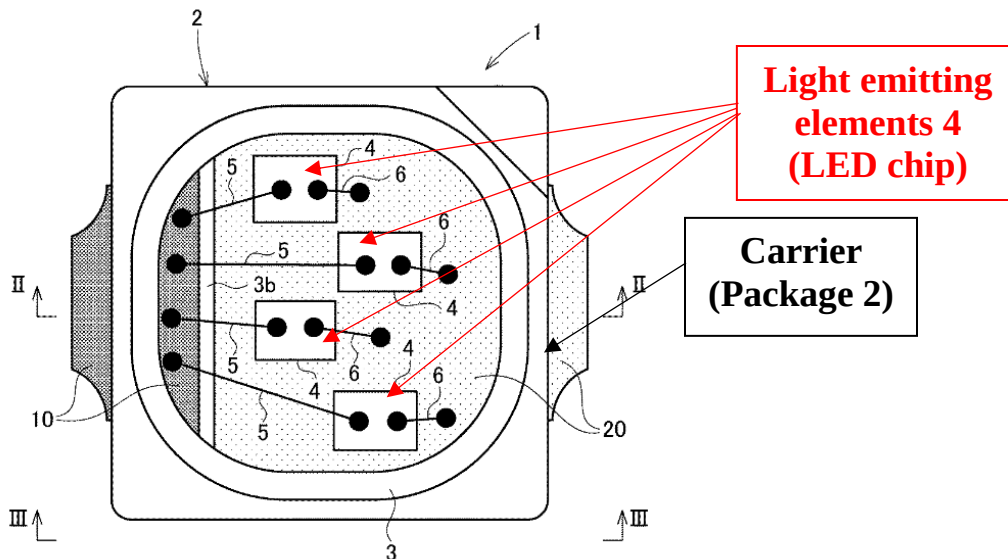


FIG. 1 of Umeda (Annotated)

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269. For these reasons, it is my opinion that Umeda discloses an LED chip carried within the carrier (package).

9.2.1.4. Claim 1: An encapsulant covering the LED chip

270. Umeda does not explicitly disclose an encapsulant covering the LED chip/light emitting element 4 (i.e., the claim “LED chip”). However, as I explain in Section 6.4 above, the use of encapsulants to cover LED chips were well-known to a POSITA, for example, as shown by the '733 patent, Carey, Bogner, Tanda, and Bando.

271. Additionally, Bando discloses an encapsulant covering an LED chip. Bando discloses that after its light emitting elements 10 (which are semiconductor light emitting elements i.e., LED chips (*see* Ex-1009 at 8:35-49) are secured in package 2, sealing resin 4 (i.e., an encapsulant) is filled within the molding member of the package (Ex-1009 at 14:41-45). Bando also discloses that the sealing resin 4 encapsulating the light emitting element has the benefit of “prevent[ing] short circuit of the wire lines 3, and the p-pad and n-pad electrodes of the light emitting elements 10” (Ex-1009 at 14:45-47). Further, Bando’s sealing resin encapsulant 4 has the beneficial effect of being “formed in a desired shape on the light emission side to provide a lens effect” in order to focus the light from the light emitting element 10 in a desired direction (Ex-1009 at 14:65-15:10). Bando further describes that the sealing resin encapsulant 4 “improve[s] adhesion between the light emitting element

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10 and the lead middle region 101” (Ex-1009 at 15:11-14). Finally, if the “sealing resin 4 is mixed with a wavelength conversion member such as phosphor material that is excited by light from the light emitting elements 10 and emits luminescent radiation, the light from the light emitting elements 10 is converted to light with different wavelength, thus, it is possible to emit mixture light of the light from the light emitting elements 10 and the light with wavelength converted by the wavelength conversion member” (Ex-1009 at 15:22-29).

272. That the use of an encapsulant to protect an LED chip was well-known to a POSITA in 2014 is also evidenced by Kishikawa. For example, Kishikawa describes that encapsulants can be used to: (i) protect the LED chip from external elements; (ii) protect the LED chip from external elements); and (iii) to allow for wavelength conversion using diffuser or fluorescent substance and improve directionality (*see* Ex-1004 at 7:6-17; 7:45-51).

273. As evidenced by Bando, among others, the use of an encapsulant to diffuse or change the direction of light was well-known to a POSITA in 2014. Likewise, the use of an encapsulant that includes a fluorescent material to change the color of emitted light – particularly to change the wavelength of the light to mimic white light – was well known to a POSITA in 2014.

274. A POSITA would have been motivated to use an encapsulant to cover and/or protect the light emitting elements of Umeda based on these well-known

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benefits and the explicit teachings of disclosure and teaching of Bando and/or the level of skill in the art as exemplified by Kishikawa, Carey, Bogner, and Tanda.

275. A POSITA would have found no technical problems or difficulties incorporating the sealing resin 4 of Bando or a known encapsulant into to the light emitting device 1 of Umeda in order to cover the light emitting element 4 of Umeda. Application of such an encapsulant was well-known, ordinary, and routine in 2014, and could easily be applied to or filled or potted “cup portion 3a” of Umeda just as Bando describes how it is applied to its opening of package 2 (Ex-1009 at 14:32-50).

276. It would have been obvious to a POSITA in 2014 to incorporate the sealing resin encapsulant 4 of Bando or the encapsulants known in the art into Umeda’s package in order to cover and protect Umeda’s light emitting element.

277. It would have also been obvious to a POSITA to use an encapsulant so that a fluorescent substance could be incorporated into the light emitting device of Umeda such that “white light can be formed relatively simply and with good reliability” (Ex-1009 at 7:62-63). For example, LED’s used in lighting applications often emit blue light. In order to use the emitted blue light for lighting, encapsulants having phosphors are disposed over the LED because the phosphor changes the LED emitted light’s wavelength so that the light changes from blue to a whitish-yellow light that can be used for lighting applications (e.g., LED light bulbs). Indeed, the

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inventors of the '733 patent admit as much, stating in the “Background” section that the use of “encapsulation process” in the manufacturing LED has been used prior to the filing of the '733 patent (*See* Ex-1001, '733 patent, 1:40-47).

278. The reasons for using an encapsulant including protecting the LED and changing LED emitted light color were well-understood by 2014. It was routine to use an encapsulant of the type claimed. The results were predictable.

279. For these reasons, it is my opinion that it would have been obvious to a POSITA in 2014 to incorporate the sealing resin encapsulant 4 of Bando or those known in the art into the Umeda light emitting device 1 to cover and protect Umeda's light emitting elements 4 or to change the emitted LED's light color.

9.3.1.5. Claim 1: each of the at least one electrode portion comprising at least an electrode portion cross section

280. It is my opinion that Umeda discloses the “each of the at least one electrode portion comprising at least an electrode portion cross section” limitation recited in claim 1 of the '733 patent.

281. As I explain in Section 9.3.1.2 above, the Umeda's package 2, which is the claimed “carrier,” comprises at least one electrode portion in lead electrodes 10, 20 (*See* Ex-1007 at [0033]).

282. And while it does not use the phraseology of “cross sections,” Umeda also discloses that each of the at least one electrode portion comprises “at least an

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electrode portion cross section,” as claimed. For example, Umeda discloses that “[t]he lead electrode 20 [claimed “at least one electrode portion”] is a thin plate having a rear edge 21 facing the bridge portion 3b, a front edge 22 protruding from the resin molded body 3, and side edges [24] connecting these (Ex-1007, ¶ [0042]). The side edges 24 correspond to the claimed “electrode portion cross sections,” as illustrated the below annotated version of Umeda FIG. 5a. Similar cross sections are likewise present on lead electrode 10.

[FIG. 5]

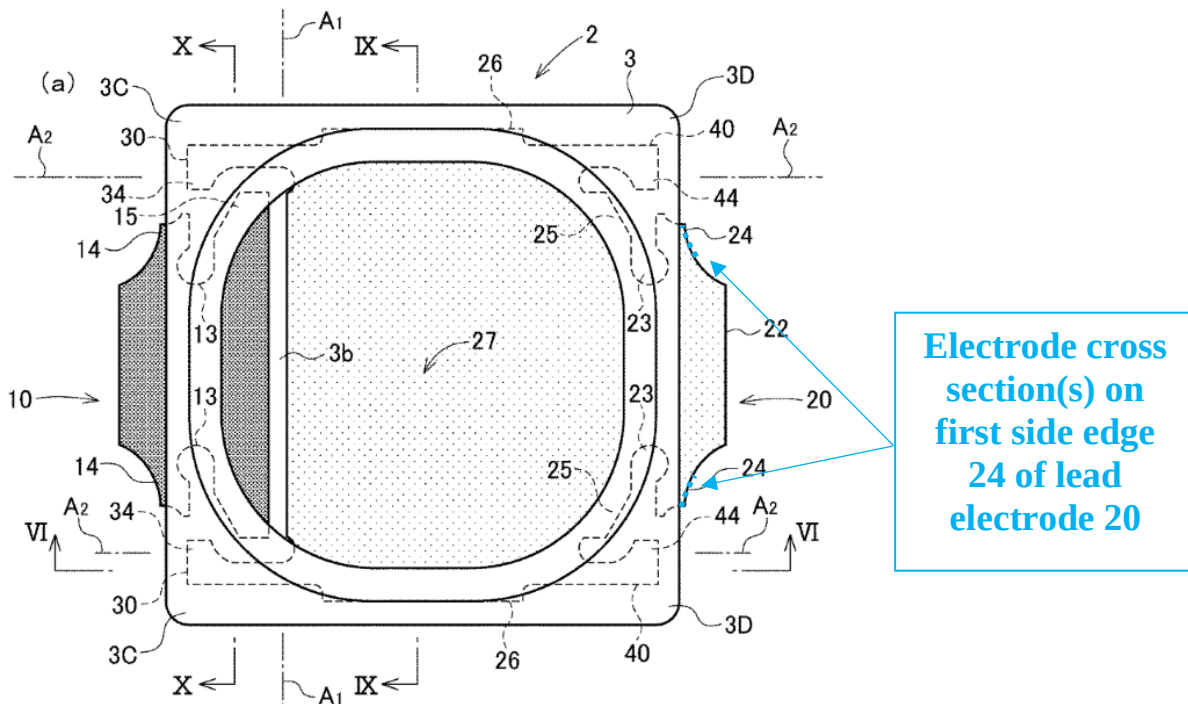


FIG. 5a of Umeda (Annotated)

283. Although I compared the claims to the prior art, it is worth noting that these electrode portion cross-sections in Umeda are also the same as and consistent

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with the electrode portion cross sections described in the '733 patent, as shown by the below annotated version of the '733 patent FIG. 6:

