



Patent Owner
Ouster, Inc.
Demonstratives

IPR2023-01456
IPR2023-01457

January 13, 2025

DEMONSTRATIVE EXHIBIT

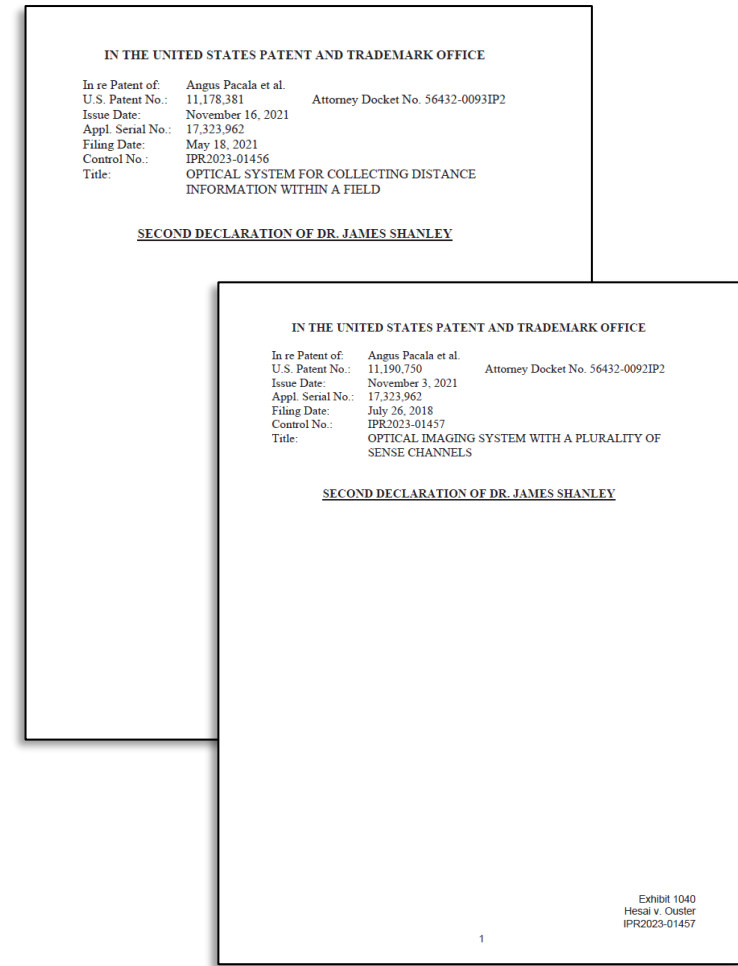
NOT EVIDENCE

Overview

- '381 patent
 - Claim 3
 - Claim 1 - “Adjacent” claim limitation
 - Claim 1 – Claim construction: “each pixel...”
 - Claims 6, 7, and 17 (Retterath grounds)
 - Secondary considerations
 - POSITA dispute
- '750 patent
 - Issues overlapping with '381 patent
 - “Threshold distance” claim language
 - Weimer-based ground

Petitioner seeks to backfill deficient petitions

- Petitioner introduced new reply theories to backfill deficient petition
- In an effort to bootstrap its untimely new opinions, Hesai introduced two ~50-page reply declarations from its expert Dr. Shanley
- Dr. Shanley was uncooperative in depositions on his reply declarations
- Dr. Shanley testified that Hesai coached him not to be too “verbose” in cross examination



³⁸¹ IPR Sur-Reply at 1-5, 9 n.5, 11 n.6, 13 n.7; ⁷⁵⁰ IPR Sur-Reply at 1-5, 9 n.4, 12 n.5, 15 n.6; EX2020, 32:3-36:1, 37:2-10, 38:3-41:21, 42:3-43:11, 49:5-19; EX2010, 140:21-147:6

Claim 3

“proportional...arrangement”

All grounds

3. The optical system according to claim 1 wherein the plurality of optical emitters are arranged in a first arrangement and the plurality of pixels are arranged in a second arrangement, proportional to the first arrangement.

EX1001, cl. 3 (highlighting added)

Grounds 1A-1G

The petition did not identify
“proportional arrangement[s]” of
emitters and detectors in Retterath

Petition

FIGS. 4, 11b. Retterath describes an equal number of detector and emitter elements, indicating first and second arrangements proportional in number. EX1005, 10:66-11:1 (“equal to”); EX1003, ¶¶169-70.

Pet. at 30 (highlighting added)

Shanley Declaration

second grid arrangement (electro-optical section 246). Retterath describes an equal number of detector and emitter elements, indicating the first and second arrangements proportional in number. *Id.*, 10:44-47 (“The number of emitter

EX1003, ¶ 170 (highlighting added)

But proportional number is different from proportional arrangement

'381

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HESAI TECHNOLOGY CO., LTD.
Petitioner

v.

OUSTER, INC.
Patent Owner

Case IPR 2023-01456
U.S. Patent No. 11,178,381
Issue Date: November 16, 2021

Title: SPINNING LIDAR UNIT WITH MICRO-OPTICS ALIGNED BEHIND
STATIONARY WINDOW

DECLARATION OF JASON A. JANÉ, PH.D.

Ouster Exhibit 2009
IPR2023-01456 - Page 001

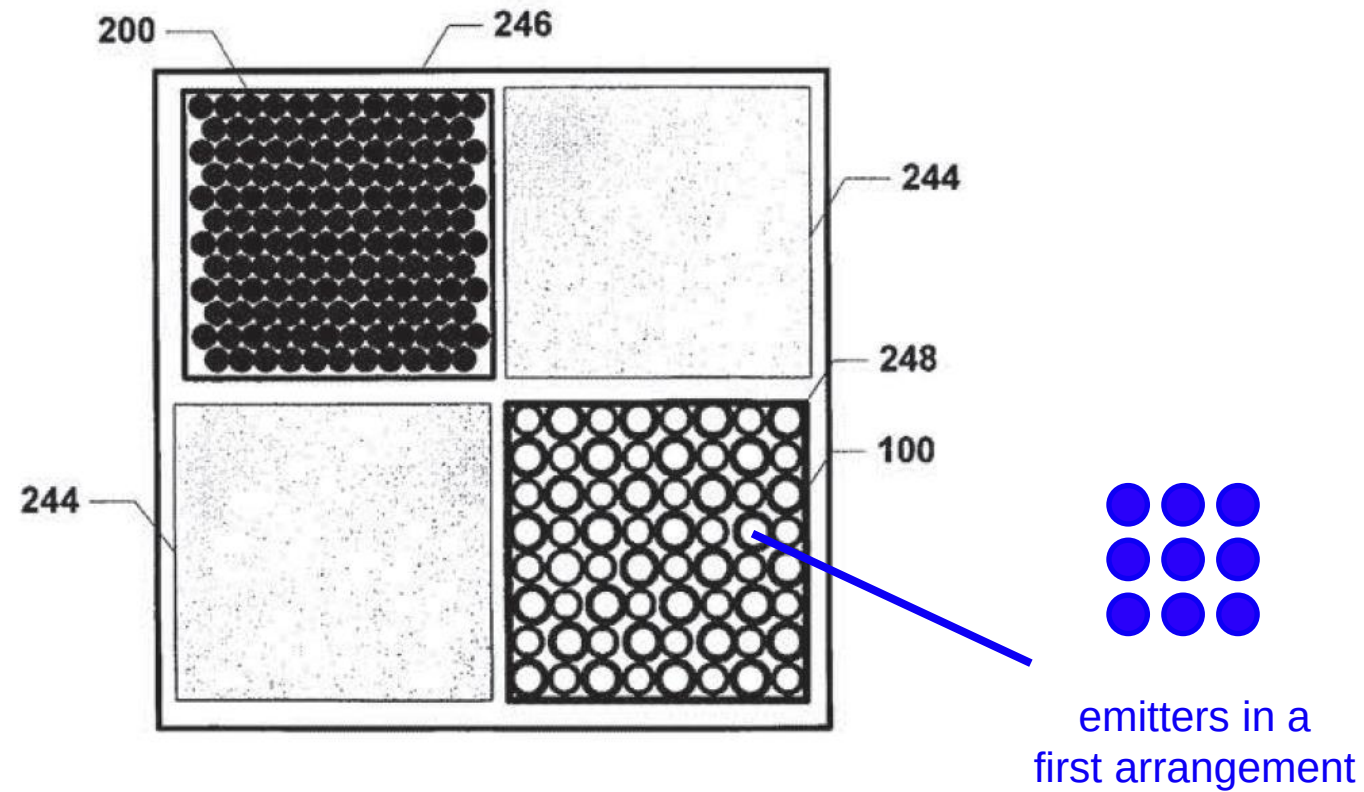
In other words, Dr. Shanley appears to be interpreting the requirement of “proportional” arrangements to include arrangements that have an equal number of elements. **But a POSITA would have understood that the *number* of elements and the *arrangement* of those elements are different.**

EX2009, ¶ 144 (emphasis added)

Petitioner points to arrangements that are not proportional

'381

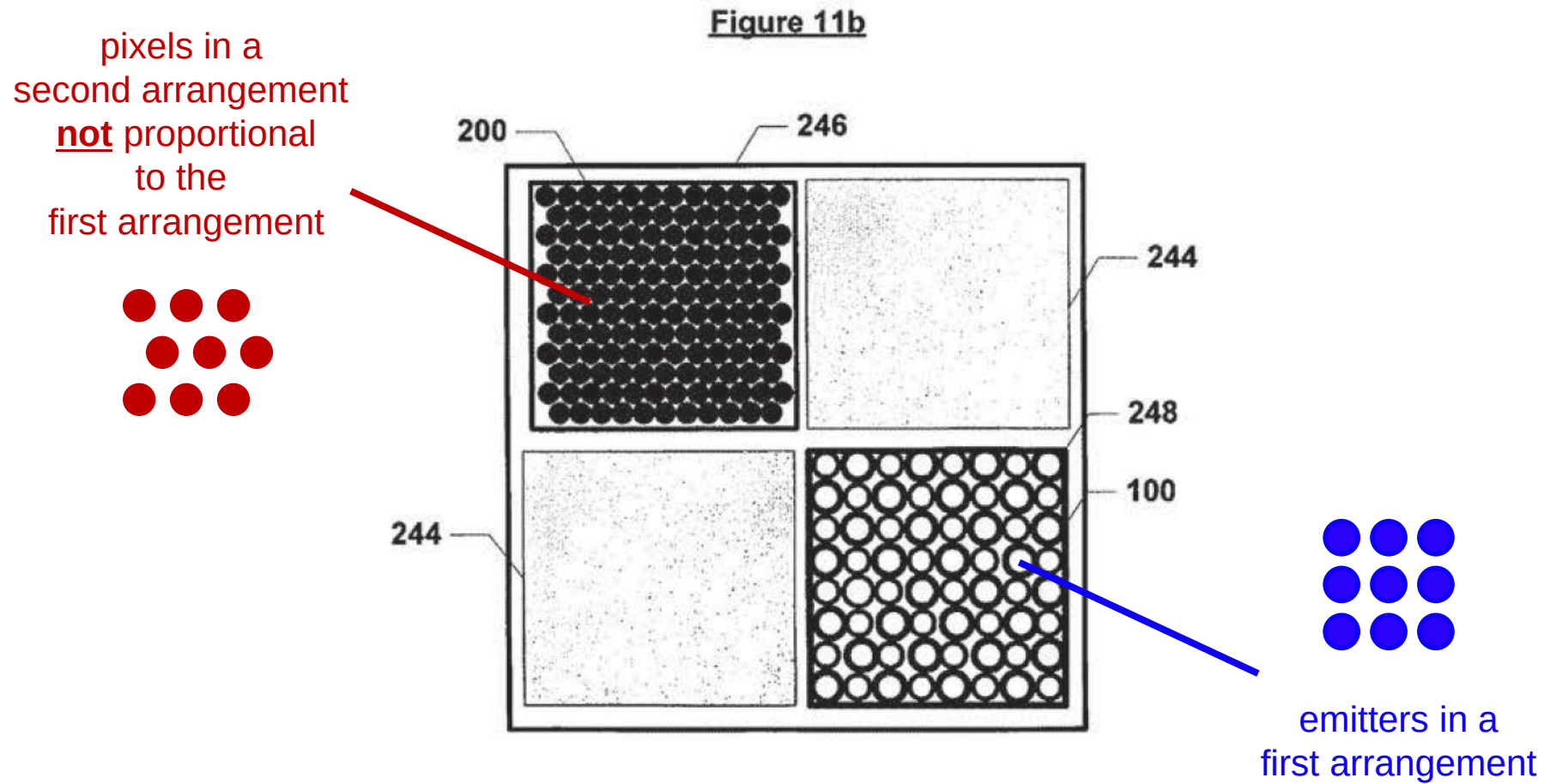
Figure 11b



POR at 40-44; EX2009, ¶¶ 138-46; Sur-Reply at 17-18

Petitioner points to arrangements that are not proportional

'381



POR at 40-44; EX2009, ¶¶ 138-46; Sur-Reply at 17-18

Dr. Janét's opinions support lack of proportionality of the asserted Retterath arrangements

'381

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Ouster Exhibit 2009
IPR2023-01456 - Page 001

A POSITA would not have understood the arrangement of (1) emitters **100** and (2) detectors **200** shown in Figure 11b of Retterath to be a “proportional” arrangement. Rather, a POSITA would have understood that the arrangement of (1) detectors and (2) emitters does not have the same spatial relationships or pattern.

