

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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HESAI TECHNOLOGY CO., LTD.  
Petitioner

v.

OUSTER, INC.  
Patent Owner

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Case No. IPR2023-01421  
U.S. Patent No. 11,175,405

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**PATENT OWNER'S  
PRELIMINARY RESPONSE  
UNDER 37 C.F.R. §42.107**

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The Board should not institute *inter partes* review of claims 21 or 23-34 (the “challenged claims”) of U.S. Patent No. 11,175,405 (the “’405 patent”).

## **I. OVERVIEW**

Ouster’s ’405 patent describes and claims an innovative technology that has transformed the burgeoning field of light detection and ranging (“LIDAR”). Hesai now attacks Ouster’s patent using impermissible hindsight, unsupportable assertions by Hesai and its expert, and claim constructions that directly contradict Hesai’s litigation positions regarding the meaning of the claims. The Board should deny review as to all of Hesai’s four asserted grounds.

Ouster was founded in 2015 to pursue a new and innovative approach to LIDAR design. Prior to Ouster, the conventional wisdom viewed a strong signal and a high signal-to-noise ratio as substantial contributors to a successful design. As a result, conventional LIDAR devices prior to 2015 combined a high wattage laser emitter with APD sensors able to filter out all but the strongest signals. Ouster, however, demonstrated that with the right optical design, a LIDAR sensor could combine low-power vertical-cavity surface-emitting lasers (“VCSELs”) and single-photon avalanche diodes (“SPADs”). The considerable optical requirements of this highly efficient, accurate, and low-cost emitter-detector pairing has led to the unique optical design of Ouster’s sensors. Ouster’s sensors incorporate bulk optics, microoptics, and apertures in an optical system design that pairs VCSELs with

SPAD detector pixels in a one-to-one arrangement. Ouster’s design yields a smaller and more compact sensor, reduces cross-talk and background noise, and improves the ability to record an image at a distance in detail including because of the outstanding quality of the optical beam produced by VCSEL lasers. Ouster’s technology is an integrated package of innovative emitter, detector, and optical elements.

Hesai now seeks to challenge Ouster’s technology by assembling disparate components into an *a la carte* approach to LIDAR systems, ignoring the difficult reality of designing systems that rely on lower-power VCSELs and SPADs. Using impermissible hindsight and *ipse dixit* assertions, Hesai pieces together four grounds based around two main obviousness combos—Pacala-Droz and Hall-Borowski-Spector—with no reasonable likelihood of success. Hesai’s asserted prior art references teach away from each other, lack elements that cannot be papered over by Hesai’s petition and its accompanying conclusory expert declaration, and contemplate combinations of elements that defy common sense.

Further, Hesai’s petition ignores claim construction positions Hesai has taken in prior litigation between Ouster and Hesai. In 2023, Ouster brought a Section 337 investigation against Hesai before the International Trade Commission (ITC)—*Certain Lidar (Light Detection and Ranging) Systems and Components Thereof*, Inv. No. 337-TA-1363—in which Ouster asserted the challenged claims of the ’405

patent. In that investigation, Hesai initially proposed so many terms for claim construction—a total of **60 terms**, including *10 terms* for the '405 patent—that the ITC Staff requested that Hesai drop terms for construction, lest Hesai violate the procedural limit on the number of terms that can be proposed for construction. (Ex. 2005.) Now, in a drastic reversal, Hesai asserts in its petition that it “does not believe any terms require construction.” (Pet. at 12.) Further, Hesai’s petition and accompanying expert declaration completely ignore at least one of its ITC proposed constructions—for the term “aperture”—without even attempting to provide evidence that such a construction is met. Hesai should not be rewarded for shifting positions to whatever is convenient before a particular tribunal.

Hesai’s selective approach to claim construction is just the latest in a long line of inconsistent positions Hesai has taken before different forums. For example, Hesai’s filing of IPRs against Ouster’s patents come after Hesai argued before the ITC—leading to termination of the investigation—that Hesai and Ouster’s dispute over patents, including the patent Hesai challenges here, must be arbitrated.<sup>1</sup> Arbitration between the parties proceeds, but now Hesai has apparently changed its tune and decided that a non-arbitration panel—the Board—should decide this

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<sup>1</sup> It should be noted that Ouster denies that the parties are subject to an arbitration agreement. The ITC has referred the question of a duty to arbitrate to arbitration.

dispute between the parties.

Hesai clearly recognizes Ouster as the vanguard of LIDAR technology. Two of Petitioner's grounds (Grounds 1 and 2) cite as the primary reference a patent publication listing the same first-named inventor as the '405 Patent: Angus Pacala, Ouster's CEO and Co-Founder. The other two grounds (Grounds 3 and 4) cite as the primary reference a patent listing as first-named inventor David S. Hall—founder of Velodyne, which merged with Ouster this year. Even in its attempt to challenge Ouster's patent, Hesai is unable to escape Ouster's orbit.

The Board should deny review of all of Hesai's asserted grounds.

## **II. BACKGROUND**

### **A. Level of Ordinary Skill in the Art**

For the limited purpose of this Preliminary Response, Patent Owner adopts Petitioner's definition of a POSITA as having an undergraduate degree in mechanical or electrical engineering or physics and two to three years of experience in LIDAR design. (Pet. at 12.)

### **B. Specification Overview**

The '405 patent sought to improve narrowband imagers that “collect[] light within a limited wavelength range.” (Ex. 1001, 1:34-35.) The '405 patent discloses that “[c]urrent narrowband imagers have either a small field-of-view or are limited in their ability to filter wavelength bands narrower than around 50 nm.” (*Id.*, 1:51-53.) “Optical filters are sensitive to the angle of incident light,” but

“[c]onstricting the angle of light incident upon the photodetector usually requires using a lens with a longer focal length, which constricts the field-of-view[.]” (*Id.*, 1:53-64.) One application of narrowband imagers is LIDAR systems, for which “it is beneficial for physical sizes of transmitters and receivers to [be] small and compact, and at the same time relatively low in cost.” (*Id.*, 2:29-31.) The ’405 patent discloses that micro-optical systems can be used for LIDAR, but “[m]icro-optical receivers arrayed adjacent to each other are susceptible to cross-talk.” (*Id.*, 2:39-41.)

The ’405 patent discloses embodiments of “wide field-of-view, narrowband imaging with micro-optic receiver channel arrays that minimize cross-talk and allow tight spectral selectivity that is uniform across the receiver channel array.” (*Id.*, 2:63-67.) One exemplary embodiment is shown in Figure 2 of the ’405 patent:

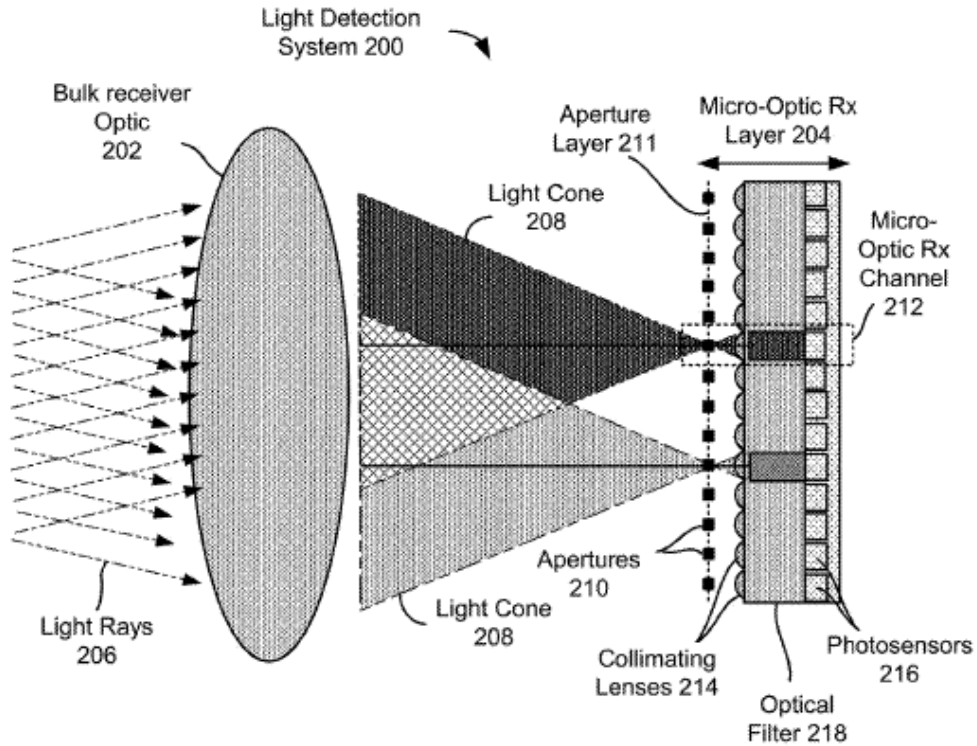


**FIG. 2**

(*Id.*, Fig. 2.) Light rays enter the system through bulk receiver optic **202** and are focused to form light cones **208**. (*Id.*, 13:39-42.) The light cones pass through apertures **210** in aperture layer **211**, enter collimating lenses **214**, and pass through optical filter **218** to reach photosensors **216**. (*Id.*, 13:42-50, 14:10-28.)

Several embodiments include VCSELs and SPADs as the emitters and detectors, respectively. (*Id.*, Figs. 8, 11, 5:64-6:10, 6:62-7:12, 21:48-58, 28:59-29:3.) The '405 patent indicates that the use of VCSELs and SPADs comes with advantages, including that it

enables multiple measurements to be taken at the same time (i.e., the VCSEL emitters can be fired

simultaneously) and also enables the set of emitters and the set of photosensors to each be fabricated using standard CMOS processes on a single chip, greatly simplifying the manufacturing and assembly process.

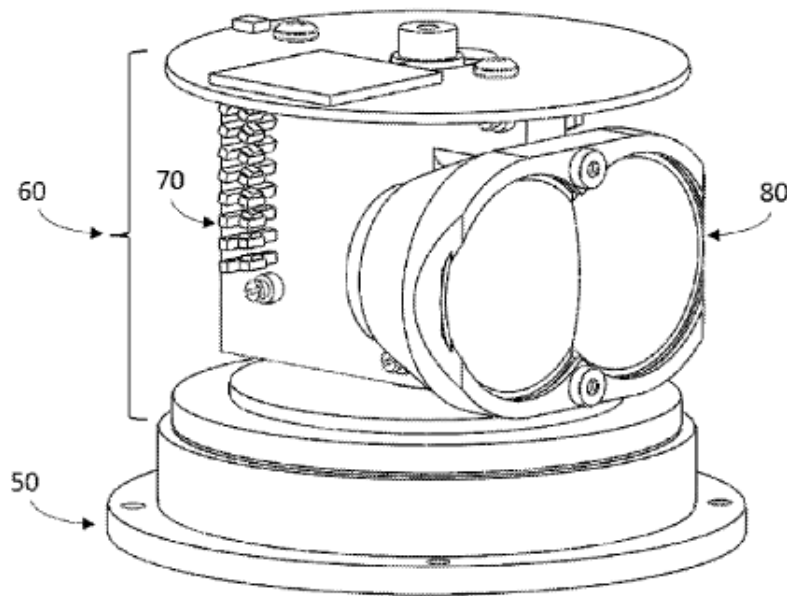
(*Id.*, 28:6-11.) Further, the '405 patent indicates that the use of VCSELs and SPADs has various disadvantages, which are addressed by the optical elements like those shown in Figure 2. (*Id.*, 28:12-27 (“[A]s discussed herein with respect to FIG. 2, a light detection system **200** can include a micro-optic receiver layer **204** for enhancing the light detected by photosensors **216**, e.g., SPADs.”).)

