UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIZIO, INC.,
Petitioner

v.

NICHIA CORPORATION,
Patent Owner

Case No. IPR2018-00437
Patent 9,537,071

DECLARATION OF DR. STANLEY R. SHANFIELD IN SUPPORT OF PETITIONER'S REPLY AND OPPOSITION TO PATENT OWNER'S CONTINGENT MOTION TO AMEND CLAIMS

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I, Dr. Stanley Shanfield, have previously been asked by VIZIO, Inc. ("Petitioner") to testify as an expert witness in this action. As part of my work in this action, I have been asked by Petitioner to respond to certain assertions offered by Nichia Corporation ("Patent Owner") in this proceeding concerning U.S. Patent No. 9,537,071 ("the '071 patent"). I hereby declare under penalty of perjury under the laws of the United States of America, as follows: [1]

I. INTRODUCTION

1. I am the same Stanley Shanfield who provided a Declaration in this proceeding, executed on January 12, 2018 as Exhibit 1003 ("January 12, 2018 Declaration"), which, including its appendices, is incorporated by reference herein in its entirety. Ex. 1003 (January 12, 2018 Declaration), ¶¶ 1-182, Appendices A-B.

2. My experience and qualifications are provided along with my January 12, 2018 Declaration and CV.

3. I offer this declaration in rebuttal to certain assertions in (1) Patent Owner's Response (Paper 22) ("POR") and the Declaration of Dr. E. Fred Schubert (Ex. 2008); and (2) Patent Owner's Contingent Motion To Amend

[1] Throughout this Rebuttal Declaration, all emphasis and annotations are added unless noted.

Claims (Paper 24) ("Motion to Amend") and the Declaration of Dr. E. Fred Schubert (Ex. 2019).

II. MATERIALS REVIEWED

4. In connection with my study of the POR, the Motion to Amend, and supporting declarations and reaching the conclusions stated herein, I have reviewed a number of additional documents. In addition to those mentioned in my previous declaration, I have reviewed the following additional documents:

- POR and its accompanying exhibits
- Motion to Amend and its accompanying exhibits
- All other documents referenced herein.

5. My opinions are also based upon my education, training, research, knowledge, and personal and professional experience.

6. I hereby declare that all statements made herein are of my own knowledge, are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001. If called to testify as to the truth of the matters stated herein, I could and would testify competently.

III. LEVEL OF ORDINARY SKILL IN THE ART

7. In my January 12, 2018 Declaration, I opined that a person of ordinary skill in the art ("POSITA") as of September 3, 2008 (the claimed priority date of the '071 patent) would have a minimum of a Bachelor's degree in Physics, Electrical Engineering, Material Science, or a related field, and approximately 5 years of professional experience in the field of semiconductor technology, including manufacturing and packaging processes for light emitting devices. Ex. 1003 (Declaration), 17. Additional graduate education could substitute for professional experience, or significant experience in the field could substitute for formal education. *Id.* I have reviewed Dr. Schubert's opinion regarding the level of skill of a POSITA with respect to the '071 patent (requiring (i) a Ph.D. degree in Electrical Engineering, Applied Physics, Materials Science, or a related field, and about 3 years of practical experience in industry; (ii) a Master's degree in Electrical Engineering, Applied Physics, Materials Science, or a related field, and about 5 years of practical experience in industry; or (iii) a Bachelor's degree in Electrical Engineering, Applied Physics, Materials Science, or a related field, and about 10 years of practical experience in industry."). Ex. 2008 (Schubert Declaration in Support of POR) 29; Ex. 2019 (Schubert Declaration In Support of Patent Owner's Contingent Motion to Amend). Under either my definition or Dr.

Schubert's definition, I met or exceeded the level of skill required as of September 3, 2008, and my opinions are the same.

IV. CLAIM CONSTRUCTION

A. Background and Legal Standards

8. In the January 12, 2018 Declaration, I had been asked to assume that all claim terms have their plain and ordinary meaning under the broadest reasonable interpretation consistent with the specification. I offered no opinion on the merits of claim constructions; however, I reserved my right to so in the future. *See* January 12, 2018 Declaration §VI.C. I understand that the Board has since provided claim construction analysis of "resin package" but did not formally construe the term. Inst. Dec. §III.A. I further understand that Dr. Schubert subsequently proposed a constructions of that term. Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶34-48.

9. I have been advised that for purposes of this *Inter Partes* Review, the standard for claim construction of terms within the claims of the patent is that claim terms are generally given their plain and ordinary meaning under the broadest reasonable interpretation in light of the specification, which is a different standard than federal district court litigation.

10. I have been advised that claims must be construed in light of and consistent with the patent's intrinsic evidence. Intrinsic evidence includes the

claims themselves, the written disclosure in the specification, and the patent's prosecution history, including the prior art that was considered by the United States Patent and Trademark Office ("PTO").

11. I have been advised that the language of the claims helps guide the construction of claim terms. The context in which a term is used in the claims can be highly instructive.

12. I have been advised that the specification of the patent is the best guide to the meaning of a disputed claim term. Embodiments disclosed in the specification help teach and enable those of skill in the art to make and use the invention, and are helpful to understanding the meaning of claim terms. Nevertheless, in most cases, preferred embodiments and examples appearing in the specification should not be read into the claims.

13. While claim terms are generally given their plain and ordinary meaning, I have been advised that the plain and ordinary meaning may not apply where the patentee disavows the full scope of the claim term either in the specification or during prosecution.

14. I also have been advised that a patentee's intent to disavow claim scope must be clear and unmistakable when considered in the context of the prosecution history as a whole.

15. I have been advised that statements made by the inventor during continued prosecution of a related patent application can be relevant to claim construction.

16. While dictionaries might be relevant to claim construction, I have been advised that dictionary definitions should not be applied if they conflict with the intrinsic record, including the claims, specification, and prosecution.

17. I have been advised that claim constructions that do not exclude preferred embodiments disclosed in the specification are preferred over claim constructions that exclude preferred embodiments.

18. For the reasons discussed further below, in my opinion Dr. Schubert's proposed construction of "a resin package comprising a resin part and a metal part" is incorrect.

B. "Resin Package Comprising a Resin Part and a Metal Part" (Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶34-48)

19. Dr. Schubert opines that the term "a resin package comprising a resin part and a metal part" is defined as referring to a resin package, a resin part, and a metal part for "a singulated light emitting device" both expressly (Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶35-38), and implicitly (Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶39-48). For the reasons explained below, I disagree. The term "resin package comprising a resin part and a metal

part" should be given its plain and ordinary meaning because the claims and specification uses the term consistent with that meaning.

20. The claim language supports the plain meaning. All of the Challenged Claims (claims 1, 2, 4–9, 11, 12, 15–19, 21–23, and 25 of the '071 patent) are apparatus claims that recite the structure of "a light emitting device" comprising "a resin package comprising a resin part and a metal part." Ex. 1001 ('071 patent), 19:17, 20:29, 20:47. The claims do not recite "singulated" and do not recite forming a light emitting device from "multiple devices." The applicant was clearly aware of the word "singulated" and the concept of forming a single LED device from multiple LED devices, because those concepts are discussed in the specification, but the applicant did not include the word or concept in the claims. Because the claims do not recite singulation, or the general concept of cutting to obtain multiple devices, the claim language does not support Dr. Schubert's proposed construction.

21. The intrinsic record also supports the plain meaning. The terms "resin package," "resin part," or "metal part" are not defined anywhere in the '071 patent's specification. In addition, the figures in the specification that show "a resin package" are consistent with my understanding of the plain meaning of the term as used in the field. *E.g.*, Ex. 1001 ('071 patent), 6:37 ("a resin package 20"), Figs. 1, 2, 6, 9, 11, 12, 13; Ex. 1039 (IEEE Standard Glossary of Computer

Hardware Terminology (1995)), 66 ("package: An external container, substrate, or platform used to hold a semiconductor or circuit.").

22. Moreover, I understand that U.S. Patent Application No. 2005/0151149 to Chia et al. ("Chia') is cited on the face of the '071 patent. Ex. 1020. Even though Chia includes no disclosure of multiple devices or singulation, a POSITA would have understood that the reference discloses a "resin package." I understand that during prosecution of the '870 patent, which is in the same family as the '071 patent, the Examiner found that Chia discloses an LED "including a ***resin package*** including a resin part." Ex. 1018 ('870 File History, Office Action), 8. Specifically, the Examiner found that Chia discloses a resin portion 525 and first and second leads 520 and 515. Ex. 1018 ('870 File History, Office Action), 8-9. Thus, consistent with intrinsic record and the term's plain and ordinary meaning, the term "resin package" does not require singulation, a post-singulation device, or a resin package formed from multiple light emitting devices.

23. Dr. Schubert's proposed construction incorrectly requires that the resin package must be for "a ***singulated*** light emitting device" formed from "***multiple devices***." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶20, 23, 35, 38-39, 46-48. These additional limitations are not found in the claim.

24. Dr. Schubert opines that "[t]he Detailed Description section of the '071 Patent begins with a summary of the problems solved by aspects of the

invention, as well as a set of definitions for key terms used throughout the specification." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶36 (citing Ex. 1001 ('071 patent), 3:26-36). Dr. Schubert further asserts that that the terms "resin package," "resin part," and "metal part" were expressly defined as referring to parts of a singulated light emitting device. Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶35-38. I disagree. The quoted portion of the specification relied on by Dr. Schubert states that "[i]n this description, terms such as leads, a resin part, and resin package are used for a singulated light emitting device." Ex. 1001 ('071 patent), 3:33-37. This statement, however, does not define the terms "resin package," "resin part," and "metal part." Rather, the sentence provides context for the specification's discussions that include those terms. Therefore, contrary to Dr. Schubert's opinion that "it would be clear to a POSITA that the '071 Patent expressly defines these terms to refer to a singulated light emitting device" (Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶35), the term "resin package" is not expressly defined in the '071 patent.

25. Patent Owner asserts that I used the cited statement from the specification to understand the term "resin package" and that I have now taken a different position. POR 9-10 (citing Ex. 2009 (Shanfield May 21, 2018 Dep. Tr.), 45:2-58:2, 44:16-45:1). This is incorrect, and Patent Owner misrepresents my testimony. I did not agree that the specification defines the term "resin package."

Indeed, my testimony following Patent Owner's quoted portion made clear that the terms such as "resin package" are not defined by the cited language in the specification (corresponding to Ex. 1001 ('071 patent), 3:33-37):

> **Q** And the part that you read to me in Column 2, lines 59 to 62, that's your understanding. Correct? That's how you use those terms. Correct? [¶] … **A** No. That's not what I said. [¶] … **Q** Did you use the terms "resin-molded body" and "resin package" as they are described in Column 2, lines 59 to 62, in doing your analysis and opinions you gave in this case? [¶] **A** No. What I was explaining earlier is, I used their explanation in Column 2, 59 through 65, 64, to understand and interpret what the '250 patent is explaining and saying.

Ex. 2009 (Shanfield May 21, 2018 Dep. Tr.), 46:18-47:21.

26. Dr. Schubert's proposed construction is also inconsistent with the patent's claims to a single "***light emitting device***" instead of multiple devices. In his declaration, Dr. Schubert repeatedly relies on disclosures in the specification of "multiple" devices. *E.g.*, Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶20 ("the '071 Patent discloses a product made by 'singulation' in which ***multiple devices*** are cut to form a plurality of singulated resin packages"), 23 ("***multiple light emitting devices***"), 24 ("The following illustration (based on FIG. 5) shows how ***multiple singulated devices*** can result from a single molded lead frame"), 36 ("***multiple light emitting devices***"), 38 ("The patent repeatedly discusses that ***manufacturing multiple light emitting devices*** quickly and efficiently is a stated

goal."), 44 ("results in ***multiple devices*** upon cutting"), 48 ("it is possible to ***manufacture multiple light emitting devices***"). This further demonstrates that the applicant could have claimed multiple devices, but did not. The applicant instead elected to claim "[a] light emitting device." Ex. 1001 ('071 patent), 19:17, 20:29, 20:47.

27. Dr. Schubert's proposed construction is also inconsistent with the specification. For example, the patent discloses that "singulation is started from the outer upper surface of the resin package." Ex. 1001 ('071 patent) 15:9-13. This statement indicates that "resin package" can refer to a device that has not yet been singulated. Thus, the specification uses the term "resin package" in a way that is inconsistent with Dr. Schubert's proposed construction.

28. Dr. Schubert's proposed construction would also change the scope of the claims, which are apparatus claims, to depend on how the light emitting device is manufactured. I have been advised that it is improper to construe an apparatus claim in a way that would depend on how the light emitting device is manufactured. As Dr. Schubert has repeatedly acknowledges, "singulation" or "singulating" is a ***manufacturing process***. For example, Dr. Schubert equates the specification's use of the "cutting" process to "singulation" and explains that "***Cutting*** a molded lead frame to produce multiple, individual devices ***is a type of singulation***." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶44 (citing Ex. 1001 ('071 patent),

16:42-51, 17:20-23, 17:56-59). Dr. Schubert also refers to a singulated device as being "***post-singulation***." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶35, 37, 38, 41, 71, 73, 76. In addition, Dr. Schubert explains that the "first three embodiments …result in many singulated devices ***upon singulation***." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶43. In a footnote, Dr. Schubert makes clear that "***the act of singulation*** refers to ***creating*** multiple individual devices." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶44 n.3. Thus, Dr. Schubert's construction would improperly add manufacturing steps into the ***apparatus*** claims.

29. On the other hand, if Dr. Schubert or Patent Owner argues that they are not interpreting the claims to cover a manufacturing process, then Dr. Schubert's proposed construction fails to describe what would be required by the structure of a resin package for "a singulated light emitting device" beyond what is already expressly stated in the claims. For example, neither Patent Owner nor Dr. Schubert has asserted that the final structure of a resin package, resin part, or metal part themselves would necessarily be any different depending on whether or not the device was singulated from multiple light emitting devices. Dr. Schubert states only that "[a] singulated device … is a unit that has been individualized from a larger batch." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶44 n.3. However, the structure of the claimed light emitting device could be manufactured

without "singulat[ing] from … multiple, pre-singulation devices." POR 12 (citing Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶ 42-48). Dr. Schubert is improperly reading limitations from the manufacturing process described in the specification into the apparatus claims, which recite "[a] light emitting device." Ex. 1001 ('071 patent), 19:17, 20:29, 20:47.

30. Dr. Schubert opines that "the term 'a resin package comprising a resin part and a metal part' … is implicitly defined through its repeated, consistent, and exclusive use in the specification." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶39. I disagree. As explained above, Dr. Schubert fails to account for the express claim language directed to a single device, or the fact that the claims are apparatus claims rather than method claims. Moreover, as explained above, the specification did not consistently use the term. For example, the patent discloses that "singulation is started from the outer upper surface of the resin package." Ex. 1001 ('071 patent) 15:9-13. This usage is inconsistent with Dr. Schubert's proposed construction. As explained above, other parts of the intrinsic record further support the plain meaning and are inconsistent with Dr. Schubert's proposal.

31. For these reasons, the term "resin package comprising a resin part and a metal part" should be given its plain and ordinary meaning, and should not be construed to require that the device be "singulated" from "multiple light emitting devices."

V. THE CHALLENGED CLAIMS 1, 2, 4–9, 11-12, 15–19, 21–23, AND 25 OF THE '071 PATENT ARE UNPATENTABLE

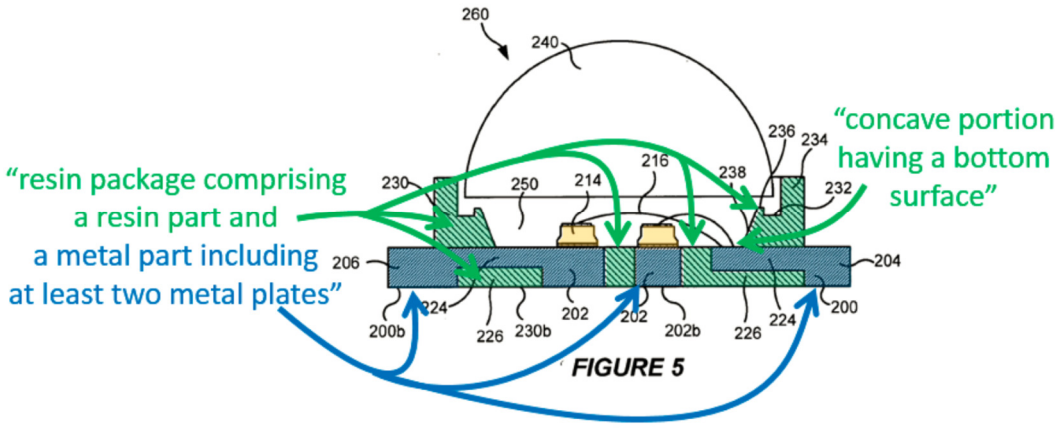
A. Legal Standards

32. My understanding of the applicable legal standards is discussed in the January 12, 2018 Declaration. Ex. 1003 (January 12, 2018 Declaration), ¶¶56-61.

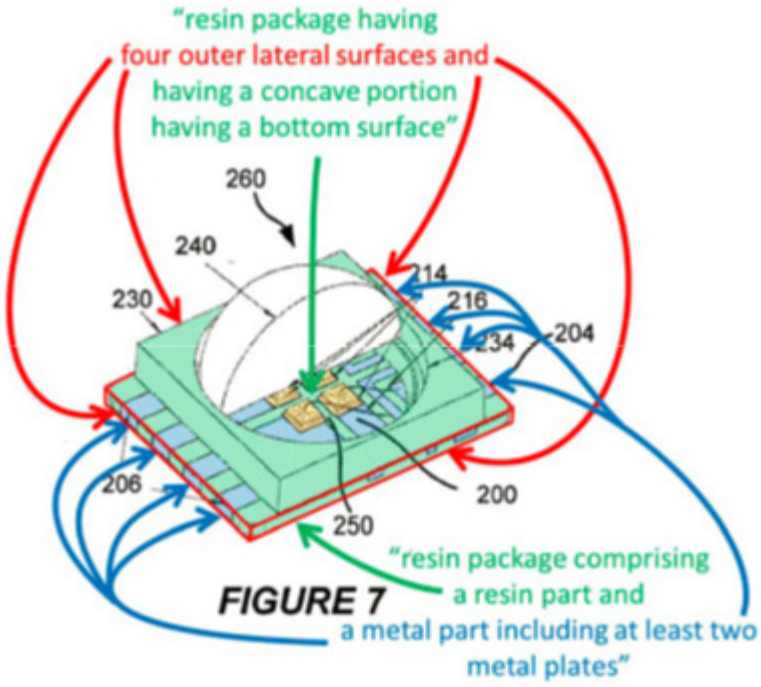
B. Loh Discloses "a Resin Package Comprising a Resin Part and a Metal Part" (Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶70-77)

33. As I discussed in my January 12, 2018 Declaration, Loh discloses and renders obvious this limitation. January 12, 2018 Declaration ¶¶56-60. Dr. Schubert opines that "Loh does not disclose a light emitting device comprising a resin package, as claimed." Ex. 2008 (Schubert Decl. Supporting PO's Response), ¶¶70-73. I disagree. As discussed in Section IV.B, Dr. Schubert's proposed construction of "resin package comprising a resin part and a metal part" improperly narrows the term to be limited to a "singulated" device formed from "multiple light emitting devices." Under the plain and ordinary meaning, Loh discloses a "resin package comprising a resin part and a metal part."

34. As explained in my January 12, 2018 Declaration and as shown in the figures below, Loh discloses a resin package (*e.g.*, "package 260") comprising a resin part (*e.g.*, "package body 230," in green) and a metal part including at least two metal plates (*e.g.*, "leads 204a-d and 206a-d," in blue). Ex. 1003 (January 12, 2018 Declaration) ¶¶82-86; Ex. 1004 (Loh) ¶¶74-77, 79-80, 103, Figs. 5-8.



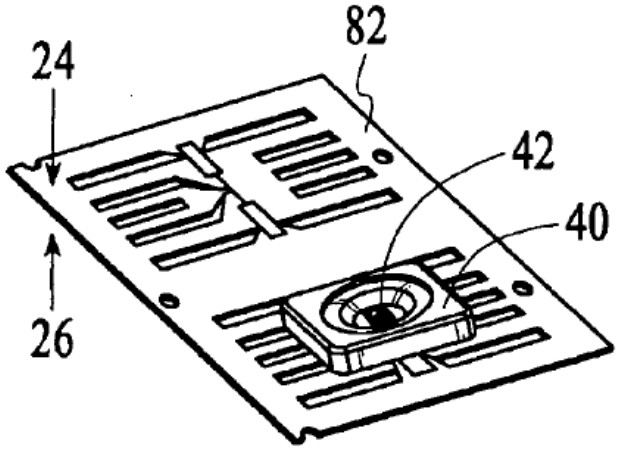
Ex. 1004 (Loh), Fig. 5.



Ex. 1004 (Loh), Fig. 7.

35. Loh also discloses a "resin package comprising a resin part and a metal part" even under Dr. Schubert's incorrect proposed construction, which would require that the resin package must be for "a singulated light emitting device"

formed from "multiple devices." For example, Loh repeatedly discloses "***package(s)***." Ex. 1004 (Loh), ¶¶2, 7, 17, 37, 85, 87. Loh further discloses that its leadframe "may be made, for example, by milling, stamping, and/or rolling a ***metal strip*** to form a leadframe having areas of different cross-sectional thickness." Ex. 1004 (Loh), ¶93. A POSITA would have understood from Loh's express disclosure of a "metal strip" that Loh's light emitting device is formed from multiple light emitting devices on a single lead frame, which are then singulated. In addition, this is confirmed by publications that Loh incorporates by reference. For example, Loh incorporates by reference U.S. Patent Application Publications 2004/0126913 and 2005/0269587 (also both to Loh), which each depict examples of such metal strips and show that the final device is singulated from a strip containing multiple devices. Ex. 1004 (Loh), ¶3; Ex. 1022 (U.S. 2005/0269587); Ex. 1021 (U.S. 2004/0126913). Similar to Loh, the '587 publication discloses a "leadframe ***strip***" that is "fabricated by stamping" or "using a chemical etching or milling processes." Ex. 1022 (U.S. 2005/0269587), ¶36. As the '587 publication further discloses and shows, "a leadframe strip can be fabricated to manufacture multiple light emitting die packages simultaneously":



E.g., Ex. 1022, (U.S. 2005/0269587), ¶35, Fig. 3C. Also similar to Loh, the '913 publication discloses a "leadframe die" that is "fabricated by stamping" or "using etching processes." Ex. 1021 (U.S. 2004/0126913), ¶28. The '913 publication further discloses and shows that "a leadframe die can be fabricated to manufacture multiple light emitting die packages simultaneously":

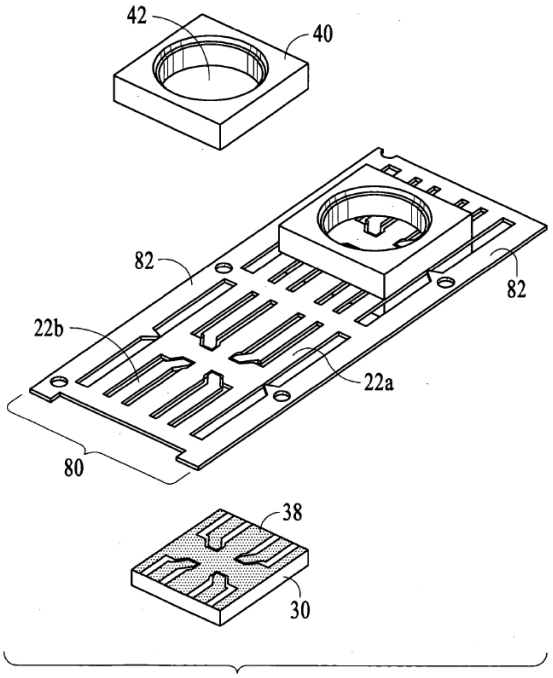


FIG. 3

E.g., Ex. 1021, (U.S. 2004/0126913), ¶28, Fig. 3. This confirms that a POSITA would have understood that Loh's "metal strip" is used to manufacture multiple light emitting die packages simultaneously. Thus, under either the proper construction or Dr. Schubert's improperly narrow proposed construction, Loh discloses "a resin package comprising a resin part and a metal part."

C. Conclusion

36. In summary, and as outlined in the January 12, 2018 Declaration and above, I have concluded that the Challenged Claims of the '071 Patent are invalid as disclosed and/or obvious under 35 U.S.C. §§ 102 and/or 103 under the following grounds of unpatentability:

- Loh anticipates claims 1, 4, 8-9, 11-12, 15-18, and 25;
- Loh renders obvious claims 1, 4, 8-9, 11-12, 15-18, and 25;
- Loh in view of Mori renders obvious claims 2 and 19;
- Loh in view of Wang renders obvious claims 5-7 and 21-23; and
- Loh in view of Wang and Oshio renders obvious claims 5-7 and 21-23.

Patent Owner's arguments and Dr. Schubert's opinions are incorrect, and do not alter my opinions expressed in the January 12, 2018 Declaration.

37. To the extent it is argued that any further disclosure is required for a limitation of any of the Challenged Claims that I have identified in the January 12, 2018 Declaration or above as having been disclosed by Loh, Mori, Wang, and

Oshio, a POSITA would certainly have found that limitation obvious to include based on the same disclosure and analysis I have identified above.

38. I reserve the right to supplement my opinions in the future to respond to any arguments that Patent Owner or its expert(s) may raise and to take into account new information as it becomes available to me.

VI. THE PROPOSED SUBSTITUTE CLAIMS 27-34 ARE INVALID FOR LACK OF WRITTEN DESCRIPTION SUPPORT

A. Proposed Substitute Claims

39. I have considered the proposed substitute claims 27-34 (Ex. 2020, Claims Appendix For Proposed Substitute Claims), which read as follows:

> **27.[pre]** A light emitting device comprising:
>
> **[27.A]** a light emitting element;
>
> **[27.B]** a resin package consisting of a resin part and first and second metal leads, the resin part including a thermosetting resin, and
>
> **[27.C]** wherein said resin package has four outer lateral surfaces and has a concave portion having a bottom surface,
>
> **[27.D]** wherein the light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the first and second metal leads,
>
> **[27.E]** wherein, at each of the four outer lateral surfaces of the resin package, at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of one or more of the first and second metal leads are coplanar,

[27.F] wherein the first metal lead is exposed at three outer lateral surfaces of the resin package,

[27.G] wherein a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package,

[27.H] wherein, at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead,

wherein, at a second of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead, and

[27.I] wherein all upper edges of the first and second metal leads are coplanar.

28.[pre] A light emitting device comprising:

[28.A] a resin package comprising a resin part and a metal part, said metal part consisting of first and second metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface;

[28.B] a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part, and

[28.C] wherein at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package,

[28.D] wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part

are coplanar at each of the four outer lateral surfaces of the resin package,

[28.E] wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

[28.F] wherein, at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate,

wherein, at a second of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate,

[28.G] wherein a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element,

[28.H] wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the first metal plate, and

wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate.

29. The light emitting device according to claim 28, wherein the resin part is made using a thermosetting resin.

30. The light emitting device according to claim 28 wherein:

the first metal plate has a first step portion that is exposed on the outer lateral surface of the first metal plate on a first side of the resin package, and

the second metal plate has a second step portion that is exposed on the outer lateral surface of the second metal plate on a second side of the resin package.

31.[pre] The light emitting device according to claim 29,

[31.A] wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors,

[31.B] wherein each of the first and second metal plates includes an etched concave portion on an upper surface of the respective metal plate,

[31.C] wherein each of the first and second metal plates includes an etched concave portion on a bottom surface of the respective metal plate, and

[31.D] wherein each of said etched concave portions is curved.

32. The light emitting device according to claim 28, wherein the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, the metal layers being made of a material that is different from that of the base portion.

33. The light emitting device according to claim 32, wherein the metal layer is disposed at all surfaces of the metal part except an exposed outer lateral surface of the metal part.

34. The light emitting device according to claim 32, wherein:

the resin part is disposed over a first portion of the metal layer at the upper surface of the metal part, and a second portion of the metal layer on the upper surface of the metal part is exposed from the resin part.

B. Legal Standard

40. I have been instructed that 35 U.S.C. §112, ¶1 requires that the specification contain a written description of the invention in sufficient detail to demonstrate that the applicant had possession of the invention as of the time of the filing date sought. To support a claim amendment, the description must convey to persons of ordinary skill in the art that the applicant had possession at that time of the later claimed subject matter. I have been further instructed that an applicant shows that it is in possession of the invention by describing the invention with all of its claimed limitations, and that a description that merely renders the invention obvious does not satisfy the written description requirement.

41. As set forth below, it is my opinion that there is no written description support for substitute claims 27-34 in any of the applications relied upon by Patent Owner and Dr. Schubert and that the substitute claims are therefore invalid under §112, ¶1.

C. Proposed Claim 27 Is Invalid for Lack of Written Description

42. In my opinion, there is no written description support for proposed claim 27. Proposed claim 27 recites, in part, "a resin package ***consisting of*** a resin

part and ***first and second metal leads***" ([27.B]). Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 5. In my opinion, there is no support in the '071 patent priority applications (Ex. 2022 (JP2008-225408, English translation of the "JP '408 application"); Ex. 2023 (application No. 12/737,940, "the '940 application")) for Element [27.B] in combination with Elements [27.D], [27.E], [27.F], [27.G], and [27.H], and nothing in Dr. Schubert's cited sections suggests that the applicants were in possession of the claimed subject matter.

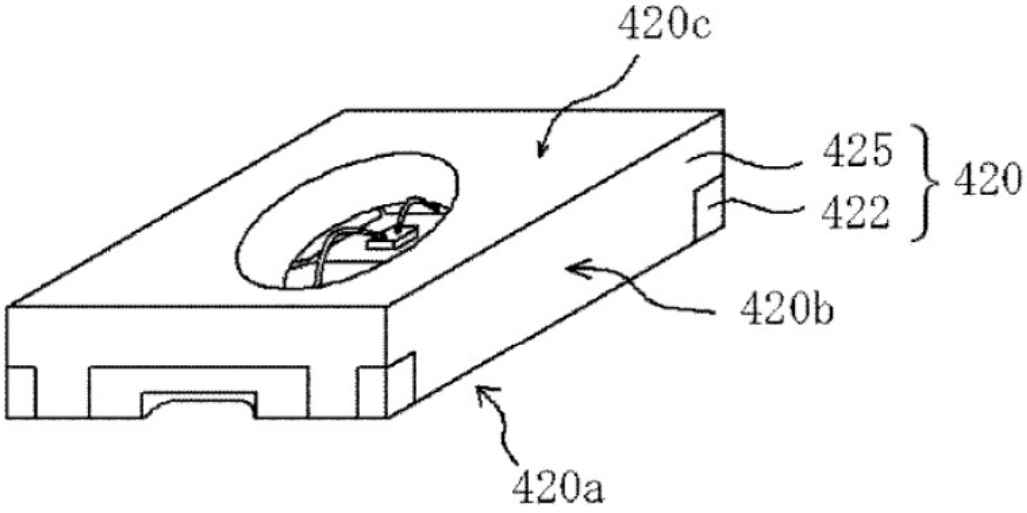
43. Dr. Schubert opines that "[t]he JP '408 application and '940 application…provide written support for each of the elements of claim 27 in a single embodiment." Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶65. Dr. Schubert's then "focus[es] [his] attention on the description of the 'Fifth Embodiment.'" *Id*. I disagree that the fifth embodiment provides written description support for claim 27. Dr. Schubert's cited disclosures in the JP '408 and '940 applications pertaining to the fifth embodiment fail to provide a written description of claim 27 at least because the resin package of the fifth embodiment does not "***consist***" of "a resin part and ***first and second*** metal leads" as required by Element [27.B]. Instead, the resin package has a ***third*** separate metal structure. Such a structure does not support proposed claim 27. Moreover, even if the requirement of Element [27.B] was ignored and any two of the metal structures of the fifth embodiment were considered as the claimed "first and second metal leads,"

the disclosures fail to provide written description support for the combination of Elements [27.D], [27.E], [27.F], [27.G], and [27.H].

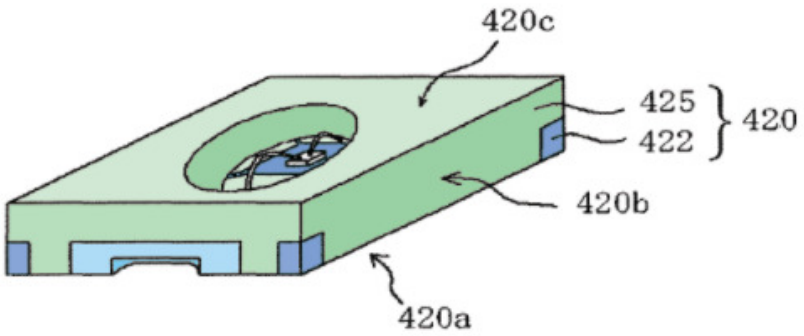
44. As an initial matter, I have been informed that when an applicant uses the term "consisting of" it is understood to be closed-ended and excludes any elements not specified in the claim. Therefore, Element [27.B] is understood to exclude from the resin package any structures that are not the claimed "resin part" or "first and second metal leads." I further understand that Patent Owner's proposed claim 27 would expressly narrow the wording of '071 patent claim 15, which recited "a resin package ***comprising a resin part and a metal part including first and second metal plates***," to instead recite "a resin package ***consisting of a resin part and first and second metal leads***." Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 1. This further confirms that Element [27.B] is understood to exclude from the resin package any structures that are not the claimed "resin part" or "first and second metal leads."

45. A POSITA would have understood from the disclosures of the '940 and JP '408 applications that the resin package of Figure 12 does not "consist" of "a resin part and first and second metal leads." It includes a third metal structure that is neither the first nor the second metal lead:

[FIG. 12]

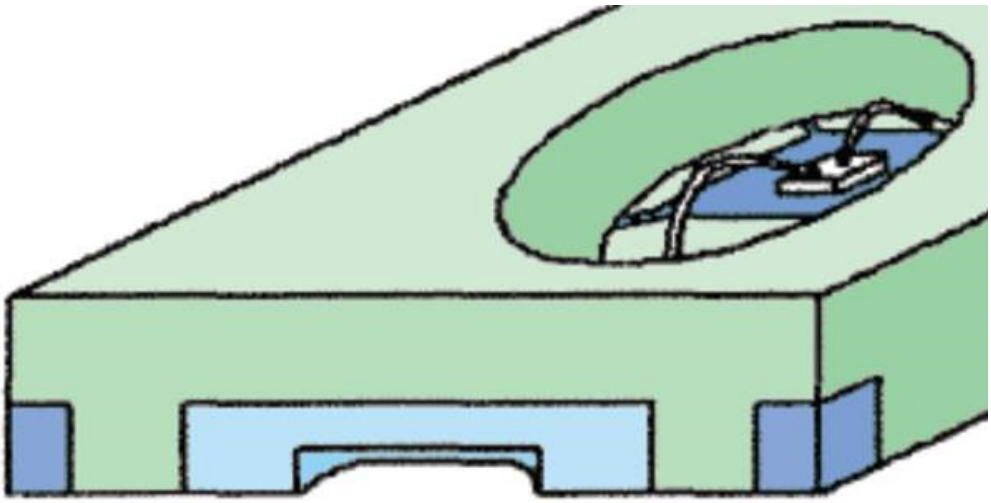


Ex. 2023 (the '940 application), Fig. 12; *see also* Ex. 2022 (JP '408 application), Fig. 12. Figure 12, annotated below, shows that the metal of the resin package in the fifth embodiment is divided into three separate structures: two metal leads in the middle front (light blue) and middle back (not shown) and a third central metal X structure (dark blue) with legs extending to each corner on which the light emitting element (white) is mounted and connected by wires to the two leads.



Ex. 1001 ('071 patent), Fig. 12; Ex. 2023 (the '940 application), Fig. 12; Ex. 2022

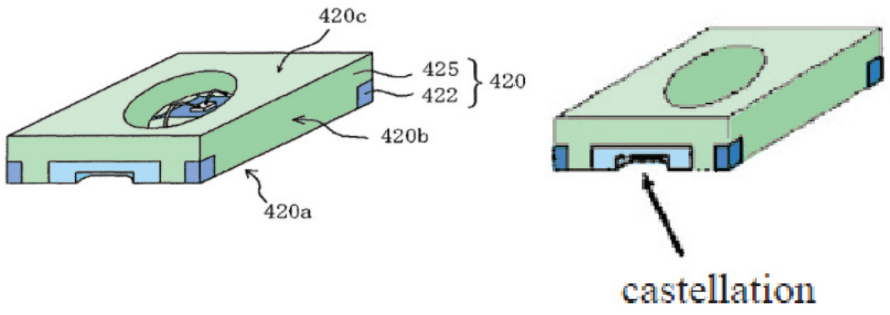
(JP '408 application), Fig. 12. The following close-up view of Figure 12 further helps to show that the metal of the fifth embodiment is divided into three structures:



Ex. 1001 ('071 patent), Fig. 12; Ex. 2023 (the '940 application), Fig. 12; Ex. 2022 (JP '408 application), Fig. 12. A POSITA would have understood the front and rear of the device are symmetrical, and that the back surface has the same design as the front. As Dr. Schubert acknowledges, "[a] POSITA would have understood that the front facing side is substantially the same at the rear of the light emitting device that is not shown." Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶83. Thus, the fifth embodiment disclosed in the applications consists of three distinct metal structures instead of only two.

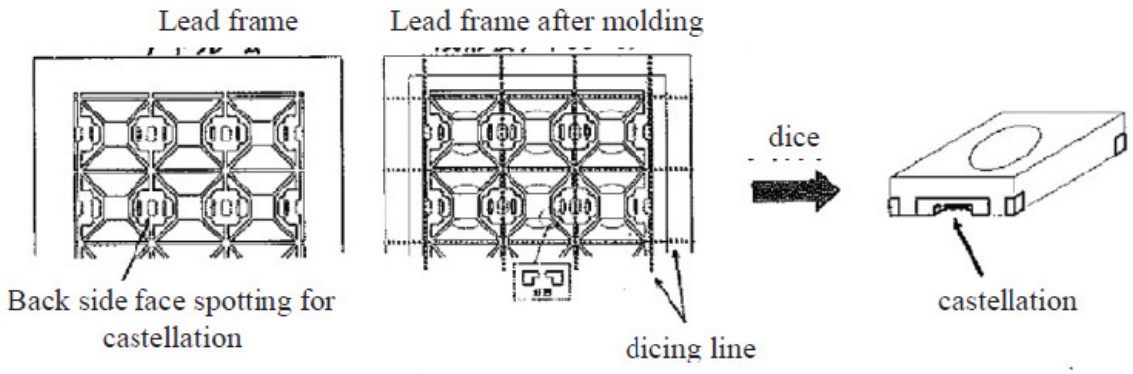
46. This understanding is consistent with and confirmed by the descriptions in the lab notebook (Ex. 1036 (IPR2017-01623 Ex. 2727), 92) of '071 applicant Hirofumi Ichikawa ("Notebook"). Below, a side-by-side comparison of Figure 12 in the applications (left) and the figure in Mr. Ichikawa's Notebook (Ex.

1036 (IPR2017-01623 Ex. 2727), 92) (right) shows that the notebook depicts the same fifth embodiment:



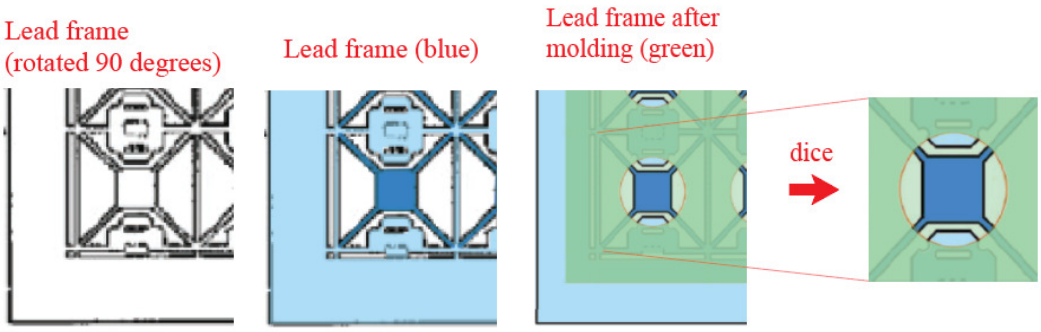
Evident is the substantially identical structure of the resin package and the exposed metal at the outer lateral surfaces of the resin package.

47. Mr. Ichikawa's Notebook also provides a detailed view of the lead frame that corresponds to the fifth embodiment in the applications:

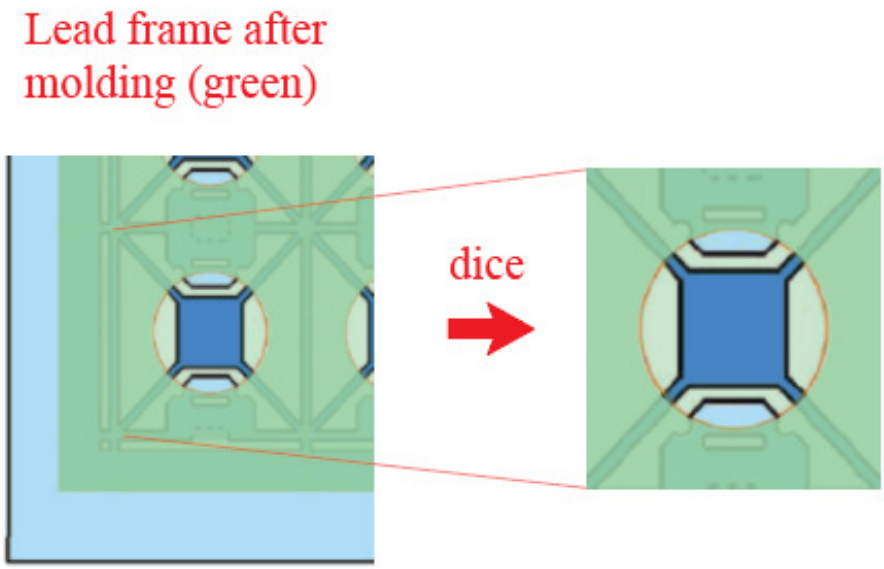


Ex. 1036 (IPR2017-01623 Ex. 2727), 92. The lead frame confirms that there is a third distinct metal structure in the shape of an "X." *See also, e.g.*, Ex. 1036 (IPR2017-01623 Ex. 2727), 78; Ex. 1038 (IPR2017-01623 Ex. 2407), 8, 15. The annotated series of images below (based on the left image above) shows how the lead frame is used to manufacture a device with three separate metal structures: a

front metal structure (light blue), a central metal "X" structure (dark blue), and a rear metal structure (light blue), partially covered by resin (green).

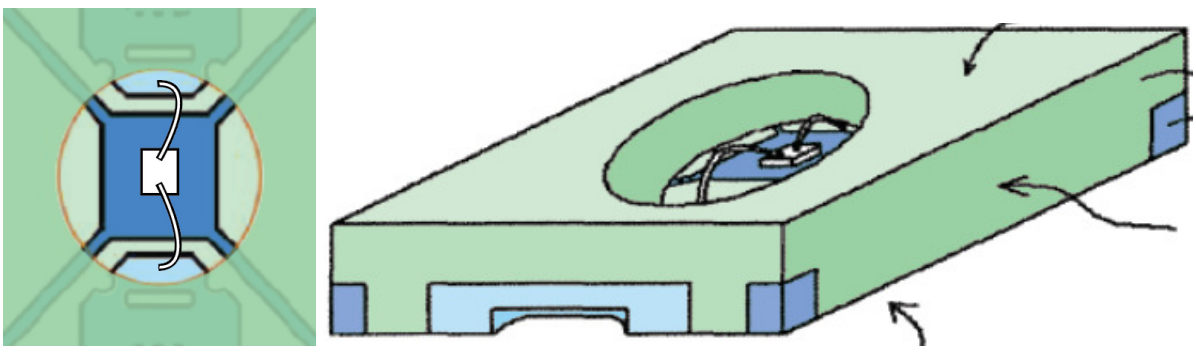


The left-most figure is simply a rotated portion of the lead frame shown above from Mr. Ichikawa's Notebook. The second figure is the same lead frame that has been annotated in shades of blue to indicate the separate metal structures. In the third figure, molding (green) is applied to the lead frame, covering a portion of it as well as filling the space between the metal structures of the lead frame. A central, circular, area remains open in the molding. Finally, the right-most figure is a resin package after dicing. Below, I have enlarged the images to better illustrate the internal structure of the device from Mr. Ichikawa's Notebook:



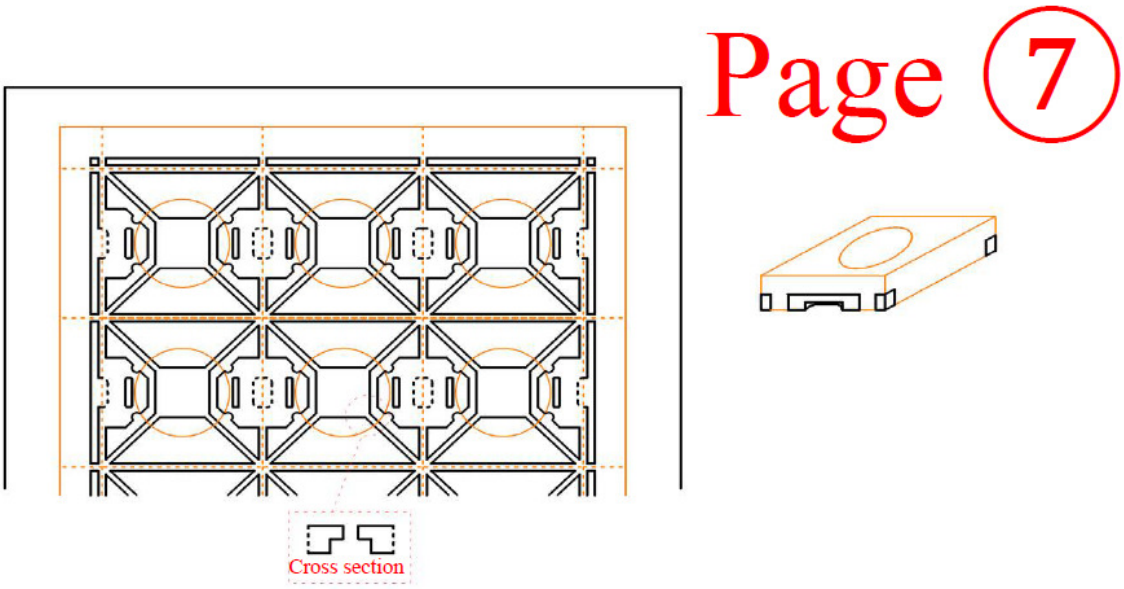
This sequence of figures clearly shows the formation of three, separate, metal structures: a front metal structure (light blue), a central metal structure (dark blue) shaped like an "X" to which the light emitting element is mounted, and a rear metal structure (light blue).

48. A comparison of the lead frame containing an LED element (left) and Fig. 12 (right) confirms that the lead frame from Mr. Ichikawa's Notebook is the lead frame used to make the device of the '940 and JP '408 applications fifth embodiment:



The images also illustrate the internal structure of the fifth embodiment. This comparison confirms that the fifth embodiment of the applications has three metal structures, instead of the required "a resin package consisting of a resin part and first and second metal leads." Thus, a POSITA would have understood that the fifth embodiment disclosed in the '940 and JP '408 applications does not provide written description support for proposed amended claim 27.

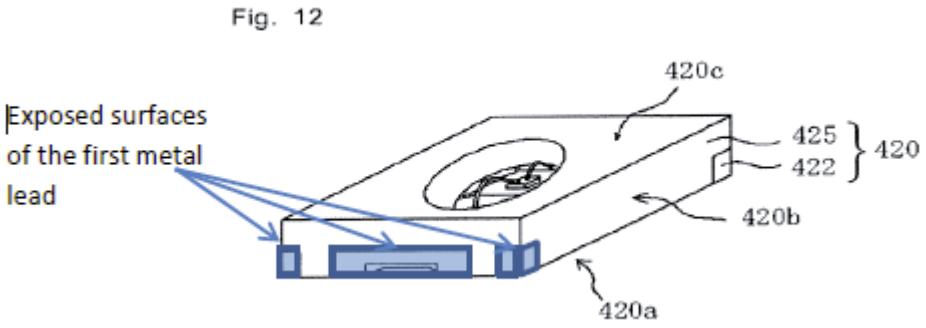
49. A nearly identical (but of higher resolution, and in color) image in the draft of patent drawings from the applicants illustrate the same lead frame and resin package:



Ex. 1038 (IPR2017-01623 Ex. 2407), 8. Like the lead frame from Mr. Ichikawa's Notebook, this lead frame is consistent with the fifth embodiment of the '940 and JP '408 applications as illustrated in Figure 12, and is further confirmation that the

fifth embodiment has three metal structures, instead of two required by proposed amended claim 27.