EX2009, ¶ 143; *see also id.*, ¶¶ 142, 144-145

Petitioner's expert disagrees with PO's expert—but never discloses his understanding of proportional arrangements

'381

Q. So here you appear to be talking about what you call patent owner's interpretation of claim 3; is that correct?

A. This is my interpretation of the -- of claim 3.

Q. But so looking back at the language of claim 3, what does it mean for a second arrangement to be proportional to a first arrangement?

MR. DEUTSCH: Objection, form; objection, scope; asked and answered multiple times.

A. Yeah, I think it's pretty clear. Paragraph 24 arrangements that are related by a scaling factor and to exclude arrangements that cannot be reduced to a scaling factor -- I think that this 23 and 24 state it pretty well, what my opinion on that is.

EX2020, 49:5-19; *see also* Sur-Reply at 4, 11 n.6; EX2009, ¶¶ 138-46, 229-31

Reply

The Petition expressly described how the combination provides the claimed “proportional” arrangement. *See, e.g.*, Pet., 30. Retterath illustrates the second arrangement (pixels) and the first arrangement (optical emitters) are “proportional” based on the overall arrangement, as illustrated in FIG. 11B.

Reply at 17 (highlighting added)

(h) *Claim 3:*

Petition

In the Retterath-Borowski combination, Retterath describes emitters 100 are in a first arrangement (i.e., electro-optical section 248) and the detectors 200 and pixels 224 are in a second arrangement (electro-optical section 246). EX1005, FIGS. 4, 11b. Retterath describes an equal number of detector and emitter elements, indicating first and second arrangements proportional in number. EX1005, 10:66-11:1 (“equal to”); EX1003, ¶¶169-70.

Pet. at 30 (highlighting added)

Sur-Reply at 17-18; EX2009, ¶¶ 138-46, 229-31

Petitioner presents an improper new obviousness argument

'381

be equal to ... the number of emitter elements 100.” As such, a POSITA would have recognized and found obvious from these teachings of Retterath that the arrangement would be proportional (as narrowly defined by PO) for such emitter and detector arrays. EX1040, ¶44 (citing FIGS. 11b and 20, showing arrangements of aligned rows).

Reply at 18 (highlighting added); *see also* Sur-Reply at 18

Petitioner's untimely new obviousness theory on reply is improper and should be disregarded

'381



Intelligent Bio-Sys. v. Illumina Cambridge

821 F.3d 1359, 1370 (Fed. Cir. 2016)

“In these circumstances, we find that the Board did not err in refusing the reply brief as improper under 37 C.F.R. § 42.23(b) because [the petitioner] relied on an **entirely new rationale** to explain why one of skill in the art would have been motivated to combine Tsien or Ju with a modification of Zavgorodny.”

Sur-Reply at 2, 17-18

Grounds 2A-2C

The petition did not identify
“proportional arrangement[s]” of
emitters and detectors in Imai

Petition only identified proportional numbers in Imai—not arrangements

'381

(h) *Claim 3:*

The Imai-Higashi combination provides this Element of claim 3. EX1003, ¶282. Imai demonstrates its optical emitters (e.g., LDs) are arranged in a first arrangement and its pixels (e.g., PDs) are arranged in a second arrangement, proportional to the first arrangement. For example, according to the first predictable manner, Imai provides 4 LDs in a first arrangement and 4 pixels (each including 4 SPADs) in a second arrangement proportional to the first arrangement. EX1009, FIG. 10; *supra*, Ground 2A, Analysis of Element 1(e). According to the second predictable manner, Imai provides 16 LDs in a first arrangement and 16 pixels (each including 4 SPADs) in a second arrangement, proportional to the first arrangement. *Id.*, FIG. 10, *supra*, Ground 2A, Analysis of Element 1(e). EX1003, ¶283.

Pet. at 71 (highlighting added); see also POR at 59-60; Sur-Reply at 21-22; EX2009, ¶¶ 138-46, 229-31

Petitioner's expert's only analysis for claim 3 is based on proportional numbers—not arrangements

'381

proportional to the first arrangement. For example, according to the first manner described above, Imai provides 4 LDs in a first arrangement and 4 pixels (each including 4 SPADs) in a second arrangement proportional to the first arrangement. EX1009, FIG. 10; *supra*, §X.H.2(e). There are 4 LDs and 4 pixels. According to the second manner described above, Imai provides 16 LDs in a first arrangement and 16 pixels (each including 4 SPADs) in a second arrangement, proportional to the first arrangement. *Id.*, FIG. 10, *supra*, §XI.H.2(e). There are 16 LDs and 16 pixels.

EX1003, ¶ 283 (highlighting added); see also POR at 59-60; Sur-Reply at 21-22; EX2009, ¶¶ 138-46, 229-31

On reply, Petitioner presents untimely new “spatial arrangement” argument

’381

Similar to PO’s faulty analysis of the Retterath Grounds, PO relies on an improperly narrow interpretation of “proportional.” As set forth in the Petition, Imai describes proportional arrangements that include a proportional number (e.g., 4 and 4, 16 and 16) of LDs and pixels. Pet., 66-70, 71. Moreover, even applying PO’s improperly narrow interpretation, Imai describes and illustrates configurations in which the LDs and pixels exhibit the same spatial arrangement, as illustrated in FIG. 11, for example.

Petition argument:
“proportional number”

New reply theory:
“same spatial arrangement”

Reply at 24-25 (highlighting added); see also Sur-Reply at 21-22

[0125] It is also possible to electrically connect LD1 to LD4 to one another to simultaneously turn on, electrically connect LD5 to LD8 to one another to simultaneously turn on, electrically connect LD9 to LD12 to one another to simultaneously turn on, and electrically connect LD13 to LD16 to one another to simultaneously turn on, as in a second modification illustrated in FIG. 11. When scanning and detecting, four LD groups each of which is formed of four LDs which are electrically connected to one another may be turned on at different timings. Herein, the number of LDs and that of PDs are the same and the LDs and PDs one-to-one correspond to each other. Meanwhile, in the second modification, connection relationship between each PD of a PDA and each amplifier is the same as that in the first modification illustrated in FIG. 10.

EX1009, ¶ [0125] (highlighting added); *see also id.*, Fig. 11; POR at 59-60; EX2009, ¶¶ 229-31

Claim 1

“a bulk imaging optic disposed
adjacent to the bulk transmitting
optic”
All grounds

1. An optical system for collecting distance information,
the optical system comprising:
a bulk transmitting optic;

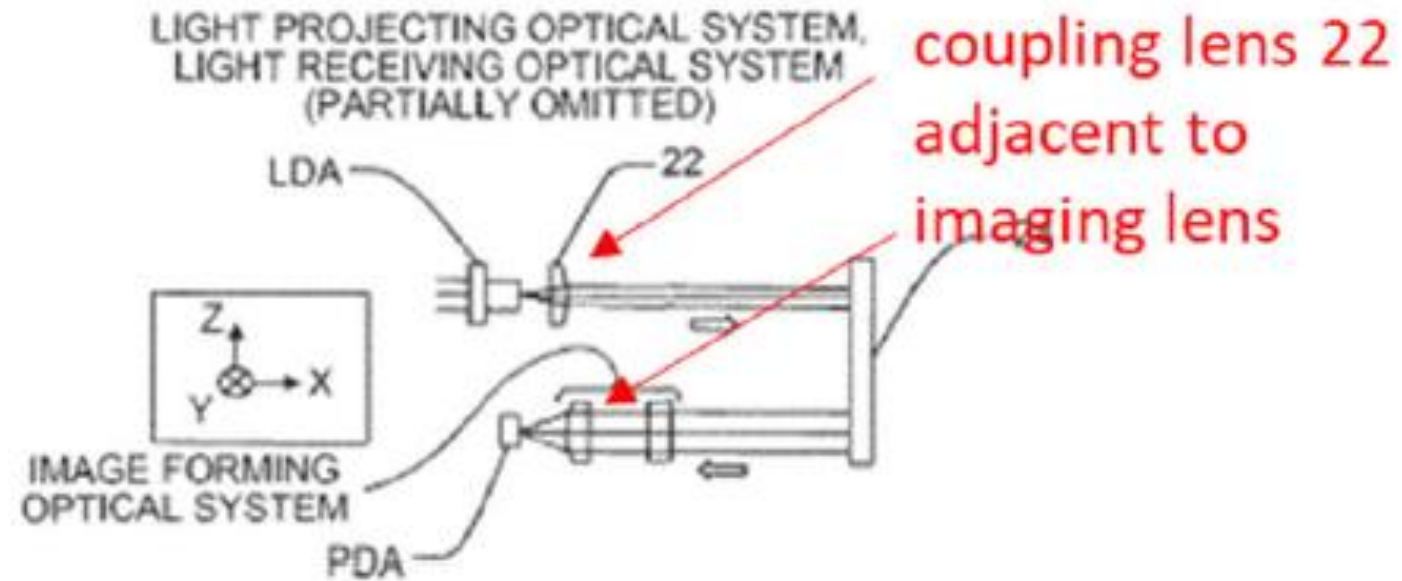
a bulk imaging optic disposed adjacent to the bulk trans-
mitting optic;

EX1001, cl. 1 (highlighting added)

Grounds 2A-2C
Petitioner failed to show “adjacent”
bulk optics in Imai

Petitioner's only basis for arguing Imai has "adjacent" bulk optics is Imai's Figure 2C

'381

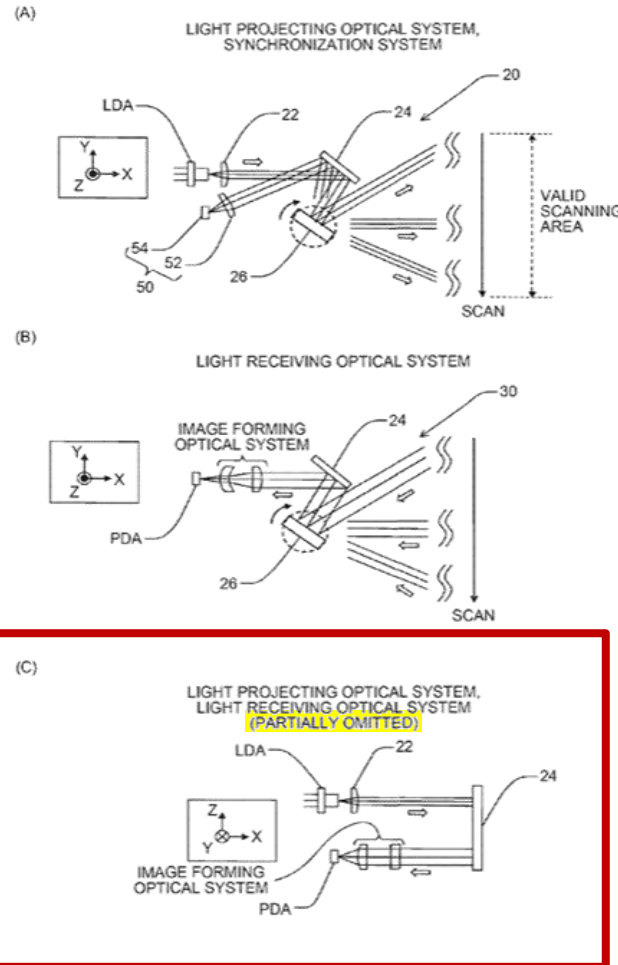


Pet. at 65-66 (citing EX1009, Fig. 2C); see also POR at 54-59; Sur-Reply at 20-21; EX2009, ¶¶ 211-18

But Figure 2C is “partially omitted”

’381

FIG.2



EX1009, Fig. 2 (annotations and highlighting added); see also POR at 54-59; Sur-Reply at 20-21; EX2009, ¶¶ 211-18

Q. So it's your understanding that 2C, a POSITA would understand that 2C includes element 26; is that correct?

MR. DEUTSCH: Objection. Form. Mischaracterizes.

A. I look at 24 and take it more as a schematic just showing the fact that they have in sort of a semi-empirical way the optics for the transmitter and receiver. To me it's just a sketch basically. There's nothing that is anything outstanding in it, but it just amplifies the emitter and the detector section. That's all.

EX2010, 90:9-21 (highlighting added)

Q. What is your understanding of what is omitted from Figure 2C of Imai?

MR. DEUTSCH: Objection. Scope.

A. If we look back on, for instance, if we go to the Paragraph 264, and above it in Figure 2A, it shows a better schematic of these things.

If you go to the first part where 22 is, you can see that he truncates a lot, a fair amount of that drawing, and he just comes up with this little schematic that we have on the bottom of Paragraph 268.

EX2010, 88:7-18 (highlighting added)

So it's just a diagram saying, hey, this is the way it is, and there's going to be a packet of imaging optics and there's going to be a packet of emitting optics. What they are in form and function – function we know they're imaging and emitting, but we don't know any of the details. It's just saying this is what they are.

EX2010, 94:18-95:3 (highlighting added)

See also POR at 54-59; Sur-Reply at 20-21; EX2009, ¶¶ 211-18

Petitioner's expert testified that Imai's accompanying description of Figure 2C is unreliable

'381

Imai

[0039] As is understood from (C) in FIG. 2, the light projecting optical system 20 and the light receiving optical system 30 are arranged so as to be overlapped in the Z-axis direction and the rotary mirror 26 and the reflecting mirror 24 are shared by the light projecting optical system 20 and the light receiving optical system 30. According to this, it is

Petitioner's expert

We get into all the translational difficulties on these patents, and basically I'm taking this as – so basically – I'm not sure "overlapped" is the right word that he should be using, but one would take it

EX2010, 96:7-11 (highlighting added)

Petitioner's expert

overlaps with beam two coming in. I'm not sure, I don't know if the translator is a technical person or you have the words in Japanese that are so – it's not a one-to-one correspondence to what we would think of in English.