### **III. PETITIONER’S ASSERTED PRIOR ART**

#### **A. Pacala (Ex. 1004)**

U.S. Patent Publication No. 2014/0211194 A1 (“Pacala”; Ex. 1004) is a high-level description of a rotating LIDAR sensor that “contains a motor and distributed electronics, and a spinning turret **60** that contains optoelectronic component **70** (including optical transmitters and receivers), collimation and focusing lenses **80** and distributed electronics.” (Ex. 1004, [0013].) Pacala was abandoned during prosecution.

The sensor is shown in Pacala’s Figure 2:



(Ex. 1004, Fig. 2.) Most of the remaining description of Pacala is dedicated to discussing signal processing circuits, with a brief note that the disclosed circuits can be “implemented with discrete integrated circuits (ICs), in the form of FPGA logic, as part of an application-specific integrated circuit (ASIC), or integrated into the pixels of a detector array (e.g., Single-Photon Avalanche Diode [SPAD] array.” (*Id.*, [0014].) Pacala includes no disclosure of the characteristics of SPADs or any indication of circuitry or optical elements for accommodating their use in a sensor design.

#### **B. Droz (Ex. 1006)**

U.S. Patent 10,605,984 (“Droz”; Ex. 1006) discloses systems for light detection. One embodiment disclosed by Droz is shown in Figure 3B:

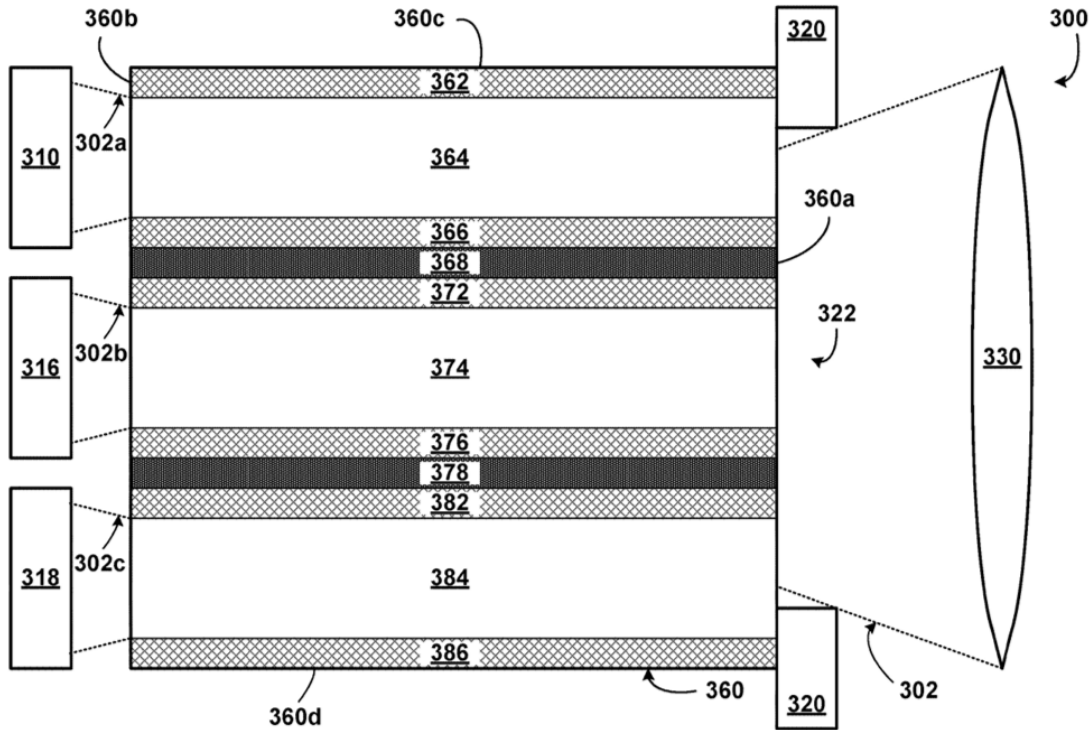


**FIG. 3B**

(Ex. 1006, Fig. 3B.) This embodiment includes a lens **300**, which focuses light through aperture **322**. (*Id.*, 13:60-63.) The light that passes through aperture **320** is then passed to light detector arrays **310**, **316**, and **318** through waveguide array **360**. (*Id.*, 13:20-22.)

Each waveguide is made up of several layers of solid material. (*Id.*, 13:28-43.) First, each waveguide consists of one of three “core layers” **364**, **374**, and **384**. These core layers are made up of “a relatively high index of refraction material, such as a glass or high-index polymer substrate for instance, that is transparent to at least some wavelengths of light **302**.” (*Id.*, 13:34-37; *see also id.*, 4:29-39, 13:44-54, 16:31-39, 19:21-26.) Second, each waveguide consists of “cladding layers” **362**, **366**, **372**, **376**, **382**, and **386**, which “may comprise a relatively low index of

refraction material, such as polymer coated or fluorine-doped glass substrates, for instance.” (*Id.*, 13:31-35; *see also id.*, 13:44-54.) Third, “absorbing layers” **368** and **378** are included in the waveguide array, which “may comprise an absorber formed from any material suitable for absorbing wavelengths of light **302** guided within waveguide array **360**,” including “carbon black, black chrome, among others.” (*Id.*, 13:39-43.)

Droz discloses only static systems that are oriented in a particular direction and detect light from a scene. For example, the system shown in Figure 3A of Droz is stationary:

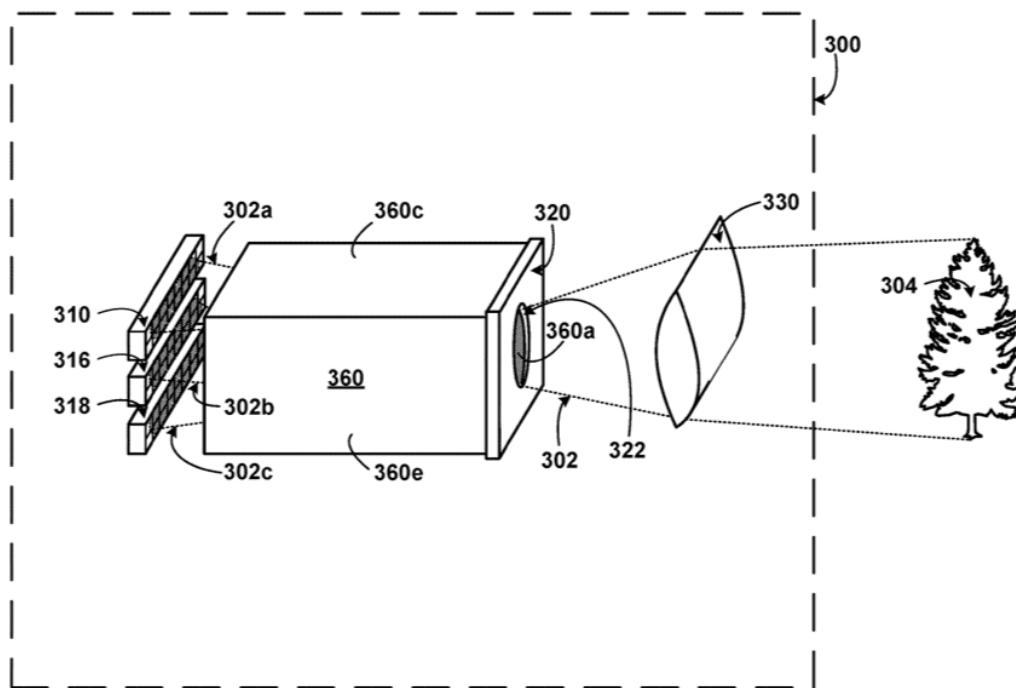


**FIG. 3A**

(Ex. 1006, Fig. 3A.) While Droz discloses an actuator that can move certain components in relation to other components (*e.g.*, moving an emitter relative to

detector components), Droz does not disclose any embodiments where all components move together (*e.g.*, on a rotating platform). (*See* Ex. 1006, 5:8-10 (“[A]rray **110** may be actuated closer to, or further from, aperture **122**.”), 11:67-12:3 (“[C]ontroller **250** could change the projection (*e.g.*, pointing) direction of emitter **240** (*e.g.*, by actuating a mechanical stage that mounts emitter **240**).”), 16:1-4 (“[S]ystem **300** may also include an actuator that moves lens **330**, opaque material **320**, and/or array **360** to achieve a particular optical configuration while scanning the scene.”), 16:7-10.)

### C. Hall (Ex. 1008)

U.S. Patent No. 9,983,297 (“Hall”; Ex. 1008) discloses “LIDAR based 3-D point cloud measuring systems.” (Ex. 1008, 1:16-17.) Hall discloses that “[a] number of schemes have been employed to interrogate the surrounding environment in three dimensions.” (*Id.*, 1:43-45.) For example, Hall discloses that “a 2-D instrument is actuated up and down and/or back and forth, often on a gimbal. This is commonly known within the art as ‘winking’ or ‘nodding’ the sensor.” (*Id.*, 1:45-48.) As another example, Hall discloses that “a prism is employed to ‘divide’ the laser pulse into multiple layers, each having a slightly different vertical angle. This simulates the nodding effect described above, but without actuation of the sensor itself.” (*Id.*, 1:50-54.) Hall discloses that in these examples “the light path of a single laser emitter/detector combination is somehow altered to achieve a

broader field of view than a single sensor.” (*Id.*, 1:55-57.) As a result, Hall discloses that “[t]he number of pixels such devices can generate per unit time is inherently limited due [to] limitations on the pulse repetition rate of a single laser.” (*Id.*, 1:57-60.) Accordingly, “[a]ny alteration of the beam path, whether it is by mirror, prism, or actuation of the device that achieves a larger coverage area comes at a cost of decreased point cloud density.” (*Id.*, 1:60-63.) Hall discloses the need for “[i]mprovements in power management of LIDAR systems ... while maintaining sufficiently high levels of imaging resolution and range.” (*Id.*, 2:46-48.)

Hall discloses “[a] LIDAR device [that] includes a plurality of pulse illumination sources and corresponding detectors.” (*Id.*, 2:54-56.) Hall discloses that “[i]n some embodiments, a pulsed illumination source and photosensitive detector are mounted to a rotating frame of the LIDAR device.” (*Id.*, 2:59-61.)

