
BEFORE THE PATENT TRIAL AND APPEAL BOARD

HESAI TECHNOLOGY CO., LTD.
Petitioner

v.

OUSTER, INC.,
Patent Owner

Patent No. 11,287,515
Inter Partes Review No. 2023-01422

PATENT OWNER RESPONSE

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UPDATED EXHIBIT LIST

Exhibit No.	Description
2001	Decision on Petition Issues
2002	'018 Provisional Application
2003	'875 Application Specification and Figures
2004	June 20, 2024 Declaration of Dr. Jason Janét
2005	May 23, 2024 Deposition of Dr. Michael Lebby
2006	U.S. Patent Publication 20160047901 (Pacala-2016)
2007	Alan Ohnsman, “Robocar LiDAR Startup Has A Novel Pitch: You Can Buy Our Sensor Now,” Forbes, Dec. 11, 2017.
2008	Velodyne image, VLS-128
2009	Velodyne LiDAR schematic, Envelope VLP-16, Drawing No. 86-0101
2010	Ouster, Inc. Datasheet, OS1 Mid-Range High-Resolution Imaging Lidar, Firmware Version v2.0, Hardware Version 840-102145-D (Rev D), Revision 2/11/2021.
2011	<i>Ouster, Inc. v. Hesai Group</i> , No. 1:23-cv-00406-CFC, (D. Del.), Dkt. No. 3, Ex. 15a (Preliminary infringement chart of U.S. 11,287,515 against PandarQT)
2012	PandarQT 64-Channel Short-Range Mechanical LiDAR User Manual, Hesai Technology Co. Ltd., Doc. Version: Q01-en-220410 (Apr. 2022)
2013	QT128C2X 128-Channel Short-Range Mechanical Lidar User Manual, Hesai Technology Co. Ltd., Doc. Version: Q03-en-231210 (Aug. 2022)

Exhibit No.	Description
2014	Multipole Ring Magnets, An In-Depth Magnet Guide, Tengye, 2023.
2015	<i>Ouster, Inc. v. Hesai Group</i> , No. 1:23-cv-00406-CFC, (D. Del.), Dkt. No. 3, Ex. 30 (PandarQT images)
2016	“Aeroscout Introduce Scout B-330 UAV Helicopter,” sUAS News – The Business of Drones, May 2017.
2017	Image from Mainblades.com home page.
2018	Joy Finnegan, “Ouster New Supplier of Digital Lidar Sensors for Drone Inspections,” Aerospace Tech Review, Jan. 27, 2021.
2019	“Lidar Odometry: Automated Drones in GPS-denied Environments,” Mainblades.com blog, May 24, 2022.
2020	Aircraft Inspection Automation, Mainblades.com home page.
2021	John Sokol, High Res Xray Teardown of Ouster OS1 Lidar, Telerobotics, Dec. 16, 2019
2022	Image from John Sokol, High Res Xray Teardown of Ouster OS1 Lidar, Telerobotics, Dec. 16, 2019.
2023	“TechInsights Teardown: Ouster OS1-64 Lidar Sensor,” Electronics360, Feb. 25, 2022.
2024	Image from “TechInsights Teardown: Ouster OS1-64 Lidar Sensor,” Electronics360, Feb. 25, 2022.
2025	11/25/2016 Executed Assignment for U.S. Pat. App. No. 15/276,532, Reel: 040539/Frame: 0269, recorded on Dec. 6, 2016.

Exhibit No.	Description
2026	12/3/2018 Executed Assignment for U.S. Pat. App. No. 16/209,875, Reel: 047788/Frame: 0249, recorded on Dec. 11, 2018.
2027	1/12/2018 Executed Assignment for U.S. Pat. App. No. 62/596,018.
2028	Velodyne LIDAR HDL-64E Spec Sheet
2029	Velodyne LiDAR VLP-16 User Manual
2030	January 5, 2024 Decision Granting Petition for U.S. Pat. App. No. 17/323,987
2031	January 8, 2024 Corrected Filing Receipt for U.S. Pat. App. No. 17/323,987
2032	U.S. Patent Publication 20200025880

Statement of Material Facts in Dispute

Petitioner did not submit a statement of material facts in its Petition.

Accordingly, no response is due pursuant to 37 C.F.R. § 42.23(a), and no facts are admitted.

Ouster, Inc. (“Ouster” or “Patent Owner”) submits this Response to the Petition for *Inter Partes* Review of U.S. Patent No. 11,287,515 (“the ’515 Patent” or “the challenged patent”), filed by Hesai Technology Co., Ltd. (“Hesai” or “Petitioner”) and the Board’s decision to institute that review.

I. INTRODUCTION

By the time of the invention, compact spinning LIDAR systems had been refined from the bucket-sized, relatively inefficient LIDAR systems that first emerged after DARPA’s Grand Challenge from 2004-2007, to much smaller offerings in 2017 that were approaching the size of a large coffee mug. The ’515 Patent’s innovative design provided the means to further reduce the form factor so that the full LIDAR system was just half the size of a coffee mug. The small, lightweight LIDAR systems practicing the ’515 Patent have made it possible to use small, unmanned aerial vehicles (*i.e.*, drones) utilizing such lightweight LIDAR systems for new applications which were not feasible with prior LIDAR designs.

Petitioner recognizes and in fact highlights Ouster as the leader of cutting-edge LIDAR technology. Angus Pacala, Ouster’s CEO and co-founder is not only the first named inventor of the ’515 Patent but he is also the first named inventor of the primary reference in each of Petitioner’s grounds. Petitioner asserts, in essence,

that the claimed invention of the '515 Patent is obvious because Mr. Pacala had previously invented an efficient, lightweight LIDAR for use in a compact design.

Petitioner's attempts to create a hindsight-driven reconstruction of the claimed invention using an array of disparate, and often conflicting, disclosures picked from the prior art fails for numerous reasons. This response is fully supported by Patent Owner's expert Dr. Janét—a highly qualified expert in the field of electro-mechanical and electro-optical devices with work experience in LIDAR design. Dr. Lebby, Petitioner's expert, has no experience working with, let alone designing or modifying rotating LIDAR systems. As provided below, Petitioner's bases for invalidity are not scientifically or legally valid as evidenced by Dr. Lebby's conclusory and often plainly inaccurate interpretations of the prior art references.

Hesai's obviousness argument is flawed for at least the following reasons: (i) it does not provide an adequate rationale for combining the cited references, (ii) it conveniently disregards relevant portions of cited art references that teach away from Hesai's combination, (iii) it relies on improper claim construction of multiple terms, and (iv) it relies on prior art that fails to teach or suggest features required by the challenged independent claims.

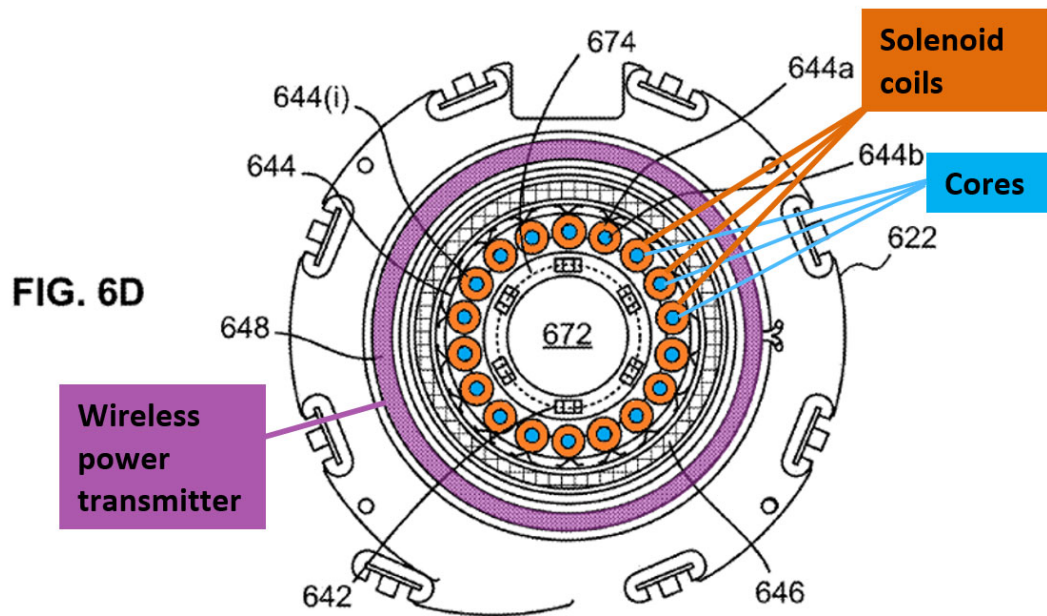
Indeed, even though every single Ground requires making modifications to the prior art in order to achieve limitations not disclosed in the art, Dr. Lebby, utterly disregards the difficulties imposed by his proposals. Contrary to Petitioner's hindsight, a POSITA would not have been motivated to pursue the proposed combinations and modifications with a reasonable expectation of success in achieving the claimed invention.

Ultimately, Petitioner asks the Board to find that the claimed invention, which has been both praised by Patent Owner's customers and copied by Petitioner, would have been obvious. Petitioner bases its argument on an assortment of cherry-picked prior art disclosures that both require ignoring the many prior art disclosures teaching away from the proposed combinations and claimed invention and going outside of those prior art disclosures to make numerous ill-advised modifications to the proposed combinations. This can only be explained by hindsight. Petitioner's hindsight – which it supports with only conclusory arguments that are inconsistent with the facts and law – does not render the '515 Patent claims obvious. The Board should uphold the patentability of all challenged claims.

II. BACKGROUND

The '515 Patent sought to improve on rotating LIDAR systems for autonomous vehicles, which are “technologically complex,” “costly to manufacture,” and involve “a conglomeration of different internal sub-systems, each of which can be in itself quite complex.” Ex. 1001 at 1:42-53. To avoid these difficulties, the '515 Patent teaches a light ranging device implemented on upper and lower circuit board assemblies in which the upper board assembly rotates with respect to the lower board assembly around a shaft that is perpendicular to the board assemblies. *Id.* at 26:19-40. The integration of various functional components into the circuit boards reduces the overall size and complexity of the system, making it suitable for applications where space and weight are critical. *Id.* at 1001 at 28:1-20; Fig. 5B. An electric rotary motor is integrated directly onto these same circuit boards. *Id.* at 30:5-9.

As depicted in Fig. 6D (reproduced below), the lower circuit board assembly includes a stator comprised of stator elements 644(i), each of which includes a solenoid coil 644*a* wound around a core 644*b* of magnetic material. Ex. 1001 at 30:24-29. Wireless power transmitter 648 is likewise placed on the circuit board outside of the plurality of stator elements. *Id.* at 31:21-48; Fig. 6D.



As depicted in Fig. 8A (excerpt reproduced below), the upper circuit board assembly 810 utilizes a two-board configuration (*e.g.*, a rotor board 850 and control board 840) arranged above the stator. Ex. 1001 at 34:37-44. The rotor board 850 includes a bearing housing 865 that fits over shaft 715 so that rotor board 850 can rotate relative to the stator assembly. *Id.* at 34:51-60. The light ranging device 820 is connected directly to the upper surface of the control board 840. The incorporation of cost-effective single photon avalanche diode (SPAD) arrays within each pixel of the light ranging device further allows for a more compact design while maintaining high sensitivity. *Id.* at 41:29-45.

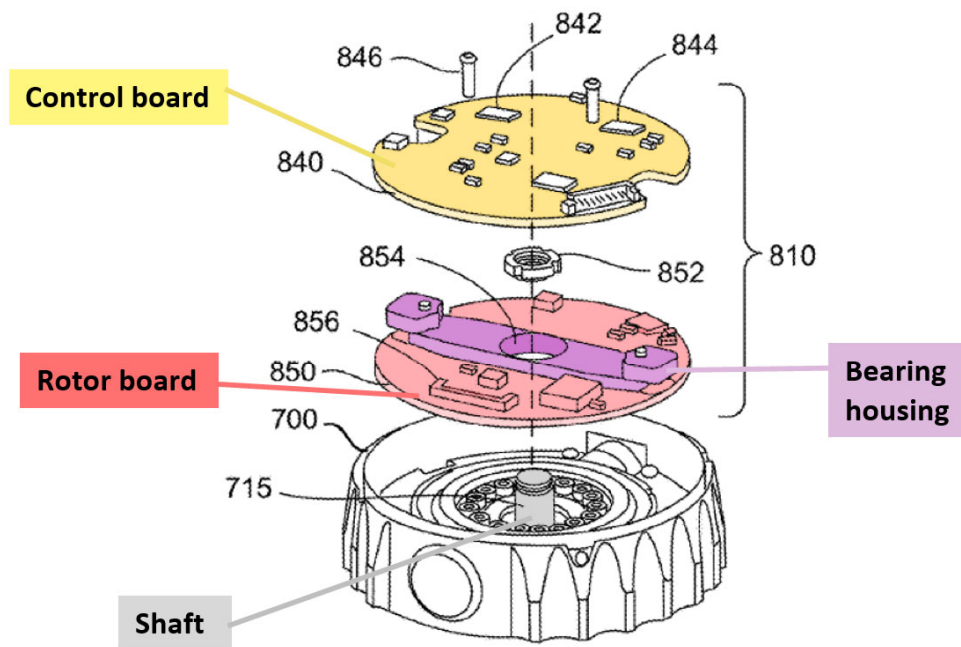


FIG. 8A

In contrast to any previously existing LIDAR devices, this design has a “highly integrated architecture” that results in a “more compact form factor and much simplified assembly process than spinning LIDAR systems that employ a separate electric motor module.” *Id.* at 16:29-33, 25:23-26. Indeed, embodiments of this design can be smaller than a coffee mug. *Id.* at 25:23-31. This compact form factor opens up new applications for LIDAR, including through deployment on airborne vehicles such as drones. *Id.* at 47:36-42.

III. EXPERT TESTIMONY AND LEVEL OF SKILL IN THE ART

A. Declaration Evidence

In support of this Response, Ouster provides the declaration of Dr. Jason Janét. Ex. 2004. Dr. Janét has a Bachelor of Science degree in Mechanical Engineering, a Master of Science degree in Integrated Manufacturing Systems Engineering, a Ph.D. in Electrical and Computer Engineering, and extensive work experience with LIDAR systems, robotics, and rotor-stator structures. Ex. 2004, ¶¶4-24.

B. Level of Skill in the Art

A person of ordinary skill in the art (POSITA) is a hypothetical person presumed to be aware of all pertinent art, to think along with conventional wisdom in the art, and to have ordinary creativity. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 407-09, 420-21 (2007).

Even though Petitioner’s expert, Dr. Lebby, opines that “[t]he claims of the ’515 patent are directed at a rotor-stator structure that includes an integrated PCB motor for rotating a LiDAR device mounted on a rotor” as well as additional electronic components (Ex. 1003, ¶40), Petitioner proposes that a POSITA need not have any direct experience with rotating LiDAR systems. *See* Pet. at 9. Patent Owner submits that Petitioner’s proposed POSITA would be acceptable if it

included the caveat that “at a minimum, at least one year of work experience was with LiDAR designs, including LiDAR designs implemented on a rotor-stator structure specifically.” Ex. 2004, ¶66. Patent Owner’s proposed addendum to Petitioner’s proposal would not require any *additional* work experience of a POSITA; it merely recognizes the POSITA should have some *relevant* experience. Ex. 2004, ¶¶67–68 (explaining LIDAR design requires one year of experience in order to bridge gaps between mechanical and electrical engineering as well as between analog and digital systems).¹

IV. CLAIM CONSTRUCTION

A. Applicable Law

Claims are ordinarily given their “ordinary and customary meaning,” which is “the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13, 1315 (Fed. Cir. 2005) (citation omitted).

