

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HESAI TECHNOLOGY CO., LTD.
Petitioner

v.

OUSTER, INC.
Patent Owner

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

PETITIONER REPLY

TABLE OF CONTENTS

I.	CLAIM CONSTRUCTION	1
A.	“a stator assembly coupled to the stator circuit board” (Limitation 1(g)/14(h))	1
B.	“each of the plurality of stator elements including a coil wound around a magnetic core” (Limitation 1(g))	2
II.	INDEPENDENT CLAIMS 1 AND 14 ARE UNPATENTABLE	3
A.	Ouster’s arguments against combining Pardhan to arrive at a “support component” mischaracterizes the prior art and misapplies the law	4
B.	Petitioner also showed that it was obvious for the support component to include a “plurality of arms”	10
C.	Ouster’s argument that Petitioner has not shown a “stator assembly... coupled to the stator circuit board” is based on erroneous claim construction and is inaccurate	14
D.	Ouster’s argument that Petitioner has not shown “...each of the plurality of stator elements including a coil wound around a magnetic core” is based on erroneous claim construction and is inaccurate	15
III.	DEPENDENT CLAIM 4 IS UNPATENTABLE	15
A.	Johnson renders obvious four circuit boards	15
B.	It would have also been obvious to utilize four circuit boards in view of Cai	19
IV.	DEPENDENT CLAIM 17 IS UNPATENTABLE	21
A.	Johnson renders obvious positioning the transformer coils outside the rotor and stator elements	21
B.	Cai renders obvious positioning the transformer coils outside the rotor and stator elements	23

V.	DEPENDENT CLAIMS 13 AND 21 ARE UNPATENTABLE	25
A.	Ouster’s argument that Droz does not render obvious a plurality of SPADs mischaracterize the prior art and misapplies the law	25
VI.	DEPENDENT CLAIMS 2, 5-9, 11-12, 14, 16, 19-20 ARE UNPATENTABLE.....	26
VII.	INDEPENDENT CLAIMS 22 IS UNPATENTABLE	27
VIII.	DEPENDENT CLAIMS 23-25 ARE UNPATENTABLE.....	27
IX.	DR. LEBBY DOES NOT LACK EXPERIENCE WITH LiDAR	27
X.	SECONDARY CONSIDERATIONS	28
A.	“Petitioner’s Copying”	28
B.	“Industry Praise”	29
XI.	CONCLUSION	30

TABLE OF AUTHORITIES

<u>Cases</u>	<u>Page</u>
<i>Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC</i> , 825 F.3d 1373 (Fed. Cir. 2016).....	8, 20
<i>Comcast Cable Commc’ns, LLC v. Promptu Sys. Corp.</i> , 838 Fed. Appx. 551 (Fed. Cir. 2021).....	2
<i>Cutsforth, Inc. v. Motivepower, Inc.</i> , 643 Fed. App’x. 1008 (Fed. Cir. 2016)	2
<i>Dicar, Inc. v. Stafford Corrugated Products, Inc.</i> , 2010 WL 988548 (D. N.J. 2010).....	1
<i>Elbrus International Limited v. Samsung Electronics Co., Ltd.</i> , 738 Fed. Appx. 694 (Fed. Cir. 2018).....	8
<i>Facebook, Inc. v. Windy City Innovations, LLC</i> , 973 F.3d 1321 (Fed. Cir. 2020).....	8
<i>Gator Tail, LLC v. Mud Buddy LLC</i> , 618 Fed. Appx. 992 (Fed. Cir. 2015).....	6
<i>Hill-Rom Servs, Inc. v. Stryker Corp.</i> , 755 F.3d 1367 (Fed. Cir. 2014).....	3
<i>Intel Corporation v. PACT XPP Schweiz AG</i> , 2023 WL 2198649 (Fed. Cir. 2023)	8
<i>KSR Int’l Co. v. Teleflex Inc.</i> , 127 S. Ct. 1727 (2007).....	8
<i>Ormco Corp. v. Align Tech., Inc.</i> , 463 F.3d 1299 (Fed.Cir.2006).....	29
<i>Thorner v. Sony Comput. Ent. Am. LLC</i> , 669 F.3d 1362 (Fed. Cir. 2012).....	2