So I would take that as coincident basically may be a better word than overlapping between the two beams.

EX2010, 97:2-10 (highlighting added)

EX1009, ¶ [0039] (highlighting added); see also POR at 58-59; Sur-Reply at 20-21; EX2009, ¶¶ 211-18

On reply, Petitioner and its expert improperly attempt to backfill

'381

New, previously
absent discussion
of what is omitted
from Fig. 2C

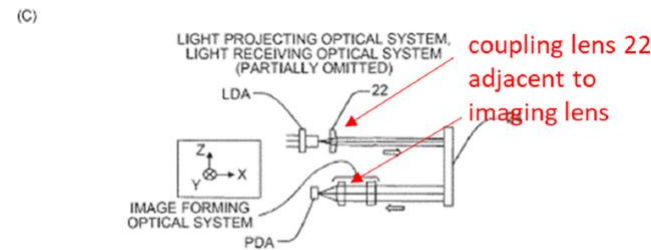
Imai explains exactly what is “partially omitted”—portions of the “optical path” to/from the mirror 24, including the optical path extending out of the page (y-axis) from the perspective shown in FIG. 2C. EX1009, [0038]. For those objects depicted in the X-Z plane of FIG. 2C, the relative positions of the structures are accurately depicted. For example, there is no dispute that the LDA is adjacent to the coupling lens 22 in that X-Z plane, nor is there any dispute that the PDA adjacent to the imaging forming optical system in that X-Z plane. EX1040, ¶¶57-59. PO provides no explanation as to why Imai’s FIG. 2C would accurately depict

Untimely new
“X-Z plane”
discussion

Reply at 23 (highlighting added); see also Sur-Reply at 20-21

(d) *Element 1(d):*

The Imai-Higashi combination provides this Element. EX1003, ¶267. Imai describes a bulk imaging optic provided by an imaging lens. *Id.* As depicted in FIG. 2C (reproduced below), coupling lens 22 of the projection optical system 20 and imaging lens on the light receiving optical system 30 are adjacent to each other along the “Z-axis” direction, similar to the embodiment of the '381 patent. *Compare*, EX1009, FIG. 2C *with* EX1001, 11:11-13 adjacent and offset laterally and/or vertically”), FIGS. 1-2; *see also* EX1003, ¶268; EX1009, [0041], [0038]-[0039]; EX1027; [0019]-[0022].



EX1003, ¶268 (EX1009, FIG. 2C (annotated))



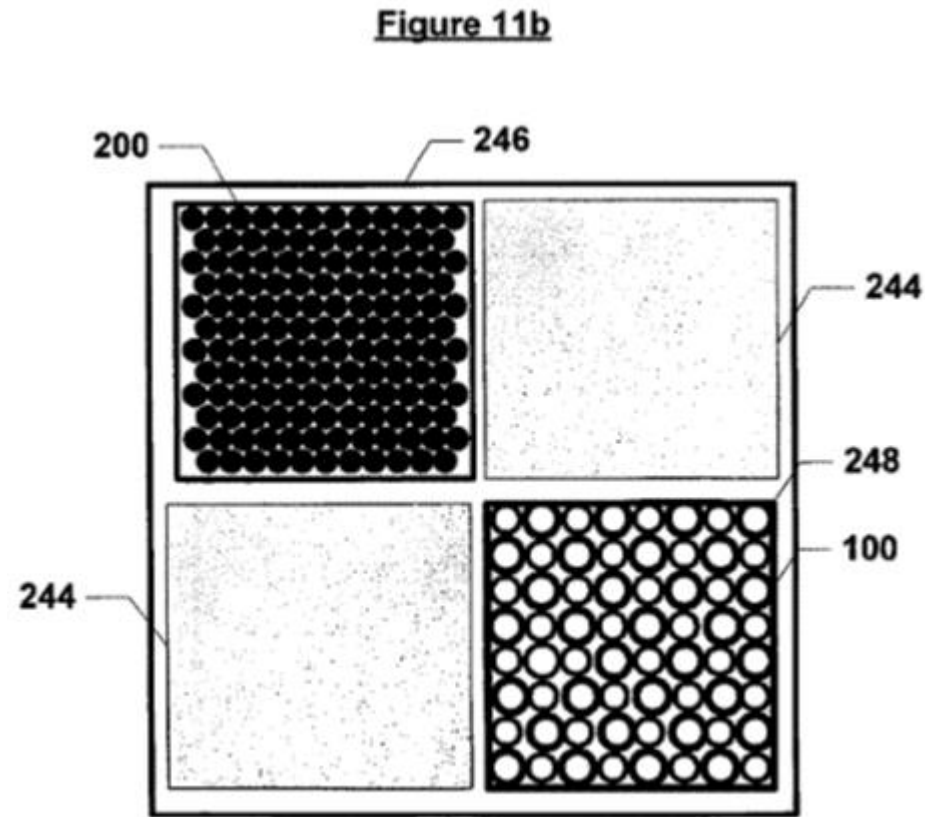
Intelligent Bio-Sys. v. Illumina Cambridge

821 F.3d 1359, 1369 (Fed. Cir. 2016)

“It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the **initial petition identify ‘with particularity’** the ‘evidence that supports the grounds for the challenge to each claim.’ 35 U.S.C. § 312(a)(3).”

Sur-Reply at 2-3, 21-22

Grounds 1A-1G
Petitioner failed to show “adjacent”
bulk optics in Retterath



EX1005, Fig. 11B; Pet. at 24-26

But there is no discussion of bulk optics for the Figure 11b embodiment in Retterath

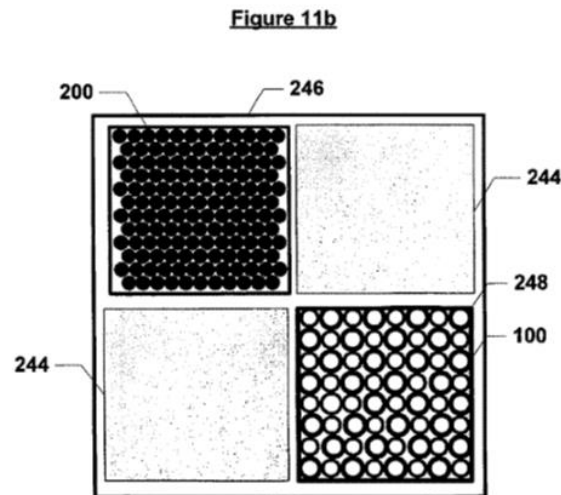
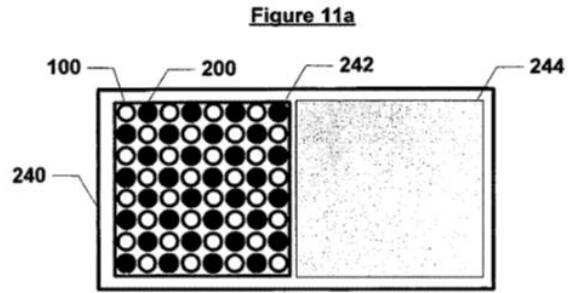
'381

Referring to FIG. 11*b* a physical device layout according to an embodiment is shown. In embodiments, emitter elements **100** can be arranged in an emitter electro-optical section **248** and detector elements **200** can be arranged in a detector electro-optical section **246** of device **240**. The number of detector elements **200** can be equal to or greater than the number of emitter elements **100**. In embodiments, for example, each emitter/detector array will comprise K detector elements **200** for each emitter of emitter elements **100**, where K is an integer value from 1 to 25.

EX1005, 10:62-11:4; see also POR at 34-40; Sur-Reply at 15; EX2009, ¶¶ 124-29

The only discussion of optics relates to a *single* global lens for the related Figure 11a embodiment

'381



Referring to FIG. 11a, a physical device layout according to an embodiment is shown. In an embodiment, emitter elements 100 and detector elements 200 can be symmetrically arranged in an electro-optical section 242 of the device 240. The number of emitter elements 100 can be equal to the number of detector elements 200, and each detector of detector elements 200 is “paired” with a designated emitter of emitter elements 100. The pulse sequence transmitted by an emitter of emitter elements 100 will be sensed and detected only by its paired detector of detector elements 200. In embodiments, a single global lens can be utilized for both emitter elements 100 and detector elements 200. When single global lens are used for emitter elements 100 and detector elements 200 optics, the distance between the emitter/detector pair must be minimal. In other embodiments, for example, where micro lens are used for emitter elements 100, the distance between each emitter/detector is not as important and can vary according to embodiments. Larger distances between micro-lens emitter elements and waveguide detector elements will require slightly larger diverging waveguides according to FIG. 9. Device circuitry is located in an electronic section 244 of the device 240.

EX1005, Figs. 11a-11b, 10:40-61 (highlighting added); see also POR at 34-40; Sur-Reply at 15; EX2009, ¶¶ 124-29

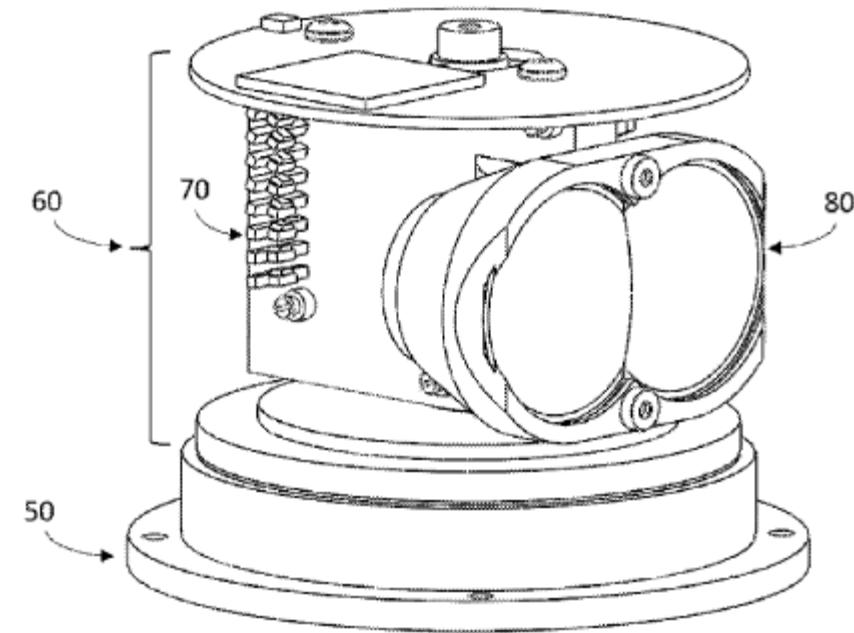
Petitioner's expert does not explain how Retterath satisfies the “adjacent to” limitation

'381

156. The emitter array 100 is adjacent to the detector array 200 next to one another in quadrants shown in FIG. 11b, thereby providing the macro lens 230 (located in front of the detector array 200) at a location adjacent to the macro lens 80 (located in front of the emitter array 100). Here again, the adjacent arrangement is like that of the '381 patent. *See e.g.*, EX1001, 11:11-13 (offset laterally “and” vertically”); FIGS. 6, 10, 2:27-34 ((showing adjacent elements 150, 160, 170 next to but not abutting one another), 9:12-20, 10:23-30 (similar descriptions with no indication of the range or the criticality of the offset).

EX1003, ¶ 156; *see also* POR at 38-40; Sur-Reply at 15

Figure 6
+
Figure 10
+
Figure 11b



Pet. at 24-26, 40-47; EX1013, Fig. 2; see also POR at 34-40; Sur-Reply at 15; EX2009, ¶¶ 124-29, 177-80

Claims 1 and 14

“each pixel in the plurality of pixels has a field of view coincident with an emission region of a corresponding optical emitter in the plurality of optical emitters”

All grounds

Claim construction

1. An optical system for collecting distance information, the optical system comprising:

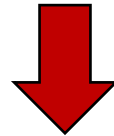
- a plurality of optical emitters arranged behind the bulk transmitting optic and configured to output electromagnetic radiation of an operating wavelength through the bulk transmitting optic into a field external to the optical system according to an illumination pattern that comprises a plurality of non-overlapping emission regions;
- a plurality of pixels arranged behind the bulk imaging optic, wherein each pixel in the plurality of pixels has a field of view coincident with an emission region of a corresponding optical emitter in the plurality of optical emitters and each pixel comprises a plurality of single photon avalanche diodes (SPADs) operable to detect photons emitted from its corresponding optical emitter and received through the bulk imaging optic after being reflected from surfaces within the field; and

14. An optical system for collecting distance information, the optical system comprising:

- a plurality of optical emitters arranged behind the bulk transmitting optic and configured to output electromagnetic radiation of an operating wavelength into a plurality of non-overlapping emission regions, each emission region representing a spot in a field ahead of the optical system;
- a plurality of pixels arranged behind the bulk imaging optic and corresponding in number to the plurality of optical emitters, wherein each pixel in the plurality of pixels is paired with a different optical emitter in the plurality of optical emitters and has a field of view coincident with an emission region of its paired optical emitter and wherein each pixel comprises a plurality of single photon avalanche diodes (SPADs) operable to detect photons emitted from its paired optical emitter and received through the bulk imaging optic after being reflected from surfaces within the field; and

EX1001, cl. 1, 14 (highlighting added)

“each pixel in the plurality of pixels has a field of view coincident with an emission region of a corresponding optical emitter in the plurality of optical emitters”



“the field of view of each pixel and the emission region of a corresponding [or paired] optical emitter **cover substantially the same area in the field**”

EX1001, cl. 1; POR at 23-29 (emphasis added); EX2009, ¶¶ 108-22; Sur-Reply at 5-10

surement technique. The system **100** includes: a column of offset apertures arranged behind a bulk imaging optic **130** and defining discrete fields of view in a field ahead of the bulk imaging optic **130** (that is non-overlapping fields of view beyond a threshold distance from the system); a set of illumination sources **110** that project discrete illuminating beams at an operating wavelength into (and substantially only into) the fields of view defined by the apertures; a

EX1001, 2:53-60 (highlighting and emphasis added); *see also* POR at 23-29; EX2009, ¶¶ 108-22; Sur-Reply at 5-10

photons). The system can therefore selectively project illuminating beams into a field ahead of the system according to an illumination pattern that substantially matches—in size and geometry across a range of distances from the system—the fields of view of the apertures. In particular, the illumi-

EX1001, 2:67-3:4 (highlighting and emphasis added); *see also* POR at 23-29; EX2009, ¶¶ 108-22; Sur-Reply at 5-10

height. The system also includes a diffuser **180** that spreads light rays passed from an aperture through the optical filter **160** across the area of a corresponding pixel such that the pixel can detect incident photons across its full width and height thereby increasing the dynamic range of the system.

