UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NICHIA CORPORATION,

Petitioner

v.

DOCUMENT SECURITY SYSTEMS, INC.,

Patent Owner

Case No. IPR2018-01165
Patent 7,524,087

PETITIONER'S DEMONSTRATIVE EXHIBITS

SHEARMAN & STERLING

Nichia Corporation

v.

Document Security Systems, Inc.

IPR2018-01165 (U.S. Patent No. 7,524,087)

ORAL ARGUMENT – AUGUST 28, 2019

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

U.S. PATENT NO. 7,524,087

US007524087B1

(12) **United States Patent**
Aizar et al.

(10) **Patent No.: US 7,524,087 B1**
(45) **Date of Patent: Apr. 28, 2009**

(54) **OPTICAL DEVICE**

(75) Inventors: **Abdul Karim Norfidathul Aizar**, Penang (MY); **Chiau Jin Lee**, Penang (MY); **Keat Chuan Ng**, Penang (MY); **Kiam Soon Ong**, Penang (MY); **Kheng Leng Tan**, Penang (MY)

(73) Assignee: **Avago Technologies ECBU IP (Singapore) Pte. Ltd.**, Singapore (SG)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/941,406**

(22) Filed: **Nov. 16, 2007**

(51) **Int. Cl.**
F21V 29/00 (2006.01)

(52) **U.S. Cl.** **362/267**; 362/310; 257/676; 257/684; 257/99; 257/100

(58) **Field of Classification Search** 362/267, 362/310, 800; 257/678, 684, 676, 81, 82, 257/98, 99, 100
See application file for complete search history.

(56) **References Cited**

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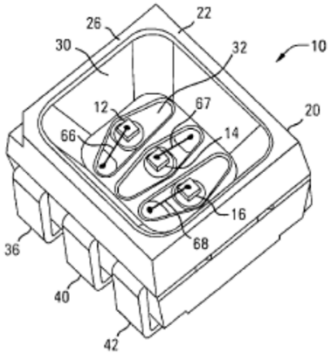
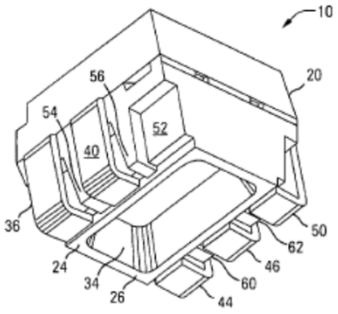
Primary Examiner—Thomas M Sember

(57) **ABSTRACT**

An exemplary embodiment of an optical device may include a lead frame with a plurality of leads and a reflector housing formed around the lead frame. The reflector housing includes a first end face and a second end face and a peripheral sidewall extending between the first end face and the second end face. The reflector housing includes a first pocket with a pocket opening in the first end face and a second pocket with a pocket opening in the second end face. At least one LED die is mounted in the first pocket of the reflector housing, and a light transmitting encapsulant is disposed in the first pocket and encapsulating the at least one LED die.

19 Claims, 6 Drawing Sheets





Patent No.: US 7,524,087 B1

OPTICAL DEVICE

Filed: **Nov. 16, 2007**

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Ex. 1001 ('087 Patent)

CLAIMS 1-19 ARE UNPATENTABLE

Claims	Prior Art Grounds
1, 6, 9-19	• Obvious over Kamada • Obvious over Okazaki in view of Critelli, Kamada, or Kyowa • Obvious over Takenaka in view of Critelli, Kamada, or Kyowa
2, 3, 5	• Obvious over Takenaka in view of Critelli, Kamada, or Kyowa
4	• Obvious over Takenaka in view of Critelli, Kamada, or Kyowa, in further view of Cheong
7, 8	• Obvious over Kamada in view of Kyowa or Cheong • Obvious over Okazaki in view of Kyowa • Obvious over Okazaki in view of Critelli or Kamada, in further view of Cheong • Obvious over Takenaka in view of Kyowa • Obvious over Takenaka in view of Critelli or Kamada, in further view of Cheong

CLAIMS 1-8

1. An optical device comprising:
a lead frame with a plurality of leads;
a reflector housing formed around the lead frame, the reflector housing having a first end face and a second end face and a peripheral sidewall extending between the first end face and the second end face, the reflector housing having a first pocket with a pocket opening in the first end face and a second pocket with a pocket opening in the second end face;
at least one LED die mounted in the first pocket of the reflector housing;
a light transmitting encapsulant disposed in the first pocket and encapsulating the at least one LED die; and
wherein a plurality of lead receiving compartments are formed in the peripheral sidewall of the reflector housing.

2. The optical device of claim **1**, wherein the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket.

3. The optical device of claim **2**, said plurality of leads being J-shaped.

4. The optical device of claim **2**, said plurality of leads comprising six leads in two rows.

5. The optical device of claim **2**, said plurality of lead receiving compartments being J-shaped.

6. The optical device of claim **1**, wherein the plurality of lead receiving compartments define a plurality of ribs disposed between the plurality of lead receiving compartments.

7. The optical device of claim **1**, said at least one LED die comprising three LED dies.

8. The optical device of claim **7**, said three LED dies comprising at least two colors.

CLAIMS 9-14

9. A display comprising a plurality of plastic leaded chip carrier LEDs, the plastic leaded chip carrier LEDs each comprising:

a lead frame with a plurality of leads;

a reflector housing formed around the lead frame, the reflector housing having a first end face and a second end face and a peripheral sidewall extending between the first end face and the second end face, the reflector housing having a cavity in the first end face, said peripheral sidewall having a plurality of lead receiving compartments formed therein;

at least one LED die mounted in the cavity of the reflector housing; and

a light transmitting encapsulant disposed in the cavity and encapsulating the at least one LED die.

10. The display of claim **9**, said reflector housing further comprising a second cavity in the second end face.

11. The display of claim **10**, wherein the plurality of lead receiving compartments define a plurality of ribs disposed between the plurality of lead receiving compartments.

12. The display of claim **11**, said plurality of leads being J-shaped.

13. The display of claim **9**, wherein said lead receiving compartments limit inward deflection of said plurality of leads.

14. The display of claim **9**, wherein said display comprises a stadium display.

CLAIMS 15-19

15. An illumination system, comprising:
a reflector housing molded on a lead frame having a plurality of electrically conductive leads, the reflector housing having a first cavity and a second cavity on opposite sides of the reflector housing;
at least one LED die mounted in said first cavity and electrically connected to said plurality of electrically conductive leads; and
said reflector housing further having a first end face and a second end face and a peripheral sidewall extending between the first end face and the second end face, the reflector housing having a cavity in the first end face, said peripheral sidewall having a plurality of lead receiving compartments formed therein.

16. The illumination system of claim **15**, wherein said plurality of electrically conductive leads have a J-shape.

17. The illumination system of claim **15**, further comprising an encapsulant filling said first cavity around said at least one LED die.

18. The illumination system of claim **15**, further comprising a plurality of other reflector housings each having at least one LED die mounted, said reflector housing and said plurality of other reflector housings arranged in an array in a display.

19. The illumination system of claim **18**, said display comprising a stadium display.

THE ’087 PATENT

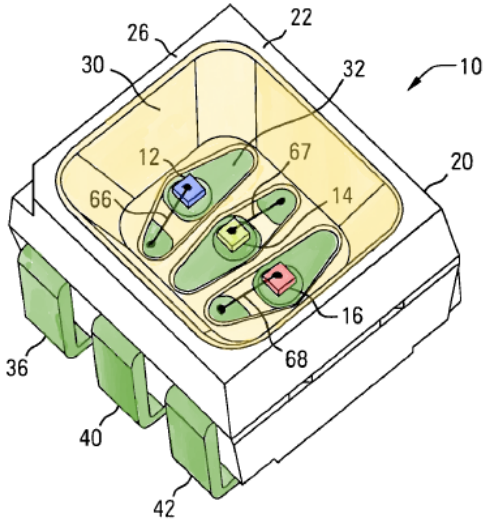


FIG. 1

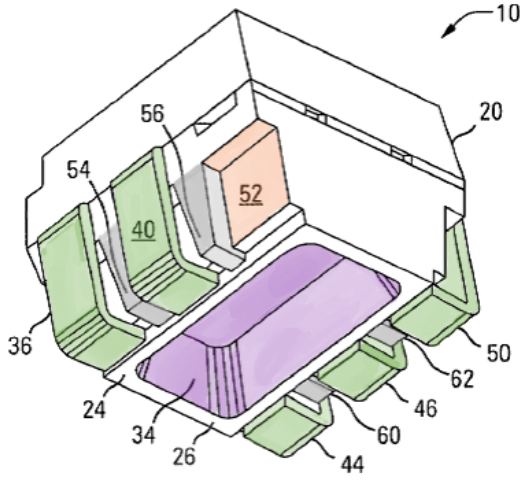


FIG. 2

Paper 1 (Pet.) at 7; Ex. 1001 (’087 Patent)

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

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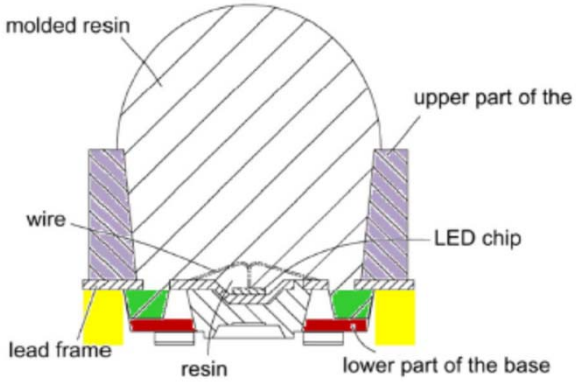
Does Critelli disclose "a plurality of lead receiving compartments …"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

PATENT OWNER'S POSITION: KAMADA DOES NOT DISCLOSE LEAD RECEIVING COMPARTMENTS IN THE REFLECTOR HOUSING'S PERIPHERAL SIDEWALL

Patent Owner Response

23. But Kamada also fails to teach or suggest lead receiving compartments formed in *the peripheral sidewall of the reflector housing*. Instead, Kamada shows leads that are routed down the side of the molded resin and a structure referred to as the lower part of the base. In the following highlighted version of Kamada's Reference Sectional View at Line A-A, the reflector sidewalls are shown in purple, the lower part of the molded resin located where the leads exit the LED structure are shown in green, and the structure referred to as the "lower part of the base" near where the leads exit the LED structure are shown in dark red.

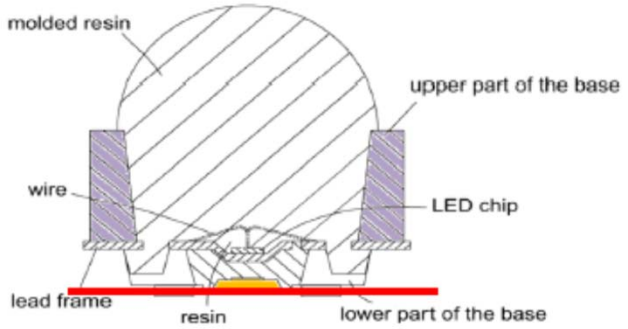
[Reference Sectional View at Line A-A]



* * * *

Moreover, claims 1, 9, and 15 each recite "a peripheral sidewall extending between the first end face and the second end face" of the reflector housing. '087 patent, 6:26-27; 6:61-62; 8:2-3. So, in order to correspond to the claimed "peripheral sidewall," the alleged "peripheral sidewall" must extend from the first end face to the second end face. Assuming that the second pocket or cavity is where Petitioner has identified it (shown in orange in the following figure from Kamada), the "peripheral sidewall" must extend down to the red line.

[Reference Sectional View at Line A-A]



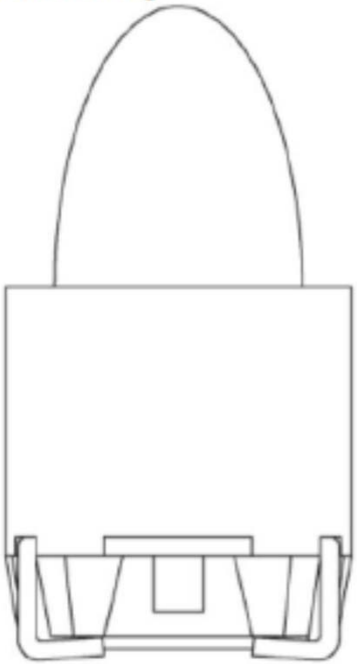
But Kamada's reflector sidewalls clearly do not extend down to the red line. Thus, Kamada does not disclose the claimed "peripheral sidewall.

PATENT OWNER'S POSITION: KAMADA DOES NOT DISCLOSE LEAD RECEIVING COMPARTMENTS IN THE REFLECTOR HOUSING'S PERIPHERAL SIDEWALL

Patent Owner Response

Although not shown in this Sectional View, the leads relied upon by Petitioner would exit the LED structure at the same vertical location as the element identified as the "lead frame" in Kamada's Sectional View, above. The leads relied upon by Petitioner would then bend downward adjacent to the green molded resin, and the dark red "lower part of the base." Those leads would be located in the area shown in yellow. Those leads are not located in or near lead receiving compartments *formed in the peripheral sidewall of the reflector housing*, as required by claims 1, 9, and 15. In fact, the accurate arrangement is shown in Kamada's Right Side View reproduced below.