EXHIBIT LIST

No.	Short Name	Exhibit
1001	‘515 Patent	U.S. Patent No. 11,287,515 to Pacala <i>et al.</i>
1002	‘515 Prosecution History	Prosecution history for U.S. Patent No. 11,287,515
1003	Lebby Declaration	Expert Declaration of Dr. Michael Lebby
1004	Pacala	U.S. Patent Pub. No. 2014/0211194 to Pacala <i>et al.</i>
1005	Johnson	U.S. Patent No. 10,790,077 to Johnson
1006	Pardhan	U.S. Patent No. 10,749,308 to Pardhan <i>et al.</i>
1007	Zhang	WO 2018/201567 to Zhang <i>et al.</i>
1008	Hall	U.S. Patent No. 11,723,762 to Hall <i>et al.</i>
1009	Cai	CN205027903U to Cai <i>et al.</i>
1010	Spector	U.S. Patent No. 10,473,766 to Spector <i>et al.</i>
1011	Droz	U.S. Patent No. 10,605,984 to Droz <i>et al.</i>
1012	Yan	U.S. Patent Pub. No. 2018/0003823 to Yan
1013	Pacala-2017	U.S. Patent Pub. No. 2017/0289524 to Pacala <i>et al.</i>
1013A	Pacala-2017 Provisional	Provisional Application No. 62/232,222
1014	Pennecot	U.S. Patent No. 9,651,658 to Pennecot <i>et al.</i>
1015	Verghese	U.S. Patent No. 10,845,470 to Verghese <i>et al.</i>

No.	Short Name	Exhibit
1016	Shah	U.S. Patent Pub. No. 2010/0030380 to Shah et al.
1017	ITC Complaint	Complaint in ITC Inv. No. 337-TA-1363
1018	Delaware Complaint	Complaint in <i>Ouster, Inc. v. Hesai Group et al</i> , No. 23-cv-00406 (D. Del.)
1019A	Stay Order (DE)	Order Granting Stay in <i>Ouster, Inc. v. Hesai Group et al.</i> , No. 23-cv-00406 (D. Del.)
1019B	Termination Order (ITC)	Order Terminating ITC Inv. No. 337-TA-1363
1020	Staff's Proposed Constructions	Commission Investigative Staff's Initial Proposed Constructions of Disputed Claim Terms (6-28-2023)
1021	Ouster's Proposed Constructions	Ouster's Initial Proposed Constructions of Disputed Claim Terms (6-28-2023)
1022	Hesai's Proposed Constructions	Hesai's Initial Proposed Constructions of Disputed Claim Terms (6-28-2023)
1023	NIST	<i>Performance Analysis of Next-Generation LADAR for Manufacturing, Construction, and Mobility</i> , National Institute of Standards and Technology (2004)
1024	Hipp	U.S. Patent No. 6,747,747 to Hipp
1025	DGC	<i>Report to Congress: DARPA Prize Authority</i> (2006)
1026	Team DAD	Hall et al., <i>Team DAD Technical Paper</i> , DARPA Grand Challenge (2005)
1027	Hall-558	U.S. Patent No. 7,969,558 to Hall

No.	Short Name	Exhibit
1028	William	U.S. Patent No. 9,935,514 to William <i>et al.</i>
1029	Droz-649	U.S. Patent No. 9,059,649 to Droz <i>et al.</i>
1030	Kim	Sang-Hoon Kim, Electric Motor Control, 2017
1031	Tong	Mechanical Design of Electric Motors, 2014
1032	Gieras	Axial Flux Permanent Magnet Brushless Machines
1033	Bearing Units Manual	https://www.ntn-snr.com/sites/default/files/2017-03/ntn_bearing_units_en.pdf
1034	Johansen	U.S. Patent No. 11,374,458 to Johansen
1035	Phaneuf	U.S. Patent No. 2,818,518 to Phaneuf <i>et al.</i>
1036	Hunter	U.S. Publication No. 2016/0380523 to Hunter <i>et al.</i>
1037	Campisi	U.S. Patent No. 4,627,157 to Campisi <i>et al.</i>
1038	Poag	U.S. Patent No. 6,324,745 to Poag <i>et al.</i>
1039	Bockenstedt	U.S. Patent No. 7,946,986 to Bockenstedt <i>et al.</i>
1040	YMS PCB	Single-Layer vs. Multilayer PCBs, available at https://www.ymspcb.com/news/single-layer-vs-multilayer-pcbs-how-do-they-differ
1041	Hayner	U.S. Patent No. 3,375,386 to P.F. Hayner <i>et al.</i>
1042	Ricci	U.S. Patent No. 10,141,822 to Ricci <i>et al.</i>
1043	Nubling	U.S. Patent No. 9,606,230 to Nubling
1044	Ouster Priority Date Disclosure	Ouster's Notice of Patent Priority Dates