¹ Patent Owner had accepted Petitioner’s definition of a POSITA for purposes of its Preliminary Response only, since it did not yet have the benefit of expert testimony to clarify the correct definition. *See* Paper 13 at 14.

B. “a stator assembly coupled to the stator circuit board”

Claim elements 1(g) and 14(h) each require “a stator assembly *coupled to* the stator circuit board.”

Under a proper construction of the phrase “coupled to,” the “stator assembly” and “stator circuit board” *must* be distinct elements such that the “stator assembly” cannot simply be a subcomponent of the “stator circuit board.”

Cutsforth, Inc. v. Motivepower, Inc., No. 2015-1314, 2016 WL 1358628, at *3-4 (Fed. Cir. Apr. 6, 2016) (*nonprecedential*) (even under the “broadest reasonable construction” standard,² Board erred in construing “coupled to” in a manner that did not require that referenced components be physically separate, but permitted a “sub-component” of an overall part, to meet the limitation); *Comcast Cable Commc’ns., LLC v. Promptu Sys. Corp.*, No. 2019-2287, 2021 WL 21487, at *2 (Fed. Cir. Jan. 4, 2021) (*nonprecedential*) (in an IPR, where claim recited “a speech recognition system *coupled to* a wireline node,” Board properly construed

² Since “coupled to” limitations require physically separate components even under the broadest reasonable construction standard, the same is necessarily true under *Phillips*.

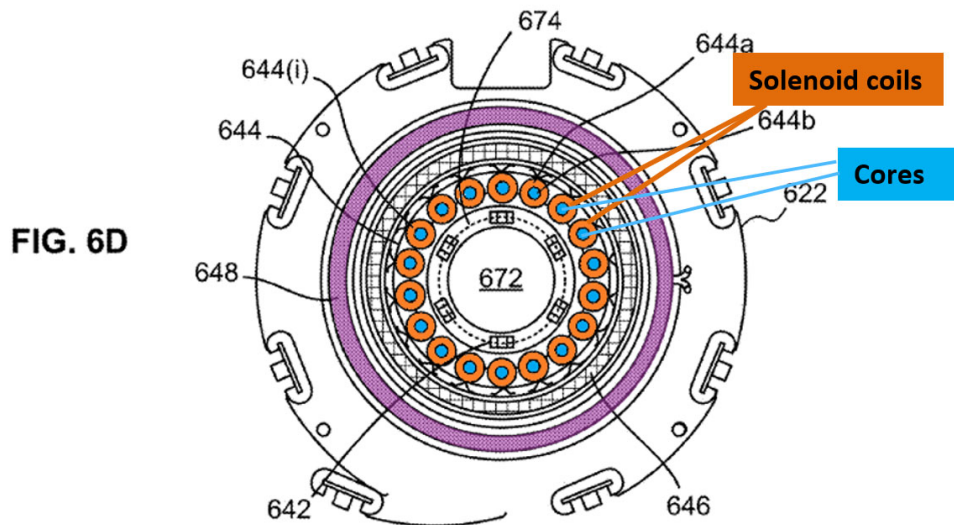
the claims as requiring that the “speech recognition system” and “wireline node” be “distinct elements”).

The Board should thus construe claims 1 and 14 to give effect to the “coupled to” limitation by requiring the “stator assembly” and “stator circuit board” be *distinct* elements. This is in line with both the plain meaning of the claim language as well as the ’515 Patent’s specification, which only discloses embodiments where the “plurality of stator elements” forming the “stator assembly” are separate structures coupled to the stator circuit board, not part of the stator circuit board itself. Ex. 2004, ¶140; Ex. 1001 at 30:15-35, Fig. 6D.

C. “each of the plurality of stator elements including a coil wound around a magnetic core”

The ’515 Patent teaches “an annular arrangement of multiple stator elements 644(i)” where “[e]ach stator element 644(i) can include a solenoid *coil 644a wound around a core 644b* of magnetic material.” Ex. 1001 at 30:15-26 (emphasis added). “The coils are oriented such that the magnetic field exiting the solenoid is substantially oriented in a direction that is substantially perpendicular to the plane of the circuit board.” *Id.* at 30:26-29. Fig. 6D of the ’515 Patent (reproduced below) shows, as an example, eighteen (18) individual stator elements 644(i), each

including a coil wound around a magnetic core (*i.e.*, 18 coils wound around 18 separate cores). *Id.* at 30:24-26, 30:29-35.



Consistent with the '515 Patent's written description, claim element 1(g) recites "a plurality of stator elements arranged annularly about the axis of rotation, each of the plurality of stator elements including a coil wound around a magnetic core." *See* Ex. 1001 at 30:15-35. The plain language of claim element 1(g) thus requires multiple magnetic cores (*i.e.*, one for each of the multiple coils).

Moreover, a POSITA would understand that the claimed configuration, where each stator has its own magnetic core, permits the creation of distinct magnetic poles in the stator and that these distinct poles better enable flux coupling with the magnets in the rotor to allow for the generation of rotating magnetic fields that interact with the rotor magnets to produce torque. Ex. 2004, ¶145.

The Board should give effect to the plain language of the claims and specification by construing claim 1 to require the magnetic core of each of the plurality of stator elements to be distinct.

V. THE GROUNDS PRESENTED BY PETITIONER DO NOT RENDER THE CHALLENGED CLAIMS OBVIOUS

Petitioner has failed to show by a preponderance of the evidence that any of the Challenged Claims are unpatentable. All nine Grounds of the Petition include a combination of Pacala (or Pacala-2017) as the primary reference and, at least, Johnson, Pardhan, and Zhang as secondary references. However, Pacala (or Pacala-2017), Johnson, and Zhang all teach away from combination with Pardhan and from the further modifications to Pardhan proposed by Petitioner to achieve the claimed invention.

Contrary to Petitioner's assertions, at least Johnson and Zhang also fail to disclose or suggest elements of the three independent claims (1, 14, and 22) as well as numerous dependent claims. None of the additional references utilized in Grounds 2-9 correct these deficiencies.

A. Petitioner's Reliance upon Dr. Lebby Is Unjustified

The Federal Circuit forbids reliance on artisans who are skilled in the wrong art. *See Kyocera Senco Indus. Tools Inc. v. Int'l Trade Comm'n*, 22 F.4th 1369, 1376–77 (Fed. Cir. 2022).

Every one of Petitioner’s invalidity arguments rests upon the opinion of Dr. Michael Lebby. While Ouster does not dispute that Dr. Lebby is highly credentialed in certain areas, those areas do not sufficiently overlap with the subject matter of this IPR in order for Dr. Lebby’s opinions to be credible, much less the substantial evidence Petitioner requires to meet its burden.

Dr. Lebby cites his “over 40 years” working on electrical and mechanical systems, generally. Ex. 1003, ¶¶4-16, 41. As Dr. Lebby himself has noted, the ’515 patent is directed to LIDAR devices implemented on a rotor-stator structure. Ex. 1003, ¶40. However, Dr. Lebby has never before “worked on a completed LiDAR system.” Ex. 2005 (Lebby Depo Tr.), at 36:19-37:10. At his deposition, Dr. Lebby could not recall ever having “been involved in the design of those types of rotor-stator systems” nor “any specific systems he had designed that utilize rotor-stator structures at any point in [his] career.” *Id.* at 39:13-40:16.

Dr. Lebby’s lack of relevant experience with LIDAR systems manifests itself through the numerous errors in his analysis and the many important details that he has overlooked. Accordingly, Dr. Lebby’s unreliable testimony should be afforded no weight.

B. Ground 1: Pacala, in view of Johnson, Pardhan, and Zhang fail to render any of claims 1-2, 4-9, 11, 14, 16-17, 19 unpatentable

In Ground 1, Petitioner relies upon key words in Johnson, Pardhan and Zhang, to cobble together unsupported changes to the LIDAR of Pacala. For example, Petitioner found a motor from Johnson, a heat sink from Pardhan (to act as a support component), and additional heat dissipation structures from Zhang (to act as arms of the support component). Pet. at 16-18; Ex. 1003, ¶¶135-142; *see also* Paper 13 at 29-32. This, however, is not the standard for obviousness, indeed “[t]he ‘as a whole’ instruction in title 35 prevents evaluation of the invention part by part.” *Ruiz v. A.B. Chance Co.*, 357 F.3d 1270, 1275 (Fed. Cir. 2004). “Without this important requirement, an obviousness assessment might break an invention into its component parts (A + B + C), then find a prior art reference containing A, another containing B, and another containing C, and on that basis alone declare the invention obvious.” *Id.*; *see also W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983). (“It is difficult but necessary that the decisionmaker forget what he or she has been taught . . . about the claimed invention and cast the mind back to the time the invention was made (often as here many years), to occupy the mind of one skilled in the art. ...”).

The '515 patent notes that the LIDAR systems of the prior art are bulky, heavy, and complex, with numerous subsystems. The '515 patent seeks to mitigate all these characteristics while Petitioner and Dr. Lebby exacerbate them.

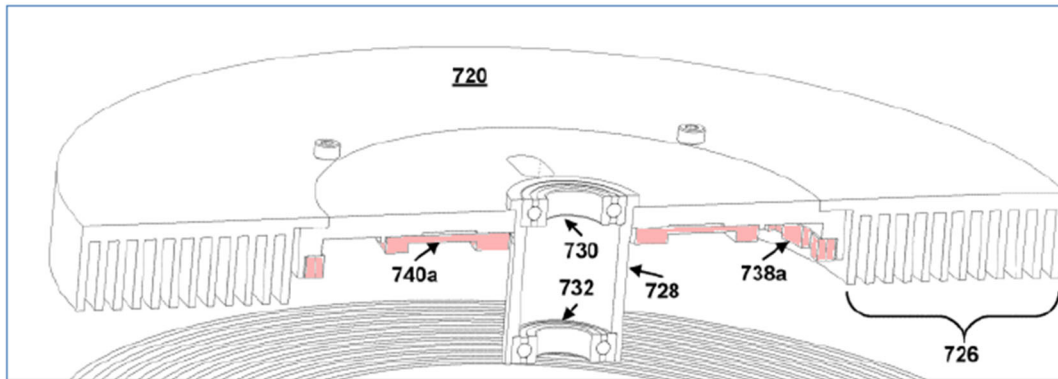
i. Petitioner provides no rational underpinning for utilizing Johnson with Pacala

a. Petitioner fails to provide an adequate motivation to combine the “compact” design of Johnson with the voluminous rotating heat sink of Pardhan

Petitioner asserts that a POSITA, starting with the LIDAR of Pacala, would have been motivated to “improve[] Pacala by providing ‘a more compact design and/or efficient use of space.’” Pet. at 51-52. To achieve this, Petitioner’s expert, Dr. Lebby, opines that Johnson would be utilized because “Johnson teaches the use of a PCB motor integrated into the rotor and stator platforms to provide a more compact and efficient use of space.” Ex. 1003, ¶84. However, no such benefit is realized by Petitioner’s combination because Pacala-Johnson is then further combined with Pardhan.

More specifically, Petitioner proposes placing Johnson’s PCB *within* Pardhan’s large, finned heat sink as shown below in the annotated figure from Petitioner where the proposed location of Johnson’s rotor is highlighted red. Pet. At 31. While Petitioner argues a POSITA would have been motivated to utilize Johnson’s design due to its compactness, any such motivation is negated by the

fact that the PCB is positioned within the voluminous structure of Pardhan, thus destroying any benefits of its compact size. Ex. 2004, ¶109; *see also id.* at ¶112 (citing Ex. 1006, 8:66-9:4, 9:54-60, 10:29-31, Fig. 3).



Notably, despite Petitioner’s proffered motivation to utilize Johnson for its compactness, Pardhan teaches that a *larger* volume design is beneficial to prevent the overheating that can occur by packing electrical components in too small a space. Ex. 1006 at 4:63-67; Ex. 2004, ¶108. In other words, Pardhan affirmatively discourages the use of a compact design like the one taught in Johnson. *Id.*; *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994) (“A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.”)

Accordingly, Petitioner provides no rational motivation to combine “improve” Pacala with Johnson. Because Johnson is relied upon for numerous claim elements, Petitioner fails at the outset for this threshold reason alone.

b. The Institution Decision mistakenly found an alternative motivation to improve Pacala with Johnson that was not in the Petition

The ID acknowledged the contradiction between the proffered motivation to utilize Johnson for its compactness within Pardhan’s heat sink, but then dismissed this flaw by relying on an alleged “increas[ed] operating life of the rotating structure.” *See* Paper 13 at 29 citing Pet. 53. But Petitioner never made such an argument. Instead, Petitioner only argues the device’s operating life would be improved by incorporating the “heat dissipation structures” of Zhang, and even that is incorrect.

As explained below, in Section V.B.vii, Petitioner’s claim that Zhang’s “heat dissipation techniques” are “complementary with and can be implemented in addition to those in Pardhan to further improve the thermal design of the combined device” to “improve heat dissipation and ventilation and increase operating life” are not accurate. More importantly, however, they do not provide a motivation to use Johnson in the first place. Petitioner *never* provides a valid reason for using

Johnson in the proposed combinations and Petitioner fails for this threshold reason.

The ID only found otherwise by mistake.

ii. There is no motivation to combine Pacala’s LIDAR with Pardhan’s “thermal rotary link”

Petitioner also errs in presuming a need for Pardhan. As motivation for combining Pacala’s LIDAR with Pardhan’s finned heat sink, Petitioner asserts that “[a] LiDAR device mounted on a rotating platform ‘generate[s] excess heat’ that makes it difficult to operate the device ‘within a safe operating temperature range’ without techniques for ‘transfer[ing] excess heat away from’ the rotating LiDAR device.” Pet. at 52-53. Petitioner’s only authority for the statement, however, is a misreading of Pardhan. *Id.* (citing Ex. 1006 at 4:54-5:80, 19:2-6).

Contrary to Petitioner’s claims, Pardhan does not teach the necessity of a heat sink in LIDAR designs. Ex. 2004, ¶¶111-112. Rather, Pardhan’s actual teaching is that to improve a low signal-to-noise ratio of LIDAR signals “the power with which the LIDAR device is operated might need to be *above* a threshold power level.” Ex. 1006 at 4:56-63 (emphasis added). The “threshold power level” is the level at which excess heat must be dissipated. *Id.*; Ex. 2004, ¶¶111-112. Thus, Pardhan’s solution to a low signal-to-noise ratio results in an excess heat that must be dissipated. Pardhan’s proposed manner of dissipating the

excess heat is its “thermal rotary link” (i.e., voluminous, rotating heat sink). Ex. 1006 at 4:56-5:4; Ex. 2004, ¶¶96, 111. In other words, Pardhan’s thermal rotary link is provided to address the problem of increased heat generation created by operating the LIDAR device above a threshold power level to improve the accuracy of the signal reception. Ex. 2004, ¶¶111-112.