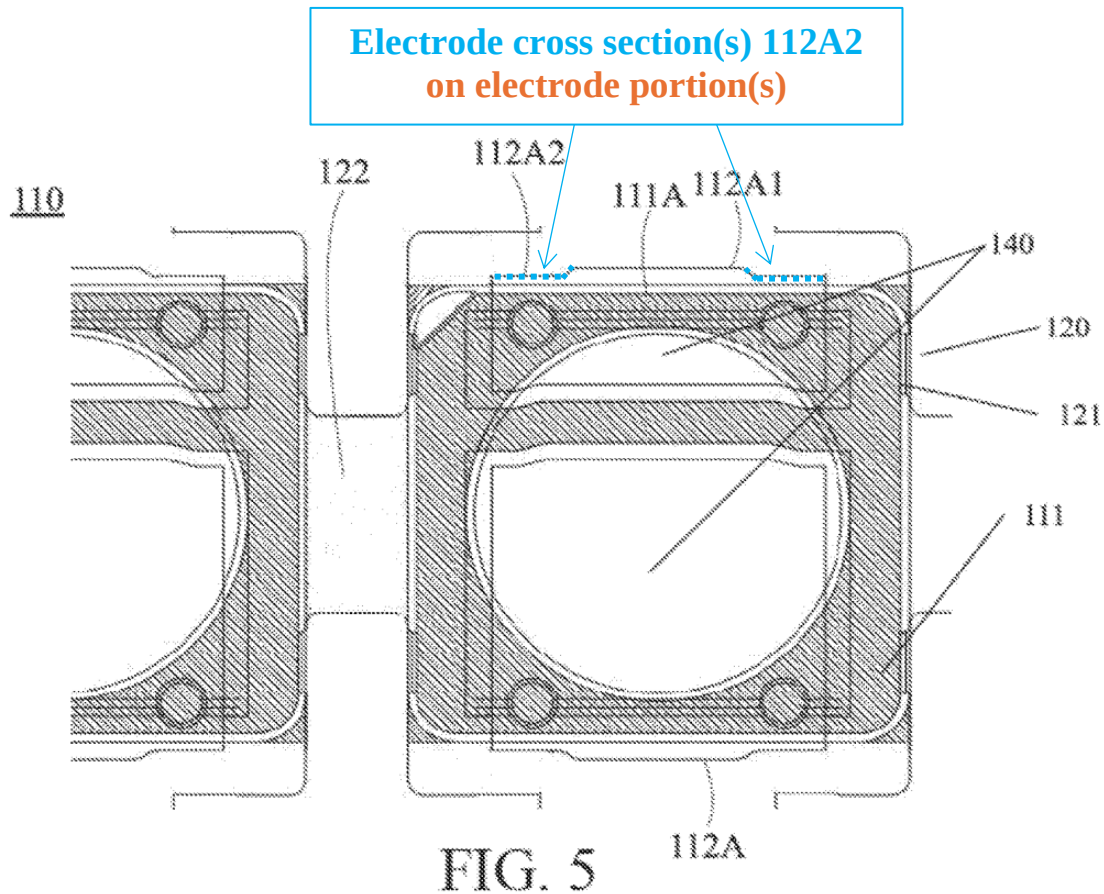


FIG. 5 of the '733 Patent (Annotated)

284. Thus, it is my opinion that Umeda discloses the “electrode portion cross section” limitation of claim 1.

9.3.1.6. Claim 1: a housing comprising a housing cross section

285. While Umeda does not use the term “cross section,” it is my opinion that Umeda discloses the carrier comprising “a housing comprising a housing cross section” limitation recited in claim 1.

286. As I explain in Section 9.3.1.2 above, the carrier/package 2 of Umeda’s package 2 (claimed “carrier”) comprises a housing in the form of resin molded body 3. Umeda explains that “package 2 [is] made up of ... a resin molded body 3 molded to be integrated with the lead electrodes 10 and 20.” (Ex-1007 at [0033]). And as shown in the below annotated version of Umeda FIG. 5a, resin molded body 3, which is a “housing,” comprises a cross section that is the claimed “housing cross section”:

[FIG. 5]

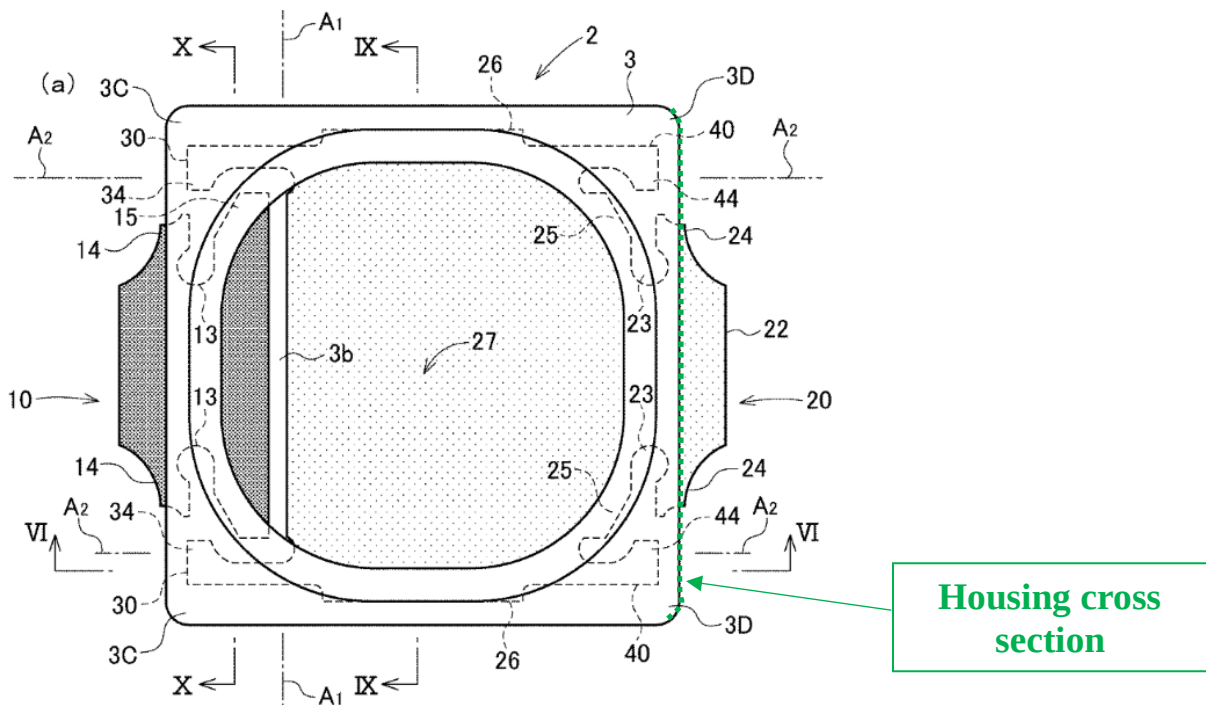


FIG. 5a of Umeda (Annotated)

287. While I compared the claims to the prior art, it is worth noting that my application of the claims to Umeda’s housing cross section is also the same as and consistent with the housing cross section described in FIG 6 of the ’733 patent:

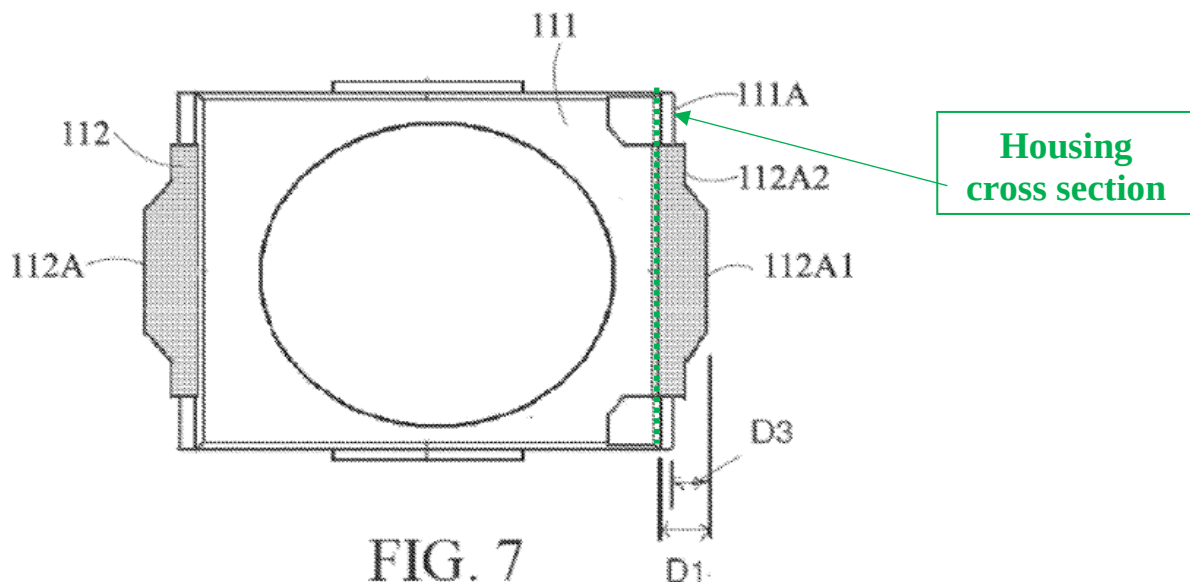


FIG. 6 of the ’733 Patent (Annotated)

9.3.1.7. Claim 1: the housing at least partially covering the at least one electrode portion

288. It is my opinion that Umeda discloses the “housing at least partially covering the at least one electrode portion” limitation of claim 1.

289. For example, Umeda discloses that “a front edge 22” of the electrode 20 “protrude[es] from the resin molded body 3” (Ex-1007 at [0039]) while “recessed portions” 13 and 23 of the electrodes are covered by resin molded body 3 (Ex-1007

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at [0040], [0042]). As shown in the below annotated version of Umeda FIG. 5a, below for lead electrode 20 including front edge 22 and “covered” recessed portion 23:

[FIG. 5]

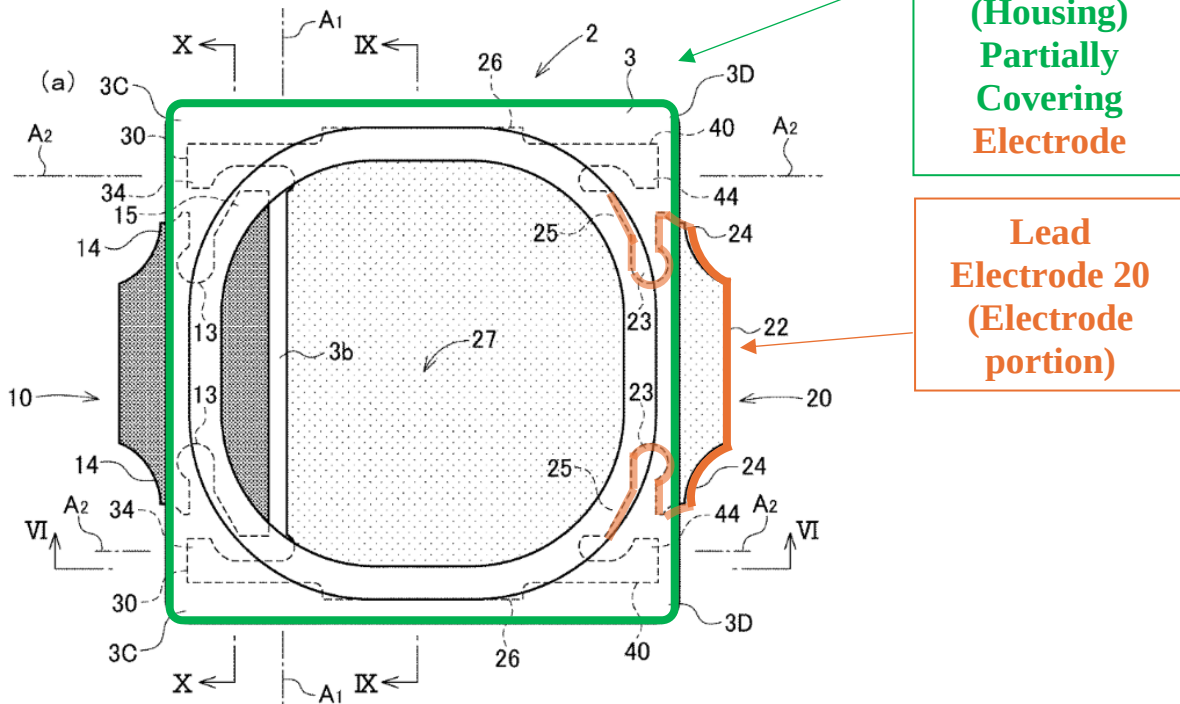


FIG. 5a of Umeda (Annotated)

290. Umeda further describes that “[i]t is preferable for the recessed portion 23 to be provided at positions that are not exposed to the bottom of the cup portion 3a of the resin molded body 3” (i.e., the claimed “housing”).