50. Dr. Schubert opines that all of the exposed metal on the front outer lateral surface of the fifth embodiment is part of a single "first lead." For example, Dr. Schubert annotates Figure 12 as follows:



Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶80. This understanding of the fifth embodiment is incorrect. As explained above (and as shown by Figure 12's visible interior structure) the resin package of the fifth embodiment actually includes three separate metal structures, which Dr. Schubert ignores in his analysis of the fifth embodiment. Therefore, Dr. Schubert's opinions based on his incorrect understanding of the fifth embodiment are flawed. For example, as shown in the figure above, the region shaded in blue by Dr. Schubert is actually two separate, distinct metal structures rather than the claimed "first metal lead." Dr. Schubert argues that Figure 12's resin package "consists" of a resin part and first and second leads. *E.g.*, Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶80. But, Dr.

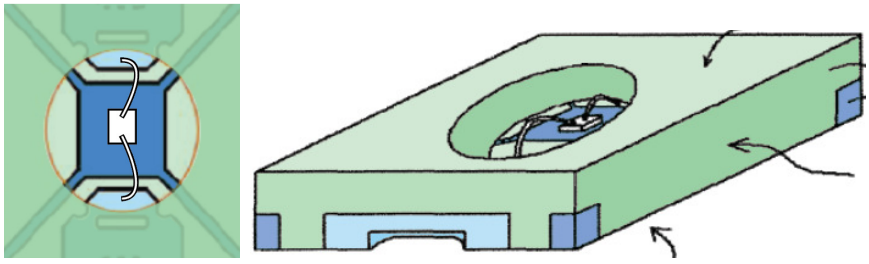
Schubert is incorrect that a POSITA would understand that Figure 12's resin package consists ***only*** of a resin part and first and second metal leads, as required by Patent Owner's proposed substitute claim 27. Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 1. To the contrary, a POSITA would understand that Figure 12's resin package "consists" of a resin part, positive and negative leads (the front and rear middle structures), ***and a third central metal structure*** with legs extending to each corner of the device.

51. To the extent Patent Owner or Dr. Schubert relies on the applications' recitation that "[i]n the outer side surface 420b of the resin package 420, the leads 422 are separated into six. The leads 422 may be separated respectively, or jointed" (Ex. 2023 (the '940 application) ¶99; Ex. 2022 (JP '408 application) ¶99), this language does not provide the necessary written description to satisfy claim 27. As an initial matter, Dr. Schubert does not cite this statement as disclosure of Element [27.B]. Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶63. And regardless, this statement from the applications is ambiguous. To the extent Patent Owner or Dr. Schubert argues that "jointed" means the leads are connected to the third, central metal structure forming the "X," the resulting device would be inoperable because the anode and cathode of the light emitting device would be connected (*i.e.*, shorted) to each other. Furthermore, the specification discloses only that the leads may be jointed at the "***outer side surface 420b***" (instead of separated into

six). Ex. 2023 (the '940 application) ¶99; Ex. 2022 (JP '408 application) ¶99. If the devices were "jointed" at the outer side surface 420b, then there would not be resin on left and right sides of the lead and the device would fail to meet the requirements of Element [27.H]. Thus, the disclosures in Paragraph 99 of the applications do not provide written description support for the device of proposed claim 27.

52. As discussed above, Element [27.B] is not supported by the fifth embodiment which contains three metal structures, and therefore there is no written description support for proposed claim 27. However, to the extent Patent Owner or Dr. Schubert incorrectly relies on two of the three metal structures of Fig. 12 as the claimed "first and second metal leads" to support Element [27.B], despite use of the closed-ended phrase "consisting" in that element, there is no written description support for several other claim elements.

53. ***First***, if the front and rear metal structures (light blue) were the claimed "first and second metal leads," then the fifth embodiment fails to satisfy the limitations of at least Elements [27.E], [27.F], and [27.G].

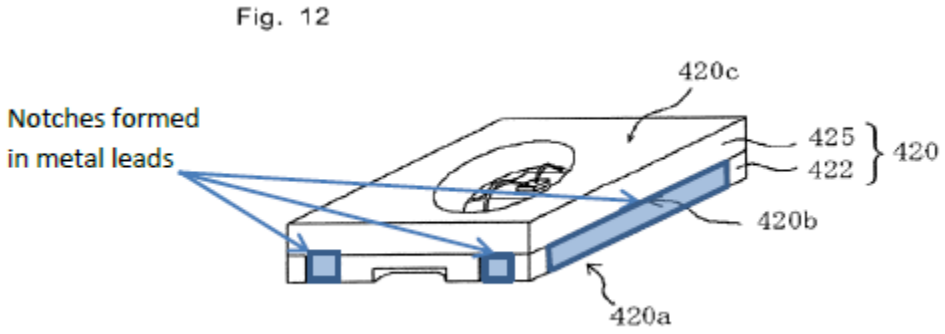


54. Element [27.E] recites "wherein, at each of the four outer lateral surfaces of the resin package, at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of one or more of the first and second metal leads are coplanar." As shown in Figure 12, above, the front and rear metal structures have exposed surfaces on only the front and rear outer lateral surfaces, respectively. This combination of metal structures does not have any exposed surfaces on the left and right outer lateral surfaces of the resin package. Therefore, the front and rear metal structures have no portion of metal (and are not coplanar with resin) at two of the four outer lateral surfaces.

55. Element [27.F] recites "wherein the first metal lead is exposed at three outer lateral surfaces of the resin package." For similar reasons discussed above with respect to Element [27.E], neither the front nor the rear metal structures satisfy Element [27.F]. The front and rear metal structures are each exposed at only a single lateral surface. Neither is exposed at three outer lateral surfaces as required by the claim.

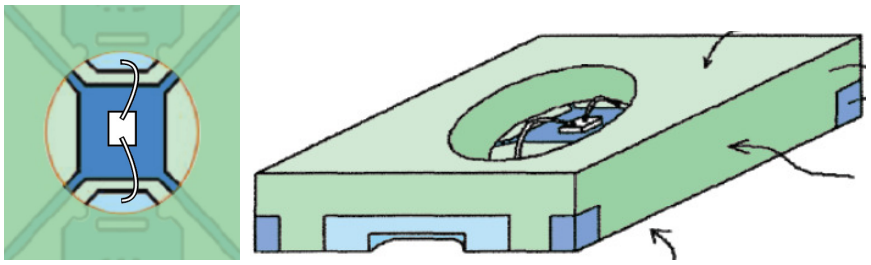
56. Element [27.G] recites "wherein a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package." The front and rear metal structures fail to satisfy Element [27.G] because the notch on at least two of the outer lateral surfaces of the resin package (the left and right sides) is formed in the central metal structure (dark blue) instead

of one of the two metal leads (light blue). Dr. Schubert opines that "Figure 12 … illustrates … a notch that is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package." Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶82. I disagree. Dr. Schubert relies on the following annotated figure:



Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶82. However, as explained above, the notches on at least the left and right sides of the resin package are formed in the third metal structure, rather than one of the two leads.

57. ***Second***, if a front or rear metal structure (light blue) and the central metal structure (dark blue) were the claimed "first and second metal leads," then the fifth embodiment fails to satisfy the limitations of at least Elements [27.D] and [27.H].



58. Element [27.D] recites "wherein the light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the first and second metal leads." However, Figure 12 shows that the light emitting element is "electrically connected to the" front and rear metal structures (light blue). Ex. 1001 ('071 patent), Fig 12; *see also* Ex. 2022 (JP '408 application), Fig. 12; Ex. 2023 (the '940 application), Fig. 12. As shown in Figure 12, the light emitting element in the fifth embodiment is not electrically connected to the central metal structure (dark blue).

59. Element [27.H] recites "wherein, at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead, [and] wherein, at a second of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead." While the front or rear metal structure (light blue) has resin located at left and right sides, the central metal structure (dark blue) is exposed at only the corners of the resin package, and therefore has no resin located at left and right sides on any of the outer lateral surfaces. Therefore, the combination of one of the front or rear metal structures (light blue) and the central metal structure (dark blue) would fail to satisfy Element [27.H].

60. Dr. Schubert opines that the fifth embodiment provides written description support for Elements [27.D], [27.E], [27.F], [27.G], and [27.H]. Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶¶75-83. However, Dr. Schubert's opinions regarding each of these elements are based on an incorrect interpretation of the fifth embodiment as having only two metal structures. As explained above, the resin package of the fifth embodiment actually has three metal structures, and selecting any two of them as the claimed "first and second metal leads" fails to support claim 27 because no two leads can satisfy the combination of Elements [27.D], [27.E], [27.F], [27.G], and/or [27.H].

61. Dr. Schubert states that "where I reference descriptions related to the first embodiment below, it is based on my opinion that such descriptions are also applicable to the fifth embodiment" because "[t]he applications explain that for this fifth embodiment, '[d]escription of some configurations employing the substantially same configuration as the light emitting device according to the first embodiment will be omitted where necessary." Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶65 (citing Ex. 2023 (the '940 application) ¶98; Ex. 2022 (JP '408 application) ¶98); *see also* Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶¶66-85. Dr. Schubert's reliance on descriptions from the first embodiment (and any reliance on descriptions from the second, third, fourth, or sixth embodiments) in combination with the fifth embodiment is incorrect.

62. As an initial matter, I have been instructed that for purposes of written description support, the proper standard is whether the specification demonstrates possession of the invention, and a description that merely renders obvious is insufficient. Therefore, it is my understanding that Dr. Schubert cannot rely on piecemeal disclosures from multiple embodiments.

63. The statement in the specification regarding "configurations employing the substantially same configuration as the light emitting device according to the first embodiment" is not applicable to the resin package of the fifth embodiment, and does not support Dr. Schubert's attempts (Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶¶66-85) to rely on piecemeal disclosures from the two different embodiments. As illustrated by the comparison of Figures 1 and 12 below, the lead frame structure of the first embodiment is not "substantially the same" as the fifth embodiment, as alleged by Dr. Schubert. *See generally* Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶¶66-85. The first embodiment (Figure 1) consists of ***only*** two metal structures (shown in light blue), while the fifth embodiment (Figure 12) has three metal structures (including the central metal structure, shown in dark blue), as discussed above:

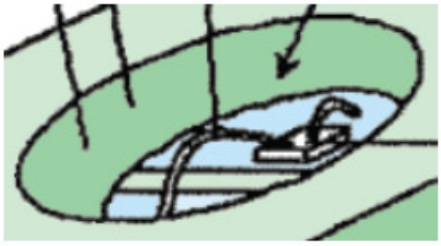
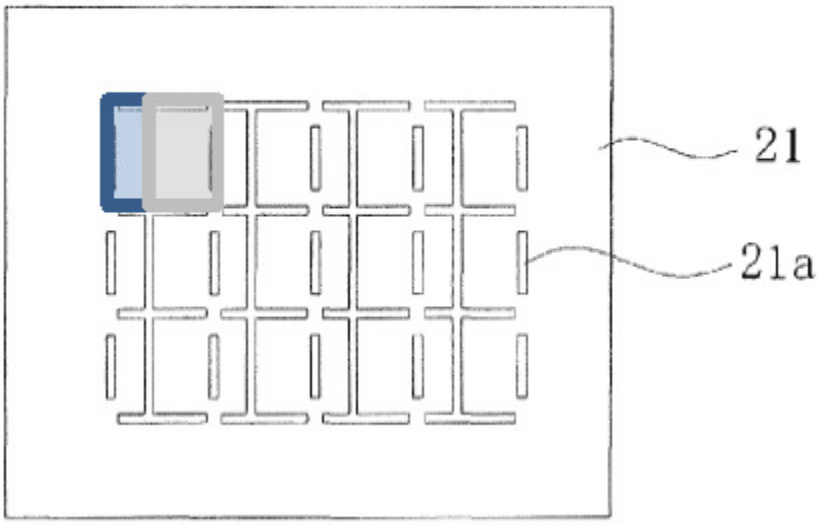


Fig. 1

Fig. 12

Ex. 1001 ('071 patent), Figs. 1, 12; Ex. 2023 (the '940 application) Figs. 1, 12; Ex. 2022 (JP '408 application), Figs. 1, 12. Dr. Schubert's reliance on Figure 3 in combination with Figure 12 is also incorrect:

Fig. 3

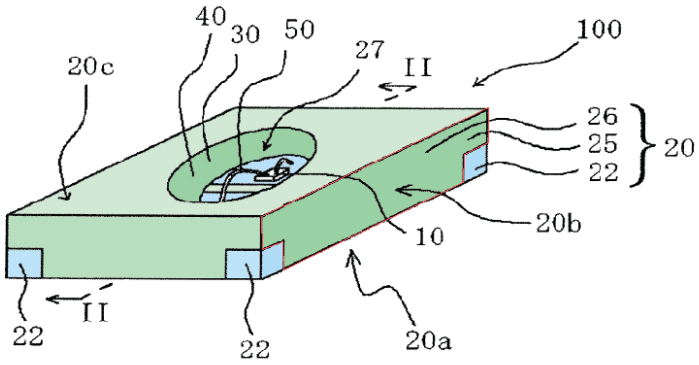


Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶70. Figure 3 is a "plan view illustrating a lead frame used in the *first embodiment*." Ex. 2023 (the '940 application) ¶32; Ex. 2022 (JP '408 application) ¶32. Contrary to Dr. Schubert's assertions, Figure 3's lead frame (which produces the device shown in Figure 1 with ***two*** metal structures) is not "substantially the same" as the lead frame used to

create Figure 12 (which produces a device shown in Figure 12 with ***three*** metal structures). In addition, because the lead frames are different, the resin part structure of the first embodiment is also not the same or "substantially the same" as the fifth embodiment. It appears that Dr. Schubert ignored these differences in rendering his opinions.

64. Moreover, setting aside the fifth embodiment, the remaining embodiments all fail to support proposed amended claim 27 at least because they fail to disclose Element [27.H]. Element [27.H] recites "wherein, at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead, [and] wherein, at a second of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead." This limitation is not disclosed by the first, second, third, fourth, or sixth embodiments. For example, as shown in Figure 1 (an in view of the symmetry of the front and rear surfaces), the first embodiment does not have resin located at left and right sides of exposed metal on any of the four outer lateral surfaces.

Fig. 1



Ex. 1001 ('071 patent), Fig. 1; Ex. 2023 (the '940 application), Fig. 1; Ex. 2022 (JP '408 application), Fig. 1. Therefore, the first embodiment fails to disclose Element [27.H]. The second, third, fourth, and sixth embodiments similarly fail to disclose Element [27.H]. Ex. 1001 ('071 patent), Figs. 6, 9, 11, 13; Ex. 2023 (same); Ex. 2022 (same).

65. In conclusion, it is my opinion that there is no written description support for proposed independent claim 27 in any of the applications relied on by Patent Owner, and it is invalid under §112, ¶1.

D. Proposed Claim 28 Is Invalid for Lack of Written Description

66. In my opinion, there is no written description support for proposed claim 28. Proposed claim 28 recites, in part, "a resin package comprising a resin part and a metal part, said metal part ***consisting of first and second metal plates***, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface" ([28.A]). Ex. 2020 (Claims Appendix For Proposed

Substitute Claims), 5-6. In my opinion, there is no support in the '940 and '408 applications for Element [28.A] in combination with Elements [28.D], [28.E], [28.F], [28.G], and [28.H], and nothing in Dr. Schubert's cited sections suggests that the applicants were in possession of the claimed subject matter.

67. Dr. Schubert opines that "[t]he JP '408 application and '940 application…provide written support for each of the elements of claim 28 in a single embodiment." Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶86. Dr. Schubert's then "focus[es] [his] attention on the description of the 'Fifth Embodiment.'" *Id*. I disagree that the fifth embodiment provides written description support for claim 28. Dr. Schubert's cited disclosures in the JP '408 and '940 applications pertaining to the fifth embodiment fail to provide a written description of claim 28 at least because the metal part of the fifth embodiment does not "***consist***" of "***first and second*** metal plates" as required by Element [28.A]. Instead, as discussed above, the metal part has a ***third*** separate metal structure. Such a structure does not support proposed claim 28. Moreover, even if the requirement of Element [28.A] was ignored and any two of the metal structures of the fifth embodiment were considered as the claimed "first and second metal plates," the disclosures fail to provide written description support for the combination of Elements [28.D], [28.E], [28.F], [28.G], and [28.H].

68. As explained above, I have been informed that when an applicant uses the term "consisting of" it is understood to be closed-ended and excludes any elements not specified in the claim. Therefore, Element [28.A] is understood to exclude from the metal part any structures that are not the claimed "first and second metal plates." I further understand that Patent Owner's proposed claim 28 would expressly narrow the wording of '071 patent claim 16, which recited "a resin package comprising a resin part and ***a metal part <u>including at least</u> two metal plates***," to instead recite "a resin package comprising a resin part and ***a metal part, said metal part <u>consisting of</u> first and second metal plates***." Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 2. This further confirms that Element [28.A] is understood to exclude from the metal part any structures that are not the claimed "first and second metal plates."

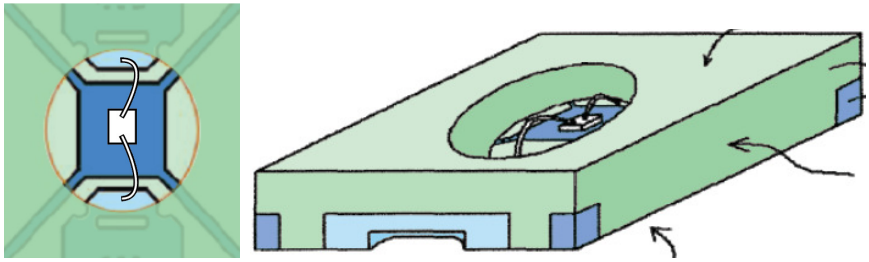
69. A POSITA would have recognized that the metal part of Fig. 12 does not "consist" of "first and second metal plates." For the reasons explained above in Paragraphs 45-50, the metal part of the fifth embodiment does not "consist" of only "first and second metal plates." It includes a third metal structure that is neither the first nor the second metal plate. As shown above, Figure 12 shows that the metal of the resin package in the fifth embodiment is divided into three separate structures: two metal leads in the middle front (light blue) and middle back (not shown) and a third central metal X structure (dark blue) with legs

extending to each corner on which the light emitting element (white) is mounted and connected by wires to the two leads. Therefore, the fifth embodiment fails to satisfy Element [28.A].

70. As explained above, to the extent Patent Owner or Dr. Schubert relies on the applications' recitation that "[i]n the outer side surface 420b of the resin package 420, the leads 422 are separated into six. The leads 422 may be separated respectively, or jointed" (Ex. 2023 (the '940 application) ¶99; Ex. 2022 (JP '408 application) ¶99), this language does not provide the necessary written description to satisfy claim 27. This statement from the applications is ambiguous. To the extent Patent Owner or Dr. Schubert argues that "jointed" means the leads are connected to the third, central metal structure forming the "X," the resulting device would be inoperable because the anode and cathode of the light emitting device would be connected (*i.e.*, shorted) to each other. Furthermore, the specification discloses only that the leads may be jointed at the "***outer side surface 420b***" (instead of separated into six). Ex. 2023 (the '940 application) ¶99; Ex. 2022 (JP '408 application) ¶99. If the devices were "jointed" at the outer side surface 420b, then there would not be resin on left and right sides of the lead and the device would fail to meet the requirements of Elements [28.F] and [28.H]. Thus, the disclosures in Paragraph 99 of the applications do not provide written description support for the device of proposed claim 28.

71. As discussed above, Element [28.A] is not supported by the fifth embodiment which contains three metal structures, and therefore there is no written description support for proposed claim 28. However, to the extent Patent Owner or Dr. Schubert incorrectly relies on two of the three metal structures of Fig. 12 as the claimed "first and second metal plates" to support Element [28.A], despite use of the closed-ended phrase "consisting of" in that element, there is no written description support for several other claim elements.

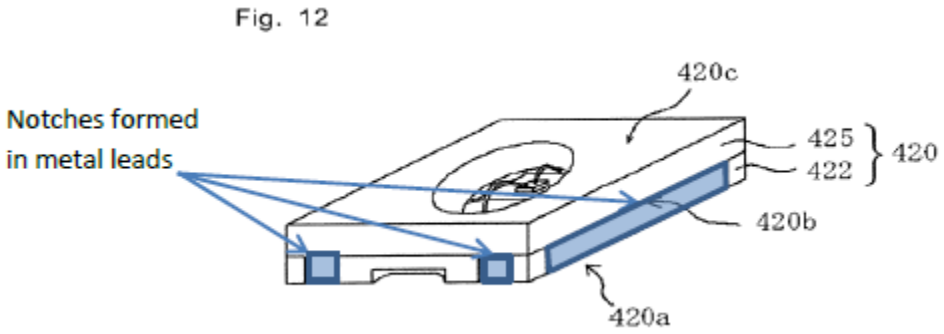
72. ***First***, if the front and rear metal structures (light blue) were the claimed "metal part consisting of first and second metal plates," then the fifth embodiment fails to satisfy the limitations of at least Elements [28.D], [28.E], and [28.G].



73. Element [28.D] recites "wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package." As shown in Figure 12, above, the front and rear metal structures have exposed surfaces on only the front and rear outer lateral surfaces, respectively.

These metal structures does not have any exposed surfaces on the left and right outer lateral surfaces of the resin package. Therefore, the front and rear metal structures have no portion of metal (and are not coplanar with resin) at two of the four outer lateral surfaces.

74. Element [28.E] recites "wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package." The front and rear metal structures fail to satisfy Element [28.E] because the notch on at least two of the outer lateral surfaces of the resin package (the left and right sides) is formed in the central metal structure (dark blue) instead of one of the two metal plates (light blue). Dr. Schubert opines that "Figure 12 … illustrates … a notch that is formed in the metal part at each of the four outer lateral surfaces of the resin package." Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶102. I disagree. Dr. Schubert relies on the following annotated figure:

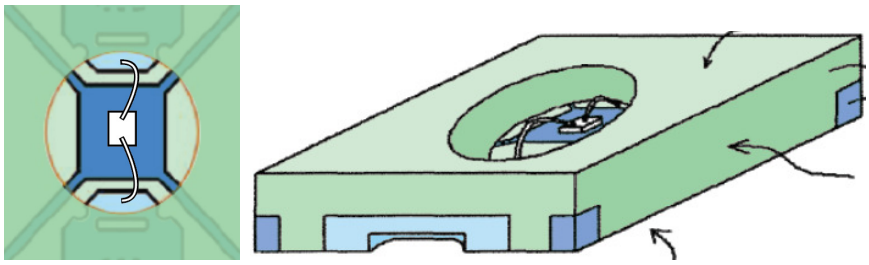


Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶102. However, as explained above, the notches on at least the left and right sides of the resin package are

formed in the third metal structure, rather than one of the two metal plates.

75. Element [28.G] recites "wherein a lower surface of the metal part is exposed from the resin part in at region directly under the light emitting element." In the fifth embodiment, as shown in Figure 12, the central metal structure (dark blue), rather than one of the two metal plates (light blue), is directly under the light emitting element. Therefore, in the situation where the two metal plates (light blue) are alleged to be the "metal part consisting of first and second metal plates," the fifth embodiment fails to disclose Element [28.G].

76. ***Second***, if a front or rear metal structure (light blue) and the central metal structure (dark blue) were the claimed "first and second metal plates," then the fifth embodiment fails to satisfy the limitations of at least Elements [28.F] and [28.H].



77. Element [28.F] recites "wherein, at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate, [and] wherein, at a second of the four outer lateral surfaces of

the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate." While a front or rear metal structure (light blue) has resin located above and at left and right sides, the central metal structure (dark blue) is exposed at only the corners of the resin package, and therefore has no resin located at left and right sides on any of the outer lateral surfaces. Therefore, the combination of a front or rear metal structure (light blue) and the central metal structure (dark blue) would fail to satisfy Element [28.F].

78. Element [28.H] recites "wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the first metal plate, and wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate." In the scenario where it is alleged that a front or rear metal structure (light blue) and the central metal structure (dark blue) are the claimed "metal part consisting of first and second metal plates," the embodiment fails to provide disclosure of Element [28.H] for the same reason discussed above for Element [28.F]. Specifically, while a front or rear metal structure (light blue) has

resin located at left and right sides, the central metal structure (dark blue) is exposed at only the corners of the resin package, and therefore has no resin located at left and right sides on any of the outer lateral surfaces.

79. Dr. Schubert opines that the fifth embodiment provides written description support for Elements [28.D], [28.E], [28.F], [28.G], and [28.H]. Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶¶98-109. However, Dr. Schubert's opinions regarding each of these elements are based on an incorrect interpretation of the fifth embodiment as having only two metal structures. As explained above, the metal part of the fifth embodiment actually has three metal structures, and selecting any two of them as the claimed "first and second metal plates" fails to support claim 28 because no two plates can satisfy the combination of Elements [28.D], [28.E], [28.F], [28.G], and/or [28.H].

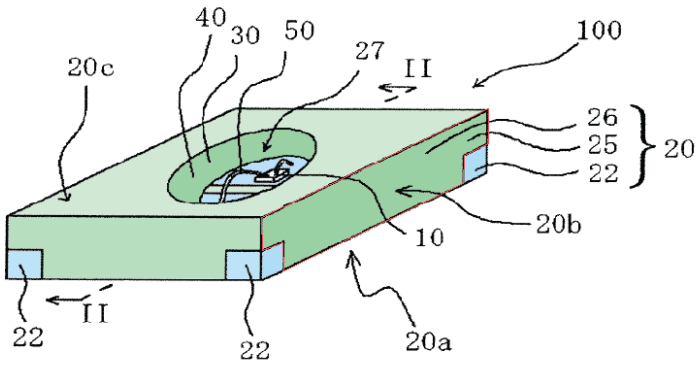
80. Dr. Schubert states that "where I reference descriptions related to the first embodiment below, it is based on my opinion that such descriptions are also applicable to the fifth embodiment" because "[t]he applications explain that for this fifth embodiment, '[d]escription of some configurations employing the substantially same configuration as the light emitting device according to the first embodiment will be omitted where necessary." Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶65 (citing Ex. 2023 (the '940 application) ¶98; Ex. 2022 (JP '408 application) ¶98); *see also* Ex. 2019 (Schubert Decl. Supporting

PO's Motion), ¶¶86-123. As explained above in Paragraphs 61-63, Dr. Schubert's reliance on descriptions from the first embodiment (and any reliance on descriptions from the second, third, fourth, or sixth embodiments) in combination with the fifth embodiment is incorrect.

81. Moreover, setting aside the fifth embodiment, the remaining embodiments all fail to support proposed amended claim 28 at least because they fail to disclose Elements [28.F] and [28.H]. Element [28.F] recites "wherein, at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate, [and] wherein, at a second of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate." And Element [28.H] recites "wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the first metal plate, and wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate." These

limitations are not disclosed by the first, second, third, fourth, or sixth embodiments. For example, as shown in Figure 1 (an in view of the symmetry of the front and rear surfaces), the first embodiment does not have resin located at left and right sides of an exposed outer lateral surface of a metal plate on any of the four outer lateral surfaces.

Fig. 1



Ex. 1001 ('071 patent), Fig. 1; Ex. 2023 (the '940 application), Fig. 1; Ex. 2022 (JP '408 application), Fig. 1. Therefore, the first embodiment fails to disclose Elements [28.F] and [28.H]. The second, third, fourth, and sixth embodiments similarly fail to disclose Elements [28.F] and [28.H]. Ex. 1001 ('071 patent), Figs. 6, 9, 11, 13; Ex. 2023 (same); Ex. 2022 (same).

82. In conclusion, it is my opinion that there is no written description support for proposed independent claim 28 in any of the applications relied on by Patent Owner, and it is invalid under §112, ¶1.

E. Proposed Claim 31 Is Invalid for Lack of Written Description

83. In my opinion, there is no written description support for proposed claim 31. Proposed claim 31 recites, in part, "wherein each of the first and second metal plates includes an etched concave portion on an upper surface of the respective metal plate" (Element [31.B]) and "wherein each of the first and second metal plates includes an etched concave portion on a bottom surface of the respective metal plate" (Element [31.C]). Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 7. In my opinion, there is no support in the '940 and '408 applications for Elements [31.B] and [31.C], and nothing in Dr. Schubert's cited sections suggests that the applicants were in possession of the claimed subject matter. Dr. Schubert identifies "etched concave portions from … Figure 11" in support of these elements. Ex. 2019 (Schubert Decl. Supporting PO's Motion), ¶¶115-119. However, as explained in Paragraphs 26-28 of my Declaration In Support of Petitioner's Reply to Patent Owner's Response in IPR2018-00386 (IPR2018-00386, Ex. 1017), a POSITA would have understood that the etched concavity/convexity shown in Figure 11 is actually a side surface, and is a different surface distinct from the upper or lower surface. Thus, it is my opinion that there is no written description support for claim 31, and the claim is invalid under §112, ¶1.

84. In addition, proposed claim 31 depends from claim 29, which in turn depends from claim 28. As explained above, there is no written description support for claim 28. Therefore, because claim 28 is invalid under §112, ¶1 for lack of written description, dependent claim 31 is also invalid.

F. Proposed Claims 29, 30, 32-34 Are Invalid for Lack of Written Description

85. Proposed claims 29, 30, and 32-34 all depend directly or indirectly from claim 28. As explained above, there is no written description support for claim 28. Therefore, because claim 28 is invalid under §112, ¶1 for lack of written description, dependent claims 29, 30, and 32-34 are also invalid.

VII. THE PROPOSED CLAIM AMENDMENTS IMPROPERLY ENLARGE THE SCOPE OF THE CLAIMS

A. Legal Standard

86. I have been instructed that a claim amendment in an *inter partes* review proceeding may not enlarge the scope of a claim. I have been further instructed that a claim is broadened if it is broadened in any respect, even though it may be narrower in other respects. As explained below, it is my opinion that Patent Owner's proposed amendments to independent claims 27 and claim 28 would enlarge the scope of claims 15 and 16, respectively, and are therefore improper.

B. Proposed Claim 27 Is Improperly Enlarged

87. Proposed claim 27 includes the amendment: "first and second metal leads … ~~part including first and second metal plates.~~" Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 1. This amendment replaces the term "metal plate" with the broader term "metal lead." Under the proposed amended claim, a resin package with metal leads that are not "metal plates" would be within the scope of proposed claim 27, while they would not be within the scope of '071 patent claim 15 which requires "metal plates." For example, under the heading of "(Lead and Lead Frame)," the '071 specification explains that "a metal plate" is "a flat plate shape … which [may have] differences in level or concavity and convexity." Ex. 1001 ('071 patent), 9:21-24; Ex. 2023 (the '940 application) ¶46; Ex. 2022 (JP '408 application) ¶46. In contrast, metal leads are not so limited. Thus, Patent Owner's proposed amendment would improperly enlarge the scope of claim 27.

C. Proposed Claim 28 Is Improperly Enlarged

88. Patent Owner's proposed claim 28 includes the amendment: "wherein, at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part ~~is~~ are located above and at left and right sides of an exposed outer lateral surface of the first metal plate, ~~a portion of the metal part at least two of the four outer lateral surfaces of the resin package, and~~ wherein, at a

second of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate." Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 2. This amendment broadens the claim by replacing the term "the resin part" with the term "***portions*** of an outer lateral surface of the resin part." '071 patent claim 16 recites "***the resin part*** is located at left and right sides of a portion of the metal part at least two of the four outer lateral surfaces." Ex. 1001 ('071 patent), 20:65-67. In contrast, PO's proposed amended claim recites "at a [first/second] of the four outer lateral surfaces of the resin package, ***portions*** of an outer lateral surface ***of the resin part*** are located above and at left and right sides of an exposed lateral surface of the [first/second] metal plate." Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 2. In the proposed amendment, the recited spatial requirement is now limited to just "portions" of the resin part. Thus, PO's proposal would improperly enlarge the scope of claim 28.

D. Proposed Claims 29-34 Are Improperly Enlarged

89. Proposed claims 29-34 all depend directly or indirectly from claim 28. As explained above, Patent Owner's proposed amendment would enlarge the scope of claim 28. In addition, I have been instructed that a claim is broadened if it is broadened in any respect, even though it may be narrower in other respects.

Claims 29-34, depending from claim 28, do not further limit the scope of the amended term: "portions of an outer lateral of the resin part are located above and at left and right sides of an exposed lateral surface of the [first/second] metal plate." Ex. 2020 (Claims Appendix For Proposed Substitute Claims), 2-4. Therefore, because the scope of claim 28 is improperly enlarged, dependent claims 29-34 are also improperly enlarged.

VIII. THE PROPOSED SUBSTITUTE CLAIMS 27-34 ARE UNPATENTABLE

90. My understanding of the applicable legal standards for 35 U.S.C. §103 is discussed in my January 12, 2018 Declaration. Ex. 1003 (January 12, 2018 Declaration) ¶¶ 56-61. I have concluded that each of proposed substitute claims 27-34 is unpatentable at least under 35 U.S.C. § 103 based on the references described below.

A. The Proposed Substitute Claims 27-34 Are Unpatentable Under § 103 Over Hsu, Koung, Urasaki, Suenaga, Mori, Glenn, Wang and/or Oshio

91. In my expert opinion, for the reasons detailed in this Declaration, a POSITA would have recognized that each and every limitation of proposed substitute claims 27-34 of the '071 patent, combined as claimed, is disclosed or suggested by the prior art. Specifically, it is my opinion that proposed substitute claims 27-34 of the '071 patent are unpatentable over Ex. 1030 (Hsu) in view of the knowledge of a POSITA, Ex. 1008 (Koung), Ex. 1031 (Urasaki), Ex. 1033

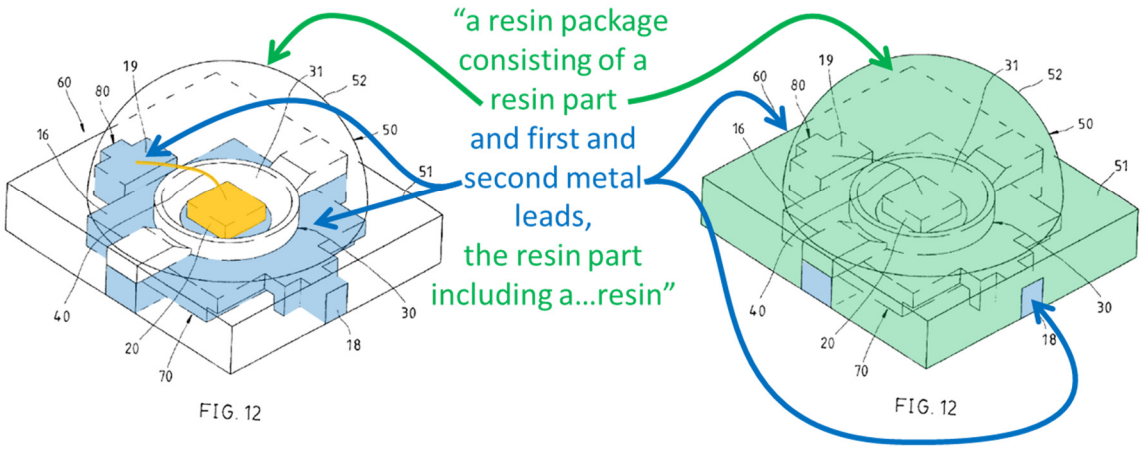
(Suenaga), Mori (Ex. 1005), Ex. 1034 (Glenn), Wang (Ex. 1006), and/or Oshio (Ex. 1007) based on the below grounds, as further discussed herein.

Ground	Prior Art	Basis	Claims Challenged
Ground 1	Hsu in view of the knowledge of a POSITA	103	27-29
Ground 2	Hsu in view of Urasaki	103	27, 29
Ground 3	Hsu in view of Koung and Urasaki	103	27, 29
Ground 4	Hsu in view of Koung	103	28
Ground 5	Hsu in view of Suenaga	103	30
Ground 6	Hsu in view of Koung and Suenaga	103	30
Ground 7	Hsu in view of Koung, Urasaki, Mori, and Glenn	103	31
Ground 8	Hsu in view of Wang, Oshio	103	32, 33
Ground 9	Hsu in view of Koung, Wang, and Oshio	103	32-34

1. Overview of U.S. Patent No. 6,770,498 ("Hsu")

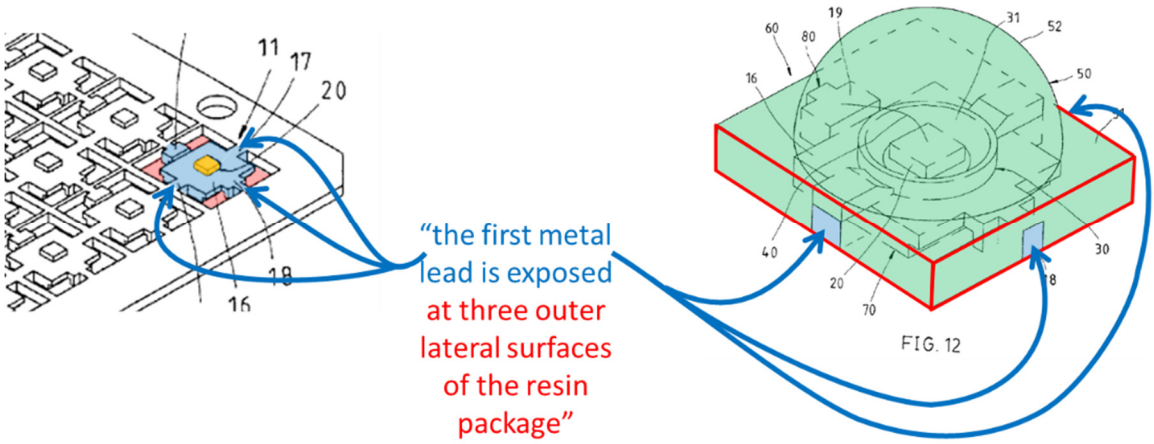
92. Ex. 1030 (Hsu) issued August 3, 2004, and I understand it is prior art to the '071 patent.

93. Hsu generally discloses a light emitting device comprising a light emitting element (shown in orange in Figure 12, item 20) and a resin package (*e.g.*, Figure 12, item 60) consisting of a resin part (shown in green in Figure 12, items 30, 50), and first and second metal leads (shown in blue in Figure 12, items 70, 80). *E.g.*, Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:56-2:14, 2:17-44, 2:48-3:22, 3:43-67, 4:1-38, cls. 1, 3-4, Figs. 1-12.



Ex. 1030 (Hsu), Fig. 12.

94. In particular, Hsu discloses an "LED package 60" with four outer lateral surfaces as shown in Figure 12. Ex. 1030 (Hsu), 4:1-38. Package 60 comprises "an encapsulant 50 [formed] on each of the cells 11 of the frame 10 with epoxy resin by means of the injection molding technique" and "a reflecting ring 30, which is bonded on each of the main plates 16 of the frame 10, with plastic materials by means of injection molding technique." *Id.*, 3:23-36, 3:43-45. The package 60 includes "a first terminal 70" and "a second terminal 80" which are "made of an electrically conductive metal" and formed when the "frame 10" is "[c]ut…such that LED packages 60 are made." *Id.*, 3:64-4:13. Therefore, Hsu's two-lead structure provides stability with respect to the resin. The "first terminal 70" is exposed at three outer lateral surfaces of the resin package. *Id.*, 4:5-7, Figs. 4, 12.



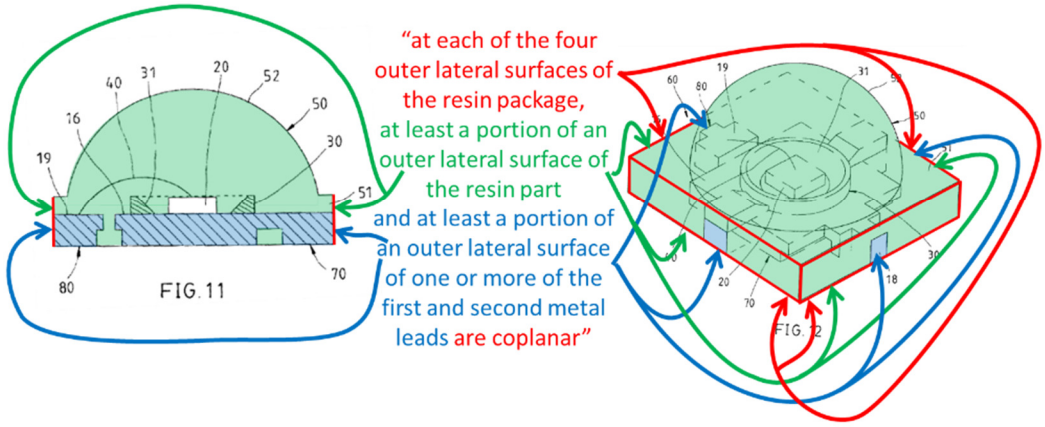
Ex. 1030 (Hsu), Figs. 4, 12.

95. All upper edges of the first and second terminals are coplanar. *Id.*, Figs. 3, 5, 7, 9, 11. Hsu further discloses, "The LED die 20 has a bottom, which is smoothly bonded to a top surface of the main plate 16 of the first terminal 70 such that an electrode at the bottom of the LED die 20 is electrically connected to the first terminal 70….The conductive wire 40 is connected between the other electrode of the top surface of the die 20 and the top surface of the second terminal 80." *Id.,* 4:13-24.

96. Hsu further discloses that the first and second metal leads include notches located at each of the four outer lateral surfaces of the resin package. Ex. 1030 (Hsu), Figs. 4, 12. Hsu describes that during "molding," resin is filled in the notches to form "encapsulant 50" and "rectangle base 51" which "covers the surface of the frame 10 with a predetermined thickness." *Id.* 3:43-54. Hsu explains, "All the bases 51 of the encapsulants 50 are integrated together initially, so that the

encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11 but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, the base 51 is higher than the frame 10…." *Id.* After "molding," the resin and lead frame are cut along the notches "according to the size of each of the cell," thus forming a resin part and metal part that are coplanar at four outer lateral surfaces. *Id.* 3:64-67, Figs. 4, 10-12.

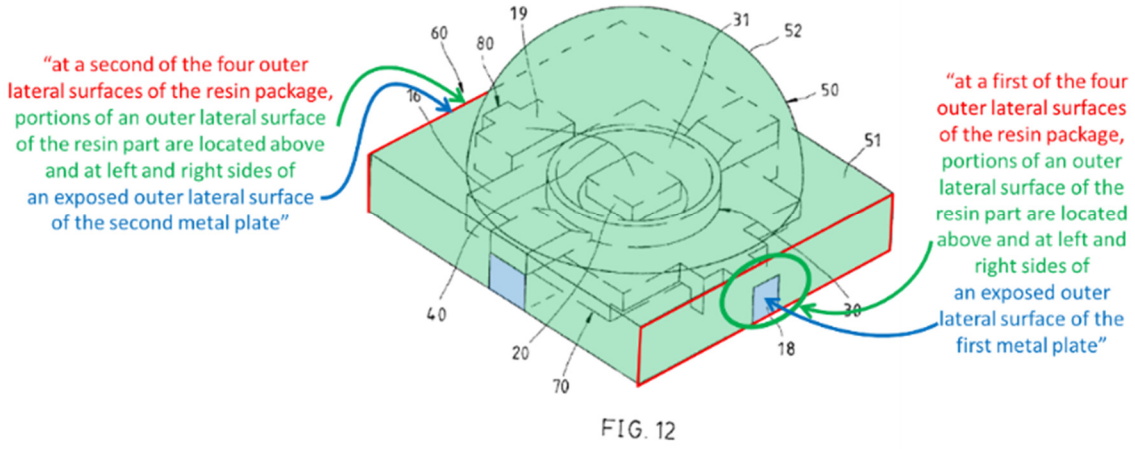
97. As shown in Figures 11-12 below, Hsu discloses that at least a portion of an outer lateral surface of the resin part (shown in green) and at least a portion of an outer lateral surface of the metal part (shown in blue) are coplanar at each of the four outer lateral surfaces (outlined in red) of the resin package.



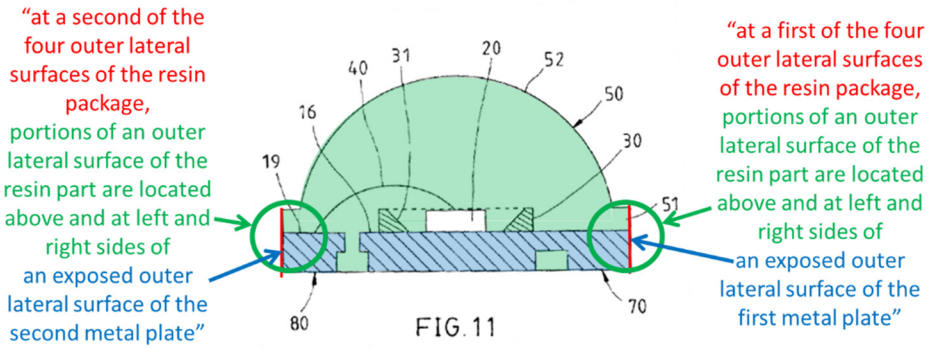
Ex. 1030 (Hsu), Figs. 11-12.

98. Figures 11 and 12 additionally show that the resin package has a concave portion with a bottom surface. Ex. 1030 (Hsu) 3:22-30 (disclosing "The

reflecting ring 30…surrounds the die 20 and has an inner surface 31, which is a slope facing upward with an angle of 45° to reflect the light emitted by the die 20."); *see also* Fig. 7. As shown in Figures 11-12 below, Hsu further discloses that the resin part (shown in green) is located above and at left and right sides of exposed surfaces of the first and second metal leads (shown in blue) at first and second outer lateral surfaces (outlined in red) of the resin package.



Ex. 1030 (Hsu), Fig. 12.



Ex. 1030 (Hsu), Fig. 11.

99. Also as shown in Figs. 11-12, Hsu discloses that the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first and second metal plates are integrally formed and are coplanar with the exposed outer lateral surfaces of the first and second metal plates.

100. Figure 11 further shows that at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package. *Id.*, Fig. 11. Figure 11 further shows that a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element. *Id.*

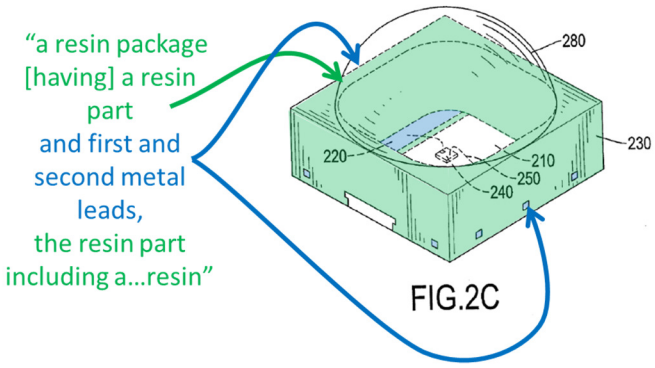
101. Hsu is analogous art to the '071 patent at least because it is in the same field of endeavor as the '071 patent and is reasonably pertinent to the problem purportedly solved by the '071 patent. The '071 patent is in the field of endeavor of "semiconductor" technology, including manufacturing and packaging processes for a "light emitting device." *E.g.*, Ex. 1001 ('071 patent), 1:18-36. Hsu is in the same field of endeavor and discloses, for example, "a process for fabricating a light emitting diode (LED) package and the structure of the LED package." *E.g.*, Ex. 1030 (Hsu), 1:7-10; 4:1-38. Furthermore, the '071 patent is directed to the purported problem of providing "[a] light emitting device using light emitting elements [that] is small, provides good power efficiency, and emits

light of bright color" and "improve[d] adhesion between the lead frame and the thermosetting resin." Ex. 1001 ('071 patent), 1:18-36, 2:32-37, 3:51-55, 5:17-21, 3:26-30, 3:28-4:10. Hsu is reasonably pertinent to the '071 patent's purported problem and discloses, for example, that "the LED package 60 of the present invention is provided with excellent efficiency of thermal dissipation so as to be durable for a long time." *E.g.*, Ex. 1030 (Hsu), 4:47-50, 1, 52-55.