In contrast, Pacala teaches operating within the threshold power level, not above it. *Id.*, ¶114. Unlike Pardhan, Pacala’s LIDAR enables detection of weak return signals slightly above the noise level ***without*** increasing the transmit power ***above*** a threshold power level by using a multi-channel TDC (time-to-digital converter) approach with individually adjustable voltage thresholds. *Id.*; Ex. 1004 at [0014], claims 12, 19, 27. There is no excess heat generated by Pacala’s design because Pacala’s design addresses the issue of weak return signals without increasing the power levels of the LIDAR’s operation beyond the threshold power level. Ex. 2004, ¶114. Thus, a POSITA would have recognized there is no reason to add Pardhan’s thermal rotary link when using Pacala’s LIDAR. *Id.* (citing Ex. 2028 and Ex. 2029 to show the well-established trend in decreased power levels for compact LIDAR designs).

Rather, a POSITA would understand that adding Pardhan’s rotating heat sink would instead result in a major additional complication to Pacala’s system

with no countervailing benefit. Ex. 2004, ¶115. Pardhan's rotor plate 720 adds substantial weight far from the central rotating axis causing motor inefficiencies as well as stability issues raising the risk of catastrophic failure. *Id.*, ¶¶116-117.

Pardhan's fins would also limit the placement of the stator and rotor elements to a small radius, which reduces torque capacity. *Id.*, ¶118. Additionally, the fluid between the fins 726 of the rotor plate and the fins 724 of the stator would cause attractive forces such as observed in the Vortex Regenerative Air Movement (VRAM)³ that draw the plates closer to each other and significantly increase the risk of interference, oscillations and damage. *Id.*, ¶119. The resulting stress would reduce the operating life of the combined system. *Id.*, ¶120. The complexity of the proposed design would also make it more challenging to manufacture, assemble, and maintain Pacala's LIDAR. *Id.*, ¶121.

Furthermore, as discussed in Section V.B.vii below, adding the heat dissipation structures of Zhang would only add more stress and vibration to the system thus further reducing its operating life making the full combination of Ground 1 even *less* desirable. Ex. 2004, ¶122.

³ See U.S. Patent No. 6,960,063.

Accordingly, because Pardhan’s ill-advised thermal rotary link would have offered no benefit in a system built with Pacala’s efficient LIDAR design, a POSITA would not have modified Pacala to unnecessarily include one. *Id.*, ¶123.

iii. Johnson and Pardhan do not provide the details for Pacala’s rotating structure

Petitioner’s back-up assertion that a POSITA would look for “detail[s] [on] the implementation of [Pacala’s] rotating structure,” including the arrangement of magnets, stator coils, and other distributed electronics, from “two Waymo patents” (Johnson and Pardhan) is simply wrong and is not a legally adequate rationale under *KSR* for either reference. *See* Pet. at 17; Ex. 2004, ¶124.

Petitioner’s reliance on *Wavetronix LLC v. Smart Microwave Sensors GmbH*, 746 Fed. Appx. 984, 987, 991 (Fed. Cir. 2018), is misplaced. *Wavetronix* does not support Petitioner’s contention that it can choose *any* prior art rotating structures for use with Pacala because Pacala itself does not provide those details. Pet. at 51. Instead, in *Wavetronix*, the primary reference expressly stated the potential for generating a signal of “any desired type,” thereby implicitly suggesting the inclusion of additional details, such as those found in the secondary reference on digital signals, specifically. *Wavetronix*, 746 Fed. Appx. at 991 (citation omitted). There is no comparable disclosure in Pacala that suggests its

LIDAR device should sit upon a large rotating sink extending far outside the Pacala’s enclosure. *Wavetronix* does not give petitioners *carte blanche* to pick-and-choose *conflicting* teachings and structures from multiple designs. That is not the law. *KSR* requires, at a minimum, “articulated reasoning with some rational underpinning” to support a prior art combination. *KSR*, 550 U.S. at 418 (*quoting In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Here, there is no articulated reasoning for Petitioner’s proposed combination.

iv. A POSITA would not have replaced Pardhan’s rotor magnets, transformer coils, and motor windings with Johnson’s PCB rotor and PCB stator

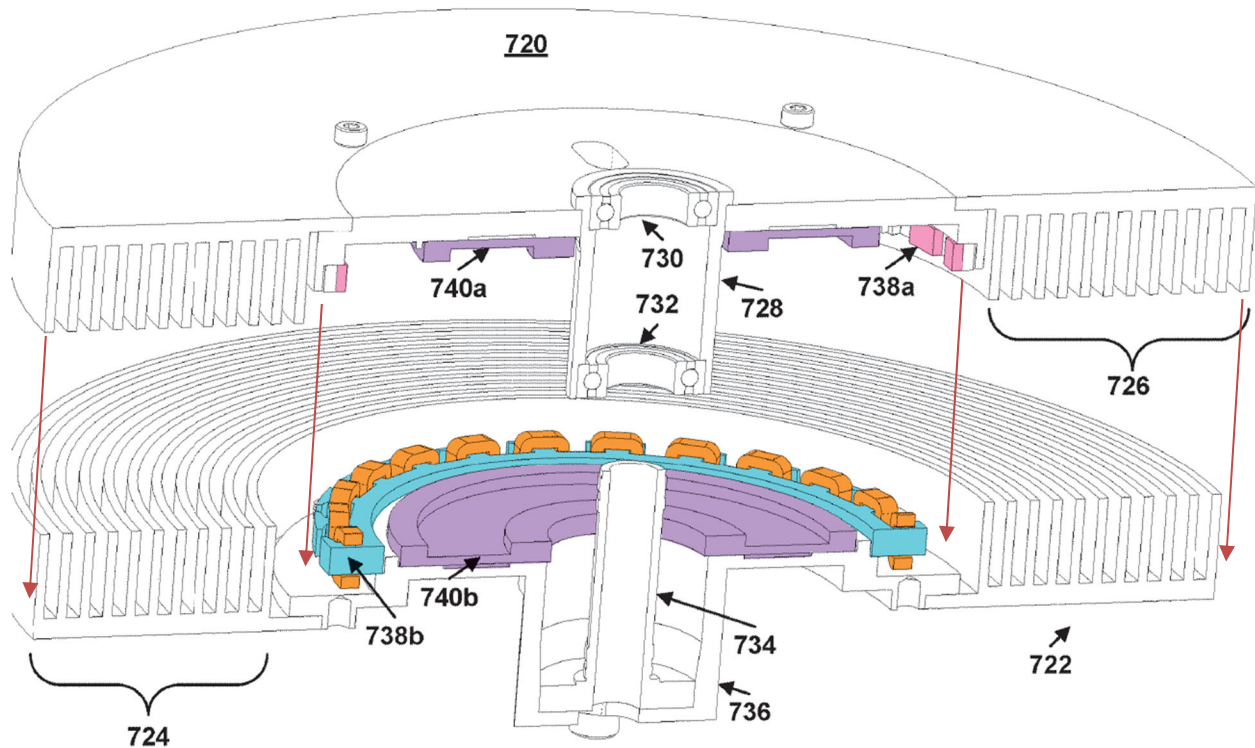
Petitioner incorrectly alleges that there is a singular “rotor-stator structure taught by Johnson-Pardhan” collectively that would be utilized with Pacala. *See e.g.*, Pet. at 21⁴. Regardless of having a common assignee, Johnson and Pardhan are directed to entirely different systems using fundamentally different motors, a point that Petitioner’s expert, Dr. Lebby, failed to appreciate. Ex. 2004, ¶¶127-128. A POSITA would not have replaced Pardhan’s rotor magnets, transformer coils,

⁴ The ID similarly *assumed* a motivation to combine Johnson and Pardhan without any reason. *See* Paper 13 at 29.

and motor windings with Johnson's PCB rotor and PCB stator because doing so would result in a cascade of negative effects. *Id.*, ¶¶130-131.

Petitioner's expert, Dr. Lebby, who lacks experience with designing rotor-stator structures, mistakenly believed Pardhan's Figure 7B teaches an "axial flux motor" simply because the rotor plate is above the stator plate. Ex. 2005 at 83:4-84:4.⁵ This is not true. Ex. 2004, ¶128. Instead, Pardhan discloses a radial flux motor that—when assembled per the red arrows—positions the rotor magnets 738a (pink) radially outwards from slotted motor windings 738b (gold) containing ferromagnetic cores (blue) to produce strong magnetic flux density in the air gap between the cores of the motor windings 738b and the adjacent magnets 738a. *Id.*; Ex. 1031 at 90-91.

⁵ At his deposition, Dr. Lebby could not recall whether he had "any experience with brushless DC axial flow motors." *Id.* at 39:10-40:16, 43:16-21.



In contrast, Johnson utilizes an axial-flux design where the rotor magnets are spaced axially above the toroidal coil windings of its PCB stator. Ex. 2004, ¶129. In order for Johnson's axial-flux design to produce a magnetic flux density into the air gap between the stator and the rotor magnets equivalent to Pardhan's radial flux motor, Johnson's PCB rotor would also produce strong magnetic flux in a large volume around the stator to detrimental effect on the system. *Id.*, ¶130.

Pardhan surrounds its rotor magnets and stator coils with finned metallic plates of high thermal and electrical conductivity for use as a heat sink, but these fins and plates are susceptible to eddy currents from moving magnetic fields. *Id.*; Ex. 2005 at 95:13-96:10; Ex. 1005 at 17:41-46, 18:9-13. A POSITA would have

expected placing Johnson's PCB rotor and PCB stator within Pardhan's rotary thermal link could generate eddy currents induced in the metal plates of the thermal link itself, causing significant waste heat. Ex. 2004, ¶130. In essence, Pardhan's heat sink, the basis for Petitioner's combination, would be converted into a heat *source* if combined with Johnson's PCB rotor and PCB stator. *Id.* Thus, in strong contrast to what Petitioner asserts, a POSITA would have avoided the combination. *In re Fritch*, 972 F.2d 1260, 1265 n.12 (Fed. Cir. 1992) (“[a] proposed modification [is] inappropriate for an obviousness inquiry when the modification render[s] the prior art reference inoperable for its intended purpose.”) (citing *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984)).

Far from the simple substitution alleged by Dr. Lebby the proposed combination of Johnson and Pardhan would be a complete redesign of Pardhan's electric motor. A POSITA would not take such a redesign lightly without understanding the negative and cascading consequences of such a redesign. Ex. 2004, ¶131; Ex. 1031 at 105-107. Here, because Dr. Lebby mistakenly believed Pardhan's Figure 7B teaches an “axial flux motor,” he failed to consider any of the complications a POSITA would have needed to address before contemplating such a redesign. Ex. 2004, ¶131; Ex. 1031 at 105-107 (describing, for example, the need for determining mechanical, electric, and electromagnetic power losses (e.g., due

to eddy currents), a thermal analysis (e.g., with a computational fluid dynamics (CFD) analysis), new torsional analysis, etc.). Further, because Johnson's motor was intended for a compact design, and Pardhan adds substantial mass extending outwards from the central axis of the motor, a POSITA would have expected difficulties in generating sufficient torque from Johnson's unusual PCB motor to function within Pardhan's design. Ex. 2004, ¶132.

As explained in Section V.B above, all of these considerations would be complicated by Pardhan's unusual decision to utilize a rotating heat sink with interleaved fins thus introducing additional concerns relating to fluid dynamics, gyroscopic forces, etc. *Id.*, ¶133; Ex. 1006 at 20:1-11 (explaining Pardhan's device was meant to be "mounted [to a] vehicle."). None of these issues were addressed in the Petition or in Dr. Lebby's declaration. Ex. 2004, ¶133; *see generally*, Ex. 1003. This is a fatal flaw in Petitioner's argument and does not reflect how a POSITA would have approached a redesign.

Moreover, due to the complexity involved, a POSITA would have been reluctant to use Pardhan's design standing alone. Ex, 2004, ¶134. Even if a POSITA assumed Pardhan's design was a viable one because it was disclosed in a patent, a POSITA would have needed a very strong incentive to make *any* tweaks to that unusual design. Petitioner, however, does not identify any suitable incentive

for the changes it proposes. *Id.*; see also *Provisur Technologies, Inc. v. Weber, Inc.*, 2022 WL 17688071, *5 (Fed. Cir. 2022) (affirming Board’s finding that a person of ordinary skill in the art would have “lacked motivation to combine the references and modify them” because of the “increased complexity” posed.)

Additionally, Petitioner assumes Johnson’s design offers “simplified electrical connections” and “reduced electronic noise,” but this is not correct. Pet. at 31; Ex. 2004, ¶135. Johnson itself explains that its design results in “interference from the stator-platform magnetic field of the coil windings” that affect any other electronic components in the vicinity. *See* Ex. 1005 at 15:1-7. Johnson further explains its compact design carries significant drawbacks regarding electrical connections as well. *See e.g., id.* at 3:9-24 (“[I]n some scenarios, adjacent coil windings may be unintentionally (e.g., due to a defect or a manufacturing error, etc.) electrically coupled (e.g., shorted) at locations other than the terminals (e.g., ends) of the respective coil windings,” and “testing each coil winding separately may be technically challenging.”)

A POSITA would understand that a PCB motor introduces risks of ground loops, unintentional capacitance, and inductive problems, which can severely impact the motor's performance and reliability. Ex. 2004, ¶135. These issues can lead to sudden failures, damage to expensive components, and increased

maintenance costs. *Id.* Moreover, the sensitivity to perturbations in a PCB design can make the motor more vulnerable to external factors, such as electromagnetic interference or power supply fluctuations. *Id.* This can result in inconsistent performance and reduced overall system reliability. *Id.* Maintaining the separate rotor and stator components in Pardhan’s configuration also allows for better heat dissipation and easier maintenance. *Id.*

Accordingly, a POSITA would not have been motivated to modify Pardhan to incorporate Johnson’s PCB rotor and PCB stator as Petitioner contends.

v. Petitioner’s proposed combination does not disclose or render obvious the required “stator assembly . . . coupled to the stator circuit board”

As explained in Section IV.B *supra*, the “coupled to” limitation of claims 1 and 14 requires that the “stator assembly” and “stator circuit board” be distinct physical elements. Petitioner, however, maps the “stator assembly” to subcomponents of Johnson’s “stator circuit board.” *See* Pet. at 21-23, 31-33, 36-37; Ex. 2004, ¶138.

Specifically, Petitioner maps the “stator circuit board” element to Johnson’s “stator platform 330.” Pet. at 21. Johnson explains “[stator] platform 330 can be physically implemented as a multi-layer circuit board (e.g., PCB).” Ex. 1005 at 12:8-11. Johnson discloses “one or more components shown in FIG. 3C may

correspond to electrically conductive material(s) (e.g., tracks, traces, copper, etc.) patterned along a first layer of the PCB” and makes an identical disclosure as to conductive materials patterned along a second layer of the PCB as shown in Fig. 3D. *Id.*, Figs. 3C-3D, 11:66-12:16. “Coil windings” are then “defined by the[se] conductive structures.” *Id.* at 12:37-39.

Petitioner maps the “stator assembly comprising a plurality of stator elements arranged annularly about the rotation axis, each of the plurality of stator elements including a coil [wound around a magnetic core]” to these “electrically conductive” subcomponents of Johnson’s stator platform 330 (*i.e.*, to the interleaved coil windings of Johnson stator PCB). *See* Pet. at 32 (citing Ex. 1005, Figs. 3C-3D, 11:66-12:13, 3:40-64). Petitioner has therefore improperly mapped the “stator assembly” to *subcomponents* of the “stator circuit board” rather than a distinct element “coupled to” the “stator circuit board” as described and claimed in the ’515 Patent. Ex. 2004, ¶¶138-139.