[Right Side View]



’087 PATENT’S FIGURE 4 AND KAMADA’S RIGHT SIDE VIEW

’087 Patent Figure 4

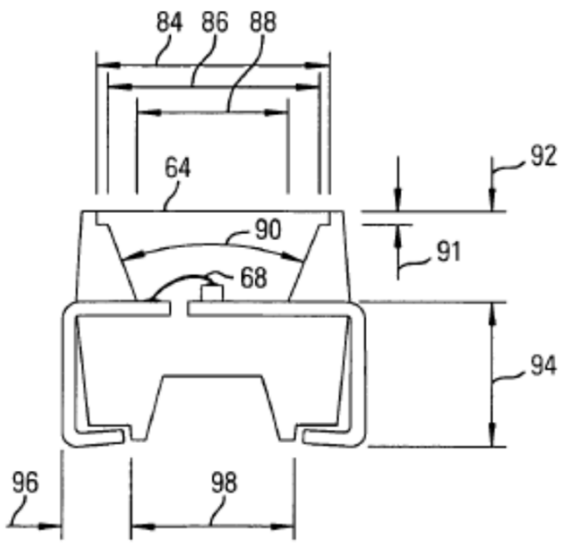
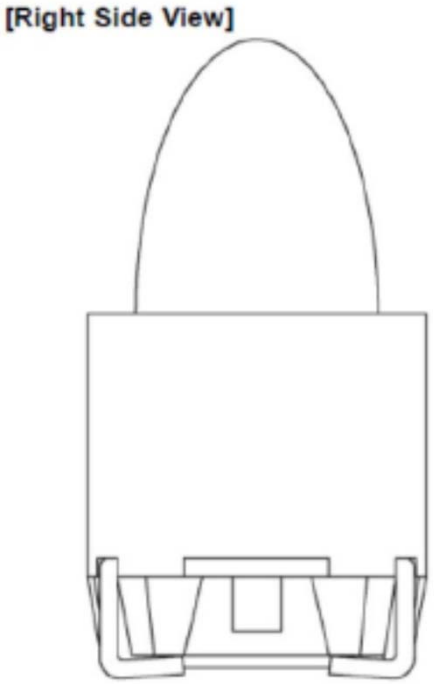


FIG. 4

Kamada “Right Side View”



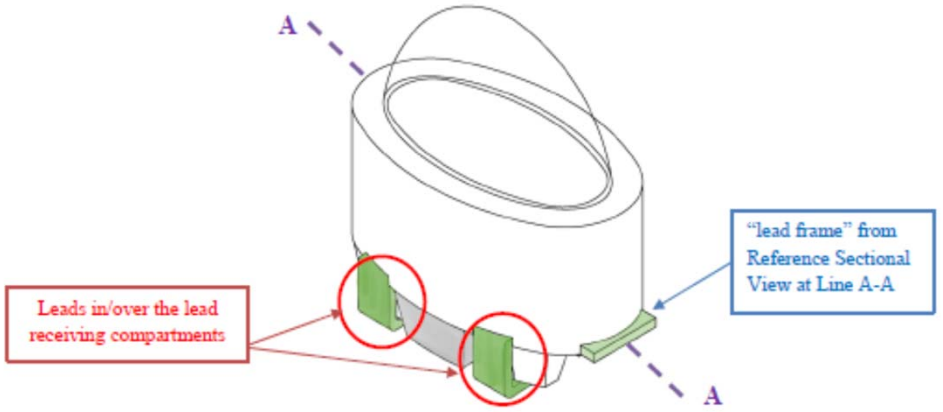
Paper 15 (POR) at 2, 22-23; Paper 18 (Reply) at 15-16; Ex. 1016 (Shealy Reply Decl.) at ¶20; Ex. 1006 (Kamada); Ex. 1001 (’087 Patent)

DR. SHEALY'S TESTIMONY: KAMADA DISCLOSES LEAD RECEIVING COMPARTMENTS IN THE REFLECTOR HOUSING'S PERIPHERAL SIDEWALL

Dr. Shealy's Reply Declaration

14. As can be seen above, the element identified as the "lead frame" in the Reference Sectional View at Line A-A is not on the "sides" of the peripheral sidewall[1] in which the lead receiving compartments are formed. This is a critical distinction; the "lead frame" is not the leads that are "bent" (per Patent Owner) over the lead receiving compartments. This can be further seen in the following annotated figure of just the Perspective View:

Kamada



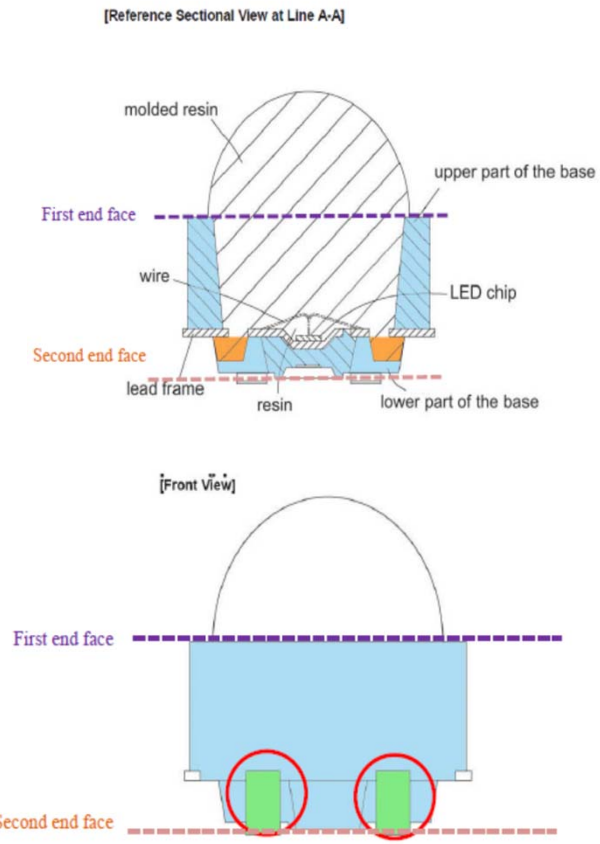
Paper 18 (Reply) at 11-12; Ex. 1016 (Shealy Reply Decl.) at ¶14; Ex. 1006 (Kamada)

DR. SHEALY'S TESTIMONY: KAMADA DISCLOSES LEAD RECEIVING COMPARTMENTS IN THE REFLECTOR HOUSING'S PERIPHERAL SIDEWALL

Dr. Shealy's Reply Declaration

21. Again, for clarity, as I have explained (including in Paragraph 15, above), the "Reference Sectional View at Line A-A" is a cutout of the "Front View," which is why the lead receiving compartments are not shown. As I have explained, a POSITA would have understood that the "Reference Sectional View at Line A-A" relied upon by Patent Owner is not the proper view to understand the "lead receiving compartments" formed in the peripheral sidewall extending between the first and second end faces. Instead, as I have explained, a POSITA would have looked to other views, including the "Front View," shown side-by-side below with the "Reference Sectional View at Line A-A." Once the "cutout" is added back to the "Reference Sectional View" to show the outer portion of the device—resulting in the "Front View"—it is clear that, on the "Front" side of the peripheral sidewall in which the lead receiving compartments are formed, the peripheral sidewall extends continuously between the first and second end faces, as shown in the following annotated Figures of Kamada:

Kamada



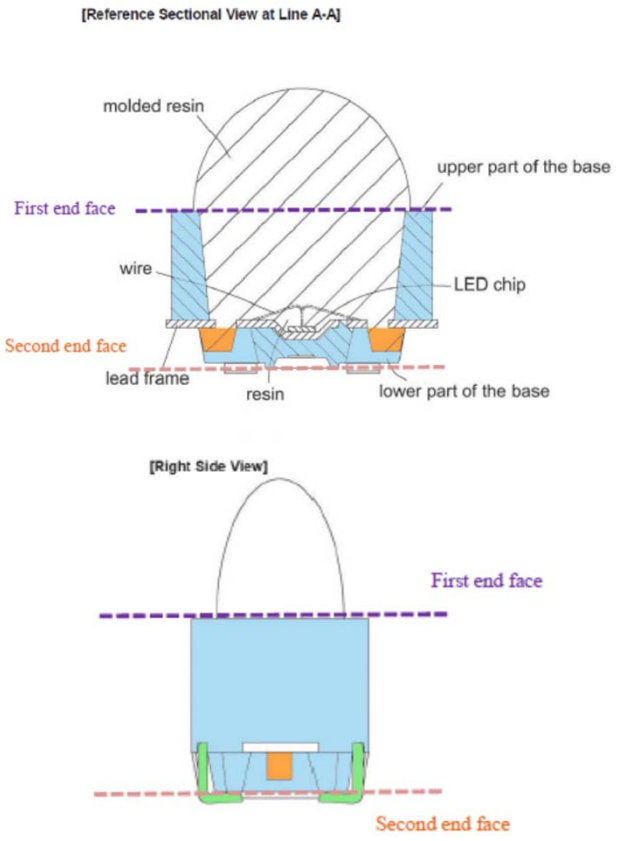
Paper 18 (Reply) at 14-15; Ex. 1016 (Shealy Reply Decl.) at ¶21; Ex. 1006 (Kamada)

DR. SHEALY'S TESTIMONY: KAMADA DISCLOSES LEAD RECEIVING COMPARTMENTS IN THE REFLECTOR HOUSING'S PERIPHERAL SIDEWALL

Dr. Shealy's Reply Declaration

20. In the following annotated figures of Kamada, I have colored in light blue the peripheral sidewall extending between the first and second end faces, and colored in orange[2] one of the small "holes" filled with molded resin that are in the "sides" of the peripheral sidewall that do not have lead receiving compartments (similar to the right side of Figure 1 of the '087 patent, which also does not have lead receiving compartments, as shown in Paragraph 16, above). A POSITA would have understood that these small "holes" (or "cavities") are filled with molded resin, which functions to keep the molded resin formed in the first pocket in place. As I discussed in Paragraphs 17-18 above, this is consistent with Mr. Credelle's statements during his deposition that holes, cavities, or depressions for a variety of purposes could be included as part of the peripheral sidewall. Again, as can be seen, the peripheral sidewall extends between the first and second end faces.

Kamada



Paper 18 (Reply) at 15-16; Ex. 1016 (Shealy Reply Decl.) at ¶20; Ex. 1006 (Kamada)

EXPERT TESTIMONY: "PERIPHERAL SIDEWALL" "DOESN'T HAVE TO BE CONTINUOUS" OR "SOLID"

Mr. Credelle's Deposition

BY MR. COLSHER:

Q And that peripheral sidewall is what has -- has the holes in the side; is that correct?

MR. HELGE: Object to form.

THE WITNESS: The peripheral sidewall has certain number of depressions, openings for lead frames, and unidentified depressions on the side that you pointed out earlier. So that peripheral sidewall has those -- those features.

BY MR. COLSHER:

Q So -- so the sidewall doesn't need to be continuous; is that fair to say?

A I think it's fair to say it doesn't have to be continuous. I think nothing in the patent I interpret as having it be continuous or solid.

Dr. Shealy's Reply Declaration

17. I further note that, during Mr. Credelle's deposition, he stated that "it's fair to say that the [peripheral sidewall] doesn't have to be continuous" and that "nothing in the patent I interpret as having it be continuous or solid." Ex. 1013 at 149:18-150:6. He also stated that "[t]he peripheral sidewall has [a] certain number of depressions, openings for lead frames, and unidentified depressions on the side…" that could also be "a hole or cavity…." Ex. 1013 at 146:14-149:25.

18. I agree with Mr. Credelle's statements. A POSITA would have understood that a "peripheral sidewall" does not need to be either continuous or solid, *e.g.*, there may be "holes" (or the like) in parts of the sidewall extending between the first and second end faces of the reflector housing that may be filled with a material, for example, where a lead frame is formed, where molded resin is formed to act as an anchor or the like, or where other materials are inserted for another purpose.