EX1001, 3:25-29 (highlighting and emphasis added); *see also* POR at 23-29; EX2009, ¶¶ 108-22; Sur-Reply at 5-10

detected by pixels in the system such that minimal power output by the system (via the illumination sources) is wasted by illuminating surfaces in the field for which the pixels are blind. The system can therefore achieve a relatively high

EX1001, 3:7-10 (highlighting added)

blind. The system can therefore achieve a relatively high ratio of output signal (i.e., illuminating beam power) to input signal (i.e., photons passed to an incident on the pixel array).

EX1001, 3:10-12 (highlighting added)

system; that is, due to the geometry of a particular aperture and its corresponding illumination source, a particular aperture may pass a signal exhibiting a relatively high SNR to its corresponding lens and thus into its corresponding pixel.

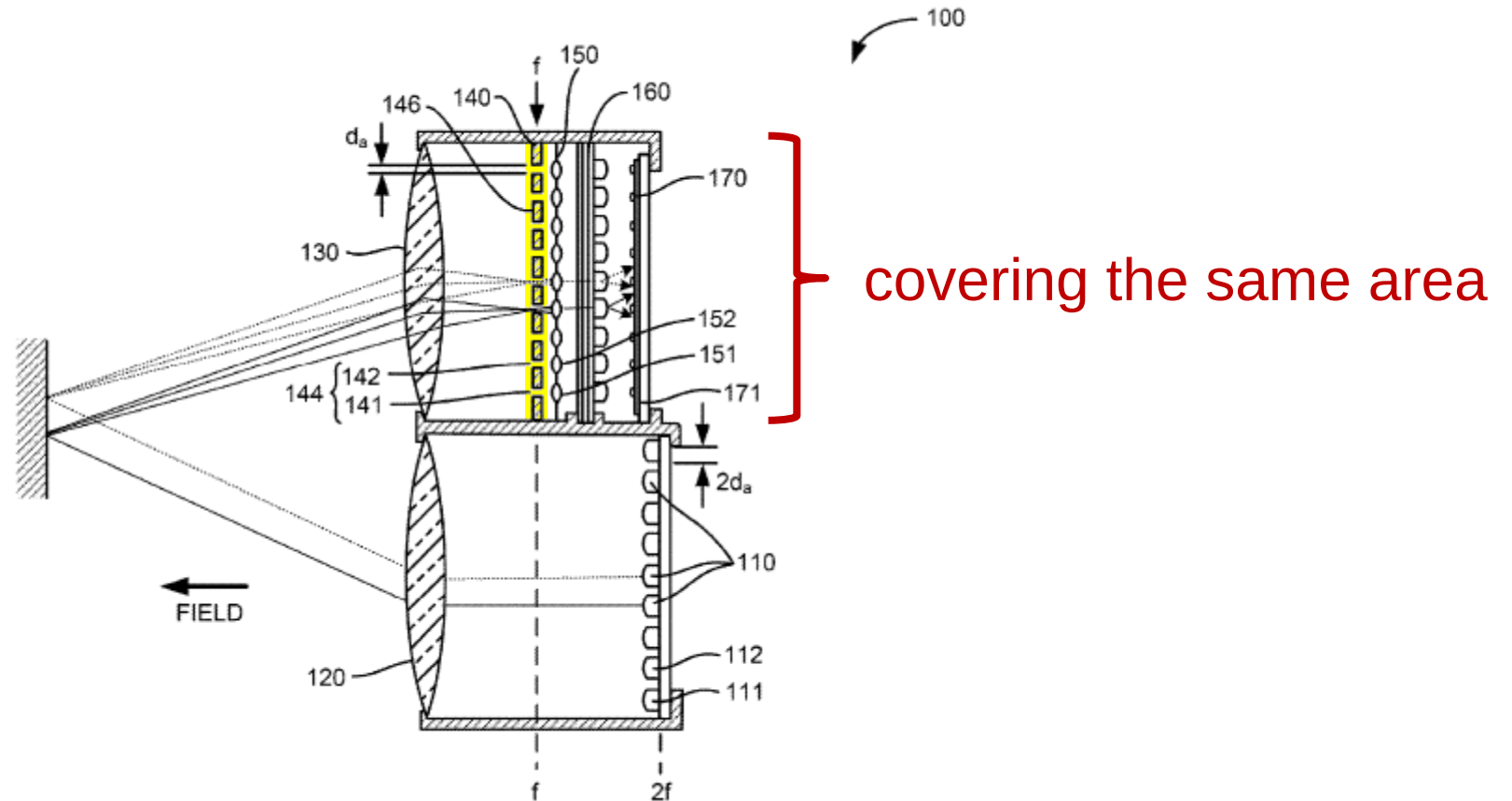
EX1001, 6:34-37 (highlighting added)

See also POR at 23-29; EX2009, ¶¶ 108-22; Sur-Reply at 5-10

Intrinsic evidence

'381

characterized by a focal plane opposite the field; an aperture layer 140 coincident the focal plane, defining a set of



EX1001, Fig. 1, 2:12-13 (highlighting and emphasis added); see also POR at 23-29; EX2009, ¶¶ 108-22; Sur-Reply at 5-10

Testimony of Jason A. Janét, Ph.D.

“[T]he '381 is concerned with minimizing waste, wasted energy, while at the same time improving or maximizing the signal-to-noise ratio. So considering where those intersect, a person with ordinary skill would take the position ... that it occupies ... substantially the same area or the same portion of space and in doing so in such a manner that you're again minimizing waste, which is to say loss of emitted energy that would be outside that field of view[.]”

EX1041, 41:7-24 (emphasis added); see also Sur-Reply at 6; see also EX2009, ¶¶ 108-22

coincident (kəu'insidənt), *a.* (and *sb.*) [*a.* F. *coïncident*, *ad.* med.L. **coincident-em*, *pres.* *pplc.* of *coincidēre* to **COINCIDERE**.]
A. *adj.* 1. Occupying the same place or portion of space.

EX2011 at 8 (emphasis added); see also POR at 28; EX2009, ¶ 122

Petition

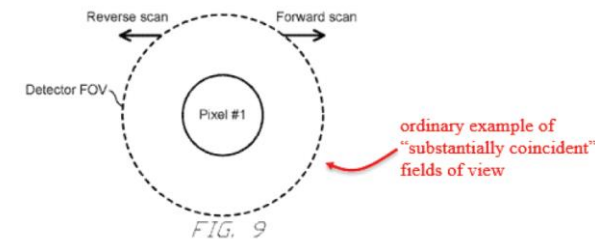
- Sufficient for emitter and detector vectors to be coincident

Retterath explains that each emission vector 120 is “on-coincident axis” with a corresponding detection vector 220—“For each emitter/detector set of elements 100/200, the emitter and detector vectors are coincident and form a common on-coincident axis that is at an angle relative to a vector normal to the plane of the array that is unique for that emitter/detector set.” EX1005, 6:23-28; 6:29-39; 10:66-11:1.

Pet. at 28 (highlighting added)

Reply

- New theory: Some undefined minimum overlap is required for emission and detection regions to be coincident



EX1040, ¶53. PO incorrectly alleges that Imai only discloses emission regions that are “*significantly* larger or smaller” than the detection regions of the corresponding detectors, and inaccurately states that the Petition “depends on the view that *any* overlap between emission and detection regions is sufficient.” POR, 51.

Reply at 5, 21 (highlighting added)

Petitioner's expert refused to discuss his opinion on cross-examination

'381

12 Q. Just to confirm, you can't tell me, sitting
13 here today, yes or no, whether there is a minimum
14 amount of overlap between emission and detection
15 regions that is necessary for those regions to be
16 coincident with each other?

17 MR. DEUTSCH: Objection, form, and calls
18 for speculation.

19 A. Yeah, I can't speculate, because the analysis
20 I did is contained in the declaration in Paragraphs 53
21 and 54, and it shows the comparison, and it explains
22 "slightly larger," "minimally larger," and it does a
1 comparison of the two patents.

EX2020, 35:12-36:1 (highlighting added); see also Sur-Reply at 4

Grounds 1A-1G

Petitioner failed to show emission and detection regions that cover substantially the same area in Retterath or Weimer

Retterath only discloses that emitters and detectors have common vectors—not area

'381

the device normal to a plane of the array 10. For each emitter/detector set of elements 100/200, the emitter and detector vectors are coincident and form a common on-coincident axis that is at an angle relative to a vector normal to the plane of the array that is unique for that emitter/detector set.

EX1005, 6:23-28 (highlighting added); see also POR at 22-23, 29; EX2009, ¶¶ 133-36; Sur-Reply at 12-13

Retterath

FIELD OF THE INVENTION

The invention relates generally to determining presence and position in a surrounding space of objects that interact with propagating electromagnetic waves. More particularly, the present invention relates to non-scanning LiDAR systems using an array of emitter/detector sets to cover a given field of view that provides for reduced interference due to crosstalk among emitters within a given LiDAR unit and also among different LiDAR units.

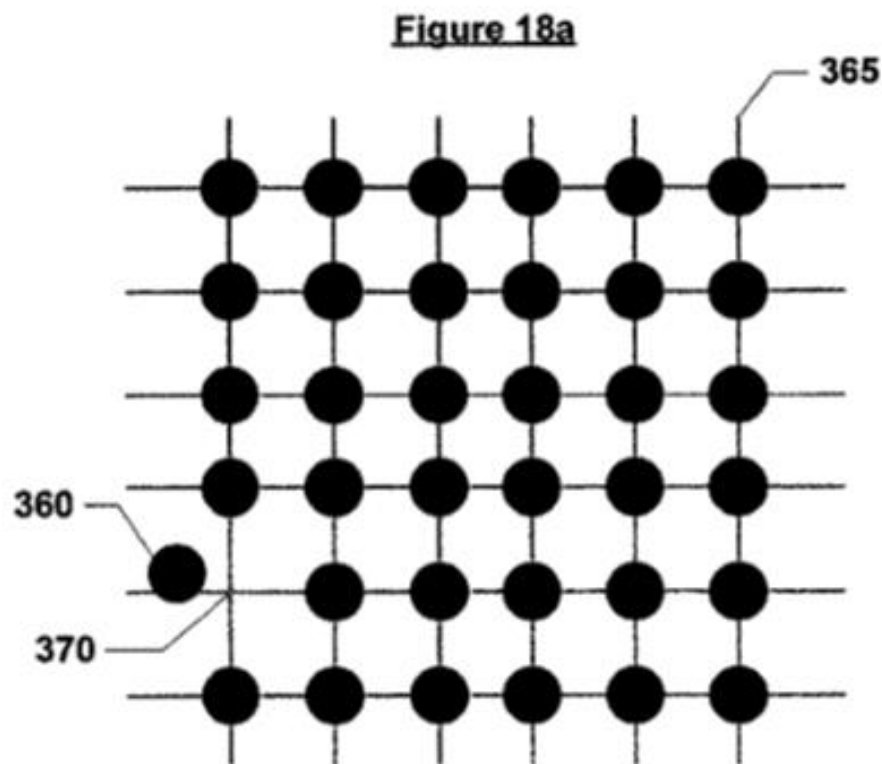
EX1005, 1:5-15 (highlighting added)

'381 patent

the fields of view of the apertures. In particular, the illumination sources are configured to illuminate substantially only surfaces in the field ahead of the system that can be detected by pixels in the system such that minimal power output by the system (via the illumination sources) is wasted by illuminating surfaces in the field for which the pixels are blind. The system can therefore achieve a relatively high ratio of output signal (i.e., illuminating beam power) to input signal (i.e., photons passed to an incident on the pixel array).