Figure 2 of Hall shows an embodiment:

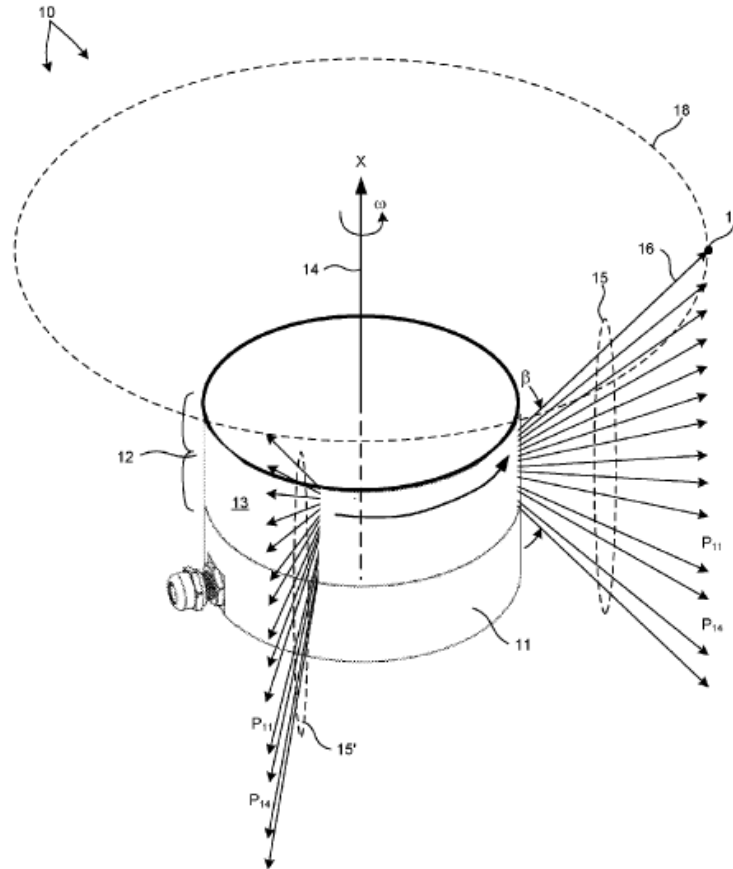


FIG. 2

(*Id.*, Fig. 2.) The embodiment shown in Hall’s Figure 2 includes “a plurality of beams of light **15**” emitted from the system and projected onto the surrounding environment “in a plurality of different directions.” (*Id.*, 5:50-56.) The LIDAR system is “configured to scan each of the plurality of beams of light **15** about central axis **14**.” (*Id.*, 5:64-66.) “As the beams of light **15** rotate about central axis **14**, each beam of light projected into the surrounding environment ... illuminates a volume of the environment corresponding [to] the cone shaped illumination beam as it is swept around central axis **14**.” (*Id.*, 6:4-9.)

#### D. Spector (Ex. 1005)

U.S. Patent Publication No. 10,473,766 (“Spector”; Ex. 1005) discloses the LIDAR system shown below:

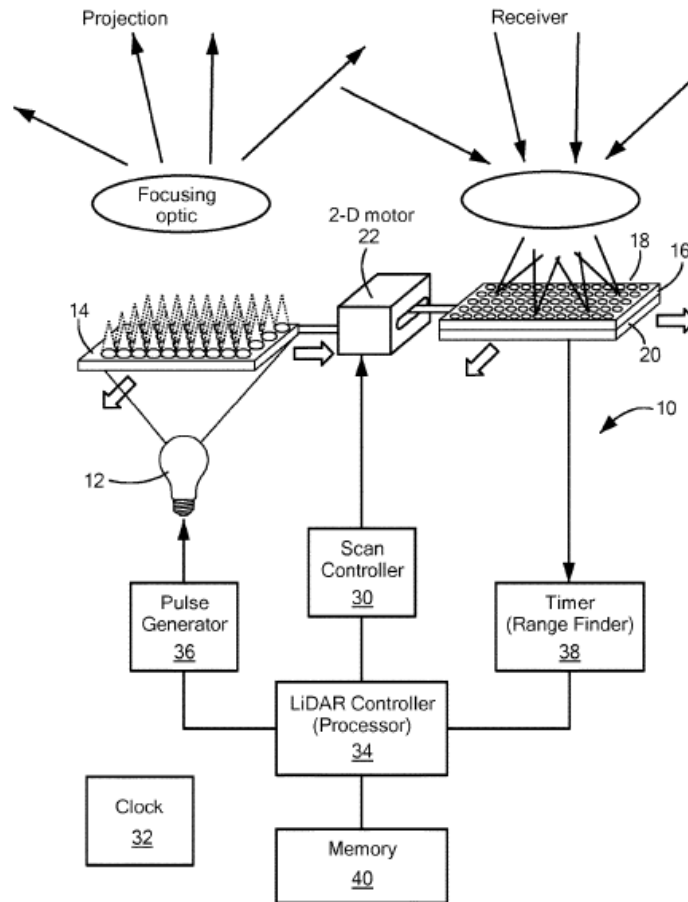


**FIG. 1**

(Ex. 1005, Fig. 1.) A single light source **12** generates optical radiation that is subdivided by micro-optic array **14**, which projects “multiple light spots” into the surrounding environment. (*Id.*, 3:10-12.) When a fraction of the outgoing light is reflected back to the LIDAR system, it is focused by a lens, subdivided by aperture array **18**, and passed through to detector array **20**. (*Id.*, 3:43-45.)

To capture information about the complete scene, Spector discloses using movable stages driven by 2-D motor **22** to scan its microoptic and aperture arrays horizontally and vertically (*i.e.*, in the X-axis and Y-axis) along a plane as shown in Figure 1 (above) and Figure 9 (below):

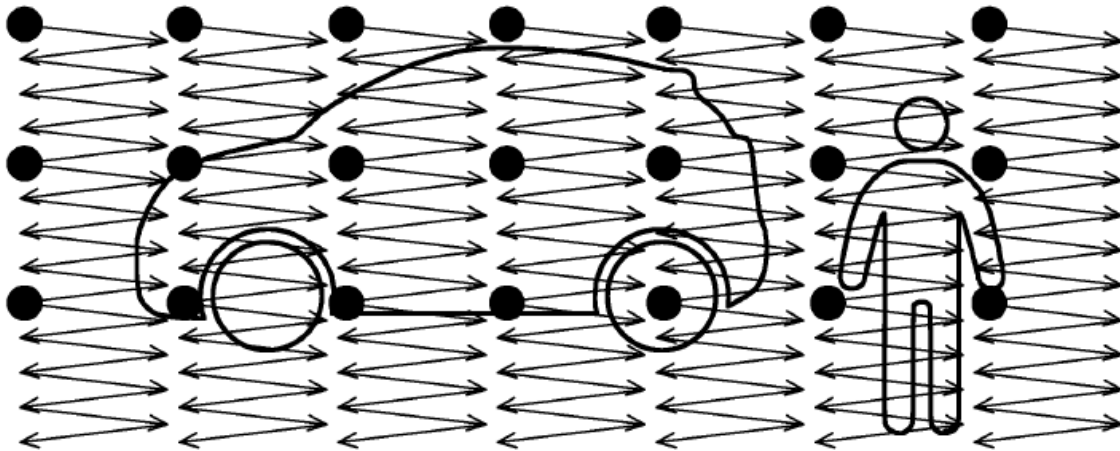


**FIG. 9**

(*Id.*, Fig. 9.) Spector discloses that the light spots and apertures should traverse the scene “no more than the distance between adjacent spots in the first dimensional direction and in the second dimensional direction[.]” (*Id.*, 1:62-67.) Spector requires both the transmitter micro-optic array **44** and the aperture array **18**/detector array **20** to scan at the same time (*i.e.*, synchronously). (*E.g.*, *id.*, 1:51-53, 3:62-65, Fig. 1.)

Petitioner relies on U.S. Provisional Application No. 62,470,706 (“Spector Provisional”; Ex. 1010) in asserting that Spector is prior art to the ’405 patent. (Pet.

at 50-55.)

**E. Villeneuve (Ex. 1007) and Borowski (Ex. 1009)**

Petitioner relies on U.S. Patent No. 10,520,602 (“Villeneuve”; Ex. 1007) in its challenge to certain dependent claims for Petitioner’s Ground 2 and on U.S. Patent Publication No. 2013/0300840 (“Borowski”; Ex. 1009) in Grounds 3 and 4. Since Villeneuve and Borowski merely add to proposed combinations that, as shown below, cannot be sustained, discussion of the additional references is currently unnecessary.

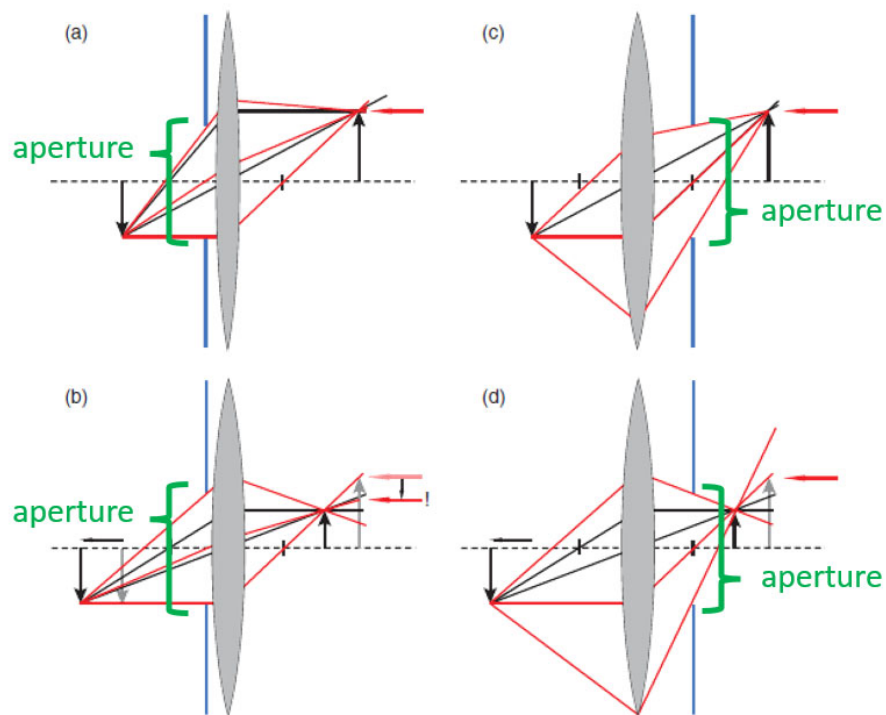
**IV. CLAIM CONSTRUCTION**

No claim construction rulings have issued in the pending litigation between Petitioner and Patent Owner. However, Petitioner has proposed claim constructions before the ITC that, among other reasons, show that the Board should not institute *inter partes* review of the challenged claims of the ’405 patent.

**A. “aperture” (claims 21, 26, and 34)**

In Patent Owner’s ITC case against Petitioner, Petitioner proposed the following construction for the term “aperture” in claims 21, 26, and 34 of the ’405 patent: “a small hole that defines a field of view for an individual pixel.” (Ex. 2001 at 2.) Petitioner cited extrinsic evidence in support of its proposed construction of the “aperture” term. (Ex. 2002 at 2-3.) Among Petitioner’s extrinsic evidence is Webster’s Dictionary, 11th Ed. (2014), which defines “aperture” as “an opening or open space: HOLE.” (Ex. 2004 at 57.) Additionally, Petitioner relied on

the textbook Pedrotti, *Introduction to Optics*, 3rd Ed., which indicates that an aperture “in its broadest sense, is an opening defined by a geometrical boundary.” (Ex. 2007 at 50; *see also id.* at 51 (referring to an aperture’s “entrance pupil” as an “opening”).) Furthermore, Petitioner relied on Graf, *Modern Dictionary of Electronics*, 7th Ed. (1999), which defines aperture as “[a]n opening that will pass light, electrons, or other forms of radiation.” (Ex. 2006 at 33.) Petitioner also relied upon the textbook *Fluorescence Microscopy - From Principles to Biological Applications*, 2nd Ed. (2017). This book includes the following diagram, which shows four “aperture stops,” consisting of the “entrance pupil” for items (a) and (b) and an opening at the “back focal plane” for items (c) and (d) (indicated in green annotations in the below figure):



(Ex. 2003 at 52 (green annotations added); *see also id.* at 29, 31, 39, 50-53, 69.)