Paper 18 (Reply) at 16; Ex. 1013 (Credelle Depo.) at 149:18-150:6; Ex. 1016 (Shealy Reply Decl.) at ¶¶17-18

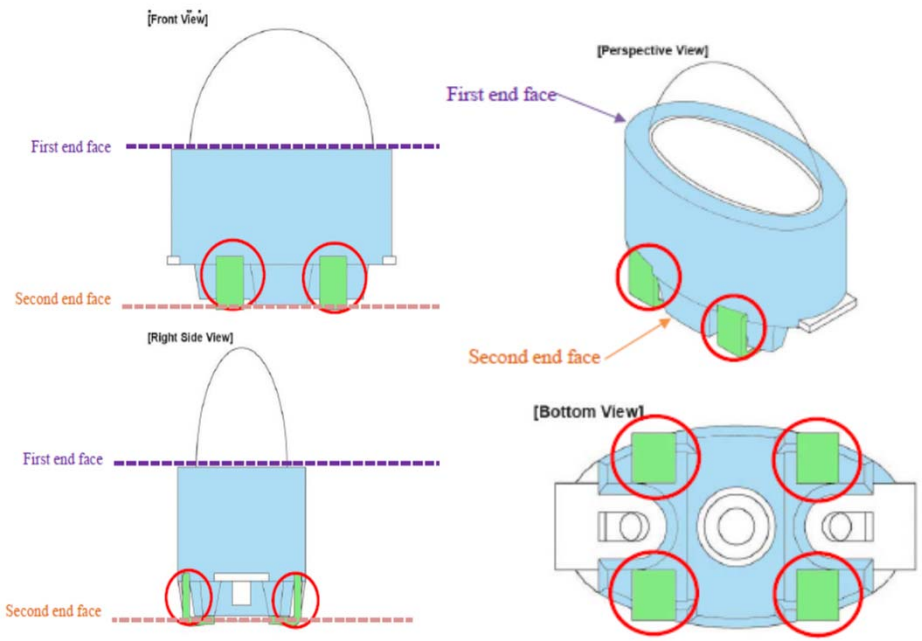
DR. SHEALY'S TESTIMONY: KAMADA DISCLOSES LEAD RECEIVING COMPARTMENTS IN THE REFLECTOR HOUSING'S PERIPHERAL SIDEWALL

Dr. Shealy's Reply Declaration

15. Moreover, a POSITA would have understood that Kamada's lead receiving compartments are formed in the peripheral sidewall that extends between the first and second end faces. For clarity, in the following Bottom View, Front View, Right Side View, and Perspective View of Kamada, I have colored in light blue the peripheral sidewall extending between the first and second end faces, and colored in green the leads that are in/over the lead receiving compartments, which I have circled in red. As I explained in my initial declaration (Exhibit 1003 at Paragraph 85), and as depicted below, the four cavities formed in the peripheral sidewall behind the outer leads correspond to the lead receiving compartments. I note that the Reference Sectional View is a cutout of the Front View (below, top left), which explains why the lead receiving compartments are not shown in the Reference Sectional View (they have been cut out to see the inside of the package).

19. This is also consistent with a POSITA's understanding of Kamada's peripheral sidewall wrapping around its device. Kamada discloses that its peripheral sidewall has two solid/continuous "sides" extending between the first and second end faces (the "Front" and "Back" sides in which the lead receiving compartments are formed, as shown in the figures in Paragraphs 15 and 16, above) and two "sides" extending between the first and second end faces that have small "holes" therein (the "Right" and "Left" sides, which do not have lead receiving compartments, but nonetheless still extend between the first and second end faces, as shown in the figures, in Paragraph 20, below).

Kamada



Paper 18 (Reply) at 12-13, 15-16; Ex. 1016 (Shealy Reply Decl.) at ¶¶15, 19; Ex. 1006 (Kamada)

DR. SHEALY'S TESTIMONY: KAMADA DISCLOSES LEAD RECEIVING COMPARTMENTS IN THE REFLECTOR HOUSING'S PERIPHERAL SIDEWALL

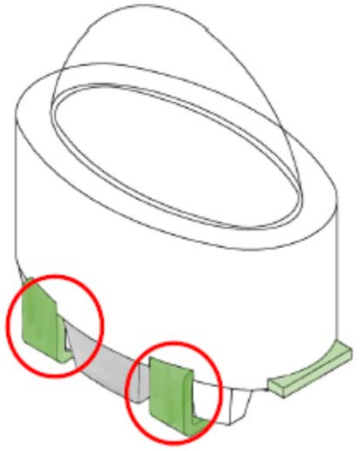
Dr. Shealy's Initial Declaration

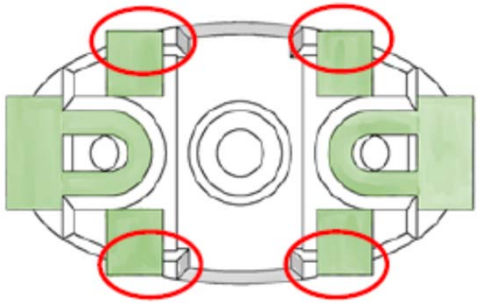
54. In Kamada's perspective and bottom views, annotated below, its outer leads are colored green. The leads are tucked into cavities in the sidewall of Kamada's base (*i.e.*, housing), which cavities are circled in red. And, the rib-like structures that separate each sidewall cavity from the next are colored gray.[2]

85. 1006 (Description; Drawings). In my opinion, a POSITA would have found that Kamada discloses cavities behind four of its shown outer leads, which cavities correspond to the claimed "lead receiving compartments," and rib-like structures in between each pair of compartments (and therefore between leads). Ex. 1006 (Front view; Sectional view at line A-A; Bottom View; Perspective view).

266. In my opinion, a POSITA would have found that Kamada discloses a housing formed around the lead frame, which has a first end face and a second end face, and a peripheral sidewall extending between the first end face and the second end face. Kamada discloses "a base formed so as to surround portions of the first and second lead frames." Ex. 1006 (Description; Drawings). Kamada further discloses that "the base comprises an upper part of the base comprising a substantially rectangular parallelepiped, and a lower part of the base positioned on the bottom thereof." Ex. 1006 (Description; Drawings). Kamada explains that "the emitted light is focused in the molded resin, and efficiently emitted to the outside therefrom." Ex. 1006 (Description; Drawings).

Kamada





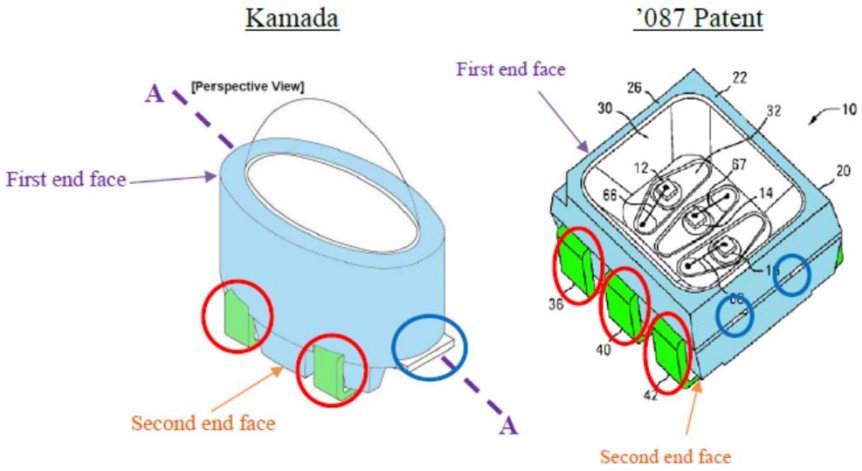
Paper 1 (Pet.) at 20-21, 72-74, 78-79; Paper 18 (Reply) at 10; Ex. 1003 (Shealy Decl.) at ¶¶54, 85, 266; Ex. 1006 (Kamada)

DR. SHEALY'S TESTIMONY: KAMADA DISCLOSES LEAD RECEIVING COMPARTMENTS IN THE REFLECTOR HOUSING'S PERIPHERAL SIDEWALL

Dr. Shealy's Reply Declaration

16. I further note that Kamada is consistent with the '087 patent, which shows leads formed over lead receiving compartments on only two "sides" of the peripheral sidewall, as I have explained, for example, in Paragraph 26 of my initial declaration (Exhibit 1003). This is consistent with the claims, which place no restriction on which "side" (or "sides") of the peripheral sidewall in which the lead receiving compartments are formed. The similarities between Kamada and the '087 patent can be seen in the following annotated figures. As can be seen in the side-by-side figures below (Kamada's Perspective View on the left and the '087 patent's Figure 1 on the right), in both Kamada and the '087 patent, the lead receiving compartments (which I have circled in red) are formed in the "Front" side of the peripheral sidewall (which I have colored in light blue). Neither Kamada nor the '087 patent have lead receiving compartments formed in the "Right" side of the peripheral sidewall (which I note is the side of Kamada corresponding to the element identified as "lead frame" in the Reference Sectional View at Line A-A; I have circled in royal blue the "lead frame" in Kamada and similarly situated holes/slots in the '087 patent).

Kamada and the '087 Patent



DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Paper 18 (Reply) at 13-14; Ex. 1016 (Shealy Reply Decl.) at ¶16; Ex. 1001 ('087 Patent); Ex. 1006 (Kamada)

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	**1, 9, 15**
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

PATENT OWNER'S POSITION: "CRITELLI IS DIRECTED TO A DIFFERENT ART...."

1. An optical device comprising:
a lead frame with a plurality of leads;
a reflector housing formed around the lead frame, the reflector housing having a first end face and a second end face and a peripheral sidewall extending between the first end face and the second end face, the reflector housing having a first pocket with a pocket opening in the first end face and a second pocket with a pocket opening in the second end face;
at least one LED die mounted in the first pocket of the reflector housing;
a light transmitting encapsulant disposed in the first pocket and encapsulating the at least one LED die; and
wherein a plurality of lead receiving compartments are formed in the peripheral sidewall of the reflector housing.

Patent Owner Response

Relatedly, another deficiency of this Ground is that Critelli is directed to a different art than the '087 patent. The '087 patent is directed to a particular LED structure. For example, the '087 patent discloses LED dies 12, 14, and 16 mounted in reflector housing 20. *See* '087 patent, 2:10-12. Critelli is directed to an LED package that is adapted to receive an LED. Critelli states that reference numeral 16 is an LED and "may be of any conventional kind – for instance, the kind sold under the designation BR 1102W by Stanley." Critelli, 4:5-7. The Stanley 1102W Series Data Sheet describes the BR1102W part number as a red LED. Ex. 2003, p. 2.[7] The package dimensions' diagrams show that the BR1102W has an LED die under a lens with a cathode and an anode on the opposite side. Ex. 2003, p. 18. The Critelli package is an adapter that makes it easier to mount LEDs to printed circuit boards. Critelli, 1:5-10, 1:50-61. The relationship between the Stanley LED and the Critelli mounting package is shown in Critelli's Figure 1. The Stanley LED is shown with reference numeral 16.

Thus, Critelli does not teach or suggest a plurality of lead receiving compartments formed in the peripheral sidewall of a reflector housing as variously recited in claims 1, 9, and 15.

Ex. 1001 ('087 Patent), claim 1; Paper 15 (POR) at 20-21

DR. SHEALY'S TESTIMONY: CRITELLI DISCLOSES LEAD RECEIVING COMPARTMENTS

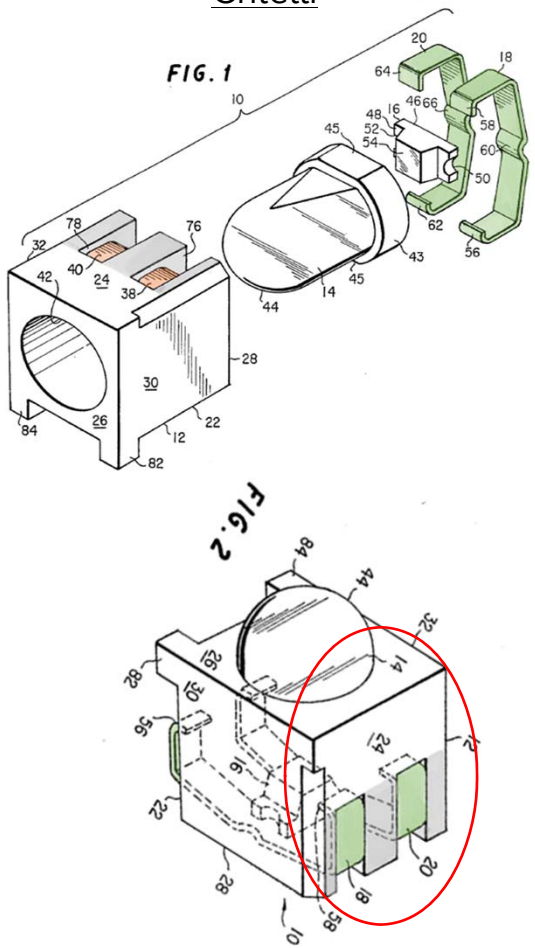
Dr. Shealy's Initial Declaration

80. Critelli discloses that its invention relates to "structures for mounting light-emitting diodes ('LEDs') on printed circuit boards using surface mount technology." Ex. 1005 at 1:6-9. Critelli criticizes prior art LED lead frames, in part, because the "leads usually provided for LEDs tend to be too pliable," (Ex. 1005 at 1:56-59), and because "the lead frame is allowed to move, causing the ultimate breakage of the wire bond" (Ex. 1005 at 2:2-45).

81. To solve these and other problems, Critelli teaches using spring clips as leads, and placing those clips in cavities in the peripheral sidewall of the LED housing, such that they are held securely over recessed shoulders and between the rib-like structures that separate the sidewall cavities. Ex. 1005 at 2:34-3:16.

83. In Figures 1 and 2, annotated below, first and second conductive spring clips 18 and 20 are colored green; shoulders 38 and 40—within slots 76 and 78—(*i.e.*, the claimed "lead receiving compartments") are colored orange, and the rib-like structures separating slots 76 and 78 (*i.e.*, the claimed "ribs") are colored gray. One of the peripheral sidewalls is circled in red in Figure 2.