Petitioner points to Johnson’s disclosures that “magnetic sensor 390” is “mounted to” side 300a of platform 330 (Ex. 1005, 15:34-42) as evidence that the “stator elements” are purportedly “‘coupled to’ the circuit board under *any proposed construction*.” Pet. at 32 (citing Ex. 1005, 15:34-42) (emphasis added). Petitioner also points to Johnson’s similar disclosure regarding the mounting of

communications interface 236, power interface 238, and magnetic field sensor 290 to a PCB. *Id.* (citing Ex. 1005, 8:62-68). Notably, however, the devices Johnson teaches are “mounted to” the PCB are not the claimed “...stator elements including a coil...” that form the “stator assembly.” Ex. 2004, ¶141. Indeed, the fact that Johnson discloses that those other devices are “mounted to” the printed circuit board and does *not* describe any of the conductive structures forming Johnson’s toroidal coil windings as being “mounted to” the printed circuit board further proves a POSITA would recognize Johnson’s coils form part of platform 330 (*i.e.*, they are “components” of the printed circuit board as Johnson expressly states) and are not “coupled to” it under the correct construction. *Id.*

Accordingly, when independent claims 1 and 14 are properly construed, Petitioner fails as to claims 1-2, 4-9, 11-14, 16-17 and 19-21 because Ground 1 does render obvious the required “stator assembly . . . coupled to the stator circuit board.”

vi. Petitioner’s proposed combination does not disclose or render obvious “. . . each of the plurality of stator elements including a coil wound around a magnetic core”

Because the ID focused on independent claim 14, it did not reach Patent Owner’s argument that claim element 1(g) is not rendered obvious by Petitioner.

As explained in Section V.B.vi *supra*, the Board should give effect to the plain language of the claims and specification by construing claim 1 to require the magnetic core of each of the plurality of stator elements to be distinct.

Petitioner relies on Johnson’s embodiment where a single “‘ring shaped’ core may be disposed in the middle layer of platform 330 ‘between the conductive structures of Figs. 3C and 3D’” as meeting element 1(g). Pet. at 37. Johnson’s disclosure of a plurality of coil windings wound around a single, ring-shaped core shared by all coil windings does not teach or suggest a plurality of stator elements *each* including a coil wound around a magnetic core. *See* Ex. 1001 at 30:15-35; Ex. 2004, ¶146.

Accordingly, when independent claim 1 is properly construed, Petitioner fails as to claims 1-2, 4-9, and 11-13 because Ground 1 does not render obvious the required plurality of stator elements where “each of the plurality of stator elements including a coil wound around a magnetic core.”

vii. Petitioner’s proposed combination does not disclose or render obvious the required “plurality of arms extending away from the sleeve”

Ground 1 also fails to make a *prima facie* showing of obviousness with respect to claim elements 1(e) and 14(e), which recite “a support component ... comprising a sleeve fitted over the shaft and ***a plurality of arms*** extending away

from the sleeve.” (emphasis added) The ID preliminarily found that “Petitioner’s evidence outweighs Patent Owner’s attorney argument on th[e] issue” of whether Zhang teaches arms that would “strengthen the attachment of Pardhan’s sleeve to its rotor plate.” Paper 13 at 35-36. Petitioner and Dr. Lebby, however, again grossly oversimplify the proposed combination. A POSITA would recognize that Zhang doesn’t disclose “arms,” and even if it did, the alleged arms would not “strengthen attachment” or “minimize vibration” as alleged by Petitioner. Ex. 2004, ¶¶148–149.

Petitioner identifies Pardhan’s “hollow shaft 728” as the claimed sleeve. Pet. at 24-25. Dr. Lebby admits that Pardhan’s alleged support component “does not include arms extending away from the sleeve.” Ex. 2005 at 71:2-7. Thus, “to invalidate Claim Limitation 14[e],” Dr. Lebby has “used Zhang” to “implement Zhang’s support structure on the rotor 720 of Pardhan.” *Id.* at 74:7-23. Petitioner asserts a POSITA would have combined Pardhan’s shaft 728 with “Zhang’s arms on the upper surface of the support component.” Pet. at 27.

Zhang, however, does not teach or suggest a plurality of arms extending away from a sleeve. Indeed, Zhang includes no teachings relating to arms whatsoever, instead it discloses heat dissipation structures. Ex. 2004, ¶148; *see generally* Ex. 1007.

Petitioner nevertheless claims Zhang teaches arms based on (i) Petitioner's selective coloring of Zhang's Fig. 1 to make it *appear* as though arms are present and (ii) a truncated quote from Zhang's page 6 (*i.e.*, p. 9 of Ex. 1007) regarding heat dissipation structures. *See* Pet. at 27; *see also* Ex. 2005 at 78:3-23. The ID found that "[f]rom Zhang's Figure 1, the alleged arms appear thicker, and thus stronger, than the areas defining the heat dissipation structures," so "Petitioner's and its declarant's contentions have some support on this record which are not sufficiently negated by Patent Owner's attorney argument." Paper 13 at 36.

However, as explained by Dr. Janét, a POSITA would not expect any alleged "arms" that purportedly emerge from viewing Zhang's Fig. 1 to "strengthen attachment" or "minimize vibration" as Petitioner contends. Ex. 2004, ¶149. Again, Dr. Lebby's contentions are unsupported.

Petitioner relies upon Ex. 1031 as teaching that adding arms would minimize vibration. *See* Pet. at 54 ("citing Ex. 1031, 329-331⁶ ('Section 6.2.5 Prevention of Bearing Axial Movement.')"") While Ex. 1031 teaches a number of methodologies for the prevention of bearing axial movement, **none** of those solutions either

⁶ The Petition cites the pages of the underlying document and not the page numbers of Exhibit 1031.

address vibration, more generally, nor do they include arms extending away from a sleeve. Ex. 2004, ¶150 (citing Ex. 1031, 364-366). And, as explained in Section V.B.iv above, a POSITA would not have shared Dr. Lebby's simplistic view regarding the ease of modifying Pardhan.

Even accepting *arguendo* the general proposition that arms could “strengthen attachment” or “minimize vibration” (or, at least, axial bearing movement) in some situations, Zhang's alleged arms are formed through “thinning of the end face of [the] rotor” (Ex. 1007 at 9), so they would not be “thicker, and thus stronger” than Pardhan's rotor plate was *before* implementation of Zhang's heat dissipation structures. Instead, using Petitioner's proposed modification, Pardhan's rotor plate would be *thinner* and thus weaker after the heat dissipation structures are added, thus contradicting Petitioner's motivation. Ex. 2004, ¶151. Moreover, the POSITA would also recognize these alleged arms would only be about 1mm thick and thus would not have expected *any* benefits in terms of attachment strength or minimizing vibration from such alleged arms as evident from Zhang's Fig. 1 (below). *Id.*

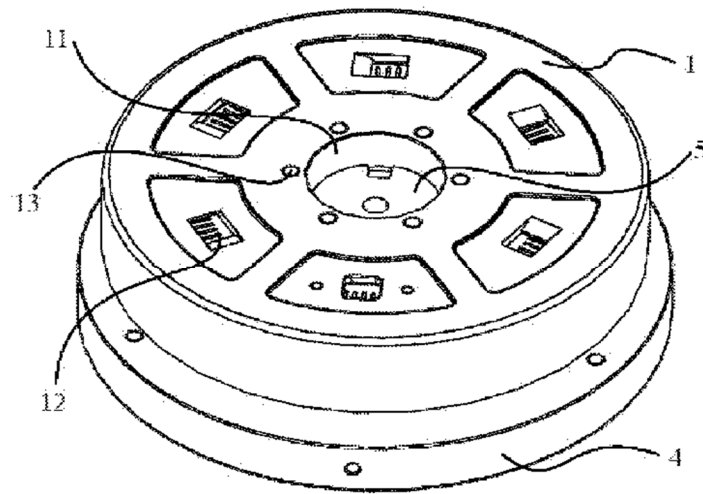


Fig. 1

Rather, a POSITA would expect that the turbulent airflows introduced by Zhang’s heat dissipation structures would induce additional vibration within Pardhan’s thermal rotary link causing problems for Pacala’s LIDAR and potentially catastrophic failure for the rotating system. *Id.*, ¶152. A POSITA would not expect the proposed combination of Ground 1 to tolerate these vibrations caused by implementing Zhang’s heat dissipation structures. *Id.*

Further, the full teaching from Zhang relied on by Petitioner explains that “...where at least one hollowed-out heat dissipation hole (12) is configured on the end face of the rotor (1), the heat generated during the operation of the rotating structure inside it can be released in time, increasing the operating life of the rotating structure.” Ex. 1007 at 9. Ex. 2004, ¶153.

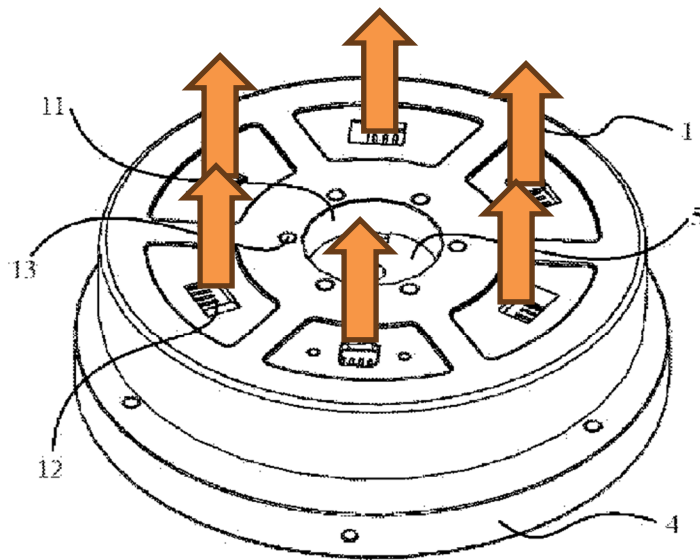
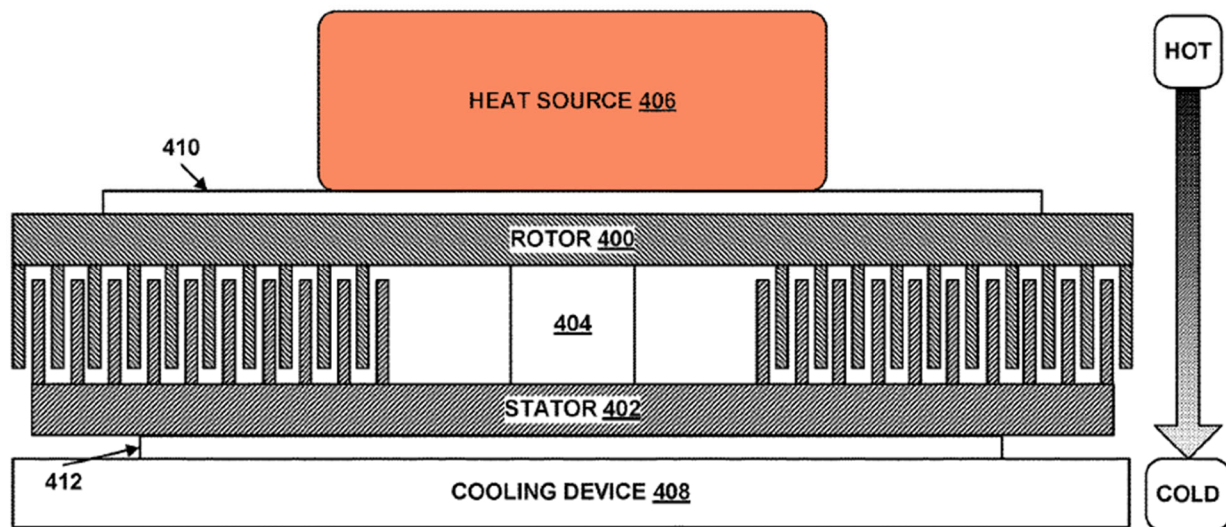


Fig. 1

As depicted above with orange arrows, Zhang’s heat dissipation structures are provided so heat produced *inside* the rotating structure (i.e., beneath and within the rotor / outer casing) “can be released” upwards thus “increasing the operating life of the rotating structure.” Ex. 1007 at 9; Ex. 2004, ¶154.

Pardhan, in contrast, teaches using the rotor and stator as a heat sink to pull heat produced by the LIDAR from *outside* the rotor and stator *down* as expressly diagrammed in Pardhan’s Figure 4 (reproduced below). *See e.g.*, Ex. 1006 at Fig. 4.



Petitioner’s proposed combination allegedly “transfers excess heat away from the LiDAR sensor, thereby allowing the device to avoid[] overheating.” Pet. at 30. Zhang’s release of excess heat upwards from below the rotor towards the LIDAR would thus be counter-productive, and a POSITA would not have been motivated to implement Zhang’s heat-dissipation structures on Pardhan’s rotor plate 720. Ex. 2004, ¶ 156. Rather, Zhang teaches away from using such structures within the Pacala, Johnson, Pardhan combination. *Id.*

Petitioner incorrectly alleged “Zhang’s heat dissipation techniques are ... complementary with and can be implemented in addition to those of Pardhan.” Pet. at 53. However, at his deposition, Dr. Lebby opined of the combination that “while there is a heat dissipation hole, some of the heat will go through the hole, but the

majority of the heat will conduct through the metal,” so “while the design does allow a little bit of air, heat to escape through those windows, 12, the majority of heat would go downwards, as indicated in Pardhan.” Ex. 2005 at 80:13-21. Even if Dr. Lebbby were correct that the majority of heat would go downwards through the metal heat sink as indicated in Pardhan, and only a minority of heat would escape upwards through the heat dissipation structures 12 as indicated in Zhang, there would still be no reason to implement Zhang’s heat dissipation structures on Pardhan’s support component. Ex. 2004, ¶157. To do so would be counter-productive to Pardhan’s design. *Id.*

Regardless of whether a POSITA could, as the ID reasoned, use Zhang’s heat dissipation structure simultaneously with Pardhan’s fins, a POSITA *would not have been motivated* to make the proposed combination. Paper 13 at 30-31. As explained above, a POSITA would *not* have had any reason to implement Zhang’s heat dissipation structures on Pardhan’s rotor plate even if theoretically, they could function together. Ex. 2004, ¶¶156–158. *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 993-994 (Fed. Cir. 2017) (It is “not enough” to show “a skilled artisan, once presented with the two references, would have understood that they *could be* combined.”) (emphasis added).

Finally, Petitioner also failed to meet its burden to prove a reasonable expectation of success in implementing Zhang's heat dissipation structures in its proposed combination. As explained in Section V.B.iv *supra*, a POSITA modifying Pardhan with a change as substantial as adding turbulence inducing heat dissipation structures from Zhang to Pardhan's rotor plate would have recognized the need to perform at least a new thermal analysis (e.g., with a computational fluid dynamics (CFD) analysis), and a new torsional analysis, in addition to other possible analyses, on the modified design. Ex. 2004, ¶159; Ex. 1031 at 105-107. Petitioner made no showing as to why a POSITA would have had a reasonable expectation of success in implementing Zhang's heat dissipation structures on Pardhan's plate because it mistakenly believed Zhang's heat dissipation techniques were complementary to those of Pardhan. Ex. 2004, ¶¶156-157, 159; Pet. at 53.

viii. Petitioner's proposed combination does not disclose or render obvious the required four circuit boards

Contrary to Petitioner's unsupported allegations, Johnson discloses only two circuit boards, not the required four circuit boards required in claim 4. Nor does Johnson teach or suggest adding additional circuit boards. Ex. 2004, ¶161. The ID preliminarily "agree[d] with Patent Owner's argument that the recitation of four circuit boards . . . is not disclosed by Johnson" but left open the question of

whether Johnson’s disclosure “renders this feature obvious” based “on a full trial record.” Paper 13 at 43. Petitioner’s arguments fail on their face as Johnson neither discloses four circuit boards, nor provides any motivation for adding two additional circuit boards.

a. Johnson does not disclose four circuit boards

Claim 4 requires “a third circuit board fixedly coupled to the base ... and disposed between the enclosure base and the stator circuit board” as well as “a fourth circuit board coupled to rotate with the rotor circuit board between the enclosure top and the rotor circuit board and arranged in a plane parallel with the first plane.” Johnson describes implementing its rotor and stator using a printed circuit board, but does not mention additional third and fourth circuit boards, much less the claimed position of any such circuit boards. Ex. 2004, ¶161.