Each of the apertures shown in the above figure—and defined or described in any of Ouster’s extrinsic evidence submissions before the ITC for the “aperture” term—is an opening (*i.e.*, an airgap or hole) in otherwise opaque material.

## **V. THE BOARD SHOULD DENY REVIEW OF ALL GROUNDS**

### **A. Overview of Petitioner’s Asserted Grounds**

#### **1. Ground 1: Obviousness of claims 21, 23, 26-31, and 34 over Pacala and Droz**

Petitioner relies on Pacala as the primary reference for Ground 1 disclosing “the basic structure of a rotating LiDAR device” and “basic optoelectronic components.” (Pet. at 17.) Petitioner relies on Droz in an effort to import into Pacala’s “basic” system various optical components required by the challenged claims—above all, alleged apertures, SPAD arrays, and optical filters. (*Id.* at 17-18.)

As discussed below, Petitioner fails to show a reasonable likelihood of success as to Ground 1 because (1) Petitioner fails to provide any evidence that the “aperture” claim limitation is met by the Pacala-Droz combination and (2) Petitioner fails to provide any adequate motivation to combine Pacala with Droz.

#### **2. Ground 2: Obviousness of claims 24-25 and 32-33 over Pacala, Droz, and Villeneuve**

In Ground 2, Petitioner relies on Villeneuve’s disclosures solely to assert that the limitations in dependent claims 24, 25, 32, and 33 requiring “non-

overlapping...fields of view” and a “one-to-one relationship” between emitter and receiver channels are obvious in light of the Pacala-Droz-Villeneuve combination.

Since claims 24 and 25 depend from independent claim 21 (challenged in Ground 1) and claims 32 and 33 depend from independent claim 26 (also challenged in Ground 1), Petitioner’s failure to show a reasonable likelihood of success as to Ground 1 means that review should not be instituted as to Ground 2.

### **3. Ground 3: Obviousness of claims 21 and 23-34 over Hall, Borowski, and Spector**

Petitioner relies on Hall as the primary reference in Ground 3, asserting that Hall discloses “the basic structure of a rotating LiDAR device” and certain optoelectronic components. (Pet. at 55.) Since Hall does not disclose SPADs, Petitioner asserts that it would be obvious to combine Hall with Borowski to import SPADs into Hall’s system. (*Id.*) Further, since neither Hall nor Borowski discloses apertures, Petitioner adds Spector to the mix in an effort to import micro-optics and apertures. (*Id.*)

As discussed below, Petitioner fails to show a reasonable likelihood of success as to Ground 3 because (1) Petitioner fails to provide any adequate motivation to combine Hall with Spector; (2) Hall teaches away from systems with a single light source like Spector; and (3) Spector teaches way from incorporating its apertures into a rotating LIDAR system like Hall.

**4. Ground 4: Obviousness of claim 34 over Hall, Borowski, Spector, and Droz**

Petitioner relies on Droz's disclosure for Ground 4 to assert that the optical filter limitations of dependent claim 34 are obvious in light of the Hall-Borowski-Spector-Droz combination. Since claim 34 depends from independent claim 26 (challenged in Ground 3), Petitioner's failure to show a reasonable likelihood of success as to Ground 3 means that review should not be instituted as to Ground 4.

**B. There is no reasonable likelihood that Petitioner will prevail in its contention that the challenged claims are obvious over Pacala in Combination with Droz or Pacala in Combination with Droz and Villeneuve**

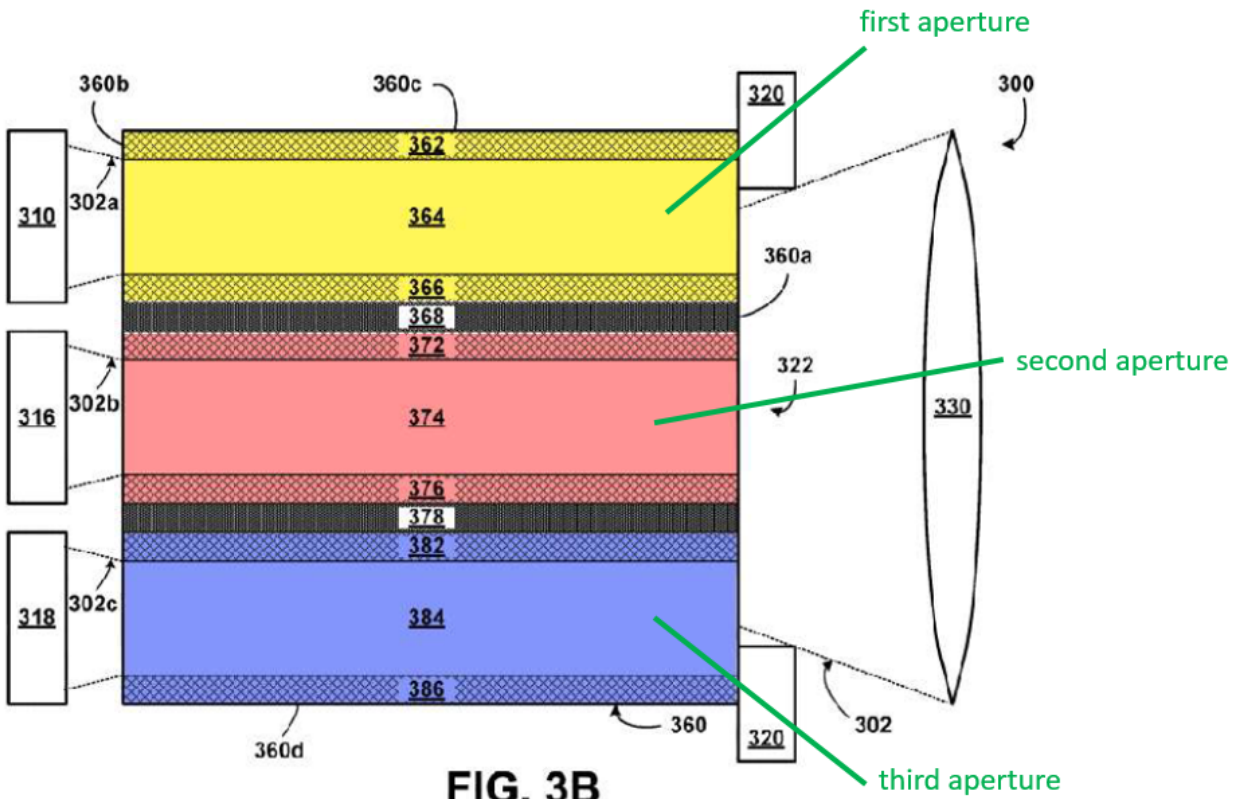
**1. Petitioner makes no attempt to show that its proposed construction of "aperture" is met by the Pacala-Droz or Pacala-Droz-Villeneuve combinations**

Petitioner's Grounds 1 and 2 rely on a layer of optically transparent material disclosed in Droz's "waveguides" as the "aperture" of claims 21, 26, and 34. But Petitioner does not even attempt to show that the optically transparent material in Droz's "waveguides" meets Petitioner's proposed construction before the ITC requiring that an "aperture" be a "hole." Rather, Petitioner points only to a layer of *solid material*—not a "hole." Petitioner provides no evidence or argument on how the solid material it relies on in Droz is a "hole." In fact, Petitioner ignores its proposed construction of "aperture" before the ITC entirely—failing to acknowledge it anywhere in its petition or to have Dr. Shanley acknowledge it in his accompanying expert declaration.

Even had Petitioner not previously adopted its definition of “aperture,” Petitioner still bears the burden of demonstrating that the aperture limitation is met. Yet nowhere does Petitioner explain why the solid material of the waveguide corresponds to the claimed aperture.

In light of these inconsistent positions and corresponding failure of proof as to Grounds 1 and 2 of Petitioner’s petition, the Board should decline to institute based on these grounds.

Petitioner concedes that Pacala, the primary reference for its first and second grounds does not disclose an “aperture layer” or “apertures” as required by claims 21, 26, and 34 of the ’405 patent (and therefore all challenged claims, which only include independent claims 21, 26, and dependents). (Pet. at 27.) Rather, Petitioner argues that it would have been obvious to a POSITA to modify Pacala to include “apertures” in light of Droz. (*Id.*) Specifically, Petitioner identifies the “input side” or “input ends” of “waveguides” disclosed by Droz as the “apertures” required by the challenged claims. (*Id.* at 27-28, 32-33.) Three such “waveguides” are identified by yellow, red, and blue highlighting in the following annotated figure from Droz, which Petitioner provided in its petition, and which has been further annotated with green rectangles showing each of the alleged “apertures” Petitioner is relying on in its petition:



(Ex. 1006, Fig 3B (highlights added by Petitioner; green annotations added by Patent Owner); Pet. at 27, 32).) Petitioner argues that the *fourth* aperture required by the challenged claims, while not visible in FIG. 3B of Droz, would be obvious to a POSITA because “Pacala includes more than three optical receivers,” and a POSITA would have allegedly been motivated to use one of Droz’s waveguides for each optical receiver disclosed by Pacala. (Pet. at 32-33.)

Droz discloses that the “input side” or “input ends” of its waveguides consist of solid, transparent material—which Droz refers to as the “[c]ore layers **364, 374, and 384**” and “cladding layers **362, 366, 372, 376, 382, and 386**” of the waveguides. (Ex. 1006, 13:29-38.) Droz discloses that the “core layers” consist of “relatively

high index of refraction material, such as a glass or high-index polymer substrate for instance, that is transparent to at least some wavelengths of light 302.” (*Id.*) Droz discloses that the “cladding layers **362**, **366**, **372**, **376**, **382**, and **386**” consist of “a relatively low index of refraction material, such as polymer coated or fluorine-doped glass substrates[.]” (*Id.*) Droz further discloses “absorbing layers **368** and **378**” consisting of “any material suitable for absorbing wavelengths of light **302** guided within waveguide array **360**,” including “carbon black” and “black chrome.” (*Id.*, 13:39-43.) In other words, the waveguides consist solely of *solid material*. Therefore, the “input end” of each waveguide—which Petitioner identifies as the “aperture” of the waveguide—consists of the “exposed surface” of the solid core. (*Id.*, 13:55-57.)