EX1001, 3:4-12 (highlighting added)

See also POR at 29-32; EX2009, ¶¶ 133-36; Sur-Reply at 12-13



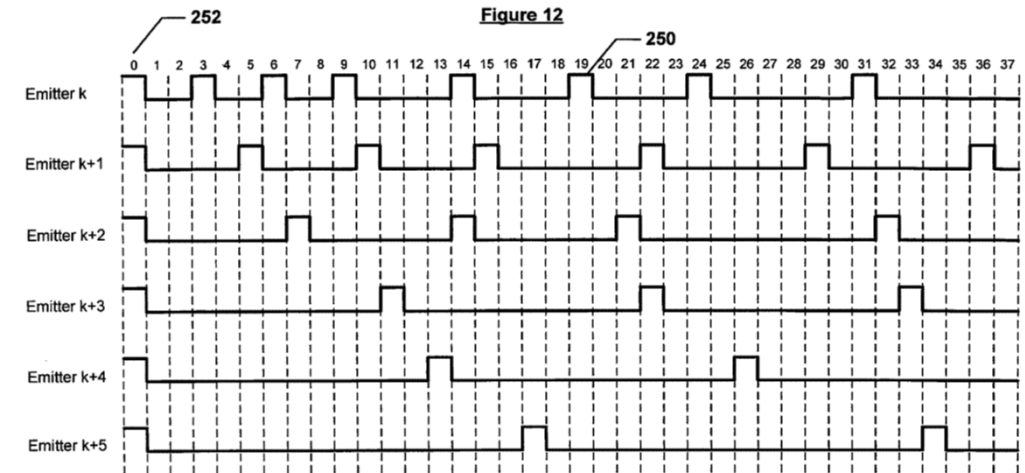
collimated beam 92 has advantages. First, a smaller round spot 94 size will result in fewer locations within the device field of view being illuminated. Since the goal of LiDAR is to measure the distance to a point at a known coincident angle, reducing the number of points that generate a return signal will increase the device's precision. Second, a smaller round spot 94 will generally reduce or remove crosstalk with detectors that are near the on-coincident axis matched detector for this emitter 90. The bottom diagram in FIG. 7 shows

EX1005, Fig. 18a, 9:36-44 (highlighting added); see also POR at 30-31; EX2009, ¶¶ 133-36; Sur-Reply at 12-13

Retterath discloses cross-talk between emitter/detector channels

'381

FIG. 12 illustrates a timing sequence for multiple emitters. A high level **250** indicates the emitter is energized or turned on by the emitter control circuitry. The energizing level is shown for six emitters that have coincident axes similar to one-another. The bit sequences utilize a rotating primes pulse train and 38-bit sequences, and the emitter levels are shown for a time period **252** ranging from 0 through 37. Since the vectors are similar, emitted energy from one emitter will possibly be received at a detector that is not its pair. To accommodate detection of pulse sequences from a detector's paired emitter the pulse sequences shown in FIG. 12 are sparsely populated. The circuitry for each paired detector is configured to detect the pulse sequence from its paired emitter.



EX1005, Fig. 12, 11:26-39 (highlighting added); see also POR at 31-32; EX2009, ¶¶ 133-36; Sur-Reply at 12-13

Petitioner's combination with Weimer does not remedy Retterath's deficiencies

'381

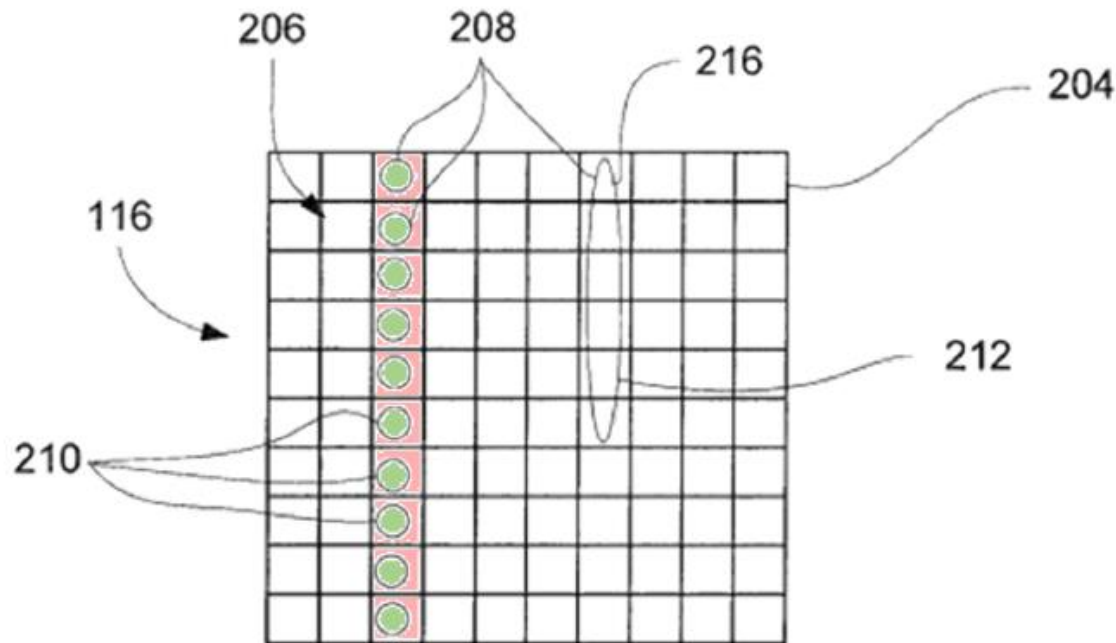


Fig. 2A

reducing the signal to noise ratio. Within the field of view, the goal for good daytime performance has been to have the laser spot size only slightly smaller than the receiver's instantaneous field of view. This requires accurate boresighting of the

EX1008, Fig. 2A, 1:56-59 (highlighting added); see also POR at 32-34; EX2009, ¶¶ 191-97; Sur-Reply at 13-15

Petitioner's improper reply argument re “non-sensitive areas between pixels” in Weimer should be disregarded

'381

PO's faulty theory is not remedied by citation to FIG. 2A of Weimer. PO shades some of the squares pink, assuming a set of square-shaped fields of view with a perfect edge-to-edge relationship. POR, 33. But, this assumes too much, especially where the pixels are behind “receive optics 322” in Weimer's embodiments. EX1008, 10:12-16. Regardless of shape, there would have been a physical boundary or space between adjacent pixels in Weimer's device of FIG. 2A—an ordinary fact of LiDAR detectors that is unrecognized by PO's shading. EX1040, ¶¶34-35. Based on this erroneous shading, PO reaches the erroneous conclusion that the emission beam is “significantly” smaller than the detector field of view. POR, 33.

New theory citing exclusively to Shanley reply declaration

Reply at 13 (highlighting added); see also Sur-Reply at 2-3, 14-15

Petitioner's expert refused to answer basic questions about the untimely new “non-sensitive areas” theory

'381

Q. I'm simply asking, Dr. Shanley, does Figure 2A of Weimer, does Figure 2A show the non-sensitive areas you're discussing at Paragraph 35 of your reply declaration in the '381 IPR?

MR. DEUTSCH: Objection, form; objection, scope.

A. I think it's pretty apparent from my declaration. "In fact, a POSITA would have recognized that there would be non-sensitive areas between pixels (for example, that provide physical separation and reduce crosstalk)," and I think that's pretty obvious. That's my answer.

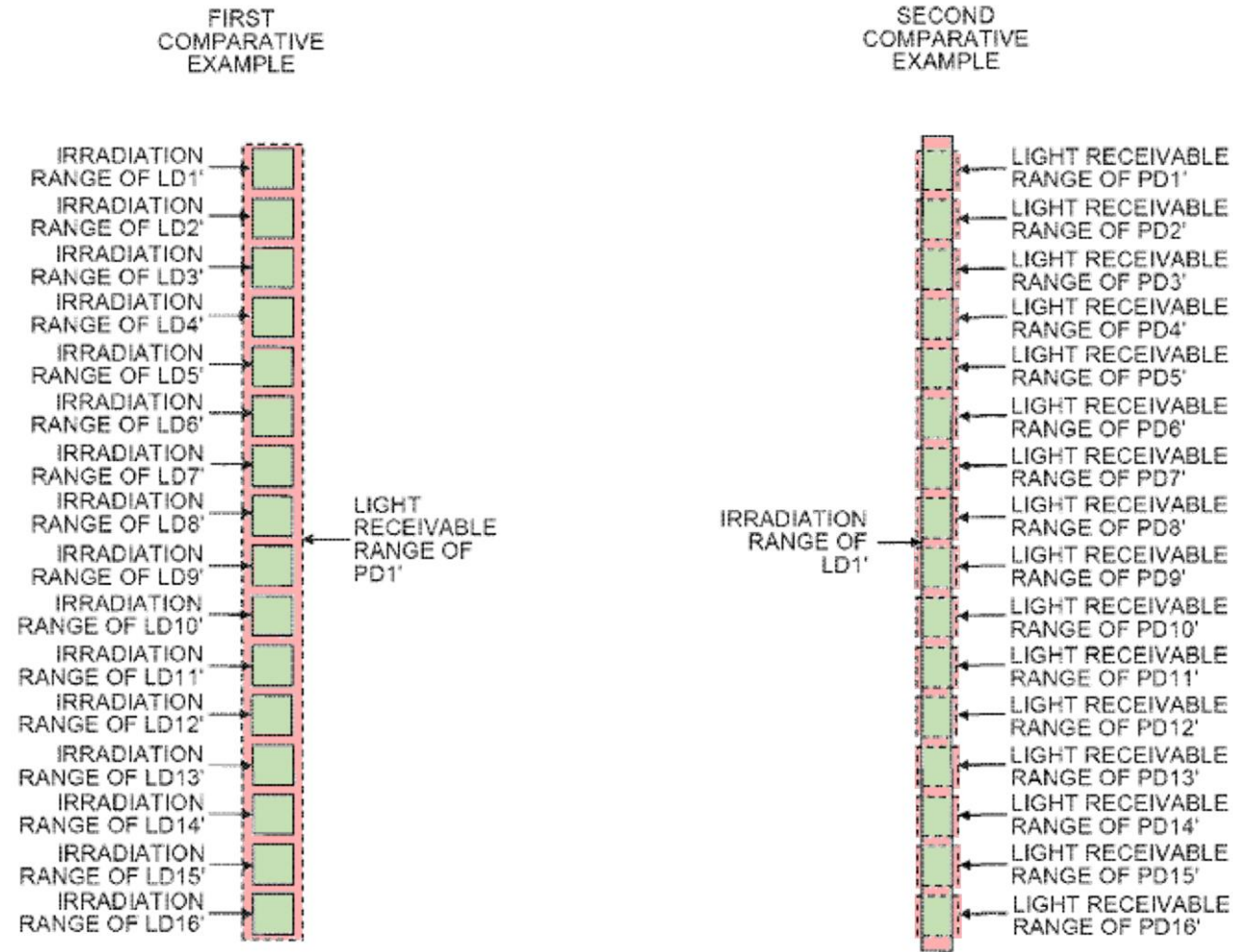
EX2020, 41:10-21; *see also* Sur-Reply at 4, 14-15

Grounds 2A-2C

Petitioner failed to show emission and detection regions that cover substantially the same area in Imai

Imai discloses mismatching emission and detection regions

'381



EX1009, Fig. 7 (highlighting added); *see also id.*, Fig. 5; POR at 51-54; EX2009, ¶¶ 222-28; Sur-Reply at 19-20

Imai

[0101] The irradiation range of each LD is set to be slightly larger than corresponding light receiving ranges of the four PDs. According to this, it is possible to efficiently irradiate the light receivable range, so that a light reception quantity in the light receivable range may be increased and detection accuracy and a detection distance may be improved. It is possible to inhibit deterioration in detection accuracy and detection distance even when the irradiation range and the light receivable range are slightly displaced with each other within a manufacturing error range.

EX1009, ¶ [0101] (highlighting added)

'381 patent

the fields of view of the apertures. In particular, the illumination sources are configured to illuminate substantially only surfaces in the field ahead of the system that can be detected by pixels in the system such that minimal power output by the system (via the illumination sources) is wasted by illuminating surfaces in the field for which the pixels are blind. The system can therefore achieve a relatively high ratio of output signal (i.e., illuminating beam power) to input signal (i.e., photons passed to an incident on the pixel array).

EX1001, 3:4-12 (highlighting added)

See also POR at 51-54; EX2009, ¶¶ 222-28; Sur-Reply at 19-20

Petitioner's alleged new obviousness theory is nothing more than an attempt to backfill

'381

Moreover, beyond Imai's explicit description for the one-to-one correspondence, a POSITA would have been motivated to implement the 16 pixels to each have a field of view coincident with an emission region of a corresponding LD. Regard-

Nothing more than Petitioner's erroneous "any overlap" interpretation of the '381 patent claim language

detection distance. EX1009, [0067-70]; EX1003, ¶¶274-276. Ultimately, a POSITA would have recognized each of pixels 1-16, as provided by the resulting combination, has a light receivable range matched with the irradiation area of a corresponding LD so that light emitted by the corresponding LD is received by the matching pixel. EX1003, ¶276.

No suggestion of substantially the same emission and detection regions

Pet. at 69-70 (highlighting added); see also POR at 51-54; EX2009, ¶¶ 219-228; Sur-Reply at 19-20

Claims 6, 7, and 17

Grounds 1A-1G

6. The optical system according to claim 1 further comprising an aperture layer disposed between the bulk imaging optic and the plurality of pixels and comprising a plurality of apertures separated by a stop region.