2. Overview of U.S. Patent Publication No. 2008/0261339 ("Koung")

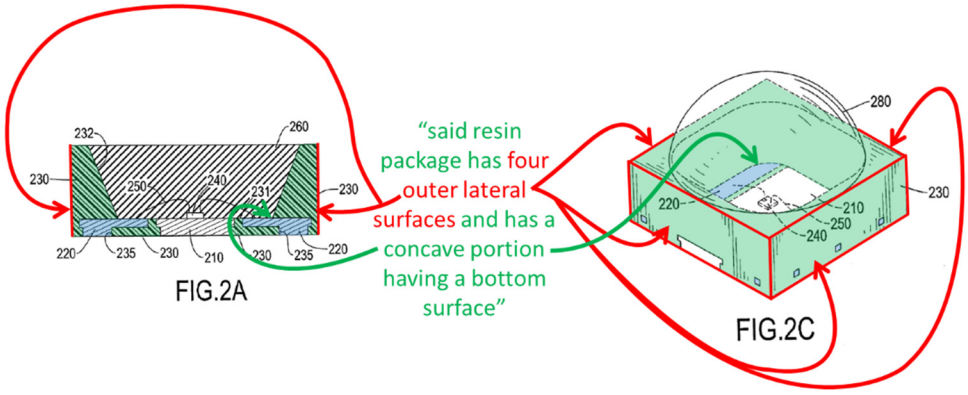
102. Ex. 1008 (Koung) published October 23, 2008, and I understand it is prior art to the '071 patent.

103. Koung generally discloses a light emitting device comprising a light emitting element (*e.g.*, Figures 2A and 2C, item 240) and a resin package (*e.g.*, shown in Figures 2A, 2C) having a resin part (shown in green in Figures 2A and 2C, item 230), and first and second metal leads (shown in blue in Figures 2A and 2C, items 220). *E.g.*, Ex. 1008 (Koung), Abstract, ¶¶ 2, 7-8, 11-22, 24, 28-29, 32, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F.



Ex. 1008 (Koung), Fig. 2C.

104. In particular, Koung discloses a "package for a high-power light emitting diode" with four outer lateral surfaces and a concave portion as shown in Figures 2A and 2C. Ex. 1008 (Koung) ¶¶ 11-14. The resin package has a concave portion with a bottom surface. Ex. 1008 (Koung) ¶ 21 (disclosing, "Each reflective base (230) has a recess (233).").



Ex. 1008 (Koung), Figs. 2A, 2C.

105. The package comprises a "reflective base 230" made of "resin" formed by "injection-compression molding." Ex. 1008 (Koung) ¶¶ 21, 30. The

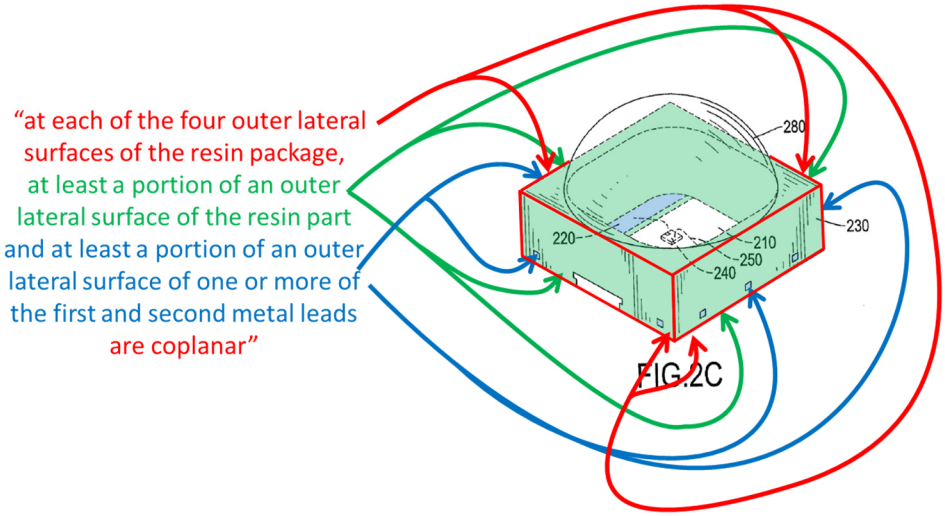
package includes a "pair of electrodes (220)" formed by "treating the metal board (300) using etching or machining (such as punching)" and "cutting off the after-packaging board (303) to form multiple individual high-power LED packages (330)." Ex. 1008 (Koung) ¶¶ 18, 20, Figs. 2A-D, 4B, 4F. Each electrode of the "pair of electrodes (220)" is exposed at three outer lateral surfaces of the resin package. *Id.*, Figs. 2B, 4B, 4F. All upper edges of the "pair of electrodes (220)" are coplanar. *Id.*, 2A-B, 4A-B. Koung further discloses "attaching LED chips (240)…and bonding conductive wires (250) in each corresponding reflective base (230)" "to connect electrically to the electrodes (220)." *Id.,* ¶¶ 18, 22.

106. Koung further discloses that the electrodes 220 include notches located at each of the four outer lateral surfaces of the resin package. Ex. 1008 (Koung), Figs. 2C, 2B, 4B-D. Koung describes that during "molding," resin is filled in the notches to form "reflective bases (230)." *Id.* ¶¶ 18, 21. After "molding," the resin and lead frame are cut along the notches, thereby "separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs" and forming a resin part and metal part that are coplanar at four outer lateral surfaces. *Id.* 24, Figs. 2B-C, 4B, 4F.

107. As shown in Figure 2C below, Koung discloses that at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral

surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package.

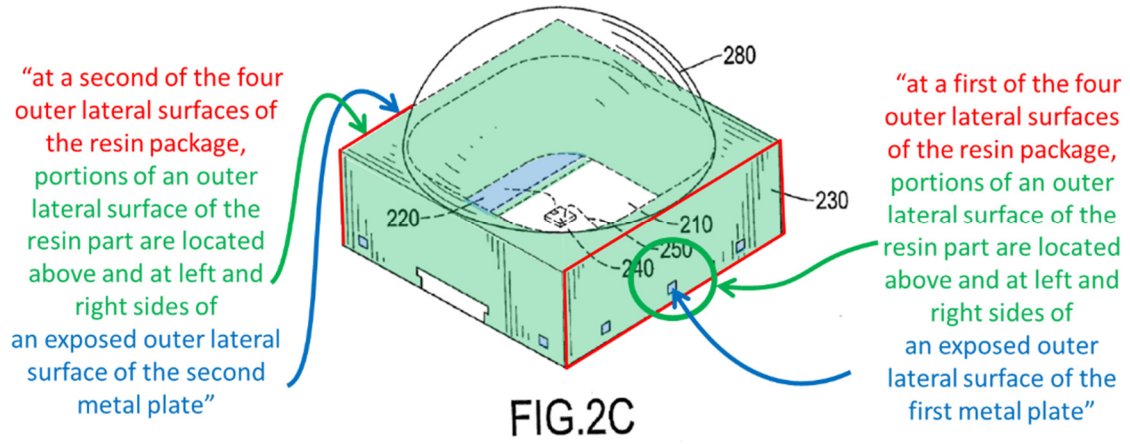
108. As shown in Figure 2C below, Koung discloses that at least a portion of an outer lateral surface of the resin part (shown in green) and at least a portion of an outer lateral surface of the metal part (shown in blue) are coplanar at each of the four outer lateral surfaces (outlined in red) of the resin package.



Ex. 1008 (Koung), Fig. 2C.

109. As shown in Figure 2C below, Koung further discloses that the resin part (shown in green) is located above and at left and right sides of exposed surfaces of the first and second metal leads (shown in blue) at first and second

outer lateral surfaces (outlined in red) of the resin package.



Ex. 1008 (Koung), Fig. 2C.

110. Also as shown in Fig. 2C, Koung discloses that the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first and second metal plates are integrally formed and are coplanar with the exposed outer lateral surfaces of the first and second metal plates.

111. Figure 2B further shows that at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package. *Id.*, Figs. 2B, 2D. Figure 2B further shows that a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element. *Id.*

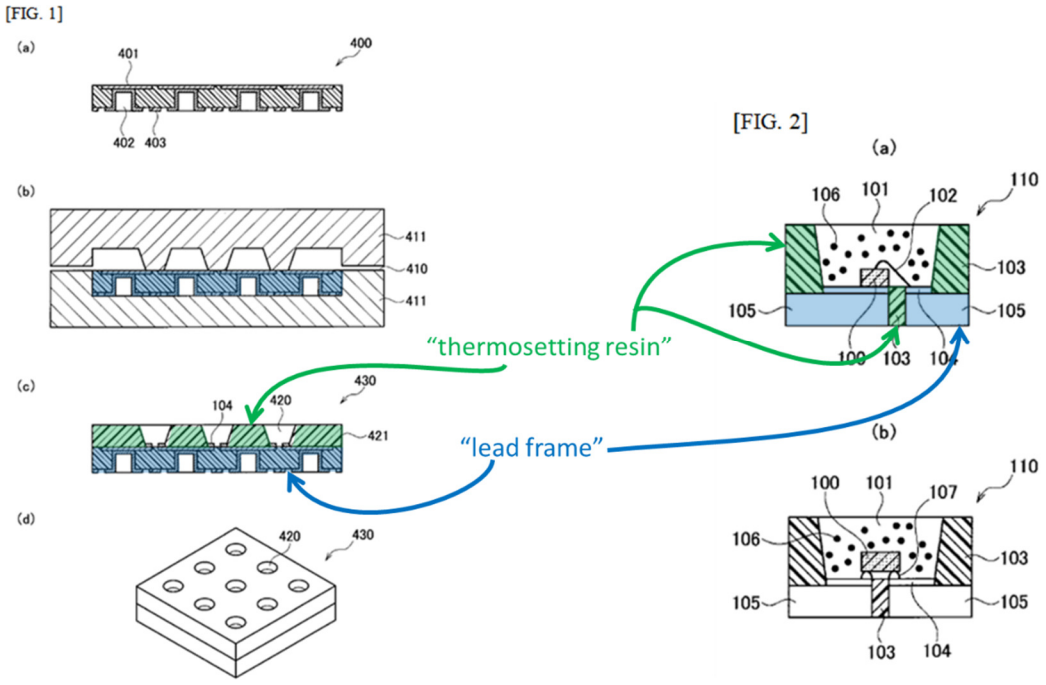
112. Koung is analogous art to the '071 patent at least because it is in the same field of endeavor as the '071 patent and is reasonably pertinent to the

problem purportedly solved by the '071 patent. The '071 patent is in the field of endeavor of "semiconductor" technology, including manufacturing and packaging processes for a "light emitting device." *E.g.*, Ex. 1001 ('071 patent), 1:18-36. Koung is in the same field of endeavor and discloses, for example, "[a] packaging method to manufacture a package for a high-power light emitting diode (LED)." *E.g.*, Ex. 1008 (Koung), Abstract, ¶ 2. Furthermore, the '071 patent is directed to the purported problem of providing "[a] light emitting device using light emitting elements [that] is small, provides good power efficiency, and emits light of bright color" and "improve[d] adhesion between the lead frame and the thermosetting resin." Ex. 1001 ('071 patent), 1:18-36, 2:32-37, 3:51-55, 5:17-21, 3:26-30, 3:28-4:10. Koung is reasonably pertinent to the '250 patent's purported problem and discloses, for example, "provid[ing] a packaging method that can save time and cost" and providing a "high-power light emitting diode (LED)." Ex. 1008 (Koung) ¶¶ 25, 28, 2, 8.

3. Overview of Japanese Patent Publication No. 2007-235085 ("Urasaki")

113. Ex. 1031 (Urasaki) published September 13, 2007, and I understand it is prior art to the '071 patent. Urasaki is referenced as "Background Art" in the '071 patent. Ex. 1001, ('071 patent), 2:15-45.

114. Urasaki discloses a method for manufacturing multiple light emitting diode packages. Ex. 1031 (Urasaki), Abstract, ¶¶ 1, 3. Urasaki discloses forming a resin package by providing a lead frame (shown in blue) and molding "a light reflecting thermosetting resin" (shown in green) on the lead frame. Ex. 1031 (Urasaki) ¶¶ 17, 23-25, Figs. 1-2. Urasaki additionally discloses cutting to form individual light emitting diode packages comprising a resin part and first and second metal leads, providing an optical semiconductor element in a concave portion of the resin package, and covering the optical semiconductor element with a transparent sealing resin containing a "known phosphor." Ex. 1031 (Urasaki) ¶¶ 1, 23, 36-38, Figs. 1-6.



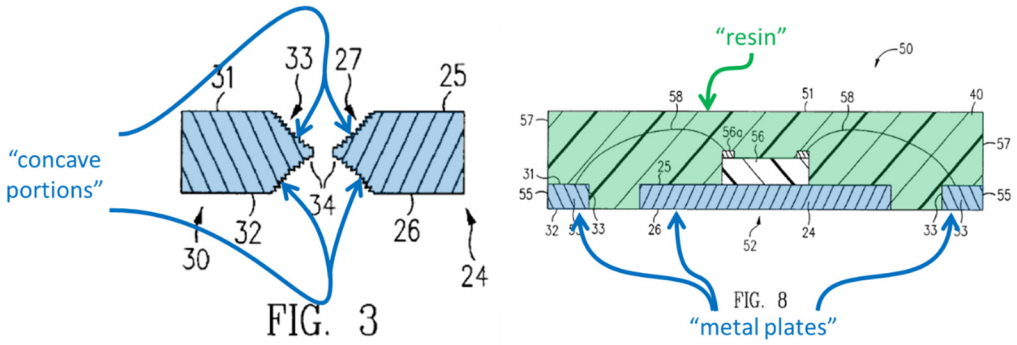
Ex. 1031 (Urasaki), Figs. 1-2.

115. Urasaki is analogous art to the '071 patent at least because it is in the same field of endeavor as the '071 patent and is reasonably pertinent to the problem purportedly solved by the '071 patent. The '071 patent is in the field of endeavor of "semiconductor" technology, including manufacturing and packaging processes for a "light emitting device." *E.g.*, Ex. 1001 ('071 patent), 1:18-36. Urasaki is in the same field of endeavor and discloses, for example, "[a] method of manufacturing a package substrate for mounting an optical semiconductor element," such as a "[l]ight emitting diode[] (LED[])." *E.g.*, Ex. 1031 (Urasaki), Abstract, ¶ 3. Furthermore, the '071 patent is directed to the problem of providing "[a] light emitting device using light emitting elements [that] is small, provides good power efficiency, and emits light of bright color" and "provid[ing] a simple and low-cost method for manufacturing, in a short time, multiple light emitting devices which has high adhesion between a lead frame and a thermosetting resin composition." Ex. 1001 ('071 patent), 1:26-28, 2:32-37, 3:26-30. Urasaki is reasonably pertinent to the '071 patent's purported problem and discloses, for example, "a method for manufacturing package substrate for mounting an optical semiconductor element, the method thereof enabling cost reductions and improvements in productivity through the reduction of lead time and the number of members and steps that are used…" and providing a "package substrate" with "minimal warping" and "excelling particularly in reflectance…." Ex. 1031 (Urasaki) ¶¶ 8, 21-22.

4. Overview of U.S. Patent No. 6,433, 277 ("Glenn")

116. Ex. 1034 (Glenn) issued August 13, 2002, and I understand it is prior art to the '071 patent.

117. Glenn generally discloses a semiconductor device comprising a semiconductor element (*e.g.*, Figure 8, item 56) and a resin package (*e.g.*, Figure 8, item 50) having a resin part (shown in green in Figure 8, item 40), and metal plates (shown in blue in Figures 3 and 8, items 24, 53). *E.g.*, Ex. 1034 (Glenn), Abstract, 1:14-16, 8:25-9:35, cls. 1, 8, 11, 17, 21, Figs. 2-3, 7-9, 11. In particular, Glenn discloses that the metal plates include etched concave portions, which "function as encapsulant fasteners or lead locks." Ex. 1034 (Glenn), 2:53-61, 4:47-60 ("[T]he upper and lower portions of side surfaces 27 and 33 are reentrant such that there is a central peak 34 which extends outward from side surfaces 27 and 33 of die pad 24 and tab 30, respectively.")



Ex. 1034 (Glenn), Figs. 3, 8.

118. Glenn is analogous art to the '071 patent at least because it is in the same field of endeavor as the '071 patent and is reasonably pertinent to the problem purportedly solved by the '071 patent. The '071 patent is in the field of endeavor of "semiconductor" technology, including manufacturing and packaging processes using lead frames and resin. *E.g.*, Ex. 1001 ('071 patent), 1:18-36, 3:26-30. Glenn is in the same field of endeavor and discloses, for example, "improved plastic packages" and "leadframes and methods for making such packages." *E.g.*, Ex. 1034 (Glenn), 1:64-2:3. Furthermore, the '071 patent is directed to the problem of "provid[ing] a simple and low-cost method for manufacturing, in a short time, multiple light emitting devices which has high adhesion between a lead frame and a thermosetting resin composition." Ex. 1001 ('071 patent), 1:26-28, 2:32-37, 3:26-30. Glenn is reasonably pertinent to the '071 patent's purported problem and discloses, for example, packages that "are easier and less expensive to make than conventional plastic packages, and are more reliable and efficiently-sized than conventional packages" and providing a "connection" between resin and metal that is "enhanced by…reentrant portions" of the metal. Ex. 1034 (Glenn) 1:64-2:25, 2:54-60.

119. A POSITA would have understood that Glenn's teachings of etching metal lead frames for integrated circuits are applicable to etching metal lead frames for light emitting devices. Indeed, Patent Owner recognized that Glenn's teachings

were analogous when it cited Glenn in an Information Disclosure Statement during prosecution of the '071 patent. Ex. 1002 ('071 File History), 87. Further, Patent Owner's expert Dr. Schubert recognized that "principles of etching" are broadly applicable across disparate materials and types of devices when he cited a document that discussed etching of semiconductor thin films (*e.g.*, Si, GaAs) for integrated circuit manufacturing to support his discussion on etching metal lead frames for light emitting devices. Ex. 2008 (Schubert Declaration In Support of Patent Owner's Response), 11 n.2. Thus, a POSITA would have looked to Glenn's express teachings of using etched curved concave portions on the metal plates to enhance adhesion between resin and metal plates, when approaching the problem purportedly solved by the '071 patent. Accordingly, Glenn is analogous art to the '071 patent at least because it is in the same field of endeavor as the '071 patent and is reasonably pertinent to the problem purportedly solved by the '071 patent.

5. Overviews of Mori, Wang, and Oshio

120. Overviews of U.S. Patent Publication No. 2005/0211991 ("Mori") (Ex. 1005), U.S. Patent Publication No. 2008/0073662 ("Wang") (Ex. 1006), and U.S. Patent Publication No. 2005/0280017 ("Oshio") (Ex. 1007) are discussed in the January 12, 2018 Declaration. Ex. 1003 (January 12, 2018 Declaration) ¶¶ 69-80.

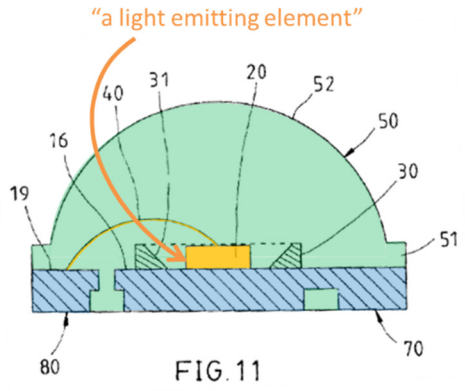
6. Invalidity of Proposed Substitute Claim 27 Over Hsu in view of the Knowledge of a POSITA (Ground 1); Hsu in view of Urasaki (Ground 2); and Hsu in view of Koung and Urasaki (Ground 3)

a. Element 27.Pre: "A light emitting device comprising"

121. To the extent that the preamble is limiting, **Hsu discloses "[a] light emitting device comprising."** For example, Hsu discloses, "The present invention relates generally to photoelectric semiconductor, and more particularly to a process for fabricating *a light emitting diode (LED) package and the structure of the LED package*." Ex. 1030 (Hsu), 1:7-10, *see also, e.g.*, Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-57, 3:12-22, 4:1-38, cls. 1-5, Figs. 1-12.

b. Element 27.A: "a light emitting element"

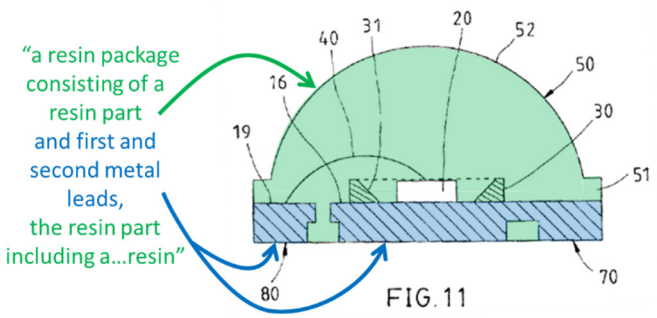
122. **Hsu discloses: "a light emitting element."** For example, Hsu discloses a light emitting element (*e.g.*, "LED die 20," shown in orange in Fig 11 below). *E.g.*, Ex. 1030 (Hsu), Fig. 11. For example, Hsu discloses "Step 2: Referring to FIGS. 4-5, *a white LED die 20* is bonded on a top surface of each of the main plates 16 of the frame 10 by means of silver adhesives (not shown)." Ex. 1030 (Hsu), 3:11-13, *see also, e.g.*, Abstract, 1:7-10 ("a light emitting diode (LED) package"), 1:13-48, 1:52-2:14, 2:17-44, 2:48-57, 3:12-22, 4:1-38, cls. 1, 4, Figs. 1, 4-12.



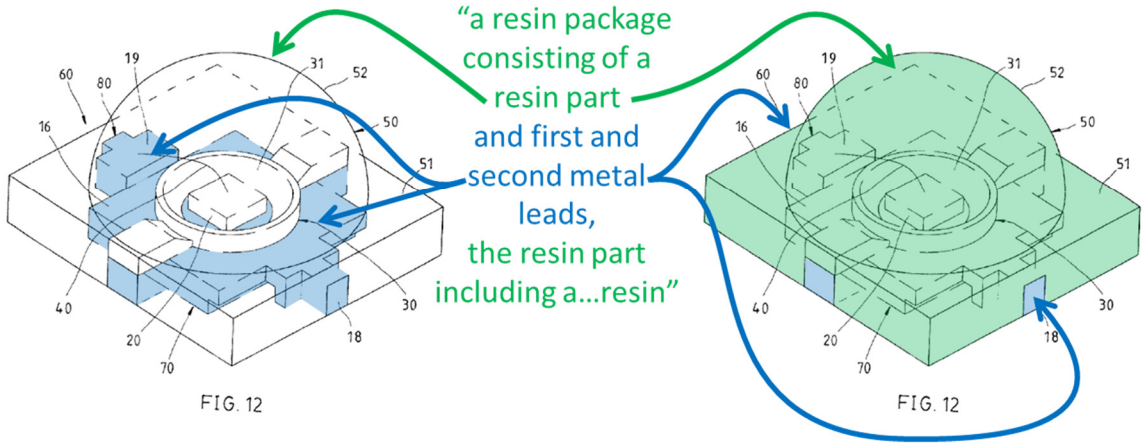
Ex. 1030 (Hsu), Fig. 11.

c. Element 27.B: "a resin package consisting of a resin part and first and second metal leads, the resin part including a thermosetting resin"

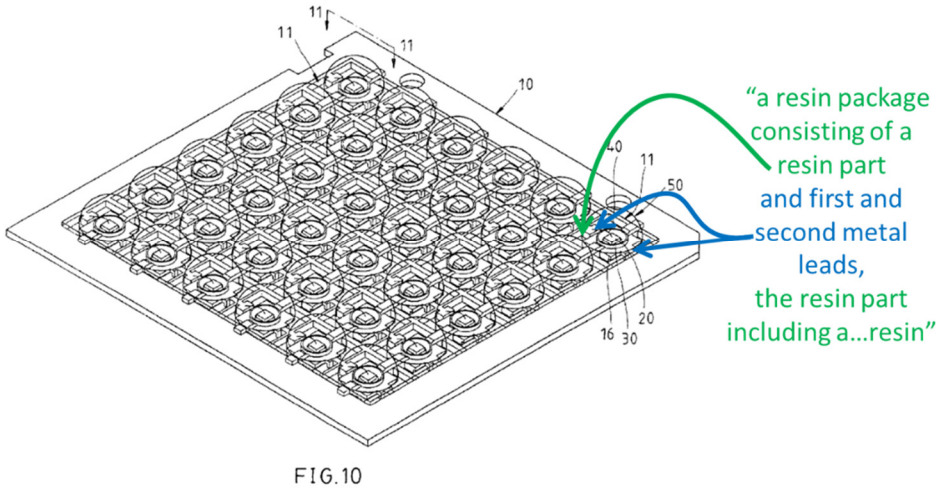
123. **Hsu discloses: "a resin package consisting of a resin part and first and second metal leads, the resin part including a…resin."** For example, Hsu discloses a resin package (*e.g.*, "LED 60 package," shown in Figs. 10-12 below) consisting of a resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Figs. 11-12 below) and first and second metal leads (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 11-12 below). *E.g.*, Ex. 1030 (Hsu), 4:1-9, Figs. 11-12.



Ex. 1030 (Hsu), Fig. 11.



Ex. 1030 (Hsu), Fig. 12.



Ex. 1030 (Hsu), Fig. 10.

124. Hsu also discloses, "Step 3: Referring to FIGS. 6-7, form *a reflecting ring 30,…with plastic materials*…." Ex. 1030 (Hsu), 3:23-30. Hsu also discloses, "form *an encapsulant 50* on each of the cells 11 of the frame 10 *with epoxy resin* by means of the injection molding technique." Ex. 1030 (Hsu), 3:43-63. Hsu

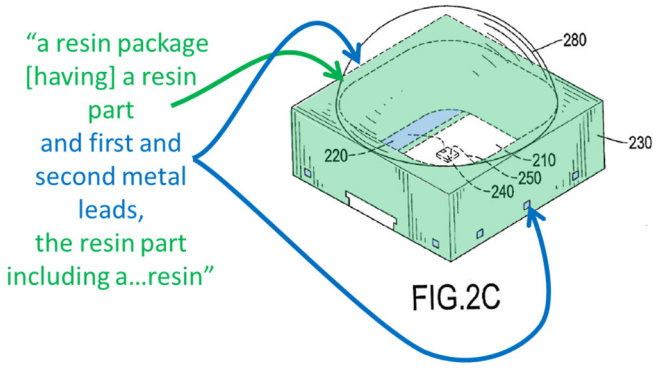
further discloses, "*Cut the frame 10 according to the size of each of the cell 11*,…*such that LED packages 60 are made*." Ex. 1030 (Hsu), 3:64-67. Additionally, Hsu discloses, "Referring to FIGS. 11-12, *the LED 60 package* made by the foregoing fabricative process structurally includes *a first terminal 70, a second terminal 80*, the LED die 20, *the reflecting ring 30*, the conductive wire 40, and *the encapsulant 50*." Ex. 1030 (Hsu), 4:1-5. Hsu also discloses, "[T]he first terminal 70 is made of an electrically conductive *metal*. The second terminal 80…is…made of the same electrically conductive *metal*." Ex. 1030 (Hsu), 4:8-13. *see also, e.g.*, Abstract, 1:7-10, 1:13-48, 1:56-2:14, 2:17-44, 2:48-3:22, 3:43-67, 4:1-38, cls. 1, 3, Figs. 1-12.

125. It would have been obvious to a POSITA and a straightforward and beneficial design choice, to include a thermosetting resin in forming the resin part of the resin package taught by Hsu. Hsu discloses molding using "epoxy resin." Ex. 1030 (Hsu) 3:43-63. A POSITA would have understood that including thermosetting resin (*e.g.*, epoxy resin) beneficially allows for molding of resin parts having better mass producibility, heat resistance, light resistance, and adhesion as compared to non-thermoset resins. *See, e.g.*, Ex. 1032 (Kuramoto) ¶¶ 10 ("the first resin molding forms a concave part having a bottom surface and a side surface"; "a second resin molding which covers the light emitting element"; "the first resin molding and second resin molding are thermosetting resins"), 52

("The thermosetting resin, first thermosetting resin and second thermosetting…make[] it possible to manufacture surface mounted light emitting devices with good mass producibility. Furthermore, because of the ample flowability and ease of heating and curing, it becomes possible to provide surface mounted light emitting devices with excellent moldability and excellent heat resistance and light resistance."), 73 ("The material of the first resin molding 40 is a thermosetting resin. It is preferably formed from at least one *thermosetting resin selected from the group consisting of epoxy resin*, modified epoxy resin…."), 87 ("The material of the second resin molding 50 is a thermosetting resin. It is preferably formed from at least one *thermosetting resin selected from the group consisting of epoxy resin*, modified epoxy resin…."), 135 ("[B]oth the first resin molding 40 and second resin molding 50 can be molded from *thermosetting resin*, making it possible to provide a surface mounted light emitting device with *high adhesion*."); Ex. 1004 (Loh) ¶¶ 103 ("Examples of thermoset materials are epoxy resins…."); 80, 93-100. In addition, as the '071 patent itself admits, it was "conventional" to include a thermosetting resin in manufacturing an LED package prior to the claimed priority date. *E.g.*, Ex. 1101, 2:15-45, Figs. 18, 19; Ex. 1031 (Urasaki), Abstract, ¶¶ 23-25, 34, Figs. 1-6; Ex. 1032 (Kuramoto) ¶¶ 40, 121, 123, 135, 138, 140, Fig. 10; Ex. 1004 (Loh) ¶¶ 80, 93-100, 103; Ex. 1003 (January 12, 2018 Declaration) ¶¶ 109-110. A POSITA would have found it routine and

straightforward to include a thermosetting resin in forming the resin part of the resin package taught by Hsu, and it would have been clear that doing so would work and provide the expected functionality.

126. To the extent it is argued further disclosure of a resin part is required, **Koung discloses: "a resin package [having] a resin part and first and second metal leads, the resin part including a…resin."** For example, Koung discloses a resin package (*e.g.*, "substrate (200)," shown in Figs. 2B-C, 4F below) having a resin part (*e.g.*, "reflective base (230)," shown in green in Figs. 2B-C below) and first and second metal leads (*e.g.*, "pair of electrodes (220)," shown in blue in Figs. 2B-C below). *E.g.*, Ex. 1008 (Koung) ¶ 21 ("Each substrate (200) comprises at least one pair of electrodes (220)…and a reflective base (230)."), 30 ("The reflective base (230)…may be resin…."), Figs. 2B-C, 4F.



Ex. 1008 (Koung), Fig. 2C.

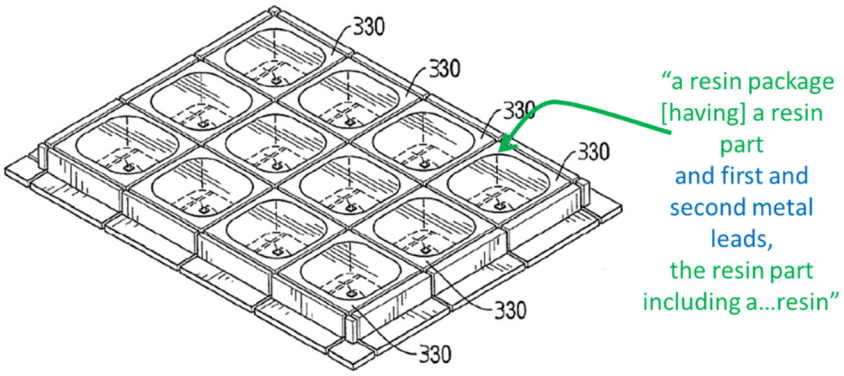


FIG.4F

Ex. 1008 (Koung), Fig. 4F.

127. Koung also discloses "a packaging method…comprises steps of:… (b) treating the metal board (300) to form an after-treating metal board (301), *(c) molding a cell matrix (320)* with multiple reflective bases (230)…and (f) cutting off the after-packaging board (303) to form *multiple individual high-power LED packages (330).*" Ex. 1008 (Koung) ¶ 18. Koung further discloses, "*Each unit has at least one pair of electrodes (220)….*" Ex. 1008 (Koung), ¶ 20. Koung further discloses, "[t]he step of *(c) molding the cell matrix (320)* may be using injection-compression molding (as shown in FIG. 4C). *The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)….Each substrate (200) comprises at least one pair of electrodes (220)*, a dissipating board (210) *and a reflective base (230).*" Ex. 1008 (Koung) ¶ 21. Koung also discloses, "The step of (f) cutting off the after-packaging board (303) comprises separating the reflective bases (230) of the *cell matrix (320)* and the units of the after-treating

metal board (301) to obtain *multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24. Additionally, Koung discloses, "*The reflective base (230) may be reflective, is electrically insulating and may be resin*…and has a top, a recess (233) and a bottom." Ex. 1008 (Koung) ¶ 30, *see also, e.g.*, Abstract, ¶¶ 2, 7-8, 11-22, 24, 28-29, 32, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F.

128. A POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. Both Hsu and Koung are in the same field of art, and relate to manufacturing multiple LED packages by molding resin on a lead frame. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1008 (Koung), Abstract, ¶¶ 2, 7-8, 11-22, 24, 28-29, 30, 32, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F. For example, Hsu discloses, *e.g.*, forming a resin package by "molding" a "resin" on a "plate-like frame" and then "[c]ut[ing]…such that LED packages…are made." Ex. 1030 (Hsu) 2:58-61, 3:43-67, Figs. 2, 10-12. Koung teaches forming a "package for a high-power light emitting diode" by "molding" a "resin" on a "metal board" patterned with "electrodes" and then "cutting…to obtain multiple individual packages." Ex. 1008 (Koung) ¶¶ 2, 20-21, 24, 30, Figs. 4B-C, 4F. In addition, Koung's resin package,

like Hsu's resin package, has a resin part. *E.g.*, Ex. 1008 (Koung) ¶¶ 18, 20-21, 24, 30, Figs. 2B-C, 4F; Ex. 1030 (Hsu), 3:23-30, 3:43-63, 3:64-67, 4:1-5, 4:8-13, 4:13-15, Figs. 10-12. Also, Koung's resin part, like Hsu's resin part, has four outer lateral surfaces (*e.g.*, Ex. 1008 (Koung) Fig. 2C; Ex. 1030 (Hsu) Fig. 12), metal and resin that are coplanar at the four outer lateral surfaces (*e.g.*, Ex. 1008 (Koung) ¶¶ 18, 20-21, 24, Fig. 2C; Ex. 1030 (Hsu), 2:67-3:11; 3:43-67, 4:5-12, Figs. 11-12), and resin above and to the left and right sides of exposed surfaces of the leads on two outer lateral surfaces (*e.g.*, Ex. 1008 (Koung) ¶¶ 18, 20-21, 24, Fig. 2C; Ex. 1030 (Hsu), 2:67-3:11, 3:43-54, 3:64-67, 4:5-12, Fig. 12; Elements 27.H, 28.F). Further, Koung, like Hsu, discloses efficiently conducting heat away from the light emitting device through flat metal plates with large surface area exposed to the mounting substrate. Ex. 1030 (Hsu), 1:34-48, 4:38-49, Figs. 11-12; Ex. 1008 (Koung), ¶ 38, Figs. 2A, 2C-D.

129. A POSITA would have understood that using Koung's teachings of a resin part having a tall, wide, reflective concave portion beneficially (1) directs light vertically, increasing directivity, brightness and luminance, (2) provides for shielding of phosphor, reducing cross-talk between adjacent light emitting devices when phosphor is used, (3) simplifies the mold, reducing manufacturing time and expense. ***First***, a POSITA would have understood that using a resin part having a tall, wide, reflective concave portion (as taught by Koung) would beneficially

direct light emitted from the light emitting element vertically, to advantageously increase directivity, brightness, and luminance of a light emitting device. For example, it was well-known that guiding light upward (as opposed to both upward and to the side) confines the same amount of emitted light to a tighter beam, thereby increasing directivity, brightness, and luminance. Ex. 1032 (Kuramoto) ¶ 71 ("The concave part 40c is provided with a slope so as to become wider in the opening direction. This makes it possible to *increase extraction of light in the forward direction*.…The slope angle of 50 the concave part, measured from the bottom surface 40c, is preferably not less than 95° and not more than 150°, or more preferably, not less than 100° and not more than 120°."), Fig. 1 (showing a concave portion with tall sidewalls relative to the height of the light emitting element), *see also ¶¶* 31, 72; Ex. 1031 (Urasaki) ¶ 24 ("[A] cup-shape (circular truncated cone shape) which reflects light emitted from the mounted LED element 10 and *guides the light thereof upward is preferable*."), Figs. 1a-d, 2 (showing a concave portion with tall sidewalls relative to the height of the light emitting element); Ex. 1007 (Oshio) ¶¶ 62-63 ("The recess 40C provided in the embedding resin 40 may comprise a first conical portion centered on the LED chip 10…as shown in FIG. 2, for example. The recess 40C formed in this way can efficiently reflect upward the light emitted from the LED chip 10 and *increase the light extraction efficiency*.")Ex. 1031 (Urasaki). Directivity, brightness, and luminance

were desirable for, *e.g.*, medical treatment, streetlights, desk lamps, and automotive lights. ***Second***, a POSITA would have understood that using a resin part having a tall, wide, reflective concave portion (as taught by Koung) would advantageously provide for shielding of phosphor (when used) near the light emitting element from incident light from outside (e.g., from adjacent LEDs). For example, Ex. 1035 (Matoba) discloses "*by deepening the cup depth*, it is possible to limit an excitation source of the fluorescent substance to only a light wavelength of the light-emitting chip," and "*incident light from outside is shielded by the cup edge*, and does not reach the fluorescent substance. For that reason, *it is possible to prevent a mixing of colors between LEDs*." Ex. 1035 (Matoba) ¶ 8, *see also, e.g.*, ¶¶ 13-14, Fig. 3. It was well-known that preventing such cross-talk (e.g., "mixing of colors between LEDs") can improve the resolution of certain displays. For example, Ex. 1035 (Matoba) discloses "when implementing a flat-screen display using this LED, *an image with extremely good resolution is attained*." Ex. 1035 (Matoba) ¶ 14. ***Third***, a POSITA would have understood that molding a resin part having a tall, wide concave portion (as taught by Koung) would simplify the mold, which advantageously reduces complexity and cost of the mold, improves flow of molten resin during molding, and simplifies mold removal. A POSITA also would have understood that Koung's concave portion is sufficiently wide to perform wire bonding within the concave portion in order to electrically connect the light

emitting element to the leads. Further, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teaching of resin part with four outer lateral surfaces having coplanar resin and metal formed by a "once-molding technique," *as expressly taught by Koung*, in implementing Hsu's light emitting device with first and second metal leads, to provide for "a packaging method that can save time and cost." *E.g.*, Ex. 1008 (Koung) ¶¶ 24-25, Figs. 2A-D, 4A-F. Configuring a resin package for an LED such that the resin extends to each of the outer lateral surfaces of the resin package (and thereby is coplanar with a portion of the metal part) was common and well-known before the claimed priority date. *See, e.g.*, Ex. 1008 (Koung) ¶¶ 20-21, 24, Fig. 2C; Ex. 1010 (Lin) ¶¶ 9, 25, Figs. 2a-2f, 3a-3b, 4a-4g; Ex. 1004 (Loh) ¶¶ 60, 73, 76, 96, Fig. 7. In view of the foregoing, a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion and four outer lateral surfaces having coplanar resin and metal formed by a "once-molding technique" in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

130. To the extent it is argued further disclosure of a resin part including a thermosetting resin is required, **Urasaki discloses: "the resin part including a**

thermosetting resin." For example, Urasaki discloses, "The present invention is a method of manufacturing a package substrate for mounting an optical semiconductor element, the package substrate thereof having a wiring board, and *a light reflecting thermosetting resin composition* layer formed on the wiring board, and having two or more concave parts (through-holes)…wherein the *light reflecting thermosetting resin composition* layer is batch formed through transfer molding." Ex. 1031 (Urasaki) ¶ 23. Urasaki also discloses "*a light reflecting thermosetting resin composition* containing…(D) an inorganic filler, (E) a white pigment…, having a light reflectance after thermal curing of at least 80%." Ex. 1031 (Urasaki) ¶ 25, *see also, e.g.*, ¶¶ 9-17, 21-32, 34, 37, 40-42, 46, 54-55, cls. 1-6, 8, Figs. 1-2; [071 patent], 2:15-31, 2:44-45.

131. A POSITA would have been motivated and found it obvious and a straightforward and beneficial design choice, to include a thermosetting resin, *as expressly taught by Urasaki*, in forming the resin part of the resin package taught by Hsu. Both Hsu and Urasaki are in the same field of art and relate to manufacturing multiple LED packages by molding resin on a lead frame. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1031 (Urasaki), Abstract, ¶¶ 11, 21, 34, Figs. 1-6. Hsu discloses molding the "encapsulant 50" using "epoxy resin" (Ex. 1030 (Hsu) 3:43-63); and that a "*reflecting ring 30…surrounds the die 20*…." Ex. 1030 (Hsu), 3:25-

27. Urasaki expressly discloses "a light reflecting thermosetting resin composition layer (reflector) 421 in which two or more concave parts (optical semiconductor element mounting regions) 420 are formed."Ex. 1031 (Urasaki) ¶ 24, *see also* ¶ 25 (" a light reflecting thermosetting resin composition containing, as essential components, (A) epoxy resin, (B) a curing agent, (C) a curing accelerator, (D) an inorganic filler, (E) a white pigment and (F) a coupling agent…."). 26-33, 40-44. Additionally, a POSITA would have understood that including thermosetting resin beneficially allows for molding of resin parts having better heat resistance, light resistance, and adhesion as compared to non-thermoset resins. *See also, e.g.*, Ex. 1032 (Kuramoto) ¶¶ 10, 52, 73, 87, 135; Ex. 1031 (Urasaki) ¶ 25; Ex. 1004 (Loh) ¶¶ 80, 93-100, 103. Urasaki further expressly discloses a "well-known thermosetting resin composition for reflecting light" may be used to advantageously "improv[e] the luminance of the optical semiconductor device." Ex. 1031 (Urasaki) ¶ 25. Urasaki also discloses that "the thermal conductivity of the light reflecting thermosetting resin composition used in the present invention is preferably at least 1 W/mK," to allow "heat generated from the optical semiconductor element" to "sufficiently escape." Ex. 1031 (Urasaki) ¶ 25, *see also, e.g.* ¶¶ 40-44. A POSITA would have understood that a resin containing a light reflecting material causes light to be directed out of the resin package, rather than being absorbed by or transmitted through the resin, thereby improving the

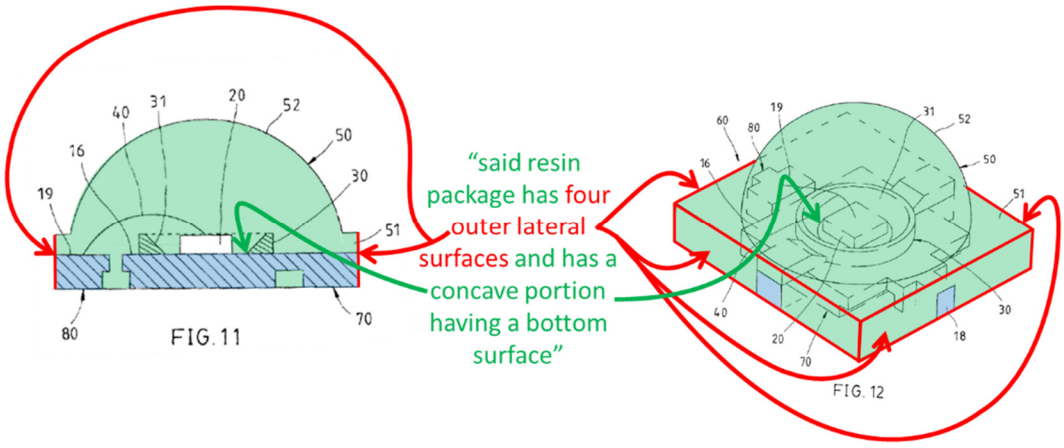
brightness of the light emitting device and reducing degradation of the resin by light. Furthermore, as the '071 patent itself admits, it was "conventional" to include a thermosetting resin in manufacturing an LED package prior to the claimed priority date. *E.g.*, Ex. 1101, 2:15-45, Figs. 18, 19; Ex. 1031 (Urasaki), Abstract, ¶¶ 23-25, 34, Figs. 1-6; Ex. 1032 (Kuramoto) ¶¶ 10, 40, 52, 121, 123, 135, 138, 140, Fig. 10; ; Ex. 1004 (Loh) ¶¶ 80, 93-100, 103; Ex. 1003 (January 12, 2018 Declaration) ¶¶ 109-110. A POSITA would have found it routine and straightforward to include a thermosetting resin, as expressly taught by Urasaki, in forming the resin part of the resin package taught by Hsu, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

132. Additionally, a POSITA would have been motivated and found it obvious and a straightforward and beneficial design choice, to include a thermosetting resin, *as expressly taught by Urasaki*, in implementing Hsu's light emitting device (as implemented using Koung's teachings of a resin part). Hsu, Koung, and Urasaki are in the same field of art and relate to manufacturing multiple LED packages by molding resin on a lead frame. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1008 (Koung), Abstract, ¶¶ 2, 7-8, 11-22, 24, 28-29, 30, 32, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F; Ex. 1031 (Urasaki), Abstract, ¶¶ 11, 21, 34, Figs. 1-6.

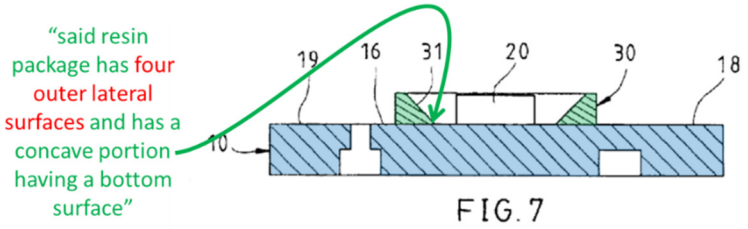
Koung discloses molding the reflective base (230)" with a "resin." Ex. 1008 (Koung) ¶ 30. As discussed above, POSITA would have understood that including thermosetting resin beneficially allows for molding of resin parts having better heat resistance, light resistance, and adhesion as compared to non-thermoset resins. A POSITA would have found it routine and straightforward to include a thermosetting resin, as expressly taught by Urasaki, in implementing Hsu's light emitting device (as implemented using Koung's teachings of a resin part), and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

d. Element 27.C: "wherein said resin package has four outer lateral surfaces and has a concave portion having a bottom surface"

133. **Hsu discloses: "said resin package has four outer lateral surfaces and has a concave portion having a bottom surface."** Hsu discloses that the resin package (*e.g.*, "LED 60 package," shown in Figs. 11-12 below) has four outer lateral surfaces (*e.g.*, outlined in red in Figs. 11-12 below) and a concave portion having a bottom surface (*e.g.*, indicated by green arrow in Figs. 7, 11-12 below). *E.g.*, Ex. 1030 (Hsu), Figs. 11-12.



Ex. 1030 (Hsu), Figs. 11-12.



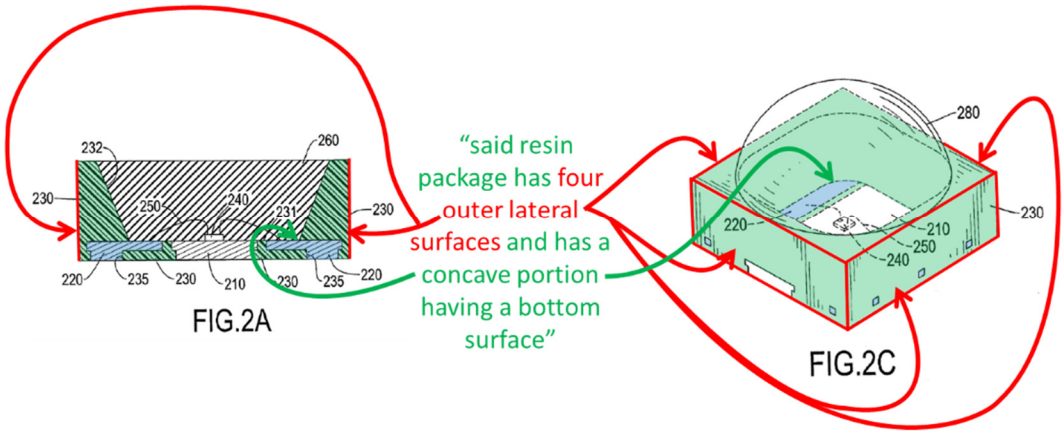
Ex. 1030 (Hsu), Fig. 7.