Droz only discloses embodiments of its “waveguides” where they consist exclusively of solid material. For example, Droz discloses that its waveguides could consist of “a glass substrate” where “doped regions” correspond to the cladding layers and “regions of the glass substrate that are not doped” correspond to the core layers. (*Id.*, 13:44-54, 19:21-26 (claim 13).) Droz further teaches that waveguides can be “implemented as glass plates that are stacked on top of one another,” with “absorbers **368** and **378** appropriately interposed between the various waveguides.” (*Id.*, 4:29-39, 16:31-39.) Droz discloses *no* embodiments in which its waveguides consist of a “hole,” per Petitioner’s claim construction of “aperture” in the ITC.

(Ex. 2001 at 2.) Indeed, Droz’s *only* use of the word “aperture” regarding the embodiment shown in Figure 3B refers to an opening **322** in opaque material **320**. (*E.g., id.*, 13:9-22.)

Petitioner provides no argument or evidence that what it is asserting as “apertures” in Droz—the “input ends” of Droz’s solid “waveguides”—consist of a “hole.” Rather, Petitioner’s proposed construction for “aperture” before the ITC does not appear *once* in the petition or the accompanying expert declaration. Both the petition and the accompanying expert declaration contain conclusory assertions that no terms of the challenged claims need construction and that the challenged claims are obvious regardless of whether any of the parties’ proposed constructions before the ITC are applied. (Pet. at 12-13; Ex. 1003, ¶¶ 81-82.) However, neither Petitioner nor its expert Dr. Shanley provide *any* explanation for how the input end of a solid waveguide disclosed by Droz constitutes a “hole” per Petitioner’s proposed construction of “aperture” before the ITC—or even how it would meet the plain and ordinary meaning of “aperture.” To the contrary, in its petition and accompanying expert declaration, Petitioner confirms that waveguides consist of solid core, cladding, and absorbing “layer[s]”—not a “hole” per Petitioner’s proposed “aperture” construction before the ITC. (Pet. at 27; Ex. 1003, ¶ 150.)

Given Petitioner’s complete failure to provide argument or evidence showing how its proposed construction of “aperture” is met by its Grounds 1 or 2, *inter partes*

review should not be instituted on these grounds. *See KioSoft Techs., LLC v. PayRange Inc.*, CBM2020-00026, Paper 11, 17-18 (P.T.A.B. Mar. 22, 2021) (denying institution and citing “the potential problems inherent in the inconsistent claim constructions set forth by Petitioner between the Petition and its proposals at the district court”).

**2. Petitioner fails to provide any adequate motivation to combine Pacala with Droz**

Petitioner fails to provide adequate motivation to combine Pacala with Droz. Instead, Petitioner pieces together a hindsight-motivated combination between these two references by forcing additional physical structures into Pacala’s rotating LIDAR system. But Pacala’s disclosure about the physical design of its system is scant—limited to two short paragraphs about two figures that are limited to showing external views of its system. (*See* Ex. 1004, Figs. 1-2, [0012]-[0013].) Further, the limited disclosures about its system Pacala *does* provide would have motivated a POSITA *not* to consider combining Pacala with a system like that disclosed by Droz. Pacala discloses a spinning LIDAR system capable of rotating 360 degrees—in contrast to Droz’s static system. (*Compare* Ex. 1004, Fig. 2 *with* Ex. 1006, Fig. 3A.) Further, while Pacala discloses using electronic signal processing techniques for “solving” detection sensitivity issues, Droz discloses adding substantial additional physical components, such as waveguides and filters, for improving detection. (*Compare* Ex. 1004 at [0007], [0010], [0014] *with* Ex. 1006, Ex. 1006, 3:34-67.)

Neither Petitioner nor its expert acknowledge these disadvantages of the alleged Pacala-Droz combination, and they fail to provide any argument or evidence supporting that there is sufficient motivation to combine to counterbalance these disadvantages. Accordingly, *inter partes* review should not be instituted on Grounds 1 and 2, which rely on combining Pacala and Droz. *See Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1329, 1331-32 (Fed. Cir. 2019) (affirming no motivation to combine where combination “would introduce additional complexity and inefficiencies” that “outweighed” any benefits).

Petitioner’s Pacala-Droz combination relies on Droz to import Droz’s “waveguides”—one end of which Petitioner contends are “apertures”—into Pacala’s rotating LIDAR system. The waveguides of Droz are made up of many layers of solid material, including materials such as glass. Droz discloses that each waveguide consists of (1) “core layers” made up of “a relatively high index of refraction material, such as a glass or high-index polymer substrate for instance, that is transparent to at least some wavelengths of light **302**,” (Ex. 1006, 13:35-38; *see also id.*, 13:44-54, 4:29-39, 16:31-39, 19:21-26); (2) “cladding layers” of “a relatively low index of refraction material, such as polymer coated or fluorine-doped glass substrates, for instance” (*id.*, 13:31-35; *see also id.*, 13:44-54); and (3) “[a]bsorbing layers,” which “may comprise an absorber formed from any material suitable for absorbing wavelengths of light **302** guided within waveguide array **360**,” including

“carbon black, black chrome, among others.” (*Id.*, 13:39-43.) These layers are shown in the below diagram outlined in red annotations:

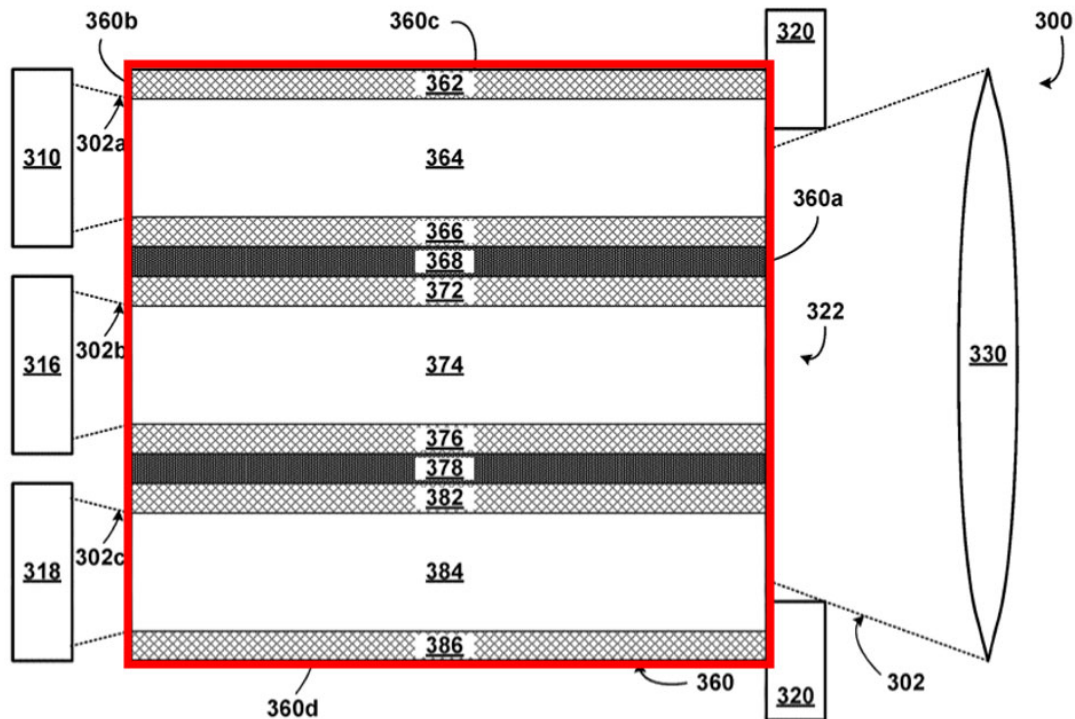
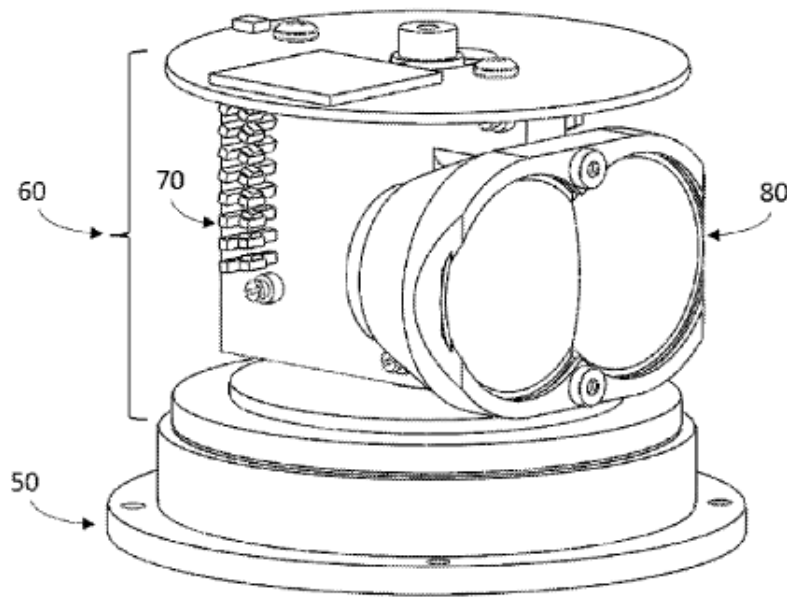


**FIG. 3B**

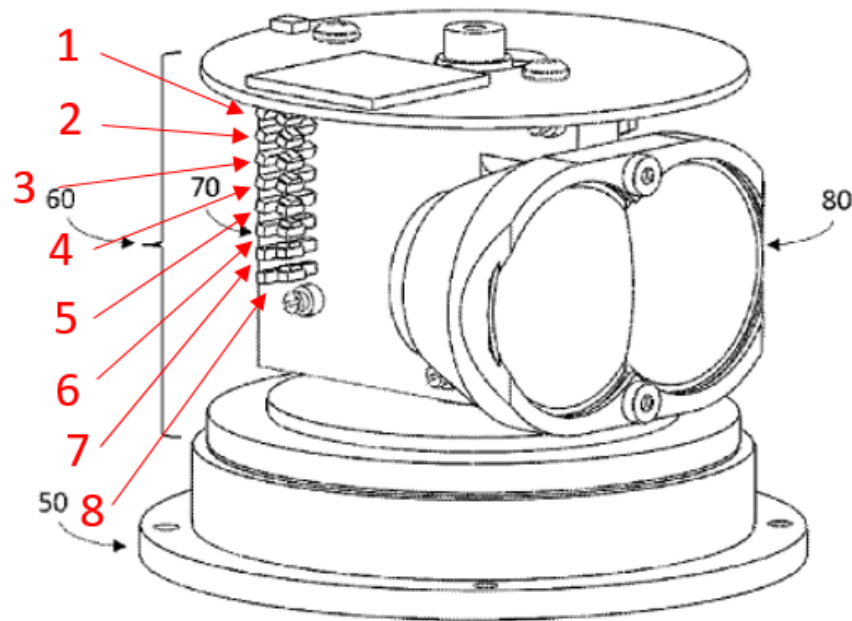
(*Id.*, Fig. 3B (annotated).)

It is unclear—and neither Petitioner nor its expert provides any explanation—as to how these heavy, solid layers of waveguide material would be used for Pacala’s compact, rotating LIDAR system. For example, Figure 2 of Pacala shows an embodiment of its rotating LIDAR system:



(Ex. 1004, Fig. 2.) Pacala discloses that the turret shown in Figure 2 “contains optoelectronic components **70** (including optical transmitters and receivers), collimation and focusing lenses **80** and distributed electronics,” and—potentially— “[t]he multi-channel TDC electronic circuitry of the present invention.” (*Id.*, [0013].) It is unclear where Droz’s solid waveguides would fit among all the different components already contained in Pacala’s rotating turret.