291. In view of these disclosures, it is my opinion that Umeda discloses the housing (i.e., resin molded body 3) at least partially covers the at least one electrode portion (i.e., recessed portion 23 of the lead electrode 20).

9.3.1.8. Claim 1: wherein the housing cross section and the electrode portion cross section are not level with one another

292. It is my opinion that Umeda discloses the “wherein the housing cross section and the electrode portion cross section are not level with one another” limitation of claim 1.

293. As I explain in Sections 9.3.1.5. and 9.3.1.6 above, Umeda discloses a housing cross section on the edge of resin molded body 3 and an electrode portion cross section on the outer edges of first side edges 14, 24 of lead electrodes 10, 20.

294. As shown in the below annotated version of Umeda FIG. 5a, the housing cross section on the right edge of resin molded body 3 and the electrode portion cross sections on first side edges 24 of lead electrode 20 are not level with one another. The cross-sections are on intersecting planes. And while not highlighted in the below annotations, the same is true for the housing cross section on the left edge of resin molded body 3 and the electrode portion cross sections on first side edges 14 of lead electrode 10.

[FIG. 5]

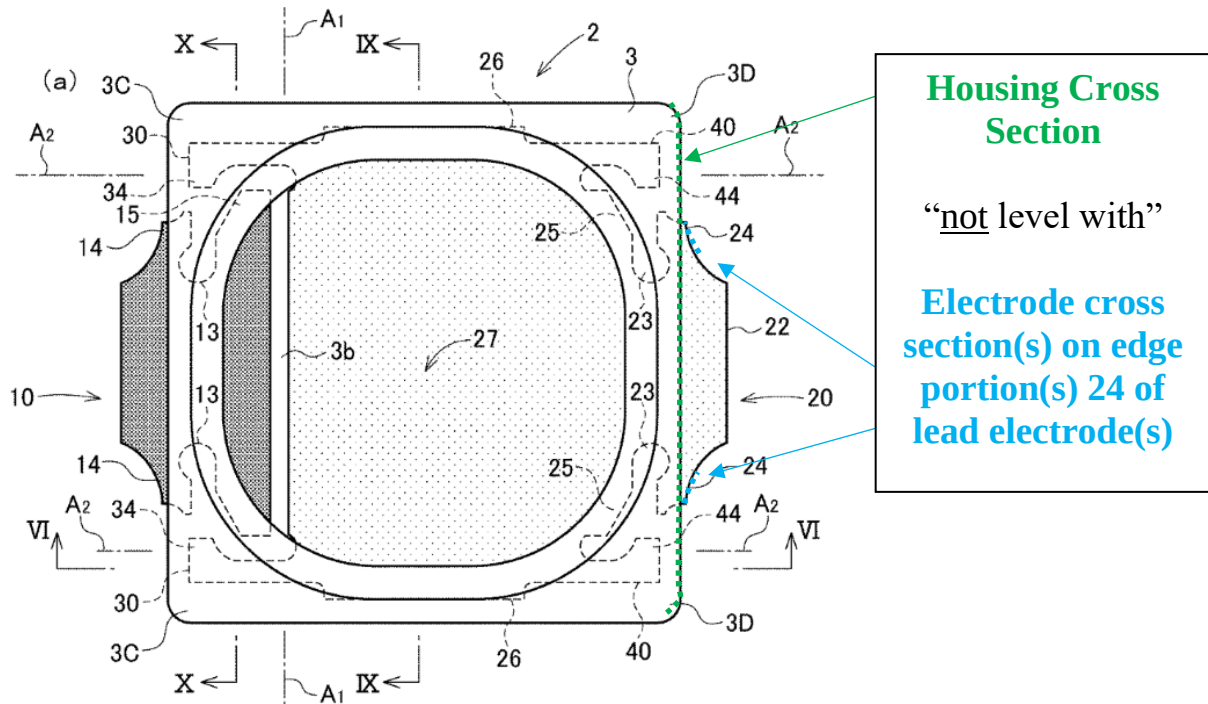


FIG. 5a of Umeda (Annotated)

295. Thus, it is my opinion that Umeda discloses a housing cross section on the edge of resin molded body 3 and an electrode portion cross section on lead electrodes 10, 20 which are not level with one another.

9.3.1.9. Claim 1: wherein each of the at least one electrode portion further comprises a central area and two edge areas

296. It is my opinion that Umeda discloses the “wherein each of the at least one electrode portion further comprises a central area and two edge areas” limitation of claim 1. For example, Umeda discloses that lead electrode 10 includes “front edge 12” i.e., the claimed “central area”) and first side edges 14 (i.e., the claimed “at least two edge areas”), and that lead electrode 20 includes “front edge 22” (i.e., the claimed

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“central area”) and first side edges 24 (i.e., the claimed “at least two edge areas”) (Ex-1007 at [0055]). This is shown for lead electrode 20 in the below annotated version of Umeda FIG. 5a of Umeda. A central area and at least two edge areas are also present for lead electrode 10.

[FIG. 5]

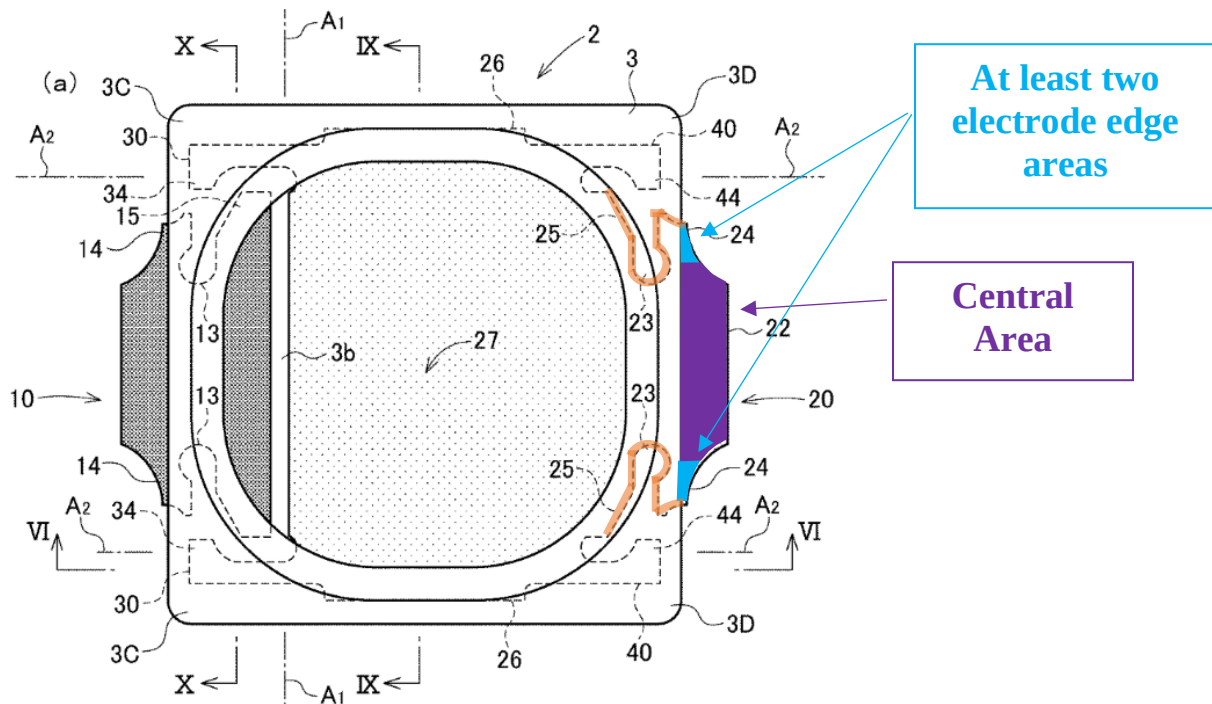


FIG. 5a of Umeda (Annotated)

297. Thus, as FIG. 5a illustrates, Umeda discloses two electrodes each having at least one electrode portion that further comprises a central area and two edge areas.

9.3.1.10. Claim 1: wherein the electrode portion cross section is located on at least one of the two edge areas

298. It is my opinion that Umeda discloses the “wherein the electrode portion cross section is located on at least one of the two edge areas” limitation of claim 1.

299. As I explain in Section 9.3.1.5 above, the electrode portion cross section is located on each of lead electrodes 10, 20. Specifically, electrode portion cross sections is on first side edges 14 and 24 for lead electrodes 10 and 20, respectively, as shown in the below annotated version of Umeda FIG. 5a. As I describe in Section 9.3.1.7 above, first side edges 24 are the claimed “at least two edge areas” of the lead electrode 20, and first side edges 14 are the claimed “at least two edge areas” of the lead electrode 10. Thus, Umeda discloses an electrode portion cross section located on the first side edges 14 and 24 of the lead electrodes 10 and 20 (i.e., the two edge areas), respectively.

[FIG. 5]

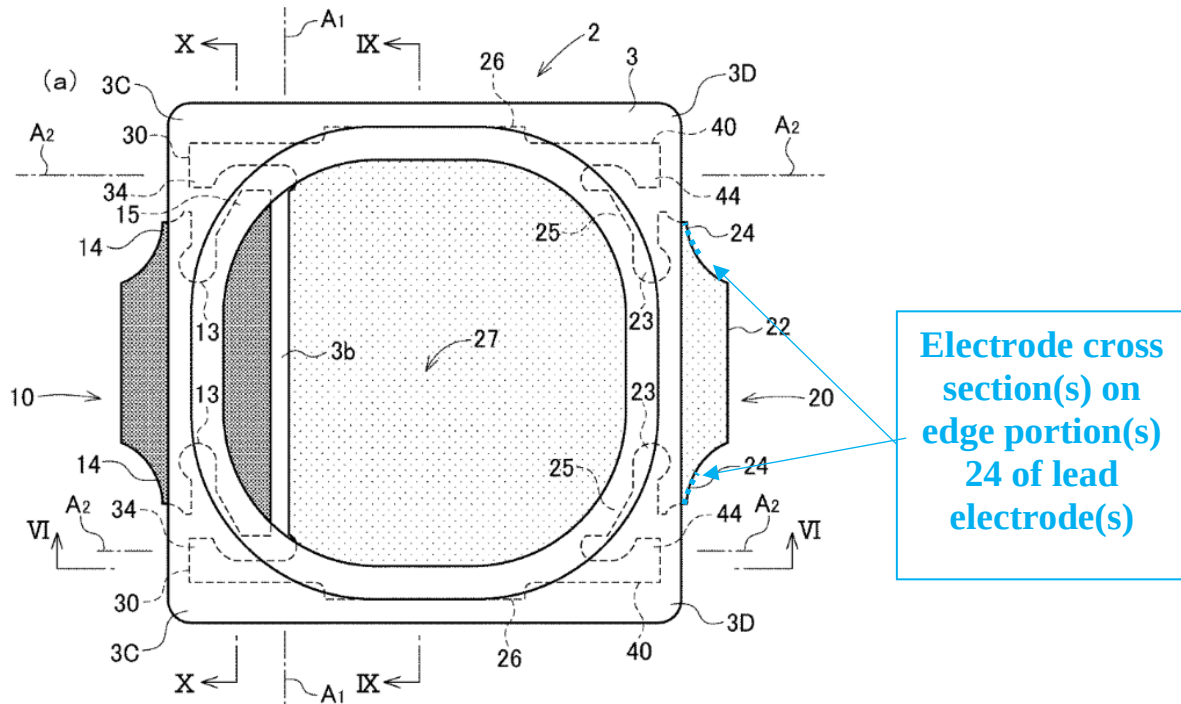


FIG. 5a of Umeda (Annotated)

300. For these reasons, it is my opinion that Umeda discloses the electrode portion cross section is located on at least one of the two edge areas.