Critelli



Paper 2 (Pet.) at 18-20; Ex. 1003 (Shealy Decl.) at ¶¶80-81, 83; Ex. 1005 (Critelli)

THE BOARD: PATENT OWNER HAS NOT PRESENTED EXPERT TESTIMONY

The Board

Patent Owner responds that Critelli does not teach or suggest the recited lead receiving compartments. Prelim. Resp. 22. Patent Owner presents evidence that the example LED Critelli names (BR 1102W by Stanley) "has an LED die under a lens with a cathode and an anode on the opposite side." Prelim. Resp. 22 (citing Ex. 2003,[11] 18); Ex. 1005, 4:5–7 (identifying example LED). Patent Owner concludes that Critelli discloses "an adapter that makes it easier to mount LEDs to printed circuit boards" and is not an LED structure as required by the claims. Prelim. Resp. 21, 22.

We conclude that the information in the Petition is sufficient to provide a reasonable likelihood that Petitioner would prevail in showing Critelli at least suggests the recited "lead receiving compartments." Dr. Shealy acknowledges that "Critelli discloses that its invention relates to 'structures for mounting light-emitting diodes (LEDs) on printed circuit boards using surface mount technology" (Ex. 1003 ¶ 47) and yet testifies, based on Critelli's Figures 1 and 2, that Critelli's Figures 1 and 2 teach or suggest the recited "lead receiving compartments." Ex. 1003 ¶ 83; Pet. 19–20 (citing Ex. 1003 ¶¶ 83, 84). This undermines Patent Owner's argument.

We also note that Petitioner relies on Critelli for the limited purpose of teaching or suggesting lead receiving compartments and relies on Okazaki for most of the LED structure recited by the claims. It is axiomatic that "[t]he test of obviousness is what the combined teachings of the references would have suggested to those having ordinary skill in the art." *In re Mouttet*, 686 F.3d 1322, 1333 (Fed. Cir. 2012) (citing *In re Keller*, 642 F.2d 413, 425 (CCPA 1981)). Furthermore, at this preliminary juncture, Patent Owner has not presented expert testimony to further support Patent Owner's contentions as to how one of ordinary skill in the art would understand Critelli in view of the particular LED named in Critelli.

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	**1, 9, 10, 15**
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

CLAIMS 1, 9, 10, 15

1. An optical device comprising:
a lead frame with a plurality of leads;
a reflector housing formed around the lead frame, the reflector housing having a first end face and a second end face and a peripheral sidewall extending between the first end face and the second end face, the reflector housing having a first pocket with a pocket opening in the first end face and a second pocket with a pocket opening in the second end face;
at least one LED die mounted in the first pocket of the reflector housing;
a light transmitting encapsulant disposed in the first pocket and encapsulating the at least one LED die; and
wherein a plurality of lead receiving compartments are formed in the peripheral sidewall of the reflector housing.

9. A display comprising a plurality of plastic leaded chip carrier LEDs, the plastic leaded chip carrier LEDs each comprising:
a lead frame with a plurality of leads;
a reflector housing formed around the lead frame, the reflector housing having a first end face and a second end face and a peripheral sidewall extending between the first end face and the second end face, the reflector housing having a cavity in the first end face, said peripheral sidewall having a plurality of lead receiving compartments formed therein;
at least one LED die mounted in the cavity of the reflector housing; and
a light transmitting encapsulant disposed in the cavity and encapsulating the at least one LED die.

10. The display of claim **9**, said reflector housing further comprising a second cavity in the second end face.

15. An illumination system, comprising:
a reflector housing molded on a lead frame having a plurality of electrically conductive leads, the reflector housing having a first cavity and a second cavity on opposite sides of the reflector housing;
at least one LED die mounted in said first cavity and electrically connected to said plurality of electrically conductive leads; and
said reflector housing further having a first end face and a second end face and a peripheral sidewall extending between the first end face and the second end face, the reflector housing having a cavity in the first end face, said peripheral sidewall having a plurality of lead receiving compartments formed therein.

PATENT OWNER'S POSITION: OKAZAKI'S "TUBULAR VESSEL" IS NOT A POCKET/CAVITY

Patent Owner Response

As disclosed and shown in the '087 patent, a pocket/cavity is an area enclosed on all sides but one. The '087 patent's Figure 4 is reproduced below with highlighting showing the first and second pockets/cavities disclosed as part of disclosed embodiments.

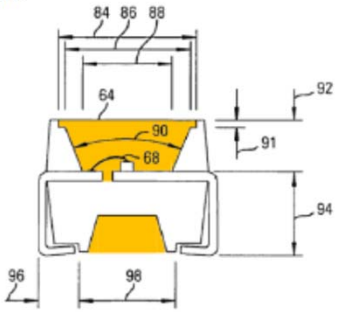
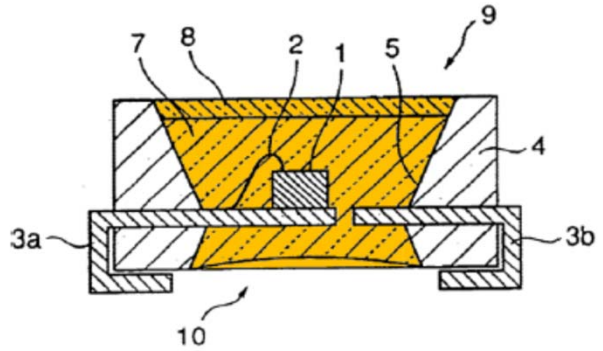


FIG. 4

In the '087 patent, the pockets/cavities are enclosed on all sides except one. The top pocket/cavity is enclosed on all sides except its top side. The bottom pocket/cavity is enclosed on all sides except its bottom side. This is consistent with the ordinary meaning of "pocket," which would not be interpreted as synonymous with a through-hole according to a POSITA. Ex. 2018, ¶¶25-26, 32. As Mr. Credelle notes, a POSITA would interpret a pocket or cavity differently than a through-hole. Ex. 2018, ¶32.

Nevertheless, in Grounds 1-3, Petitioner relies upon Okazaki as disclosing the "pocket" and "cavity" elements of the claims. Pet., 13-16, 29-31, 36-39. Petitioner identifies Okazaki's tubular vessel 4 as the claimed "reflector housing." Pet., 12. But as introduced above, Okazaki's tubular vessel 4 has a single through-hole (or tube) extending from its top surface to its bottom surface, and this through-hole would not be referred to as a pocket or cavity. That through-hole or tube in Okazaki's tubular vessel 4 is shown below in the annotated Figure 3.

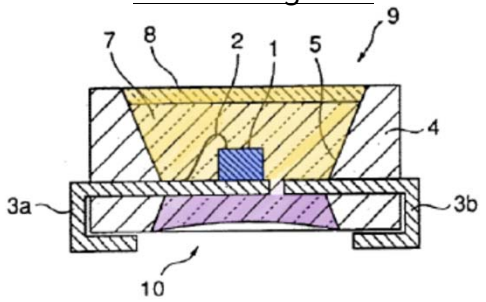


DR. SHEALY'S TESTIMONY: OKAZAKI DISCLOSES A FIRST AND SECOND POCKET/CAVITY

Dr. Shealy's Initial Declaration

71. In my opinion, a POSITA would have found that Okazaki discloses that its reflector housing has the claimed first pocket with a pocket opening in the first end face and second pocket with a pocket opening in the second end face because it discloses that "tubular vessel 4 has an upper opening 9 and a lower opening 10, the LED element 1 is positioned between the upper opening 9 and the lower opening 10 such that the LED element 1 emits light toward the upper opening 9, and the vessel 4 is filled with a light-transmissive resin 7 from the upper opening 9 to the lower opening 10." Ex. 1004 at 9:25-31. The portion of tubular vessel 4 corresponding to the claimed "first pocket with a pocket opening in the first end face" is colored yellow, and the portion corresponding to the claimed "second pocket with a pocket opening in the second end face" is colored purple below in annotated Figure 3. In my opinion, a POSITA would consider those portions to be separate pockets despite the existence of a small "slot" there between. Vessel 4 and lead frame 3a/3b are formed together; and lead frame 3a/3b (as well as the "pinching in" of the vessel walls themselves) bisects the structure into two cavities. The slot is there for an electrical reason, not a mechanical reason. Namely, the lead frames 3a/3b must be physically separate so as to not short circuit the LED. The existence of a small slot between the leads does not make the two cavities a single cavity. A pocket with a slot in it is still a pocket.

Okazaki Figure 3



Dr. Shealy's Deposition

Q What does that sentence mean?

A A pocket -- well, there's several ways to maybe explain what I was thinking when I wrote that.

There's no reason why you can't have a pocket with a hole in the bottom of it. A pocket doesn't have to hold water. It's still a pocket. You can describe a funnel as having a pocket and a hole in the bottom of it. It's still a pocket. There's no -- a pocket to me or one skilled in the art would not say it's not a pocket just because it's got a hole in it.

Q And what's your basis for that opinion?

A If the -- if inventors of the '087 patent intended -- they use pocket and cavity to mean the same thing. If they meant that that pocket could not have a hole in it, I think they would have stated it.

Paper 1 (Pet.) at 13-15; Paper 18 (Reply) at 5; Ex. 1003 (Shealy. Decl.) at ¶71; Ex. 2016 (Shealy Depo.) at 55:1-18; Ex. 1004 (Okazaki)

DR. SHEALY'S TESTIMONY: OKAZAKI DISCLOSES A FIRST AND SECOND POCKET/CAVITY

Dr. Shealy's Deposition

Q So you view the upper opening 9 and lower opening 10 as separate pockets --

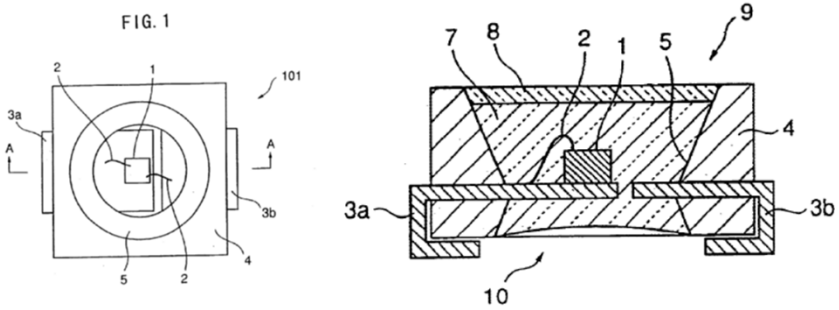
A Yes.

Q -- because the lead frame separates them. Is that right?

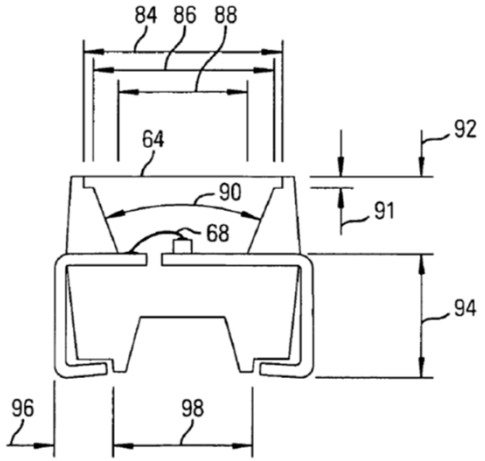
MR. COLSHER: Objection to form.

A Yes, you can also look at the top view which is Figure 1 in the patent, and it shows that the lead frame isolates the vast majority of the surface area where it bisects the two pockets.

Okazaki Figures 1 and 3



'087 Patent Figure 4



DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Paper 1 (Pet.) at 13-15; Paper 18 (Reply) at 6-7; Ex. 2016 (Shealy Depo.) at 46:9-22; Ex. 1001 ('087 Patent); Ex. 1004 (Okazaki)

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	**1, 9, 15**
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

PATENT OWNER'S POSITION: INSUFFICIENT REASONS TO COMBINE OKAZAKI WITH CRITELLI, KAMADA, OR KYOWA

Patent Owner Response

Petitioner has not provided sufficient reasons why a POSITA would have combined Okazaki with any of the secondary references (*i.e.*, Critelli, Kamada, and Kyowa). Petitioner argues that a POSITA would have combined Okazaki with each of the secondary references because Critelli and Kyowa teach that the use of lead receiving compartments would help protect leads from external forces, and that Kyowa teaches that its design enables downsizing of the LED package. Pet., 25-26. Petitioner also argues that it was known that the use of lead receiving compartments provides a guide for where to position the electrodes during assembly. Pet., 26.

* * * *

Unlike Okazaki's process, Kyowa's device is injection molded. Kyowa, ¶22. Petitioner has not explained how and why a POSITA would manufacture the Okazaki device using the Okazaki manufacturing process where the lead frames 3a and 3b are formed in lead receiving compartments. In fact, Okazaki shows that during the manufacturing process, the lead frame 3b extends from the center of one LED assembly into the middle of the next LED assembly. Okazaki, Fig. 4(a). That is inconsistent with Kyowa's teaching that the leads from one LED assembly are separate from the leads of another LED assembly, and that the Kyowa leads are bent into a U shape before the housing is formed using injection molding.

* * * *

As explained above in Section III.A.2, Critelli is directed to an entirely different art. In addition, while Petitioner argues that one reason for combining the references is to enable downsizing of the LED packages, Critelli dramatically *increases* the size of its assembly. The LED assembly of the '087 patent would be located in Critelli's assembly where reference numeral 16 is located. Critelli, Fig. 1. Contrary to Petitioner's assertions, Critelli has nothing to do with putting lead receiving compartments on the sidewall of an LED assembly. Thus, there is no reason why a POSITA would look to Critelli to modify the teachings of Okazaki.