134. Hsu further discloses "a plate-like frame 10, which is substantially rectangle and has a plurality of *cells 11*. The cells 11, each of which has a plurality of openings, are well positioned in an arrangement of matrix." Ex. 1030 (Hsu), 2:58:67. Hsu also discloses, "form a *reflecting ring 30*, which is bonded on each of the main plates 16 of the frame 10, *with plastic materials* by means of injection molding technique. *The reflecting ring 30*…surrounds the die 20 and *has an inner surface 31, which is a slope facing upward with an angle of 45°* to reflect the light emitted by the die 20." Ex. 1030 (Hsu), 3:22-30. Hsu further discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10*

with epoxy resin by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11 and covers the surface of the frame 10 with a predetermined thickness.* All the bases 51 of the encapsulants 50 are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11 but also the dividing bars 14 and 15 of the frame 10.* In this embodiment of the present invention, *the base 51 is higher than the frame 10* and substantially as high as the reflecting ring 30." Ex. 1030 (Hsu), 3:43:63. Additionally, Hsu discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 *such that LED packages 60 are made*." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:13-48, 1:56-2:14, 2:17-44, 2:48-57, 3:23-36, 3:43-67, 4:1-38, cls. 1, 3, 5, Figs. 1-12.

135. To the extent it is argued further disclosure of a resin part having a concave portion is required, **Koung discloses: "said resin package has four outer lateral surfaces and has a concave portion having a bottom surface."** Koung discloses that the resin package (*e.g.*, "substrate (200)," shown in Figs. 2A, 2C below) has four outer lateral surfaces (*e.g.*, outlined in red in Figs. 2A, 2C below) and a concave portion having a bottom surface (*e.g.*, "recess (233)" with "a

reflective bottom (231)," indicated by green arrow in Figs. 2A, 2C below). *E.g.*, Ex. 1008 (Koung), Figs. 2A, 2C.



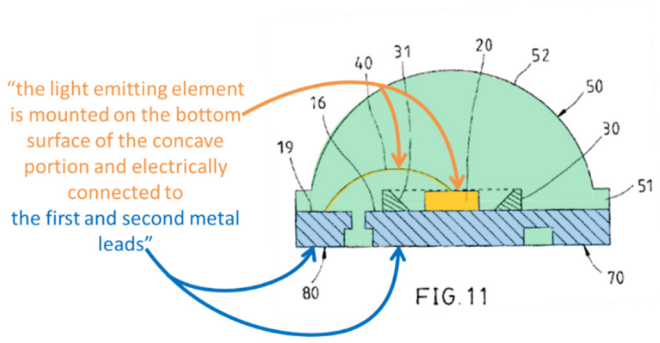
Ex. 1008 (Koung), Figs. 2A, 2C.

136. For example, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises *separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24. Koung further discloses, "*The reflective base (230)* may be reflective, is electrically insulating and may be resin or ceramic and *has* a top, *a recess (233)* and *a bottom.* The *recess (233)* is formed in the top of the reflective base (230) and *has a reflective bottom (231)* and a reflective sidewall (232)." Ex. 1008 (Koung) ¶ 30, *see also, e.g.,* Abstract, ¶¶ 8, 11-18, 21, 24, 29-30, cl. 1, Figs. 2A-D, 3A-B, 4A-F.

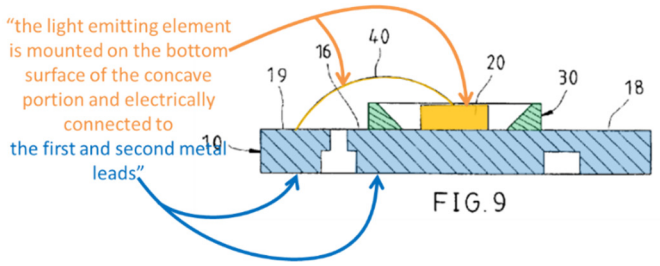
137. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion and molding formed by a "*once-molding technique*" with four outer lateral surfaces in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). In view of the foregoing discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

e. Element 27.D: "wherein the light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the first and second metal leads"

138. **Hsu discloses: "the light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the first and second metal leads."** Hsu discloses that the light emitting element (*e.g.*, "LED die 20," shown in orange in Figs. 11, 9 below) is mounted on the bottom surface of the concave portion and is electrically connected to the first and second metal leads (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 11, 9 below). *E.g.*, Ex. 1030 (Hsu), Figs. 11, 9.



Ex. 1030 (Hsu), Fig. 11.

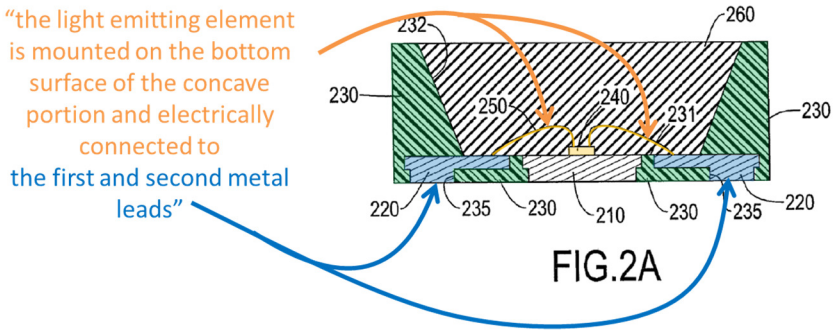


Ex. 1030 (Hsu), Fig. 9.

139. For example, Hsu discloses, "Referring to FIGS. 4-5, *a white LED die 20 is bonded on a top surface of each of the main plates 16* of the frame 10 by means of silver adhesives (not shown). The die 20 has a bottom to be smoothly bonded on the top surface of the main plate 16 such that an *electrode positioned on the bottom of the die 20 directly electrically contacts the main plate* 16 by means of the silver adhesive." Ex. 1030 (Hsu), 3:12-18. Hsu also discloses, "*The reflecting ring 30…surrounds the die 20….*" Ex. 1030 (Hsu), 3:25-27. Hsu further discloses, "Referring to FIGS. 8-9, connect a top surface of the die 20 to a top surface of the separate arm 19 of the cell 11 with a gold conductive wire 40 of 99%

Au by wire bonding technique such that the other *electrode positioned on the top surface of the die 20 can be electrically connected with the separate arm 19*." Ex. 1030 (Hsu), 3:37-42" Ex. 1030 (Hsu), 4:13-15, *see also, e.g.,* Abstract, 1:13-48, 1:56-2:14, 2:17-44, 2:48-57, 3:12-42, 4:1-38, cls. 1-5, Figs. 1, 4-12.

140. To the extent it is argued further disclosure of a concave portion is required, **Koung discloses: "the light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the first and second metal leads."** Koung discloses that light emitting element (*e.g.*, "LED chip (240)," shown in orange in Fig. 2A below) is mounted on the bottom surface of the concave portion (*e.g.*, "recess (233)" with "a reflective bottom (231)," shown in Fig. 2A below) and is electrically connected to the first and second metal leads (*e.g.*, "pair of electrodes (220)," shown in blue in Fig. 2A below). *E.g.*, Ex. 1008 (Koung), Fig. 2A.



Ex. 1008 (Koung), Fig. 2A.

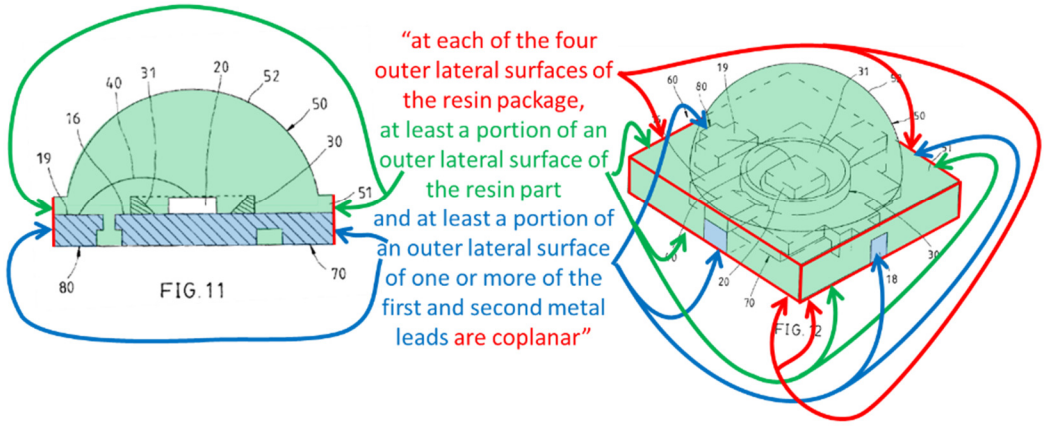
141. For example, Koung discloses, "a packaging method…comprises steps of:…(d) *attaching LED chips (240)* onto the dissipating boards (210) *and bonding conductive wires (250) in each corresponding reflective base (230)* of the cell matrix (320) of the after-molding board (302)…." Ex. 1008 (Koung) ¶ 18. Koung also discloses, "The step of (d) attaching LED chips (240) and bonding a pair of conductive wires (250) comprises *wire bonding at least one LED chip (240)* onto the dissipating boards (210) of each substrate (200) *to connect electrically to the electrodes (220) by the conductive wires (250)*…." Ex. 1008 (Koung) ¶ 22, *see also, e.g.*, Abstract, ¶¶ 2, 7-8, 11-22, 32, 36, cls. 1, 2-4, Figs. 2A-D, 3A-B, 4D-F.

142. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose that a light emitting element is mounted on a bottom surface of a concave portion and electrically connected to first and second metal leads. Ex. 1030 (Hsu), Figs. 9, 11; Ex. 1008 (Koung), Fig. 2A. In implementing Hsu's light emitting device using Koung's teachings of a resin part having a tall, wide, reflective concave portion, a POSITA would have understood that a light emitting element is mounted on a bottom surface of a concave portion and electrically connected to first and second metal leads. In view of the foregoing and

the discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

f. Element 27.E: "wherein, at each of the four outer lateral surfaces of the resin package, at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of one or more of the first and second metal leads are coplanar"

143. **Hsu discloses: "at each of the four outer lateral surfaces of the resin package, at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of one or more of the first and second metal leads are coplanar."** For example, Hsu discloses that at each of the four outer lateral surfaces of the resin package (*e.g.*, outlined in red in Figs. 11-12 below), at least a portion of an outer lateral surface of the resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Figs. 11-12 below) and at least a portion of an outer lateral surface of one or more of the first and second metal leads (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 11-12 below) are coplanar. *E.g.*, Ex. 1030 (Hsu), Figs. 11-12.



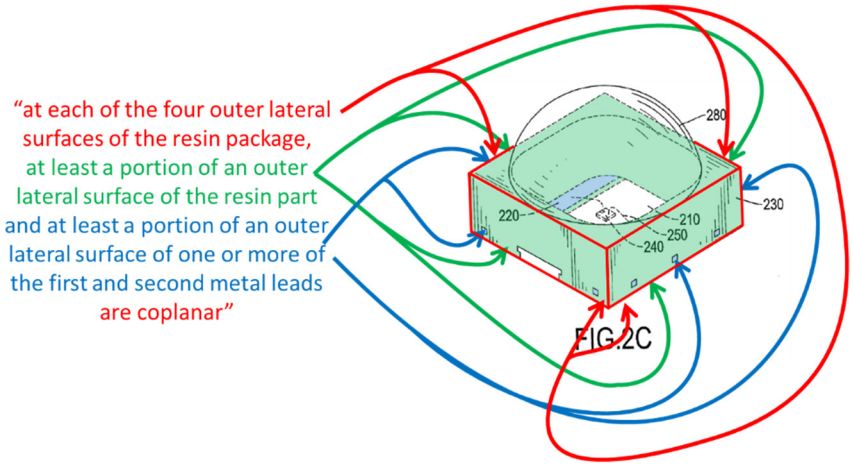
Ex. 1030 (Hsu), Figs. 11, 12.

144. Hsu further discloses, "*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the *transversal dividing bar 15* or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the *longitudinal dividing bars 14* or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell 11* to connect only the longitudinal dividing bar 14 or the longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:67-3:11. Hsu also discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11* and covers the surface of the

frame 10 with a predetermined thickness. All the bases 51 of the encapsulants 50 are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11* but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, the base 51 is higher than the frame 10…." Ex. 1030 (Hsu), 3:43-54. Hsu further discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 1-12.

145. To the extent it is argued further disclosure of a resin part is required, **Koung discloses: "at each of the four outer lateral surfaces of the resin package, at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of one or more of the first and second metal leads are coplanar."** For example, Koung discloses that at each of the four outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2C below), at least a portion of an outer lateral surface of the resin part (*e.g.*, "reflective base (230)," shown in green in Fig. 2C below) and at least a portion of an outer lateral surface of one or more of the first and second metal leads (*e.g.*,

"pair of electrodes (220)," shown in blue in Fig. 2C below) are coplanar. *E.g.*, Ex. 1008 (Koung), Fig. 2C.



Ex. 1008 (Koung), Fig. 2C.

146. Koung further discloses, "[t]he step of (b) treating the metal board (300) comprises treating the metal board (300) using etching or machining (such as punching) to form an after-treating metal board (301) with a margin (310) and multiple units (as shown in FIG. 4B)….Each unit has at least one pair of electrodes (220), a dissipating board (210) and multiple gaps (311)." Ex. 1008 (Koung) ¶ 20. Koung further discloses, "The step of (c) molding the cell matrix (320) comprises forming a cell matrix (320) on the after-treating metal board (301) and *filling the gaps (311)* with an insulating material simultaneously to form an after-molding board (302) with multiple substrates (200)….The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)…." Ex. 1008 (Koung) ¶ 21. Additionally, Koung discloses, "The step of (f) cutting off the after-

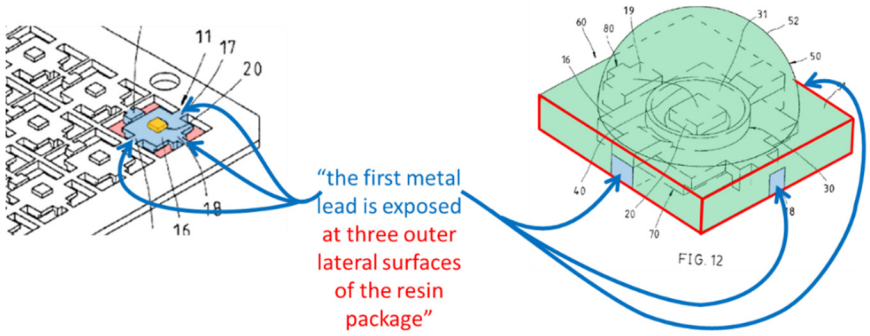
packaging board (303) comprises separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24, see also, e.g., Abstract, ¶¶ 8, 11-21, 24, 29-30, cl. 1, Figs. 2A-D, 3A-B, 4A-F.

147. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). In view of the foregoing discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion and four outer lateral surfaces having coplanar resin and metal in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

g. Element 27.F: "wherein the first metal lead is exposed at three outer lateral surfaces of the resin package"

148. **Hsu discloses: "the first metal lead is exposed at three outer lateral surfaces of the resin package."** For example, Hsu discloses that the first

metal lead (*e.g.*, "first terminal 70," shown in blue and indicated by blue arrows in Figs. 4, 12 below) is exposed at three outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 12 below). *E.g.*, Ex. 1030 (Hsu), Figs. 4, 12.



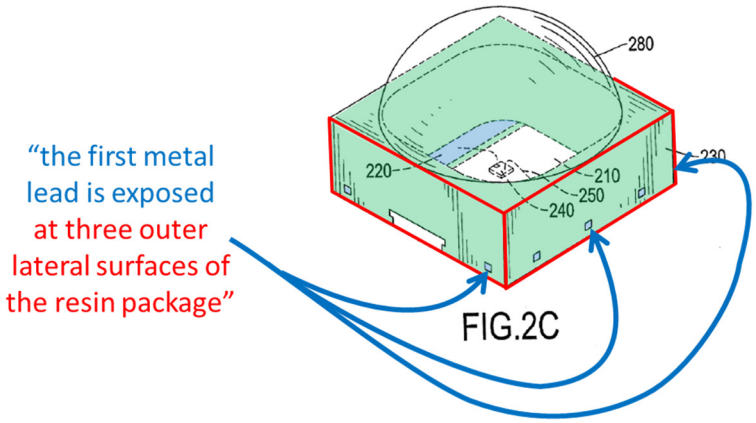
Ex. 1030 (Hsu), Figs. 4 (excerpt), 12.

149. Hsu also discloses, "*The first terminal 70* is formed by the main plate 16, *the extending arm 18 located at a right side of the main plate 16*, and *the bridges 17* respectively *located at upper and lower sides of the main plates 16*." Ex. 1030 (Hsu), 4:5-7. Hsu also discloses, "*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the transversal dividing bar 15 or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the longitudinal dividing bars 14 or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell 11* to connect only the longitudinal dividing bar 14 or the

longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:67-3:11. Hsu further discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11* and covers the surface of the frame 10 with a predetermined thickness. All the bases 51 of the encapsulants 50 are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11* but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, the base 51 is higher than the frame 10…." Ex. 1030 (Hsu), 3:43-54. Additionally, Hsu discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 2-12.

150. To the extent it is argued further disclosure of a resin package (with a resin part) is required, **Koung discloses: "the first metal lead is exposed at three outer lateral surfaces of the resin package."** For example, Koung discloses that the first metal lead (*e.g.*, "electrode[] (220)," shown in blue and indicated by blue

arrows in Fig. 2C below) is exposed at three outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2C below). *E.g.*, Ex. 1008 (Koung), Fig. 2C.



Ex. 1008 (Koung), Fig. 2C.

151. For example, Koung discloses, "The step of (b) treating the metal board (300) comprises *treating the metal board (300) using etching or machining (such as punching) to form an after-treating metal board (301) with a margin (310) and multiple units (as shown in FIG. 4B)….Each unit has at least one pair of electrodes (220)*, a dissipating board (210) and multiple gaps (311). *Each electrode (220) connects to an electrode (220) of an adjacent unit. The electrode (220) adjacent to the margin (310) further connect to the margin (310).* " Ex. 1008 (Koung) ¶ 20. Koung further discloses, "The step of (c) molding the cell matrix (320) comprises forming a cell matrix (320) on the after-treating metal board (301) and *filling the gaps (311) with an insulating material* simultaneously to form an after-molding board (302) with multiple substrates (200). The step of *(c) molding the cell matrix (320)* may be using injection-compression molding (as shown in

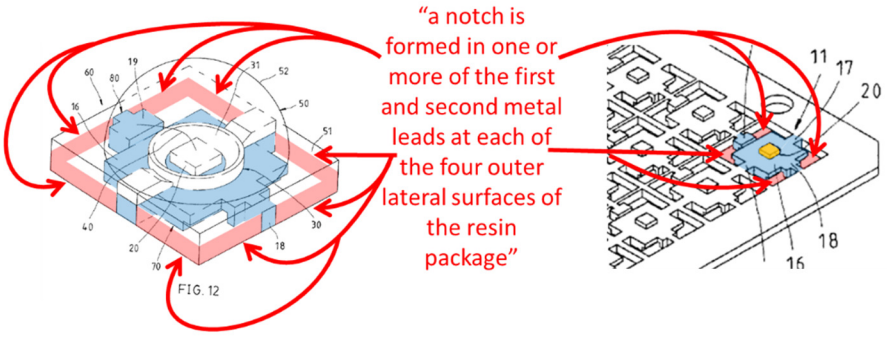
FIG. 4C). *The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)….*" Ex. 1008 (Koung) ¶ 21. Additionally, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises *separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24, *see also, e.g.,* Abstract, ¶¶ 8, 11-21, 24, 29-30, cl. 1, Figs. 2A-D, 3A-B, 4A-F.

152. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose that the first metal lead is exposed at three outer lateral surfaces of the resin package. Ex. 1030 (Hsu), Figs. 4, 12; Ex. 1008 (Koung), Fig. 2C. In implementing Hsu's light emitting device using Koung's teachings of a resin part, a POSITA would have understood that the first metal lead is exposed at three outer lateral surfaces of the resin package. In view of the foregoing and the discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such

a combination (yielding the claimed limitation) would work and provide the expected functionality.

h. Element 27.G: "wherein a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package"

153. **Hsu discloses: "a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package."** For example, Hsu discloses a notch (*e.g.*, shown in red in Figs. 4, 12 below) is formed in one or more of the first and second metal leads (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 4, 12 below) at each of the four outer lateral surfaces of the resin package. *E.g.*, Ex. 1030 (Hsu), Figs. 4, 12.



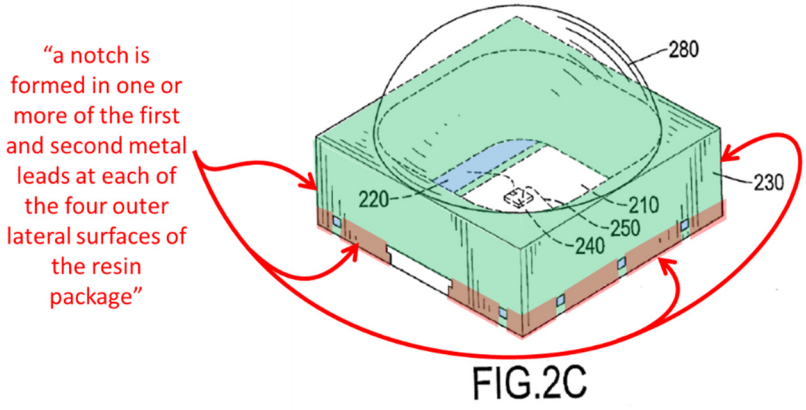
Ex. 1030 (Hsu), Figs. 12, 4 (excerpt).

154. For example, Hsu discloses, "Referring to FIGS. 2-3, firstly, provide a plate-like frame 10, which is substantially rectangle and has a plurality of cells 11. *The cells 11, each of which has a plurality of openings*, are well positioned in an

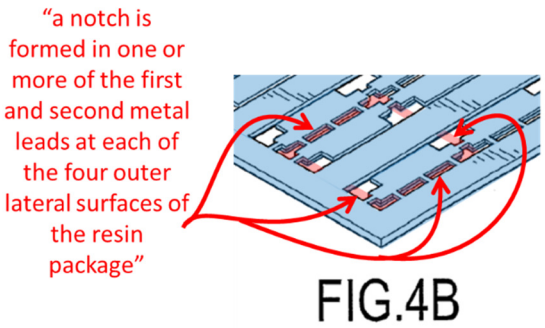
arrangement of matrix….*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the transversal dividing bar 15 or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the longitudinal dividing bars 14 or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell 11* to connect only the longitudinal dividing bar 14 or the longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:58-3:11. Hsu also discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11* and covers the surface of the frame 10 with a predetermined thickness. All the bases 51 of the encapsulants 50 are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11* but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, the base 51 is higher than the frame 10…." Ex. 1030 (Hsu), 3:43-54. Hsu further discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15

of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 2-12.

155. To the extent it is argued further disclosure of a resin package (with a resin part) is required, **Koung discloses: "a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package."** For example, Koung discloses a notch (*e.g.*, shown in red in Figs. 2C, 2B, 4B below) is formed in one or more of the first and second metal leads (*e.g.*, "pair of electrodes (220)," shown in blue in Figs. 2C, 2B, 4B below) at each of the four outer lateral surfaces of the resin package. *E.g.*, Ex. 1008 (Koung), Figs. 2B-C, 4B.



Ex. 1008 (Koung), Fig. 2C.



Ex. 1008 (Koung), Fig. 4B (excerpt).

156. Koung further discloses, "The step of (b) treating the metal board (300) comprises *treating the metal board (300) using etching or machining (such as punching) to form an after-treating metal board (301) with a margin (310) and multiple units (as shown in FIG. 4B)….Each unit has at least one pair of electrodes (220)*, a dissipating board (210) and multiple gaps (311). *Each electrode (220) connects to an electrode (220) of an adjacent unit. The electrode (220) adjacent to the margin (310) further connect to the margin (310).* Each dissipating board (210) is surrounded by at least one pair of the electrodes (220) and connects to a dissipating board (210) of an adjacent unit. The dissipating boards (210) adjacent to the margin (310) further connect to the margin (310). The gaps (311) are formed between each one pair of the electrodes (220) and the dissipating board (210)." Ex. 1008 (Koung) ¶ 20. Koung further discloses, "[t]he step of *(c) molding the cell matrix (320)* may be using injection-compression molding (as shown in FIG. 4C). *The insulating material may be resin….The cell*

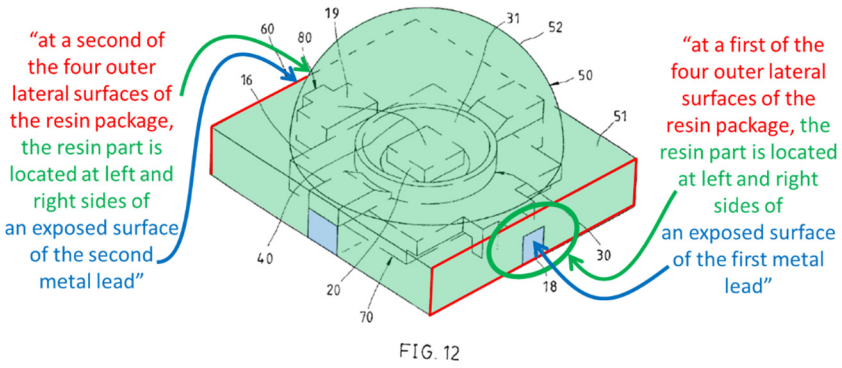
matrix (320) has multiple reflective bases (230)…." Ex. 1008 (Koung) ¶ 21. Additionally, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises *separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24, *see also, e.g.,* Abstract, ¶¶ 8, 11-21, 24, 29-30, 32. cls 1-8, Figs. 2A-D, 3A-B, 4A-F.

157. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose that a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package. Ex. 1030 (Hsu), Figs. 4, 12; Ex. 1008 (Koung), Figs. 2B-C, 4B. In implementing Hsu's light emitting device using Koung's teachings of a resin part, a POSITA would have understood that a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package. In view of the foregoing and the discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and

would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

i. Element 27.H: "wherein, at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead, wherein, at a second of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead"

158. **Hsu discloses: at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead" and "at a second of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead."** For example, Hsu discloses that at first and second outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 12 below), the resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Fig. 12 below) is located at left and right sides of an exposed surface of the first and second metal leads (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Fig. 12 below). *E.g.*, Ex. 1030 (Hsu), Fig. 12.



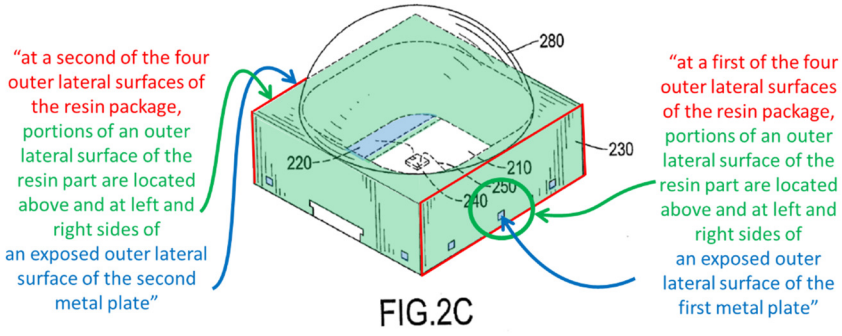
Ex. 1030 (Hsu), Fig. 12.

159. Hsu further discloses, "*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the transversal dividing bar 15 or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the longitudinal dividing bars 14 or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell 11* to connect only the longitudinal dividing bar 14 or the longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:67-3:11. Hsu also discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11* and covers the surface of the frame 10 with a predetermined thickness. All the bases 51 of the encapsulants 50

are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11* but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, the base 51 is higher than the frame 10…." Ex. 1030 (Hsu), 3:43-54. Hsu further discloses, *Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67. Hsu additionally discloses, "*The first terminal 70* is formed by the main plate 16, *the extending arm 18 located at a right side of the main plate 16*, and *the bridges 17* respectively *located at upper and lower sides of the main plates 16*. Additionally, the first terminal 70 is made of an electrically conductive metal. *The second terminal 80, which is the separate arm 19*, is *located at a left side of the first terminal 70* and spaced an appropriate distance apart from the first terminal 70 and made of the same electrically conductive metal." Ex. 1030 (Hsu) 4:5-12, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 1-12.

160. To the extent it is argued further disclosure of a resin part is required, **Koung discloses: at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead" and "at a second of the four outer lateral surfaces of**

the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead." For example, Koung discloses that at first and second outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2C below), the resin part (*e.g.*, "reflective base (230)," shown in green in Fig. 2C below) is located at left and right sides of an exposed surface of the first and second metal leads (*e.g.*, "pair of electrodes (220)," shown in blue in Fig. 2C below). *E.g.*, Ex. 1008 (Koung), Fig. 2C.



Ex. 1008 (Koung), Fig. 2C.

161. For example, Koung discloses, "a packaging method…comprises steps of:… *(b) treating the metal board (300)* to form an after-treating metal board (301), *(c) molding a cell matrix (320) with multiple reflective bases (230) on the after-treating metal board (301) to form a after-molding board (302)…* and *(f) cutting off the after-packaging board (303) to form multiple individual high-power LED packages (330).*" Ex. 1008 (Koung) ¶ 18. Koung also discloses, "[t]he step of (b) treating the metal board (300) comprises *treating the metal board (300) using*

etching or machining (such as punching) to form an after-treating metal board (301) with a margin (310) and multiple units (as shown in FIG. 4B). The after-treating metal board (301) comprises the margin (310) and multiple units to connect integrally to each other. *Each unit has at least one pair of electrodes (220)*, a dissipating board (210) and multiple gaps (311). *Each electrode (220) connects to an electrode (220) of an adjacent unit. The electrode (220) adjacent to the margin (310) further connect to the margin (310).*" Ex. 1008 (Koung) ¶ 20. Koung further discloses, "[t]he step of *(c) molding the cell matrix (320)* may be using injection-compression molding (as shown in FIG. 4C). *The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)….*" Ex. 1008 (Koung) ¶ 21. Additionally, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises *separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24, *see also, e.g.,* Abstract, ¶¶ 8, 11-21, 24, 29-30, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F.

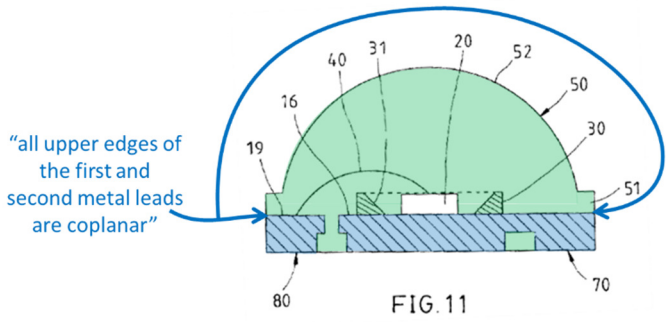
162. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having four outer lateral surfaces with coplanar resin and metal in implementing Hsu's light emitting device with first and second metal leads. *See*

Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose that at first and second four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first and second metal leads. Ex. 1030 (Hsu), Fig. 12; Ex. 1008 (Koung), Fig. 2C. In implementing Hsu's light emitting device using Koung's teachings of a resin part, a POSITA would have understood that at first and second four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first and second metal leads. In view of the foregoing and the discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

j. Element 27.I: "wherein all upper edges of the first and second metal leads are coplanar"

163. **Hsu discloses: "all upper edges of the first and second metal leads are coplanar."** For example, Hsu discloses that all upper edges of the first and second metal leads (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Fig. 11 below) are coplanar. *E.g.*, Ex. 1030 (Hsu), Fig. 11. Hsu also discloses, "[P]rovide a plate-like frame 10, which is substantially rectangle and has

a plurality of cells 11." Ex. 1030 (Hsu), 2:58-60, *see also, e.g.,* Abstract, 2:58-3:11, Figs. 2-10, 12.



Ex. 1030 (Hsu), Fig. 11.

7. Invalidity of Proposed Substitute Claim 28 Over Hsu in view of the Knowledge of a POSITA (Ground 1) and Hsu in view of Koung (Ground 4)

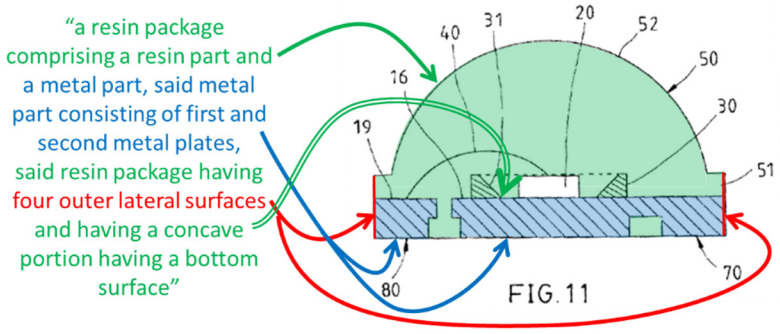
a. Element 28.Pre: "A light emitting device comprising"

164. **Hsu discloses: "a light emitting device."** *See* Element 27.pre.

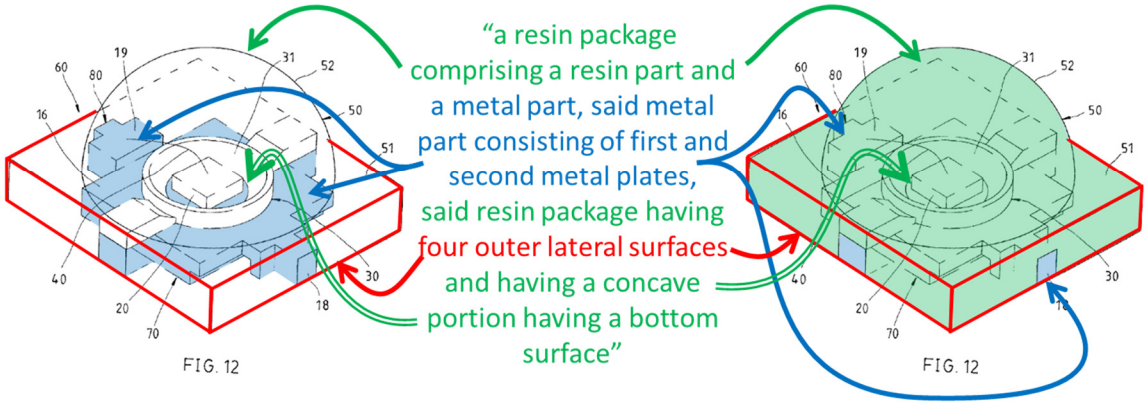
b. Element 28.A: "a resin package comprising a resin part and a metal part, said metal part consisting of first and second metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface"

165. **Hsu discloses: "a resin package comprising a resin part and a metal part, said metal part consisting of first and second metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface."** For example, Hsu discloses a resin package (*e.g.*, "LED 60 package," shown in Figs. 10-12 below) comprising a resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Figs. 11-12 below)

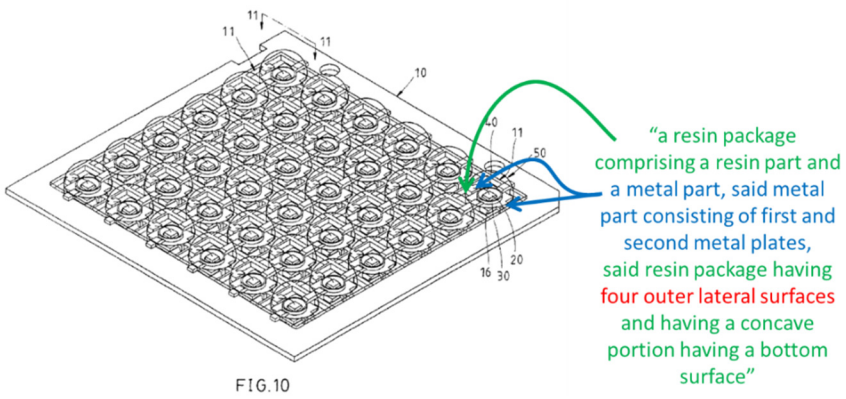
and a metal part, said metal part consisting of first and second metal plates (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 11-12 below), said resin package having four outer lateral surfaces (*e.g.*, outlined in red in Figs. 11-12 below) and having a concave portion having a bottom surface (*e.g.*, indicated by double green arrows in Figs. 7, 11-12 below). *E.g.*, Ex. 1030 (Hsu), Figs. 7, 10-12.



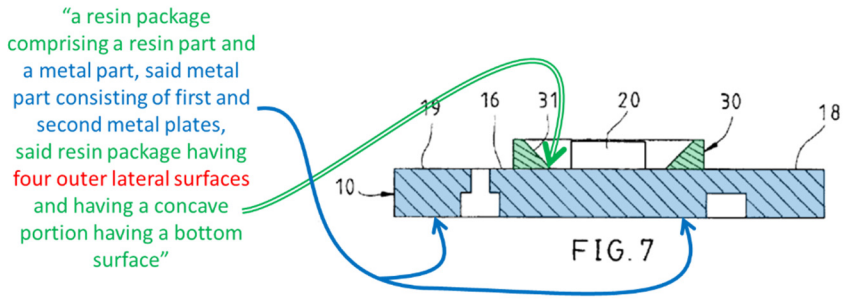
Ex. 1030 (Hsu), Fig. 11.



Ex. 1030 (Hsu), Fig. 12.



Ex. 1030 (Hsu), Fig. 10.



Ex. 1030 (Hsu), Fig. 7.

166. Hsu also discloses, "Step 3: Referring to FIGS. 6-7, form *a reflecting ring 30,…with plastic materials*…." Ex. 1030 (Hsu), 3:23-30. Hsu also discloses, "form *an encapsulant 50* on each of the cells 11 of the frame 10 *with epoxy resin* by means of the injection molding technique." Ex. 1030 (Hsu), 3:43-63. Hsu further discloses, "*Cut the frame 10 according to the size of each of the cell 11,…such that LED packages 60 are made*." Ex. 1030 (Hsu), 3:64-67. Additionally, Hsu discloses, "Referring to FIGS. 11-12, *the LED 60 package* made

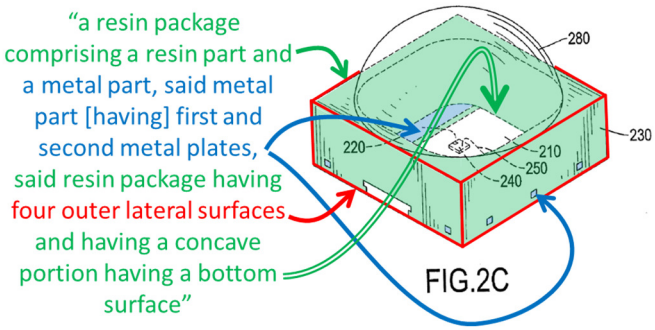
by the foregoing fabricative process structurally includes *a first terminal 70, a second terminal 80*, the LED die 20, *the reflecting ring 30*, the conductive wire 40, and *the encapsulant 50*." Ex. 1030 (Hsu), 4:1-5. Hsu also discloses, "[T]he first terminal 70 is made of an electrically conductive *metal*. The second terminal 80…is…made of the same electrically conductive *metal*." Ex. 1030 (Hsu), 4:8-13. *see also, e.g.*, Abstract, 1:7-10, 1:13-48, 1:56-2:14, 2:17-44, 2:48-3:22, 3:43-67, 4:1-38, cls. 1, 3, Figs. 1-12.

167. Hsu further discloses "a plate-like frame 10, which is substantially rectangle and has a plurality of *cells 11*. The cells 11, each of which has a plurality of openings, are well positioned in an arrangement of matrix." Ex. 1030 (Hsu), 2:58:67. Hsu also discloses, "form a *reflecting ring 30*, which is bonded on each of the main plates 16 of the frame 10, *with plastic materials* by means of injection molding technique. *The reflecting ring 30*…surrounds the die 20 and *has an inner surface 31, which is a slope facing upward with an angle of 45°* to reflect the light emitted by the die 20." Ex. 1030 (Hsu), 3:22-30. Hsu further discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11 and covers the surface of the frame 10 with a predetermined thickness.* All the bases 51 of the encapsulants 50 are integrated

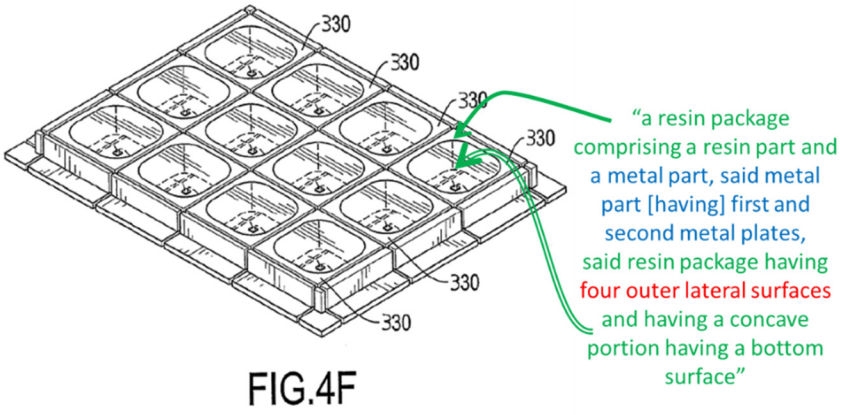
together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11 but also the dividing bars 14 and 15 of the frame 10.* In this embodiment of the present invention, *the base 51 is higher than the frame 10* and substantially as high as the reflecting ring 30." Ex. 1030 (Hsu), 3:43:63. Additionally, Hsu discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 *such that LED packages 60 are made*." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:13-48, 1:56-2:14, 2:17-44, 2:48-57, 3:23-36, 3:43-67, 4:1-38, cls. 1, 3, 5, Figs. 1-12.

168. To the extent it is argued further disclosure of a resin part having a concave portion is required, **Koung discloses: "a resin package comprising a resin part and a metal part, said metal part [having] first and second metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface."** For example, Koung discloses a resin package (*e.g.*, "substrate (200)," shown in Figs. 2B-C, 4F below) comprising a resin part (*e.g.*, "reflective base (230)," shown in green in Figs. 2B-C, below) and a metal part, said metal part consisting of first and second metal plates (*e.g.*, "pair of electrodes (220)," shown in blue in Figs. 2B-C below), said resin package having four outer lateral surfaces (*e.g.*, outlined in red in Figs. 2B-C below) and

having a concave portion having a bottom surface (*e.g.*, indicated by double green arrows in Figs. 2B-C, 4F below). *E.g.*, Ex. 1008 (Koung) ¶ 21 ("Each substrate (200) comprises at least one pair of electrodes (220)…and a reflective base (230)."), 30 ("The reflective base (230)…may be resin…."), Figs. 2B-C, 4F.



Ex. 1008 (Koung), Fig. 2C.



Ex. 1008 (Koung), Fig. 4F.

169. Koung also discloses "a packaging method…comprises steps of:… (b) treating the metal board (300) to form an after-treating metal board (301), *(c) molding a cell matrix (320)* with multiple reflective bases (230)…and (f) cutting

off the after-packaging board (303) to form *multiple individual high-power LED packages (330)*." Ex. 1008 (Koung) ¶ 18. Koung further discloses, "*Each unit has at least one pair of electrodes (220)*…." Ex. 1008 (Koung), ¶ 20. Koung further discloses, "[t]he step of *(c) molding the cell matrix (320)* may be using injection-compression molding (as shown in FIG. 4C). *The insulating material may be resin*….*The cell matrix (320) has multiple reflective bases (230)*….*Each substrate (200) comprises at least one pair of electrodes (220)*, a dissipating board (210) *and a reflective base (230)*." Ex. 1008 (Koung) ¶ 21. Koung also discloses, "The step of (f) cutting off the after-packaging board (303) comprises separating the reflective bases (230) of the *cell matrix (320)* and the units of the after-treating metal board (301) to obtain *multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24. Additionally, Koung discloses, "*The reflective base (230) may be reflective, is electrically insulating and may be resin*…and has a top, a recess (233) and a bottom." Ex. 1008 (Koung) ¶ 30, *see also, e.g.*, Abstract, ¶¶ 2, 7-8, 11-22, 24, 28-29, 32, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F.

170. For example, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises *separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)."

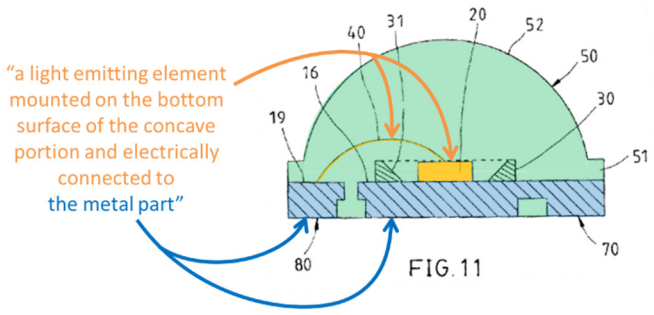
Ex. 1008 (Koung) ¶ 24. Koung further discloses, "*The reflective base (230)* may be reflective, is electrically insulating and may be resin or ceramic and *has* a top, *a recess (233)* and *a bottom.* The *recess (233)* is formed in the top of the reflective base (230) and *has a reflective bottom (231)* and a reflective sidewall (232)." Ex. 1008 (Koung) ¶ 30, *see also, e.g.,* Abstract, ¶¶ 8, 11-18, 21, 24, 29-30, cl. 1, Figs. 2A-D, 3A-B, 4A-F.

171. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion and four outer lateral surfaces in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose a resin package having four outer lateral surfaces and having a concave portion having a bottom surface. Ex. 1030 (Hsu), Figs. 7, 10-12; Ex. 1008 (Koung), Figs. 2B-C, 4F. In implementing Hsu's light emitting device using Koung's teachings of a resin part, a POSITA would have understood that the resin package has four outer lateral surfaces and has a concave portion having a bottom surface. In view of the foregoing and the discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion with a bottom surface and four outer lateral surfaces in implementing Hsu's light emitting

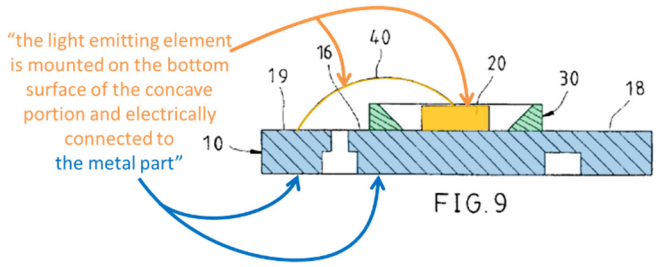
device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

c. Element 28.B: "a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part"

172. **Hsu discloses: "a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part."** For example, Hsu discloses Hsu discloses that the light emitting element (*e.g.*, "LED die 20," shown in orange in Figs. 11, 9 below) is mounted on the bottom surface of the concave portion and is electrically connected to the metal part (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 11, 9 below). *E.g.*, Ex. 1030 (Hsu), Figs. 11, 9.



Ex. 1030 (Hsu), Fig. 11.



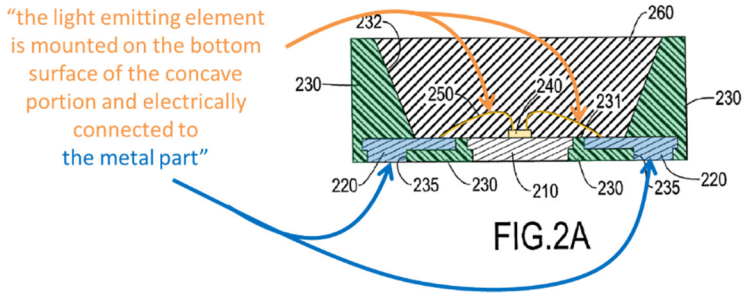
Ex. 1030 (Hsu), Fig. 9.

173. For example, Hsu discloses, "Referring to FIGS. 4-5, *a white LED die 20 is bonded on a top surface of each of the main plates 16* of the frame 10 by means of silver adhesives (not shown). The die 20 has a bottom to be smoothly bonded on the top surface of the main plate 16 such that an *electrode positioned on the bottom of the die 20 directly electrically contacts the main plate* 16 by means of the silver adhesive." Ex. 1030 (Hsu), 3:12-18. Hsu also discloses, "*The reflecting ring 30…surrounds the die 20*…." Ex. 1030 (Hsu), 3:25-27. Hsu further discloses, "Referring to FIGS. 8-9, connect a top surface of the die 20 to a top surface of the separate arm 19 of the cell 11 with a gold conductive wire 40 of 99% Au by wire bonding technique such that the other *electrode positioned on the top surface of the die 20 can be electrically connected with the separate arm 19*." Ex. 1030 (Hsu), 3:37-42" Ex. 1030 (Hsu), 4:13-15, *see also, e.g.,* Abstract, 1:13-48, 1:56-2:14, 2:17-44, 2:48-57, 3:12-42, 4:1-38, cls. 1-5, Figs. 1, 4-12.

174. To the extent it is argued further disclosure of a concave portion is required, **Koung discloses: "a light emitting element mounted on the bottom**

surface of the concave portion and electrically connected to the metal part."