The difficulty of using Droz’s waveguides in Pacala’s rotating LIDAR system is particularly evident considering that Droz discloses that each detector array has its own dedicated waveguide. (Ex. 1006, Fig. 3B, 14:11-17.) Figure 2 of Pacala shows “optoelectronic components **70** (including optical transmitters and receivers).” (Ex. 1004, [0013].) There appear to be at least eight different optoelectronic channels, called out in the below annotated version of Pacala’s Figure 2:



(Ex. 1004, Fig. 2 (annotated).) The presence of eight optoelectronic channels in Pacala’s Figure 2 embodiment suggests that the Pacala-Droz combination would require fitting a total of *eight* waveguides into Pacala’s rotating turret. In addition to size issues, it is unclear how Pacala’s rotating LIDAR system could accommodate the *weight* of Droz’s solid waveguides. Further, Droz discloses that the core layers of its waveguides consist of a “high index of refraction material.” (Ex. 1006, 13:35-38.) Any use of such waveguides in Pacala’s system would have to account for refraction caused by the waveguides. Additionally, Pacala discloses that its invention relates to the use of “cost-effective” LIDAR sensors. (Ex. 1004, [0003].) The waveguides of Droz, however are costly, somewhat exotic materials: *e.g.*, polymer coated or fluorine-doped glass substrates and black chrome. (Ex. 1006, 4:29-39, 13:31-54, 16:31-39, 19:21-26.) Neither the petition nor its supporting

materials suggest how a POSITA would execute such a combination in a “cost-effective” system. (Ex. 1004, [0003].)

The issues with combining Pacala’s rotating LIDAR system with Droz’s waveguides are further reinforced by the fact that Droz discloses only static embodiments for its imaging system. While Droz discloses that its system could accommodate some actuation of certain of its disclosed elements, it does not indicate that its entire system—including emitters, detectors, and optical elements like waveguides—could be rotated like Pacala’s system. (See Ex. 1006, 5:8-10 (“[A]rray **110** may be actuated closer to, or further from, aperture **122**.”), 11:67-12:3 (“[C]ontroller **250** could change the projection (e.g., pointing) direction of emitter **240** (e.g., by actuating a mechanical stage that mounts emitter **240**).”), 16:1-4 (“[S]ystem **300** may also include an actuator that moves lens **330**, opaque material **320**, and/or array **360** to achieve a particular optical configuration while scanning the scene.”), 16:7-10.)

Petitioner and its expert assert that a POSITA would have been motivated to incorporate Droz’s waveguides to improve detection sensitivity of Pacala’s system. (Pet. at 19-20; Ex. 1003, ¶ 132.) But neither Petitioner nor its expert provides any evidence or argument that these alleged motivations to combine would be sufficient to overcome the clear practical obstacles to using Droz’s waveguides with Pacala’s rotating LIDAR system. In fact, neither Petitioner nor its expert provide *any*

indication of how Droz's waveguides would be used in Pacala's rotating LIDAR system.

Further, Petitioner's asserted motivations to combine do not make sense given the explicit disclosures of Pacala. Petitioner and its expert assert that a POSITA would have been motivated to combine Droz's waveguides with Pacala to improve detection sensitivity given Pacala's purported concerns with "miss[ing] low intensity pulses." (Ex. 1004 at [0007]; Pet. at 19-20; Ex. 1003, ¶ 132.) But Pacala discloses the problem of missing low intensity pulses in its "Background of the Invention" section where it is discussing issues with the "standard single threshold TDC-based [Time-to-Digital Converter] approach" in the prior art. (Ex. 1004 at [0007], [0010].) Pacala then explicitly discloses methods for "**solving** the signal quality issues associated with the standard single threshold TDC-based approach" via Pacala's disclosure of signal processing techniques. (*Id.* at [0010] (emphasis added).) Since Pacala already solved the signal quality issue, a POSITA would have no reason to incorporate the waveguides of Droz into the Pacala system. Petitioner's purported motivation to combine Pacala and Droz's waveguides fails.

Nor does Petitioner provide adequate evidence to show that a POSITA would have had reasonable success in combining Pacala with Droz's waveguides given the apparent physical issues such a combination would present. Accordingly, the Board should not institute as to Petitioner's Grounds 1 and 2. *Henny Penny*, 938 F.3d at

1331-32.

**C. There is no reasonable likelihood that Petitioner will prevail in its contention that the challenged claims are obvious over Hall in combination with Spector**

For its Grounds 3 and 4, Petitioner relies on the combination of Hall and Spector. Since Hall lacks any disclosure of an “aperture layer” or “apertures” as required by limitations 21(f), 21(i), 26(f), and 26(i), Petitioner relies on obviousness in combination with Spector for these limitations. (Pet. at 55, 62-65, 67, 72-73.) Petitioner has not adequately shown that a POSITA would have been motivated to combine Hall with Spector. Accordingly, the Board should not institute *inter partes* review based on Petitioner’s Grounds 3 and 4.

**1. Petitioner fails to provide any adequate motivation to combine Hall with Spector**

Petitioner’s asserted motivations to combine Hall with Spector contradict or are entirely unsupported by the evidence presented in the petition. Accordingly, the Board should not institute *inter partes* review on any ground that relies on combining those references.

Petitioner and its expert contend that a POSITA would have been motivated to combine Hall with Spector in order to reduce cross-talk in Hall’s system. (Pet. at 57-58; Ex. 1003, ¶¶ 186-87, 191.) However, reducing cross-talk cannot serve as the motivation to combine Hall with Spector, because Hall itself discloses ways of *eliminating* cross-talk from its system. Spector therefore would add nothing.

Hall discloses two ways of eliminating cross-talk from its system. First, Hall discloses that cross-talk can be eliminated if the delay time between one laser firing a measurement pulse and the next laser firing a measurement pulse is “set to be greater than the time of flight of the measurement pulse sequence to and from an object located at the maximum range of the LIDAR device.” (Ex. 1008, 9:13-16.) If this condition is met, Hall discloses that “there is **no cross-talk** among any of the sixteen multi-pulse illumination systems.” (*Id.*, 9:16-17 (emphasis added).)

Second, Hall discloses that even if “a measurement pulse may be emitted from one pulsed illumination system before a measurement pulse emitted from another pulsed illumination system has had time to return to the LIDAR device,” cross-talk can still be eliminated. (*Id.*, 9:18-21.) Hall discloses that if there is “sufficient spatial separation between the areas of the surrounding environment interrogated [sic] by each beam,” then the system will “**avoid cross-talk**.” (*Id.*, 9:21-25 (emphasis added).)

In its petition, Petitioner does not address or even acknowledge Hall’s disclosure of these methods of eliminating cross-talk from its system or why a POSITA would have been motivated to rely on the disclosure in Spector to the exclusion of Hall’s disclosures. Instead, Petitioner quotes without context the words “avoid cross-talk” from Hall—which, as described above, are used in the context of describing how Hall *itself* avoids cross-talk—to suggest that avoidance of cross-talk

is a problem that needs solving in Hall’s system. (Pet. at 57 (“Hall acknowledges that there is a need to ‘avoid cross-talk’ in LiDAR systems with multiple emitters.”).) Petitioner’s mischaracterization of Hall does not change the fact that Hall clearly discloses multiple ways of eliminating cross-talk from its system—rendering Petitioner’s asserted combination of Hall with Spector redundant. *See South-Tek Sys., LLC v. Engineered Corrosion Sols., LLC*, 748 F. App’x 1003, 1006-1007 (Fed. Cir. 2018) (affirming lack of motivation to combine to add redundant feature); *Ex Parte James Pinon*, No. 2017-005566, 2018 WL 1287471, at \*4 (P.T.A.B. Mar. 9, 2018) (finding no motivation to combine references where addition of feature based on secondary reference’s disclosures would be redundant).

Buried in Dr. Shanley’s declaration (although never mentioned in Petitioner’s petition) is the contention that a POSITA would have been motivated *not* to use either of the methods of eliminating cross-talk explicitly disclosed by Hall because they “limit[] the speed at which detection can be performed.” (Ex. 1003, ¶ 191.) Dr. Shanley’s statement is conclusory—the only citation he provides is to the language in the Hall specification that *discloses* the two ways of eliminating cross-talk from Hall’s system. (*Id.* (citing Ex. 1008, 9:13-25.)) Dr. Shanley cites to no disclosure in Hall that discusses the importance of detection speed. He also cites to no publications discussing detection speed or its importance to LIDAR systems. Further, Dr. Shanley provides no analysis about detection speed other than his

conclusory statement about Hall.<sup>2</sup> The Board should decline to consider Dr. Shanley's conclusory testimony on the impact of Hall's cross-talk elimination on detection speed. *Rohm and Haas Co. v. Brotech Corp.*, 127 F.3d 1089, 1092 (Fed. Cir. 1997) (noting that a fact finder is not required to "credit the unsupported assertions of an expert witness"); 37 C.F.R. §42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight."); *Facebook, Inc. v. Windy City Innovations, LLC*, No. IPR2016-01156, 2017 WL 6210806, at \*12 (P.T.A.B. Dec. 6, 2017) (declining to credit expert's assertions "without citation to the basis for his testimony")..

Other than reducing cross-talk, Petitioner's only proffered motivation to combine Hall with Spector is "permitting 'smaller and/or simpler and less expensive scanning mechanisms.'" (Pet. at 58 (quoting Ex. 1005, 6:15-20).) But this cannot be a motivation to combine Hall with Spector, because Petitioner is not asserting

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<sup>2</sup> There is likely good reason why Dr. Shanley declines to provide such analysis. Light travels approximately 300 *million* meters per second. For light to bounce off an object 15 meters away (a not unreasonable distance in many applications) and return to the sensor is a round trip of 30 meters. Such a round trip would require  $1 \times 10^{-7}$  seconds. Even waiting such a time between pulses would allow the collection of ten thousand data points in one millisecond.

that the combination of Hall with Spector involves making *any* change to the scanning mechanism of Hall. Petitioner relies on Spector in the Hall-Borowski-Spector combination only for Spector’s disclosure of “an arrayed micro-optic” and “apertures.” (Pet. at 57-58; *see also id.* at 55 (“Spector’s aperture array is further incorporated[.]”).) At no point does Petitioner suggest that a POSITA would have modified anything about Hall’s scanning mechanism based on Spector. Further, any such suggestion would not make sense, because Hall and Spector use fundamentally different types of scanning mechanisms. Hall discloses a system that scans via 360-degree rotation. (*See, e.g.*, Ex. 1008, 3:31-35 (“[T]he field of view of a rotational scanning LIDAR device extends radially.”), Figs. 1-2, 6:4-9.) In contrast, Spector discloses a system that points in a single direction and scans via linear motion on the X- and Y-axis. (*See, e.g.*, Ex. 1005, Fig. 9, 4:55-60; *see also* Ex. 1010 at 12, 18.) Neither Petitioner nor Dr. Shanley attempt to provide any explanation for how a POSITA would have made any change to Hall’s scanning mechanism based on Spector’s fundamentally dissimilar (and apparently incompatible) scanning mechanism. *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017) (requiring an “evidence-supported account of the contemplated workings of the combination”).