Petitioner claims Johnson discloses the “third circuit board” as the “bottom layer of the PCB,” with the top layer being the “stator circuit board.” Pet. at 41. However, the plain language of the claim requires separate circuit boards, not different layers of the same board. Ex. 2004, ¶165. Petitioner’s attempts to read out the claim’s clear requirements of separate circuit boards must fail as unsupported by either fact or law.

Petitioner also suggests the “rotor circuit board” is an outer layer of the circuit board on the rotor platform's bottom side and that Johnson’s disclosure of an “outer layer” implies an “inner” layer for additional electronics. Pet. at 41. Johnson does not disclose or suggest an inner layer for the rotor circuit board. Ex. 2004, ¶¶166–168.

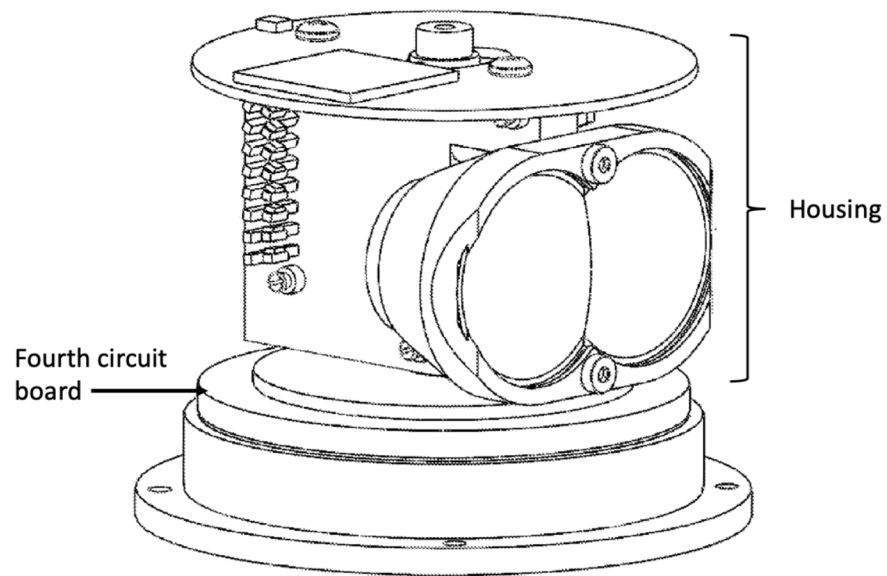
b. Johnson does not render obvious the recited four circuit boards

Petitioner’s alternative argument for the “third circuit board” is that it would have been obvious to implement “the multi-layer PCB of Johnson” (i.e., stator circuit board) as multiple single-layer PCBs. *See* Pet. at 42. However, to assert the independent claims are met, Petitioner expressly relies on Johnson’s teachings of toroidal coil windings formed in two separate layers of a single multi-layer PCB (depicted in Johnson’s 3C and 3D) that are bridged by interconnect elements. *See* Pet. at 31-33, 36-37; Ex. 2004, ¶174. Thus, Petitioner’s proposed modification of Johnson to use multiple single-layer PCB’s instead of its multi-layer PCB would mean that element 1(g) is no longer met. Ex. 2004, ¶174. In such circumstances, claim 4 would still not be rendered obvious by the proposed modified system because of claim 4’s dependency from claim 1.

Most of Petitioner’s alternative argument is in fact inapplicable to the “fourth circuit board” requirement since Johnson only discloses the use of a multi-layer PCB in relation to the stator and not the rotor. Ex. 2004, ¶¶166-167.

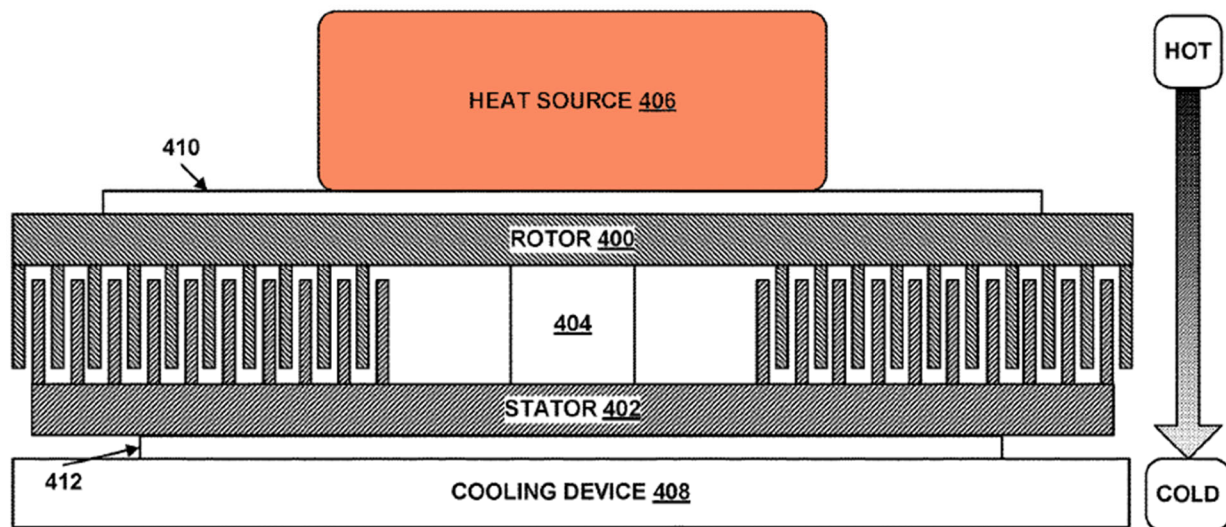
In addition, Petitioner’s argument that an additional rotor circuit board could be needed as “reflected in U.S. Patent No. 9,606,230 (“Nubling”),” (Pet. at 42-43), also fails on its face as Nubling discloses that additional circuit boards should be *perpendicular* to the rotor platform – in direct conflict with claim 4’s requirement that the fourth circuit board be *parallel* to the stator circuit board. Ex. 2004, ¶177 (citing Ex. 1043 at 5:50-52, Fig. 3). Like Nubling, Hall (Ex. 1009), cited by Petitioner, explains that additional circuit boards above the rotor platform should be perpendicular with it, and should “provide mechanical support and electrical connectivity between rotating electronics board 111 and various elements of light emission/collection engine 112.” Ex. 1009, Fig. 4, 7:3-9; Ex. 2004, ¶177. Thus, Nubling does not support Petitioner’s argument.

With no support, Petitioner nevertheless proposes a “fourth circuit board” would have been implemented in the combination of Ground 1 as illustrated below:



Pet. at 44 (annotating Fig. 2 of Ex. 1004). This placement, however, is directly contrary to Pardhan’s teachings because the fourth circuit board is placed directly under the presumed LIDAR “heat source” as shown in Pardhan’s Fig. 4 (below).

Ex. 2004, ¶179.



Petitioner expressly asserted a POSITA would have been motivated to use Pardhan’s support component because it “transfers excess heat away from the LiDAR sensor, thereby allowing the device to avoid[] overheating.” Pet. at 30. As shown in Pardhan’s Fig. 4 (above), Pardhan expressly teaches placement of “coupling 410” between heat source 406 and rotor 400 in order to “thermally and/or mechanically” couple the two components. Ex. 1006 at 16:55-56; Ex. 2004, ¶179. Pardhan thus teaches away from placing a circuit board in Petitioner’s proposed location because doing so would disrupt the heat “flow from heat source 406, through coupling 410, to rotor 400 and fins 500-599 thereof” and prevent the LIDAR device from being “maintained at a stable operating temperature,” which is Pardhan’s primary concern. Ex. 1006 at 18:60-19:6; Ex. 2004, ¶179; *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); *see also Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, 4 F.4th 1370, 1376-77 (Fed. Cir. 2021), *cert. denied*, 142 S. Ct. 1418 (2022).

Without a suitable motivation to implement the claimed fourth circuit board despite Pardhan’s teachings, Petitioner’s argument must fail.

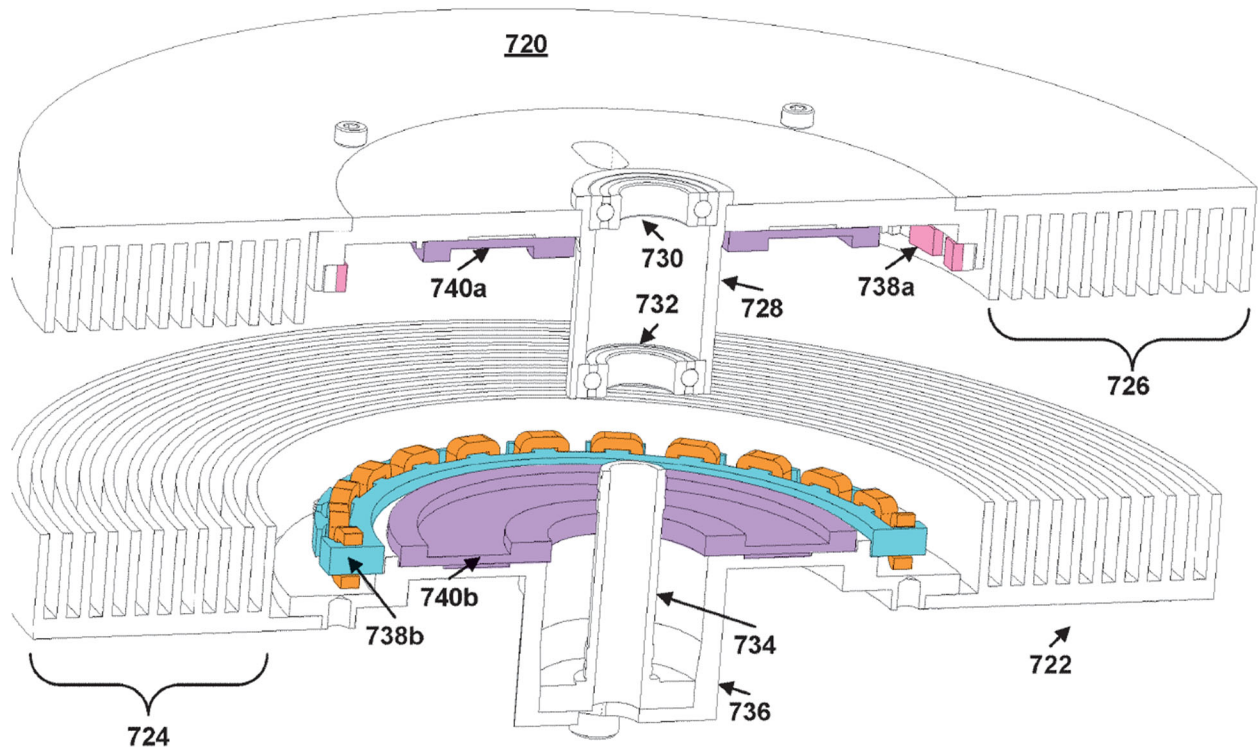
For Ground 1, this results in failure to show dependent claim 4 is obvious. As discussed below, the same error is repeated again in Ground 6 for independent claim 22.

ix. Petitioner’s proposed combination does not disclose or render obvious the required first and second transformer coils “positioned outside an outer perimeter” of the plurality of stator elements and rotor assembly annular arrangement

Claim 17 requires a “wireless power transformer comprising a first annular transformer coil . . . positioned outside an outer perimeter of the plurality of stator elements” and a “second transformer coil . . . positioned outside an outer perimeter of the rotor assembly annular arrangement.” The ID invited a fully-developed trial record on this claim. Paper 13 at 43. Petitioner admits that none of the references relied upon by Petitioner teach first and second transformed coils positioned as claimed. *See* Pet. at 50. Faced without a single reference disclosing the claimed

positions of the first and second transformer coils, Petitioner makes the desperate argument that it would have been obvious to modify the disclosures of Pardhan, Johnson, and Zhang to position the two transformer coils in the entirely opposite position as taught by each of those references. This argument necessarily fails as there is no teaching or motivation to do the opposite of what the references teach.

Pardhan teaches away from the claimed configuration. Ex. 1006 at 21:9-13 (“The windings 738b are connected to the stator, as opposed to the rotor, so that energy to power the motor is not transferred through the rotational connection via rotary transformer 740a/740b (thus allowing for a smaller rotary transformer)”) (emphasis added), Fig. 7B (showing the transformer coils 740a/740b are inside the perimeter of rotor magnets 738a and stator windings 738b) (reproduced below); Ex. 2004, ¶¶182–183.



Zhang also teaches away from the claimed configuration. *See e.g.*, Ex. 1007 at 6 (describing installation of “the electrical power transmission structure on the *inner side* of the shaft system” as a “*technical advantage[]*” of its disclosure) (emphasis added); Ex. 2004, ¶184 (citing Ex. 1007 at 4 (“The motor coil (2) is configured on the outer side of stator body (41)...”), 5 (“...first coupling coil (5) ... is configured on the inner side of the stator body (41).”)).