For example, Koung discloses Koung discloses that light emitting element (*e.g.*, "LED chip (240)," shown in orange in Fig. 2A below) is mounted on the bottom surface of the concave portion (*e.g.*, "recess (233)" with "a reflective bottom (231)," shown in Fig. 2A below) and is electrically connected to the metal part (*e.g.*, "pair of electrodes (220)," shown in blue in Fig. 2A below). *E.g.*, Ex. 1008 (Koung), Fig. 2A.



Ex. 1008 (Koung), Fig. 2A.

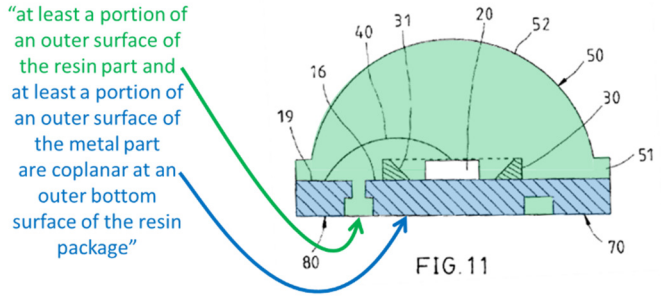
175. For example, Koung discloses, "a packaging method…comprises steps of:…(d) *attaching LED chips (240)* onto the dissipating boards (210) *and bonding conductive wires (250) in each corresponding reflective base (230)* of the cell matrix (320) of the after-molding board (302)…." Ex. 1008 (Koung) ¶ 18. Koung also discloses, "The step of (d) attaching LED chips (240) and bonding a pair of conductive wires (250) comprises *wire bonding at least one LED chip (240)* onto the dissipating boards (210) of each substrate (200) *to connect electrically to*

the electrodes (220) by the conductive wires (250)…." Ex. 1008 (Koung) ¶ 22, *see also, e.g.*, Abstract, ¶¶ 2, 7-8, 11-22, 32, 36, cls. 1, 2-4, Figs. 2A-D, 3A-B, 4D-F.

176. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part. Ex. 1030 (Hsu), Figs. 9, 11; Ex. 1008 (Koung), Fig. 2A. In implementing Hsu's light emitting device using Koung's teachings of a resin part, a POSITA would have understood that a light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the metal part. In view of the foregoing discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

d. Element 28.C: "wherein at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package"

177. **Hsu discloses: "at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package."** For example, Hsu discloses at least a portion of an outer surface of the resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Fig. 11 below) and at least a portion of an outer surface of the metal part (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Fig. 11 below) are coplanar at an outer bottom surface of the resin package (*e.g.*, "LED 60 package," shown in Fig. 11 below). *E.g.*, Ex. 1030 (Hsu), Fig. 11.

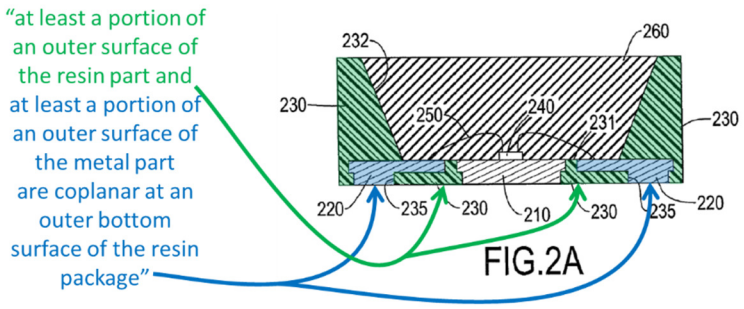


Ex. 1030 (Hsu), Fig. 11.

178. Hsu also discloses, "Referring to FIGS. 10-11, form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which*

corresponds to the cell 11 in size and *fills the openings of the cell 11* and covers the surface of the frame 10 with a predetermined thickness." Ex. 1030 (Hsu), 3:43-48. Hsu also discloses, "[T]he main plate 16, more precisely, *the first terminal 70 has a large bottom surface to be totally exposed outside*, so that the heat generated by the die 20 can be conducted to the first terminal 70 and further conducted outside from the bottom surface of the first terminal 70." Ex. 1030 (Hsu), 4:41-46. Hsu further discloses, "*[T]he base 51 of the encapsulant 50* covers the top surface of the first terminal 70 and the second terminal 80 and *fills the space therebetween to remain two terminals 70 and 80 spaced apart in opposite relationship*." Ex. 1030 (Hsu), 4:26-29, *see also, e.g.,* 1:52-55, 2:17-44, 2:58-3:11, 3:43-67, 4:1-49, cls. 1, 3, Figs. 10-12.

179. To the extent it is argued further disclosure of a resin part is required, **Koung discloses: "at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package."** For example, Koung discloses at least a portion of an outer surface of the resin part (*e.g.*, "reflective base (230)," shown in green in Fig. 2A below) and at least a portion of an outer surface of the metal part (*e.g.*, "pair of electrodes (220)," shown in blue in Fig. 2A below) are coplanar at an outer bottom surface of the resin package (*e.g.*, "substrate (200)," shown in Fig. 2A below). *E.g.*, Ex. 1008 (Koung), Fig. 2A.



Ex. 1008 (Koung), Fig. 2A.

180. For example, Koung discloses, "*The step of (c) molding the cell matrix (320) comprises forming a cell matrix (320)* on the after-treating metal board (301) *and filling the gaps (311) with an insulating material* simultaneously to form an after-molding board (302) with multiple substrates (200). The step of (c) molding the cell matrix (320) may be using injection-compression molding (as shown in FIG. 4C). *The insulating material may be resin*…At least a portion of an upper surface of the dissipating board (210) and at least a portion of an upper surface of the electrode (220) are exposed to the recess (233) and at least a portion of an lower surface of the dissipating board (210) and *at least a portion of an lower surface of the electrodes (220) are exposed from a lower surface of the reflective base (230).*" Ex. 1008 (Koung) ¶ 21, *see also, e.g.,* Abstract, ¶¶ 2, 7, 11-21, 28-30, 32, 38-39, Figs. 2A-D, 3A-B, 4A-F.

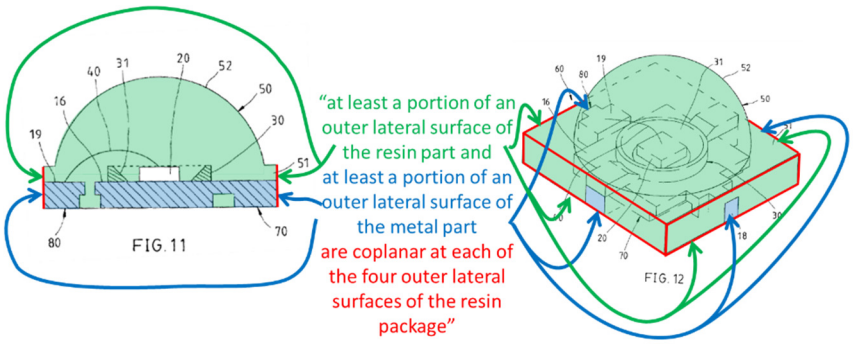
181. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin

part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose that the resin and metal are coplanar at an outer bottom surface of the resin package. Ex. 1030 (Hsu), Fig. 11; Ex. 1008 (Koung), Figs. 2A, 2D. In implementing Hsu's light emitting device using Koung's teachings of a resin part, a POSITA would have understood that resin and metal are coplanar at an outer bottom surface of the resin package. In view of the foregoing and the discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

e. Element 28.D: "wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package"

182. **Hsu discloses: "at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package."** For example, Hsu discloses that at least a portion of an outer lateral surface of the resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Figs.

11-12 below) and at least a portion of an outer lateral surface of the metal part (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 11-12 below) are coplanar at each of the four outer lateral surfaces of the resin package (*e.g.*, outlined in red in Figs. 11-12 below). *E.g.*, Ex. 1030 (Hsu), Figs. 11-12.



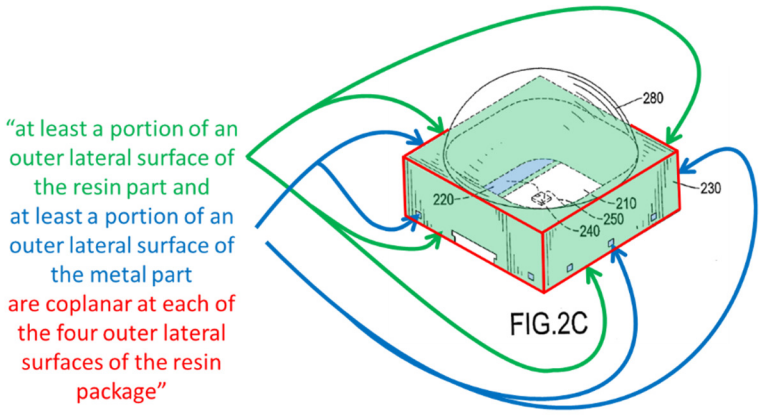
Ex. 1030 (Hsu), Figs. 11-12.

183. Hsu further discloses, "*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the *transversal dividing bar 15* or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the *longitudinal dividing bars 14* or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell 11* to connect only the longitudinal dividing bar 14 or the longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:67-3:11. Hsu also discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the*

cells 11 of the frame 10 with epoxy resin by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11* and covers the surface of the frame 10 with a predetermined thickness. All the bases 51 of the encapsulants 50 are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11* but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, the base 51 is higher than the frame 10…." Ex. 1030 (Hsu), 3:43-54. Hsu further discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 1-12.

184. To the extent it is argued further disclosure of a resin part is required, **Koung discloses: "at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package."** For example, Koung discloses that at least a portion of an outer lateral surface of the resin part (*e.g.*, "reflective base (230)," shown in green in Fig. 2C below) and at least a portion of an outer lateral surface of the metal part (*e.g.*, "pair of electrodes

(220)," shown in blue in Fig. 2C below) are coplanar at each of the four outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2C below). *E.g.*, Ex. 1008 (Koung), Fig. 2C.



Ex. 1008 (Koung), Fig. 2C.

185. Koung further discloses, "[t]he step of (b) treating the metal board (300) comprises treating the metal board (300) using etching or machining (such as punching) to form an after-treating metal board (301) with a margin (310) and multiple units (as shown in FIG. 4B)….Each unit has at least one pair of electrodes (220), a dissipating board (210) and multiple gaps (311)." Ex. 1008 (Koung) ¶ 20. Koung further discloses, "The step of (c) molding the cell matrix (320) comprises forming a cell matrix (320) on the after-treating metal board (301) and *filling the gaps (311)* with an insulating material simultaneously to form an after-molding board (302) with multiple substrates (200)….The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)…." Ex. 1008

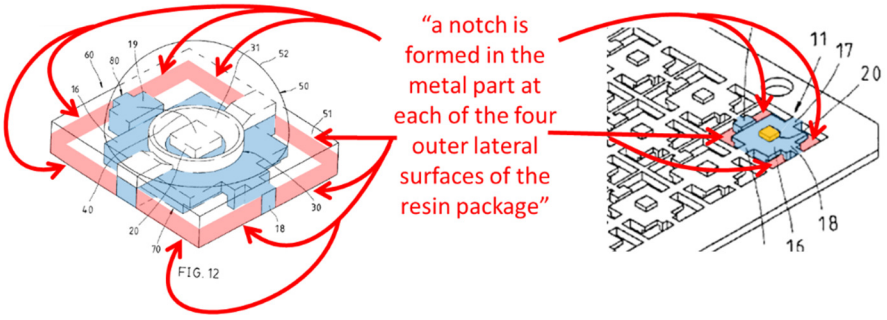
(Koung) ¶ 21. Additionally, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24, see also, e.g., Abstract, ¶¶ 8, 11-21, 24, 29-30, cl. 1, Figs. 2A-D, 3A-B, 4A-F.

186. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion and four outer lateral surfaces having coplanar resin and metal in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). In view of the foregoing discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

f. Element 28.E: "wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package"

187. **Hsu discloses: "a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package."** For example, Hsu discloses a

notch (*e.g.*, shown in red in Figs. 4, 12 below) is formed in the metal part (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 4, 12 below) at each of the four outer lateral surfaces of the resin package. *E.g.*, Ex. 1030 (Hsu), Figs. 4, 12.



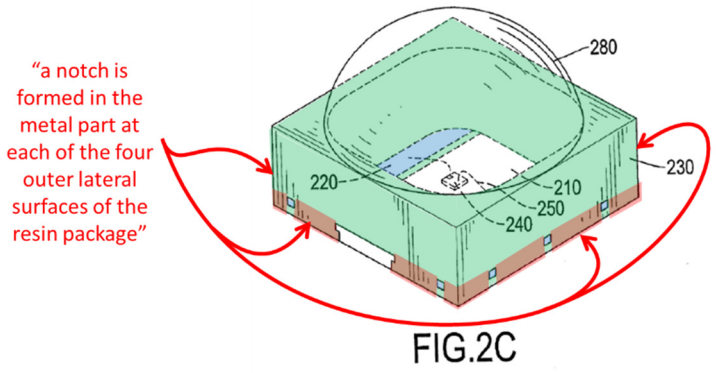
Ex. 1030 (Hsu), Figs. 12, 4 (excerpt).

188. For example, Hsu discloses, "Referring to FIGS. 2-3, firstly, provide a plate-like frame 10, which is substantially rectangle and has a plurality of cells 11. *The cells 11, each of which has a plurality of openings*, are well positioned in an arrangement of matrix….*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the transversal dividing bar 15 or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the longitudinal dividing bars 14 or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell 11* to

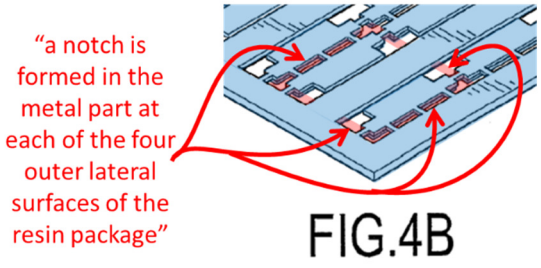
connect only the longitudinal dividing bar 14 or the longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:58-3:11. Hsu also discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11* and covers the surface of the frame 10 with a predetermined thickness. All the bases 51 of the encapsulants 50 are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11* but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, the base 51 is higher than the frame 10…." Ex. 1030 (Hsu), 3:43-54. Hsu further discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 2-12.

189. To the extent it is argued further disclosure of a resin package (with a resin part) is required, **Koung discloses: "a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package."** For example, Koung discloses a notch (*e.g.*, shown in red in Figs. 2C, 2B, 4B below) is formed

in the metal part (*e.g.*, "pair of electrodes (220)," shown in blue in Figs. 2C, 2B, 4B below) at each of the four outer lateral surfaces of the resin package. *E.g.*, Ex. 1008 (Koung), Figs. 2B-C, 4B.



Ex. 1008 (Koung), Fig. 2C.



Ex. 1008 (Koung), Figs. 2B, 4B (excerpt).

190. Koung further discloses, "The step of (b) treating the metal board (300) comprises *treating the metal board (300) using etching or machining (such as punching) to form an after-treating metal board (301) with a margin (310) and multiple units (as shown in FIG. 4B)….Each unit has at least one pair of electrodes (220)*, a dissipating board (210) and multiple gaps (311). *Each electrode (220) connects to an electrode (220) of an adjacent unit. The electrode*

(220) adjacent to the margin (310) further connect to the margin (310). Each dissipating board (210) is surrounded by at least one pair of the electrodes (220) and connects to a dissipating board (210) of an adjacent unit. The dissipating boards (210) adjacent to the margin (310) further connect to the margin (310). The gaps (311) are formed between each one pair of the electrodes (220) and the dissipating board (210)." Ex. 1008 (Koung) ¶ 20. Koung further discloses, "[t]he step of *(c) molding the cell matrix (320)* may be using injection-compression molding (as shown in FIG. 4C). *The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)….*" Ex. 1008 (Koung) ¶ 21. Additionally, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises *separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24, *see also, e.g.,* Abstract, ¶¶ 8, 11-21, 24, 29-30, 32. cls 1-8, Figs. 2A-D, 3A-B, 4A-F.

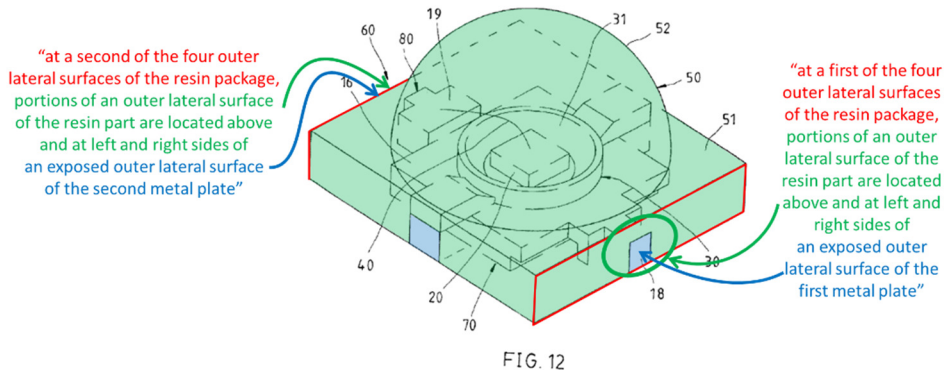
191. A POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose that a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package. Ex.

1030 (Hsu), Figs. 4, 12; Ex. 1008 (Koung), Figs. 2B-C, 4B. In implementing Hsu's light emitting device using Koung's teachings of a resin part, a POSITA would have understood that a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package. In view of the foregoing and the discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

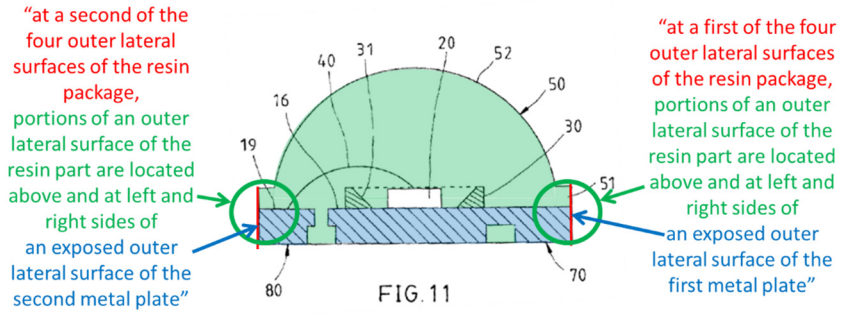
g. Element 28.F: "wherein, at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate, wherein, at a second of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate"

192. **Hsu discloses: "at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate" and "at a second of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located**

above and at left and right sides of an exposed outer lateral surface of the second metal plate." For example, Hsu discloses that at first and second outer lateral surfaces of the resin package (*e.g.*, outlined in red in Figs. 11-12 below), portions of outer lateral surfaces of the resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Figs. 11- 12 below) are located above and at left and right sides of exposed outer lateral surfaces of the first and second metal plates (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 11-12 below). *E.g.*, Ex. 1030 (Hsu), Figs. 11-12.



Ex. 1030 (Hsu), Fig. 12.



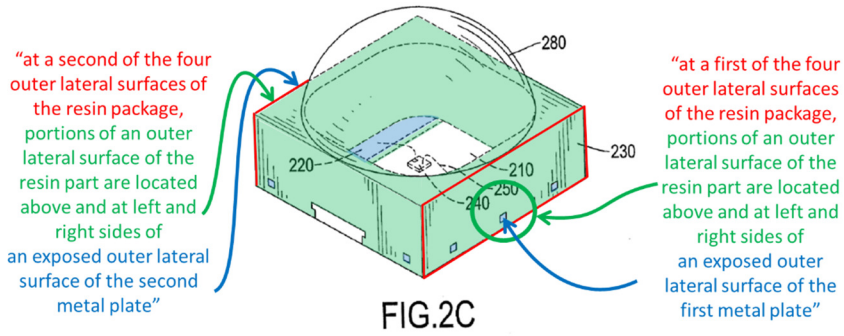
Ex. 1030 (Hsu), Fig. 11.

193. Hsu further discloses, "*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the transversal dividing bar 15 or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the longitudinal dividing bars 14 or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell 11* to connect only the longitudinal dividing bar 14 or the longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:67-3:11. Hsu also discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11* and covers the surface of the frame 10 with a predetermined thickness. All the bases 51 of the encapsulants 50 are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11* but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, *the base 51 is higher than the frame 10*…." Ex. 1030 (Hsu), 3:43-54. Hsu further discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing

bars 14 and 15 of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67. Hsu additionally discloses, "*The first terminal 70* is formed by the main plate 16, *the extending arm 18 located at a right side of the main plate 16*, and *the bridges 17* respectively *located at upper and lower sides of the main plates 16*. Additionally, the first terminal 70 is made of an electrically conductive metal. *The second terminal 80, which is the separate arm 19*, is *located at a left side of the first terminal 70* and spaced an appropriate distance apart from the first terminal 70 and made of the same electrically conductive metal." Ex. 1030 (Hsu), 4:5-12, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 1-12.

194. To the extent it is argued further disclosure of a resin part is required, **Koung discloses: "at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate" and "at a second of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate."** For example, Koung discloses that at first and second outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2C below), portions of outer lateral surfaces of the resin part (*e.g.*, "reflective base (230),"

shown in green in Fig. 2C below) are located above and at left and right sides of exposed outer lateral surfaces of the first and second metal plates (*e.g.*, "pair of electrodes (220)," shown in blue in Fig. 2C below). *E.g.*, Ex. 1008 (Koung), Fig. 2C.



Ex. 1008 (Koung), Fig. 2C.

195. Koung further discloses, "[t]he step of (b) treating the metal board (300) comprises *treating the metal board (300) using etching or machining (such as punching) to form an after-treating metal board (301) with a margin (310) and multiple units (as shown in FIG. 4B).* The after-treating metal board (301) comprises the margin (310) and multiple units to connect integrally to each other. *Each unit has at least one pair of electrodes (220)*, a dissipating board (210) and multiple gaps (311). *Each electrode (220) connects to an electrode (220) of an adjacent unit. The electrode (220) adjacent to the margin (310) further connect to the margin (310).* Each dissipating board (210) is surrounded by at least one pair of the electrodes (220) and connects to a dissipating board (210) of an adjacent unit.

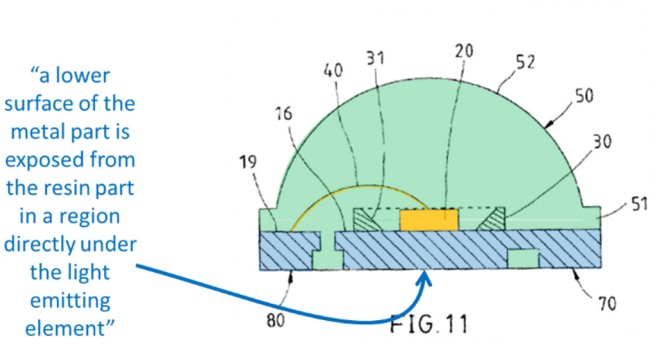
The dissipating boards (210) adjacent to the margin (310) further connect to the margin (310). The gaps (311) are formed between each one pair of the electrodes (220) and the dissipating board (210)." Ex. 1008 (Koung) ¶ 20. Koung further discloses, "[t]he step of *(c) molding the cell matrix (320)* may be using injection-compression molding (as shown in FIG. 4C). *The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)….*" Ex. 1008 (Koung) ¶ 21. Additionally, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises *separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs* (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24, *see also, e.g.,* Abstract, ¶¶ 8, 11-21, 24, 29-30, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F.

196. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose that at first and second outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first and second metal plate. Ex. 1030 (Hsu), Figs. 11-12; Ex. 1008 (Koung), Fig. 2C. In implementing Hsu's light emitting device using

Koung's teachings of a resin part, a POSITA would have understood that portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first and second metal plate. In view of the foregoing discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

h. Element 28.G: "wherein a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element"

197. **Hsu discloses: "a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element."** For example, Hsu discloses that a lower surface of the metal part (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Fig. 11 below) is exposed from the resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Figs. 11-12 below) in a region directly under the light emitting element (*e.g.*, "LED die 20," shown in orange in Fig 11 below). *E.g.*, Ex. 1030 (Hsu), Fig. 11.



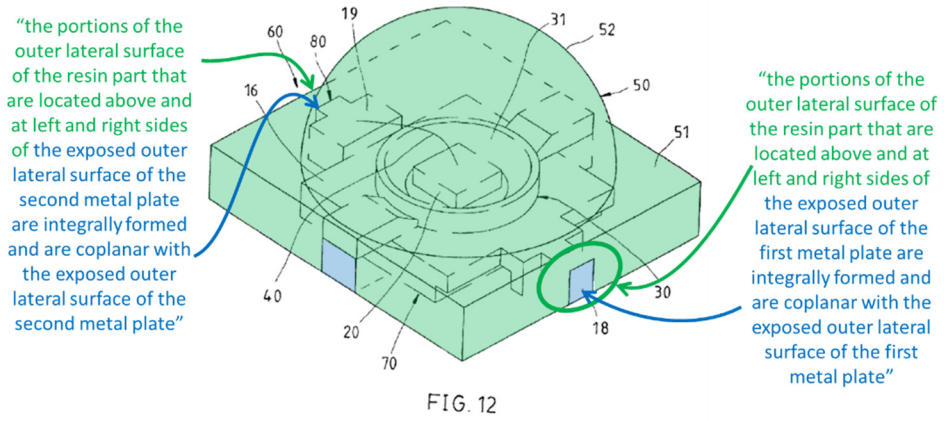
Ex. 1030 (Hsu), Fig. 11.

198. Hsu further discloses, "The LED die 20 has a bottom, which is smoothly bonded to a top surface of the main plate 16 of the first terminal 70." Ex. 1030 (Hsu), 4:13-15. Hsu also discloses, "[T]he main plate 16, more precisely, *the first terminal 70 has a large bottom surface to be totally exposed outside*, so that the heat generated by the die 20 can be conducted to the first terminal 70 and further conducted outside from the bottom surface of the first terminal 70." Ex. 1030 (Hsu), 4:41-46, *see also, e.g.,* 1:52-55, 2:58-3:22, 3:43-67, 4:1-49, cls. 1, 3, Figs. 10-12; Element 28.C.

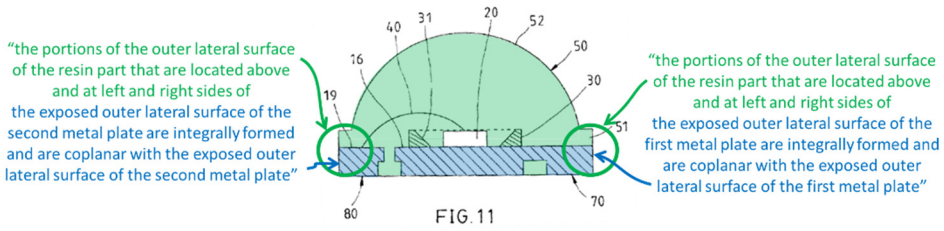
i. Element 28.H: "wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the first metal plate, and wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate"

199. **Hsu discloses: "the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the first metal plate, and wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate."** For example, Hsu discloses that the portions of the outer lateral surface of the resin part (*e.g.*, "reflecting ring 30" and "encapsulant 50," shown in green in Figs. 11-12 below) that are located above and at left and right sides of the exposed outer lateral surfaces of the first and second metal plates (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Figs. 11-12 below) are integrally formed and are

coplanar with the exposed outer lateral surfaces of the first and second metal plates. *E.g.*, Ex. 1030 (Hsu) Figs. 11-12.



Ex. 1030 (Hsu), Fig. 12.



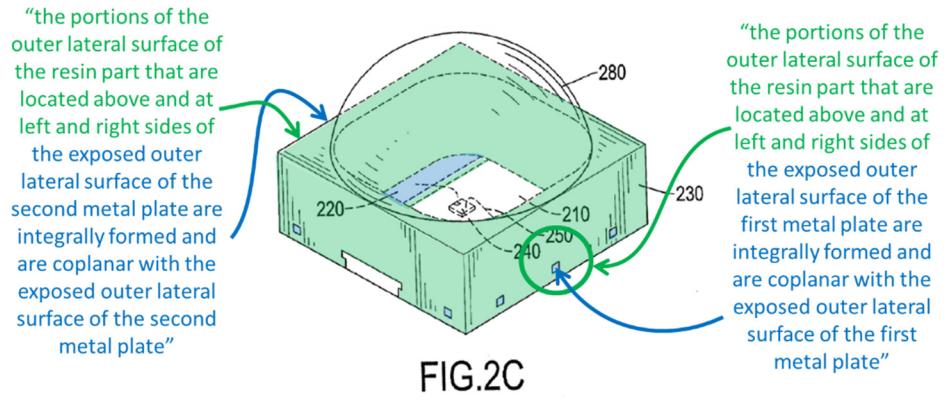
Ex. 1030 (Hsu), Fig. 11.

200. Hsu further discloses, "*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the transversal dividing bar 15 or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the longitudinal dividing bars 14 or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell*

11 to connect only the longitudinal dividing bar 14 or the longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:67-3:11. Hsu also discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding technique. *The encapsulant 50 has a rectangle base 51, which corresponds to the cell 11 in size and fills the openings of the cell 11* and covers the surface of the frame 10 with a predetermined thickness. All the bases 51 of the encapsulants 50 are integrated together initially, so that *the encapsulants 50 not only cover the main plates 16, the bridges 17, the extending arms 18 and the separate arms 19 of the cells 11* but also the dividing bars 14 and 15 of the frame 10. In this embodiment of the present invention, the base 51 is higher than the frame 10…." Ex. 1030 (Hsu), 3:43-54. Hsu further discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 1-12.

201. To the extent it is argued further disclosure of a resin part is required, **Koung discloses: "the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the**

exposed outer lateral surface of the first metal plate, and wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate." For example, Koung discloses that the portions of the outer lateral surface of the resin part (*e.g.*, "reflective base (230)," shown in green in Fig. 2C below) that are located above and at left and right sides of the exposed outer lateral surfaces of the first and second metal plates (*e.g.*, "pair of electrodes (220)," shown in blue in Fig. 2C below) are integrally formed and are coplanar with the exposed outer lateral surfaces of the first and second metal plates. *E.g.*, Ex. 1008 (Koung) Fig. 2C.



Ex. 1008 (Koung), Fig. 2C.

202. Koung further discloses, "a packaging method…comprises steps of:… (b) treating the metal board (300) to form an after-treating metal board (301), (c) molding a cell matrix (320) with multiple reflective bases (230) on the after-

treating metal board (301) to form a after-molding board (302)… and (f) cutting off the after-packaging board (303) to form multiple individual high-power LED packages (330)." Ex. 1008 (Koung) ¶ 18. Koung also discloses, "The step of (c) molding the cell matrix (320) comprises forming a cell matrix (320) on the after-treating metal board (301) and *filling the gaps (311)* with an insulating material simultaneously to form an after-molding board (302) with multiple substrates (200). The step of (c) molding the cell matrix (320) may be using injection-compression molding (as shown in FIG. 4C). The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)…." Ex. 1008 (Koung) ¶ 21. Additionally, Koung discloses, "The step of (f) cutting off the after-packaging board (303) comprises separating the reflective bases (230) of the cell matrix (320) and the units of the after-treating metal board (301) to obtain multiple individual packages (330) for high-power LEDs (as shown in FIG. 4F)." Ex. 1008 (Koung) ¶ 24, see also, e.g., Abstract, ¶¶ 8, 11-21, 24-25, 29-30, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F.

203. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). Both Hsu and Koung disclose that the portions of the outer lateral surface of the resin part that are located above and at left and right

sides of the exposed outer lateral surface of the first and second metal plates are integrally formed and are coplanar with the exposed outer lateral surface of the first and second metal plates. Ex. 1030 (Hsu), Figs. 11-12; Ex. 1008 (Koung), Fig. 2C. In implementing Hsu's light emitting device using Koung's teachings of a resin part, a POSITA would have understood that the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first and second metal plates are integrally formed and are coplanar with the exposed outer lateral surface of the first and second metal plates. In view of the foregoing and the discussion above in Element 27.B (¶¶ 128-129), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

8. Invalidity of Proposed Substitute Claim 29 Over Hsu in view of the Knowledge of a POSITA (Ground 1); Hsu in view of Urasaki (Ground 2); and Hsu in view of Koung and Urasaki (Ground 3)

a. Claim 29: "The light emitting device according to claim 28, wherein the resin part is made using a thermosetting resin."

204. **Hsu in view of the knowledge of a POSITA and Hsu in view of Koung render obvious: "The light emitting device according to claim 28."** *See* claim 28.

205. **Hsu discloses: "the resin part is made using a…resin."** For example, Hsu discloses, "Step 5: Referring to FIGS. 10-11, form ***an encapsulant 50*** on each of the cells 11 of the frame 10 ***with epoxy resin*** by means of the injection molding technique." Ex. 1030 (Hsu), 3:43-45. *See, e.g.*, 1:13-48, 1:56-2:14, 3:43-63, 4:1-38, cl. 1, Figs. 1-12.

206. It would have been obvious to a POSITA and a straightforward and beneficial design choice, to use a thermosetting resin in forming the resin part of the resin package taught by Hsu. *See* Element 27.B (¶ 125).

207. To the extent it is argued further disclosure of a resin part including a thermosetting resin is required, **Urasaki discloses: "the resin part is made using a thermosetting resin."** *See* Claim 27.B.

208. A POSITA would have been motivated and found it obvious and a straightforward and beneficial design choice, to use a thermosetting resin, *as*

expressly taught by Urasaki, in forming the resin part of the resin package taught by Hsu. *See* Claim 27.B (¶ 131). Additionally, a POSITA would have been motivated and found it obvious and a straightforward and beneficial design choice, to use a thermosetting resin, *as expressly taught by Urasaki*, in implementing Hsu's light emitting device (as implemented using Koung's teachings of a resin part). *See* Claim 27.B (¶ 132).

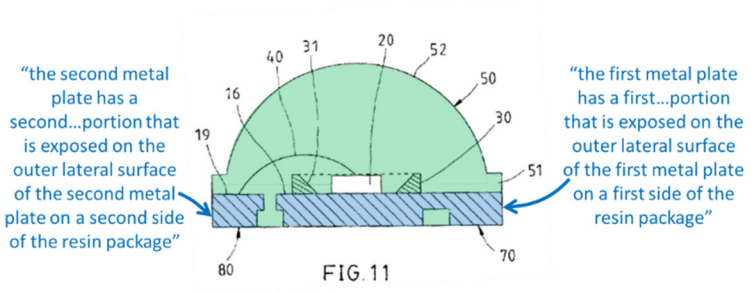
9. Invalidity of Proposed Substitute Claim 30 Over Hsu in view of Suenaga (Ground 5) and Hsu in view of Koung and Suenaga (Ground 6)

a. Claim 30: "The light emitting device according to claim 28 wherein: the first metal plate has a first step portion that is exposed on the outer lateral surface of the first metal plate on a first side of the resin package, and the second metal plate has a second step portion that is exposed on the outer lateral surface of the second metal plate on a second side of the resin package."

209. **Hsu in view of the knowledge of a POSITA and Hsu in view of Koung render obvious: "The light emitting device according to claim 28."** *See* claim 28.

210. **Hsu discloses: "the first metal plate has a first…portion that is exposed on the outer lateral surface of the first metal plate on a first side of the resin package and the second metal plate has a second…portion that is exposed on the outer lateral surface of the second metal plate on a second side of the resin package."** For example, Hsu discloses that the first and second metal

plates (*e.g.*, "first terminal 70" and "second terminal 80," shown in blue in Fig. 11 below) have first and second portions that are exposed on the outer lateral surfaces of the first and second metal plates on first and second sides of the resin package (*e.g.*, indicated by blue arrows in Fig. 11 below). *E.g.*, Ex. 1030 (Hsu), Fig. 11.



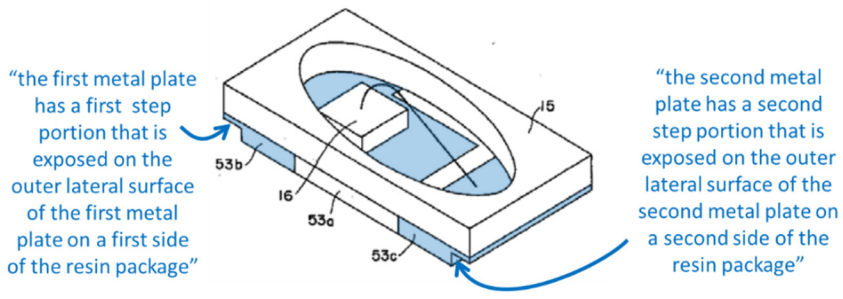
Ex. 1030 (Hsu), Fig. 11.

211. Hsu further discloses, "*The openings of the cell 11 are alike in shape*, that is, *the cell 11 has* a rectangle main plate 16 at a center thereof, and *two bridges 17 respectively at two centers of the upper and the lower lateral sides* to connect the main plate 16 and the transversal dividing bar 15 or the transversal lateral bars 13, *and an extending arm 18 at the middle of right lateral side of the cell 11* to connect the main plate 16 and the longitudinal dividing bars 14 or the longitudinal lateral bars 12, *and an separate arm 19 at the middle of left lateral side of the cell 11* to connect only the longitudinal dividing bar 14 or the longitudinal lateral bar 12 but to be spaced apart from the main plate 16." Ex. 1030 (Hsu), 2:67-3:11. Hsu also discloses, "Referring to FIGS. 10-11, *form an encapsulant 50 on each of the cells 11 of the frame 10 with epoxy resin* by means of the injection molding

technique." Ex. 1030 (Hsu), 3:43-54. Hsu further discloses, "*Cut the frame 10 according to the size of each of the cell 11*, or smaller, by cutting out the lateral bars 12 and 13 and the dividing bars 14 and 15 of the frame 10 such that LED packages 60 are made." Ex. 1030 (Hsu), 3:64-67, *see also, e.g.,* Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 2-12.

212. **Suenaga discloses: "the first metal plate has a first step portion that is exposed on the outer lateral surface of the first metal plate on a first side of the resin package and the second metal plate has a second step portion that is exposed on the outer lateral surface of the second metal plate on a second side of the resin package."** For example, Suenaga discloses first and second metal plates (*e.g.*, "first metal thin plate 53b and the second metal thin plate 53c," shown in blue in Fig. 12 below) have first and second step portions that are exposed on the outer lateral surfaces of the first and second metal plates on first and second sides of the resin package (*e.g.*, "cutout parts," indicated by blue arrows in Fig. 12 below). *E.g.*, Ex. 1033 (Suenaga), Fig. 12.

[FIG. 12]



Ex. 1033 (Suenaga), Fig. 12.

213. Suenaga further discloses, "Here, with the example shown in FIG. 12, *on the first metal thin plate 53b and the second metal thin plate 53c, cutout parts are formed* at the parts positioned at both ends of the chip bonding surface. *By having cutouts formed in this way, it is possible to increase the bonding area when bonding with the mounting substrate, making it possible to improve the adhesive strength.* Also, on the cutout portions, for example, it is possible to implement metal plating to make soldering easy, and to connect at the cutout portions." Ex. 1033 (Suenaga) ¶ 45, *see also, e.g.,* Abstract, ¶¶ 1, 6, 30-32, 35-36, Figs. 3-10.

214. A POSITA would have been motivated and found it obvious and straightforward and beneficial design choice to provide a step portion that is exposed on the outer lateral surface of the first and second metal plates on the first and second sides of the resin package, *as expressly taught by Suenaga*, in implementing the metal plates for a resin package taught by Hsu, to provide for increased bonding area when bonding the resin package to a mounting substrate, which beneficially allows for improved bonding strength. Both Hsu and Suenaga are in the same field of art and relate to manufacturing multiple LED packages using a lead frame. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1033 (Suenaga), Abstract, ¶¶ 1, 35, 38, 45, Figs. 3-12. Suenaga expressly teaches that by including a step portions

that are exposed on the outer lateral surfaces of the metal plates, "*it is possible to increase the bonding area when bonding with the mounting substrate, making it possible to improve the adhesive strength.*" Ex. 1033 (Suenaga) ¶ 45. And a POSITA would have been motivated to use Suenaga's teachings of step portions that are exposed on the outer lateral surfaces of metal plates in implementing the metal plates taught by Hsu to increase the strength of bonds formed between the metal plates and the mounting substrate. Ex. 1033 (Suenaga) ¶ 45. Hsu, like Suenaga, discloses first and second metal plates that have first and second portions that are exposed on the outer lateral surfaces of the first and second metal plates on first and second sides of the resin package. Ex. 1030 (Hsu), Fig. 11, *see also, e.g.*, Abstract, 1:56-2:14, 2:17-44, 2:48-3:11, 3:43-67, 4:1-38, cls. 1, 3, Figs. 1-12; Ex. 1033 (Suenaga), Abstract, ¶¶ 1, 6, 30-32, 35-36, Figs. 3-10, 12. Thus, it would have been obvious to a POSITA to implement the exposed outer lateral surfaces of Hsu's metal plates using exposed step portions, as taught by Suenaga. A POSITA would have found it routine and straightforward to include step portions that are exposed on the outer lateral surfaces of metal plates, as taught in Suenaga, implementing Hsu's metal plates for a light emitting device and would have known that such a combination (yielding the claimed limitation) would predictably work and provide the expected functionality.

10. Invalidity of Proposed Substitute Claim 31 Over Hsu in view of Koung, Urasaki, Mori, and Glenn (Ground 7)

a. Element 31.Pre: "The light emitting device according to claim 29"

215. **Hsu in view of Koung and Urasaki renders obvious: "The light emitting device according to claim 29."** *See* Claim 29.

b. Element 31.A: "wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors"

216. **Koung discloses: "a sealing member that contains…phosphors."** For example, Koung discloses a sealing member (*e.g.*, "encapsulant (260)" and "fluorescer (270)," shown in brown in Fig. 2D below) that contains phosphors (*e.g.*, "fluorescer (270)," shown in brown in Fig. 2D below). *E.g.*, Ex. 1008 (Koung) ¶¶ 33-35, 37, Fig. 2D.

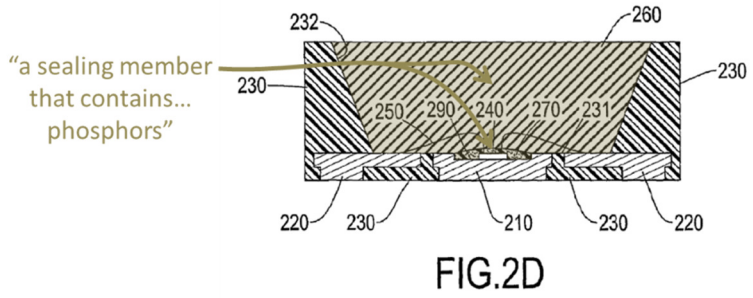


FIG.2D

Ex. 1008 (Koung), Fig. 2D.

217. Koung further discloses, ("*The encapsulant (260)* is pervious to light, preferably is transparent, *may be* transparent resin, *transparent resin with fluorescer or the like* and is formed in and fills the recess (233) of the substrate

(200) to hold and protect each LED chip (240) and each pair of conductive wires." Ex. 1008 (Koung) ¶ 37. Koung also discloses, "*Each LED chip (240)* connects electrically to one pair of the electrodes (220) and is adhered to the dissipating board (210) and may be mounted in the chip-bonding recess (290), *may be surrounded by the fluorescer (270) to excite the fluorescer (270)* and has two terminals. When the LED chip (240) is *blue LED*, the fluorescent agent (270) will be excited to generate yellow light. A balanced mixing of yellow and blue lights results in an appearance of white light." Ex. 1008 (Koung) ¶ 33. Koung further discloses, "*Techniques for mixing lights and utilizing fluorescers (270) are well known by those possessing ordinary skill in the art.*" Ex. 1008 (Koung) ¶ 34. Additionally, Koung discloses, "*Light emitted by the package can be tailored using the fluorescer (270)* or multiple lights emitting different wavelengths that are mixed, *techniques for mixing lights and utilizing fluorescer (270) is well known by those possessing ordinary skill in the art.*" Ex. 1008 (Koung) ¶ 35, *see also, e.g.,* Abstract, ¶¶ 8, 11-18, 23, 28, 31-35, 37, cls. 1, 10-16, Figs. 2A-D, 3A-B, 4E-F.

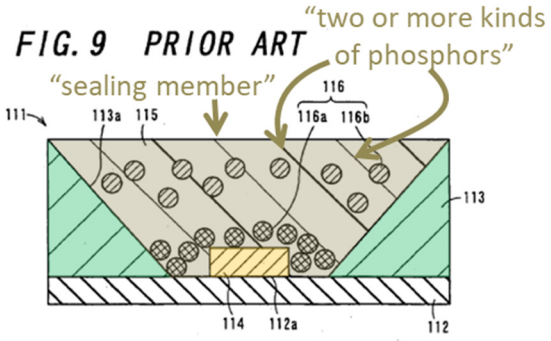
218. A POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a concave portion filled with a sealing member containing phosphor and a blue LED chip in implementing Hsu's light emitting device. As noted above, Hsu and Koung are in the same field of art. It would have been obvious to implement Hsu's device using Koung's

"reflective base" filled with a "transparent resin with fluorescer." Ex. 1008 (Koung) ¶¶ 30, 37, Figs. 2A, 2D; *see also* Element 27.B (¶¶ 128-129). A POSITA would have recognized that doing so would advantageously protect the LED chip from mechanical stress, moisture, and oxidation, and convert light to a different color. *Koung expressly discloses* that "transparent resin with fluorescer" is used advantageously "to hold and protect each LED chip (240) and each pair of conductive wires." Ex. 1008 (Koung) ¶ 37. Koung also expressly discloses, "Light emitted by the package can be tailored using the fluorescer (270)…, techniques for mixing lights and utilizing fluorescer (270) is well known by those possessing ordinary skill in the art." Ex. 1008 (Koung) ¶ 35. Koung further discloses use of a "blue LED" chip. Ex. 1008 (Koung) ¶ 33. A POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a concave portion filled with a sealing member containing phosphor and a blue LED chip in implementing Hsu's light emitting device, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

219. As set forth in the January 12, 2018 Declaration, Mori discloses this element. Ex. 1003 (January 12, 2018 Declaration) ¶¶ 137-139.

220. **Mori discloses: "a sealing member that contains two or more kinds of phosphors."** For example, Mori discloses a sealing member (*e.g.*, "a light

transmitting member 115," shown in brown in Fig. 9 below) that contains two or more kinds of phosphors (*e.g.*, "*two kinds of phosphors 116a, 116b*", shown in brown in Fig. 9 below). *E.g.*, Ex. 1005 (Mori) ¶ 5, Fig. 9.



Ex. 1005 (Mori), Fig. 9.

221. Mori further discloses, "FIG. 9 is a sectional view showing a light-emitting apparatus 111 *of conventional design* in which any color lights are emitted by *two kinds of phosphors 116a, 116b* which convert near-ultraviolet light, blue-color light or the like emitted from a light-emitting element 114 such as a light-emitting diode (LED) into light such as red-color light, green-color light, blue-color light, or yellow-color light." Ex. 1005 (Mori) ¶ 5. Mori also discloses, "the light-emitting apparatuses are allowed to emit white light under conditions where the light emitted from the light-emitting elements 104, 114 and the light emitted from the phosphors 106, 116 emitting fluoresce by being excited by the light emitted from the light-emitting elements 104, 114 are in a complementary-color relation to each other. *The preferred examples of the phosphors 106, 116 in use*

include: a cerium (Ce)-activated yttrium aluminum garnet-based phosphor; a perylene derivative; copper (Cu).Al-activated zinc cadmium sulfide; manganese (Mn)-activated magnesium oxide; and manganese (Mn)-activated titanium oxide. The phosphors 106, 116 may be formed of either a single substance or a mixture of two or more different substances." Ex. 1005 (Mori) ¶ 10. Mori further discloses, "*the phosphors 106, 116 are admixed in the light transmitting members 105, 115 made of epoxy resin, silicone resin, or the like*. Then, the light transmitting members 105, 115 containing the phosphors 106, 116 are so charged inside of the frame bodies 103, 113 as to cover the light-emitting elements 104, 114 from above, and is then cured with heat, thereby constituting a phosphor layer." Ex. 1005 (Mori) ¶ 11. Mori also discloses, "the mixing ratio of the phosphors" can be "adjust[ed]," making it "*possible to set a color temperature without restraint*." Ex. 1005 (Mori) ¶ 12. Mori further discloses, "By blending these phosphors 6 in a given proportion, *it is possible to put out light having the desired emission spectrum and color*." Ex. 1005 (Mori) ¶ 91, *see also, e.g.,* ¶¶ 5-11, 17, 27, 39, 59-66, 70-71, 87-94, 104-05, 110-11, 116, Figs. 1-3, 8; Ex. 1003 (January 12, 2018 Declaration) ¶¶ 137-38.