Similarly, if the alleged motivation to combine references is the desire to enable downsizing of the LED assembly, there is no reason why a POSITA would look to Kamada to modify Okazaki. Kamada appears to be much larger than Okazaki. Kamada has space for six leads extending from its housing, whereas Okazaki only has two external leads.

THE BOARD: BODILY INCORPORATION OF REFERENCES IS NOT REQUIRED

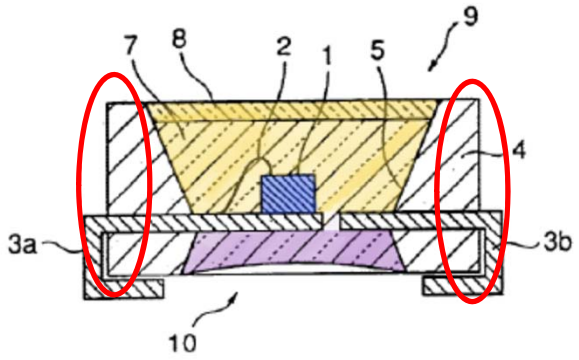
The Board

After evaluating Petitioner's purported reasons and Patent Owner's responses, we find Petitioner has provided adequate reasoning supported by sufficient evidence to present a reasonable likelihood of showing it would have been obvious to modify Okazaki's reflector housing sidewall to form lead receiving compartments as required by the claim 1. As described above, Petitioner provides evidence of motivation from the references themselves and evidence of declaration testimony by Dr. Shealy.

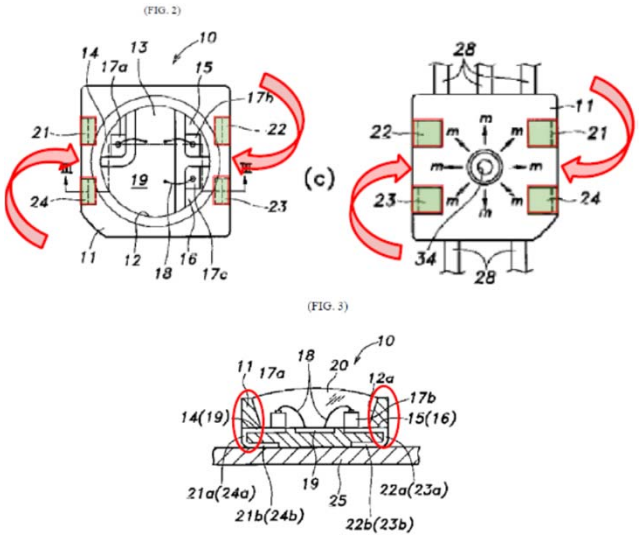
In addition, at this preliminary junction and without a full record, Patent Owner's contentions seem to suggest, at least somewhat, that bodily incorporation of references is required to demonstrate obviousness. *See e.g.*, *Mouttet,* 686 F.3d at 1332 ("It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of the elements."). Furthermore, at least on this preliminary record, Patent Owner's contentions do not seem to address what the combined references would have suggested to one of ordinary skill in the art. *Mouttet*, 686 F.3d at 1333 ("[T]he test for obviousness is what the combined teachings of the references would have suggested to those having ordinary skill in the art." (citing *Keller*, 642 F.2d at 425)).

THE PRIOR ART: OKAZAKI, CRITELLI, KAMADA, AND KYOWA

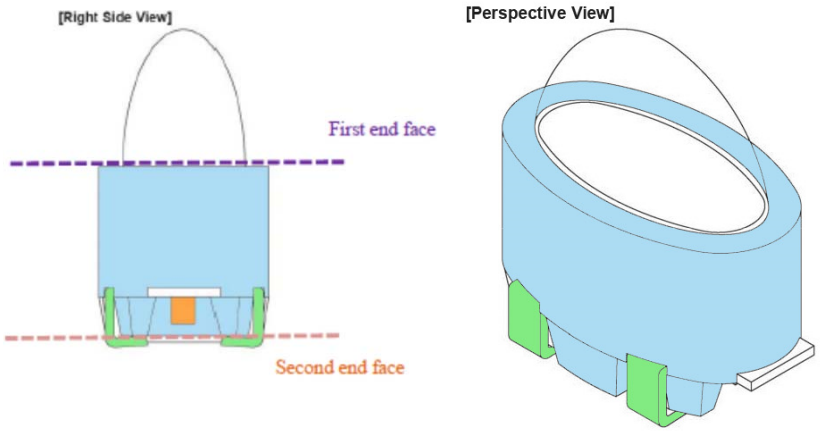
Okazaki



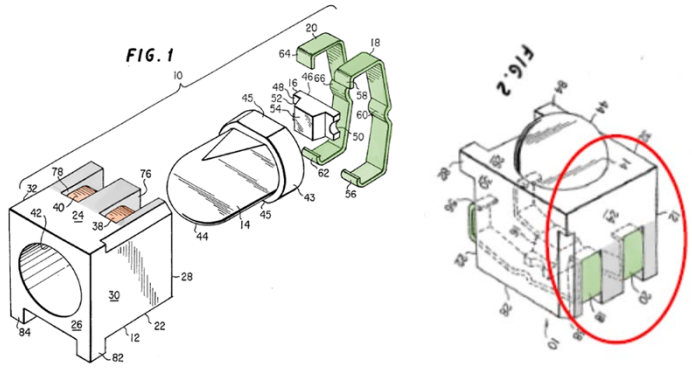
Kyowa



Kamada



Critelli



DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Paper 1 (Pet.) at 12-13, 15, 18-25; Paper 18 (Reply) at 13, 16; Ex. 1004 (Okazaki); Ex. 1005 (Critelli); Ex. 1006 (Kamada); Ex. 1010 (Kyowa)

DR. SHEALY'S TESTIMONY: IT WOULD HAVE BEEN OBVIOUS TO ADD LEAD RECEIVING COMPARTMENTS TO OKAZAKI'S PERIPHERAL SIDEWALL

Dr. Shealy's Initial Declaration

93. However, Critelli, Kamada, and Kyowa teach forming a plurality of lead receiving compartments in the peripheral sidewall of an LED housing; and, as discussed in paragraphs 48 and 80, Critelli and Kyowa, in my opinion, provide a motivation to add compartments to a sidewall of an LED housing: to help protect the leads from external forces. Ex. 1005 at 1:56-59, 2:2-4; Ex. 1010, ¶0006. Kyowa touts the additional advantage that its design "enables downsizing more than in prior products." Ex. 1010, ¶0006.

94. In my opinion, modifying Okazaki's reflector housing sidewall to form lead receiving compartments would have been a simple mechanical design change, and it would have been well within the skill of a POSITA to perform this simple change. It is my further opinion that a POSITA would have had a reasonable expectation of success in doing so. In addition to the straight-forward motivation presented in Critelli and Kyowa, it was also known that having lead receiving compartments in the peripheral sidewall of an LED housing would provide a guide for where to position the electrodes during assembly. This would have been particularly called for in an LED device that required at least four leads (such as in Kamada or Kyowa).

Critelli

1

The mounting of circuit components on surface mount boards often is accomplished simply by cutting the electrical lead conductors of the devices, bending the conductors to a proper shape, and then soldering them to the pads on to which the devices are to be mounted. This technique also has been used to mount LEDs on surface mount boards. However, the leads usually provided for LEDs tend to be too pliable and narrow to balance the LED on the circuit board until it is soldered. Furthermore, the conical dome shape of

2

the soldering furnace. As the epoxy softens, the lead frame is allowed to move, causing the ultimate breakage of the wire bond. Manufacturers that have attempted to use conventional LEDs in surface mount processes have experienced unacceptable failure rates.

Kyowa

[0006] Therefore, to solve abovementioned problems of prior art, this invention provides surface mounted parts wherein attachment structure of lead frame including outer leads on the package and its manufacturing method are improved so that it will receive less influence of outer force than in prior surface mounted parts, and this improvement enables secure installation of the package in a horizontal condition to the printed circuit board, and also enables downsizing more than in prior products, and provides their manufacturing method.

Paper 1 (Pet.) at 25-26; Ex. 1003 (Shealy Decl.) at ¶¶93-94; Ex. 1005 (Critelli) at 1:56-59, 2:2-4; Ex. 1010 (Kyowa) at ¶0006

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
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PATENT OWNER'S POSITION: INSUFFICIENT REASONS TO COMBINE TAKENAKA WITH CRITELLI, KAMADA, OR KYOWA

Patent Owner Response

Petitioner has not provided sufficient reasons why a POSITA would have combined Takenaka with any of the secondary references (*i.e.*, Critelli, Kamada, and Kyowa). Petitioner argues that a POSITA would have combined Takenaka with each of the secondary references because Critelli and Kyowa teach that the use of lead receiving compartments would help protect leads from external forces, and that Kyowa teaches that its design enables downsizing of the LED package. Pet., 53-54. Petitioner also argues that it was known that the use of lead receiving compartments provides a guide for where to position the electrodes during assembly. Pet., 54. These reasons fail for the same reasons explained above with respect to Grounds 1-3. *See* Section III.A.2-3, *supra*.

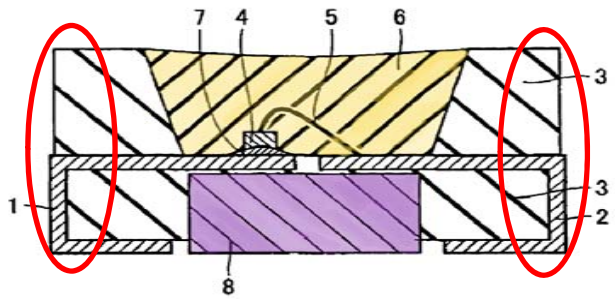
* * * *

There is also no apparent reason why a POSITA would consider the alleged need to protect leads from external forces when looking at Takenaka. Takenaka has a metal body 8 that protrudes from the lower surface of the LED assembly. Takenaka, Fig. 1. The bottom of metal body 8 is in a horizontal line with the bottom of lead frames 1 and 2. *Id.* As such, metal body 8 would serve to protect lead frames 1 and 2 from damage caused, for example, during assembly of the LED device on a printed circuit board. A POSITA would not have looked to Critelli or Kyowa to add a feature (protection of its leads from damage) to Takenaka that Takenaka already possesses. *See TRW Automotive U.S. LLC v.*

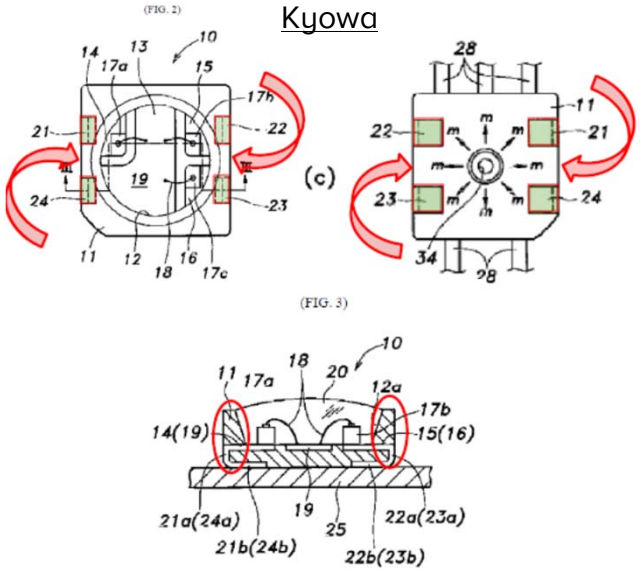
THE PRIOR ART: TAKENAKA, CRITELLI, KAMADA, AND KYOWA

Takenaka

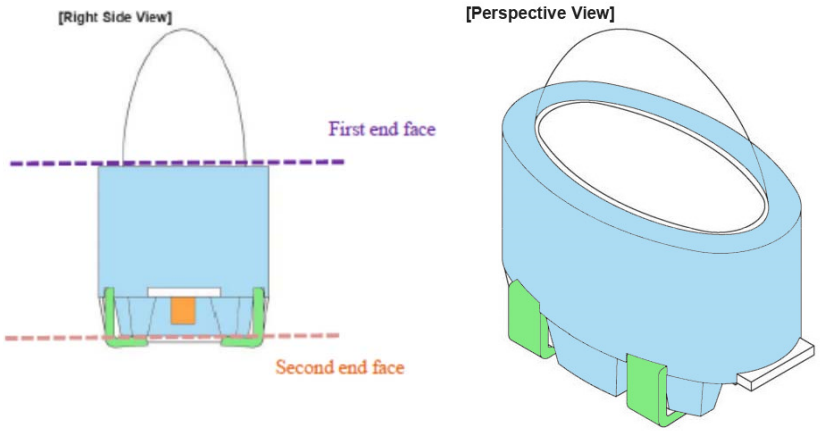
FIG.1



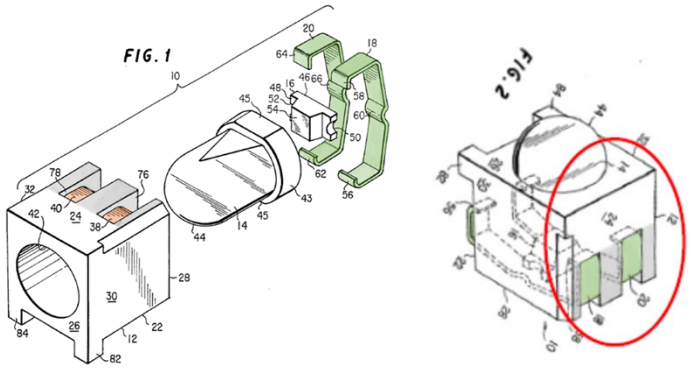
Kyowa



Kamada



Critelli



DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Paper 1 (Pet.) at 18-25, 47-48, 51-53; Paper 18 (Reply) at 13, 16; Ex. 1005 (Critelli); Ex. 1006 (Kamada); Ex. 1008 (Takenaka); Ex. 1010 (Kyowa)

DR. SHEALY'S TESTIMONY: IT WOULD HAVE BEEN OBVIOUS TO ADD LEAD RECEIVING COMPARTMENTS TO TAKENAKA'S PERIPHERAL SIDEWALL

Dr. Shealy's Initial Declaration

184. However, Critelli, Kamada, and Kyowa teach forming a plurality of lead receiving compartments in the peripheral sidewall of an LED housing; and, as discussed in paragraphs 48 and 80, Critelli and Kyowa provide a motivation to add compartments to a sidewall of an LED housing: to help protect the leads from external forces. Ex. 1005 at 1:56-59, 2:2-4; Ex. 1010, ¶0006. Kyowa touts the additional advantage that its design "enables downsizing more than in prior products." Ex. 1010, ¶0006. In my opinion, these motivations would apply with equal force to Takenaka.