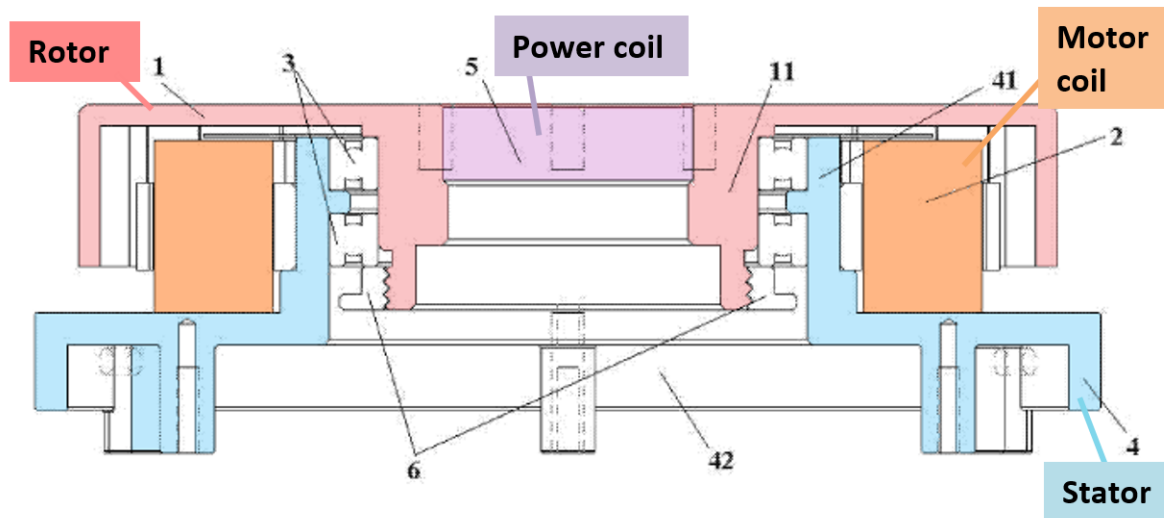
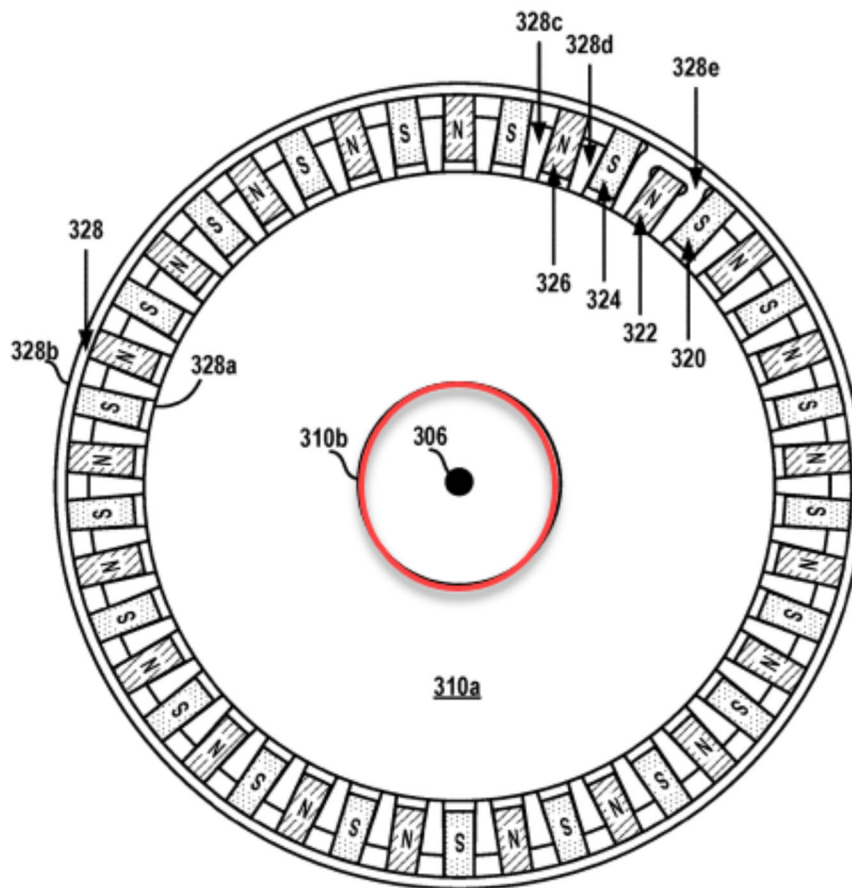


Figure 2

Ex. 1007 (Zhang), Fig. 2.

Accordingly, by necessity, Petitioner contends claim 17's configuration is obvious in view of Johnson. *See* Pet. at 48-51. Petitioner admits, however, that Johnson—like Pardhan and Zhang—*also* teaches its wireless transformer coil should be positioned *inside* an outer perimeter of its coil windings and rotor magnets—contrary to the requirement of claim 17. *See id.* at 50 (admitting Johnson's "Figures 3B-3C illustrate the transformer coils on the inside of the stator and rotor elements"); Ex. 2004, ¶185. Petitioner's annotated Figure 3B from Johnson showing the transformer coil (red) on the inside of the stator and rotor elements is reproduced below.



Notably, to support Petitioner’s motivation to combine Johnson and Pardhan for claim 14, Petitioner’s expert, Dr. Lebby, opined that Johnson and Pardhan are a “natural fit” *because* their combination “would result in Pardhan’s support component *continuing* to include the magnets and transformer coils *in the same position*.” Ex. 1003, ¶ 173 (emphases in original).⁷ Yet when arriving at claim 17,

⁷ This is, of course, not a motivation under any legal theory; it is a hindsight-based conclusion.

Petitioner changes tack and asserts it would have been obvious to go *against* the express teachings of Zhang, Pardhan, and Johnson and reposition the transformer coils outside of the stator and rotor elements as “one of a limited number of obvious design choices” because Johnson states “[o]ther configurations are possible.” Pet. at 50-51. However, “[m]erely stating that a particular placement of an element is a design choice does not make it obvious.” *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1067-70, 1069 n.4 (Fed. Cir. 2018); Ex. 2004, ¶186.

Petitioner further asserts “[t]he region in the center of a circuit board has limited space, so it is logical and common to place transformer coils on the outside of the rotor/stator elements.” Pet. at 51. But there is no room for Johnson’s transformer coils to be positioned outside of its stator and rotor elements because those elements are intentionally and expressly placed at the outermost portion of the rotor and stator platforms. *See* Johnson’s Figs. 3B and 3C (reproduced below); Ex. 2004, ¶187. A POSITA would understand that Johnson’s toroidal coil windings and rotor magnets are placed as far from the rotating axis as possible to maximize the torque they produce while maintaining a compact design. *Id.*

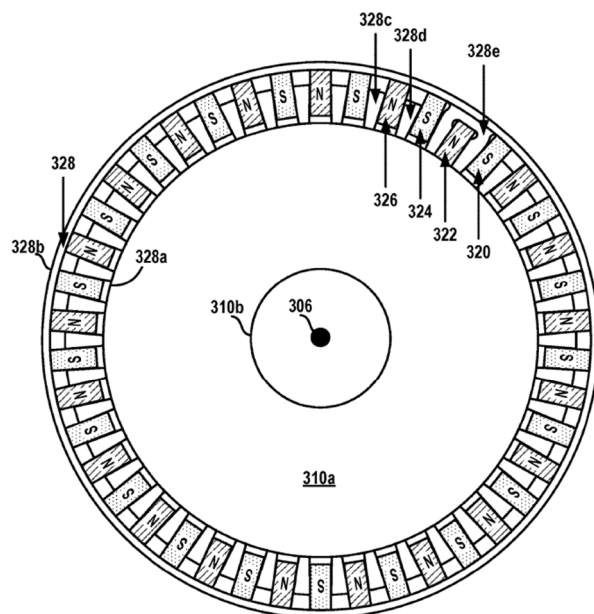


FIG. 3B

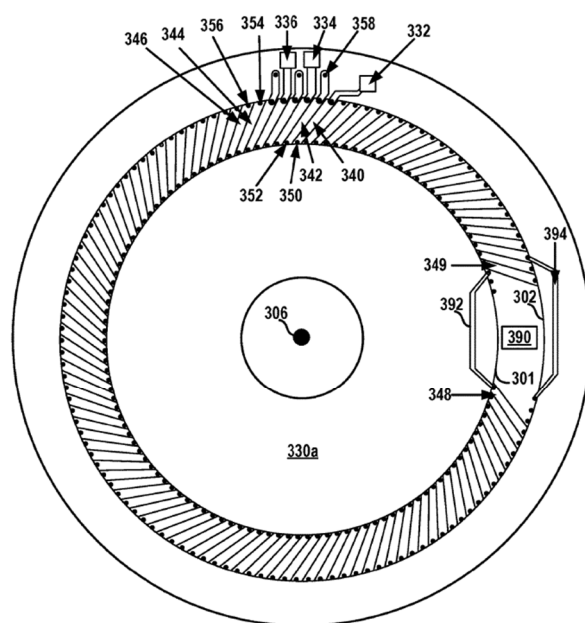
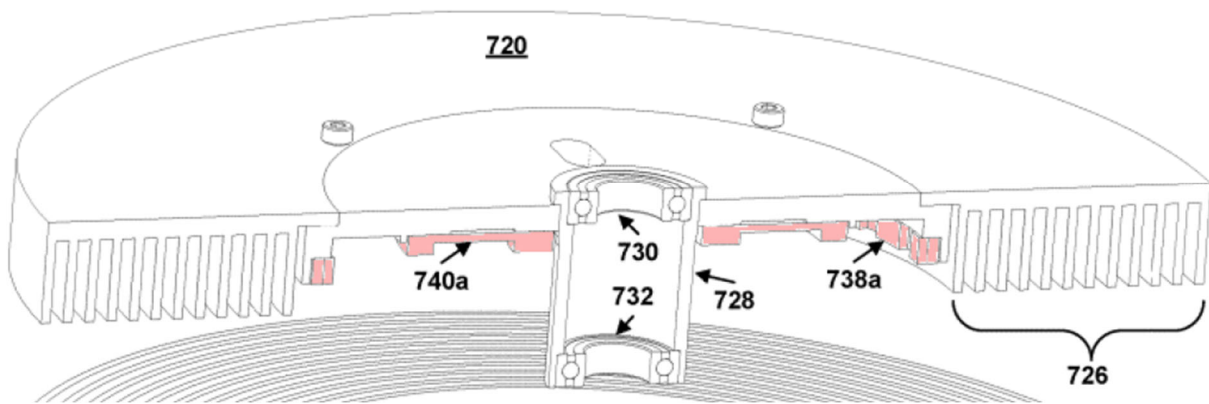


FIG. 3C

Johnson's transformer coils are also placed intentionally inside of its rotor and stator elements both because that is the space made available for them within Johnson's intentionally compact design and because it enables use of a "magnetic core . . . extending through the center gap to guide a magnetic flux" between transformer coils. Ex. 1005 at 11:51-60; Ex. 2004, ¶188. Expanding the size of the rotor and stator platforms to accommodate transformer coils *outside* of Johnson's rotor and stator elements would run counter to Johnson's compact design and undercut the very reason Petitioner contends a POSITA using Pacala's LIDAR would have chosen Johnson in the first place. *See* Pet. at 21; Ex. 2004, ¶188.

Moreover, a POSITA attempting to utilize oversized transformer coils *against* the express teachings of Johnson, Pardhan, and Zhang would find no room for them to be positioned outside the rotor magnets due to Pardhan’s fins 726 (as shown below), which Petitioner asserts are necessary “to avoid[] overheating.” Pet. at 30; Ex. 2004, ¶189.



At his deposition, Dr. Lebby opined that “a POSITA . . . *could have* certainly designed another embodiment where the magnets and transform windings would have been outside the coils.” Ex. 2005 at 100:22-101:4 (emphasis added). However, he also admitted “I really can’t predict how a POSITA would *like* to design a system.” *Id.* at 103:15-16 (emphasis added).⁸ “[O]bviousness concerns

⁸ Of course, Dr. Lebby would be better equipped to opine as to what a POSITA would have liked had he the experience of a POSITA.

whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC*, 805 F. 3d 1064, 1073 (Fed. Cir. 2015) (emphasis in original). While Petitioner provides conjecture about other systems where a POSITA “may” want larger transformer coils, that says nothing about whether a POSITA would have been motivated to modify Johnson to meet claim 17. *See e.g.*, Pet. at 54. Indeed, Dr. Lebby, who lacks experience designing such systems, has acknowledged his inability to predict what a POSITA “would” have done. Ex. 2005 at 103:15-16. Petitioner provides no rational explanation for why a POSITA *would* modify Johnson to meet claim 17 when Johnson, Pardhan, *and* Zhang all teach away from the claimed invention. Ex. 2004, ¶190. Accordingly, Petitioner has not shown claim 17 obvious.

C. Grounds 2-5 fail to render any of the dependent claims unpatentable

Grounds 2-5 use the same combination of Pacala-Johnson-Pardhan-Zhang as set forth in Ground 1 with further modifications addressing certain dependent claims. *See* Pet. at 59, 65, 68, 72-73, 76-77, 79-80. Grounds 2-5 challenge claims depending from claims 1 and 14. Because Patent Owner’s arguments in Section

V.B *supra* show that independent claims 1 and 14 are non-obvious, these dependent claims are also nonobvious. *See e.g., Fritch*, 972 F.2d at 1266.

Additionally, Grounds 2-5 further fail because (i) Petitioner lacks motivation to combine the additional references with the those of Pacala-Johnson-Pardhan-Zhang combination of Ground 1 and (ii) because those references do not teach or suggest the limitations alleged by Petitioner.

i. Ground 2 fails to articulate a motivation for modifying Pacala-Johnson-Pardhan-Zhang with Cai to address claim 4

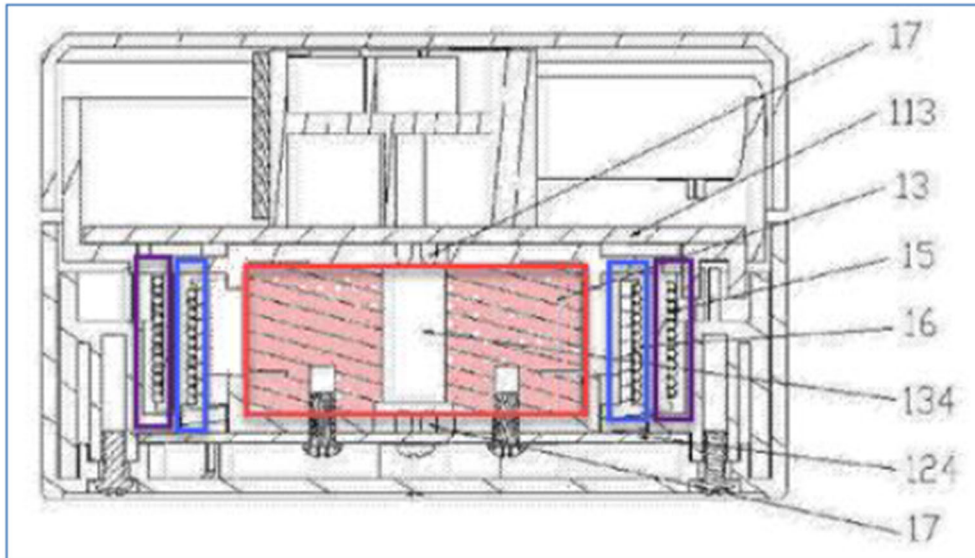
Ground 2 proposes the same combination of Pacala-Johnson-Pardhan-Zhang as set forth in Ground 1 further modified by Cai. *See* Pet. at 59. To address claim 4, which requires a third circuit board and a fourth circuit board, Petitioner asserts Cai teaches placing two circuit boards (113/124) “above and below the motor for mounting transceivers (17).” *Id.* at 61. However, Johnson already teaches a means for communication between its rotor and stator circuit boards: placing a communications interface on the circuit boards within its motor. This renders Cai redundant. Ex. 2004, ¶196-197 (citing Ex. 1005 at 7:8-21, 8:54-67, 9:4-18). Cai’s similar use of transceivers to form a communications interface on its only two circuit boards illustrates that **only** two circuit boards are needed for a communications interface, already achieved by Johnson. *Id.* Because a POSITA

utilizing the combination of Ground 1 was already allegedly motivated to use Johnson for its compactness, the POSITA would not then increase the size of the system using Cai's circuit boards merely to provide a redundant feature. *Id.*

i. Ground 2 fails to render claim 17 obvious because a POSITA has no motivation to incorporate Cai into Pacala-Johnson-Pardhan-Zhang and Cai teaches away from the alleged modification

Petitioner also asserts that Cai shows transformer coils “outside an outer perimeter” of its motor. Pet. at 65. This does not change the fact that there is no room in the Johnson-Pardhan combination to move the transformer coils—which Johnson, Pardhan, and Zhang all teach should be in the free space *inside* of the rotor and stator elements—*outside* of those elements. *See* Section V.B.ix *supra*.

Further, as explained by Petitioner, Cai's “Figure 8 . . . shows the [transformer] coils (purple and blue) are outside the motor (red)” as depicted below.



Pet. at 64.