222. A POSITA would have been motivated and found it obvious and straightforward to use Mori's advantageous teachings of a "near-ultraviolet" or "blue-color" light emitting element and a sealing member that contains two or more kinds of phosphors in implementing Hsu's light emitting device (as

implemented using Koung's teachings) to beneficially adjust the color of the light emitted from the light emitting element, advantageously making it "*possible to set a color temperature without restraint*." Ex. 1005 (Mori) ¶¶ 4, 12, 10-11; *see also* Ex. 1002 ('071 File History), 145; Ex. 1003 (January 12, 2018 Declaration) ¶ 139. Hsu, Koung, and Mori are in the same field of art, and relate to an LED package having a resin part. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, Figs. 1-12; Ex. 1008 (Koung) ¶¶ 33-35, 37, Fig. 2D; Ex. 1005 (Mori) ¶¶ 4-5, 37, 87, 2, Figs. 3, 9. Koung further discloses using, *e.g.*, a "blue" light emitting diode, and explains that the sealing member used to encapsulate the light emitting diode may be "transparent resin with fluorescer or the like" in order to "tailor[]" the "[l]ight emitted by the package." Ex. 1008 (Koung) ¶¶ 33, 35, 37. Mori expressly teaches that it is "*conventional*" *to use two or more kinds of phosphors* in the sealing member filled in the concave portion of an LED package to "perform wavelength conversion" to convert the color of light emitted by the light emitting diode (such as "near-ultraviolet light, blue-color light or the like") to a different color (such as "white light," "red-color light, green-color light, blue-color light, or yellow-color light"). Ex. 1005 (Mori) ¶¶ 5, 10. Mori also discloses that "various materials may be used in consideration of the luminescence wavelength of the light emitted from the light-emitting elements 104, 114, as well as desired light emitted from the light-emitting apparatuses 101, 111." *Id.* ¶ 10.

Mori further explains that *by using two or more kinds of phosphors* in the sealing member, "the mixing ratio of the phosphors" can be "adjust[ed]" as needed to advantageously "*set a color temperature without restraint*" and obtain the desired color of light. Ex. 1005 (Mori) ¶¶ 12, 91. Mori thus teaches that using two or more kinds of phosphors in the sealing member (as opposed to just one phosphor) advantageously provides more options as to the color temperature output from the light emitting device. Ex. 1005 (Mori) ¶¶ 12, 87. Indeed, it was well-known and conventional (as Mori expressly describes – *id.* ¶¶ 4-5) to use a "near-ultraviolet" or "blue-color" light emitting element and two or more kinds of phosphors in a sealing member of a light emitting device to advantageously tailor the color of the emitted light with flexibility—for example, to downconvert light from an ultraviolet or blue LED to a desirable warm color of visible light by adjusting the mixing ratio of two or more phosphors. In view of the foregoing, a POSITA would have found it routine and straightforward to use a sealing member that contains two or more kinds of phosphors, as taught in Mori, in implementing Hsu's light emitting device (as implemented using Koung's teachings), and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

c. Element 31.B: "wherein each of the first and second metal plates includes an etched concave portion on an upper surface of the respective metal plate"

223. **Hsu discloses: "first and second metal plates."** *See* Claim 28.

224. As discussed above (§ VI.E), there is no disclosure in the specification that the etched concave portion is on an *upper surface* of the metal plate. However, to the extent it is argued this element is disclosed in the '071 specification (*see, e.g.*, Ex. 2019 ¶ 63 (citing '071 patent Fig. 11), **Glenn discloses: "each of the first and second metal plates includes an etched concave portion on an upper surface of the respective metal plate."** For example, Glenn discloses, ("Side surface 27 of die pad 24 and side surface 33 of tab 30 of FIG. 3 have reentrant portions. *In particular, the upper and lower portions of side surfaces 27 and 33 are reentrant such that there is a central peak 34 which extends outward from side surfaces 27 and 33 of die pad 24 and tab 30*, respectively. Encapsulant material flows into the reentrant portions of side surfaces 27 and 33. *Central peak 34 extends into the encapsulant material.* The reentrant portions of side surfaces 27 of die pad 24 and side surfaces 33 of tabs 30 of FIG. 3 have the function, in a completed package, of *enhancing the connection between the encapsulating material*, on the one hand, *and die pad 24 and the contacts of the package* (i.e., severed tabs 30), on the other hand." Ex. 1034 (Glenn), 4:47-60. Glenn also discloses, "A leadframe 20 having side surfaces like FIG. 3 can be formed by *chemically etching the rolled strip metal*

stock from both sides using a conventional liquid etchant. The etch process is stopped early so that there is an underetching of all of the side surfaces of the components of leadframe 20, including side surfaces 27 of die pad 24 and side surfaces 33 of tabs 30, compared to the time it would take to form vertical side surfaces. The size and shape of central peak 34 of FIG. 2 is controlled by the amount of underetching." Ex. 1034 (Glenn), 5:63-6:4, *see also, e.g.*, 2:4-15, 2: 53-60, 3:47-4:46, 8:25-9:51, Fig. 8.

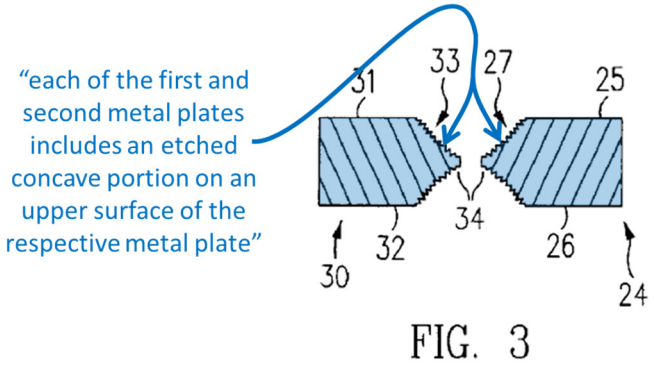


FIG. 3

Ex. 1034 (Glenn), Fig. 3.

225. A POSITA would have been motivated and found it obvious and straightforward to use Glenn's advantageous teachings of etched curved concave portion on each of the first and second metal plates in implementing Hsu's light emitting device that utilizes first and second metal plates to beneficially provide metal portions that extend into the resin, advantageously improving the adhesion and stability of the connection between the resin and the metal plates. Both Hsu and Glenn are in the same field of art, and relate to a resin package with metal

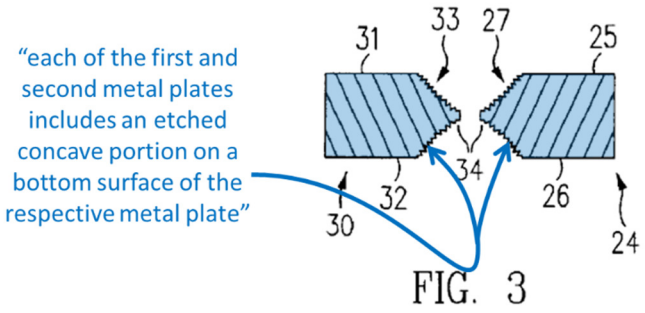
leads frame and resin. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1034 (Glenn), Abstract, 1:14-2:15, 2:22-31, 2:66-3:13, 3:44-64, 5:43-48, 6:57-7:39, 8:26-45, 9:1-7. Hsu further discloses using, *e.g.*, a lead frame having first and second metal plates. Ex. 1030 (Hsu), Abstract, 1:58-62, 2:58-3:11, 4:1-38, Figs. 2-12. Glenn expressly teaches using metal plates with "reentrant portions" on the sides of the metal plates (resulting in "a central peak") that are formed by "underetching." Ex. 1034 (Glenn), 4:46-60, 5:63-6:4. Glenn also discloses that because the resin "flows into the reentrant portions" and the "[c]entral peak 34 extends into" the resin, the connection between the resin and the metal plates is "enhanced" and "[t]he reentrant portions and asperities of the side surfaces of the die pad and contacts function as encapsulant fasteners or lead locks." Ex. 1034 (Glenn), 2:53-61, 4:47-60. Glenn discloses in Fig. 3 that the etched portions are curved, which shape results from the underetching. Ex. 1034 (Glenn) 5:63-6:4 ("The size and *shape of central peak* 34 of FIG. 2 *is controlled by the amount of underetching*.") (by context, clearly referring to Fig. 3 instead of Fig. 2). Glenn thus teaches that using etched curved concave portions advantageously improve the adhesion and stability of the resin package, which a POSITA would have understood contributes to longer lifetimes. *Id.* Indeed, it was well-known and conventional (as Glenn expressly describes – *id.*) to use etched curved concave portions on the metal plates

in a resin package to improve adhesion and stability of the resin package and extend package lifetime. In view of the foregoing, a POSITA would have found it routine and straightforward to use etched curved concave portions on the metal plates, as taught in Glenn, in implementing the metal plates used in Hsu's light emitting device, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

d. Element 31.C: "wherein each of the first and second metal plates includes an etched concave portion on a bottom surface of the respective metal plate"

226. **Hsu discloses: "first and second metal plates."** *See* Claim 28.

227. As discussed above (§ VI.E), there is no disclosure in the specification that the etched concave portion is on a *bottom surface* of the metal plate. However, to the extent it is argued this element is disclosed in the '071 specification (*see, e.g.*, Ex. 2019 ¶ 63 (citing '071 patent Fig. 11)), **Glenn discloses: "each of the first and second metal plates includes an etched concave portion on a bottom surface of the respective metal plate."** *See* Element 31.B, Ex. 1034 (Glenn), Fig. 3.



Ex. 1034 (Glenn), Fig. 3.

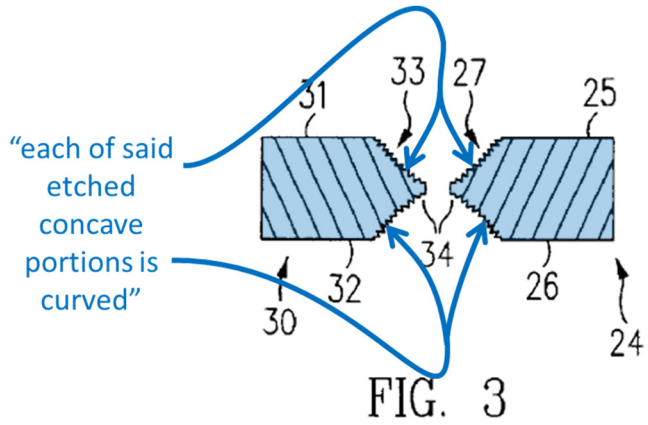
228. A POSITA would have been motivated and found it obvious and straightforward to use Glenn's advantageous teachings of etched curved concave portion on each of the first and second metal plates in implementing Hsu's light emitting device that utilizes first and second metal plates. *See* Element 31.B (¶ 225). In view of the foregoing discussion above in Element 31.B (¶ 225), a POSITA would have found it routine and straightforward to use etched curved concave portions on the metal plates, as taught in Glenn, in implementing the metal plates used in Hsu's light emitting device, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

e. Element 31.D: "wherein each of said etched concave portions is curved"

229. **Hsu discloses: "first and second metal plates."** *See* Claim 28.

230. To the extent it is argued Element 31.D is disclosed in the '071 specification, **Glenn discloses: "each of said etched concave portions is curved."**

As shown in Fig. 3 below, each of the etched concave portions (indicated by blue arrows) is curved. *See* Element 31.B, Ex. 1034 (Glenn), Fig. 3.



Ex. 1034 (Glenn), Fig. 3.

231. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Glenn's advantageous teachings of etched curved concave portion on each of the first and second metal plates in implementing Hsu's light emitting device that utilizes first and second metal plates. *See* Element 31.B (¶ 225). In view of the foregoing discussion above in Element 31.B (¶ 225), a POSITA would have found it routine and straightforward to use etched curved concave portions on the metal plates, as taught in Glenn, in implementing the metal plates used in Hsu's resin package, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

11. Invalidity of Proposed Substitute Claim 32 Over Hsu in view of Wang and Oshio (Ground 8) and Hsu in view of Koung, Wang, and Oshio (Ground 9)

a. Claim 32: "The light emitting device according to claim 28, wherein the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, the metal layers being made of a material that is different from that of the base portion."

232. **Hsu in view of the knowledge of a POSITA and Hsu in view of Koung render obvious: "The light emitting device according to claim 28."** *See* claim 28.

233. As set forth in the January 12, 2018 Declaration, Wang and Oshio disclose this element. Ex. 1003 (January 12, 2018 Declaration) ¶¶ 145-150.

234. **Wang discloses: "the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, the metal layers being made of a material that is different from that of the base portion."** For example, Wang discloses the metal part includes a base portion (*e.g.*, "lead frames 1," shown in blue in Fig. 4) and a metal layer disposed on each of an upper surface and a lower surface of the base portion (*e.g.*, "electroplating layer 2," shown in pink in Fig. 4), the metal layers being made of a material that is different from that of the base portion (*e.g.*, "electroplating layer 2" is a different material than the "lead frames 1," *see* Fig. 4). *E.g.* Ex. 1006 (Wang) ¶ 41, Fig. 4.

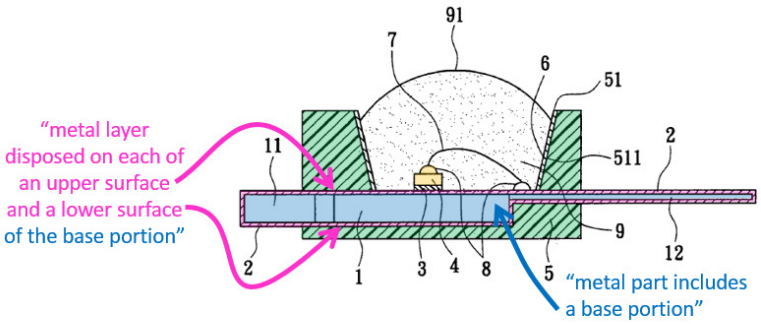


FIG. 4

Ex. 1006 (Wang), Fig. 4.

235. For example, Wang discloses, "a *plurality of lead frames are formed on a metal strip* with good electric conductivity and good heat conduction." Ex. 1006 (Wang) ¶ 40, Fig. 2. Wang thus discloses that the leads, which are a base portion, are formed of metal. Wang discloses "[n]ext, *electroplating a layer of metal* on each of outer surface of the lead frames 1 each to form an electroplating layer 2." *Id.* ¶ 41; *see also id.* ¶¶ 9, 13, 39, 41, 53-54, Figs. 2-5. Wang thus discloses that a metal layer is disposed on each of an upper surface and a lower surface of the base portion. Figure 4 of Wang further shows that the "electroplating layer 2" (shown in pink) is a different material than the leadframe 1 (shown in blue), as the "electroplating layer 2" has a different shading texture than the leadframe 1. *Id.* ¶ 54, Fig. 4; *see also, e.g.*, *id.* ¶¶ 9, 13, 39, 41, 53-54, Figs. 2-5. Indeed, a POSITA would have understood that the benefits of electroplating are to deposit a layer of a material with advantageous surface properties (*e.g.*, corrosion resistance, higher reflectivity) on a base portion of a different material having

advantageous bulk properties (*e.g.*, low cost and high conductivity) but problematic surface properties (*e.g.*, tendency to corrode, lower reflectivity).

236. A POSITA would have been motivated to use Wang's advantageous teachings of plating a metal layer (made of a material that is different from the metal part) on all surfaces of the metal part in implementing a metal part for a light emitting device, as taught by Hsu, to obtain the beneficial surface properties of the plated metal layer while retaining the beneficial properties of the base portion of the metal part. Both Hsu and Wang are in the same field of art, and relate to light emitting devices, and packages for light emitting devices. *E.g.*, Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12, Abstract; Ex. 1006 (Wang) ¶¶ 2, 8, 39, Abstract, Fig. 4. It was well-known in the art that it was advantageous to plate all surfaces of, *e.g.*, a leadframe "made of an electrically conductive metal" as taught by Hsu, with a metal layer made of a material that is different from the leadframe, *e.g.*, silver or gold, to obtain the beneficial surface properties of the metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the metal part (such as high thermal and electrical conductivity at a lower cost). *See also* Ex. 1007 (Oshio) ¶¶ 69, 113 (teaching that it is advantageous to plate a leadframe made of a

"copper…alloy…for…high thermal conductivity" with silver or a nickel/palladium/gold laminate "*to increase the light reflectance*" and "*to increase…the bonding strength of solder*."), Figs. 1-4; Ex. 1002 ('071 File History), 142-143 (Examiner finding during prosecution that it was known in the art and would have been obvious to use plated copper leadframes for mounting light emitting devices to "protect[] the metal of the lead frame from oxidation"). Indeed, it was well-known and conventional in the art to use electroplating (which involves submerging the leadframe in an electroplating bath) to form a metal layer on all surfaces of the leadframe. Furthermore, while copper, iron, or alloys thereof (commonly used for the base portion of a leadframe) have advantageous bulk properties such as low thermal and electrical resistance and relatively low cost, such materials are susceptible to corrosion at the surface. A POSITA would have understood that Hsu's leadframe would have benefited from plating (such as silver-plating or nickel/palladium/gold-plating) because surface corrosion causes decreased solderability, increased contact resistance in electrical connections to other elements, decreased hermeticity at resin/metal interfaces, and decreased reflectivity, each of which decreases reliability and/or performance of a light emitting device, as was well-known in the art. A POSITA would have understood that applying Wang's teaching of electroplating to all surfaces of Hsu's leadframe would have improved Hsu's leadframe by coating the leadframe with a metal layer

having advantageous surface properties (*e.g.*, a corrosion-resistant metal such as silver or gold), thereby inhibiting surface corrosion, increasing solderability, decreasing contact resistance in connections to other elements, increasing hermeticity at resin/metal interfaces, and increasing reflectivity. It would have been obvious to a POSITA to plate Hsu's leadframe with a different material to obtain these advantageous surface properties for the leadframe while retaining the beneficial bulk properties (*i.e.*, low cost and high conductivity) for the base portion.

237. A POSITA would have found it routine and straightforward to plate all surfaces of the leadframe with a metal layer that is made of a different metal than the leadframe (as taught by Wang) in implementing the manufacturing process for an LED package using a metal leadframe (as taught by Hsu), and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. Ex. 1003 (January 12, 2018 Declaration) ¶ 146. Indeed, it was well-known in the art to perform plating on a leadframe. *E.g.*, Ex. 1007 (Oshio) ¶ 69, Figs. 1-4 (teaching that a leadframe made of a "copper (Cu) based alloy" is plated with "silver (Ag), or nickel (Ni)/palladium (Pd)/gold (Au)"); Ex. 1008 (Koung) ¶ 26 (teaching that a leadframe "may be plated with silver coating or other conductive materials").

238. Moreover, a POSITA would have been motivated and found it obvious and a straightforward and beneficial design choice, to plate all surfaces of

the leadframe with a metal layer that is made of a different metal than the leadframe (as taught by Wang) in implementing Hsu's light emitting device (as implemented using Koung's teachings). Hsu, Koung, and Wang are in the same field of art and relate to manufacturing multiple LED packages by molding resin on a lead frame. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1008 (Koung), Abstract, ¶¶ 2, 7-8, 11-22, 24, 28-29, 30, 32, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F; Ex. 1006 (Wang) ¶¶ 2, 8, 39, Abstract, Fig. 4. Koung, like Wang, discloses plating the leadframe beforemolding. Ex. 1008 (Koung) ¶¶ 19-24, 26, 30; Ex. 1006 (Wang), Abstract, ¶¶ 9, 39, 49, Figs. 2-5. As discussed above, POSITA would have understood that plating all surfaces with a metal layer of a material different than the base portion provides beneficial surface properties of the metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the metal part (such as high thermal and electrical conductivity at a lower cost). A POSITA would have found it routine and straightforward to plate all surfaces of the leadframe with a metal layer that is made of a different metal than the leadframe (as taught by Wang) in implementing Hsu's light emitting device (as implemented using Koung's teachings), and would have understood that the combination (yielding the

limitation as claimed) would have predictably worked and provided the expected functionality.

239. **Oshio discloses: "the metal layers being made of a material that is different from that of the base portion."** For example, Oshio discloses the metal layers being made of a material (*e.g.*, "silver (Ag), or nickel (Ni)/palladium (Pd)/gold (Au) laminated in this order") that is different from that of the base portion (*e.g.*, "copper (Cu) based alloy"). *E.g.* Ex. 1007 (Oshio) ¶ 69.

240. Oshio further discloses forming the base portion, "the pair of leads 20 and 30," from a metal such as a "copper (Cu) based alloy" to obtain "high thermal conductivity." Ex. 1007 (Oshio) ¶ 69. Oshio further discloses "[c]oating" the surfaces of the leadframe "by plating or other process…to increase the light reflectance at the sidewall of the cup-shaped recess 20C and the bonding strength of solder on the rear face of the outer lead sections 20A and 30A and of the lead 20 directly below the chip 10." *Id.* ¶ 69. Oshio further discloses "[s]uch coating may include, for example, silver (Ag), or nickel (Ni)/palladium (Pd)/gold (Au) laminated in this order." *Id.* ¶ 69. The materials that Oshio discloses using for the metal layer (*e.g.*, silver, nickel/palladium/gold) is "a material that is different from that of" the leads (*e.g.*, copper). Ex. 1007 (Oshio) ¶ 69, *see also, e.g.*, ¶ 113, Figs. 1-4.

241. A POSITA would have been motivated to use Oshio's advantageous express teachings of using a metal layer made of a material that is different from the base portion, in implementing the combined teachings of Hsu and Wang (and alternatively, Hsu, Koung, and Wang) having a leadframe for an LED package that includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, to obtain the beneficial surface properties of the plated metal layer while retaining the beneficial properties of the base portion of the metal part. *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143. Hsu, Koung, Wang, and Oshio are in the same field of art, and relate to light emitting devices, and packages for light emitting devices. *E.g.*, Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1006 (Wang) ¶¶ 2, 8, 39, Abstract, Fig. 4; Ex. 1007 (Oshio) ¶¶ 49, 61-63, 69, 71, 113-114, Abstract, Figs. 1-4; Ex. 1008 (Koung), Abstract, ¶¶ 2, 7-8, 11-22, 24, 28-29, 30, 32, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F.

242. As expressly disclosed by Oshio, it was common and well-known in the art to use copper as a base portion of a metal part due to its high thermal and electrical conductivity at a relatively low cost. *See, e.g.*, Ex. 1007 (Oshio) ¶ 69. Oshio also discloses that the "pair of leads 20 and 30" may be made of a "copper (Cu) based alloy" to "advantageously…obtain[] high thermal conductivity." Ex. 1007 (Oshio) ¶¶ 69. It was further well-known in the art that it was advantageous

to plate, *e.g.*, a copper leadframe, with a metal layer made of a material that is different from the leadframe, *e.g.*, silver, to obtain the beneficial surface properties of the metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the metal part (such as high thermal and electrical conductivity at a lower cost). Oshio itself expressly teaches that it is advantageous to plate a copper leadframe with silver "***to increase the light reflectance***" and "***to increase…the bonding strength of solder***." Ex. 1007 (Oshio) ¶¶ 69, 113, Figs. 1-4; *see also* Ex. 1002 ('071 File History), 142-143. A POSITA would have found it routine and straightforward to use a metal layer that is a different metal from the leadframe (as expressly taught by Oshio), in plating all surfaces of the leadframe with a metal layer in the combined teachings of Hsu and Wang (and alternatively Hsu, Koung, and Wang) and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. Indeed, it was well-known to perform plating on a leadframe. *E.g.*, Ex. 1008 (Koung) ¶ 26 (teaching that a leadframe "may be plated with silver coating or other conductive materials").

12. Invalidity of Proposed Substitute Claim 33 Over Hsu in view of Wang and Oshio (Ground 8) and Hsu in view of Koung, Wang, and Oshio (Ground 9)

a. Claim 33: "The light emitting device according to claim 32, wherein the metal layer is disposed at all surfaces of the metal part except an exposed outer lateral surface of the metal part."

243. **Hsu in view of Wang and Oshio; and Hsu in view of Koung, Wang, Oshio render obvious: "The light emitting device according to claim 32."** *See* claim 32.

244. As set forth in the January 12, 2018 Declaration, Wang and Oshio disclose this element. Ex. 1003 (January 12, 2018 Declaration) ¶¶ 151-161.

245. **Wang discloses: "the metal layer is disposed at all surfaces of the metal part except an exposed outer lateral surface of the metal part."** For example, Wang discloses, "a plurality of lead frames are formed on a metal strip." Ex. 1006 (Wang) ¶ 40, Fig. 2. Wang discloses "[n]ext, electroplating a layer of metal on each of outer surface of the lead frames 1 each to form an electroplating layer 2." *Id.* ¶¶ 41, 54, Figs. 2, 4; *see also, e.g., id.* ¶¶ 9, 13, 39, 41, 53-54, Figs. 2-5. Wang further discloses, after electroplating the leadframes and molding a reflector cup on the leadframes, "the tie-bars are cut off to separate the lead frames 1 from one another so as to form a plurality of high power light-emitting device packages." Ex. 1006 (Wang) ¶ 49, Fig. 2; *see also, e.g., id.* ¶¶ 9, 39, 41, 44, 49, 53-54, Figs. 2-5; Claim 32. A POSITA would have understood that cutting a plated leadframe

would result in an outer lateral surface of the metal part (which includes a portion of an outer lateral surface of the metal part) that is not plated with the metal layer—at the cut surfaces of the leadframe. During prosecution, the Examiner further confirmed this understanding, which the Applicants did not dispute. Ex. 1002 ('071 File History), 143. Because Wang discloses cutting the leadframes after electroplating, a POSITA would have understood that the electroplating layer is not disposed on the cut surfaces of the leadframe, thereby disclosing the claimed limitation "wherein the metal layer is disposed at all surfaces of the metal part except a portion of an outer lateral surface of the metal part."

246. As discussed above (Claim 32 (¶¶ 236-237)), a POSITA would have been motivated to use Wang's advantageous teachings of plating a metal layer (made of a material that is different from the metal part) on all surfaces of the metal part in implementing a metal part for a light emitting device, as taught by Hsu to obtain the beneficial surface properties of the plated metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the base portion of the metal part (such as high thermal and electrical conductivity at a lower cost). *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143. Furthermore, Hsu like Wang, discloses providing a leadframe, molding a

resin part, then "cut[ting]" to separate the light emitting device, and as also discussed above (¶ 244), Wang discloses molding and cutting the leadframes *after* electroplating. Ex. 1030 (Hsu) 2:58-3:11, 3:43-3:67, Figs. 1-12; Ex. 1006 (Wang), Abstract, ¶¶ 9, 39, 49, Figs. 2-5. Accordingly, a POSITA would have understood that implementing Wang's teachings of plating all surfaces of the metal part before molding and cutting in Hsu's manufacturing process for an LED package would result in a metal layer that is disposed at all surfaces of the metal part except an outer lateral surface of the metal part at the cut section.

247. Moreover, a POSITA would have been motivated and found it obvious and straightforward to use Wang's advantageous teachings of plating a metal layer on all surfaces of the metal part before molding and cutting, in implementing Hsu's manufacturing process for an LED package (as implemented using Koung's teachings)—thereby leaving a metal part that is unplated at the cut section—to increase the electrical and thermal conductivity of the leadframe and improve the performance and operating lifetime of the device. *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143. Indeed, it was well-known in the art before the claimed priority date to plate a leadframe, then perform a molding and cutting step, thereby leaving a metal part that is unplated at the cut section. *E.g.*, Ex. 1006 (Wang) ¶¶ 9, 39, Fig. 2 (teaching steps of electroplating the leadframe, forming an encapsulant on the leadframes, and then cutting); Ex. 1007

(Oshio) ¶¶ 69, 89, 114 (teaching steps of plating the leadframe to improve solderability of the lead to the chip, performing molding after the chip is mounted, then cutting); Ex. 1008 (Koung) ¶¶ 19-24, 26 (teaching steps of plating the leadframe, molding, then cutting). It would have been nothing more than an obvious, straightforward, and beneficial design choice to plate the leadframe on all surfaces (*e.g.*, by submerging the leadframe in an electroplating bath) and then perform molding and cutting. As further confirmed by the Examiner during prosecution, it was well-known that cutting after plating results in an unplated portion at the cut section. Ex. 1002 ('071 File History), 143; *see also* Ex. 1007 (Oshio) ¶ 114. Furthermore, it would have been beneficial to perform plating before molding and cutting and to plate all surfaces of the leadframe to provide for plating on a greater surface area of the leadframe, thereby increasing the thermal conductivity of the leadframe, leading to lower operating temperature and increased lifetime for the LED chip (which is small but has a high power-density). If regions of the leadframe, including those that are subsequently covered by resin, were not plated, the mounted LED would operate at a higher temperature, and the operating lifetime of the LED is shortened. Accordingly, by plating (*e.g.*, silver-plating) the entire leadframe before molding and cutting, the overall electrical and thermal conductivity of the leadframe is considerably increased, thus improving overall efficiency and reducing undesirable heating (and improving thermal and

electrical conductivity). Furthermore, plating the portions of the leadframe that are in contact with resin reduces the likelihood of corrosion-induced LED package failure at the resin/leadframe interface, thus improving the reliability of the interface between the resin and leadframe. Additionally, in view of these design needs and the finite number of options as to when to perform plating in the manufacturing process, performing plating before molding and cutting would have been obvious to try.

248. A POSITA would have found it obvious, routine and straightforward to use Wang's advantageous teachings of plating a metal layer on all surfaces of the metal part before molding and cutting, in implementing Hsu's manufacturing process for an LED package (as implemented using Koung's teachings)—thereby leaving an outer lateral surface of the metal part unplated after cutting—and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. A POSITA would have also understood that because Hsu teaches a leadframe with minimal cross-sectional area exposed by cutting, the impact of leaving cut areas exposed would also be minimized while still obtaining the benefits of plating as to the rest of the leadframe. Ex. 1007 (Oshio) ¶ 114.

249. **Oshio discloses: "the metal layer is disposed at all surfaces of the metal part except an exposed outer lateral surface of the metal part."** For

example, Oshio discloses, "if the lead frame is plated with silver or the like, an *unplated surface* of base material *is exposed* at the cut section…." Ex. 1007 (Oshio) ¶ 114, *see also, e.g.,* Abstract, ¶¶ 2, 100, 113, Figs. 4, 18A; Claim 32.

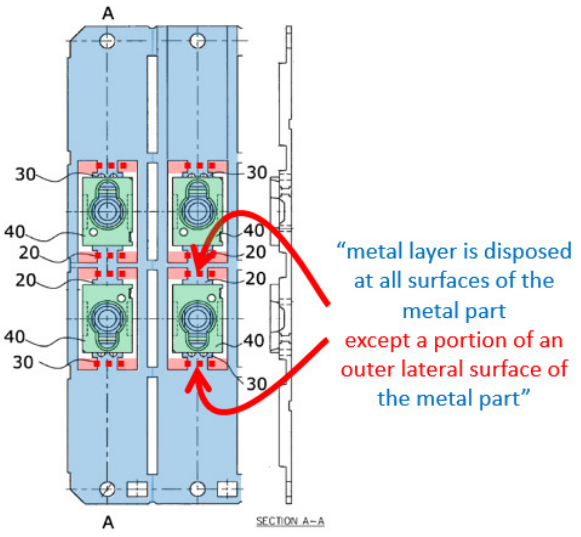


FIG. 13

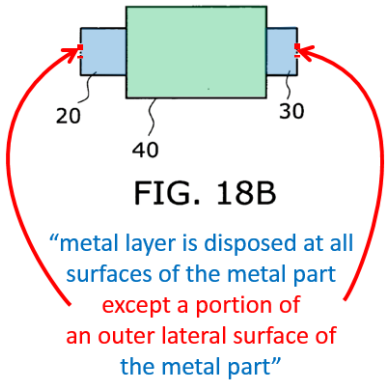


FIG. 18B

Ex. 1007 (Oshio), Figs. 13, 18B.

250. As discussed above (Claim 32 (¶¶ 241-242)), a POSITA would have been motivated to use Oshio's advantageous express teachings of using a metal layer made of a material that is different from the base portion, in implementing the combined teachings of Hsu and Wang (and alternatively Hsu, Koung, and Wang) having a leadframe for an LED package that includes a base portion and a metal layer disposed on all surfaces of the base portion, to obtain the beneficial surface properties of the plated metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other

elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the base portion of the metal part (such as high thermal and electrical conductivity at a lower cost). *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143. Furthermore, Hsu and Koung, like Wang and Oshio, discloses providing a leadframe, molding a resin part, then "cut[ting]" to separate the light emitting device, and Oshio (like Wang and Koung) further disclose molding and cutting the leadframes *after* plating. Ex. 1030 (Hsu) 2:58-3:11, 3:43-3:67, Figs. 1-12; Ex. 1006 (Wang), Abstract, ¶¶ 9, 39, 49, Figs. 2-5; Ex. 1007 (Oshio) ¶¶ 69, 89, 114; Ex. 1008 (Koung) ¶¶ 19-24, 26, 30. Accordingly, a POSITA would have understood that implementing Oshio's teachings of plating before molding and cutting, thereby resulting in a metal part that is unplated at the cut section, in the manufacturing process for an LED package in the combined teachings of Hsu and Wang (and alternatively Hsu, Koung, and Wang) would result in a metal layer that is disposed at all surfaces of the metal part except an outer lateral surface of the metal part (and a portion of an outer lateral surface of the metal part) at the cut section.

251. Moreover, a POSITA would have been motivated and found it obvious and straightforward to use Oshio's advantageous teachings of plating before molding and cutting—thereby leaving a metal part that is unplated at the cut section—in implementing the manufacturing process for an LED package in the

combined teachings of Hsu and Wang (and alternatively Hsu, Koung, and Wang) to further increase the electrical and thermal conductivity of the leadframe and improve the performance and operating lifetime of the device. *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 143. Indeed, it was well-known in the art before the claimed priority date to plate a leadframe, then perform a molding and cutting step, thereby leaving a metal part that is unplated at the cut section. *E.g.*, Ex. 1006 (Wang) ¶¶ 9, 39, Fig. 2 (teaching steps of electroplating the leadframe, forming an encapsulant on the leadframes, and then cutting); Ex. 1007 (Oshio) ¶¶ 69, 89, 114 (teaching steps of plating the leadframe to improve solderability of the lead to the chip, performing molding after the chip is mounted, then cutting); Ex. 1008 (Koung) ¶¶ 19-24, 26 (teaching steps of plating the leadframe, molding, then cutting). It would have been nothing more than an obvious, straightforward, and beneficial design choice to plate the leadframe on all surfaces (*e.g.*, by submerging the leadframe in an electroplating bath) and then perform molding and cutting. As further confirmed by the Examiner during prosecution, it was well-known that cutting after plating results in an unplated portion at the cut section. Ex. 1002 ('071 File History), 143; *see also* Ex. 1007 (Oshio) ¶ 114. Furthermore, it would have been beneficial to perform plating before molding and cutting and to plate all surfaces of the leadframe to provide for plating on a greater surface area of the leadframe, thereby increasing the thermal

conductivity of the leadframe, leading to lower operating temperature and increased lifetime for the LED chip (which is small but has a high power-density). If regions of the leadframe, including those that are subsequently covered by resin, were not plated, the mounted LED would operate at a higher temperature, and the operating lifetime of the LED is shortened. Accordingly, by plating (*e.g.*, silver-plating) the entire leadframe before molding and cutting, the overall electrical and thermal conductivity of the leadframe is considerably increased, thus improving overall efficiency and reducing undesirable heating (and improving thermal and electrical conductivity). Furthermore, plating the portions of the leadframe that are in contact with resin reduces the likelihood of corrosion-induced LED package failure at the resin/leadframe interface, thus improving the reliability of the interface between the resin and leadframe. Additionally, in view of these design needs and the finite number of options as to when to perform plating in the manufacturing process, performing plating before molding and cutting would have been obvious to try.

252. A POSITA would have found it obvious, routine and straightforward to use Oshio's advantageous teachings of plating before molding and cutting—thereby leaving a metal part that is unplated at the cut section—in implementing the manufacturing process for an LED package, as taught by Hsu and Wang (and alternatively, Hsu, Koung, and Wang) and would have understood that the

combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. A POSITA would have also understood that because Hsu teaches a leadframe with minimal cross-sectional area exposed by cutting, the impact of leaving cut areas exposed would also be minimized while still obtaining the benefits of plating as to the rest of the leadframe. Ex. 1007 (Oshio) ¶ 114.

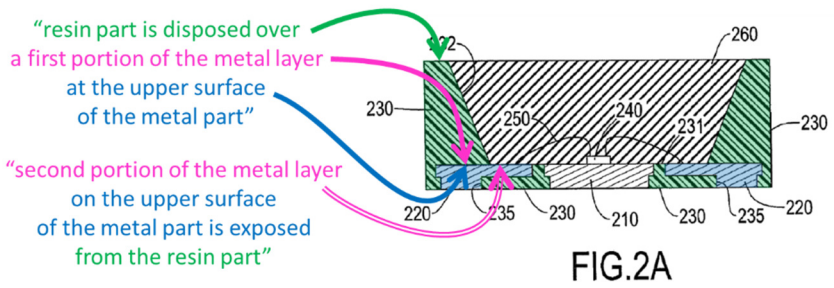
13. Invalidity of Proposed Substitute Claim 34 Over Hsu in view of Koung, Wang, and Oshio (Ground 9)

a. Claim 34: "The light emitting device according to claim 32, wherein: the resin part is disposed over a first portion of the metal layer at the upper surface of the metal part, and a second portion of the metal layer on the upper surface of the metal part is exposed from the resin part."

253. **Hsu in view of Koung, Wang, Oshio renders obvious: "The light emitting device according to claim 32."** *See* claim 32.

254. **Koung discloses: "the resin part is disposed over a first portion of the metal layer at the upper surface of the metal part, and a second portion of the metal layer on the upper surface of the metal part is exposed from the resin part."** For example, Koung discloses the resin part (*e.g.*, "reflective base (230)," shown in green in Fig. 2A below) is disposed over a first portion of the metal layer (*e.g.*, "silver coating," indicated by pink single arrow in Fig. 2A below) at the upper surface of the metal part (*e.g.*, "pair of electrodes (220)," shown in

blue in Fig. 2A below), and a second portion of the metal layer (*e.g.*, "silver coating," indicated by pink double arrow in Fig. 2A below) on the upper surface of the metal part (*e.g.*, "pair of electrodes (220)," shown in blue in Fig. 2A below) is exposed from the resin part (*e.g.*, "a portion of an upper surface of the electrode (220) are exposed to the recess (233)"). *E.g.*, Ex. 1008 (Koung), ¶¶ 21, 26, Fig. 2A.



Ex. 1008 (Koung), Fig. 2A.

255. Koung further discloses, "*[T]he electrodes (220) of each substrate (200) may be coated or plated with a reflective coating after the step of (b) and before the step of (c)*…. The dissipating board (210) and *the electrodes (220) may be plated with silver coating or other conductive materials.*" Ex. 1008 (Koung) ¶ 26, *see also* ¶¶ 18-21. Koung also discloses "The step of *(c) molding the cell matrix (320)* may be using injection-compression molding (as shown in FIG. 4C). *The insulating material may be resin….The cell matrix (320) has multiple reflective bases (230)*…At least a portion of an upper surface of the dissipating board (210) and *at least a portion of an upper surface of the electrode (220) are exposed to the recess (233)* and at least a portion of an lower surface of the

dissipating board (210) and at least a portion of an lower surface of the electrodes (220) are exposed from a lower surface of the reflective base (230)." Ex. 1008 (Koung) ¶ 21. Koung also discloses, "*The reflective base (230) may be reflective, is electrically insulating and may be resin*…." Ex. 1008 (Koung) ¶ 30, *see also, e.g.,* Abstract, ¶¶ 8, 11-21, 25-26, 29-30, 37, cls. 1, 4-8, Figs. 2A-D, 3A-B, 4A-F.

256. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Koung's advantageous teachings of a resin part having a tall, wide, reflective concave portion and formed by a "*once-molding technique*" in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 128-129). As discussed above, a POSITA also would have understood that Koung's concave portion is sufficiently wide to perform wire bonding within the concave portion in order to connect the leads. *See* Element 27.B (¶¶ 128-129). In view of the foregoing discussion above in Element 27.B (¶¶ 128-129), Claim 32 (¶¶ 241-242) and Claim 33 (¶¶ 250-252), a POSITA would have found it routine and straightforward to use Koung's advantageous teachings of a resin part in implementing Hsu's leadframe (that is plated in view of Wang and Oshio), and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

257. To the extent it is argued further disclosure of the resin part disposed over a first portion of the metal layer at the upper surface of the metal part is

required, **Wang discloses: "the…part is disposed over a first portion of the metal layer at the upper surface of the metal part, and a second portion of the metal layer on the upper surface of the metal part is exposed from the…part."** For example, Wang discloses the…part (*e.g.*, "encapsulant 5," shown in green in Fig. 4 below) is disposed over a first portion of the metal layer (*e.g.*, "electroplating layer 2," indicated by pink single arrow in Fig. 4 below) at the upper surface of the metal part (*e.g.*, "lead frames 1," shown in blue in Fig. 4 below), and a second portion of the metal layer (*e.g.*, "electroplating layer 2," indicated by pink double arrows in Fig. 4 below) on the upper surface of the metal part (*e.g.*, "lead frames 1," shown in blue in Fig. 4 below) is exposed from the…part. *E.g.*, Ex. 1006 (Wang) ¶¶ 41, 44, Fig. 4.

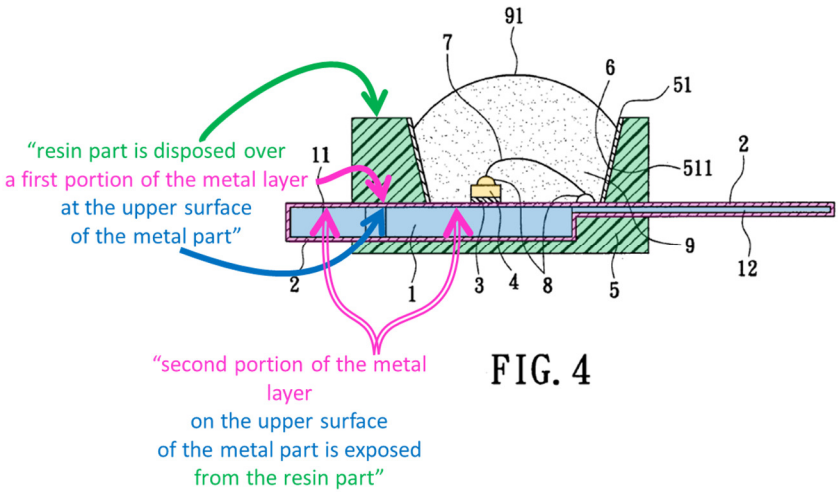


FIG. 4

Ex. 1006 (Wang), Fig. 4.

258. For example, Wang discloses "a plurality of *lead frames are formed on a metal strip*." Ex. 1006 (Wang) ¶ 40, Fig. 2. Wang discloses "[n]ext, *electroplating a layer of metal on each of outer surface of the lead frames* 1 each to form *an electroplating layer 2*." *Id.* ¶¶ 41, 54, Figs. 2, 4; *see also, e.g.*, *id.* ¶¶ 9, 13, 39, 41, 53-54, Figs. 2-5. Wang further discloses "*forming an encapsulant 5 on each of the lead frames 1* by means of injection molding and the encapsulant 5 covered on a portion of the heat-dissipating element 11 and a portion of the leads 12 each." Ex. 1006 (Wang) ¶ 44. Wang thus discloses plating the leadframes prior to forming an encapsulant on the leadframes, which results in the encapsulant disposed over a first portion of the plated metal layer (annotated with single pink arrow above). *See, e.g.*, Ex. 1006 (Wang) ¶¶ 9, 13, 39-41, 44, 53-54, Figs. 2 (S102, S108), 3-5; Ex. 1003 (January 12, 2018 Declaration) ¶ 165. Wang further discloses that a portion of the plated metal layer is exposed from the encapsulant (annotated with double pink arrows above). Ex. 1006 (Wang), Fig. 4, *see also, e.g.*, Figs. 3, 5. A POSITA would have understood that resin is a type of encapsulant.

259. As discussed above (Claim 32 (¶¶ 238)), a POSITA would have been motivated to use Wang's advantageous teachings of plating a metal layer (made of a material that is different from the metal part) on all surfaces of the metal part in implementing Hsu's light emitting device (as implemented using Koung's teachings of a tall, wide, reflective resin part), to obtain the beneficial surface

properties of the plated metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the base portion of the metal part (such as high thermal and electrical conductivity at a lower cost). *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143; Ex. 1003 (January 12, 2018 Declaration) ¶ 166. Furthermore, Hsu, like Wang, discloses providing a leadframe, molding a resin part, then "cut[ting]" to separate the light emitting device, and as also discussed above (¶¶ 244-246), Wang discloses molding and cutting the leadframes *after* electroplating. Ex. 1030 (Hsu) 2:58-3:11, 3:43-3:67, Figs. 1-12; Ex. 1006 (Wang), Abstract, ¶¶ 9, 39, 49, Figs. 2-5. Accordingly, a POSITA would have understood that implementing Wang's teachings of plating all surfaces of the metal part before molding (*i.e.*, a part having a wide concave portion) and cutting in Hsu's manufacturing process for an LED package (as implemented using Koung's teachings of a resin part, also having a molded part with a wide concave portion) would result in a resin part disposed over a first portion of the metal layer at the upper surface of the metal part, and a second portion of the metal layer on the upper surface of the metal part that is exposed from the resin part.

260. Moreover, a POSITA would have been motivated and found it obvious and straightforward to use Wang's advantageous teachings of plating a metal layer on all surfaces of the metal part before molding and cutting, in implementing Hsu's light emitting device (as implemented using Koung's teachings of a resin part having a tall, wide, reflective concave portion)—thereby disposing a resin part over a first portion of the metal layer and leaving a second portion of the metal layer exposed from the resin part —to increase the electrical and thermal conductivity of the leadframe and improve the performance and operating lifetime of the device. *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143; Ex. 1003 (January 12, 2018 Declaration) ¶ 167. Indeed, it was well-known in the art before the claimed priority date to plate a leadframe, then perform a molding and cutting step. *E.g.*, Ex. 1006 (Wang) ¶¶ 9, 39, Fig. 2 (teaching steps of electroplating the leadframe, forming an encapsulant on the leadframes, and then cutting); Ex. 1007 (Oshio) ¶¶ 69, 89, 114 (teaching steps of plating the leadframe to improve solderability of the lead to the chip, performing molding after the chip is mounted, then cutting); Ex. 1008 (Koung) ¶¶ 19-24, 26 (teaching steps of plating the leadframe, molding, then cutting). It would have been nothing more than an obvious, straightforward, and beneficial design choice to plate the leadframe on all surfaces (*e.g.*, by submerging the leadframe in an electroplating bath) and then perform molding and cutting. Furthermore, it

would have been beneficial to perform plating before molding and cutting and to plate all surfaces of the leadframe to provide for plating on a greater surface area of the leadframe, thereby increasing the thermal conductivity of the leadframe, leading to lower operating temperature and increased lifetime for the LED chip (which is small but has a high power-density). If regions of the leadframe, including those that are subsequently covered by resin, were not plated, the mounted LED would operate at a higher temperature, and the operating lifetime of the LED is shortened. Accordingly, by plating (*e.g.*, silver-plating) the entire leadframe before molding and cutting, the overall electrical and thermal conductivity of the leadframe is considerably increased, thus improving overall efficiency and reducing undesirable heating (and improving thermal and electrical conductivity). Furthermore, plating the portions of the leadframe that are in contact with resin reduces the likelihood of corrosion-induced LED package failure at the resin/leadframe interface, thus improving the reliability of the interface between the resin and leadframe. It is also desirable to perform plating before molding to avoid contaminating the plating bath with resin. Furthermore, leaving a portion of the metal layer surrounding the LED chip exposed from the resin part beneficially and predictably increases reflectivity of the leadframe near the LED chip, where increased reflectivity is beneficial for directing light out of the package. Leaving a portion of the plated metal layer on the upper surface of the metal part

exposed from the resin part further beneficially, predictably, and practically allows the LED chip to be bonded to the plated metal part and wires to be bonded to the plated metal part and the LED chip. Additionally, in view of these design needs and the finite number of options as to when to perform plating in the manufacturing process, performing plating before molding and cutting would have been obvious to try.

261. Accordingly, a POSITA would have found it obvious, routine and straightforward to use Wang's advantageous teachings of plating a metal layer on all surfaces of the metal part before molding (*i.e.*, a part having a wide concave portion) and cutting, in implementing in Hsu's manufacturing process for an LED package (as implemented using Koung's teachings of a resin part, also having a molded part with a wide concave portion)—thereby disposing a resin part over a first portion of the metal layer at the upper surface of the metal part and a second portion of the metal layer on the upper surface of the metal part that is exposed from the resin part (in the combined teachings of Hsu, Koung, Wang, and Oshio)—and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. *See also, e.g.*, Ex. 1003 (January 12, 2018 Declaration) ¶ 168.