9.3.1.11. Claim 1: wherein the central area and the two edge areas protrude from the housing cross section

301. It is my opinion that Umeda discloses the “wherein the central area and the two edge areas protrude from the housing cross section” limitation of claim 1.

302. The front edges 12 and 22 (central area) and the first side edges 14 and 24 (at least two edge areas) of lead electrodes 10 and 20, respectively, protrude from the housing cross-section of resin molded body 3. For example, the protrusion of front edges 12 and 22 (central area) and the first side edges 14 and 24 (at least two

9.3.1.12. Claim 1: wherein the central area protrudes from the two edge areas

305. It is my opinion that Umeda discloses the “wherein the central area protrudes from the two edge areas” limitation of claim 1. For example, as shown in the below annotated version of FIG. 5a, the front edges 12 and 22 (central area) respectively protrude from the first side edges 14 and 24 (two edge areas) of lead electrodes 10 and 20, respectively:

[FIG. 5]

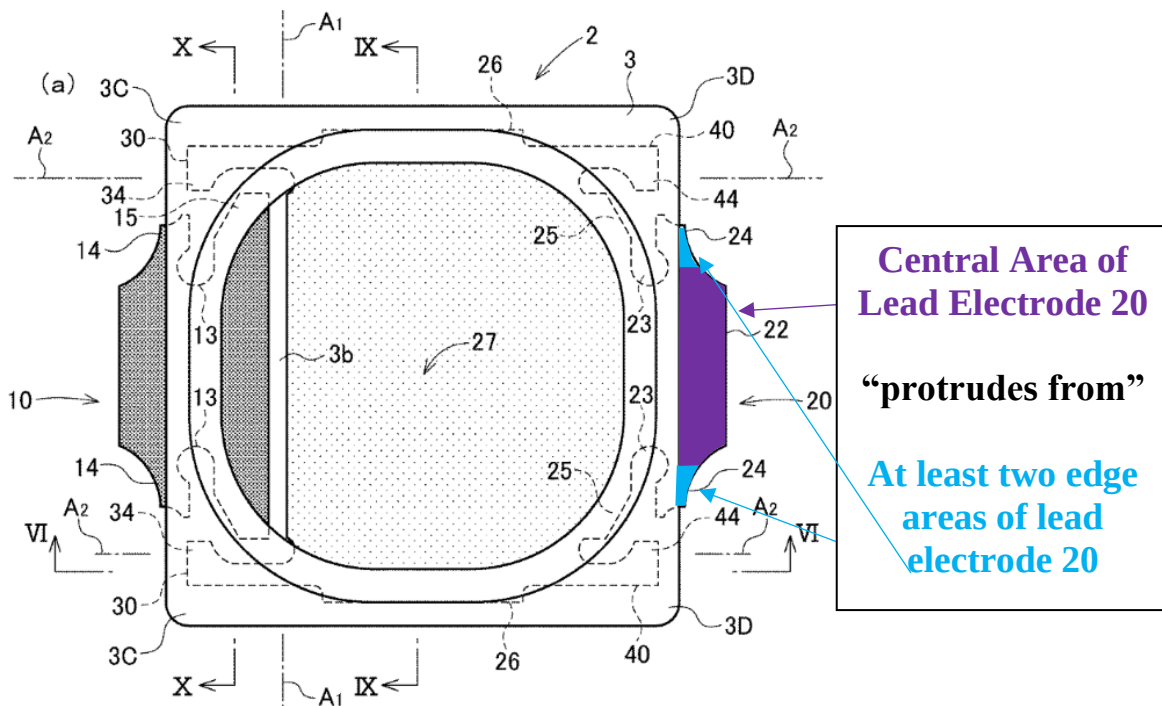


FIG. 5a of Umeda (Annotated)

306. Thus, as FIG. 5a illustrates, Umeda discloses that the central area protrudes from the two edge areas, as recited in claim 1 of the '733 patent.

9.3.2. Claim 2: The light emitting device of claim 1, wherein the electrode portion cross section comprises a sloping surface.

307. It is my opinion that Umeda discloses a light emitting device “wherein the electrode portion cross section comprises a sloping surface,” as recited in claim 2 of the ’733 patent. For example, as illustrated in FIG. 5a of Umeda, the first side edges 14 and 24 (two edge areas) of lead electrodes 10 and 20 are curved. Each point of the curved edge areas is associated with a tangential slope, and thus it is my opinion that the cross sections on first side edges 14, 24 (i.e., the claimed “electrode portion cross section”) comprise a “sloping surface” as claimed.

308. For these reasons, it is my opinion that Umeda alone or Umeda in view of Kishikawa or Banso discloses that the electrode portion cross section comprises a sloping surface, as recited in claim 2 of the ’733 patent.

9.3.3. Claim 3: The light emitting device of claim 1, wherein the electrode portion cross section and the central area are not coplanar

309. It is my opinion that Umeda discloses a light emitting device “wherein the electrode portion cross section and the central area are not coplanar,” as recited in claim 3 of the ’733 patent. For example, as shown in the below annotated version of Umeda FIG. 5a, the electrode portion cross section on first side edges 24 of lead electrode 20 are not co-planar with front edge 22 of lead electrode 20. And while

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not shown in the below annotations, FIG. 5a illustrates the same is true of first side edges 14 of lead electrode 10 and front edge 12 of lead electrode 10.

[FIG. 5]

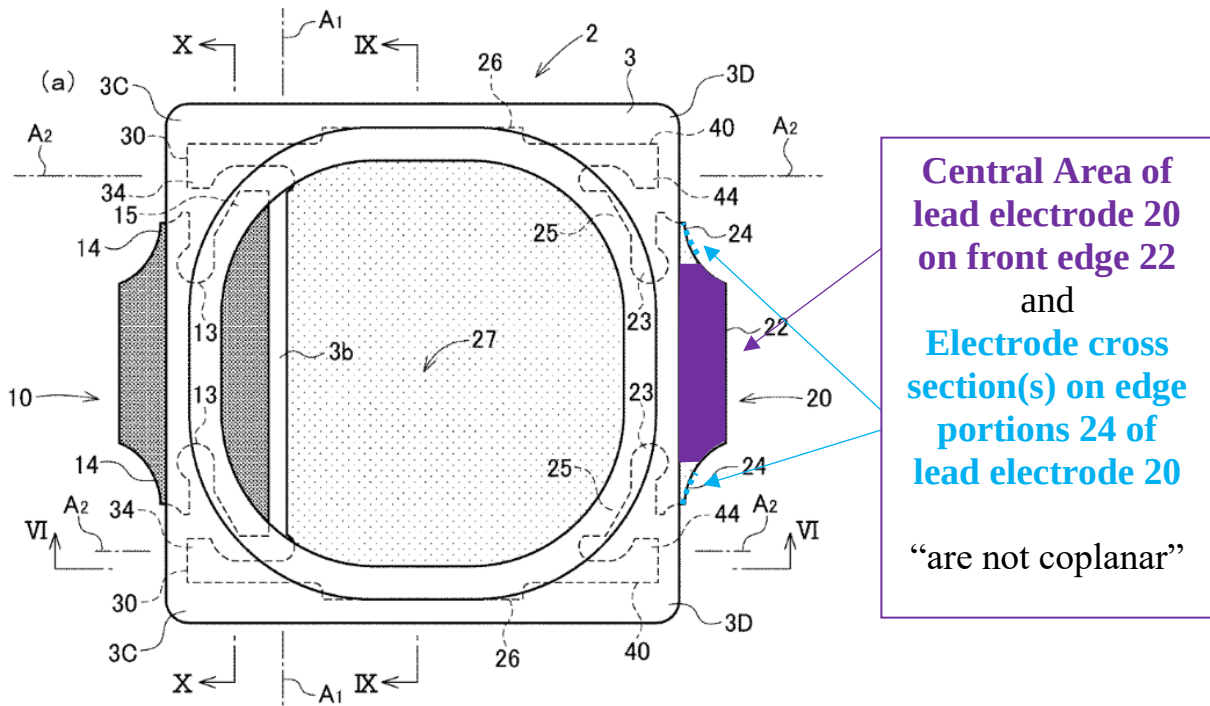


FIG. 5a of Umeda (Annotated)

310. Thus, as FIG. 5a illustrates, Umeda discloses that the electrode portion cross section and the central area are not coplanar.

9.3.4. Claim 4: The light emitting device of claim 1, wherein the housing cross section or the electrode portion cross section comprises a curved surface

311. It is my opining that Umeda discloses a light emitting device “wherein the housing cross section or the electrode portion cross section comprises a curved surface,” as recited in claim 4 of the ’733 patent.

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312. As shown below, the housing cross-section includes the curved corners and therefore “comprises a curved surface.” Also, the electrode cross sections on edge portions 24 are curved. This is illustrated in the below annotated version of FIG. 5a of Umeda:

[FIG. 5]

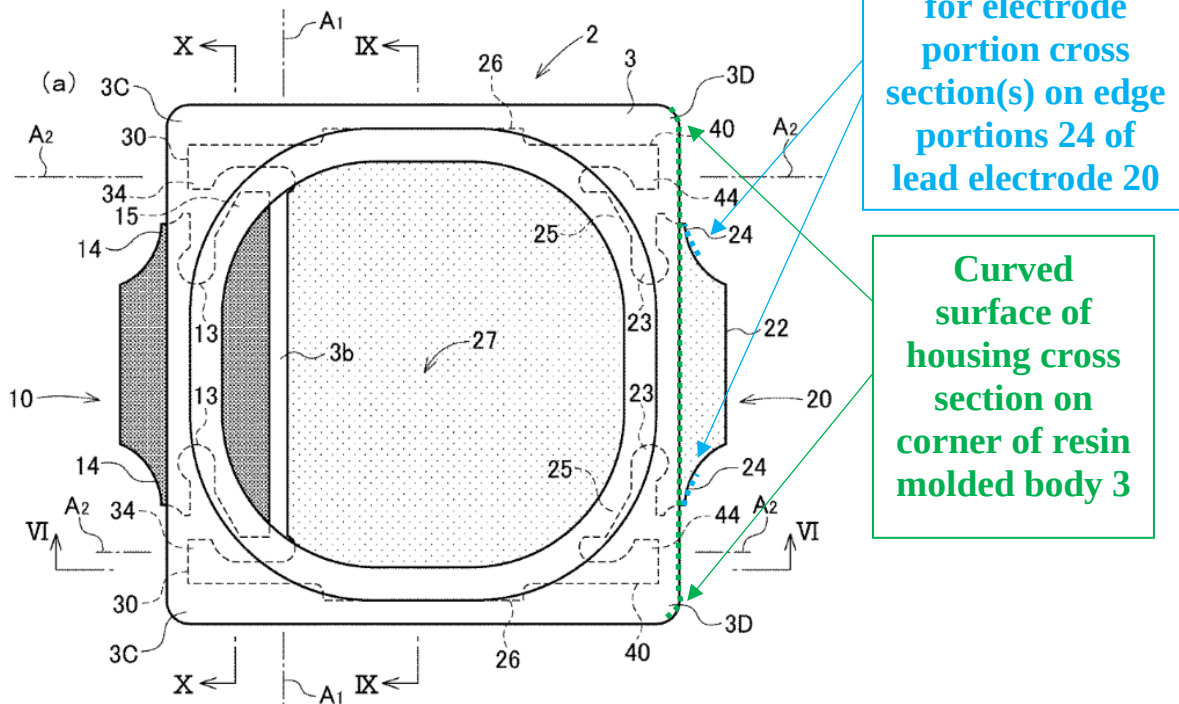


FIG. 5a of Umeda (Annotated)

9.3.5. Claim 5: The light emitting device of claim 1, wherein the housing cross section comprises a rounded corner

313. It is my opinion that Umeda discloses the “wherein the housing cross section comprises a rounded corner” limitation of claim 5. For example, as illustrated in the below annotated version of Umeda FIG. 5a, the resin molded body

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3 (the claimed “housing”), on which the housing cross section is located, is shown to have a rounded corner.