185. In my opinion, modifying Takenaka's reflector housing sidewall to form lead receiving compartments would have been a simple mechanical design change, and it would have been well within a POSITA's skill to perform that change. It is my further opinion that a POSITA would have had a reasonable expectation of success in doing so. In addition to the straight-forward motivations presented in Critelli and Kyowa, it was also known that having lead receiving compartments in the peripheral sidewall of an LED housing would provide a guide for where to position the electrodes during the assembly process. This would have been particularly called for in an LED device that required at least four leads (such as in Kamada or Kyowa).

Critelli

1

The mounting of circuit components on surface mount boards often is accomplished simply by cutting the electrical lead conductors of the devices, bending the conductors to a proper shape, and then soldering them to the pads on to which the devices are to be mounted. This technique also has been used to mount LEDs on surface mount boards. However, the leads usually provided for LEDs tend to be too pliable and narrow to balance the LED on the circuit board until it is soldered. Furthermore, the conical dome shape of

2

the soldering furnace. As the epoxy softens, the lead frame is allowed to move, causing the ultimate breakage of the wire bond. Manufacturers that have attempted to use conventional LEDs in surface mount processes have experienced unacceptable failure rates.

Kyowa

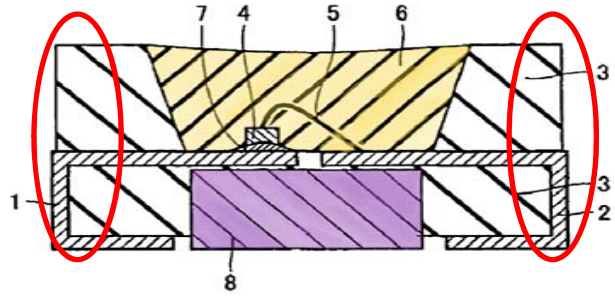
[0006] Therefore, to solve abovementioned problems of prior art, this invention provides surface mounted parts wherein attachment structure of lead frame including outer leads on the package and its manufacturing method are improved so that it will receive less influence of outer force than in prior surface mounted parts, and this improvement enables secure installation of the package in a horizontal condition to the printed circuit board, and also enables downsizing more than in prior products, and provides their manufacturing method.

Paper 1 (Pet.) at 53-54; Ex. 1003 (Shealy Decl.) at ¶¶184-85; Ex. 1005 (Critelli) at 1:56-59, 2:2-4; Ex. 1010 (Kyowa) at ¶0006

DR. SHEALY'S TESTIMONY: PROTECTING TAKENAKA'S LEADS

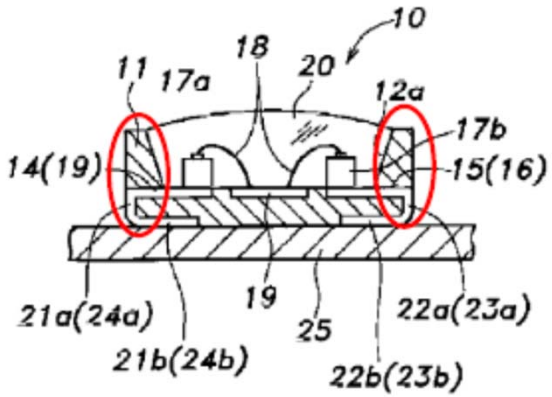
Takenaka

FIG.1

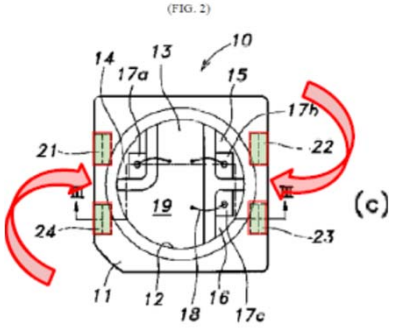


Kyowa

(FIG. 3)



(FIG. 2)



(c)

Paper 1 (Pet.) at 47-48, 51-53; Paper 18 (Reply) at 23-26; Ex. 1003 (Shealy Decl.) at ¶¶88-90, 183-84; Ex. 1016 (Shealy Reply Decl.) at ¶¶29-33; Ex. 1008 (Takenaka); Ex. 1010 (Kyowa); Paper 15 (POR) at 36-37

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	**2**
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

PATENT OWNER'S POSITION: TAKENAKA DOES NOT DISCLOSE THE RELATIVE CLAIMED VOLUMES

2. The optical device of claim 1, wherein the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket.	Patent Owner Response Claim 2 recites the optical device of claim 1, "wherein the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket." '087 patent, 6:38-40. Petitioner alleges that Takenaka's metal body 8 is a second pocket or cavity, but Takenaka does not disclose any information about the relative volume of Takenaka's metal body 8 compared to the upper area where the epoxy resin 6 would be located. As Petitioner concedes, patent figures are not necessarily drawn to scale. Pet., 55. But Petitioner then goes on to urge the Board to treat Takenaka's figures as if they are to scale. *Id.* Takenaka never discloses any dimensions or other information that would allow a POSITA to draw any fact-based conclusions about the relative volumes of those two areas.

Ex. 1001 ('087 Patent), claim 2; Paper 15 (POR) at 38

DR. SHEALY'S TESTIMONY: TAKENAKA'S SECOND POCKET IS AT LEAST 50% OF ITS FIRST POCKET

Dr. Shealy's Initial Declaration

189. In my opinion, a POSITA would have understood that Takenaka discloses the claimed optical device wherein the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket because it discloses that "preferably the volume of metal body 8 in the package is as large as possible in the package," and that this results in "improv[ed] heat radiation." Ex. 1008, ¶0044-45. As discussed in paragraphs 172-175, "metal body 8" is inserted into "concave 13" (*i.e.*, the claimed "second pocket"). Thus, in my opinion, it follows that Takenaka also teaches to make the volume of concave 13—which corresponds to the claimed second pocket —"as large as possible."

190. I have been informed that patent figures are not necessarily drawn to scale, but that when drawn in sufficient detail they can allow some findings and conclusions with regard to the relative size of the depicted structures. It is therefore my opinion that a POSITA would have understood that Takenaka depicts in, *e.g.*, Figures 7B and 7C that the relative volumes of the first pocket (yellow) and second pocket (purple) are approximately the same order of magnitude, *i.e.*, that the volume of the second pocket (not even considering the volume of the lead receiving compartments) is significantly more than the "at least 50%" of the volume of the first pocket required by claim 2. Contrast these figures with those of Kamada's (very small) second cavity, discussed below at paragraph 269-271.

Takenaka

FIG.7B

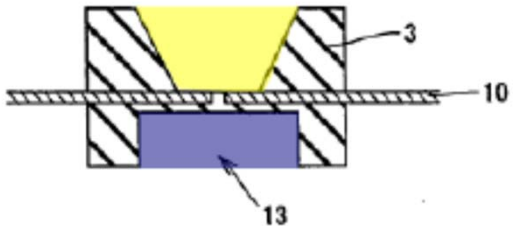
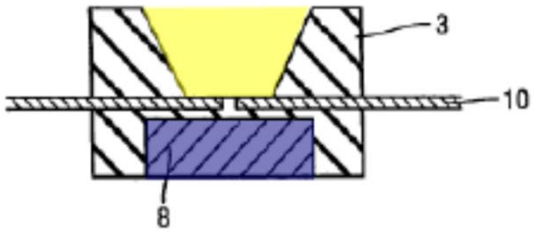


FIG.7C



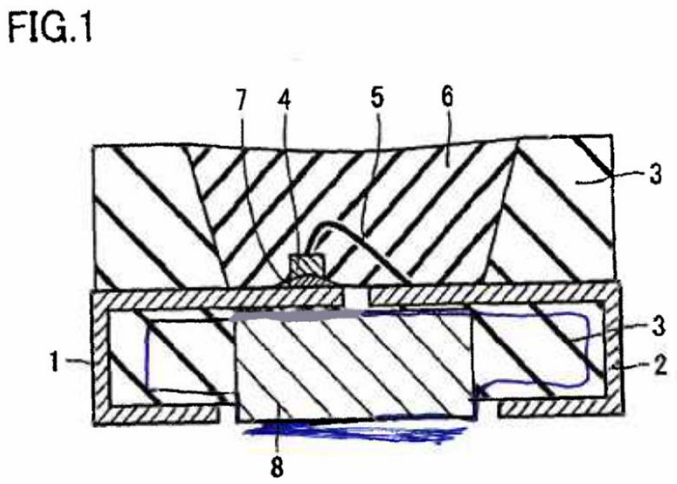
Paper 1 (Pet.) at 54-56; Ex. 1003 (Shealy Decl.) at ¶¶ 189-90; Ex. 1008 (Takenaka)

DR. SHEALY'S TESTIMONY: OTHERWISE, IT WOULD HAVE BEEN OBVIOUS TO MAKE TAKENAKA'S SECOND POCKET AT LEAST 50% OF ITS FIRST POCKET

Dr. Shealy's Initial Declaration

191. And, even if Takenaka is found not to specifically disclose the claimed relative volume, in my opinion, a POSITA would have found it obvious. In my opinion, based on the teaching in Takenaka to make the heat-sink metal body volume (and therefore second pocket volume) "as large as possible," a POSITA would have found it obvious to try different volume pockets and would have had a reasonable expectation of success in creating a second pocket volume that was at least half of the first pocket volume.

Dr. Shealy's Takenaka Annotation (at Deposition)



Paper 1 (Pet.) at 54-56; Paper 18 (Reply) at 26-27; Ex. 1003 (Shealy Decl.) at ¶191; Ex. 2016 (Shealy Depo.) at 31:1-33:13; Ex. 2017 (Shealy Depo. Annotation)

TAKENAKA'S SECOND POCKET IS TAUGHT TO BE "AS LARGE AS POSSIBLE"

[0044] The reason why a gap is provided between first and second lead frames **1** and **2** and metal body **8** is to prevent the patterns of first and second lead frames **1** and **2** formed in separation from short-circuiting due to contact therebetween. In the first embodiment, the heat generated from LED chip **4** is sequentially transmitted through the first lead frame **1**, the gap between first lead frame **1** and metal body **8**, and then to metal body **8** to be discharged towards the mounting board. In order to efficiently transmit the heat generated at LED chip **4** to metal body **8**, the aforementioned gap is preferably as small as possible. Also preferably, the volume of metal body **8** in the package is as large as possible in the package.

FIG.7B

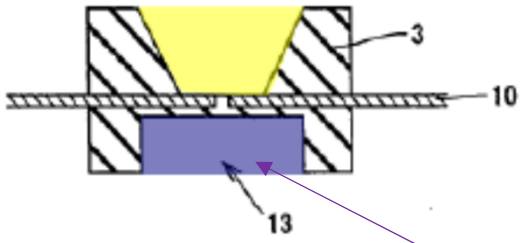
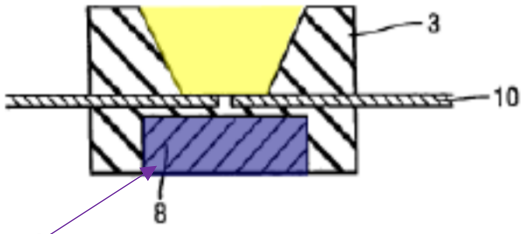


FIG.7C



Second Pocket

Paper 1 (Pet.) at 54-56; Ex. 1008 (Takenaka) at ¶0044

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	**3, 12, 16**
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

PATENT OWNER'S POSITION: NO MOTIVATION TO USE J-SHAPED LEADS

3. The optical device of claim **2**, said plurality of leads being J-shaped. **12**. The display of claim **11**, said plurality of leads being J-shaped. **16**. The illumination system of claim **15**, wherein said plurality of electrically conductive leads have a J-shape.	Patent Owner Response In essence, Petitioner argues that because J-shaped leads were known, the combination would have been obviousness. This is not the law of obviousness.