Given Petitioner and its expert’s failure to adequately identify a motivation to combine Hall and Spector, the Board should not institute *inter partes* review based

on Petitioner's Grounds 3 and 4.

**2. Hall teaches away from a system like Spector's with only a single light source**

Petitioner fails to show that a POSITA would have looked to Spector for teachings to “improve” Hall as Petitioner asserts, because Hall teaches away from systems like Spector.

Hall teaches that in some systems, “the light path of a single laser emitter/detector combination is somehow altered to achieve a broader field of view than a single sensor.” (Ex. 1008, 1:55-57.) For example, Hall discloses that in some such systems, “a 2-D instrument is actuated up and down and/or back and forth, often on a gimbal. This is commonly known within the art as ‘winking’ or ‘nodding’ the sensor.” (*Id.*, 1:45-48.) Hall teaches the disadvantages of such systems:

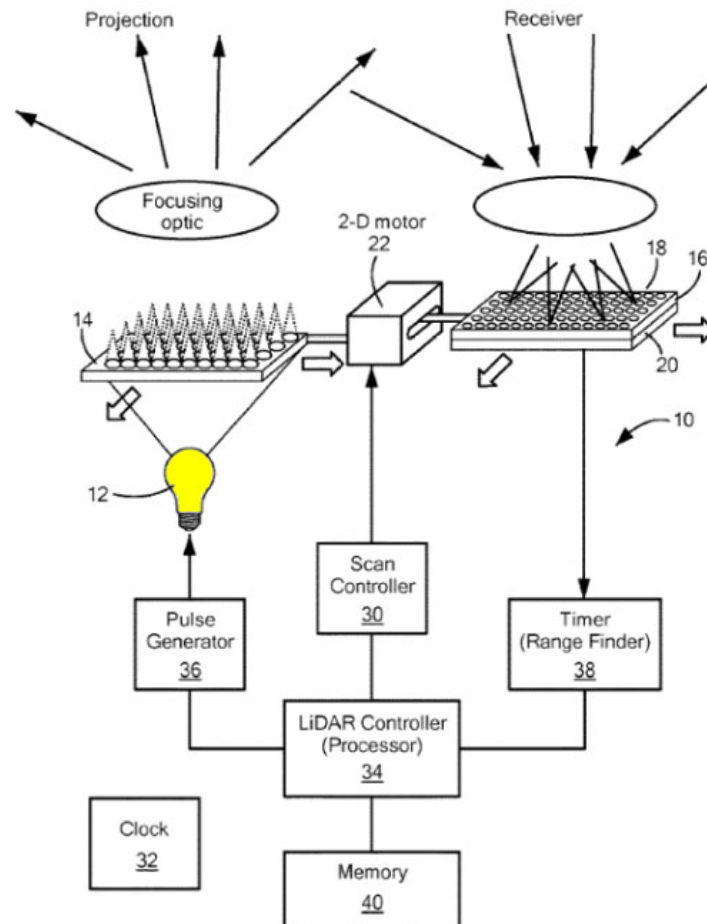
The number of pixels such devices can generate per unit time is inherently limited due limitations [sic] on the pulse repetition rate of a single laser. Any alteration of the beam path, whether it is by mirror, prism, or actuation of the device that achieves a larger coverage area comes at a cost of decreased point cloud density.

(*Id.*, 1:57-63.)

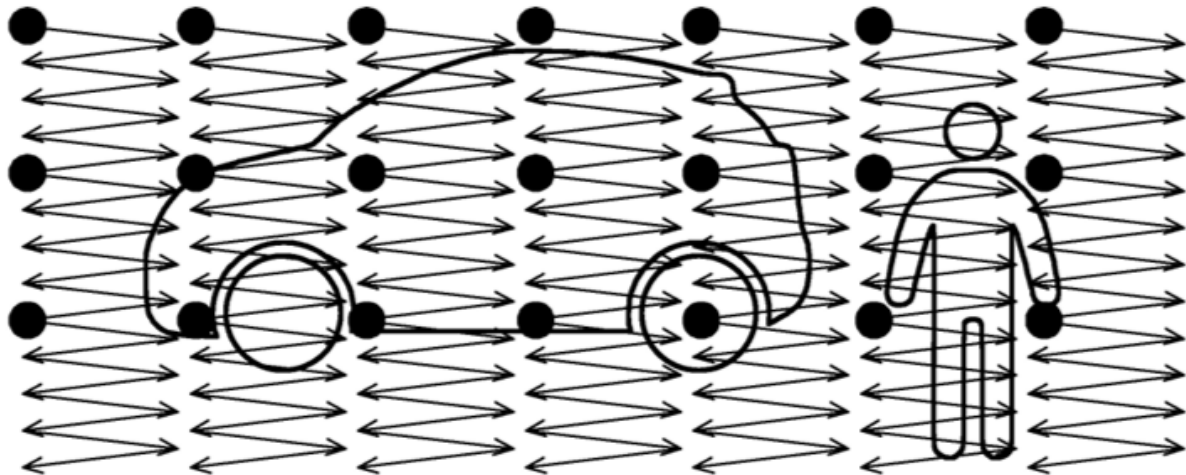
Spector discloses exactly the sort of gimballed system with a single light source taught away from by Hall. Spector discloses using a single light source—a feature that Hall teaches is “inherently limited due [to] limitations on the pulse

(Ex. 1005, Fig. 1 (highlighting added); *see also* Ex. 1010 at 12, 14, 17, 19.) Due to Spector's disclosure of the use of a single light source, there is strong evidence that a POSITA would not have looked to Spector for elements to combine with Hall based on Hall's teaching away from single light source systems.

Further evidence that a POSITA would not have looked to combine Spector with Hall comes from the fact that Spector discloses using two-dimensional actuation to “achieve a broader field of view than a single sensor”—exactly what



Hall teaches away from. (Ex. 1008 at 1:55-57, 1:60-63.) Spector discloses actuating its transmitter and detector hardware in the X and Y directions to yield a field of view larger than if no actuation took place. For example, Spector discloses the following figure showing the course of this actuation:



(Ex. 1005, Fig. 9; *see also* Ex. 1010 at 18.) The black dots in the above figure represent the field of view if Spector's system performed no actuation of the transmitter and detector hardware. The arrows in the above figure represent the "broader" field of view of Spector's system when actuation takes place. Accordingly, this illustrates that a POSITA would have understood that Spector is precisely the kind of "winking" or "nodding" system Hall teaches away from. (Ex. 1005, 1:45-48.)

Neither Petitioner nor its expert address or even acknowledge Hall's teaching away of single light source systems like the one disclosed in Spector. Instead,

Petitioner asserts generally that “[a] POSITA would have thus looked to other references in the field, such as ... Spector.” (Pet. at 56.) Dr. Shanley makes similarly conclusory assertions that are rendered hollow by Hall’s clear teaching away from a system like Spector. (*See, e.g.*, Ex. 1003, ¶ 192.) For example, Dr. Shanley broadly asserts “POSITA would have had a reasonable expectation of success in making the proposed modifications based on the similarity of the LiDAR systems in Hall, Borowski, and Spector”—even though Hall explicitly discloses that its system is *dissimilar* from disadvantageous systems in the art like the one disclosed by Spector. (Ex. 1008, 1:42-63; *see also* Ex. 1003, ¶ 192 (asserting without support that “Spector describes known improvements to **similar** devices” to Hall’s system) (emphasis added).) These bare assertions regarding similarity lack support given the many dissimilarities between Hall and Spector’s systems, which are described in more detail below.

Regardless of Dr. Shanley’s conclusory assertions regarding the alleged similarity of Hall and Spector, it is clear Dr. Shanley is fully aware that Hall teaches away from single light source systems like Spector. Dr. Shanley cites the part of the Hall specification that teaches away from single light source systems. (Ex. 1003, ¶ 105 (citing Ex. 1008, 1:55-57, 1:57-60).) Dr. Shanley further explains that “[i]n applications where a broad field of view is needed ... Hall explains that systems have been developed that ‘include[] an array of multiple laser emitters and

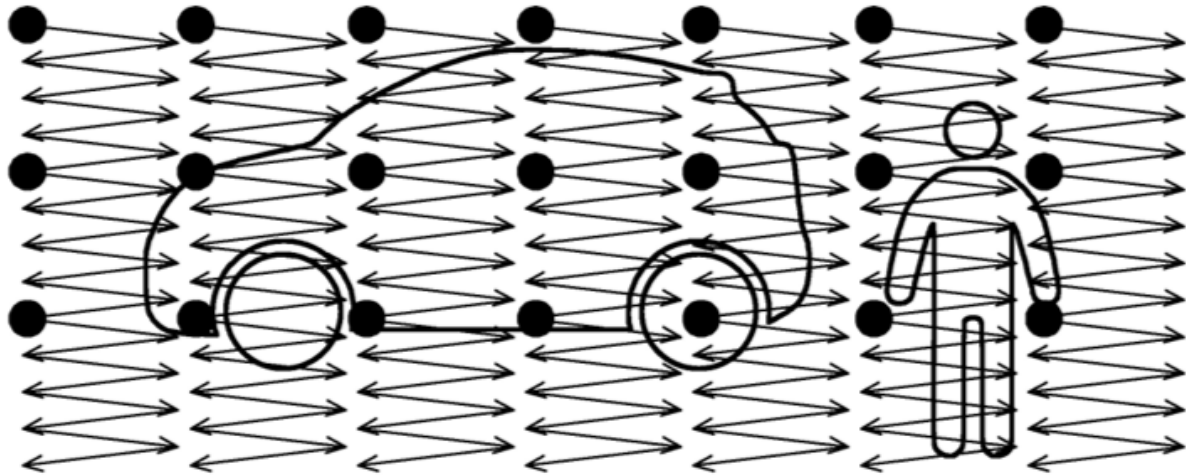
detectors.’” (*Id.*, ¶ 105 (quoting Ex. 1008, 1:64-2:14).) Thus, Dr. Shanley appears to acknowledge that Hall explicitly teaches away from single light source systems like the one disclosed by Spector.

Since there is clear evidence Hall taught away from single light source systems like Spector, and since Petitioner and its expert have made no effort to overcome this obstacle in combining the two references, Petitioner has failed to show that a POSITA would have been motivated to combine the Hall and Spector references. *See Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, 4 F.4th 1370, 1376-77 (Fed. Cir. 2021).

### **3. Spector teaches away from incorporating its apertures into a rotating system like Hall**

Petitioner’s proposed combination of Hall and Spector fails for the further reason that a POSITA would not have thought to consider the alleged apertures from Spector’s system—which scans in two planar dimensions—to be valuable in Hall’s system—which rotates in only one rotary dimension.