[FIG. 5]

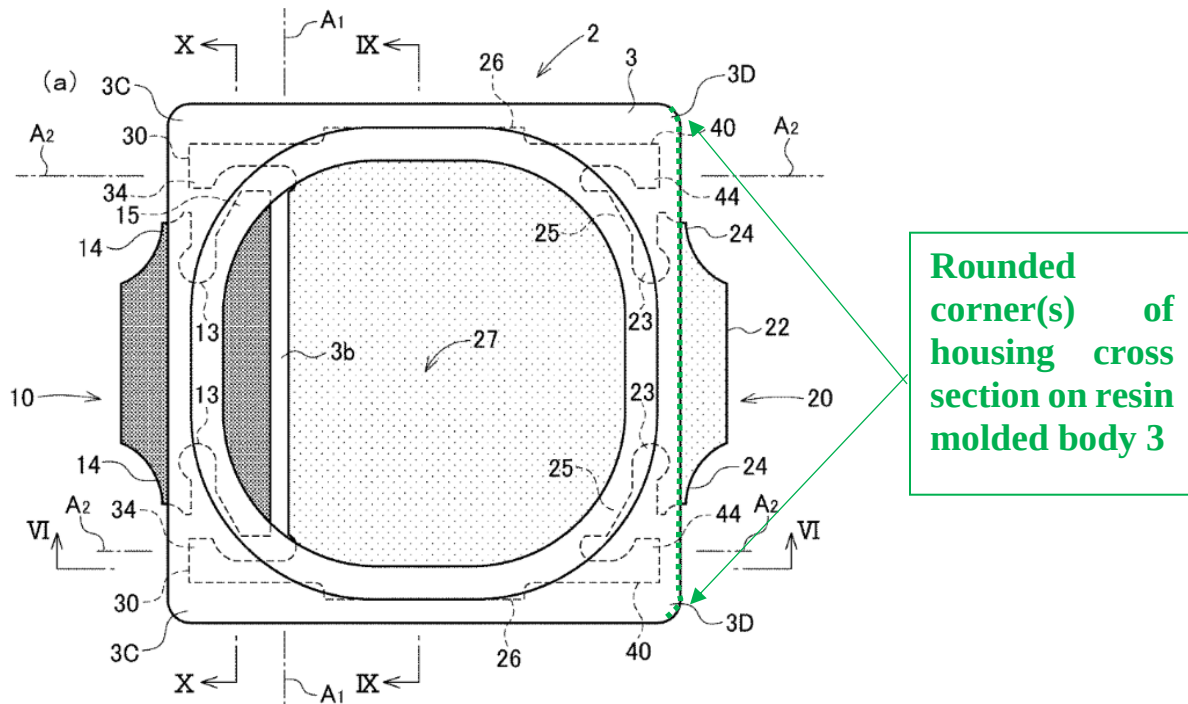


FIG. 5a of Umeda (Annotated)

314. Thus, it is my opinion that Umeda discloses that the housing cross section comprises a rounded corner.

9.3.6. Claim 7: The light emitting device of claim 1, wherein the at least one electrode portion comprises an antioxidant layer, and wherein the electrode portion cross section comprises a cross section uncovered by the antioxidant layer.

315. Although Umeda does not explicitly disclose that at least one electrode portion comprises an antioxidant layer, and wherein the electrode portion cross

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section comprises a cross section uncovered by the antioxidant layer, it is my opinion that claim 7 is obvious in view of Bando and/or the level of skill in the art.

316. Bando discloses the claimed antioxidant layer. Bando describes how electrodes can be “plated to prevent oxidation” (Ex-1009 at 2:3-8) where, for example, “silver is plated thereon” such that it “is less prone to be oxidized by air, and thus is prevented from corrosion of metal” (Ex-1009 at 19:3-5). The electrodes and structural arrangements disclosed in Bando and Umeda are substantially similar, and one skilled in the art would not have faced any technical difficulties in using a plated metal disclosed as disclosed in Bando for the electrodes of Umeda, for example to achieve Bando’s disclosed benefit of preventing corrosion (Ex-1009 at 19:3-5).

317. Bando discloses that when a plated electrode (*i.e.*, electrode with antioxidant layer) is cut in order to form the shape desired during manufacturing (e.g., Umeda’s trapezoidal), the portion that is cut on the edge of the electrode would form a cross section that is uncovered with the antioxidant plating. For example, Bando discloses that the “cut surfaces of the lead connection portions 111 are not subjected to plating that prevents corrosion of metal” (*See e.g.*, Ex-1009 at 17:66-18:3). Bando also discloses that “silver is not plated on the lead cut surfaces 111 b as cut surfaces of the lead connection portions 111” and that “the lead cut surfaces 111 b may be oxidized by air or the like” (Ex-1009, 19:9-13). If plating was applied

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to Umeda's electrodes, the electrode cross section would include a cross section that uncovers the antioxidant layer.

318. It is therefore my opinion that using a plated metal as disclosed in Bando for the electrode material in Umeda would result in an electrode with an antioxidant layer where the electrode portion cross section comprising a cross section uncovered by the antioxidant layer. Further, in 2014, a POSITA would have found it obvious to use such a plated metal in order to prevent corrosion on the electrode as taught by Bando. The advantages of using the claimed antioxidant layer were known. The application and results were predictable. The '733 patent inventors did not invent any claimed antioxidant layers. Thus, it would have been obvious to use the claimed antioxidant layer in combination with Umeda.

9.4 Claims 1-5 and 7 are Anticipated by Kuramoto

319. It is my opinion that claims 1-5 and 7 of the '733 patent are anticipated by Kuramoto.

9.4.1. Independent Claim 1

320. For the following reasons, it is my opinion Kuramoto anticipates claim 1 of the '733 patent.

9.4.1.1. Claim 1: “A light emitting device, comprising”

321. It is my opinion that Kuramoto discloses a “light emitting device.” For example, Kuramoto’s light emitting device 100 is a “light emitting device” (Ex-1008 at [0043]).

9.4.1.2. Claim 1: “A carrier ... comprises at least one electrode portion ... and a housing”

322. It is my opinion that Kuramoto discloses the claimed “carrier” that comprises “at least one electrode portion” and a “housing.”

323. Kuramoto’s base body 30 is a carrier that “is a mount base on which the light emitting element is mounted” (Ex-1008 at [0128]). The base body includes “a conductive member 20” (at least one electrode portion) “that is connected to the light emitting element 10” (Ex-1008 at [0043]). Kuramoto’s base body 30, or carrier, includes “a molding 25 that is integrally formed with the conductive member 20,” which is the claimed electrode (*Id.*).

324. Although Kuramoto does not use the term “carrier” its base body 30 including conductive member 20 and molding 25 are the same structurally as the housing and electrode portions of the carrier claimed in the ’733 patent. This is shown in the below annotated Kuramoto FIG. 1A.

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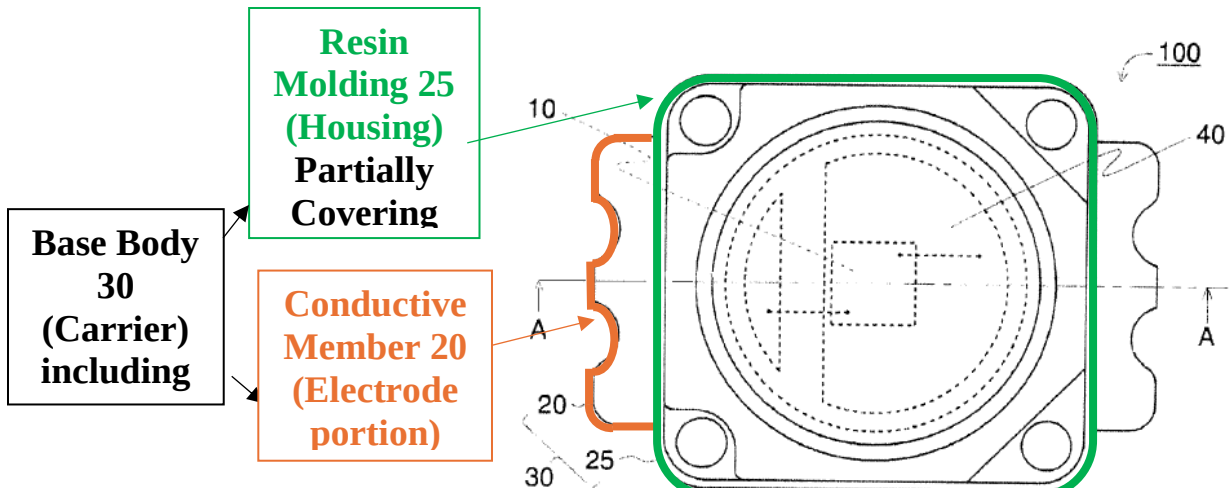


Fig. 1A

Kuramoto FIG. 1A (Annotated)

9.4.1.3. Claim 1: “A light emitting diode (LED) chip carried within the carrier ...”

325. It is my opinion that Kuramoto discloses the claimed “light emitting diode (LED) chip carried within the carrier.” For example, Kuramoto discloses a “light emitting element 10 is an LED chip that is pasted on the bottom surface of the recess 31 of the base body by an adhesive (not shown) and is connected to the conductive member 20 by wires” (Ex-1008 at [0044]; [0127]). As shown in Fig. 1A, the LED chip in the form of light emitting element 10 is carried within the base body 25 (carrier).

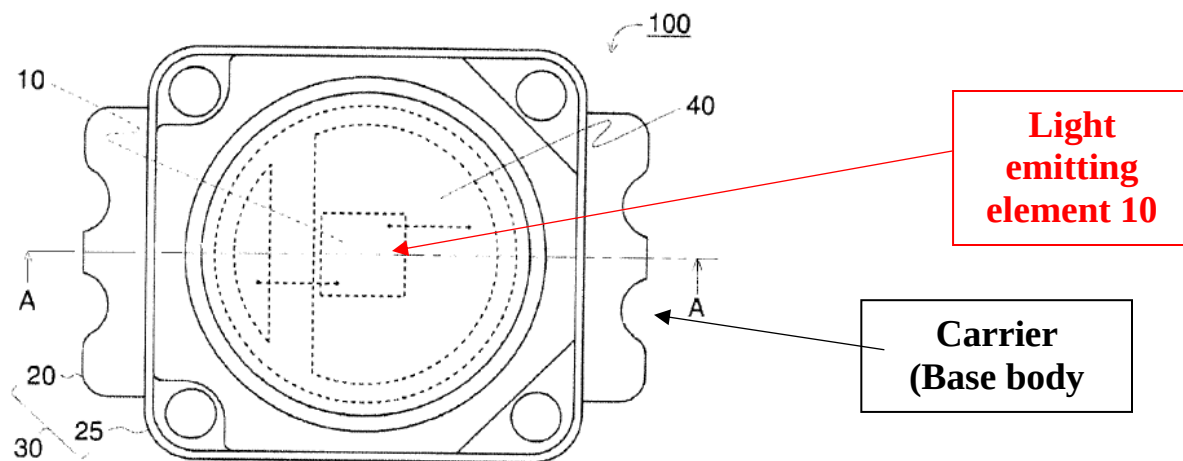


Fig. 1A

Kuramoto FIG. 1A (Annotated)

9.4.1.4. Claim 1: An encapsulant covering the LED chip

326. It is my opinion that Kuramoto discloses the claimed “encapsulant covering the LED chip” via its “sealing member 40.” Kuramoto describes that the sealing member 40 is an encapsulant that “seals the light emitting element, the wires and a part of the conductive member so as to protect them from dust, moisture external force and the like” (Ex-1008 at [0133]). Kuramoto further discloses that the sealing resin “is provided to cover the light emitting element 10” (Ex-1008 at [0044]).