Petitioner contends “[a] POSITA would have understood that Johnson’s stator and rotor elements are housed in the motor, such that the transformer coils in Cai, when applied to Johnson, would have been concentric with and positioned outside an outer perimeter of the stator elements and rotor assembly” as shown above. Pet. at 65. Claim 17, however, expressly requires “a wireless power transformer *integrated directly onto the stator and rotor circuit boards.*” (emphasis added). It further recites “a first annular transformer coil *disposed on a surface of the stator circuit board,*” and “a second annular transformer coil *disposed on a surface of the rotor circuit board.*” (emphasis added). Because Cai’s transformer coils are outside an outer perimeter of the motor, they are necessarily outside an outer perimeter of Johnson’s PCBs—which are part of that

motor—and cannot be disposed on surfaces of those PCBs as required by the claim. Ex. 2004, ¶202.

Cai further teaches away from the claimed invention since it teaches placing transformer coils *outside* of the motor where the stator and rotor circuit boards are located whereas claim 17 requires integrating the transformer coils “directly onto the stator and rotor circuit boards” such that one coil is “disposed on a surface of the stator circuit board” and the other “disposed on a surface of the rotor circuit board.” Ex. 2004, ¶203.

For Ground 2, this results in failure to show dependent claim 17 is obvious.

ii. Ground 5 fails to render obvious claims 13 and 21

Pacala teaches a LIDAR sensor in the context of a “spinning turret.” Ex. 1004 at [0013]. Johnson, Pardhan, and Zhang all, likewise, cover rotary joints. Petitioner provides no explanation for why a POSITA would have been motivated to modify the proposed combination of Ground 5 in view of Droz’s teachings regarding *stationary* (non-rotary) LIDAR with a reasonable expectation of success in making such modifications to achieve the claimed invention. Ex. 2004, ¶¶213–214.

First, Petitioner shows no support for its proposition that Droz combined with Pacala-Johnson-Pardhan-Zhang-Spector⁹ teaches the limitation of claims 13 and 21. Ex. 2004, ¶208. Moreover, as explained by Dr. Janét, the proposed combination includes Droz’s waveguides. Ex. 2004, ¶207. These waveguides are bulky structures consisting of multiple layers. Droz only discloses using the waveguides in stationary applications. Yet Dr. Lebby provided no analysis for how Droz could be combined with the spinning Pacala-Johnson-Pardhan-Zhang-Spector system, including how the waveguides could be accounted for, or how the waveguides could fit into the “compact” volume of the Pacala-Johnson-Pardhan-Zhang-Spector system. *Id.*, ¶¶211-212. Accordingly, Petitioner failed to articulate a motivation for a POSITA to incorporate Droz into the Pacala-Johnson-Pardhan-Zhang-Spector system.

Additionally, the Petition asserts that “Droz teaches an array of light detectors that can be configured for increased sensitivity to low intensities of light, ‘thereby enhancing their detection qualities.’” Pet. at 78. As explained in Section

⁹ Spector was added to the Pacala-Johnson-Pardhan-Zhang combination in Ground 4 to allegedly address the limitations of claims 12 and 20, upon which claims 13 and 21 depend, respectively.

V.B.ii supra, a POSITA utilizing light detectors configured to achieve increased sensitivity would not have been motivated to use Pardhan's thermal rotary link because overheating would not have been expected in such a LIDAR device. Ex. 2004, ¶215. Thus, even accepting *arguendo* Petitioner's contentions relating to Droz and claim 13, Ground 5 nevertheless fails to render any claim obvious due to the resulting lack of motivation to combine with Pardhan. *Id.*

D. Ground 6: The Pacala-Johnson-Pardhan-Zhang-Droz-Cai combination further in view of Yan fail to render claims 22-24 unpatentable

Ground 6 utilizes the same Pacala-Johnson-Pardhan-Zhang combination of Ground 1 but further adds three additional references: Droz (from Ground 5), Cai (from Ground 2), and Yan to address independent claim 22 and dependent claims 23-24. Petitioner asserts “[m]ost limitations in claim 22 correspond to those in claims 1 and 14, and are thus rendered obvious by the Ground 1 references” citing “Sections IX.B.1-2” of the Petition. Pet. at 83. Accordingly, Ground 6 fails for the same reasons described in Section V.B for Ground 1. Additionally, Petitioner fails to provide a rational motivation for further combining Ground 1 with Droz, Cai and Yan. And even those references fail to teach the elements of claims 22-24. For at least these reasons, Petitioner fails to show claims 22-24 are obvious.

i. Petitioner provides inadequate motivations to combine Pacala, Johnson, and Pardhan

Ground 6 relies upon the same purported motivations to combine Pacala, Pardhan, and Johnson cited for Ground 1. *See* Petition at 83-86, 90-91. This proposed combination is irrational for the reasons explained above in Sections V.B.i-iii. The only reason for combining Pacala, Johnson and Pardhan is improper hindsight. Ex. 2004, ¶216.

ii. Petitioner’s proposed combination does not disclose or render obvious the required “plurality of arms extending away from the sleeve” (22(e.i))

Like independent claims 1 and 14, claim 22 recites “a plurality of arms extending away from the sleeve.” Petitioner relies on the same arguments from Ground 1 to allege Pardhan and Zhang disclose this limitation. *See* Pet. at 86-87 (citing Sections IX.E.1(e)-(f)). These arguments fail for the same reasons stated in Section V.B.vii. Ex. 2004, ¶216.

In Ground 6, however, Petitioner also asserts “Pardhan, when combined with the knowledge of a POSITA . . . renders obvious arms extending away from the sleeve.” Pet. at 87. This argument was not made for Ground 1. *See* Pet. at 27 (describing combining Pardhan “...with Zhang’s arms...”). This new argument for Ground 6 is supported only by conclusory testimony by Dr. Lebby. Pet. at 87 (citing Ex. 1003, ¶ 335); Ex. 2004, ¶220. Dr. Janét explains that Dr. Lebby is

mistaken about the interchangeability of bearing housings in this field of art, and overlooked the many drawbacks from the modifications Dr. Lebby proposes to Pardhan. Ex. 2004, ¶ 221. Accordingly, this alternative theory disregarding “Zhang’s arms” also fails. *Id.*

iii. Petitioner’s proposed combination does not disclose or render obvious the four required “circuit boards” of claim 22 (elements 22(d.i), (d.ii), (e.ii), (e.iii))

a. Johnson does not disclose or suggest two circuit boards as part of the stator circuit board assembly

Claim 22 recites a “stator circuit board assembly comprising . . . a first circuit board [22(d.i)] . . .[and] a second circuit board [22(d.ii)].” Petitioner’s arguments that Johnson discloses this element mirror those for Ground 1 and thus fail for the same reasons explained in Section V.B.viii. Ex. 2004, ¶223.

b. Pacala-Johnson-Pardhan-Zhang-Droz-Cai-Yan does not disclose or suggest two circuit boards as part of a rotor circuit board assembly

Independent claim 22 further recites a “rotor circuit board assembly comprising . . . a support component having lower and upper surfaces [22(e.i)]. . . a third circuit board coupled to the lower surface of the support component [22(e.ii)] . . .[and] “a fourth circuit board coupled to the upper surface of the support component [22(e.iii)].” Petitioner’s claims that Johnson renders these limitations obvious fails for the same reasons discussed above for Ground 1. Pet. at 90-92.

As element 22(e.iii), Petitioner further cites Cai and Yan—neither of which discloses four circuit boards—as evidence that a circuit board *can* be mounted on the top surface of a support component in some designs. Pet. at 92-93. As explained in Sections V.C.i-ii *supra*, Petitioner fails to explain why Cai would have motivated a POSITA to use a fourth circuit board in the claimed configuration. Moreover, the design of the proposed combination of Ground 6 greatly differs from Cai and Yan—neither of which contemplates any overheating of a LIDAR component that would allegedly necessitate Pardhan’s thermal rotary link in the first place. Ex. 2004, ¶¶224–225.

As explained in Section V.B.viii.b *supra*, Pardhan teaches away from placing a circuit board in the claimed configuration because doing so would disrupt the heat “flow from heat source 406, through coupling 410, to rotor 400 and fins 500-599 thereof...” This would prevent the LIDAR device from being “maintained at a stable operating temperature,” which is Pardhan’s primary concern. Ex. 2004, ¶226.

Yan relates to “an automatic sweeping robot.” Ex. 1012 at [0004], [0075]-[0076]. A POSITA would have understood that such indoor range detecting devices “exhibit[ed] low power consumption requirements of 2 W or less.” *E.g.*, Ex. 1016 at [0027]. In contrast, Pardhan teaches its finned rotor plate is needed

only when a LIDAR device is operated “above a threshold power level.” Ex. 1006 at 4:54-63; Ex. 2004, ¶225. Whereas Yan’s circuit board was capable of being placed directly underneath its low-power range detecting device—one suitable for an indoor sweeping robot—a POSITA would not adopt the same configuration if, as Petitioner contends, they were so concerned with the LIDAR overheating that Pardhan’s finned rotor plate were used. Ex. 2004, ¶226.

Because Petitioner fails to provide any rational reason to add the claimed fourth circuit board “coupled to the upper surface of the support component” of the proposed combination of Ground 6, Ground 6 fails to render obvious claim 22.

iv. Petitioner’s proposed combination does not disclose or render obvious the required first and second transformer coils

Like claim 17, claim 22 requires a “wireless power transformer comprising a first annular transformer coil disposed on a surface of the stator circuit board . . . positioned outside an outer perimeter of the plurality of stator elements” and a “second transformer coil disposed on a surface of the rotor circuit board . . . positioned outside an outer perimeter of the rotor assembly annular arrangement.” Petitioner relies on the same arguments for this element in Ground 6 as it does for claim 17 and Grounds 1 and 2. *See* Pet. at 94 (citing “Sections IX.E.11 and X.B.5”).

In its Ground 1 arguments, Petitioner has failed to make a *prima facie* showing of obviousness with respect to claim 22 for the same reasons described in Section V.B.ix *supra* for claim 17. In its Ground 2 arguments, Petitioner's citation to Cai fails for the same reasons discussed above in Section V.C *supra*. Accordingly, the Petitioner has failed to make a *prima facie* showing of obviousness with respect to claim 22 for this additional reason.

v. Petitioner fails to provide a motivation to combine Droz's stationary LIDAR with the rotary system of Ground 6

As explained in Section V.C.iii above, Petitioner fails to provide a motivation to combine Droz's stationary LIDAR with a rotary system with a reasonable expectation of success. Accordingly, Ground 6 fails for the same reasons as Ground 5.

vi. Petitioner's proposed combination does not disclose or render obvious Claim 23

For Claim 23, Petitioner merely points to Sections XIV.B.1.e and XIV.B.1.i without further explanation. Pet. at 94. However, the alleged plurality of stator elements Petitioner identified in Johnson are not "each disposed between a surface of the second circuit board and a surface of the third circuit board" as required by Claim 23 because they are entirely within Johnson's alleged "second circuit

board.” Ex. 2004, ¶235. Ground 6 fails to render claim 23 obvious for this additional reason.

E. Ground 7 fails to render dependent claim 25 unpatentable

Like Grounds 2-5, Ground 7 relies on the Pacala-Johnson-Pardhan-Zhang combination of Ground 1 with further modifications addressing claim 25, which depends from claim 22. *See* Pet. at 96. Because Patent Owner’s arguments in Section V.D *supra* show that independent claim 22 is non-obvious, dependent claim 25 is also non-obvious. *Fritch*, 972 F.2d at 1266. Ground 7 thus fails for, at least, the same reasons as Ground 6.

F. Ground 8: Pacala-2017, Johnson, Pardhan, and Zhang fail to render claims 1-2, 4-9, 11-14, 16-17, 19-21 unpatentable

For Ground 8, Petitioner “substitutes Pacala-2017 for Pacala.” Pet. at 98. Petitioner contends all of the limitations Ouster has discussed above “are disclosed by the Johnson-Pardhan-Zhang combination in the same manner as was discussed in Ground 1.” *Id.* at 100. Petitioner further contends a POSITA would have been motivated to combine Johnson-Pardhan-Zhang for the same reasons as for Ground 1 and contends a POSITA would have been motivated to combine Pacala-2017 for essentially the same reasons as for Pacala in Ground 1. *Id.* at 104-105.

i. Pacala-2017 is Not Available as Prior Art Because the '515 Patent Claims are Entitled to the December 7, 2017 Priority Date

a. Pacala-2017 is Unavailable as Prior Art

Contrary to the assertions in the Petition, Pacala-2017 does not qualify as prior art to the '515 Patent under either 35 U.S.C. § 102(a)(1) or (a)(2). Pet. at 97. The effective filing date of the '515 Patent is December 7, 2017, the filing date of U.S. Provisional Application No. 62/596,018 to which the '515 Patent ultimately claims priority.¹⁰ Pacala-2017 was published on October 5, 2017. The '515 Patent names inventors Angus Pacala, Mark Frichtl, Marvin Shue, and Eric Younge. Pacala-2017 names inventors Angus Pacala, Mark Frichtl. Pacala-2017 is not prior art. *See* MPEP 717.01 III.

Pacala-2017 is not prior art to the '515 Patent under 35 U.S.C. § 102(a)(1) pursuant to the exception provided by 35 U.S.C. 102 (b)(1)(A) because (i) Pacala-

¹⁰ Patent Owner submitted a Petition to accept an unintentionally delayed priority claim, which was granted by the USPTO on January 5, 2024. Ex. 2030; Ex. 2031. Patent Owner was informed by the USPTO that an erroneous hold on the certificate of correction was lifted as of June 3, 2024 and that the certificate has been sent for printing.

2017 was less than one year before the December 7, 2017 effective filing date of the '515 Patent and (ii) the subject matter disclosed in Pacala-2017 was obtained directly or indirectly from its inventors Angus Pacala and Mark Frichtl, who are also inventors of the '515 Patent. Therefore, Pacala-2017 is a grace period disclosure and is not prior art to the claimed invention.

Nor is Pacala-2017 prior art to the '515 Patent under 35 U.S.C. §102(a)(2), because as set forth in 35 U.S.C. §102(b)(2)(A) the subject matter disclosed in Pacala-2017 was obtained directly or indirectly from Angus Pacala and Mark Frichtl who are also named as inventors on the '515 Patent. Ex. 1013 at 1. Therefore, Pacala-2017 is disqualified as prior art under 35 U.S.C. §102(a)(2). Likewise, Pacala-2017 is disqualified as prior art under 35 U.S.C. §102(b)(2)(C), because no later than the effective filing date of the '515 Patent, the '515 Patent and Pacala-2017 were owned by the same entity or subject to an obligation of assignment to the same entity, here Ouster, Inc¹¹.

¹¹ See Ex. 2025 (November 25, 2016 assignment of Pacala-2017 to Ouster); Ex. 2026 (December 4, 2018 assignment of U.S. Pat. App. No. 16/209,875 to Ouster); Ex. 2027 (January 11, 2018 assignment of the provisional application to which the '515 Patent ultimately claims priority to Ouster).

Accordingly, Pacala-2017 is not prior art to the '515 Patent under either 35 U.S.C. §102(a)(1) or 35 U.S.C. §102(a)(2).

b. Support for each of the Challenged Claims of the '515 Patent was Explicitly Disclosed in the '018 Application

As demonstrated below, each challenged claim of the '515 Patent has explicit support in the '018 Application, including in the claims. Ex. 2004, ¶240.