B. The Proposed Substitute Claims 27-34 Are Unpatentable Under § 103 Over Hsu, Lin, Urasaki, Suenaga, Mori, Glenn, Wang and/or Oshio

262. In my expert opinion, for the reasons detailed in this Declaration, a POSITA would have recognized that each and every limitation of proposed substitute claims 27-34 of the '071 patent, combined as claimed, is disclosed or suggested by the prior art. Specifically, it is my opinion that proposed substitute claims 27-34 of the '071 patent are unpatentable over Ex. 1030 (Hsu) in view of Ex. 1010 (Lin), Ex. 1031 (Urasaki), Ex. 1033 (Suenaga), Ex. 1034 (Glenn), Wang (Ex. 1006), and Oshio (Ex. 1007) based on the below grounds, as further discussed herein.

Ground	Prior Art	Basis	Claims Challenged
Ground 10	Hsu, Lin, and Urasaki	103	27, 29
Ground 11	Hsu and Lin	103	28
Ground 12	Hsu, Lin, and Suenaga	103	30
Ground 13	Hsu, Lin, Urasaki, and Glenn	103	31
Ground 14	Hsu, Lin, Wang, and Oshio	103	32-34

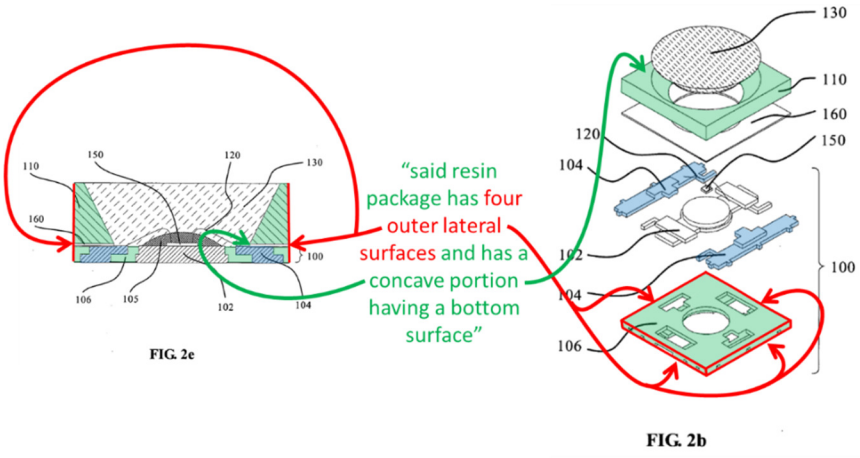
1. Overview of U.S. Patent No. 6,770,498 ("Hsu")

263. *See* Section VIII.A.1 above.

2. Overview of U.S. Patent Publication No. 2007/0126020 ("Lin")

264. Ex. 1010 (Lin) published June 7, 2007, and I understand it is prior art to the '071 patent.

265. Lin generally discloses a light emitting device comprising a light emitting element (shown in orange in Figures 2b, 2e, item 150) and a resin package (*e.g.*, Figures 2b, 2e) having a resin part (shown in green in Figures 2b, 2e, items 106, 110), and first and second metal leads (shown in blue in Figure 12, items 104). *E.g.*, Ex. 1010 (Lin), Abstract, ¶¶ 2, 7-8, 11-22, 24, 28-29, 32, cls. 1-8, Figs. 2A-D, 3A-B, 4A-F. In particular, Lin discloses "a packaging structure for a high-power light emitting diode chip" with four outer lateral surfaces as shown in Figures 2b and 2e. *E.g.*, Ex. 1010 (Lin) ¶¶ 2, 15-20, Figs. 2a-f.



Ex. 1010 (Lin), Figs. 2e, 2b.

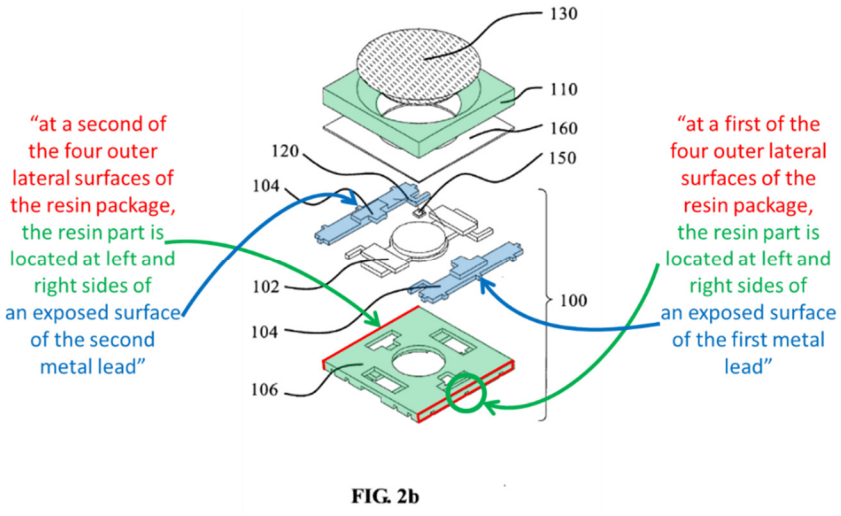
266. The package comprises an "insulator 106…made of an insulating material such as resin" and a "reflection plate 110…made of an insulating material such as resin." *Id.*, ¶¶ 25, 27. The package also includes first and second "electrodes 104" which are "made of a metallic material having high electrical and thermal conductivities" and formed when "the packaging units 200 are separated

by cutting." *Id.*, ¶¶ 25, 33. The first and second "electrodes 104" are exposed at three outer lateral surfaces of the resin package. *Id.*, Fig. 2b. Lin further discloses, "The positive and negative electrodes (not shown) of the LED chip 150 are connected to separate electrodes 104 of the base 100 respectively via the bonding wires 120." *Id.,* ¶ 28.

267. Lin further discloses that the first and second metal leads include notches located at each of the four outer lateral surfaces of the resin package, as shown in red in Figure 2b below. Ex. 1010 (Lin), Fig. 2b. Lin describes that "the part of the bases 100 etched away is filled with the insulator 106." *Id.* ¶ 31. After forming the resin part on the lead frame, the resin and lead frame are cut along the notches, thus forming a resin part and metal part that are coplanar at four outer lateral surfaces. *Id.*, ¶¶ 11, 33.

268. As shown in Figure 2b below, Lin discloses that at least a portion of an outer lateral surface of the resin part (shown in green) and at least a portion of an outer lateral surface of the metal part (shown in blue) are coplanar at each of the four outer lateral surfaces (outlined in red) of the resin package. Figure 2b additionally shows that the resin package has a concave portion with a bottom surface. Ex. 1010 (Lin) ¶ 27 (disclosing, "The reflection plate 110 also has a flat form factor with a vertical through hole (not numbered) at an appropriate location in the middle."). As shown in Figure 2b, Lin further discloses that the resin part is

located above and at left and right sides of exposed surfaces of the first and second metal leads at first and second outer lateral surfaces of the resin package. Also as shown in Fig. 2b, Lin discloses that the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first and second metal plates are integrally formed and are coplanar with the exposed outer lateral surfaces of the first and second metal plates.



Ex. 1010 (Lin), Fig. 2b.

269. Figure 2e further shows that at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package. *Id.*, Figs. 2e, 2a, 2c-d, 2f. Figure 2e further shows that a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element. *Id.*

270. Lin is analogous art to the '071 patent at least because it is in the same field of endeavor as the '071 patent and is reasonably pertinent to the problem purportedly solved by the '071 patent. The '071 patent is in the field of endeavor of "semiconductor" technology, including manufacturing and packaging processes for a "light emitting device." *E.g.*, Ex. 1001 ('071 patent), 1:18-36. Lin is in the same field of endeavor and discloses, for example, "a packaging structure for a high-power light emitting diode chip and a related fabrication method thereof." *E.g.*, Ex. 1010 (Lin) ¶¶ 2, 8-11. Furthermore, the '071 patent is directed to the purported problem of providing "[a] light emitting device using light emitting elements [that] is small, provides good power efficiency, and emits light of bright color" and "improve[d] adhesion between the lead frame and the thermosetting resin." Ex. 1001 ('071 patent), 1:18-36, 2:32-37, 3:51-55, 5:17-21, 3:26-30, 3:28-4:10. Lin is reasonably pertinent to the '071 patent's purported problem and discloses, for example, that "the major objective of the present invention is to provide a packaging structure and a related fabrication method for packaging a high-power LED chip which, in one way, achieve superior heat dissipation efficiency and, in another way, are applicable in mass production for a significantly reduced production cost." *E.g.*, Ex. 1010 (Lin) ¶ 8.

3. Overview of Japanese Patent Publication No. 2007-235085 ("Urasaki")

271. *See* Section VIII.A.3 above.

4. Overview of U.S. Patent No. 6,433, 277 ("Glenn")

272. *See* Section VIII.A.4 above.

5. Overviews of Mori, Wang, and Oshio

273. *See* Section VIII.A.5 above.

6. Invalidity of Proposed Substitute Claim 27 Over Hsu, Lin, and Urasaki (Ground 10)

a. Element 27.Pre: "A light emitting device comprising"

274. To the extent that the preamble is limiting, **Hsu discloses "[a] light emitting device comprising."** *See* Section VIII.A.6.a above.

b. Element 27.A: "a light emitting element"

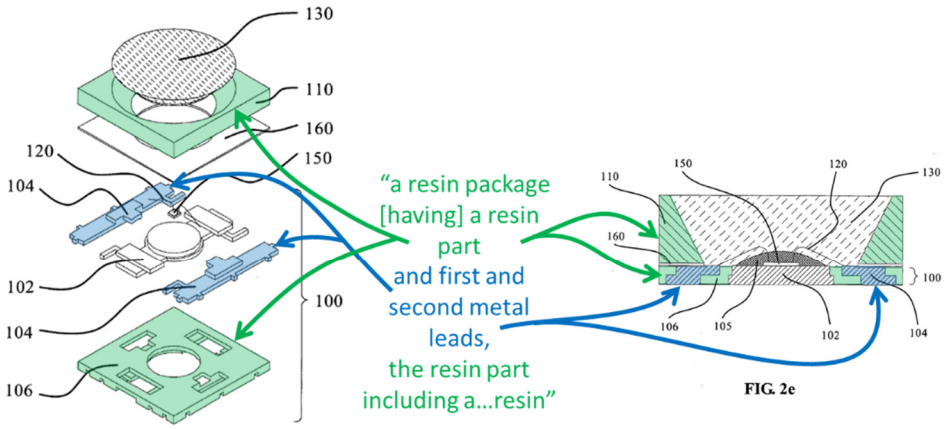
275. **Hsu discloses: "a light emitting element."** *See* Section VIII.A.6.b above.

c. Element 27.B: "a resin package consisting of a resin part and first and second metal leads, the resin part including a thermosetting resin"

276. **Hsu discloses: "a resin package consisting of a resin part and first and second metal leads, the resin part including a…resin."** *See* Section VIII.A.6.c above.

277. To the extent it is argued further disclosure of a resin part is required, **Lin discloses: "a resin package [having] a resin part and first and second**

metal leads, the resin part including a…resin." For example, Lin discloses a resin package (*e.g.*, "packaging structure," "packaging unit[] 200," shown in Figs. 2b, 2e, 4g below) having a resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Figs. 2b, 2e below) and first and second metal leads (*e.g.*, "electrodes 104," shown in blue in Figs. 2b, 2e below). Ex. 1010 (Lin) ¶ 25, Figs. 2b, 3a, 4g.



Ex. 1010 (Lin), Figs. 2b, 2e.

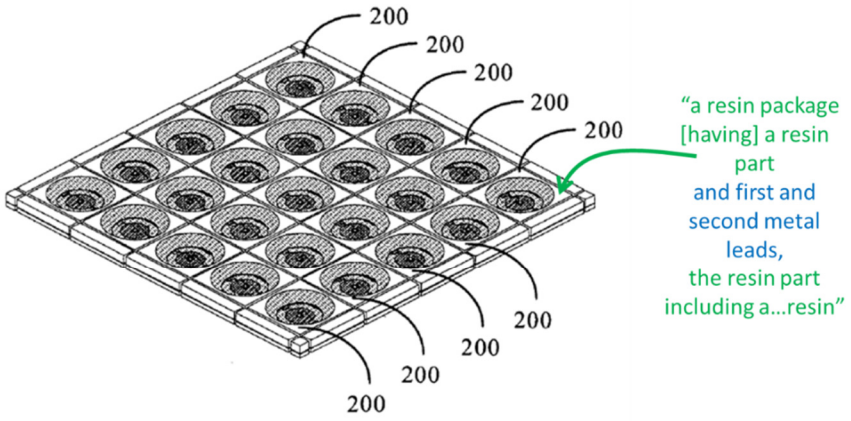


FIG. 4g

Ex. 1010 (Lin), Fig. 4g.

278. For example, Lin discloses, "As illustrated, the ***packaging structure*** provided by the present embodiment contains at least a base 100, a reflection plate 110, the LED chip being packaged 150, a plurality of the bonding wires 120, and a transparent filler 130. The base 100, having a flat form factor, is composed of a heat sinking seat 102, ***a plurality of electrodes 104***, and an insulator 106, integrated together into a single solid object. The heat sinking seat 102 and ***the electrodes 104 are made of a metallic material*** having high electrical and thermal conductivities. ***The insulator 106, on the other hand, is made of an insulating material such as resin*** or the like." Ex. 1010 (Lin) ¶ 25.

279. A POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. Both Hsu and Lin are in the same field of art, and relate to manufacturing multiple LED packages by molding resin on a lead frame. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1010 (Lin), Abstract,¶¶ 2, 4, 8-11, 15-23, 25-26, 28-31, cls. 1, 3, 5-6, 9, 11, 15-16, Figs. 2a-f, 3a-b, 4a-g. For example, Hsu discloses, *e.g.*, forming a resin package by "molding" a "resin" on a "plate-like frame" and then "[c]ut[ing]…such that LED packages…are made." Ex. 1030 (Hsu)

2:58-61, 3:43-67, Figs. 2, 10-12. Lin teaches forming a "a packaging structure for a high-power light emitting diode chip" by forming "resin," including a "through hole," on a "metallic plate" patterned with "electrodes" and then "cutting" to "separate[]" "the packaging units." Ex. 1010 (Lin) ¶¶ 2, 25, 2, 31, 33, Figs. 4a-g. In addition, Lin's resin package, like Hsu's resin package, has a resin part. *E.g.*, Ex. 1010 (Lin) ¶¶ 25, Figs. 2b, 4g; Ex. 1030 (Hsu), 3:23-30, 3:43-63, 3:64-67, 4:1-5, 4:8-13, 4:13-15, Figs. 10-12. Also, Lin's resin part, like Hsu's resin part, has four outer lateral surfaces (*e.g.*, Ex. 1010 (Lin) Figs. 2b, 2e; Ex. 1030 (Hsu) Fig. 12), metal and resin that are coplanar at the four outer lateral surfaces (*e.g.*, Ex. 1010 (Lin) ¶¶ 26, 31, 33, Fig. 2b; Ex. 1030 (Hsu), 2:67-3:11; 3:43-67, 4:5-12, Figs. 11-12), and resin above and to the left and right sides of exposed surfaces of the leads on two outer lateral surfaces (*e.g.*, Ex. 1010 (Lin) ¶¶ 26, 31, Fig. 2b; Ex. 1030 (Hsu), 2:67-3:11, 3:43-54, 3:64-67, 4:5-12, Fig. 12; Elements 27.H, 28.F). Further, Lin, like Hsu, discloses efficiently conducting heat away from the light emitting device through flat metal plates with large surface area exposed to the mounting substrate. Ex. 1030 (Hsu), 1:34-48, 4:38-49, Figs. 11-12; Ex. 1010 (Lin), Figs. 2a-f.

280. A POSITA would have understood that using Lin's teachings of a resin part having a tall, wide, reflective concave portion beneficially (1) directs light vertically, increasing directivity, brightness, and luminance, (2) provides for shielding of phosphor, reducing cross-talk between adjacent light emitting devices

when phosphor is used, (3) simplifies the mold, reducing manufacturing time and expense. ***First***, a POSITA would have understood that using a resin part having a tall, wide, reflective concave portion (as taught by Lin) would beneficially direct light emitted from the light emitting element vertically, to advantageously increase directivity, brightness, and luminance of a light emitting device. For example, it was well-known that guiding light upward (as opposed to both upward and to the side) confines the same amount of emitted light to a tighter beam, thereby increasing directivity, brightness, and luminance. Ex. 1032 (Kuramoto) ¶ 71 ("The concave part 40c is provided with a slope so as to become wider in the opening direction. This makes it possible to *increase extraction of light in the forward direction*.…The slope angle of 50 the concave part, measured from the bottom surface 40c, is preferably not less than 95° and not more than 150°, or more preferably, not less than 100° and not more than 120°."), Fig. 1 (showing a concave portion with tall sidewalls relative to the height of the light emitting element), *see also ¶¶* 31, 72; Ex. 1031 (Urasaki) ¶ 24 ("[A] cup-shape (circular truncated cone shape) which reflects light emitted from the mounted LED element 10 and *guides the light thereof upward is preferable*."), Figs. 1a-d, 2 (showing a concave portion with tall sidewalls relative to the height of the light emitting element); Ex. 1007 (Oshio) ¶¶ 62-63 ("The recess 40C provided in the embedding resin 40 may comprise a first conical portion centered on the LED chip 10…as

shown in FIG. 2, for example. The recess 40C formed in this way can efficiently reflect upward the light emitted from the LED chip 10 and *increase the light extraction efficiency*.")Ex. 1031 (Urasaki). Directivity, brightness, and luminance were desirable for, *e.g.*, medical treatment, streetlights, desk lamps, and automotive lights. ***Second***, a POSITA would have understood that using a resin part having a tall, wide, reflective concave portion (as taught by Lin) would advantageously provide for shielding of phosphor (when used) near the light emitting element from incident light from outside (e.g., from adjacent LEDs). For example, Ex. 1035 (Matoba) discloses "*by deepening the cup depth*, it is possible to limit an excitation source of the fluorescent substance to only a light wavelength of the light-emitting chip," and "*incident light from outside is shielded by the cup edge*, and does not reach the fluorescent substance. For that reason, *it is possible to prevent a mixing of colors between LEDs*." Ex. 1035 (Matoba) ¶ 8, *see also, e.g.*, ¶¶ 13-14, Fig. 3. It was well-known that preventing such cross-talk (e.g., "mixing of colors between LEDs") can improve the resolution of certain displays. For example, Ex. 1035 (Matoba) discloses "when implementing a flat-screen display using this LED, *an image with extremely good resolution is attained*." Ex. 1035 (Matoba) ¶ 14. ***Third***, a POSITA would have understood that molding a resin part having a tall, wide concave portion (as taught by Lin) would simplify the mold shape, which advantageously reduces complexity and cost of the mold, improves flow of molten

resin during molding, and simplifies mold removal. A POSITA also would have understood that Lin's concave portion is sufficiently wide to perform wire bonding within the concave portion in order to connect the leads. Further, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teaching of resin part with four outer lateral surfaces having coplanar resin and metal, in implementing Hsu's light emitting device with first and second metal leads, to provide for a method of manufacturing multiple LEDs in a short time and at a low cost. *See, e.g.*, Ex. 1008 (Koung) ¶¶ 24-25 (disclosing that forming a resin part with four outer lateral surfaces having coplanar resin and metal using a "once-molding technique" provides for "a packaging method that can save time and cost."), Figs. 2A-D, 4A-F. Configuring a resin package for an LED such that the resin extends to each of the outer lateral surfaces of the resin package (and thereby is coplanar with a portion of the metal part) was common and well-known before the claimed priority date. *See, e.g.*, Ex. 1008 (Koung) ¶¶ 20-21, 24, Fig. 2C; Ex. 1010 (Lin) ¶¶ 9, 25, Figs. 2a-2f, 3a-3b, 4a-4g; Ex. 1004 (Loh) ¶¶ 60, 73, 76, 96, Fig. 7. In view of the foregoing, a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion and four outer lateral surfaces having coplanar resin and metal in implementing Hsu's light emitting device with first and

second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

281. To the extent it is argued further disclosure of a resin part including a thermosetting resin is required **Urasaki discloses: "the resin part including a thermosetting resin."** *See* Section VIII.A.6.c above.

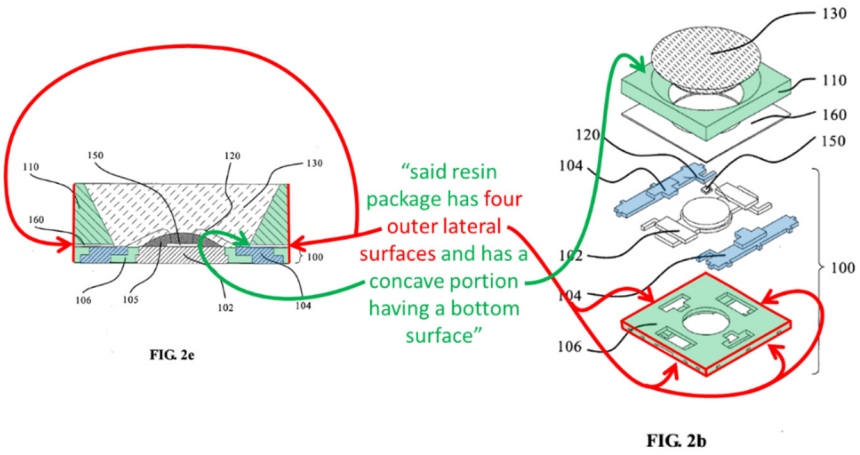
282. A POSITA would have been motivated and found it obvious and a straightforward and beneficial design choice, to include a thermosetting resin, *as expressly taught by Urasaki*, in implementing Hsu's light emitting device (as implemented using Lin's teachings of a resin part). Hsu, Lin, and Urasaki are in the same field of art and relate to manufacturing multiple LED packages by molding resin on a lead frame. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1010 (Lin), Abstract,¶¶ 2, 4, 8-11, 15-23, 25-26, 28-31, cls. 1, 3, 5-6, 9, 11, 15-16, Figs. 2a-f, 3a-b, 4a-g; Ex. 1031 (Urasaki), Abstract, ¶¶ 11, 21, 34, Figs. 1-6. Lin discloses forming the "insulator 106" with a "resin." Ex. 1010 (Lin) ¶ 25. As discussed above (¶¶ 125, 131-132) a POSITA would have understood that including thermosetting resin beneficially allows for molding of resin parts having better heat resistance, light resistance, and adhesion as compared to non-thermoset resins. A POSITA would have found it routine and straightforward to include a thermosetting resin, as expressly taught by Urasaki, in implementing Hsu's light

emitting device (as implemented using Lin's teachings of a resin part), and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

d. Element 27.C: "wherein said resin package has four outer lateral surfaces and has a concave portion having a bottom surface"

283. **Hsu discloses: "said resin package has four outer lateral surfaces and has a concave portion having a bottom surface."** *See* Section VIII.A.6.d above.

284. To the extent it is argued further disclosure of a resin package having a concave portion is required, **Lin discloses: "said resin package has four outer lateral surfaces and has a concave portion having a bottom surface."** Lin discloses that the resin package (*e.g.*, "packaging structure," "packaging unit[] 200," shown in Figs. 2e, 2b below) has four outer lateral surfaces (*e.g.*, outlined in red in Figs. 2e, 2b below) and a concave portion having a bottom surface (*e.g.*, indicated by green arrow in Figs. 2e, 2b below). *E.g.*, Ex. 1010 (Lin), Figs. 2e, 2b.



Ex. 1010 (Lin), Figs. 2e, 2b.

285. For example, Lin discloses, "The reflection plate 110 also has a flat form factor with a vertical through hole (not numbered) at an appropriate location in the middle. *The reflection plate 110* is made of a metallic material having high reflectivity (e.g., aluminum), or it *could be made of an insulating material such as resin* but the wall of the through hole has a white coating, or is coated with a film made of highly reflective material such as silver.…[W]hen the LED chip 150 is fixed on the exposed top surface of the heat sinking seat 102, the light emitted from the LED chip 150 is able to radiate out of the packaging structure via the through hole. *The through hole in the present embodiment has a circular aperture and the diameter of the aperture is larger as it is closer to the top*." Ex. 1010 (Lin) ¶ 27. Lin also discloses, "The metallic plate 190 is used for the subsequent formation of the bases 100 of multiple packaging units 200 simultaneously. The bases 100 of the packaging units 200 are arranged in an array.…Then, *the part of*

the bases 100 etched away is filled with the insulator 106 and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31. Lin further discloses, "At last, as illustrated in FIG. 4g, *the packaging units 200 are separated by cutting*." Ex. 1010 (Lin) ¶ 33, *see also, e.g.,* Abstract,¶¶ 9-11, 15-23, 25-27, 29-30, 33, cls. 1, 9, Figs. 2a-f, 3a-b, 4a-g.

286. A POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). In view of the foregoing discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

e. Element 27.D: "wherein the light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the first and second metal leads"

287. **Hsu discloses: "the light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the first and second metal leads."** *See* Section VIII.A.6.e above.

288. To the extent it is argued further disclosure of a concave portion is required, **Lin discloses: "the light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the first and second metal leads."** Lin discloses that light emitting element (*e.g.*, "LED chip 150," shown in orange in Fig. 2e below) is mounted on the bottom surface of the concave portion and is electrically connected to the first and second metal leads (*e.g.*, "electrodes 104" shown in blue in Fig. 2e below). *E.g.*, Ex. 1010 (Lin), Fig. 2e.

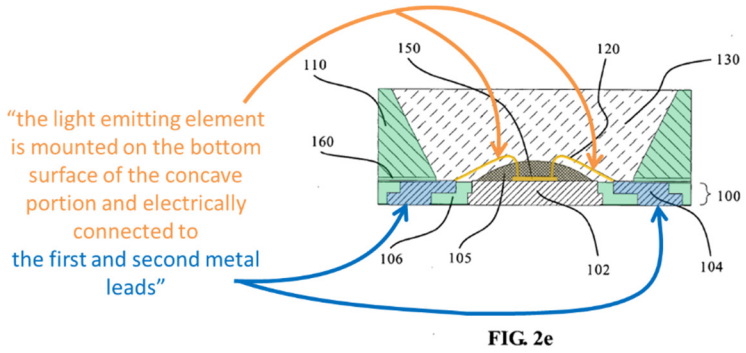


FIG. 2e

Ex. 1010 (Lin), Fig. 2e.

289. For example, Lin discloses, "The location and aperture of the through hole are properly configured so that, after the reflection plate 110 is joined with the base 100, *the top surface of the heat sinking seat 102 and at least some portion of the top surface of the electrodes 104 are exposed for the fixation of the LED chip 150* and the connection of the bonding wires 120 respectively." Ex. 1010 (Lin) ¶ 27. Lin also discloses, "*The LED chip 150 is fixedly adhered* to the top surface of

the heat sinking seat 102 as mentioned earlier. *The positive and negative electrodes (not shown) of the LED chip 150 are connected to separate electrodes 104 of the base 100 respectively via the bonding wires 120.*" Ex. 1010 (Lin) ¶ 28, *see also, e.g.,* Abstract,¶¶ 9-11, 15-23, 25, 27-30, 33, cl. 1, Figs. 2a-f, 3a-b, 4a-g.

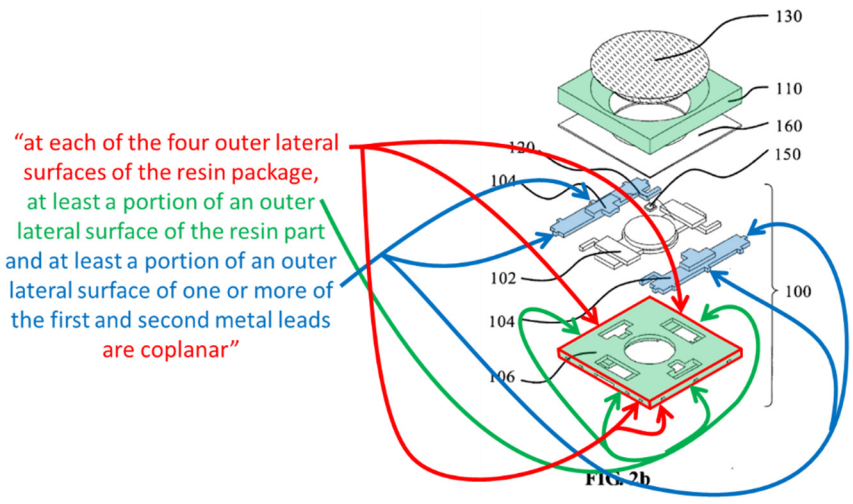
290. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose that a light emitting element is mounted on a bottom surface of a concave portion and electrically connected to first and second metal leads. Ex. 1030 (Hsu), Figs. 9, 11; Ex. 1010 (Lin), Fig. 2e. In implementing Hsu's light emitting device using Lin's teachings of a resin part having a tall, wide, reflective concave portion, a POSITA would have understood that a light emitting element is mounted on a bottom surface of a concave portion and electrically connected to first and second metal leads. In view of the foregoing and the discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination

(yielding the claimed limitation) would work and provide the expected functionality.

f. Element 27.E: "wherein, at each of the four outer lateral surfaces of the resin package, at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of one or more of the first and second metal leads are coplanar"

291. **Hsu discloses: "at each of the four outer lateral surfaces of the resin package, at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of one or more of the first and second metal leads are coplanar."** *See* Section VIII.A.6.f above.

292. To the extent it is argued further disclosure of a resin part is required, **Lin discloses: "at each of the four outer lateral surfaces of the resin package, at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of one or more of the first and second metal leads are coplanar."** For example, Lin discloses that at each of the four outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2b below), at least a portion of an outer lateral surface of the resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Fig. 2b below) and at least a portion of an outer lateral surface of one or more of the first and second metal leads (*e.g.*, "electrodes 104," shown in blue in Fig. 2b below) are coplanar. *E.g.*, Ex. 1010 (Lin), Fig. 2b.



Ex. 1010 (Lin), Fig. 2b.

293. Lin further discloses, "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of* the bottom surface and *a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26. Lin also discloses, "*The bases 100 are formed mainly by appropriate means of etching* and machinery *to remove the part of the bases 100 for the subsequent filling of the insulator 106 and, after that,* the heat sinking seats 102 and *the electrodes 104 of the bases 100 are left behind*, as shown in FIG. 4b. *Then, the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31. Lin additionally discloses "At last, as illustrated in FIG. 4g, *the packaging units 200 are separated by cutting*." Ex. 1010 (Lin) ¶ 33, *see also, e.g.,* Abstract,¶¶ 9, 11, 15-23, 26, 29-31, 33, cls. 1, 3, 9, 11, Figs. 2a-f, 3a-b, 4a-g.

294. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part

having a tall, wide, reflective concave portion and four outer lateral surfaces having coplanar resin and metal in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). In view of the foregoing discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

g. Element 27.F: "wherein the first metal lead is exposed at three outer lateral surfaces of the resin package"

295. **Hsu discloses: "the first metal lead is exposed at three outer lateral surfaces of the resin package."** *See* Section VIII.A.6.g above.

296. To the extent it is argued further disclosure of a resin package (with a resin part) is required, **Lin discloses: "the first metal lead is exposed at three outer lateral surfaces of the resin package."** For example, Lin discloses that the first metal lead (*e.g.*, "electrode[] 104," shown in blue and indicated by blue arrows in Fig. 2b below) is exposed at three outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2b below). *E.g.*, Ex. 1010 (Lin), Fig. 2b.

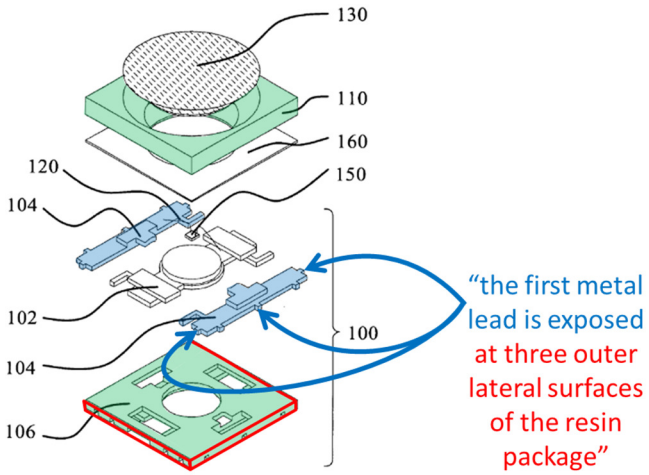


FIG. 2b

Ex. 1010 (Lin), Fig. 2b.

297. For example, Lin discloses, "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of the bottom surface and a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26. Lin also discloses, "*The bases 100 are formed mainly by appropriate means of etching* and machinery *to remove the part of the bases 100 for the subsequent filling of the insulator 106 and, after that,* the heat sinking seats 102 and *the electrodes 104 of the bases 100 are left behind*, as shown in FIG. 4b. *Then, the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31, *see also, e.g.,* Abstract,¶¶ 9, 11, 15-23, 25-26, 29-31, 33, cls. 1, 3, 9, 11, Figs. 2a-f, 3a-b, 4a-g.

298. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part

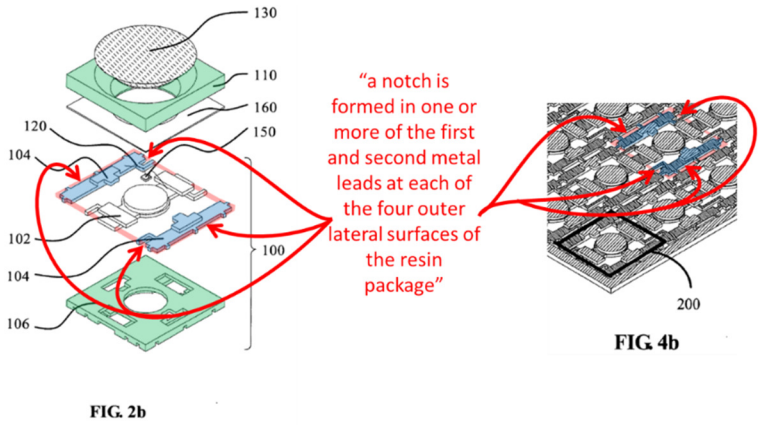
in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose that the first metal lead is exposed at three outer lateral surfaces of the resin package. Ex. 1030 (Hsu), Figs. 4, 12; Ex. 1010 (Lin), Fig. 2b. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that the first metal lead is exposed at three outer lateral surfaces of the resin package. In view of the foregoing discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

h. Element 27.G: "wherein a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package"

299. **Hsu discloses: "a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package."** *See* Section VIII.A.6.h above.

300. To the extent it is argued further disclosure of a resin package (with a resin part) is required, **Lin discloses: "a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package."** For example, Lin discloses a notch (*e.g.*, shown in red in Figs. 2b,

4b below) is formed in one or more of the first and second metal leads (*e.g.*, "electrodes 104," shown in blue in Figs. 2b, 4b below) at each of the four outer lateral surfaces of the resin package. *E.g.*, Ex. 1010 (Lin), Figs. 2b, 4b.



Ex. 1010 (Lin), Figs. 2b, 4b (excerpt).

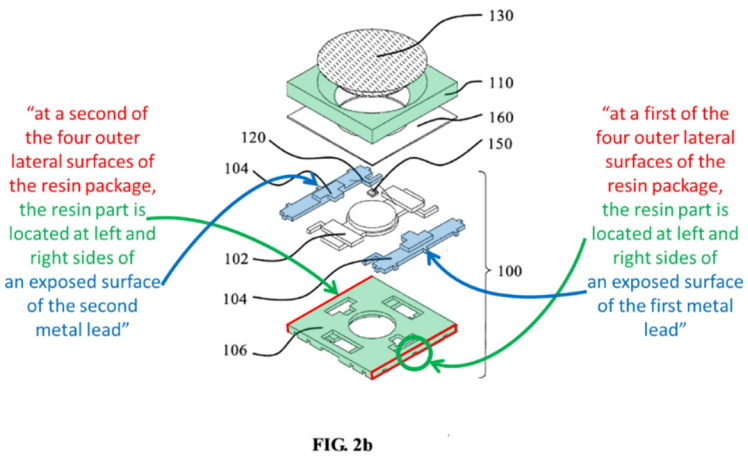
301. Lin further discloses, "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of the bottom surface and a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26. Lin also discloses, "*The bases 100 are formed mainly by appropriate means of etching* and machinery *to remove the part of the bases 100 for the subsequent filling of the insulator 106 and, after that,* the heat sinking seats 102 and *the electrodes 104 of the bases 100 are left behind*, as shown in FIG. 4b. *Then, the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31.

302. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose that a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package. Ex. 1030 (Hsu), Figs. 4, 12; Ex. 1010 (Lin), Figs. 2b, 4b. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that a notch is formed in one or more of the first and second metal leads at each of the four outer lateral surfaces of the resin package. In view of the foregoing discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

i. Element 27.H: "wherein, at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead, wherein, at a second of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead"

303. **Hsu discloses: at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead" and "at a second of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead."** *See* Section VIII.A.6.i above.

304. To the extent it is argued further disclosure of a resin part is required **Lin discloses: at a first of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first metal lead" and "at a second of the four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the second metal lead."** For example, Lin discloses that at first and second outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2b below), the resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Fig. 2b below) is located at left and right sides of an exposed surface of the first and second metal leads (*e.g.*, "electrodes 104," shown in blue in Fig. 2b below). *E.g.*, Ex. 1010 (Lin), Fig. 2b.



Ex. 1010 (Lin), Fig. 2b.

305. For example, Lin discloses, "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of the bottom surface and a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26. Lin also discloses, "*The bases 100 are formed mainly by appropriate means of etching* and machinery *to remove the part of the bases 100 for the subsequent filling of the insulator 106 and, after that,* the heat sinking seats 102 and *the electrodes 104 of the bases 100 are left behind*, as shown in FIG. 4b. *Then, the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31, *see also, e.g.,* Abstract,¶¶ 9, 11, 15-23, 25-26, 29-31, 33, cls. 1, 3, 9, 11, Figs. 2a-f, 3a-b, 4a-g.

306. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part having four outer lateral surfaces with coplanar resin and metal in implementing

Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose that at first and second four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first and second metal leads. Ex. 1030 (Hsu), Fig. 12; Ex. 1010 (Lin), Fig. 2b. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that at first and second four outer lateral surfaces of the resin package, the resin part is located at left and right sides of an exposed surface of the first and second metal leads. In view of the foregoing and the discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

j. Element 27.I: "wherein all upper edges of the first and second metal leads are coplanar"

307. **Hsu discloses: "all upper edges of the first and second metal leads are coplanar."** *See* Section VIII.A.6.j above.

7. Invalidity of Proposed Substitute Claim 28 Over Hsu and Lin (Ground 11)

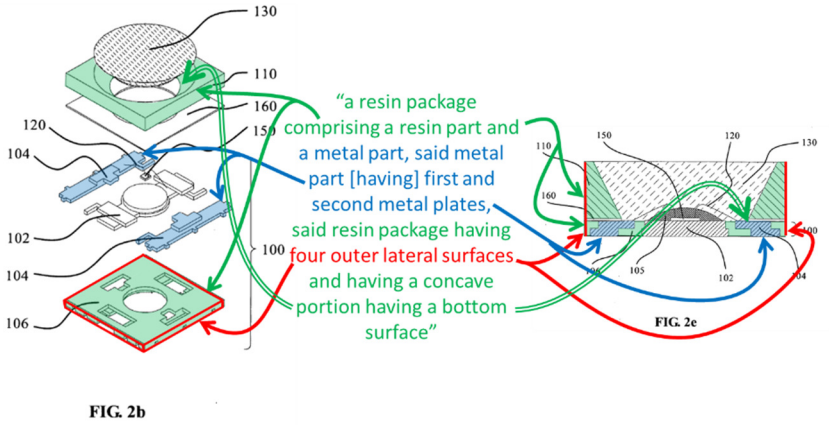
a. Element 28.Pre: "A light emitting device comprising"

308. **Hsu discloses: "a light emitting device."** *See* Element 27.pre.

b. Element 28.A: "a resin package comprising a resin part and a metal part, said metal part consisting of first and second metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface"

309. **Hsu discloses: "a resin package comprising a resin part and a metal part, said metal part consisting of first and second metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface."** *See* Section VIII.A.7.b above.

310. To the extent it is argued further disclosure of a resin part having a concave surface is required, **Lin discloses: "a resin package comprising a resin part and a metal part, said metal part [having] first and second metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface."** For example, Lin discloses a resin package (*e.g.*, "packaging structure," "packaging unit[] 200," shown in Figs. 2b, 2e, 4g below) comprising a resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Figs. 2b, 2e below) and a metal part, said metal part consisting of first and second metal plates (*e.g.*, "electrodes 104," shown in blue in Figs. 2b, 2e below), said resin package having four outer lateral surfaces (*e.g.*, outlined in red in Figs. 2b, 2e below) and having a concave portion having a bottom surface (*e.g.*, indicated by double green arrows in Figs. 2b, 2e, 4g below). *E.g.*, Ex. 1010 (Lin), Figs. 2b, 2e, 4g.



Ex. 1010 (Lin), Figs. 2b, 2e.

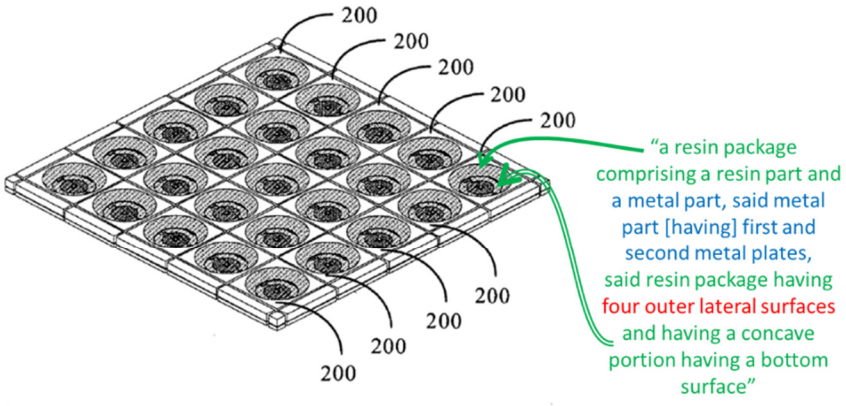


FIG. 4g

Ex. 1010 (Lin), Fig. 4g.

311. For example, Lin discloses, "As illustrated, the ***packaging structure*** provided by the present embodiment contains at least a base 100, a reflection plate 110, the LED chip being packaged 150, a plurality of the bonding wires 120, and a transparent filler 130. The base 100, having a flat form factor, is composed of a heat sinking seat 102, ***a plurality of electrodes 104***, and an insulator 106, integrated together into a single solid object. The heat sinking seat 102 and ***the***

electrodes 104 are made of a metallic material having high electrical and thermal conductivities. ***The insulator 106, on the other hand, is made of an insulating material such as resin*** or the like." Ex. 1010 (Lin) ¶ 25.

312. Lin also discloses, "The reflection plate 110 also has a flat form factor with a vertical through hole (not numbered) at an appropriate location in the middle. *The reflection plate 110* is made of a metallic material having high reflectivity (e.g., aluminum), or it *could be made of an insulating material such as resin* but the wall of the through hole has a white coating, or is coated with a film made of highly reflective material such as silver.…[W]hen the LED chip 150 is fixed on the exposed top surface of the heat sinking seat 102, the light emitted from the LED chip 150 is able to radiate out of the packaging structure via the through hole. *The through hole in the present embodiment has a circular aperture and the diameter of the aperture is larger as it is closer to the top*." Ex. 1010 (Lin) ¶ 27. Lin also discloses, "The metallic plate 190 is used for the subsequent formation of the bases 100 of multiple packaging units 200 simultaneously. The bases 100 of the packaging units 200 are arranged in an array….Then, *the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31. Lin further discloses, "At last, as illustrated in FIG. 4g, *the packaging units 200 are separated by cutting*." Ex. 1010 (Lin) ¶ 33, *see also, e.g.,* Abstract,¶¶ 9-11, 15-23, 25-27, 29-30, 33, cls. 1, 9, Figs. 2a-f, 3a-b, 4a-g.

313. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion and four outer lateral surfaces in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose a resin package having four outer lateral surfaces and having a concave portion having a bottom surface. Ex. 1030 (Hsu), Figs. 7, 10-12; Ex. 1010 (Lin), Figs. 2b, 2e, 4g. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that the resin package has four outer lateral surfaces and has a concave portion having a bottom surface. In view of the foregoing and the discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion with a bottom surface and four outer lateral surfaces in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

c. Element 28.B: "a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part"

314. **Hsu discloses: "a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part."** *See* Section VIII.A.7.c above.

315. To the extent it is argued further disclosure of a concave portion is required, **Lin discloses: "a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part."** For example, Lin discloses Lin discloses that light emitting element (*e.g.*, "LED chip 150," shown in orange in Fig. 2e below) is mounted on the bottom surface of the concave portion and is electrically connected to the metal part (*e.g.*, "electrodes 104" shown in blue in Fig. 2e below). *E.g.*, Ex. 1010 (Lin), Fig. 2e.

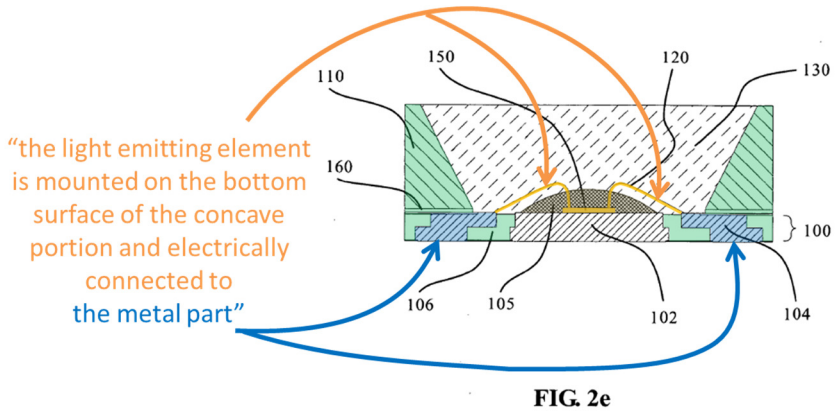


FIG. 2e

Ex. 1010 (Lin), Fig. 2e.

316. For example, Lin discloses, "The location and aperture of the through hole are properly configured so that, after the reflection plate 110 is joined with the

base 100, *the top surface of the heat sinking seat 102 and at least some portion of the top surface of the electrodes 104 are exposed for the fixation of the LED chip 150* and the connection of the bonding wires 120 respectively." Ex. 1010 (Lin) ¶ 27. Lin also discloses, "*The LED chip 150 is fixedly adhered* to the top surface of the heat sinking seat 102 as mentioned earlier. *The positive and negative electrodes (not shown) of the LED chip 150 are connected to separate electrodes 104 of the base 100 respectively via the bonding wires 120.*" Ex. 1010 (Lin) ¶ 28, *see also, e.g.,* Abstract,¶¶ 9-11, 15-23, 25, 27-30, 33, cl. 1, Figs. 2a-f, 3a-b, 4a-g.

317. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part. Ex. 1030 (Hsu), Figs. 9, 11; Ex. 1010 (Lin), Fig. 2e. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that a light emitting element is mounted on the bottom surface of the concave portion and electrically connected to the metal part. In view of the foregoing and the discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part having a tall,

wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

d. Element 28.C: "wherein at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package"

318. **Hsu discloses: "at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package."** *See* Section VIII.A.7.d above.

319. To the extent it is argued further disclosure of a resin part is required, **Lin discloses: "at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package."** For example, Lin discloses at least a portion of an outer surface of the resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Fig. 2e below) and at least a portion of an outer surface of the metal part (*e.g.*, "electrodes 104," shown in blue in Fig. 2e below) are coplanar at an outer bottom surface of the resin package (*e.g.*, "packaging structure," "packaging unit[] 200," shown in Fig. 2e below). *E.g.*, Ex. 1010 (Lin), Fig. 2e.

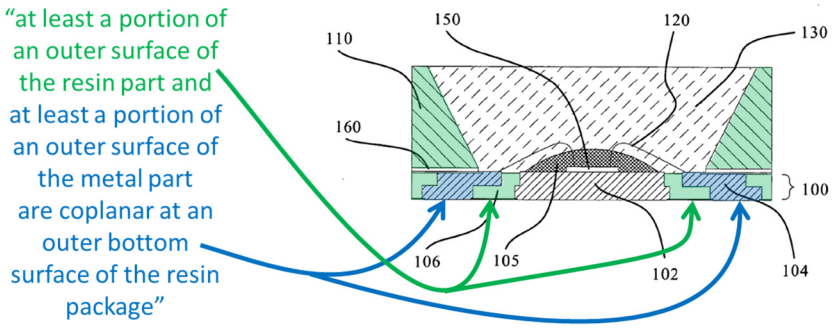


FIG. 2e

Ex. 1010 (Lin), Fig. 2e.