9.4.1.5. Claim 1: A carrier comprising “at least one electrode portion”

327. It is my opinion that Kuramoto discloses the claimed carrier comprising “at least one electrode portion.”

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328. As described in Section 9.4.1.2 above, Kuramoto's base body 30 (or carrier) comprises at least one electrode portion in the form of conductive member 20 (Ex-1008 at [0043]). Kuramoto further discloses that conductive member 20 "may be made of a metal that can be connected to the light emitting element to conduct electricity. Specifically, it may be a lead frame or a lead electrode made of copper, aluminum, gold, silver, tungsten, iron, nickel, cobalt, molybdenum, an alloy thereof, phosphor bronze, iron-containing copper or the like" (Ex-1008 at [0129]).

329. Thus, it is my opinion that Kuramoto's "conductive member 20" is the claimed "at least one electrode portion."

9.4.1.6. Claim 1: Each of the at least one electrode portion comprising at least an electrode portion cross section

330. It is my opinion that Kuramoto discloses that at least one electrode portion comprises "at least an electrode portion cross section," as claimed. For example, the below annotated Kuramoto FIG. 1A illustrates example electrode portion cross sections on the edge portions of each of conductive member 20 (*i.e.*, the claimed "electrode portion").

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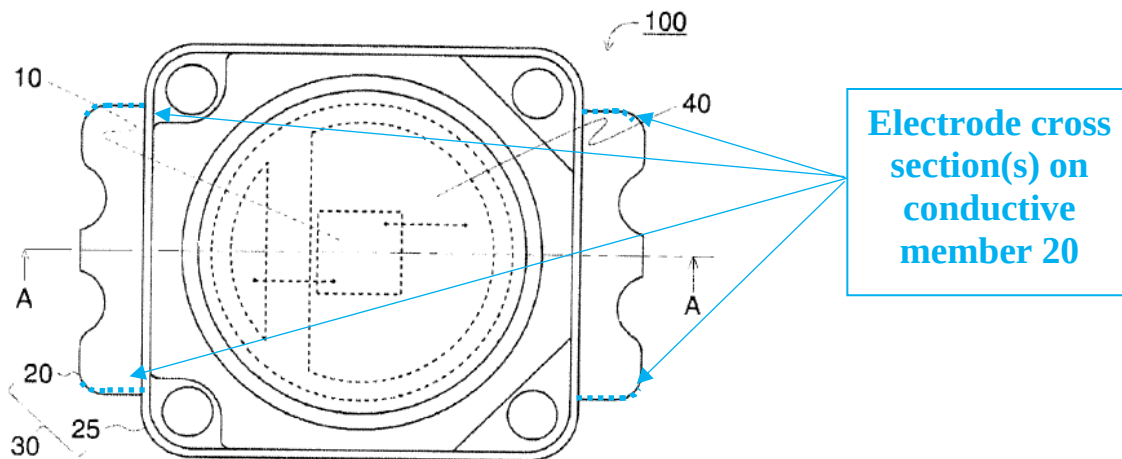


Fig. 1A

Kuramoto FIG. 1A (Annotated)

9.4.1.7. Claim 1: A housing comprising a housing cross section

331. It is my opinion that Kuramoto discloses the claimed “housing comprising a housing cross section.”

332. As explained in Section 9.4.1.2 above, Kuramoto’s base body carrier 30 comprises a housing in the form of resin molding 25. “[T]he base body is package including ... the resin molding 25” which may be made of a thermoplastic, thermosetting, epoxy, silicone, polyamide, or polyurethane resins (Ex-1008 at [0044]; [0130]).

333. As shown in Kuramoto FIG. 1A, the edges of resin molding housing 25 form a housing cross section. The housing cross section extends into the rounded corners of Kuramoto’s housing.

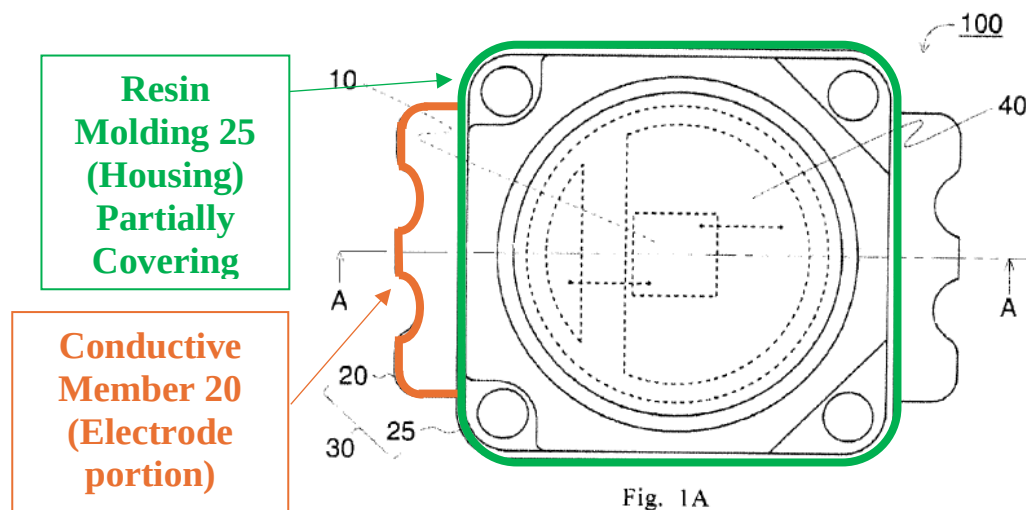


Fig. 1A

Kuramoto FIG. 1A (Annotated)

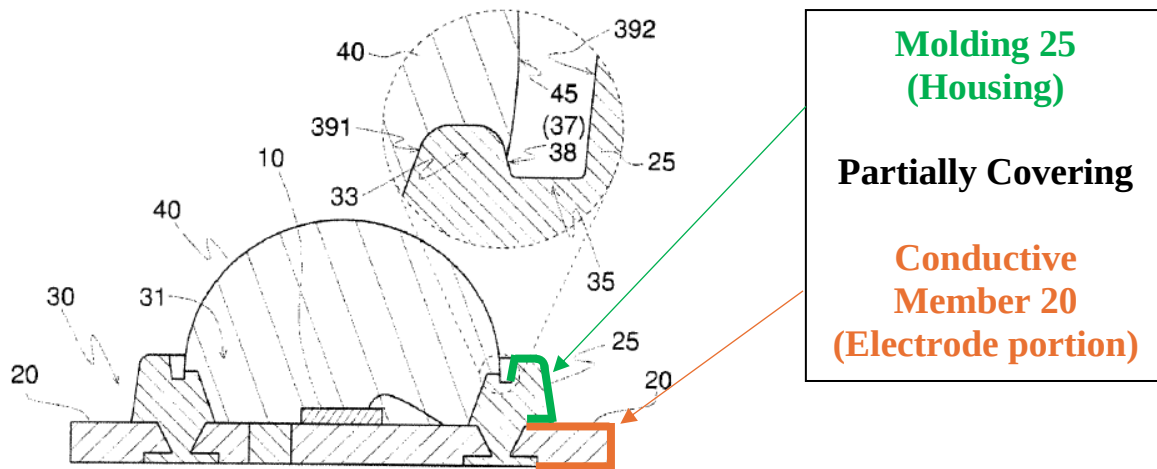


Fig. 1B

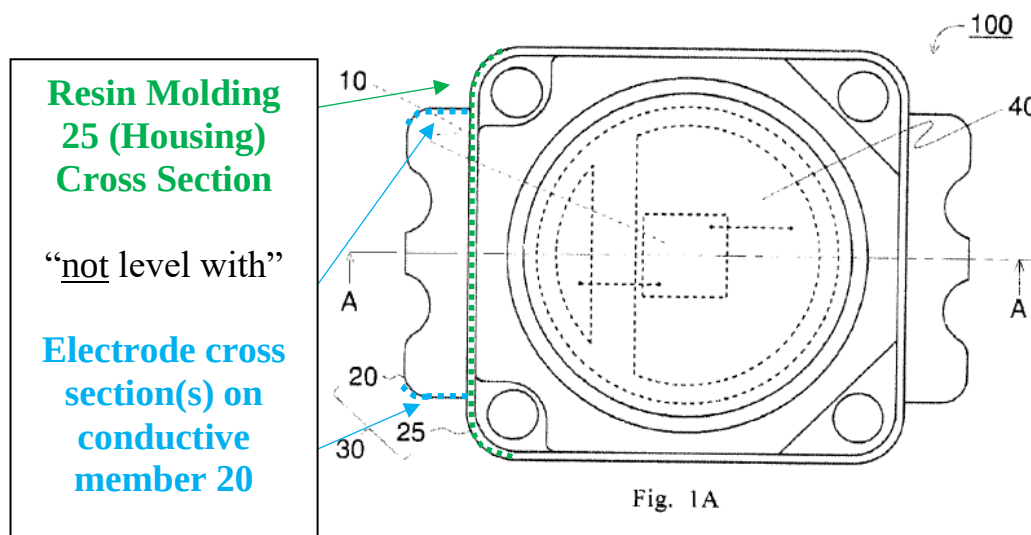
Kuramoto FIG. 1B (Annotated)

9.4.1.9. Claim 1: wherein the housing cross section and the electrode portion cross section are not level with one another

336. It is my opinion that Kuramoto discloses the claimed “wherein the housing cross section and the electrode portion cross section are not level with one another.”

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337. As I explain in Section 9.4.1.7 above, Kuramoto discloses a housing cross section on the edge of molding 25 and an electrode portion cross section on outer edges of conductive member 20. As shown in Kuramoto FIG. 1A, the housing cross section on the edge of molding 25 and an electrode portion cross section on outer edges of conductive member 20 are not level with one another.



Kuramoto FIG. 1A (Annotated)

338. Thus, as FIG. 1A illustrates, Kuramoto discloses a housing cross section on the edge of resin molding 25 and an electrode portion cross section on outer edges of conductive member 20 that are not level.

9.4.1.10. Claim 1: wherein each of the at least one electrode portion further comprises a central area and two edge areas

339. It is my opinion that “the at least one electrode portion further comprises a central area and two edge areas,” as claimed.

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340. For example, as shown in FIG. 1A, conductive member (*i.e.*, electrode portion) comprises a central area and two edge areas.