Ex. 1001 ('087 Patent), claims 3, 12, 16;
Paper 15 (POR) at 31

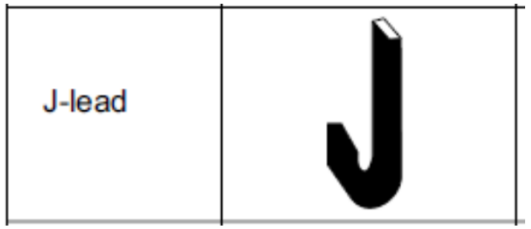
DR. SHEALY'S TESTIMONY: OBVIOUS TO USE J-SHAPED LEADS

Dr. Shealy's Initial Declaration

120. In my opinion, J-shaped leads were well known to be a "preferred surface mount lead form" used on plastic leaded chip carriers. Ex. 1009 at 651. Examples of J-shaped leads can be seen well before the '087 patent in textbooks and the patent literature: Printed Circuit Boards, Design Fabrication, and Assembly (Ex. 1009) at 90, 651; Japanese Laid Open Patent Application No. H07-78917 ("Kitamura") (Ex. 1012) ¶¶0001-02, Figs. 3-4, 6-7, 9 (describing as prior art "conventional J-lead (PLCC) package[s]" and teaching an improved "J-lead package … and … dissipation of heat from surface mounted components…"). In my opinion, the choice of lead depends on the desired size, durability, configuration, and housing, and it would have been well within the skill of a POSITA to use J-shaped leads, a preferred lead form for surface mount components. Ex. 1009 at 90, 651. The leads in some sense define how the LED packages can be attached to, *e.g.*, a display or circuit board. In my opinion, a POSITA would have been aware of a finite number of identifiable, predictable solutions, and would have simply pursued the known options within his or her technical grasp to choose the appropriately shaped lead.

Khandpur: Printed Circuit Boards

J-Leads: The preferred surface mount lead form used on PLCCs, so named because the lead departs the package body near its Z-axis centre-line, is formed down the rolled under the package. Leads so formed are shaped like the letter "J".

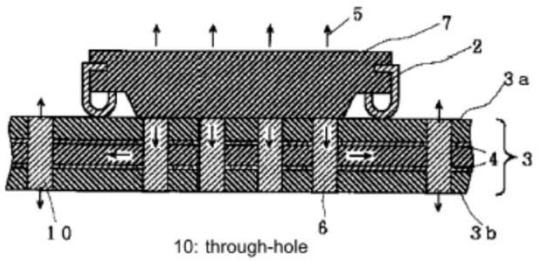


Kitamura

[0001]

[Field of Industrial Application] This invention relates to a J-lead package (also referred to as a PLCC package) and to the dissipation of heat from surface mounted components that are mounted on printed wiring boards.

[FIG. 4]



Paper 1 (Pet.) at 32; Ex. 1003 (Shealy Decl.) at ¶120; Ex. 1009 (Khandpur) at 7-8; Ex. 1012 (Kitamura) at ¶0001

KEY REMAINING DISPUTES

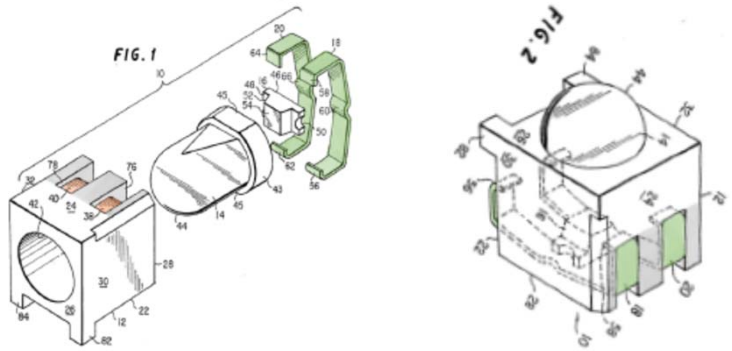
Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	**13**
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

PATENT OWNER'S POSITION: PRIOR ART DOES NOT MENTION LIMITING INWARD DEFLECTION

13. The display of claim **9**, wherein said lead receiving compartments limit inward deflection of said plurality of leads.	Patent Owner Response Petitioner's deficiency as to claim 13 is similar. The Board evaluated the Petition's challenge of claim 13 at pp. 57-58 of the Institution Decision. There, the Board noted that "Petitioner's contentions are not extensive and appear to be conclusory statements … . The information in the Petition[] does not explain how the required lead receiving compartments limit inward deflection of the leads." Paper 11, 57. This defect is clear in the Petition, which reproduces certain figures of Critelli and Kyowa, and draws conclusions about those figures without concomitant disclosures in their respective specifications. *See, e.g.*, Pet., 33-35. In particular, the Petition cites to Critelli, 1:56-59, and Kyowa, ¶0006, even though those disclosures make no mention about inward deflection of the leads. Pet., 35; *see also* Section III.A.2, *supra* (addressing the limited conclusion that can be drawn from Critelli's 1:56-59). Furthermore, while the Board states that "one of ordinary skill in the art may understand the figure itself to show the required limitation," Petitioner and Dr. Shealy failed to establish that understanding in the Petition, and they cannot establish such a factor for the first time on reply, as explained below in Section III.G.

DR. SHEALY'S TESTIMONY: PRIOR ART LEAD RECEIVING COMPARTMENTS LIMIT INWARD DEFLECTION

Critelli

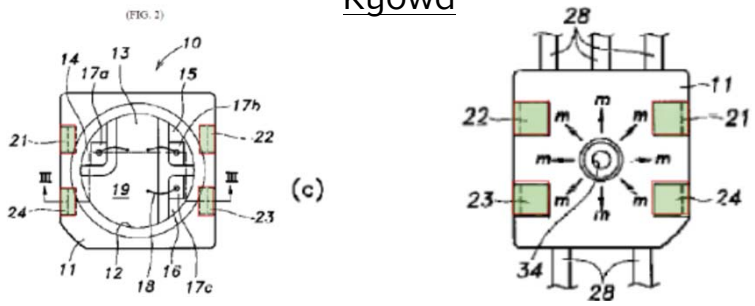


Dr. Shealy's Initial Declaration

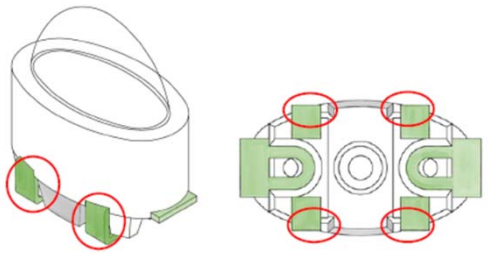
125. In my opinion, Critelli's lead receiving compartments—particularly the shoulders—physically limit the inward deflection of the leads, (Ex. 1005, Figs. 1-2), as do the lead receiving compartments of Kamada, (Ex. 1006 [Perspective view; Bottom view]), and Kyowa (Ex. 1010, Figs. 2 and 5c). This can be seen below in annotated Figures 1 and 2 of Critelli, in the annotated perspective and bottom views of Kamada, and in annotated Figures 2 and 5c of Kyowa.

126. In fact, as discussed in paragraphs 80-84 and 88-90, Critelli and Kyowa explain that that was a reason for having lead-receiving compartments. Ex. 1005 (Critelli) at 1:56-59 (prior art LED leads were "too pliable,"); Ex. 1010, ¶0006 (to help protect the leads from "outer force").

Kyowa



Kamada



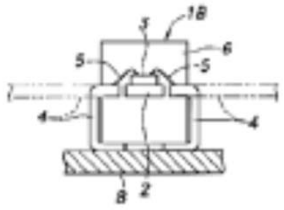
Paper 1 (Pet.) at 33-35; Ex. 1003 (Shealy Decl.) at ¶¶125-26; Ex. 1005 (Critelli); Ex. 1006 (Kamada); Ex. 1010 (Kyowa)

DR. SHEALY'S TESTIMONY: PRIOR ART LEAD RECEIVING COMPARTMENTS LIMIT INWARD DEFLECTION

Dr. Shealy's Reply Declaration

29. As I explained in Paragraphs 124-126 of my initial declaration (Exhibit 1003), it is my opinion that a POSITA would have understood that each of Kyowa, Kamada, and Critelli discloses that the lead receiving compartments limit inward deflection. As I stated in Paragraph 126 of my initial declaration, Critelli teaches that prior art leads are "too pliable" and that its invention is intended to reduce such pliability. Ex. 1005, 1:56-59. Similarly, as I stated in the same paragraph, Kyowa teaches that its invention helps protect the leads from outer force. Ex. 1010, ¶0006 (the invention was designed to "provide[] surface mounted parts wherein the attachment structure of [the] lead frame including outer leads on

30. I further note that the prior art identified in Kyowa did not have lead receiving compartments, as shown in Figure 1(b). Note that the external leads 4 are simply formed over the package 6:



31. This is in contrast to Kyowa's invention, which adds lead receiving compartments to reduce outer force thereby limiting inward deflection. As I explained in my initial declaration (Exhibit 1003 at Paragraphs 56 and 126), Kyowa improves upon prior art LED packaging assemblies by forming its leads "integrally with the package 11 in a state that is almost flush with the side and bottom surfaces of the package 11," (Ex. 1010, ¶0016), which, among other things, improves the lead stability, (Ex. 1010, ¶0006). That is, a POSITA would have understood, based on the teachings of Kyowa, that the addition of lead receiving compartments (which were not in the prior art design) results in the reduction of outer force and limits inward deflection.

DR. SHEALY'S TESTIMONY: PRIOR ART LEAD RECEIVING COMPARTMENTS LIMIT INWARD DEFLECTION

Dr. Shealy's Reply Declaration

32. Although neither Critelli nor Kyowa use the term "inward deflection," a POSITA would have understood their disclosures of reducing lead pliability and lessening the influence of outer force to mean that their disclosures limit inward deflection.

33. That is, a POSITA would have understood, based on Critelli, Kyowa, and the '087 patent, as well as a basic understanding of the laws of physics, that fitting leads into/over lead receiving compartments would necessarily limit inward deflection. Said differently, fitting a lead in or over a carved out compartment will necessary result in less inward deflection than simply placing the leads around the outer-wall of a package. Indeed, it is confirmed by the '087 patent's design, (Ex. 1001, 2:67-3:3), which, as I have explained above and in my initial declaration, is effectively the same as the prior art.

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	**18**
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	14, 19

PATENT OWNER'S POSITION: PRIOR ART DOES NOT TEACH THE REQUIRED ARRAY

18. The illumination system of claim **15**, further comprising a plurality of other reflector housings each having at least one LED die mounted, said reflector housing and said plurality of other reflector housings arranged in an array in a display.	Patent Owner Response Finally, the Board evaluated claim 18 on pp. 60-61 of the Institution Decision. Therefore, the Board noted that "Petitioner does not identify any portion of the asserted references that purportedly teaches the additional limitation of reflector housings arranged in an array in a display." Paper 11, 60. Further, the Board stated that "On this preliminary record, Petitioner's contentions regarding the cited portions of Okazaki and Kamada appear conclusory and may lack sufficient explanation as to how the quoted portions of the references relate to the required array." *Id.*, 61.

Ex. 1001 ('087 Patent), claim 18; Paper 15 (POR) at 33

DR. SHEALY'S TESTIMONY: '087 PATENT ADMITS PRIOR ART DISPLAYS ARE ARRANGED IN ARRAYS

Dr. Shealy's Reply Declaration

23. I note that the '087 patent admits in its "Background" section that it was known that "[l]arge display panels such as stadium displays may consist of numerous small light emitting elements arranged in an array." Ex. 1001 at 1:5-11.

'087 Patent

1

BACKGROUND

Large display panels such as stadium displays may consist of numerous small light emitting elements arranged in an array. A typical light emitting element consists of an LED die mounted in a plastic housing. However, many plastics used in LED housings are susceptible to moisture absorption from the environment which can cause the LED in the housing to fail.

Paper 18 (Reply) at 24-25; Ex. 1016 (Shealy Reply Decl.) at ¶23; Ex. 1001 ('087 Patent) at 1:5-11

SHEARMAN & STERLING

DR. SHEALY'S TESTIMONY: PRIOR ART TEACHES DISPLAYS ARRANGED IN ARRAYS

Dr. Shealy's Initial Declaration

152. As discussed in paragraphs 35, 108, and 139, Okazaki discloses that its invention "relates to a chip-type LED utilized as a light source for various display panels or a backlight source for liquid crystal display devices." Ex. 1004 at 1:17-20. Also, Kamada explains that "[t]he present article can be used principally as a light emitting diode for the display of a semi-outdoor TV." Ex. 1006 (Description). In my opinion, a POSITA would have understood that, at least in display panels and TVs, the reflector housings were virtually always arranged in an array.

244. As discussed in paragraphs 40, 205, and 230, Takenaka discloses that its invention is applicable "to a product such as a full color display…." Ex. 1008, ¶0021, 37. Also, Kamada explains that "[t]he present article can be used principally as a light emitting diode for the display of a semi-outdoor TV." Ex. 1006 (Description). In my opinion, a POSITA would have understood that, at least in display panels and TVs, the reflector housings were virtually always arranged in an array.