320. "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of the bottom surface and a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26, *see also, e.g.,* Abstract,¶¶ 2, 4, 8-9, 15-23, 25-26, 29-31, cls. 1, 3, 9, 11, Figs. 2a-f, 3a-b, 4a-g.

321. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose that the resin and metal are coplanar at an outer bottom surface of the resin package. Ex. 1030 (Hsu), Fig. 11; Ex. 1010 (Lin), Figs. 2a, 2c-f. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that resin and metal are coplanar at an outer bottom surface of the resin package. In view of the foregoing and the discussion above in Element 27.B (¶¶ 279-280), a POSITA

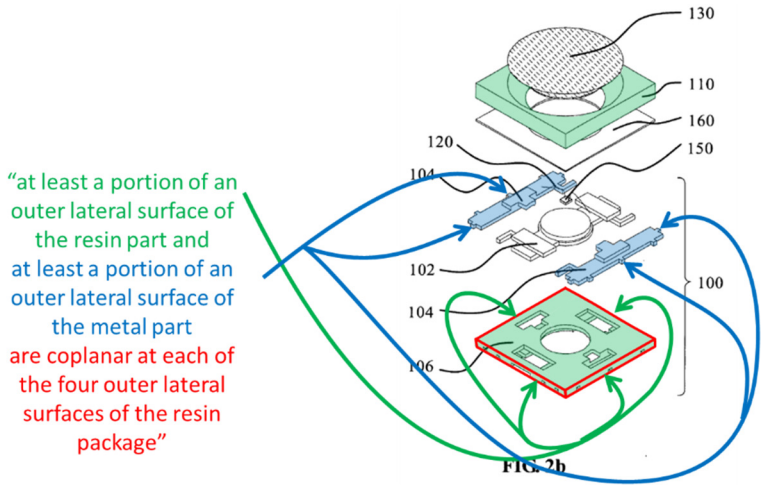
would have found it routine and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

e. Element 28.D: "wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package"

322. **Hsu discloses: "at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package."** *See* Section VIII.A.7.e above.

323. To the extent it is argued further disclosure of a resin part is required, **Lin discloses: "at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package."** For example, Lin discloses that at least a portion of an outer lateral surface of the resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Fig. 2b below) and at least a portion of an outer lateral surface of the metal part (*e.g.*, "electrodes 104," shown in blue in Fig. 2b below) are coplanar at each of the four outer lateral

surfaces of the resin package (*e.g.*, outlined in red in Fig. 2b below). *E.g.*, Ex. 1010 (Lin), Fig. 2b.



Ex. 1010 (Lin), Fig. 2b.

324. Lin further discloses, "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of* the bottom surface and *a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26. Lin also discloses, "*The bases 100 are formed mainly by appropriate means of etching* and machinery *to remove the part of the bases 100 for the subsequent filling of the insulator 106 and, after that,* the heat sinking seats 102 and *the electrodes 104 of the bases 100 are left behind*, as shown in FIG. 4b. *Then, the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31. Lin additionally discloses "At last, as illustrated in FIG. 4g, *the packaging units 200 are separated by cutting*." Ex. 1010 (Lin) ¶ 33, *see also, e.g.,* Abstract,¶¶ 9, 11, 15-23, 26, 29-31, 33, cls. 1, 3, 9, 11, Figs. 2a-f, 3a-b, 4a-g.

325. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion and four outer lateral surfaces having coplanar resin and metal in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). In view of the foregoing discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

f. Element 28.E: "wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package"

326. **Hsu discloses: "a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package."** *See* Section VIII.A.7.f above.

327. To the extent it is argued further disclosure of a resin package (with a resin part) is required, **Lin discloses: "a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package."** For example, Lin discloses a notch (*e.g.*, shown in red in Figs. 2b, 4b below) is formed in the metal part (*e.g.*, "electrodes 104," shown in blue in Figs. 2b, 4b below) at each of the four outer lateral surfaces of the resin package. *E.g.*, Ex. 1010 (Lin), Figs. 2b, 4b.

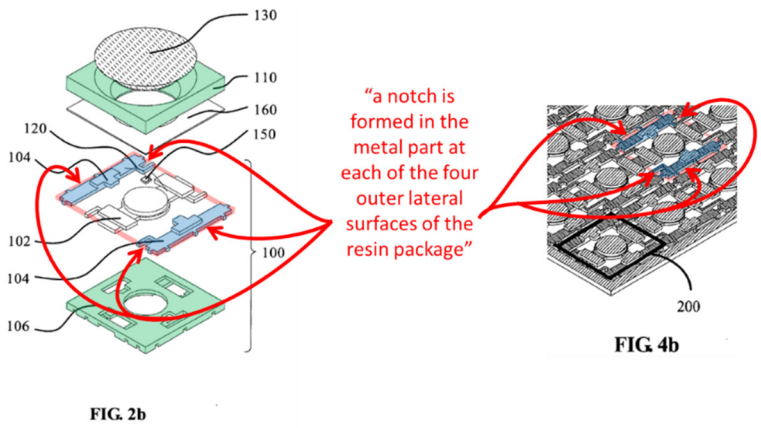


FIG. 2b

FIG. 4b

Ex. 1010 (Lin), Figs. 2b, 4b.

328. Lin further discloses, "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of the bottom surface and a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26. Lin also discloses, "*The bases 100 are formed mainly by appropriate means of etching* and machinery *to remove the part of the bases 100 for the subsequent filling of the insulator 106 and, after that,* the heat sinking seats 102 and *the electrodes 104 of the bases 100 are left behind*, as shown in FIG. 4b. *Then, the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31.

329. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose that a notch is formed in

the metal part at each of the four outer lateral surfaces of the resin package. Ex. 1030 (Hsu), Figs. 4, 12; Ex. 1010 (Lin), Figs. 2b, 4b. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package.. In view of the foregoing discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

g. Element 28.F: "wherein, at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate, wherein, at a second of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate"

330. **Hsu discloses: "at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate" and "at a second of the four outer lateral surfaces of the resin**

package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate." *See* Section VIII.A.7.g above.

331. To the extent it is argued further disclosure of a resin part is required, **Lin discloses: "at a first of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first metal plate" and "at a second of the four outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the second metal plate."** For example, Lin discloses that at first and second outer lateral surfaces of the resin package (*e.g.*, outlined in red in Fig. 2b below), portions of outer lateral surfaces of the resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Fig. 2b below) are located above and at left and right sides of exposed outer lateral surfaces of the first and second metal plates (*e.g.*, "electrodes 104," shown in blue in Fig. 2b below). *E.g.*, Ex. 1010 (Lin), Fig. 2b.

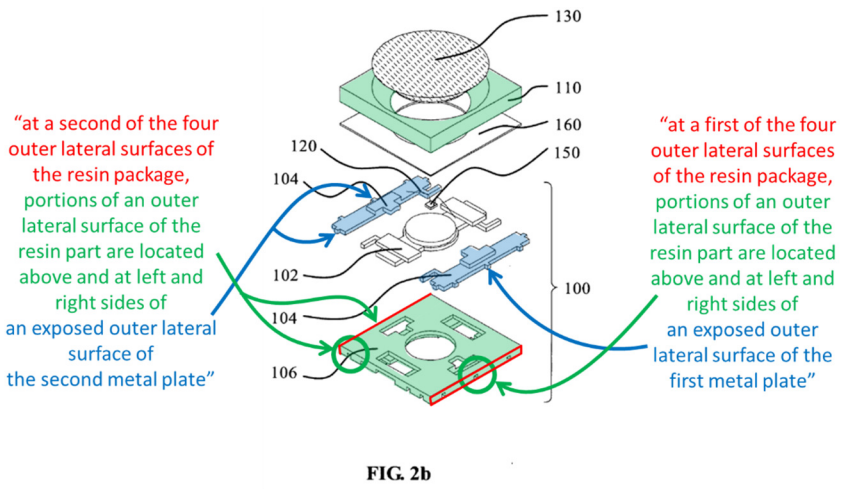


FIG. 2b

Ex. 1010 (Lin), Fig. 2b.

332. Lin further discloses, "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of the bottom surface and a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26. Lin also discloses, "*The bases 100 are formed mainly by appropriate means of etching* and machinery *to remove the part of the bases 100 for the subsequent filling of the insulator 106 and, after that,* the heat sinking seats 102 and *the electrodes 104 of the bases 100 are left behind*, as shown in FIG. 4b. *Then, the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31, *see also, e.g.,* Abstract,¶¶ 9, 11, 15-23, 25-26, 29-31, 33, cls. 1, 3, 9, 11, Figs. 2a-f, 3a-b, 4a-g.

333. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See*

Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose that at first and second outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first and second metal plate. Ex. 1030 (Hsu), Figs. 11-12; Ex. 1010 (Lin), Fig. 2b. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that at first and second outer lateral surfaces of the resin package, portions of an outer lateral surface of the resin part are located above and at left and right sides of an exposed outer lateral surface of the first and second metal plate. In view of the foregoing discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

h. Element 28.G: "wherein a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element"

334. **Hsu discloses: "a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element."** *See* Section VIII.A.7.h above.

i. Element 28.H: "wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the first metal plate, and wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate"

335. **Hsu discloses: "the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the first metal plate, and wherein the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate."** *See* Section VIII.A.7.i above.

336. To the extent it is argued further disclosure of a resin part is required, **Lin discloses: "the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the first metal plate, and wherein the portions**

of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the second metal plate are integrally formed and are coplanar with the exposed outer lateral surface of the second metal plate." For example, Lin discloses that the portions of the outer lateral surface of the resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Fig. 2b below) that are located above and at left and right sides of the exposed outer lateral surfacess of the first and second metal plates (*e.g.*, "electrodes 104," shown in blue in Fig. 2e below) are integrally formed and are coplanar with the exposed outer lateral surfaces of the first and second metal plates. *E.g.*, Ex. 1010 (Lin) Fig. 2b.

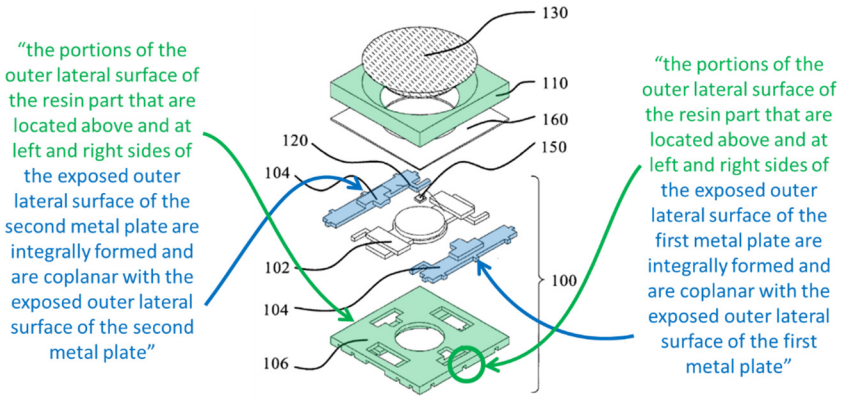


FIG. 2b

Ex. 1010 (Lin), Fig. 2b.

337. Lin further discloses, "As illustrated, the packaging structure provided by the present embodiment contains at least a base 100, a reflection plate 110, the LED chip being packaged 150, a plurality of the bonding wires 120, and a

transparent filler 130. *The base 100, having a flat form factor, is composed of* a heat sinking seat 102, *a plurality of electrodes 104, and an insulator 106, integrated together into a single solid object.* The heat sinking seat 102 and the electrodes 104 are made of a metallic material having high electrical and thermal conductivities. The insulator 106, on the other hand, is made of an insulating material such as resin or the like." Ex. 1010 (Lin) ¶ 25. Lin also discloses, "Similarly, *the electrodes 104 are exposed* both from the top surface of the base 100, and *from at least one of the bottom surface and a side surface of the base 100, respectively*." Ex. 1010 (Lin) ¶ 26. Lin further discloses, "*The bases 100 are formed mainly by appropriate means of etching* and machinery *to remove the part of the bases 100 for the subsequent filling of the insulator 106 and, after that,* the heat sinking seats 102 and *the electrodes 104 of the bases 100 are left behind*, as shown in FIG. 4b. *Then, the part of the bases 100 etched away is filled with the insulator 106* and the result is shown in FIG. 4c." Ex. 1010 (Lin) ¶ 31, *see also, e.g.,* Abstract,¶¶ 9, 11, 15-23, 25-26, 29-31, 33, cls. 1, 3, 9, 11, Figs. 2a-f, 3a-b, 4a-g.

338. A POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). Both Hsu and Lin disclose that the portions of the

outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first and second metal plates are integrally formed and are coplanar with the exposed outer lateral surface of the first and second metal plates. Ex. 1030 (Hsu), Figs. 11-12; Ex. 1010 (Lin), Fig. 2b. In implementing Hsu's light emitting device using Lin's teachings of a resin part, a POSITA would have understood that the portions of the outer lateral surface of the resin part that are located above and at left and right sides of the exposed outer lateral surface of the first and second metal plates are integrally formed and are coplanar with the exposed outer lateral surface of the first and second metal plates. In view of the foregoing and the discussion above in Element 27.B (¶¶ 279-280), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part in implementing Hsu's light emitting device with first and second metal leads, and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

8. Invalidity of Proposed Substitute Claim 29 Over Hsu, Lin, and Urasaki (Ground 10)

a. Claim 29: "The light emitting device according to claim 28, wherein the resin part is made using a thermosetting resin."

339. **Hsu in view of Lin renders obvious: "The light emitting device according to claim 28."** *See* claim 28.

340. **Hsu discloses: "the resin part is made using a…resin."** *See* Section VIII.A.8.a above.

341. To the extent it is argued further disclosure of a resin part including a thermosetting resin is required, **Urasaki discloses: "the resin part is made using a thermosetting resin."** *See* Claim 27.B.

342. A POSITA would have been motivated and found it obvious and a straightforward and beneficial design choice, to use a thermosetting resin, *as expressly taught by Urasaki*, in implementing Hsu's light emitting device (as implemented using Lin's teachings of a resin part). *See* Claim 27.B (¶¶ 282).

9. Invalidity of Proposed Substitute Claim 30 Over Hsu, Lin, and Suenaga (Ground 12)

a. Claim 30: "The light emitting device according to claim 28 wherein: the first metal plate has a first step portion that is exposed on the outer lateral surface of the first metal plate on a first side of the resin package, and the second metal plate has a second step portion that is exposed on the outer lateral surface of the second metal plate on a second side of the resin package."

343. **Hsu in view of Lin renders obvious: "The light emitting device according to claim 28."** *See* claim 28.

344. **Hsu discloses: "the first metal plate has a first…portion that is exposed on the outer lateral surface of the first metal plate on a first side of the resin package and the second metal plate has a second…portion that is**

exposed on the outer lateral surface of the second metal plate on a second side of the resin package." *See* Section VIII.A.9.a above.

345. **Suenaga discloses: "the first metal plate has a first step portion that is exposed on the outer lateral surface of the first metal plate on a first side of the resin package and the second metal plate has a second step portion that is exposed on the outer lateral surface of the second metal plate on a second side of the resin package."** *See* Section VIII.A.9.a above.

346. A POSITA would have been motivated and found it obvious and straightforward and beneficial design choice to provide a step portion that is exposed on the outer lateral surface of the first and second metal plates on the first and second sides of the resin package, *as expressly taught by Suenaga*, in implementing the metal plates for a resin package taught by Hsu. *See* Section VIII.A.9.a above.

10. Invalidity of Proposed Substitute Claim 31 Over Hsu, Lin, Urasaki, and Glenn (Ground 13)

a. Element 31.Pre: "The light emitting device according to claim 29"

347. **Hsu in view of Lin and Urasaki renders obvious: "The light emitting device according to claim 29."** *See* Claim 29.

b. Element 31.A: "wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors"

348. **Lin discloses: "a sealing member that contains two or more kinds of phosphors."** For example, Lin discloses a sealing member (*e.g.*, "filler 130" and "phosphors 105," shown in brown in Fig. 2e below) that contains two or more kinds of phosphors (*e.g.*, "red, green, and blue phosphors 105," shown in brown in Fig. 2e below). *E.g.*, Ex. 1010 (Lin) ¶¶ 28-29, Fig. 2e.

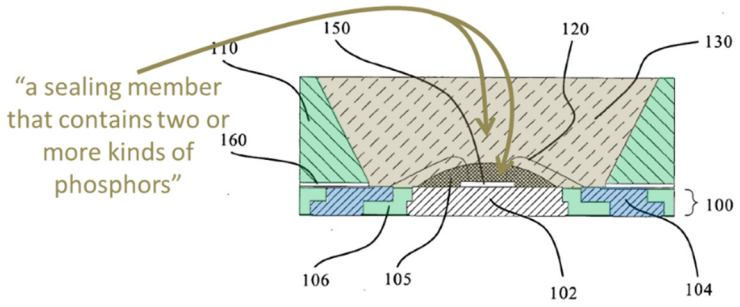


FIG. 2e

Ex. 1010 (Lin), Fig. 2e.

349. Lin further discloses , "*The through hole of the reflection plate 160 is filled with the filler 130 made of a transparent material such as resin so as to seal and protect the LED chip 150 and the bonding wires 120.*" Ex. 1010 (Lin) ¶ 28. Lin also discloses, "The fourth embodiment shown in FIG. 2e is to demonstrate that the present invention could also be applied in producing white light from various colored LEDs and appropriate phosphors. In this embodiment, a blue-light LED chip 150 is buried inside a yellow phosphor 105 before they are sealed by the

filler 130…. *[A]n UV (ultra-violet) LED chip 150 is buried in red, green, and blue phosphors 105*, and the red, green, and blue lights from the excitation of the red, green, and blue phosphors 105 by the UV light from the LED chip 150 are mixed to produce three-wavelength white light…. *A large number of research results about* the reflection mirror 103 and *the phosphors 105 have already been disclosed in the related arts*, and their implementations are not limited to those exemplified in the afore-mentioned embodiments." Ex. 1010 (Lin) ¶ 29, *see also, e.g.,* Abstract,¶¶ 10-11, 15-23, 28-30, cls. 1, 8-9, Figs. 2a-f, 3a-b, 4f-g.

350. A POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a sealing member that contains two or more kinds of phosphors in implementing Hsu's light emitting device to protect the LED chip and to beneficially adjust the color of the light emitted from the light emitting element, advantageously making it possible to produce light in a variety of colors, such as "three-wavelength white light." Lin ¶ 29, *see also, e.g.,* Ex. 1005 (Mori) ¶¶ 12, 10-11; Ex. 1002 ('071 File History), 145; Ex. 1003 (January 12, 2018 Declaration) ¶ 139. Hsu and Lin are in the same field of art, and relate to an LED package having a resin part. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, Figs. 1-12; Ex. 1010 (Lin), Abstract,¶¶ 2, 4, 8-11, 15-23, 25-26, 28-31, cls. 1, 3, 5-6, 9, 11, 15-16, Figs. 2a-f, 3a-b, 4a-g. It was well-known in the art—as expressly disclosed by

Lin—to use a sealing member "to seal and protect the LED chip 150 and the bonding wires 120." Ex. 1010 (Lin) ¶ 28. Such protection includes protection from mechanical stress as well as from oxidation and moisture. It was also well-known in the art—as expressly disclosed by Lin—to use phosphors for color conversion. *E.g.*, Ex. 1010 (Lin) ¶ 29 ("A large number of research results about…the phosphors 105 have already been disclosed in the related arts…"). Furthermore, it was well-known in the art—as Mori expressly teaches—that it is "*conventional*" *to use two or more kinds of phosphors* in the sealing member filled in the concave portion of an LED package to "perform wavelength conversion" to convert the color of light emitted by the light emitting diode (such as "near-ultraviolet light, blue-color light or the like") to a different color (such as "red-color light, green-color light, blue-color light, or yellow-color light"). Ex. 1005 (Mori) ¶¶ 5, 10. Mori also discloses that "various materials may be used in consideration of the luminescence wavelength of the light emitted from the light-emitting elements 104, 114, as well as desired light emitted from the light-emitting apparatuses 101, 111." *Id.* ¶ 10. Mori further explains that *by using two or more kinds of phosphors* in the sealing member, "the mixing ratio of the phosphors" can be "adjust[ed]" as needed to advantageously "*set a color temperature without restraint*" and obtain the desired color of light. Ex. 1005 (Mori) ¶¶ 12, 91. Mori thus teaches that using two or more kinds of phosphors in the sealing member advantageously provides more

options as to the color temperature output from the light emitting device. Ex. 1005 (Mori) ¶¶ 12, 87. Indeed, it was well-known and conventional (as Lin and Mori expressly describe – Ex. 1010 (Lin) ¶ 29; Ex. 1005 (Mori) ¶ 5) to use two or more kinds of phosphors in a sealing member of a light emitting device to advantageously tailor the color of the emitted light with flexibility—for example, to downconvert light from an ultraviolet or blue LED to a desirable warm color of visible light by adjusting the mixing ratio of two or more phosphors. In view of the foregoing, a POSITA would have found it routine and straightforward to use a sealing member that contains two or more kinds of phosphors, as taught in Lin, in implementing Hsu's light emitting device (as implemented using Lin's teachings of a resin part), and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

c. Element 31.B: "wherein each of the first and second metal plates includes an etched concave portion on an upper surface of the respective metal plate"

351. As discussed above (§ VI.E), there is no disclosure in the specification that the etched concave portion is on an *upper surface* of the metal plate. However, to the extent it is argued this element is disclosed in the '071 specification, **Hsu discloses: "first and second metal plates."** *See* Claim 28. To the extent it is argued this element is disclosed in the '071 specification, **Glenn discloses: "each**

of the first and second metal plates includes an etched concave portion on an upper surface of the respective metal plate." *See* Section VIII.A.10.c above.

352. A POSITA would have been motivated and found it obvious and straightforward to use Glenn's advantageous teachings of an etched curved concave portion on each of the first and second metal plates in implementing Hsu's light emitting device that utilizes first and second metal plates. *See* Section VIII.A.10.c above.

d. Element 31.C: "wherein each of the first and second metal plates includes an etched concave portion on a bottom surface of the respective metal plate"

353. As discussed above (§ VI.E), there is no disclosure in the specification that the etched concave portion is on an *bottom surface* of the metal plate. However, to the extent it is argued this element is disclosed in the '071 specification, **Hsu discloses: "first and second metal plates."** *See* Claim 28. To the extent it is argued this element is disclosed in the '071 specification, **Glenn discloses: "each of the first and second metal plates includes an etched concave portion on a bottom surface of the respective metal plate."** *See* Section VIII.A.10.d above.

354. A POSITA would have been motivated and found it obvious and straightforward to use Glenn's advantageous teachings of an etched curved concave portion on each of the first and second metal plates in implementing Hsu's

light emitting device that utilizes first and second metal plates. *See* Section VIII.A.10.d above.

e. Element 31.D: "wherein each of said etched concave portions is curved"

355. To the extent it is argued this element is disclosed in the '071 specification (*see, e.g.*, Ex. 2019 ¶¶ 63, 115-119 (citing '071 patent Fig. 11)), **Hsu discloses**: "first and second metal plates." *See* Claim 28. To the extent it is argued this element is disclosed in the '071 specification, **Glenn discloses: "each of said etched concave portions is curved."** *See* Section VIII.A.10.e above.

356. A POSITA would have been motivated and found it obvious and straightforward to use Glenn's advantageous teachings of an etched curved concave portion on each of the first and second metal plates in implementing Hsu's light emitting device that utilizes first and second metal plates. *See* Section VIII.A.10.e above.

11. Invalidity of Proposed Substitute Claim 32 Over Hsu in view of Lin, Wang, and Oshio (Ground 14)

a. Claim 32: "The light emitting device according to claim 28, wherein the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, the metal layers being made of a material that is different from that of the base portion."

357. **Hsu in view of Lin renders obvious: "The light emitting device according to claim 28."** *See* claim 28.

358. **Wang discloses: "the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion."** *See* Section VIII.A.11.a above.

359. A POSITA would have been motivated and found it obvious and a straightforward and beneficial design choice, to plate all surfaces of the leadframe with a metal layer that is made of a different metal than the leadframe (as taught by Wang) in implementing Hsu's light emitting device (as implemented using Lin's teachings). Hsu, Lin, and Wang are in the same field of art and relate to manufacturing multiple LED packages by molding resin on a lead frame. Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1010 (Lin), Abstract,¶¶ 2, 4, 8-11, 15-23, 25-26, 28-31, cls. 1, 3, 5-6, 9, 11, 15-16, Figs. 2a-f, 3a-b, 4a-g; Ex. 1006 (Wang) ¶¶ 2, 8, 39, Abstract, Fig. 4. Wang discloses plating the leadframe before molding. Ex. 1006 (Wang), Abstract, ¶¶ 9, 39, 49, Figs. 2-5. As discussed above, POSITA would have understood that plating all surfaces with a metal layer of a material different than the base portion provides beneficial surface properties of the metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the metal part (such as high thermal and electrical conductivity at a lower cost). A POSITA

would have found it routine and straightforward to plate all surfaces of the leadframe with a metal layer that is made of a different metal than the leadframe (as taught by Wang) in implementing Hsu's light emitting device (as implemented using Lin's teachings), and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality.

360. **Oshio discloses: "the metal layers being made of a material that is different from that of the base portion."** *See* Section VIII.A.11.a above.

361. A POSITA would have been motivated to use Oshio's advantageous express teachings of using a metal layer made of a material that is different from the base portion, in implementing the combined teachings of Hsu, Lin, and Wang having a leadframe for an LED package that includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, to obtain the beneficial surface properties of the plated metal layer while retaining the beneficial properties of the base portion of the metal part. *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143. Hsu, Koung, Wang, and Oshio are in the same field of art, and relate to light emitting devices, and packages for light emitting devices. *E.g.*, Ex. 1030 (Hsu), Abstract, 1:7-10, 1:13-48, 1:52-2:14, 2:17-44, 2:48-3:30, 3:43-67, 4:1-38, cls. 1-5, Figs. 1-12; Ex. 1006 (Wang) ¶¶ 2, 8, 39, Abstract, Fig. 4; Ex. 1007 (Oshio) ¶¶ 49, 61-63, 69, 71, 113-114, Abstract,

Figs. 1-4; Ex. 1010 (Lin), Abstract,¶¶ 2, 4, 8-11, 15-23, 25-26, 28-31, cls. 1, 3, 5-6, 9, 11, 15-16, Figs. 2a-f, 3a-b, 4a-g.

362. As expressly disclosed by Oshio, it was common and well-known in the art to use copper as a base portion of a metal part due to its high thermal and electrical conductivity at a relatively low cost. *See, e.g.*, Ex. 1007 (Oshio) ¶ 69. Oshio also discloses that the "pair of leads 20 and 30" may be made of a "copper (Cu) based alloy" to "advantageously…obtain[] high thermal conductivity." Ex. 1007 (Oshio) ¶¶ 69. It was further well-known in the art that it was advantageous to plate, *e.g.*, a copper leadframe, with a metal layer made of a material that is different from the leadframe, *e.g.*, silver, to obtain the beneficial surface properties of the metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the metal part (such as high thermal and electrical conductivity at a lower cost). Oshio itself expressly teaches that it is advantageous to plate a copper leadframe with silver "***to increase the light reflectance***" and "***to increase…the bonding strength of solder***." Ex. 1007 (Oshio) ¶¶ 69, 113, Figs. 1-4; *see also* Ex. 1002 ('071 File History), 142-143. A POSITA would have found it routine and straightforward to use a metal layer that is a different metal from the leadframe (as expressly taught by Oshio), in plating all surfaces of the leadframe

with a metal layer in the combined teachings of Hsu and Wang (and alternatively Hsu, Lin, and Wang) and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. Indeed, it was well-known to perform plating on a leadframe. *E.g.*, Ex. 1008 (Koung) ¶ 26 (teaching that a leadframe "may be plated with silver coating or other conductive materials").

12. Invalidity of Proposed Substitute Claim 33 Over Hsu in view of Lin, Wang, and Oshio (Ground 14)

a. Claim 33: "The light emitting device according to claim 32, wherein the metal layer is disposed at all surfaces of the metal part except an exposed outer lateral surface of the metal part."

363. **Hsu in view of Lin, Wang, and Oshio renders obvious: "The light emitting device according to claim 32."** *See* claim 32.

364. **Wang discloses: "the metal layer is disposed at all surfaces of the metal part except an exposed outer lateral surface of the metal part."** *See* Section VIII.A.12.a above.

365. A POSITA would have been motivated and found it obvious and straightforward to use Wang's advantageous teachings of plating a metal layer on all surfaces of the metal part before molding and cutting, in implementing Hsu's manufacturing process for an LED package (as implemented using Lin's teachings)—thereby leaving a metal part that is unplated at the cut section—to

increase the electrical and thermal conductivity of the leadframe and improve the performance and operating lifetime of the device. *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143. Indeed, it was well-known in the art before the claimed priority date to plate a leadframe, then perform a molding and cutting step, thereby leaving a metal part that is unplated at the cut section. *E.g.*, Ex. 1006 (Wang) ¶¶ 9, 39, Fig. 2 (teaching steps of electroplating the leadframe, forming an encapsulant on the leadframes, and then cutting); Ex. 1007 (Oshio) ¶¶ 69, 89, 114 (teaching steps of plating the leadframe to improve solderability of the lead to the chip, performing molding after the chip is mounted, then cutting); Ex. 1008 (Koung) ¶¶ 19-24, 26 (teaching steps of plating the leadframe, molding, then cutting). It would have been nothing more than an obvious, straightforward, and beneficial design choice to plate the leadframe on all surfaces (*e.g.*, by submerging the leadframe in an electroplating bath) and then perform molding and cutting. As further confirmed by the Examiner during prosecution, it was well-known that cutting after plating results in an unplated portion at the cut section. Ex. 1002 ('071 File History), 143; *see also* Ex. 1007 (Oshio) ¶ 114. Furthermore, it would have been beneficial to perform plating before molding and cutting and to plate all surfaces of the leadframe to provide for plating on a greater surface area of the leadframe, thereby increasing the thermal conductivity of the leadframe, leading to lower operating temperature and increased lifetime for the LED chip (which is

small but has a high power-density). If regions of the leadframe, including those that are subsequently covered by resin, were not plated, the mounted LED would operate at a higher temperature, and the operating lifetime of the LED is shortened. Accordingly, by plating (*e.g.*, silver-plating) the entire leadframe before molding and cutting, the overall electrical and thermal conductivity of the leadframe is considerably increased, thus improving overall efficiency and reducing undesirable heating (and improving thermal and electrical conductivity). Furthermore, plating the portions of the leadframe that are in contact with resin reduces the likelihood of corrosion-induced LED package failure at the resin/leadframe interface, thus improving the reliability of the interface between the resin and leadframe. Additionally, in view of these design needs and the finite number of options as to when to perform plating in the manufacturing process, performing plating before molding and cutting would have been obvious to try.

366. A POSITA would have found it obvious, routine and straightforward to use Wang's advantageous teachings of plating a metal layer on all surfaces of the metal part before molding and cutting, in implementing Hsu's manufacturing process for an LED package (as implemented using Lin's teachings)—thereby leaving an outer lateral surface of the metal part unplated after cutting—and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. A POSITA

would have also understood that because Hsu teaches a leadframe with minimal cross-sectional area exposed by cutting, the impact of leaving cut areas exposed would also be minimized while still obtaining the benefits of plating as to the rest of the leadframe. Ex. 1007 (Oshio) ¶ 114. **Oshio discloses: "the metal layer is disposed at all surfaces of the metal part except an exposed outer lateral surface of the metal part."** *See* Section VIII.A.12.a above.

367. As discussed above (Claim 32 (¶¶ 361-362)), a POSITA would have been motivated to use Oshio's advantageous express teachings of using a metal layer made of a material that is different from the base portion, in implementing the combined teachings of Hsu, Lin, and Wang having a leadframe for an LED package that includes a base portion and a metal layer disposed on all surfaces of the base portion, to obtain the beneficial surface properties of the plated metal layer (such as higher resistance to corrosion, increased solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the base portion of the metal part (such as high thermal and electrical conductivity at a lower cost). *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143. Furthermore, Hsu and Lin, like Wang and Oshio, discloses providing a leadframe, molding a resin part, then "cut[ting]" to separate the light emitting device, and Oshio (like Wang) further disclose molding and cutting the

leadframes *after* plating. Ex. 1030 (Hsu) 2:58-3:11, 3:43-3:67, Figs. 1-12; Ex. 1006 (Wang), Abstract, ¶¶ 9, 39, 49, Figs. 2-5; Ex. 1007 (Oshio) ¶¶ 69, 89, 114; Ex. 1010 (Lin), Abstract,¶¶ 2, 4, 8-11, 15-23, 25-26, 28-31, cls. 1, 3, 5-6, 9, 11, 15-16, Figs. 2a-f, 3a-b, 4a-g. Accordingly, a POSITA would have understood that implementing Oshio's teachings of plating before molding and cutting, thereby resulting in a metal part that is unplated at the cut section, in the manufacturing process for an LED package in the combined teachings of Hsu and Wang (and alternatively Hsu, Lin, and Wang) would result in a metal layer that is disposed at all surfaces of the metal part except an outer lateral surface of the metal part (and a portion of an outer lateral surface of the metal part) at the cut section.

368. Moreover, a POSITA would have been motivated and found it obvious and straightforward to use Oshio's advantageous teachings of plating before molding and cutting—thereby leaving a metal part that is unplated at the cut section—in implementing the manufacturing process for an LED package in the combined teachings of Hsu and Wang (and alternatively Hsu, Lin, and Wang) to further increase the electrical and thermal conductivity of the leadframe and improve the performance and operating lifetime of the device. *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 143. Indeed, it was well-known in the art before the claimed priority date to plate a leadframe, then perform a molding and cutting step, thereby leaving a metal part that is unplated at the cut

section. *E.g.*, Ex. 1006 (Wang) ¶¶ 9, 39, Fig. 2 (teaching steps of electroplating the leadframe, forming an encapsulant on the leadframes, and then cutting); Ex. 1007 (Oshio) ¶¶ 69, 89, 114 (teaching steps of plating the leadframe to improve solderability of the lead to the chip, performing molding after the chip is mounted, then cutting); Ex. 1008 (Koung) ¶¶ 19-24, 26 (teaching steps of plating the leadframe, molding, then cutting). It would have been nothing more than an obvious, straightforward, and beneficial design choice to plate the leadframe on all surfaces (*e.g.*, by submerging the leadframe in an electroplating bath) and then perform molding and cutting. As further confirmed by the Examiner during prosecution, it was well-known that cutting after plating results in an unplated portion at the cut section. Ex. 1002 ('071 File History), 143; *see also* Ex. 1007 (Oshio) ¶ 114. Furthermore, it would have been beneficial to perform plating before molding and cutting and to plate all surfaces of the leadframe to provide for plating on a greater surface area of the leadframe, thereby increasing the thermal conductivity of the leadframe, leading to lower operating temperature and increased lifetime for the LED chip (which is small but has a high power-density). If regions of the leadframe, including those that are subsequently covered by resin, were not plated, the mounted LED would operate at a higher temperature, and the operating lifetime of the LED is shortened. Accordingly, by plating (*e.g.*, silver-plating) the entire leadframe before molding and cutting, the overall electrical and

thermal conductivity of the leadframe is considerably increased, thus improving overall efficiency and reducing undesirable heating (and improving thermal and electrical conductivity). Furthermore, plating the portions of the leadframe that are in contact with resin reduces the likelihood of corrosion-induced LED package failure at the resin/leadframe interface, thus improving the reliability of the interface between the resin and leadframe. Additionally, in view of these design needs and the finite number of options as to when to perform plating in the manufacturing process, performing plating before molding and cutting would have been obvious to try.

369. A POSITA would have found it obvious, routine and straightforward to use Oshio's advantageous teachings of plating before molding and cutting—thereby leaving a metal part that is unplated at the cut section—in implementing the manufacturing process for an LED package, as taught by Hsu and Wang (and alternatively, Hsu, Lin, and Wang) and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. A POSITA would have also understood that because Hsu teaches a leadframe with minimal cross-sectional area exposed by cutting, the impact of leaving cut areas exposed would also be minimized while still obtaining the benefits of plating as to the rest of the leadframe. Ex. 1007 (Oshio) ¶ 114.

13. Invalidity of Proposed Substitute Claim 34 Over Hsu in view of Lin, Wang, and Oshio (Ground 14)

a. Claim 34: "The light emitting device according to claim 32, wherein: the resin part is disposed over a first portion of the metal layer at the upper surface of the metal part, and a second portion of the metal layer on the upper surface of the metal part is exposed from the resin part."

370. **Hsu in view of Lin, Wang, and Oshio renders obvious: "The light emitting device according to claim 32."** *See* claim 32.

371. **Lin discloses: "the resin part is disposed over a first portion…at the upper surface of the metal part, and a second portion…on the upper surface of the metal part is exposed from the resin part."** For example, Lin discloses the resin part (*e.g.*, "insulator 106" and "reflection plate 110," shown in green in Fig. 2e below) is disposed over a first portion (*e.g.*, indicated by blue single arrow in Fig. 2e below) at the upper surface of the metal part (*e.g.*, "electrodes 104," shown in blue in Fig. 2e below), and a second portion (*e.g.*, indicated by blue double arrow in Fig. 2A below) on the upper surface of the metal part (*e.g.*, "electrodes 104," shown in blue in Figs. 2b, 2e below) is exposed from the resin part. *E.g.*, Ex. 1010 (Lin), Fig. 2e.

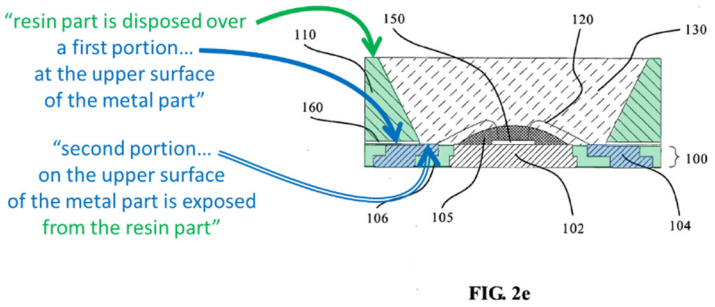


FIG. 2e

Ex. 1010 (Lin), Fig. 2e.

372. Lin further discloses, "Similarly, *the electrodes 104 are exposed both from the top surface of the base 100*, and from at least one of the bottom surface and a side surface of the base 100, respectively." Ex. 1010 (Lin) ¶ 26. "The location and aperture of the through hole are properly configured so that, after the reflection plate 110 is joined with the base 100, the top surface of the heat sinking seat 102 and *at least some portion of the top surface of the electrodes 104 are exposed for* the fixation of the LED chip 150 and *the connection of the bonding wires 120* respectively." Ex. 1010 (Lin) ¶ 27, *see also, e.g.,* Abstract,¶¶ 9-11, 15-23, 26-27, 29-30, cls. 1, 3, 9, 11, Figs. 2a-f, 3a-b, 4a-g.

373. As discussed above, a POSITA would have been motivated and found it obvious and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion in implementing Hsu's light emitting device with first and second metal leads. *See* Element 27.B (¶¶ 279-280). As discussed above, a POSITA also would have understood that Lin's concave portion is sufficiently wide to perform wire bonding within the concave portion in order to

connect the leads. In view of the foregoing discussion above in Element 27.B (¶¶ 279-280), Claim 32 (¶¶ 359, 361-362), and Claim 33 (¶ 365), a POSITA would have found it routine and straightforward to use Lin's advantageous teachings of a resin part having a tall, wide, reflective concave portion and four outer lateral surfaces having coplanar resin and metal in implementing Hsu's leadframe (that is plated in view of Wang and Oshio), and would have known that such a combination (yielding the claimed limitation) would work and provide the expected functionality.

374. To the extent it is argued further disclosure of the resin part disposed over a first portion of the metal layer at the upper surface of the metal part is required, **Wang discloses: "the…part is disposed over a first portion of the metal layer at the upper surface of the metal part, and a second portion of the metal layer on the upper surface of the metal part is exposed from the…part."** *See* Section VIII.A.13.a above.

375. As discussed above (Claim 32 (¶ 359)), a POSITA would have been motivated to use Wang's advantageous teachings of plating a metal layer (made of a material that is different from the metal part) on all surfaces of the metal part in implementing Hsu's light emitting device (as implemented using Lin's teachings of a tall, wide, reflective resin part), to obtain the beneficial surface properties of the plated metal layer (such as higher resistance to corrosion, increased

solderability, decreased contact resistance in connections to other elements, increased hermeticity at resin/metal interfaces, and increased reflectivity) while retaining the beneficial properties of the base portion of the metal part (such as high thermal and electrical conductivity at a lower cost). *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143; Ex. 1003 (January 12, 2018 Declaration) ¶ 166. Furthermore, Hsu and Lin, like Wang, discloses providing a leadframe, molding a resin part, then "cut[ting]" to separate the light emitting device, and as also discussed above (¶ 359), Wang discloses molding and cutting the leadframes *after* electroplating. Ex. 1030 (Hsu) 2:58-3:11, 3:43-3:67, Figs. 1-12; Ex. 1010 (Lin), Abstract,¶¶ 2, 4, 8-11, 15-23, 25-26, 28-31, cls. 1, 3, 5-6, 9, 11, 15-16, Figs. 2a-f, 3a-b, 4a-g; Ex. 1006 (Wang), Abstract, ¶¶ 9, 39, 49, Figs. 2-5. Accordingly, a POSITA would have understood that implementing Wang's teachings of plating all surfaces of the metal part before molding (*i.e.*, a part having a wide concave portion) and cutting in Hsu's manufacturing process for an LED package (as implemented using Lin's teachings of a resin part, also having a molded part with a wide concave portion) would result in a resin part disposed over a first portion of the metal layer at the upper surface of the metal part, and a second portion of the metal layer on the upper surface of the metal part that is exposed from the resin part.

376. Moreover, a POSITA would have been motivated and found it obvious and straightforward to use Wang's advantageous teachings of plating a metal layer on all surfaces of the metal part before molding and cutting, in implementing Hsu's light emitting device (as implemented using Lin's teachings of a resin part having a tall, wide, reflective concave portion)—thereby disposing a resin part over a first portion of the metal layer and leaving a second portion of the metal layer exposed from the resin part —to increase the electrical and thermal conductivity of the leadframe and improve the performance and operating lifetime of the device. *See also* Ex. 1007 (Oshio) ¶¶ 69, 113; Ex. 1002 ('071 File History), 142-143; Ex. 1003 (January 12, 2018 Declaration) ¶ 167. Indeed, it was well-known in the art before the claimed priority date to plate a leadframe, then perform a molding and cutting step. *E.g.*, Ex. 1006 (Wang) ¶¶ 9, 39, Fig. 2 (teaching steps of electroplating the leadframe, forming an encapsulant on the leadframes, and then cutting); Ex. 1007 (Oshio) ¶¶ 69, 89, 114 (teaching steps of plating the leadframe to improve solderability of the lead to the chip, performing molding after the chip is mounted, then cutting); Ex. 1008 (Koung) ¶¶ 19-24, 26 (teaching steps of plating the leadframe, molding, then cutting). It would have been nothing more than an obvious, straightforward, and beneficial design choice to plate the leadframe on all surfaces (*e.g.*, by submerging the leadframe in an electroplating bath) and then perform molding and cutting. Furthermore, it would have been

beneficial to perform plating before molding and cutting and to plate all surfaces of the leadframe to provide for plating on a greater surface area of the leadframe, thereby increasing the thermal conductivity of the leadframe, leading to lower operating temperature and increased lifetime for the LED chip (which is small but has a high power-density). If regions of the leadframe, including those that are subsequently covered by resin, were not plated, the mounted LED would operate at a higher temperature, and the operating lifetime of the LED is shortened. Accordingly, by plating (*e.g.*, silver-plating) the entire leadframe before molding and cutting, the overall electrical and thermal conductivity of the leadframe is considerably increased, thus improving overall efficiency and reducing undesirable heating (and improving thermal and electrical conductivity). Furthermore, plating the portions of the leadframe that are in contact with resin reduces the likelihood of corrosion-induced LED package failure at the resin/leadframe interface, thus improving the reliability of the interface between the resin and leadframe. It is also desirable to perform plating before molding to avoid contaminating the plating bath with resin. Furthermore, leaving a portion of the metal layer surrounding the LED chip exposed from the resin part beneficially and predictably increases reflectivity of the leadframe near the LED chip, where increased reflectivity is beneficial for directing light out of the package. Leaving a portion of the plated metal layer on the upper surface of the metal part exposed from the resin part

further beneficially, predictably, and practically allows the LED chip to be bonded to the plated metal part and wires to be bonded to the plated metal part and the LED chip. Additionally, in view of these design needs and the finite number of options as to when to perform plating in the manufacturing process, performing plating before molding and cutting would have been obvious to try.

377. Accordingly, a POSITA would have found it obvious, routine and straightforward to use Wang's advantageous teachings of plating a metal layer on all surfaces of the metal part before molding (*i.e.*, a part having a wide concave portion) and cutting, in implementing in Hsu's manufacturing process for an LED package (as implemented using Lin's teachings of a resin part, also having a molded part with a wide concave portion)—thereby disposing a resin part over a first portion of the metal layer at the upper surface of the metal part and a second portion of the metal layer on the upper surface of the metal part that is exposed from the resin part (in the combined teachings of Hsu, Lin, and Wang)—and would have understood that the combination (yielding the limitation as claimed) would have predictably worked and provided the expected functionality. *See also, e.g.*, Ex. 1003 (January 12, 2018 Declaration) ¶ 168.

C. Secondary Considerations

378. At this time, including after review of the documents and materials cited herein and in my prior declaration, there is no evidence in the prosecution

history of the '071 patent of secondary considerations or objective factors of non-obviousness, and it is my opinion that proposed substitute claims 27-34 of the '071 patent are obvious over the prior art. And to the extent Patent Owner alleges secondary considerations in this proceeding, it is my opinion that they would not outweigh the strong evidence of obviousness of the proposed substitute claims, as set forth herein. I understand that if the Patent Owner presents in this proceeding evidence of objective factors that it argues support a finding of non-obviousness, I may be asked to review such evidence and to formulate an opinion and reserve the right to address any such evidence and/or arguments that Patent Owner may raise in this regard.

D. Conclusion

379. In summary, in connection with Patent Owner's Contingent Motion to Amend Claims, I have concluded that each of the proposed substitute claims is invalid as obvious under 35 U.S.C. § 103 in light of the prior art references as discussed above and the knowledge of one of ordinary skill in the art, as described in this Declaration.

380. Specifically, in my opinion, for at least the above reasons:

- Hsu in view of the knowledge of a POSITA renders obvious substitute claims 27-29;
- Hsu in view of Urasaki renders obvious substitute claims 27, 29;

- Hsu in view of Koung and Urasaki renders obvious substitute claims 27, 29;
- Hsu in view of Koung renders obvious substitute claim 28;
- Hsu in view of Suenaga renders obvious substitute claim 30;
- Hsu in view of Koung and Suenaga renders obvious substitute claim 30;
- Hsu in view of Koung, Urasaki, Mori, and Glenn renders obvious substitute-claim 31;
- Hsu in view of Wang, Oshio renders obvious substitute claims 32, 33;
- Hsu in view of Koung, Wang, and Oshio renders obvious substitute claims 32-34;
- Hsu in view of Lin and Urasaki renders obvious substitute claims 27, 29;
- Hsu in view of Lin renders obvious substitute claim 28;
- Hsu in view of Lin and Suenaga renders obvious substitute claim 30;
- Hsu in view of Lin, Urasaki, and Glenn renders obvious substitute claim 31;
- Hsu in view of Lin, Wang, and Oshio renders obvious substitute claims 32-34.

381. To the extent it is argued that any further disclosure is required for a limitation in proposed substitute claims 27-34 that I have identified above as having been disclosed by Hsu, Koung, Urasaki, Mori, Glenn, Wang, Oshio, and

Lin, a POSITA would certainly have found that limitation obvious to include based on the same disclosure and analysis I have identified above.

382. I reserve the right to supplement my opinions in the future to respond to any arguments that Patent Owner or its expert(s) may raise and to take into account new information as it becomes available to me.

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

384. Sworn to this 11th day of December, 2018 in Newton, Massachusetts.

Stanley Shanfield, Ph.D.