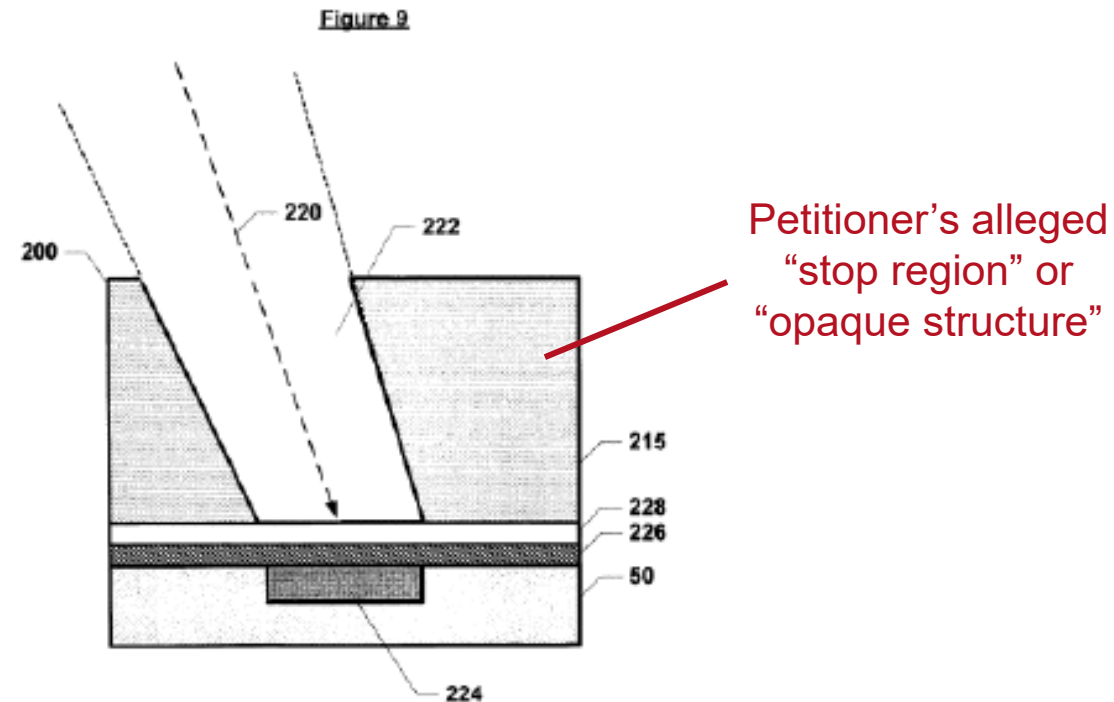
7. The optical system according to claim 6 wherein the aperture layer comprises a thin opaque structure.

17. The optical system according to claim 14 further comprising an aperture layer disposed between the bulk imaging optic and the plurality of pixels and comprising a plurality of apertures separated by a stop region.

EX1001, cls. 6, 7, 17 (highlighting added)

Adjacent apertures are offset by an aperture pitch distance greater than the aperture diameter and substantially similar to the lens pitch distance, and the aperture layer **140** defines a stop region **146** (i.e., an opaque or reflecting region)

EX1001, 4:40-43 (highlighting added); *see also* POR at 21; EX2009, ¶¶ 151-52



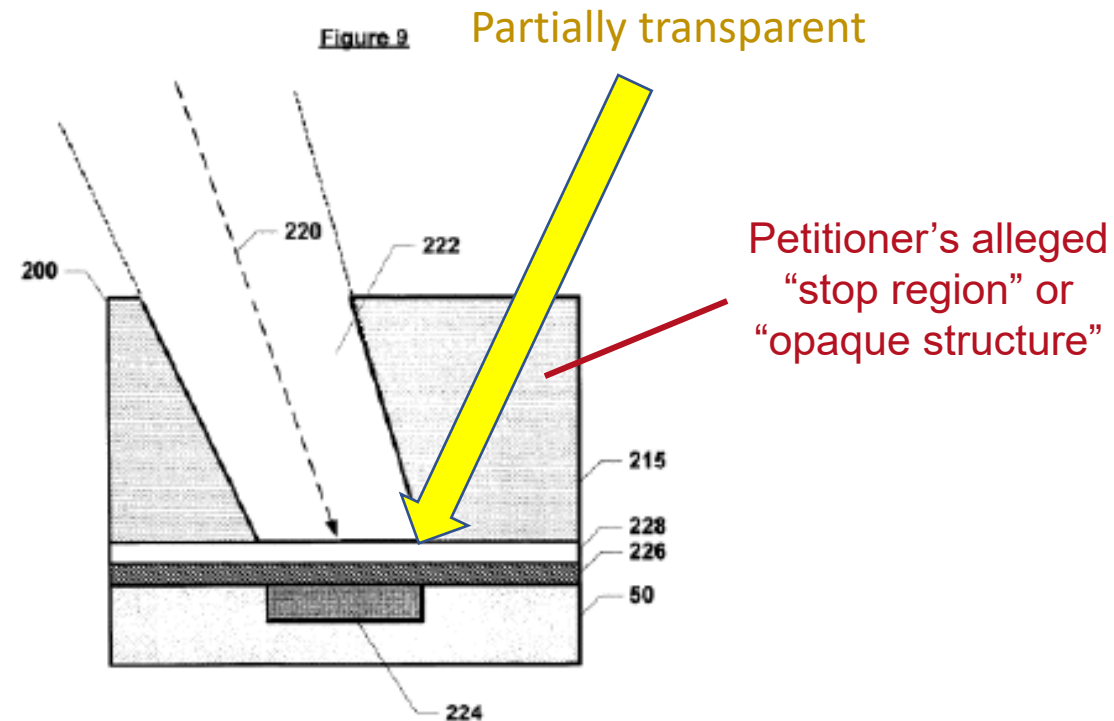
EX1005, Fig. 9 (annotation added); Pet. at 30-31

Retterath's waveguide material only partially blocks light

'381

macro lens. Inbound optical energy that is more than slightly-non-parallel to the receive detector vector (coincident axis) **220** will be substantially blocked by the detector waveguide or directed elsewhere by the macro lens. For

EX1005, 9:62-65 (highlighting added); *see also* POR at 43-50; EX2009, ¶¶ 147-60; Sur-Reply at 11-12



EX1005, Fig. 9 (annotations added); see also POR at 43-50; EX2009, ¶¶ 147-60; Sur-Reply at 11-12

A partially transparent layer is not “opaque” or a “stop region”

'381

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HESAI TECHNOLOGY CO., LTD.
Petitioner

v.

OUSTER, INC.
Patent Owner

Case IPR 2023-01456
U.S. Patent No. 11,178,381
Issue Date: November 16, 2021

Title: SPINNING LIDAR UNIT WITH MICRO-OPTICS ALIGNED BEHIND
STATIONARY WINDOW

DECLARATION OF JASON A. JANÉ, PH.D.

Ouster Exhibit 2009
IPR2023-01456 - Page 001

150. Retterath's waveguide material 215 is not a “stop region.” Rather, Retterath discloses that waveguide material 215 is at least partially transparent to certain light, as shown in the below demonstrative diagram:

157. Retterath's waveguide material 215 is not opaque. Rather, Retterath discloses that waveguide material 215 is at least partially transparent to certain light, as shown in the below demonstrative diagram:

EX2009, ¶¶ 150, 157

Petitioner's expert agreed that an opaque structure is not transparent to certain light

'381

My question is, is layer 215 still opaque if light can get through that layer?

MR. DEUTSCH: Objection. Scope. Form.

A. Yeah, I mean, it's – it depends.

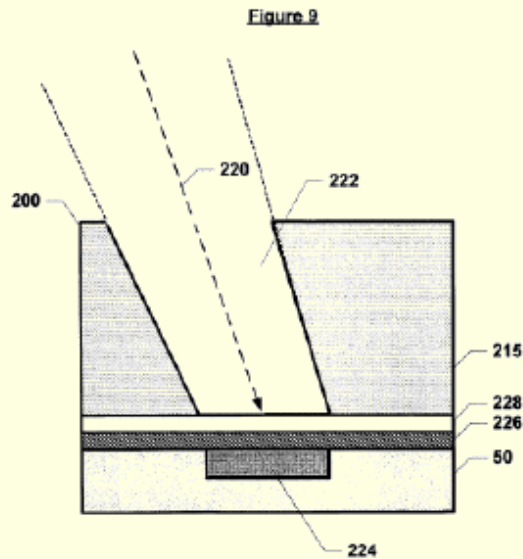
Light is a funny thing. It's like water basically, I mean, referred to in an optical system. It can go the strangest places. When you think you've designed an optical system that's the best you can do, and all of a sudden you get your stray light analysis and you go, oh, my God, and you've got to go back and do all of these supernatural things.

Would it happen? I highly doubt it. Could it happen? I guess it could. But if it's an opaque material, it shouldn't, and if you choose your material right, it shouldn't.

EX2010, 76:1-18 (highlighting added); see also POR at 45; EX2009, ¶ 152

A POSITA would not have been motivated to combine Hipp's “shadow mask” with Retterath and Borowski

'381

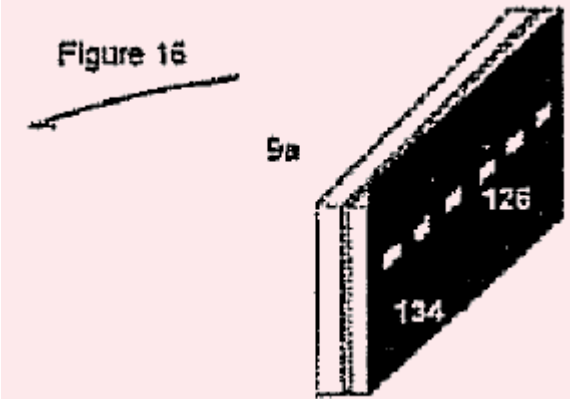


Retterath

+

SPADs

+



Hipp

EX1005, Fig. 9; EX1007, Fig. 16; POR at 47-49; EX2009, ¶¶ 165-70

A POSITA would not have been motivated to combine Hipp's shadow mask with SPADs

'381

SPADs

Per Petitioner's expert

55. Because LiDAR systems are designed to detect information about objects and environments outside of the system, there is a high potential for noise and interference to affect the system—specifically, in the form of light that gives rise to erroneous measurements. Noise and interference can affect the sensitivity of the system—for example, the ability of the LiDAR device to accurately detect objects at longer ranges, or in poor weather conditions. They may be particularly problematic in systems that employ SPADs, because even a single errant photon may cause a false positive detection, while also rendering the SPAD inoperable until it is quenched. Two particularly well-known noise conditions affecting LiDAR systems are stray light and cross-talk.

EX1003, ¶ 55 (highlighting added); see also EX2009, ¶¶ 166-70

Hipp

However, some of the light which passes through the holes of the shadow mask could be reflected by the APD and be reflected back from the lower side of the shadow mask and also still be scattered under certain circumstances. After approximately a two-fold reflection to and fro, this light would be able to reach the adjacent active zones and act as an interference signal there. This effect can be reduced in that the

EX1007, 22:1-7 (highlighting and emphasis added); see also POR at 47-49; Sur-Reply at 16; EX2009, ¶¶ 166-70

Petitioner failed to acknowledge Hipp's noise issues until reply—and its attempt to backfill should be disregarded

'381

Petition

Retterath describes tightly controlled beam spots and precise alignment of emitters and detectors. EX1005, 9:29-44, 9:59-65, 10:47-49. Hipp complements Retterath through its teaching of a shadow mask to avoid interference between pixels in a detector array. EX1007, 21:57-67. The shadow mask of Hipp provides an enhanced mechanism to block unintended photons from reaching a pixel—an express goal of Retterath. EX1005, 9:41-59. In the resulting system, a shadow mask in accordance with Hipp would have been utilized together with Retterath's macro detector lens 230, in addition or as an alternative, to a waveguide. EX1003, ¶208.