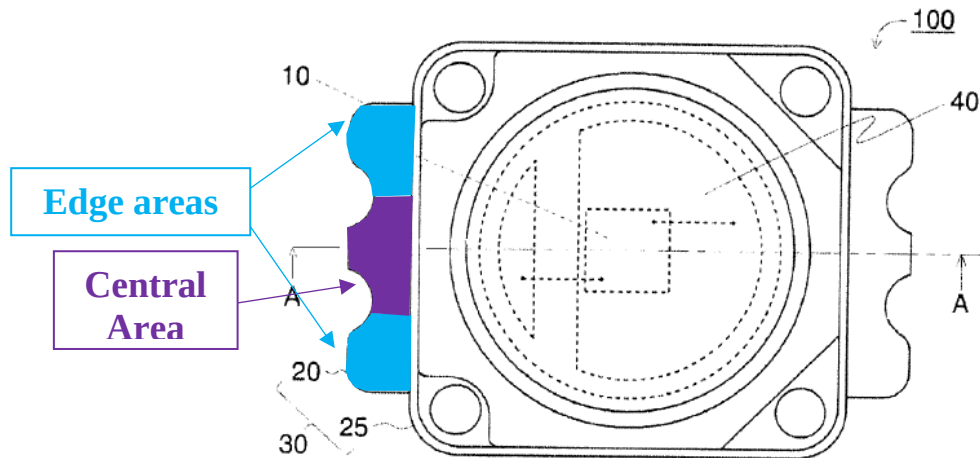
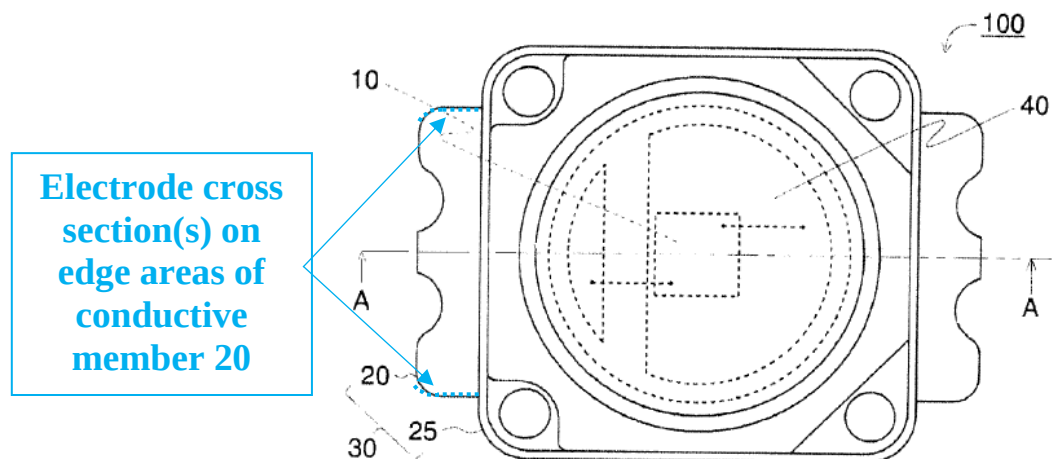


Fig. 1A

9.4.1.11. Claim 1: wherein the electrode portion cross section is located on at least one of the two edge areas

341. It is my opinion that Kuramoto discloses the “wherein the electrode portion cross section is located on at least one of the two edge areas” limitation of claim 1. For example, as shown in the below annotated Kuramoto FIG. 1A, the electrode portion cross sections are located on the two edge areas of conductive member 20.

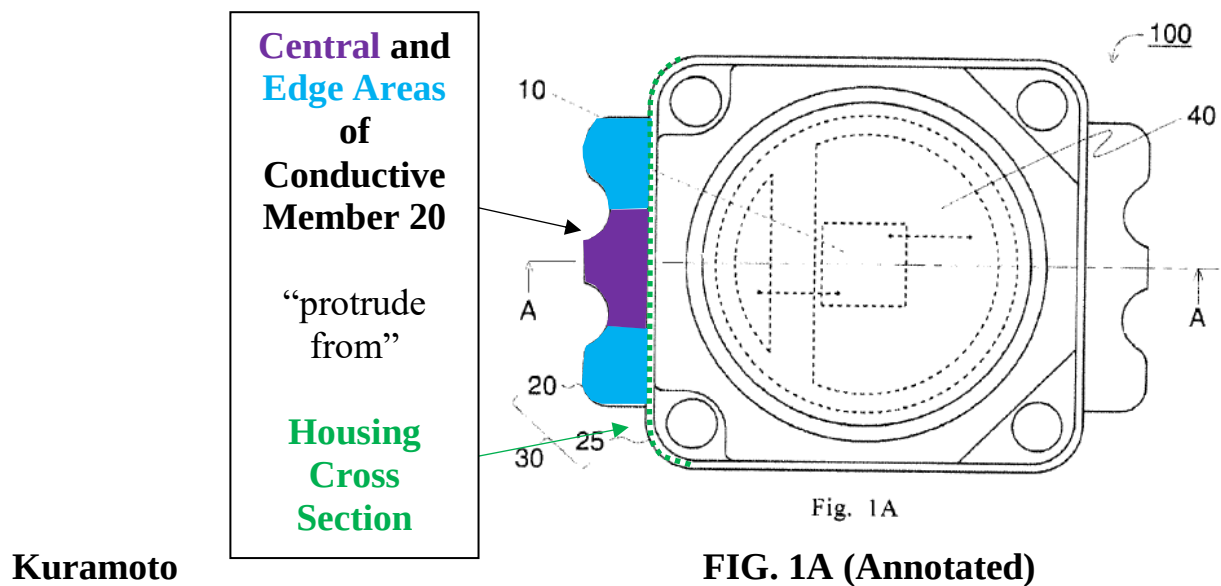


Kuramoto FIG. 1A (Annotated)

9.4.1.12. Claim 1: wherein the central area and the two edge areas protrude from the housing cross section

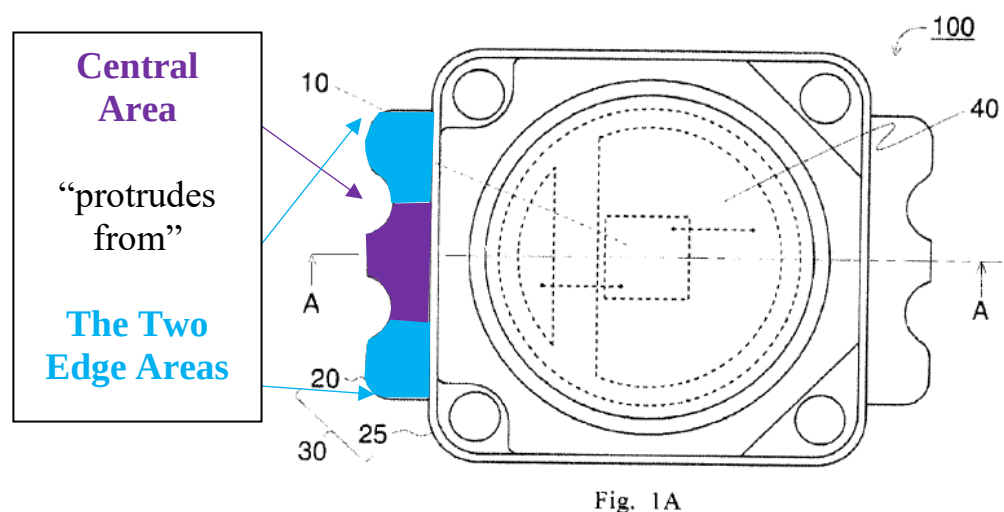
342. It is my opinion that Kuramoto discloses the “wherein the central area and the two edge areas protrude from the housing cross section” limitation of claim 1.

343. For example, the below annotated Kuramoto FIG. 1A illustrates the that the “central area” (purple) and the “two edge areas” (blue) protrude from the “housing cross section” (green):



9.4.1.13. Claim 1: wherein the central area protrudes from the two edge areas

344. It is my opinion that Kuramoto discloses the “wherein the central area protrudes from the two edge areas” limitation of claim 1. For example, as shown in the below annotated Kuramoto Figure 1A, the “central area” protrudes from the “two edge areas”:



Kuramoto FIG. 1A (Annotated)

9.4.2. Claim 2: The light emitting device of claim 1, wherein the electrode portion cross section comprises a sloping surface

345. It is my opinion that Kuramoto discloses a light emitting device “wherein the electrode portion cross section comprises a sloping surface,” as recited in claim 2 of the ’733 patent. For example, as shown below in the annotated Kuramoto FIG. 1A, the edge area cross section is sloped.

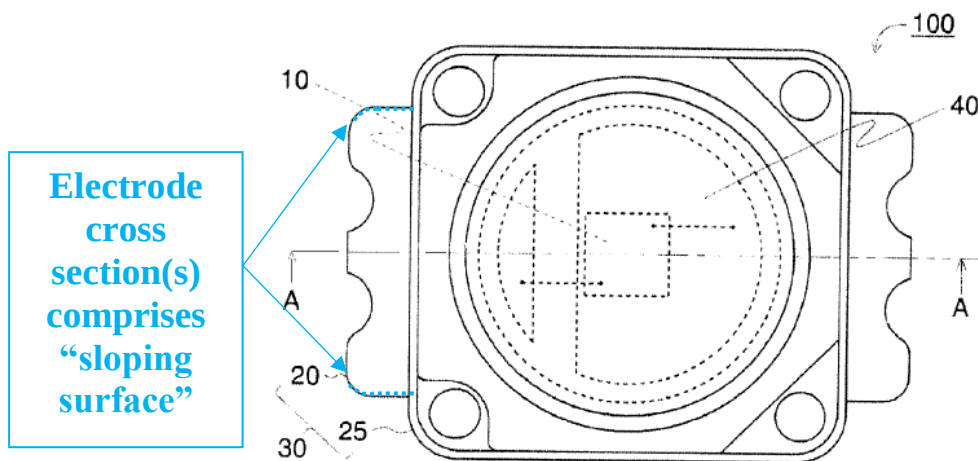


Fig. 1A

9.4.3. Claim 3: The light emitting device of claim 1, wherein the electrode portion cross section and the central area are not coplanar

346. It is my opinion that Kuramoto discloses a light emitting device “wherein the electrode portion cross section and the central area are not coplanar,” as recited in claim 3 of the ’733 patent. As shown in the annotated version of Kuramoto FIG. 1A, the central portion of conductive member 20 is somewhat

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irregularly shaped and not co-planar with the electrode cross sections on the edge portions of conductive member 20.

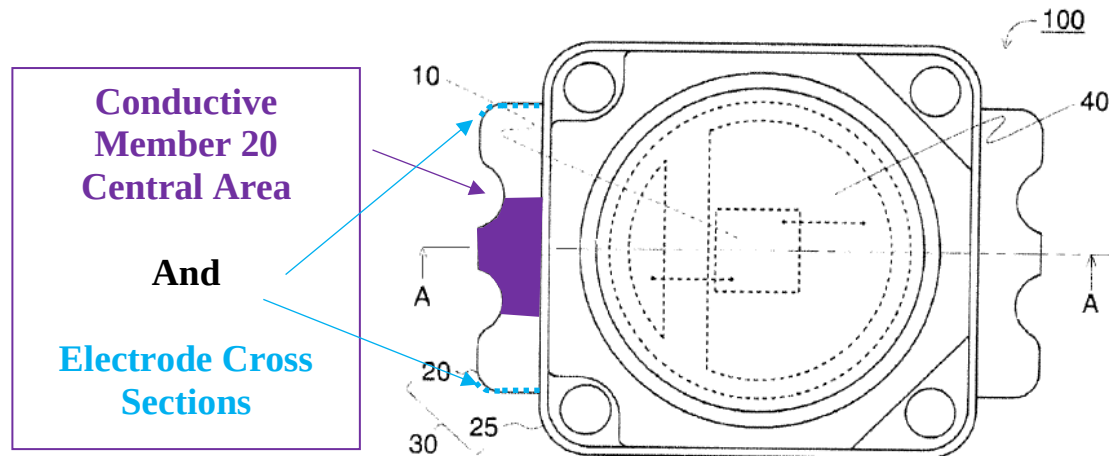


Fig. 1A

Kuramoto FIG. 1A (Annotated)

9.4.4. Claim 4: The light emitting device of claim 1, wherein the housing cross section or the electrode portion cross section comprises a curved surface

347. It is my opinion that Kuramoto discloses the “wherein the housing cross section or the electrode portion cross section comprises a curved surface” limitation of claim 4. For example, both the resin molding housing 52, on which the housing cross section is located, and conductive member 20 electrodes, on which the electrode cross section is located comprises a curved surface. The housing cross section extends into the curved corners. This is illustrated in the below annotated Kuramoto FIG. 1A:

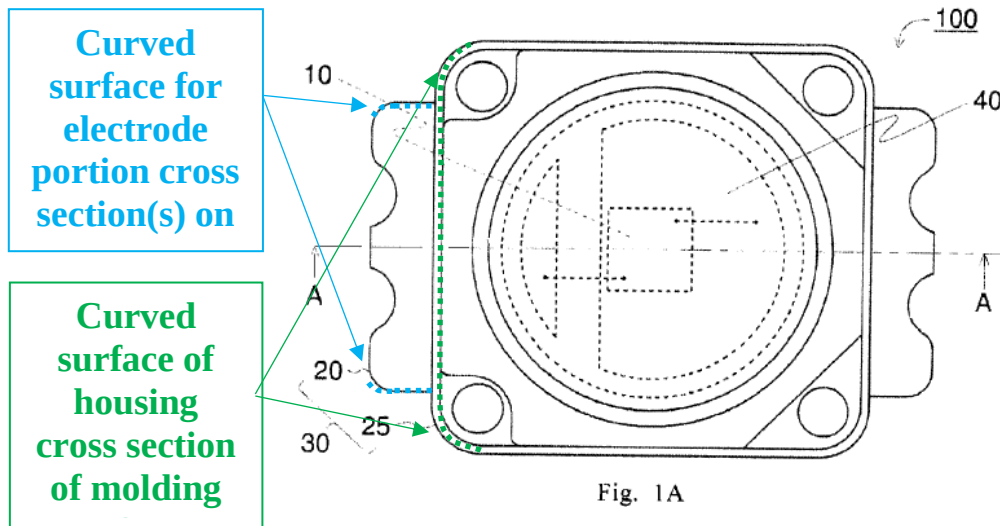


Fig. 1A

Kuramoto FIG. 1A (Annotated)

9.4.5. Claim 5: The light emitting device of claim 1, wherein the housing cross section comprises a rounded corner

348. It is my opinion that Kuramoto discloses the “wherein the housing cross section comprises a rounded corner” limitation of claim 5. For example, resin molding housing 25, on which the housing cross section is located, is shown to have a rounded corner in the below annotated Kuramoto FIG. 1A.

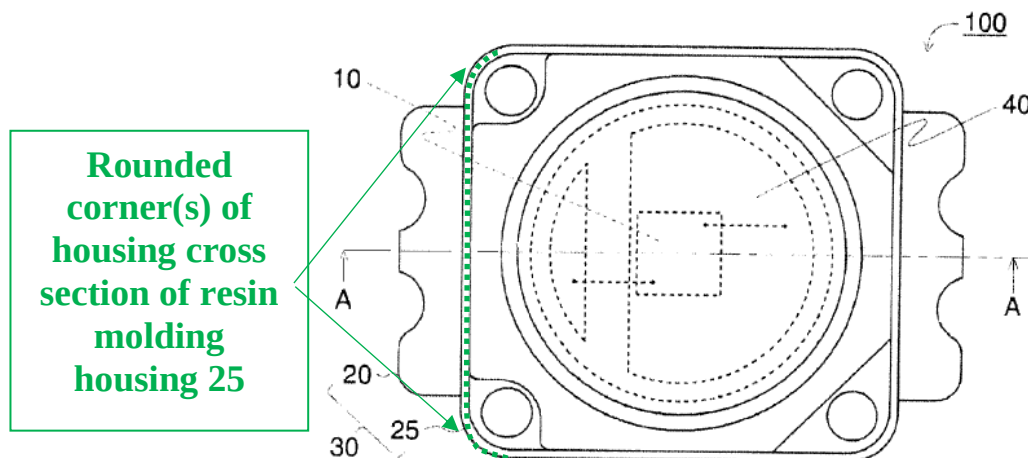


Fig. 1A

9.4.6. Claim 7: The light emitting device of claim 1, wherein the at least one electrode portion comprises an

antioxidant layer, and wherein the electrode portion cross section comprises a cross section uncovered by the antioxidant layer.

349. It is my opinion that Kuramoto discloses the “wherein the at least one electrode portion comprises an antioxidant layer, and wherein the electrode portion cross section comprises a cross section uncovered by the antioxidant layer” limitation of claim 7.

350. Kuramoto discloses that the surface of conductive member 20 (i.e., the claimed “at least one electrode portion”) may be protected or “coated with a plating of silver, aluminum, rhodium, gold, copper or an alloy thereof” (Ex-1008, Kuramoto, ¶ [0129]).

351. The platings of “silver, aluminum, rhodium, gold, copper or an alloy thereof” described in Kuramoto would protect the underlying metal (e.g., copper) from interacting with oxygen in the air, and thus are an “antioxidant layer.” This is evidenced by Bando, which describes how electrodes can be “plated to prevent oxidation” (Ex-1009 at 2:3-8) where, for example, “silver is plated thereon” such that it “is less prone to be oxidized by air, and thus is prevented from corrosion of metal” (Ex-1009 at 19:3-5) In my opinion, the coated plating of silver in of silver Kuramoto would be understood by a POSITA to be an anti-oxidant layer.

352. Kuramoto also describes its process for manufacturing its light emitting device 100 with respect to FIG. 2A-2E (Ex-1008 at [0030]). For example, the below

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Kuramoto FIG. 2E illustrates the final step of cutting the plate in order to form individual light emitting diodes 100 (Ex-1008 at [0052]).

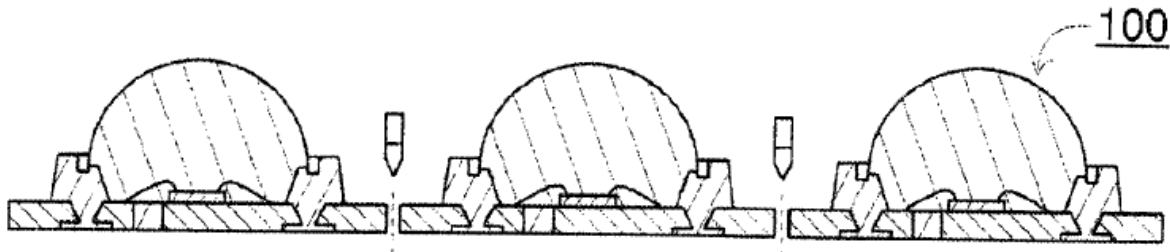


Fig. 2E

FIG. 2E of Kuramoto

353. The cutting illustrated in FIG. 2E would result in the shaping of the exposed portions of the conductive member 20 electrodes – including the electrode portion cross section – on the edge area of conductive member 20. And the cut area forming on the cross section would be uncovered by the silver plating antioxidant layer.

354. Thus, it is my opinion that the antioxidant layer of silver plating applied to conductive member 20 would be uncovered when the cutting (or cross sectioning) of light emitting device 100 is performed in accordance with FIG. 2E.

9.5. Claim 7 is Rendered Obvious by the Combination of Bando with any of Nakashima, Kishikawa, Umeda, or Kuramoto

355. Claim 7 recites “[t]he light emitting device of claim 1, wherein the at least one electrode portion comprises an antioxidant layer, and wherein the electrode portion cross section comprises a cross section uncovered by the antioxidant layer.”

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356. In my opinion, it would have been obvious to utilize the “protection film” disclosed in Bando to “protect the lead arrangement” and “prevent oxidation” (Ex-1009 at 6:19-21) of any of the electrodes disclosed by Nakashima, Kishikawa, or Kuramoto.

357. To the extent that Nakashima, Kishikawa, or Kuramoto don’t explicitly disclose that the “at least one electrode portion comprises an antioxidant layer, and wherein the electrode portion cross section comprises a cross section uncovered by the antioxidant layer,” Bando discloses this limitation. For example, as described in Sections 6.5.1 and 9.4.6 above, Bando describes how electrodes can be “plated to prevent oxidation,” e.g., by silver (Ex-1009 at 2:3-8). Bando further describes that silver “is less prone to be oxidized by air, and thus is prevented from corrosion of metal” electrodes (Ex-1009 at 19:3-5).

358. The electrodes and structural arrangements disclosed in Bando, Nakashima, Kishikawa, and Kuramoto are all substantially similar, and one skilled in the art would not have faced any technical difficulties in using a plated metal disclosed as disclosed in Bando for the electrodes of Nakashima, Kishikawa, and Kuramoto, for example, to achieve Bando’s disclosed benefit of preventing corrosion (Ex-1009 at 19:3-5).

359. Bando discloses that when a plated electrode (*i.e.*, electrode with antioxidant layer) is cut in order to form the desired shape during manufacturing, the

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portion that is cut on the edge of the electrode would form a cross section that is uncovered with the antioxidant plating. For example, Bando discloses that “cut surfaces of the lead connection portions 111 are not subjected to plating that prevents corrosion of metal” (Ex-1009, Bando, 17:66-18:3) and that “silver is not plated on the lead cut surfaces 111 b as cut surfaces of the lead connection portions 111. Accordingly, the lead cut surfaces 111 b may be oxidized by air or the like” (Ex-1009, Bando, 19:9-13).

360. Thus, using a plated metal, as disclosed in Bando, for the electrode material in Nakashima, Kishikawa, or Kuramoto would result in an electrode with an antioxidant layer where the electrode portion cross section that comprises a cross section uncovered by the antioxidant layer. One skilled in the art would have found it obvious to use such a plated metal in order to prevent corrosion on the electrode, as taught by Bando and/or as known in the level of skill in the art. A POSITA knew that certain electrode metals can be oxidized and that oxidizing can lead to failure. A POSITA also knew that antioxidants prevent oxidizing and knew how to apply antioxidants to an electrode. Further, antioxidants were widely available and competitively priced in the LED market and a person having ordinary skill in the art would have found no difficulty in obtaining them. The process and results were known and predictable, and could have been achieved without undue experimentation.

9.6. Claims 1-5 are Obvious over Kishikawa, Nakashima, or Kuramoto

361. As I explain in Sections 9.1, 9.2, and 9.4 above, it is my opinion that claims 1-5 are anticipated by Kishikawa, Nakashima, and Kuramoto. But should any of the limitations recited in claims 1-5 be considered novel over Kishikawa, Nakashima, or Kuramoto, it is my opinion that such limitations would have been obvious over any of Kishikawa, Nakashima, or Kuramoto.

362. As I have shown above, the prior art structures of Kishikawa, Nakashima, and Kuramoto are substantially similar, if not identical, to the structures claimed in the '733 patent. Any alleged differences between the claims 1-5 of the '733 patent and any of Kishikawa, Nakashima, or Kuramoto would be inconsequential and would not provide any technical benefit in view of a POSITA's common knowledge.

363. It is therefore my opinion that claims 1-5 are obvious over any of Kishikawa, Nakashima, or Kuramoto.

10. Secondary Considerations of Non-Obviousness

364. I am not aware of any secondary considerations of nonobviousness.

Ex-1003 – Declaration of Dr. Michael S. Lebby Regarding U.S. Patent No. 9,640,733

11. Use of Demonstratives

365. I reserve the right to make demonstratives (including product demonstrations, product usage, and videos thereof), charts, graphs, or other similar visual aids for trial based upon the opinions expressed in this report, the data contained in this report, the exhibits or other things cited in this report and/or attached as exhibits to this report.

12. Sworn Statement

366. I, Dr. Michael S. Lebby, do hereby declare and state, that: (1) all statements made herein of my own knowledge are true; (2) all statements made herein on information and belief are believed to be true; and (3) these statements were made with the knowledge that willful false statements and the like so made are punishable by fine, imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: May 28, 2024



Dr. Michael S. Lebby

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