Spector’s “aperture array” is part of a system that faces in a single direction and continually scans through a scene by moving in horizontal (X-axis) and vertical (Y-axis) directions. The projected light spots and the photodetectors are mounted to a “stage” that continually moves in the X and Y directions to scan through the scene. This scanning action is shown in Figure 9 of Spector:

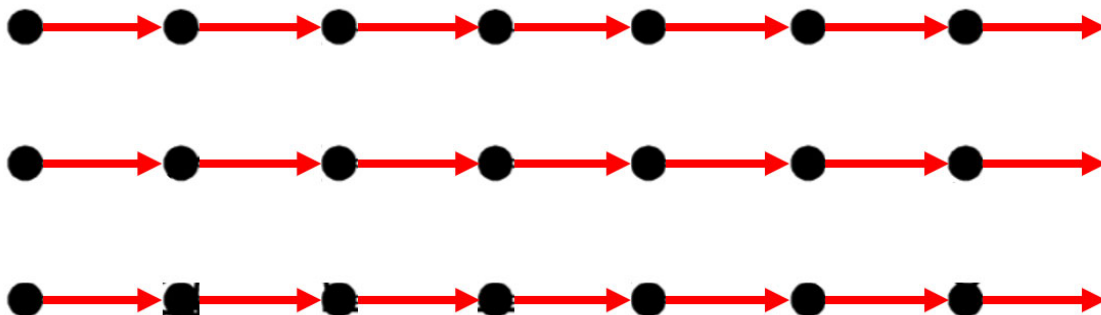


(Ex. 1005, Fig. 9; *see also* Ex. 1010 at 18.) Spector discloses that the horizontal and vertical scanning shown in Figure 9 is necessary for “accomplish[ing]” a “complete scan of the scene.” (Ex. 1005, 5:8-12; *see also* Ex. 1010 at 13, 15 (disclosing that scanning motion is necessary to “fill the scene”).)

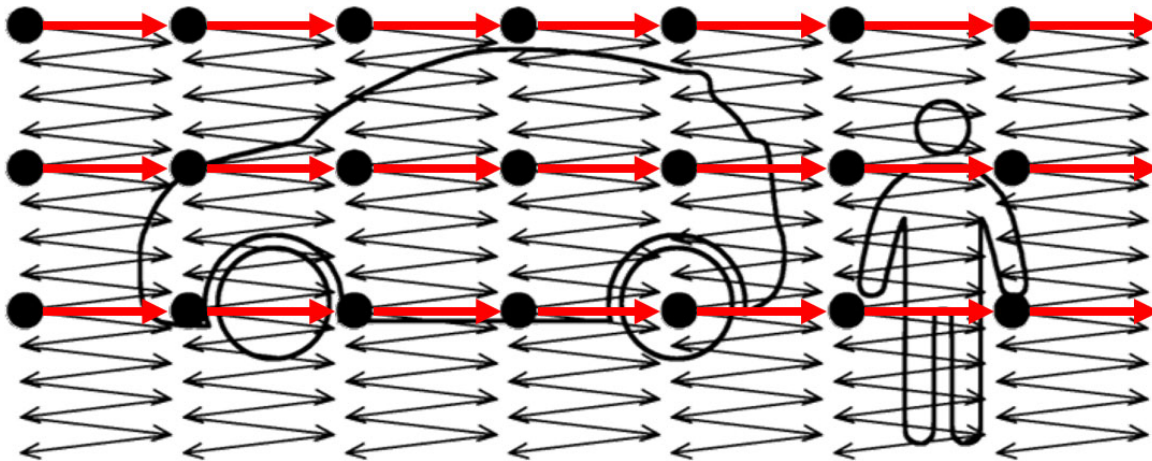
Hall discloses a fundamentally different type of scanning motion. Hall discloses only horizontal scanning along a radial axis. (Ex. 1008, 5:33-40 (“3-D LIDAR system **100** is configured to scan each of the plurality of beams of light **105** about central axis **104**.”), Figs. 1-2, 2:59-3:2, 5:35-40, 5:64-6:9, 6:18-30, 11:1-19.) Hall discloses no scanning in the vertical direction.

As a result of Hall’s horizontal, radial scanning motion, the outcome of incorporating Spector’s “aperture array” into Hall’s rotating LIDAR system would look significantly different from Spector’s “complete scan” of a scene depicted in Spector’s Figure 9 reproduced above. Instead of scanning horizontally and vertically

in an effort to fill in the gaps in the scene between Spector's separated light spots and apertures, Hall's rotating LIDAR system would result in an image of a scene as shown in the following annotated version of Spector's Figure 9:



(Ex. 1005, Fig. 9 (annotated); *see also* Ex. 1010 at 18.) An image of a scene scanned according to Hall's horizontal, radial scanning method using Spector's separated light spots and apertures would thus cause the system contemplated in Petitioner's Hall-Spector combination to miss all the information shown by the zigzagging black lines in Spector's Figure 9. The following diagram shows the original Spector Figure 9 superimposed on the annotated Spector Figure 9 shown above. Anything in the below image that does not overlap with the red lines is information missed by the system contemplated in Petitioner's Hall-Spector combination:



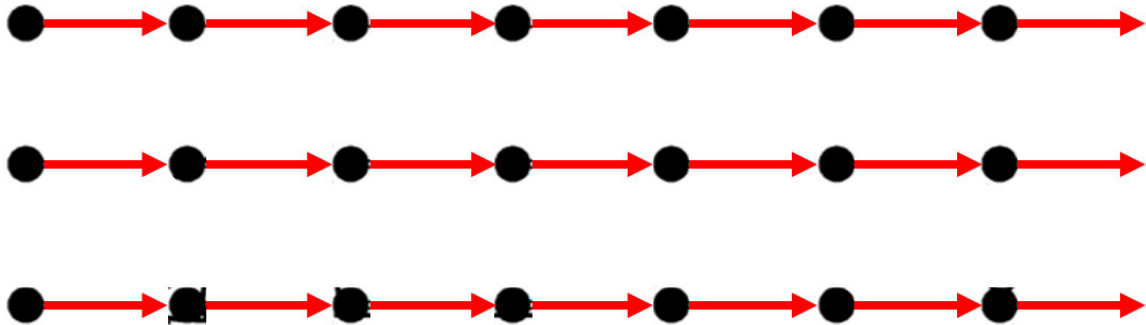
(Ex. 1005, Fig. 9 (annotated); *see also* Ex. 1010 at 18.)

Spector’s disclosure of horizontal and vertical scanning to complete or fill a scene at a static (*i.e.*, non-rotating) angle teaches away from the incorporation of Spector’s “arrayed micro-optics” and “aperture array” into a rotating system like Hall’s that does no vertical scanning. Spector discloses that by using discrete light spots and apertures in a grid array, its system only sees an incomplete part of a scene—*i.e.*, the points in the external world corresponding to the light spots and apertures. Accordingly, Spector teaches that scanning horizontally and vertically is necessary to *complete* the scene. For example, Spector teaches that “[a] LiDAR system and scanning method creates a two-dimensional array of light spots. A scan controller causes the array of light spots to move back and forth so as to complete a scan of the scene.” (Ex. 1005, Abstract (emphasis added), 2:12-16 (“The two dimensional array of light spots are scanned to complete a scan of the scene in such a manner that the spots traverse the scene in the first dimensional direction and in

the second dimensional direction[.]”), 5:8-12 (as a result of scanning, “a complete scan of the scene is accomplished”), 5:45-47 (“When the scene has been scanned, a three-dimensional reconstruction **160** of the scene can be completed.”), 1:48-62, 4:55-65; *see also* Ex. 1010 at 12-13, 18, 20.) Spector’s emphasis on the importance of scanning to complete a scene follows from its disclosure of discrete light spots and apertures. *Id.* Spector teaches that if a system is going to incorporate discrete light spots, then it must be paired with horizontal and vertical scanning. Otherwise, a system will detect incomplete information about a scene—rather than a “complete” picture of a scene that can be used in a three-dimensional reconstruction of a scene. Accordingly, Spector teaches away from the incorporation of its light spots and apertures into a rotating system like Hall’s that does not scan vertically. *See Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (finding no motivation to modify the prior art where doing so “would destroy the basic objective” of the prior art).

Spector also teaches away from using its light spots and apertures in a system like Hall’s where the scanning paths will cause substantial overlap between light spots and/or apertures. Spector discloses that if discrete light spots and apertures in a grid pattern like it discloses are used in a LIDAR system, then scanning should be performed “**no more than the distance between adjacent spots.**” (Ex. 1005, 1:62-67 (emphasis added), 4:67-5:5, Fig. 9; *see also* Ex. 1010 at 12 (“The scanning range

is minimal, as only the distance between the spots needs to be covered.”), 18, 20.) But as shown above, the use of Spector’s discrete light spots and apertures within Hall’s rotating LIDAR system would cause there to be *complete* overlap between the paths of light spots and apertures within a given row of the grid:



(Ex. 1005, Fig. 9 (annotated); *see also* Ex. 1010 at 18.) Spector explicitly taught away from such a use of its light spots and apertures—disclosing that each spot or aperture should be scanned “no more than the distance between adjacent spots.” (Ex. 1005, 1:62-67.)

Petitioner and its expert fail to address Spector’s teaching away from incorporation of its light spots and apertures into Hall’s rotating LIDAR system. (See Pet. at 57-58, 62-67; Ex. 1003, ¶¶ 191-92.) Neither petitioner nor its expert provide any support for why a POSITA would have been motivated to incorporate Spector’s light spots and apertures into a system like Hall’s that provides no vertical scanning. Moreover, neither petitioner nor its expert provide any support for why a POSITA would have ignored Spector’s teachings about minimizing scanning of its light spots and apertures so there is little to no overlap between the regions scanned

by different light spots and apertures. Instead, as outlined above, Petitioner and its expert's only motivations to combine relate to cross-talk and smaller, simpler scanning—neither of which makes sense in the context of the Hall-Spector combination. *See* Section IV.C.1; *Personal Web*, 848 F.3d at 994 (“[A] clear, evidence-supported account of the contemplated workings of the combination is a prerequisite to adequately explaining and supporting a conclusion that a relevant skilled artisan would have been motivated to make the combination and reasonably expect success in doing so.”).

Since Spector teaches away from incorporating its light spots and apertures into a rotating LIDAR system like Hall's, and since Petitioner fails to point to *any* motivation to overcome this teaching away, the Board should not institute as to Petitioner's Grounds 3 and 4, which depend on the combination of Hall and Spector. *See Chemours.*, 4 F.4th at 1376-77.

## **VI. CONCLUSION**

In light of Petitioner's failure to show a reasonable likelihood of success in showing the unpatentability of any of claims 21 or 23-34 of the '405 patent, the Board should not institute *inter partes* review as to the challenged claims.

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## **CERTIFICATE OF COMPLIANCE WITH WORD COUNT**

Pursuant to 37 C.F.R. § 42.24(d), I certify that this petition complies with the type-volume limits of 37 C.F.R. § 42.24(a)(1)(i) because it contains 8,794 words, according to the word-processing system used to prepare this petition, excluding the parts of this petition that are exempted by 37 C.F.R. § 42.24(a) (including the table of contents, a table of authorities, mandatory notices, a certificate of service or this certificate word count, appendix of exhibits, and claim listings).

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## **CERTIFICATE OF SERVICE**

I hereby certify, pursuant to 37 C.F.R. Sections 42.6 and 42.105, that a complete copy of the attached **PATENT OWNER'S PRELIMINARY RESPONSE**, including all exhibits (**Nos. 2001-2007**) and related documents, are being served via electronic mail on the 21<sup>st</sup> day of December 2023, upon Petitioner by serving Petitioner's counsel of record as follows:

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