Okazaki

1

1. Field of the Invention

The present invention relates to a chip-type LED and a process of manufacturing the same, and more particularly, it relates to a chip-type LED utilized as a light source for various display panels or a backlight source for liquid crystal display devices.

Kamada

The present article can be used principally as a light emitting diode for the display of a semi-outdoor TV.

Takenaka

[0037] In the first to fifth embodiments set forth below, the number of LED chips **4** mounted is preferably in plurality. Accordingly, applicability of the semiconductor light emitting device to a product such as a full color display can be increased. In the case where a plurality of LED chips are mounted in one product, heat radiation is critical due to the large heat generation. The present embodiment is particularly advantageous to overcome this problem.

Paper 1 (Pet.) at 40-41, 66; Ex. 1003 (Shealy Decl.) at ¶¶152, 244; Ex. 1004 (Okazaki) at 1:17-20; Ex. 1006 (Kamada) at 6-7; Ex. 1008 (Takenaka) at ¶0037

DR. SHEALY'S TESTIMONY: PRIOR ART TEACHES DISPLAYS ARRANGED IN ARRAYS

Dr. Shealy's Reply Declaration

25. I further note that the '087 patent does not define or provide any detail regarding "stadium displays" or "arrays." It does not describe a particular size of the display, nor does it specify whether the display is indoor or outdoor (*compare* the Tokyo Dome with Nationals Park). A POSITA would have understood that these generic "stadium" displays are simply typical display panels in which LED packages are intended to be used. Similarly, the patent does not describe any particulars regarding the "arrays," and the claims require only three packages in an "array," which is nothing more than a two-dimensional line. A POSITA would have understood the simple claimed array to be the routine byproduct of arranging multiple packages into a display, including those of Okazaki, Kamada, and Takenaka.

26. This is consistent with my opinion that the LED packages in the prior art (including Okazaki, Kamada, and Takenaka) were intended for use in a variety of displays, including stadium displays. This is also consistent with my opinion that, although Okazaki and Kamada do not use the word "stadium," a POSITA would have understood that Okazaki's disclosure that its invention "relates to a chip-type LED utilized as a light source for various display panels or a backlight source for liquid crystal display devices," (Ex. 1004 at 1:17-20), and Kamada's disclosure that its invention "can be used principally as a light emitting diode for display of a semi-outdoor TV," (Ex. 1006 (Description)), both encompass and are intended to be used in various locations (including stadiums), as generally described and claimed in the '087 patent, and that LED packages in these displays are arranged in arrays.

KEY REMAINING DISPUTES

Key Remaining Disputes	Claim(s)
Does Kamada disclose "a plurality of lead receiving compartments … formed in the peripheral sidewall of the reflector housing"?	1, 9, 15
Does Critelli disclose "a plurality of lead receiving compartments…"?	1, 9, 15
Does Okazaki disclose a first pocket/cavity (claims 1, 9, 15) or a second pocket/cavity (claims 1, 10, 15)?	1, 9, 10, 15
Would it have been obvious to combine Okazaki with Critelli, Kamada, or Kyowa?	1, 9, 15
Would it have been obvious to combine Takenaka with Critelli, Kamada, or Kyowa?	1, 9, 15
Does Takenaka disclose that "the combined volume of the second pocket and the lead receiving compartments is at least 50% of the volume of the first pocket," or would claim 2 otherwise have been obvious?	2
Would it have been obvious to form the prior art leads in a J-shape?	3, 12, 16
Do the prior art lead receiving compartments "limit inward deflection" of the leads?	13
Would it have been obvious to arrange the prior-art packages in an array?	18
Does "stadium" operate to limit the claimed "display"; does the prior art disclose "stadium displays"?	**14, 19**

PATENT OWNER'S POSITION: PRIOR ART DOES NOT TEACH "STADIUM" DISPLAY

	Patent Owner Response
14. The display of claim **9**, wherein said display comprises a stadium display. **19**. The illumination system of claim **18**, said display comprising a stadium display.	More specifically, as explained in Patent Owner's Preliminary Response, the defects in these challenges of claims 14 and 19 are numerous. Petitioner provides no evidence that the particular LED structure disclosed in the asserted references were ever used in a stadium display. Petitioner essentially asks the Board to take "judicial notice" that such displays are in the prior art disclosure without a comparable showing, in violation of 35 U.S.C. § 311(b). Pet., 35-36, 41.

Ex. 1001 ('087 Patent), claims 14, 19; Paper 15 (POR) at 29-30

DR. SHEALY'S TESTIMONY: "STADIUM" IMPLIES A LOCATION FOR USE

Dr. Shealy's Reply Declaration

25. I further note that the '087 patent does not define or provide any detail regarding "stadium displays" or "arrays." It does not describe a particular size of the display, nor does it specify whether the display is indoor or outdoor (*compare* the Tokyo Dome with Nationals Park). A POSITA would have understood that these generic "stadium" displays are simply typical display panels in which LED packages are intended to be used. Similarly, the patent does not describe any

28. In my opinion, the claimed elements related to arrays and stadium displays add little, if anything, to the claimed invention. This is consistent with the '087 patent and its file history. For example, in addition to admitting these were known in the patent Background and not providing any detail in the patent specification, I note that, during prosecution, the Examiner found that "claim 19, as broadly claimed the display can be used as a stadium display (intended use)." Ex. 1002 at 42. I agree with the Examiner's interpretation that a POSITA would have understood that this unspecified "stadium" is simply a possible location for the claimed "display" to be used at, and does not add anything to the claimed "display." I also note that the Applicant did not attempt to rebut the Examiner's finding, and instead focused on the lead receiving compartments. Ex. 1002 at 59-64.

'087 Patent

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BACKGROUND

Large display panels such as stadium displays may consist of numerous small light emitting elements arranged in an array. A typical light emitting element consists of an LED die mounted in a plastic housing. However, many plastics used in LED housings are susceptible to moisture absorption from the environment which can cause the LED in the housing to fail.

'087 Patent File History

4. Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song et al '069 in view of Devos et al '620. Song et al '069 discloses the claimed invention except for the teaching that there are a plurality of reflective housings which form a display. Devos et al '620 teaches a plurality of reflective housings which form a display. It would have been obvious to one skilled in the art at the time the invention was made to use a plurality of the reflector housings for the reflective housing of Song et al '069 as taught by Devos et al '620 in order to provide an efficient display panel. Regarding claim 19, as broadly claimed the display can be used as a stadium display (intended use).

Paper 18 (Reply) at 19-20; Ex. 1001 ('087 Patent) at 1:5-11; Ex. 1002 (File History) at 42; Ex. 1016 (Shealy Reply Decl.) at ¶¶25, 28

DR. SHEALY'S TESTIMONY: PRIOR ART TEACHES DISPLAYS

Dr. Shealy's Initial Declaration

130. As discussed in, *e.g.*, paragraphs 35 and 108, Okazaki discloses that its invention "relates to a chip-type LED utilized as a light source for various display panels or a backlight source for liquid crystal display devices." Ex. 1004 at 1:17-20. Also, Kamada explains that "[t]he present article can be used principally as a light emitting diode for the display of a semi-outdoor TV." Ex. 1006 (Description). In my opinion, it has been well-known to POSITAs, and the population generally, that sports stadiums are prime locations for displays. The article attached as Exhibit 13 provides evidence of this. Daktronics Chosen to Provide New Multi-Million Dollar Scoring and Video System for Toronto Blue Jays and Rogers Centre, BUSINESS WIRE (Feb. 2, 2005) (Ex. 1011).

226. As discussed in paragraphs 40 and 205, Takenaka discloses that its invention is applicable "to a product such as a full color display…." Ex. 1008, ¶0021, 37. Also, Kamada explains that "[t]he present article can be used principally as a light emitting diode for the display of a semi-outdoor TV." Ex. 1006 (Description). In my opinion, it has been well-known to POSITAs, and the population generally, that sports stadiums are prime locations for displays. Ex. 1011.

Okazaki

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[0037] In the first to fifth embodiments set forth below, the number of LED chips **4** mounted is preferably in plurality. Accordingly, applicability of the semiconductor light emitting device to a product such as a full color display can be increased. In the case where a plurality of LED chips are mounted in one product, heat radiation is critical due to the large heat generation. The present embodiment is particularly advantageous to overcome this problem.

Paper 1 (Pet.) at 35-36, 63, 83; Ex. 1003 (Shealy Decl.) at ¶¶130, 226; Ex. 1004 (Okazaki) at 1:17-20; Ex. 1006 (Kamada) at 6-7; Ex. 1008 (Takenaka) at ¶0037

DR. SHEALY'S TESTIMONY: PRIOR ART TEACHES USING DISPLAYS IN A "STADIUM"

Dr. Shealy's Initial Declaration

130. As discussed in, *e.g.*, paragraphs 35 and 108, Okazaki discloses that its invention "relates to a chip-type LED utilized as a light source for various display panels or a backlight source for liquid crystal display devices." Ex. 1004 at 1:17-20. Also, Kamada explains that "[t]he present article can be used principally as a light emitting diode for the display of a semi-outdoor TV." Ex. 1006 (Description). In my opinion, it has been well-known to POSITAs, and the population generally, that sports stadiums are prime locations for displays. The article attached as Exhibit 13 provides evidence of this. Daktronics Chosen to Provide New Multi-Million Dollar Scoring and Video System for Toronto Blue Jays and Rogers Centre, BUSINESS WIRE (Feb. 2, 2005) (Ex. 1011).

Dr. Shealy's Reply Declaration

27. I relied on the Daktronics article (Exhibit 1011) as an example to further illustrate that a POSITA would have understood that it was typical that these types of displays with LED packages were intended to be used at various locations, such as sports "stadiums."

Daktronics

Daktronics Chosen to Provide New Multi-Million Dollar Scoring and Video System for Toronto Blue Jays and Rogers Centre

February 02, 2005 11:15 AM Eastern Standard Time

BROOKINGS, S.D.--(BUSINESS WIRE)--Feb. 2, 2005--Daktronics, Inc. (Nasdaq:DAKT) announced today it has been awarded a contract in excess of $4.5 million (USD) to design, manufacture and install a unique integrated scoring and display system in Toronto's Rogers Centre (formerly SkyDome), home of Major League Baseball's Toronto Blue Jays. The order was booked during the Company's third quarter.

The venue is among the most well-known sports and entertainment facilities in the world, recognized for its use of innovative technologies, including a unique retractable roof design. Another well-known feature of the Rogers Centre is the existing video screen in centerfield, one of the largest in the world at the time of its installation. The existing display, which uses cathode ray tube (CRT) technology, measures approximately 33 feet high by 110 feet wide, and cost approximately $17 million at the time of installation. Daktronics will replace that famous display with its industry-leading ProStar(R) VideoPlus technology. The new Daktronics ProStar(R) display will be the same size, yet provide much greater resolution, increased brightness and improved viewing angles for Blue Jays fans. The new display, utilizing state of the art light emitting diode (LED) technology, will cost a fraction of the original display cost.

Paper 1 (Pet.) at 35-36, 63, 83; Paper 18 (Reply) at 21; Ex. 1003 (Shealy Decl.) at ¶130; Ex. 1016 (Shealy Reply Decl.) at ¶27; Ex. 1011 (Daktronics)

SHEARMAN & STERLING

DR. SHEALY'S TESTIMONY: PRIOR ART TEACHES LED PACKAGES INTENDED TO BE USED IN DISPLAYS, INCLUDING "STADIUM" DISPLAYS

Dr. Shealy's Reply Declaration

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[0037] In the first to fifth embodiments set forth below, the number of LED chips **4** mounted is preferably in plurality. Accordingly, applicability of the semiconductor light emitting device to a product such as a full color display can be increased. In the case where a plurality of LED chips are mounted in one product, heat radiation is critical due to the large heat generation. The present embodiment is particularly advantageous to overcome this problem.

Paper 18 (Reply) at 21; Ex. 1016 (Shealy Reply Decl.) at ¶26; Ex. 1004 (Okazaki) at 1:17-20; Ex. 1006 (Kamada) at 6; Ex. 1008 (Takenaka) at ¶0037

MR. CREDELLE'S TESTIMONY

Mr. Credelle's Deposition

BY MR. COLSHER:

Q The specifications that you were working on, were you involved in the individual LED packages?

MR. HELGE: Object to form.

THE WITNESS: I don't -- I guess I don't quite understand what you're asking. Did I design the packages? I did not design the packages. These were purchased components, typically.

BY MR. COLSHER:

Q Have you ever worked on the manufacturing of LED packaging?

A No.

Q Have you ever worked on the development of LED packaging?

A There's only one example. It was a very custom design that we did at Display Engineering where we mounted bare die to a circuit board, as opposed to using a package purchased from the outside, and then that was coated with an epoxy coating.

To some extent, you might call that an LED package, but it's not a traditional device that you would purchase, you know, from Nichia or other companies.

Q Other than that, the custom design, have you done any development work for LED packaging?

A No.

CERTIFICATE OF SERVICE

I hereby certify that the foregoing Petitioner's Demonstrative Exhibits was served on August 23, 2019 via electronic mail upon counsel of record for Patent Owner at the following email addresses:

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