Pet. at 40 (highlighting added)

Reply

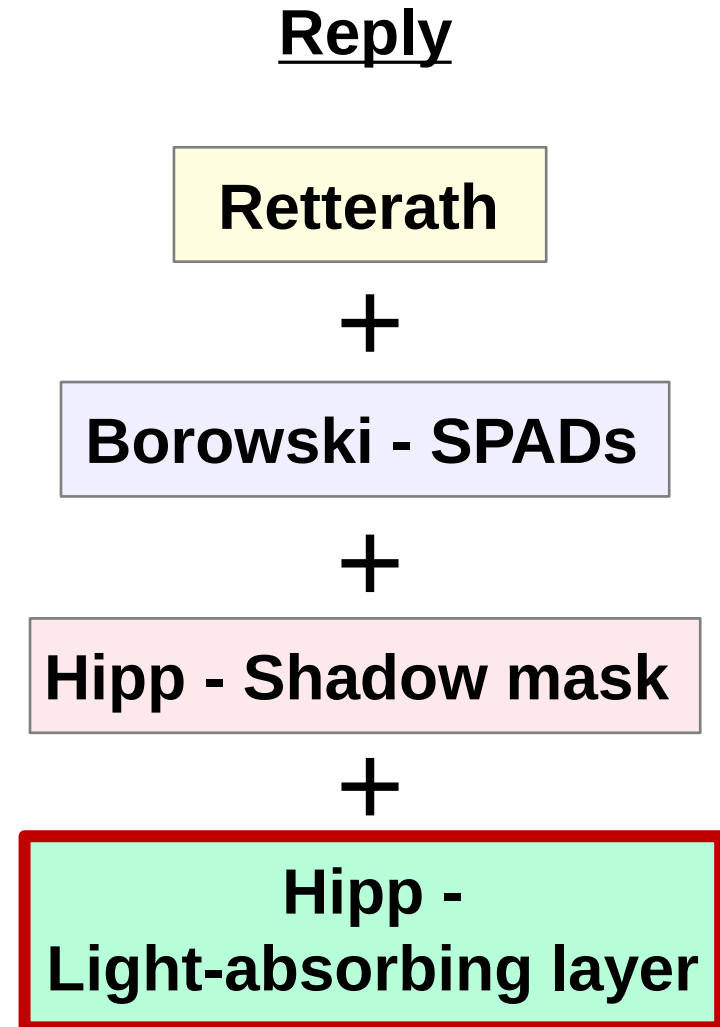
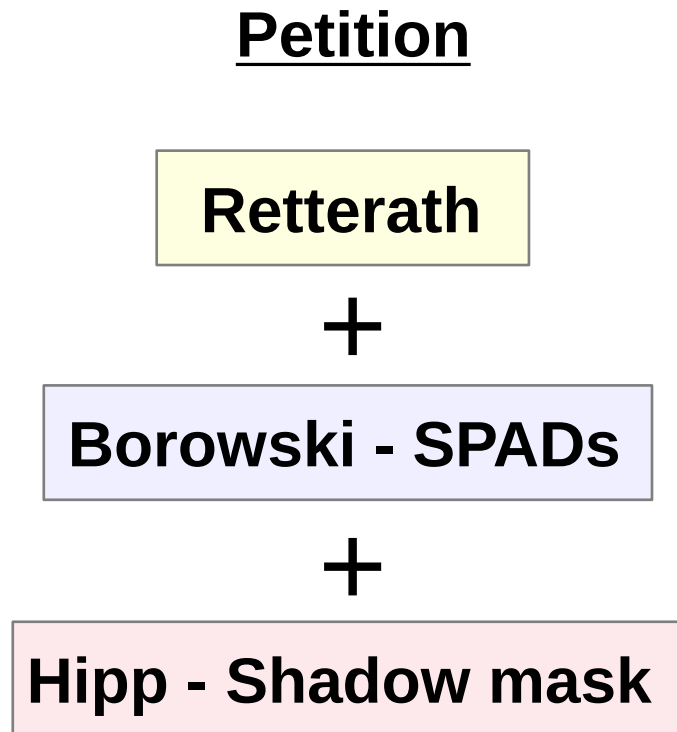
The fulsome obviousness analysis set forth in the Petition is not undermined by PO's assertions that the combination presents "risk of interference from light scattered by the underside of Hipp's shadow mask." POR, 48-49. Hipp not only acknowledges this potential scenario but offers the traditional solution in which "the rear side of the carrier glass is provided with a layer of material absorbing signal light"—a solution applicable regardless of detector type. EX1007, 22:7-10; *see also* EX1003, ¶107, 214; EX1040, ¶¶49-50.

New light-absorbing
layer theory

Reply at 20 (highlighting added); *see also* Sur-Reply at 16

Petitioner failed to acknowledge Hipp's noise issues until reply—and its attempt to backfill should be disregarded

'381



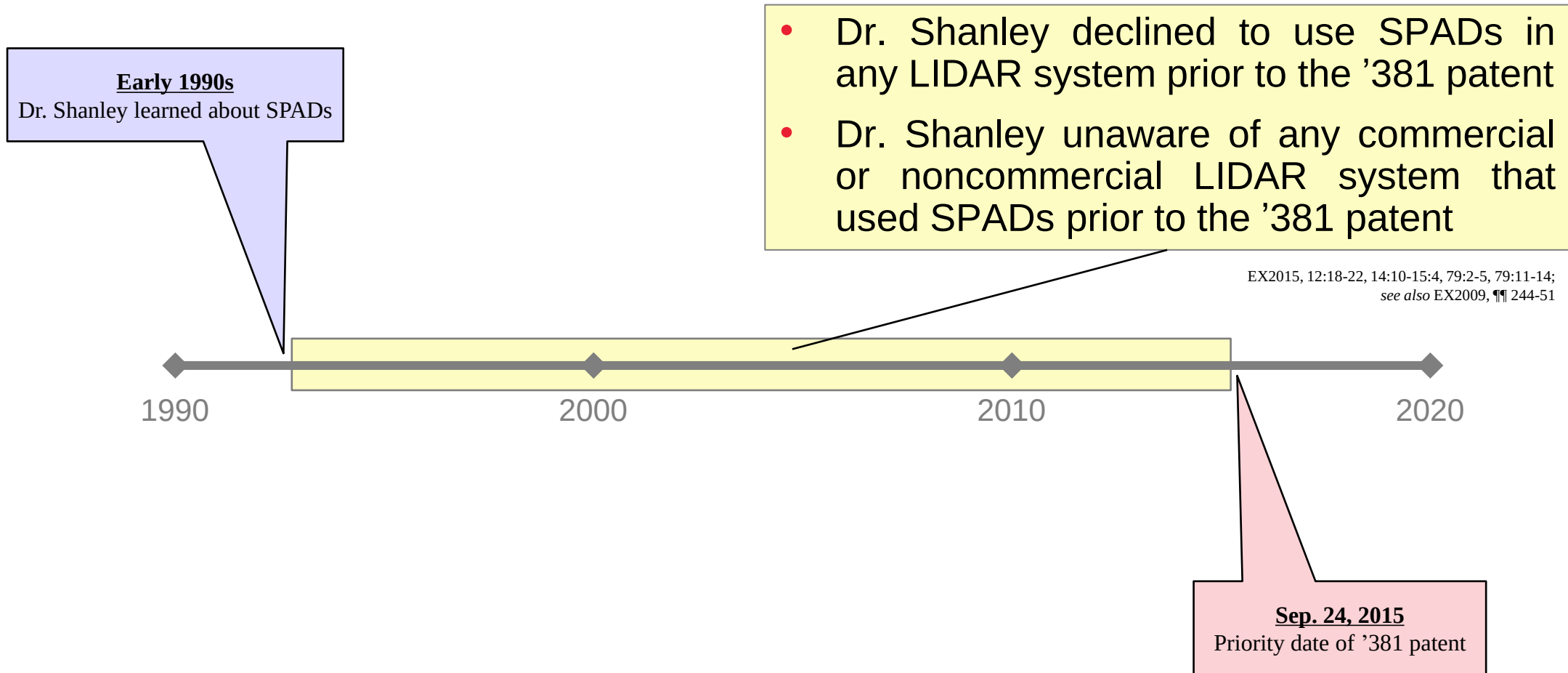
Pet. at 40 (highlighting added); Reply at 20 (highlighting added); see also Sur-Reply at 16

OUSTER, INC. – DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Secondary Considerations of Nonobviousness

Industry skepticism

'381



Evaluation of performance of silicon photomultipliers in LIDAR applications

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ABSTRACT

Silicon Photomultipliers (SiPMs) are a well-recognized new generation of photon number resolving avalanche photodetectors. Many advantages – a high gain with an ultra-low excess noise of multiplication, multi-panel architecture, relatively low operating voltage – make SiPMs very competitive in a growing number of applications. Challenging demands of LIDAR applications for a receiver having high sensitivity starting from single photons, superior time-of-flight resolution, robustness including surviving at bright light flashes, solid-state compactness and more, are expected to be feasible for the SiPMs. Despite some known drawbacks, namely crosstalk, afterpulsing, dark noise, limited dynamic range, SiPMs are already considered as promising substitutes for conventional APDs and PMTs in LIDAR applications. However, these initial considerations are based on a rather simplified representation of the SiPM as a generic LIDAR receiver described by generic expressions.

This study is focused on a comprehensive evaluation of a SiPM potential considering essential features of this new technology, which could affect applicability and performance of SiPMs as LIDAR receivers. Namely, an excess noise due to correlated processes of crosstalk and afterpulsing, are included into account utilizing the well-established framework of analytical probabilistic models. The analysis of SiPM performance in terms of a photon number and time resolution clarifies their competitiveness over conventional APD and PMT and anticipates the development of next SiPM generations.

Keywords: silicon photomultiplier, SiPM, LIDAR, SNR, time resolution, analytical model

1. INTRODUCTION

Nowadays a SiPM is a well-established new generation of photodetectors widely recognized due to their unique advantages with respect to conventional PMT, linear mode APD, and Geiger mode APD in photon number resolving detection of low-level light pulses. An initial SiPM generation has been developed in Russia starting from basic research of an avalanche breakdown with negative feedback in Metal-Insulator-Semiconductor structures in 1970s-1980s [1-3]. R&D of Metal-Resistor-Semiconductor structures as operational SiPM prototypes in 1980s-1990s [4-5], and development of the most feasible, reliable, efficient and thus popular design of a modern conventional SiPM as a matrix of independent GM APD cells with polysilicon quenching resistors with common output in 2000s [6-7]. Some more details on the R&D of SiPMs could be found elsewhere, for example, the author's point of view is expressed in [8].

Most of the SiPM application studies during the 2000s were focused on a detection of scintillation and Cherenkov light pulses in high energy particle physics, astrophysics, and nuclear medicine, especially positron emission tomography, as discussed in [6-7] and [9]. However, the feasibility of a LIDAR receiver based on SiPM technology has been undisclosed till the 2010s, even if some SiPM developers (Semul, Amplification Technologies) mentioned LIDAR as a target application for their SiPMs on the corporate web pages much earlier. So, this application area is rather new, and just a few papers reported on studies in it as discussed below.

To the best of author's knowledge, first experimental studies on SiPM feasibility as a LIDAR receiver have been started

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Photon Counting Applications 2017, edited by Ivan Prochadka, Roman Sobolewski, Ralph B. James, Proc. of SPIE Vol. 10229, 102290L, © 2017 SPIE, CCC code: 0277-786X/17/\$18 doi: 10.1117/12.2259435

Proc. of SPIE Vol. 10229 102290L-1

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“Therefore, to the best of the author’s knowledge, there are **no attempts either to implement SPAD arrays** or dSiPMs as a single photon number resolving LIDAR receiver or to combine an array of SPAD arrays or dSiPMs as a focal plane array of photon number resolving detectors **in 3D imaging LIDARs**. In this situation, detailed analysis of the SPAD-based receivers is out of the scope of this paper.”

EX2012 at 4 (emphasis added) (published 2017); see also EX2009, ¶¶ 252-54

Petitioner's attempt to discredit PO's secondary considerations evidence is unsupported

'381



WBIP v. Kohler

829 F.3d 1317, 1330-31 (Fed. Cir. 2016)

“[T]he fact that an isolated feature may be present in the prior art may not render irrelevant objective evidence of non-obviousness of that feature in the claimed combination.”

Sur-Reply at 23

POSITA Dispute

Petitioner

The evidence here confirms that a person of ordinary skill in the art at the time of the Critical Date of the '381 patent (a "POSITA") would have had an undergraduate degree in mechanical or electrical engineering or physics, plus 2-3 years of experience in LiDAR design. EX1003, ¶72-77.

Pet. at 3 (highlighting added)

Patent Owner

Patent Owner submits that a POSITA would have had an undergraduate degree in mechanical or electrical engineering and two to three years of work experience with electro-optical and electro-mechanical devices or systems, with, at a minimum, at least one year of work experience was with LIDAR designs, where less work experience may be compensated by a higher level of education or vice versa. (EX2009, ¶60.)

POR at 4 (highlighting added)

Dr. Janét's CV confirms he meets either party's POSITA definition

'381

Petitioner

Undergrad degree in mechanical or electrical engineering or physics	✓
2-3 years work experience in LIDAR design	✓

PO

Undergrad degree in mechanical or electrical engineering	✓
2-3 years work with electro-optical and electro-mechanical devices or systems	✓
>=1 year work experience with LIDAR designs	✓

Education

- Ph.D. Electrical & Computer Engineering, North Carolina State University, 1998
- M.S. Integrated Manufacturing Systems Engineering, North Carolina State University, 1994
- B.S. Mechanical Engineering, University of Virginia, 1990

ONR/USMC Cargo UGV – PM for ONR/USMC-sponsored Cargo Unmanned Ground Vehicle (CUGV) Program subcontract (2011-2012). Manage team of engineers and scientists, in coordination with contract prime (Oshkosh) for unmanned combat vehicle control, perception and navigation. Multi-sensor suite included EO/IR Vision, LIDAR, IMU, and GPS.

Army LTL – PM for Army-sponsored Lighten-the-Load (LTL) Program subcontract (2012-2013). Manage team to develop perception system comprised of stereo EO and stereo LWIR cameras to find and track leader(s), perform optical odometry, detect and map obstacles, and enhance SIGINT. Interface with sensors (LIDAR, IMU, GPS), autonomy for ATV-sized unmanned ground vehicles.

EX2009, Ex. A at 1-2 (highlighting added); see also EX2009, ¶¶ 1-22

Year of LIDAR design experience in 1995-98 timeframe

Q Well, setting aside the specific man-hours, do you know if that LiDAR design or LiDAR building project, was that something you worked on over the span of weeks? Months? Years?

MR. LAUPPE: Object to form, scope.

A I would say it spanned at least a year. I don't know if it crossed the two-year threshold at that point.

Work on LIDAR as Duke professor (1999-2021)

But not everything is listed of the projects that I oversaw. But you may notice under Duke University and possibly at NC State University it's listed. But at both places the courses that I taught were project intensive, building, operating, utilizing in some way, shape or form robotics, and that included, I would say, a good portion of those were mobile robots and a good portion of those mobile robots had LiDAR systems on them of various types. Again, some were your bigger kind of off-the-shelf systems that came along I would say later in the 2010s time frame. Some of them were just early stage laser range finder bolted on something that scans and try to extract meaningful information from it.