'515 Patent Claim¹²	Representative Support in the '018 Application (Ex. 2002)¹³
1(a); 14(a); 22(a)	To the extent preamble is limiting: Claim 1
1(b); 14(b); 22(b)	Fig. 5B, [0095]
1(c); 14(c); 22(c)	[0011], [0055]
1(d); 14(d); 22(d); 22(d.ii)	FIG. 3, [0072], [0095], Claim 26
1(e); 14(e); 14(f); 22(e.i)	FIG. 8, [0127], [0128]
1(f); 14(g); 22(e); 22(e.ii)	FIG. 5B, FIG. 8, [0095], [0127] , Claim 26
1(g); 14(h); 22(d.iii)	FIGs., 6D–6E, 8, [0013], [0110], [0112]
1(h); 14(i); 22(e.iv)	FIGS. 6D–6E, 8, [0013], [0111]

¹² The claim element identifiers used here are the ones from the Petition (Paper 2 at viii-xvi).

¹³ All citations in this column are to Ex. 2002.

'515 Patent Claim¹²	Representative Support in the '018 Application (Ex. 2002)¹³
1(i); 14(j); 22(f.i)	FIGS. 5B, 8, 9A–9C [0096], [0117], [0133], [0136], Claim 1
1(j); 14(k); 22(g)	Claim 11
2; 22(i)	[0012], [0076], [0077], Claim 4; <i>see also</i> [0073], [0099], [0101]
4; 22(d.i); 22(e.iii)	[0039], [0040], [0096], [0098], [0100], FIGS. 5A–5B, Claims 27 and 29
5	FIG. 5A–5B, 6C, FIG. 8, [0095], Claim 23
6	FIGS. 5A–5B, [0096], [0098]
7; 16; 24	FIG. 6E, [0111]
8; 19; 22(f.iii)	[0038], [0059], [0067], [0070], [0079], [0092]
9	[0074]
11	Claim 20
12; 20; 25	[0060], [0087]–[0089]
13; 21	[0151]–[0154]
17; 22(h)	[0100], [0113]–[0114], Claims 25, 30–31
22(f.ii)	[0060], [0087]–[0089], [0151]–[0154]
23	FIGS. 3, 5A–5B, 8, [0039]–[0040], [0072], [0095]– [0096], [0098], [0100], [0127], Claims 26–27 and 29

ii. Ground 8 also fails for the same reasons as Ground 1

Even if Pacala-2017 were to qualify as prior art, as explained in Section V.F.i.a above, Ground 8 fails to show any of claims 1-2, 4-9, 11-14, 16-17, or 19-21 are unpatentable for at least the same reasons provided in Section V.A as to Ground 1. Patent Owner's arguments above in Section V.A apply with equal force to Ground 8 as Petitioner identifies no meaningful difference resulting from the substitution of Pacala-2017 for Pacala.

In fact, if Pacala-2017 was available as prior art, it would only further affirm that a POSITA would have no motivation to combine Pardhan's rotating finned heat sink with a LIDAR designed by Angus Pacala. Ex. 2004, ¶242. Pacala-2017 teaches and claims a more efficient design for the optoelectronics in a LIDAR system wherein optical channels for receiving photons and detecting the photons are arranged on a single image sensor fabricated directly onto a semiconductor chip. Ex. 1013 at [0050], Claims 1, 5, and 6; Ex. 2004, ¶242. Pacala-2017's system focuses on "achieving a relatively high signal-to-noise ratio ('SNR') through techniques that ensure "minimal power output by the system (via the illumination sources) is wasted." Ex. 1013 at [0016]; Ex. 2004, ¶242. In this manner, Pacala-2017 "achieve[s] 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).” Ex. 1013, [0016]; *see also id.* at [0028] (explaining how its improved optics “reduce[s] crosstalk between channels, thereby improving SNR within the system.”); Ex. 2004, ¶242. A POSITA would therefore understand that Pacala-2017, even more than Pacala, teaches away from combination with Pardhan as described in Section V.B.i *supra*. Ex. 2004, ¶242.

G. Ground 9: The Pacala-2017-Johnson-Pardhan-Zhang combination in further view of Cai and Yan fails to render claims 22-25 unpatentable

In Ground 9, Petitioner substitutes Pacala-2017 for Pacala in Ground 6 and Spector in Ground 7. Pet. at 105. As explained in Section V.F.i.a *supra*, Pacala-2017 does not qualify as prior art, so Ground 9 fails for the same reason as Ground 8.

Even if Pacala-2017 qualified as prior art, Petitioner contends “Johnson-Pardhan-Zhang-Cai-Yan are combined in the same way as” in Ground 6 but “[t]he combined system is then further modified by integrating the LiDAR device of Pacala-2017, rather than Pacala-Spector.” Pet. at 105-106. Petitioner contends all the limitations Ouster has discussed above are disclosed by the combination of Johnson-Pardhan-Zhang-Cai-Yan in the same manner as in Ground 6. *Id.* at 106. Accordingly, Ground 9 fails to show claims 22-24 are rendered unpatentable for

the same reasons discussed above in Sections V.D and V.E *supra*. Claim 25 depends from claim 22 and is likewise valid because it depends from a valid independent claim. *See, e.g., Fritch*, 972 F.2d at 1266.

H. Petitioner Failed to Meet Its Burden to Show a Reasonable Expectation of Success

As explained above, Petitioner asserts the claimed invention would have been constructed by a POSITA from various disparate prior art disclosures, and/or based on modifying those references using purported common knowledge.

Petitioner fails to explain how a POSITA would have had a reasonable expectation of success in combining these references (and then further modifying them) to meet the limitations of the claimed invention despite the readily apparent difficulties stemming from their contradictory teachings. *Samsung Elecs. Co. v. Elm 3DS Innovations, LLC*, 925 F.3d 1373, 1380-83 (Fed. Cir. 2019) (finding Petitioner failed to establish a reasonable expectation of success in combining incompatible references after “analyzing Petitioners’ obviousness grounds in the way presented in the Petition”).

Petitioner thus failed to meet its burden to show a reasonable expectation of success for any of Grounds 1-9.

VI. SECONDARY CONSIDERATIONS

A. Petitioner's Copying

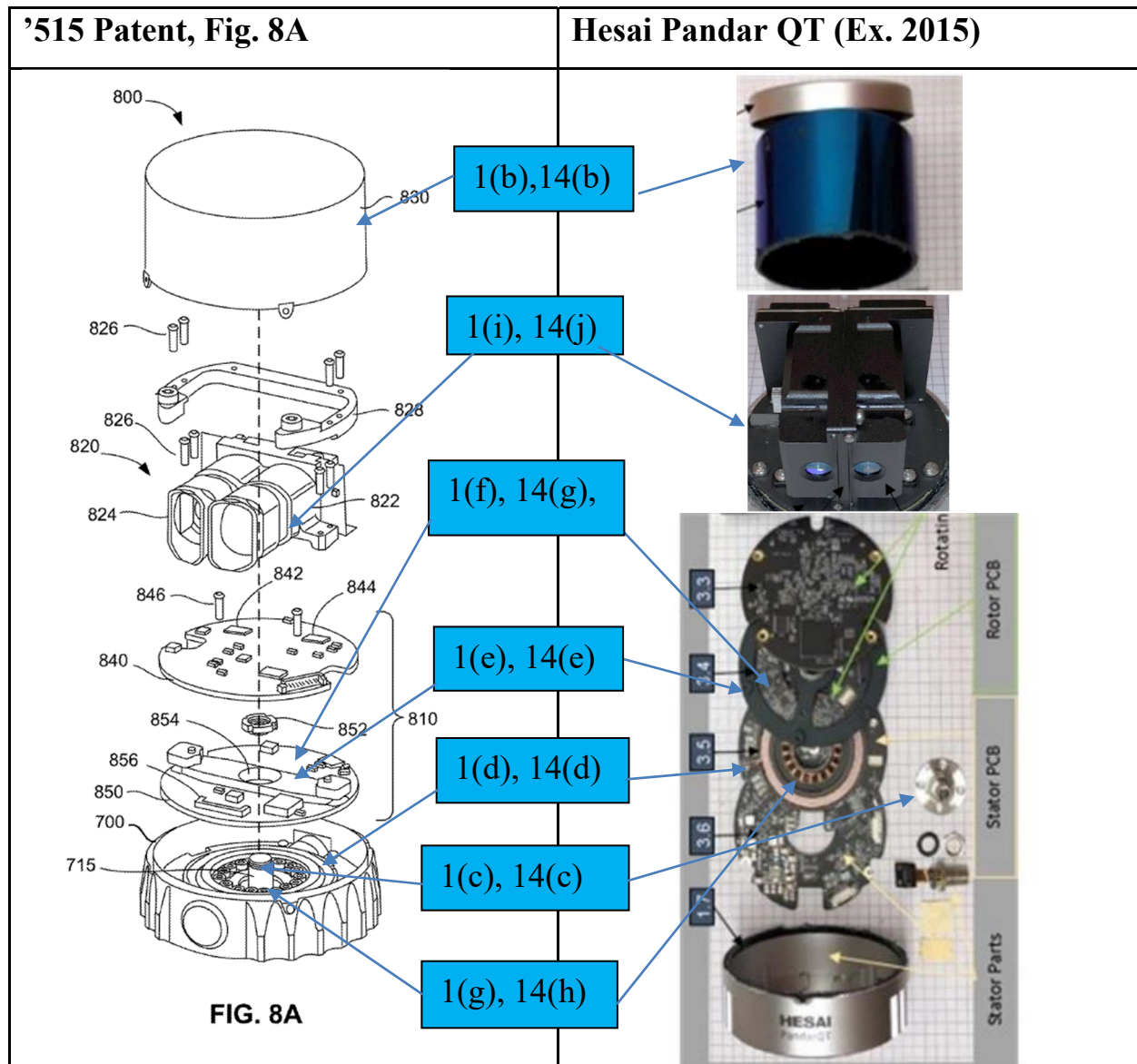
“The objective indicia analysis is . . . a fundamental part of the overall § 103 obviousness inquiry.” *Liqwd, Inc. v. L’Oreal USA, Inc.*, 941 F.3d 1133, 1137 (Fed. Cir. 2019) (citation omitted). It is an essential safeguard that protects against hindsight bias. *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Pat. Litig.*, 676 F.3d 1063, 1079 (Fed. Cir. 2012).

Petitioner contends that a POSITA could have pieced together the claimed invention of the ’515 Patent by cherry-picking components from at least four and as many as eight prior art references—many of which taught away from the claimed invention. However, as explained below, Petitioner’s product, the Hesai PandarQT, tells an entirely different story since it is plainly a copy of Fig. 8A, a claimed embodiment of the ’515 Patent.

“Copying, an indicium of nonobviousness, requires duplication of features of the patentee’s work based on access to that work.” *Institut Pasteur & Universite Pierre Et Marie Curie v. Focarino*, 738 F.3d 1337, 1347-48 (Fed. Cir. 2013); *Seadrill Americas, Inc. v. Transocean Offshore Deepwater Drilling, Inc.*, IPR2015-01989, Paper 102 at 54-57 (P.T.A.B. May 18, 2017). A patent owner may rely on evidence that its patent (rather than a product embodying the patent) was copied.

Liqwd, 941 F.3d at 1136, 1139 (finding Board erred when it “disregarded its finding that L'Oreal copied Liqwd's patented method, determining that the evidence of L'Oreal's copying efforts was irrelevant because Liqwd had not shown that L'Oreal ‘copied a patented product.’”).

Petitioner’s PandarQT is a rotating light ranging system [1(a), 14(a)] contained with an enclosure with a transparent window [1(b), 14(b)]. Ex. 2004 ¶249; Ex. 2012 at 9. As shown in the side-by-side comparison below, the PandarQT copies each and every claim element of the ’515 patent directly from the ’515 patent itself, from the four circuit boards, to the support component with arms extending from a sleeve, to the positioning of the transformer coils outside of the rotor and stator elements. Ex. 2004, ¶251.



In addition to the elements visible in the comparison above (Ex. 2004, ¶251), the underside of the PandarQT's rotor circuit board includes a rotor assembly coupled to the rotor circuit board in the form of a ring magnet with alternating magnetic poles [1(h), 14(i)] with the transformer coil positioned outside

the ring magnet [17] as recited by the '515 patent claims. Ex. 2004, ¶252; Ex 2011 at 27-28. During operation, the PandarQT's stator driver circuit provides a drive signal that imparts electromagnetic force on the rotor assembly to rotate [1(j), 14(k), 22(g)]. Ex. 2004, ¶252. As a result, the transmit module and receive module are operable in the manner recited by the claims [1(i), 14(j)]. Ex. 2004, ¶253. Thus, not only are the claims of the '515 Patent practiced by the Hesai PandarQT, it bears such striking similarities to Fig. 8A of the '515 Patent that copying should be inferred.

The Federal Circuit has emphasized that no “direct evidence ‘such as photos of patented features or disassembly of products’” is required to prove copying. *Medtronic, Inc. v. Teleflex Innovations S.a.r.l.*, 70 F. 4th 1331, 1340 (Fed. Cir. 2023). Rather, “[e]vidence of access and substantial similarity *is* evidence of copying.” *Id.* (emphasis in original); *see also Cable Elec. Prods., Inc. v. Genmark, Inc.*, 770 F.2d 1015, 1027 (Fed. Cir. 1985) (“Access in combination with similarity can create a strong inference of copying.”), *overruled on other grounds by Midwest Indus., Inc. v. Karavan Trailers, Inc.*, 175 F.3d 1356 (Fed. Cir. 1999).

The Fig. 8A embodiment of the '515 Patent has been available to Petitioner since at least the publication of U.S. Patent Application 16/209,875¹⁴ as U.S. Patent No. 20200025880A1 on January 23, 2020. *See* Ex. 2032. Moreover, Ouster's products utilizing the same design shown in Fig. 8A of the '515 Patent have been on the market and available to Petitioner since late 2018. *See* Ex. 2004, ¶¶ 255–262 (citing Ex. 2010, Exs. 2021–2024).

The Petitioner's copying is objective evidence that the claimed invention would not have been obvious to a person of ordinary skill in the art at the priority date and further evidence that Petitioner has failed to show that any of the challenged claims are obvious.

B. Industry Praise

Ouster's OS sensors practicing the '515 Patent have opened the door to new uses for drones resulting in industry praise for the claimed invention of the '515 Patent. Ex. 2004, ¶¶263–264. For example, light, maneuverable drones utilizing Ouster OS sensors practicing the '515 patent's claimed invention have enabled drones to be used in performing, for example, detailed up-close airplane inspections. *Id.*, ¶¶265–267. The praise Ouster has received from industry

¹⁴ The '595 Patent is a continuation of this application.

publications and customers for its Ouster OS sensor products is further evidence that none of the challenged claims are obvious. *Id.*, ¶¶266–269; Ex. 2018 (“...This combination of performance, precision, lightweight, and reliability is particularly critical for moving applications like drones...”).

VII. CONCLUSION

For at least the reasons set forth above, Petitioner fails to establish that any of claims 1-2, 4-9, 11-14, 16-17, and 19-25 are unpatentable.

Respectfully submitted,

Dated: June 20, 2024

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Patent Owner's Response contains 13,977 words, as measured by the word-processing system used to prepare this paper. This word count does not include the items excluded by 37 C.F.R. § 42.24 as not counting towards the word limit.

Respectfully submitted,

Dated: June 20, 2024

By: /s/ Megan Bussey
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CERTIFICATE OF SERVICE

I hereby certify that on June 20, 2024, I caused a true and correct copy of the foregoing Patent Owner's Response to be served electronically on Petitioner at the following email addresses:

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