Work with LIDAR for DARPA Grand and Urban Challenge

But among other things, we participated in the DARPA Grand and Urban Challenge, challenges plural I should say. And I believe the first one that we participated in the Grand Challenge we didn't really have a commercial off-the-shelf LiDAR option. But subsequent challenges, especially and including the Urban Challenge, we did. When we could buy them off-the-shelf we did, so it was more of an integration and an application and a post-signal processing effort, not necessarily working at the optics and emitter detector level.

But when we were looking at fielding both of the red team vehicles for the Grand Challenge, the first Grand Challenge, we fitted one with a radar system and we made efforts to fit the other with a LiDAR variant. And I'm trying to remember what was around at the time, I think it was called Regal. I could have the name wrong. And but -- but didn't get great results from that.

EX2019, 24:15-22, 27:17-28:9, 33:3-21; see also Sur-Reply at 24-27

'750 patent
Issues overlapping with
'381 patent

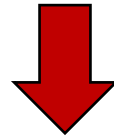
Claim 44

“Electromagnetic radiation
output from...” claim
construction

44. An optical imaging system comprising:
- a plurality of pixels arranged behind the bulk imaging optic, wherein each pixel in the plurality of pixels comprises a plurality of single photon avalanche diodes (SPADs) and has a field of view that is non-overlapping beyond a threshold distance in a field external to the optical imaging system with fields of view of all other pixels in the plurality of pixels, and wherein the plurality of pixels includes at least a first pixel and a second pixel;
 - a plurality of emitters arranged to project electromagnetic radiation through the bulk transmitting optic and into the field according to an illumination pattern where electromagnetic radiation output from each emitter in the illumination pattern is coincident with a field of view of a corresponding pixel in the plurality of pixels.

EX1001, cl. 44 (highlighting added)

“electromagnetic radiation output from each emitter in the illumination pattern is coincident with a field of view of a corresponding pixel in the plurality of pixels”



“electromagnetic radiation output from each emitter in the illumination pattern and the field of view of a corresponding pixel **cover substantially the same area in the field**”

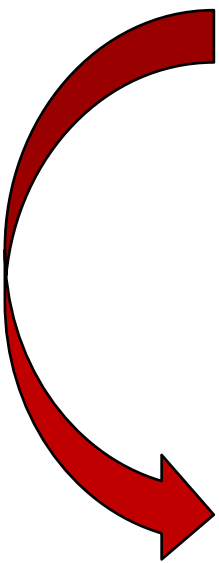
EX1001, cl. 44; POR at 24-30; EX2009, ¶¶ 105-119; Sur-Reply at 5-10

- Same specification between '381 and '750 patents
- As for the '381 patent, **none** of Petitioner's grounds teach emission and detection regions that are substantially the same:
 - Retterath-based grounds (Grounds 1A-1D)
 - Imai-based ground (Ground 2)
 - Weimer-based ground (Ground 3)

Claim 44
“stop region”

44. An optical imaging system comprising:

an aperture layer disposed between the bulk imaging optic and the plurality of pixels, the aperture layer comprising a plurality of apertures separated from each other by a stop region, the plurality of apertures including a first aperture disposed in a first optical path extending between the bulk imaging optic and the first pixel and a second aperture disposed in a second optical path extending between the bulk imaging optic and the second pixel;



As discussed for '381 patent claims 6 and 17, the Retterath-based grounds do not satisfy this limitation

EX1001, cl. 44 (highlighting added); POR at 19-24; EX2009, ¶¶ 126-31, 159-64; Sur-Reply at 12-14

Claim 44
“adjacent to”

44. An optical imaging system comprising:

a bulk imaging optic;

a bulk transmitting optic disposed adjacent to the bulk imaging optic; and

As discussed for the '381 patent, neither the Retterath nor Imai-based grounds satisfy this limitation

- Secondary considerations of nonobviousness
- POSITA dispute

POR at 54-58; Sur-Reply at 23-27; EX2009, ¶¶ 1-22, 220-232, Ex. A

Claim 44
“threshold distance”

44. An optical imaging system comprising:

a plurality of pixels arranged behind the bulk imaging optic, wherein each pixel in the plurality of pixels comprises a plurality of single photon avalanche diodes (SPADs) and has a field of view that is non-overlapping beyond a threshold distance in a field external to the optical imaging system with fields of view of all other pixels in the plurality of pixels, and wherein the plurality of pixels includes at least a first pixel and a second pixel;

EX1001, cl. 44 (highlighting added)

Petitioner's expert could not identify a "threshold distance" in any of the grounds

'750

Retterath

Q. What is the threshold distance Retterath discloses?

A. I would have to go and look at Retterath. I don't think it's absolutely designed as an absolute number on it. So I can't be certain.

EX2010, 56:6-11 (highlighting added)

Imai

Q. So what is the threshold distance you're referring to here for the Imai, Higashi, Grzesik combo?

MR. DEUTSCH: Objection. Form.

A. I think that's just the projection distance that I'm referring to so that you have individual beams. So it's not a quantifiable number.

EX2010, 99:15-22 (highlighting added)

Weimer

Q. And then if you move down to Paragraph 271, discussing Weimer, do you see that you say, "Each pixel in the plurality of pixels has a field-of-view that is non-overlapping beyond a threshold distance in a field external to the optical imaging systems with fields of view of all other pixels in the plurality of pixels"?

A. Yes.

Q. And what is that threshold distance that you're referring to there?

MR. DEUTSCH: Objection. Form.

A. I can't quantify that.

EX2010, 114:21-115:11 (highlighting added)

See also POR at 40-41, 50, 53-54

Patent Owner's expert testified that the asserted prior art is missing "threshold distance" disclosures of the '750 patent

'750

Q. Does the '750 patent identify a number for a threshold distance?

MR. LAUPPE: Object to form.

THE WITNESS: Unlike Retterath, the '750 patent describes how a person of ordinary skill would arrive at a number.

EX1041, 91:12-17 (highlighting added); *see also* Sur-Reply at 12

Petitioner's untimely reply arguments regarding “threshold distance” should be disregarded

'750



Intelligent Bio-Sys. v. Illumina Cambridge

821 F.3d 1359, 1369 (Fed. Cir. 2016)

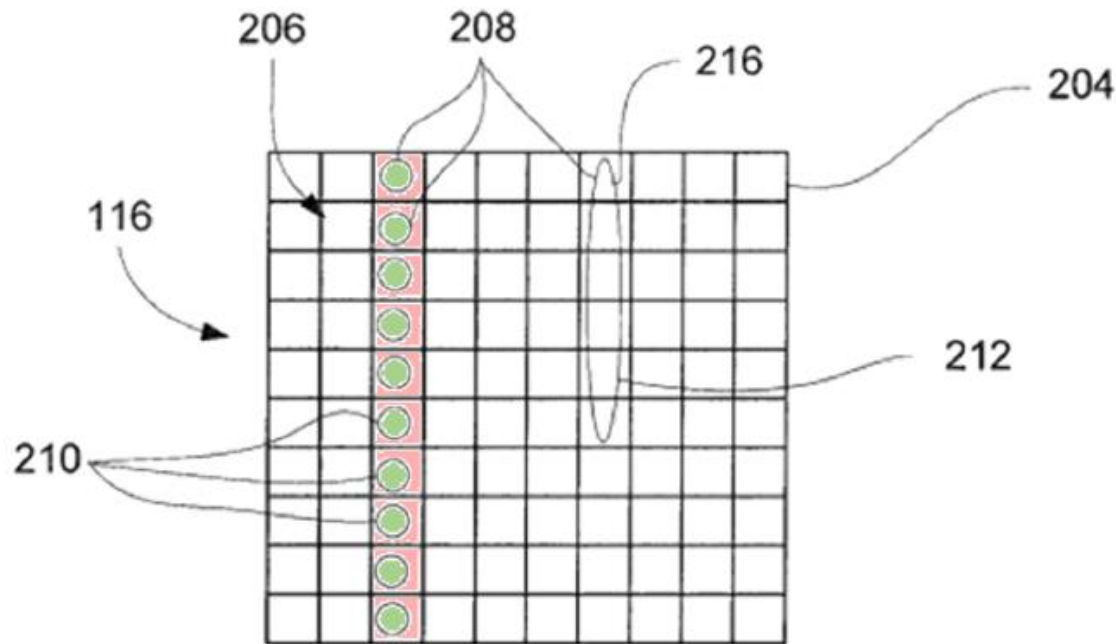
“It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the **initial petition identify ‘with particularity’** the ‘evidence that supports the grounds for the challenge to each claim.’ 35 U.S.C. § 312(a)(3).”

Sur-Reply at 2-3

Ground 3 Weimer

Weimer does not satisfy the “electromagnetic radiation...” limitation as properly construed

750



reducing the signal to noise ratio. Within the field of view, the goal for good daytime performance has been to have the laser spot size only slightly smaller than the receiver's instantaneous field of view. This requires accurate boresighting of the

EX1008, Fig. 2A, 1:56-59 (highlighting added); see also POR at 34-35; EX2009, ¶¶ 155-58; Sur-Reply at 15-17

44. An optical imaging system comprising:
a bulk imaging optic;
a bulk transmitting optic disposed adjacent to the bulk imaging optic; and

Petition

(e) *Element 44(e)*

The Weimer-Borowski-Hipp combination provides a bulk transmitting optic (e.g., transmit optic 318) that transmits light beams 208 to the surrounding environment and disposed adjacent to the bulk transmit optic 31:

No bulk imaging optic
is identified

There is no element 31
in Weimer

The petition's missing element is also missing from the accompanying expert declaration

'750

44. An optical imaging system comprising:

a bulk imaging optic;

a bulk transmitting optic disposed adjacent to the bulk imaging optic; and

Shanley Declaration

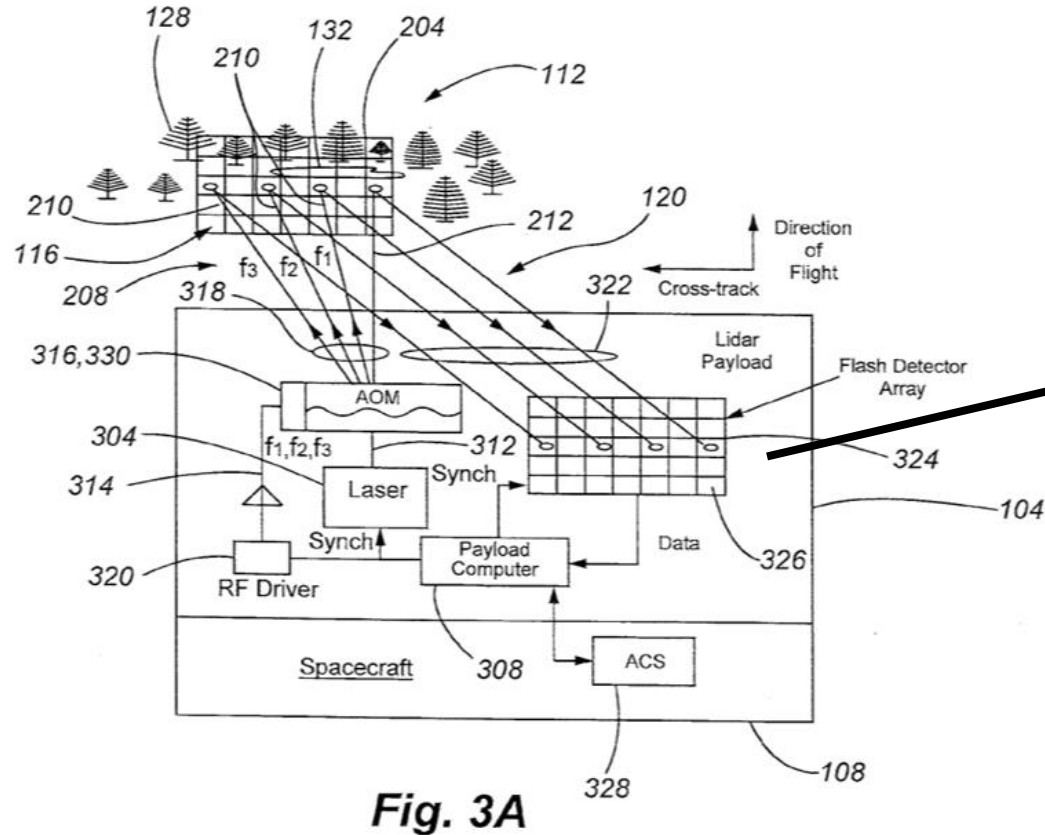
277. As I have explained above, *supra* Section X.D-E, XI.F.1, in the Weimer-Borowski-Hipp combination, Weimer provides a bulk transmitting optic (e.g., transmit optic 318) that transmits light beams 208 to the surrounding environment and disposed adjacent to the bulk transmit optic 31:

No bulk imaging optic
is identified

There is no element 31
in Weimer

On reply, Petitioner attempts to backfill using apparent spatial relationships in an unreliable figure

'750



EX1008, Fig. 3A

Petitioner's Expert:

Q. Sure. Is Figure 3A of Weimer to scale?

A. I wouldn't – I have no idea.

EX2010, 108:18-20

See also POR at 50-51; EX2009, ¶¶ 208-211