No.	Short Name	Exhibit
1045	Karplus	U.S. Patent No. 10,530,209 to Karplus <i>et al.</i>
1046	Pacala-2017 Provisional	Provisional Application No. 62/232,222
1047	Zhang	WO2018201567A1 to Zhang et al
1048	Cai	CN205027903U to Cai et al
1049	Webster's	Webster's New World College Dictionary, 5 th Ed.
1050	Lebby Reply Declaration	Expert Reply Declaration of Dr. Michael Lebby
1051	Janet Depo Tr.	9-13-2024 Deposition Transcript of Dr. Janet
1052	Pacala-205	U.S. Patent No. 11,726,205 to Pacala et al.
1053	Pacala-2019	U.S. Publication No. 2019/0011567 to Pacala et al.
1054	M8 Guide	Quanergy M8 Sensor User Guide
1055	Webster Dictionary	Meriam-Webster Dictionary – “arm” definition
1056	Waymo Article	Alexis C. Madrigal, The Most Important Self-Driving Car Announcement Yet (3-28-218), available at www.theatlantic.com/technology/archive/2018/03/the-most-important-self-driving-car-announcement-yet/556712/
1057	Ouster Website	Ouster Thermal Integration Guide, available at https://static.ouster.dev/sensor-docs/image_route1/image_route2/thermal_int_guide/therm_int_guide.html
1058	Hunstable	U.S. Patent No. 10,447,103 to Hunstable

Patent Owner Ouster, Inc.’s (“Ouster”) Response (“POR”) does not raise any persuasive reason to preserve the validity of the challenged claims.

I. CLAIM CONSTRUCTION

A. “a stator assembly coupled to the stator circuit board” (Limitation 1(g)/14(h))

Ouster argues that this phrase requires that the “stator assembly” and “stator circuit board” be “distinct elements.” POR, 10. Ouster does not explain what it means by “distinct elements,” but appears to be reading this term to exclude a stator assembly that is built onto the stator circuit board. Pet., 9-10; EX2004, ¶141.

The plain meaning of “coupled to” encompasses “anything joining two things together” or otherwise associating or uniting the stator assembly and circuit board. EX1049; EX1050, ¶27. Moreover, the ’515 patent teaches coupling the assembly and circuit board to one another in the way that Ouster is attempting to read out of the claims. EX1001, 4:28-31 (“...rotor and stator elements built onto the circuit boards themselves”), 4:19-22 (“...stator and rotor elements integrated on” circuit boards). Ouster’s construction conflicts with the intrinsic evidence. *See Dicar, Inc. v. Stafford Corrugated Products, Inc.*, 2010 WL 988548, *8 (D. N.J. 2010) (“Based on the usage of the term throughout the patent specification, this Court finds that the term [“coupled”] need not refer to the attachment of two separately manufactured elements.”).

Ouster's reliance on *Cutsforth, Inc. v. Motivepower, Inc.*, 643 Fed. App'x. 1008 (Fed. Cir. 2016) and *Comcast Cable Commc'ns., LLC v. Promptu Sys. Corp.*, 838 Fed. Appx. 551 (Fed. Cir. 2021) is misplaced. Neither case stands for the proposition that different components of a single structure cannot be "coupled." *Cutsforth* found that a "sub-component" could not be "'coupled to' the component as a whole," but noted that the sub-component could be "coupled to" "the remaining portion of the [component], excluding the sub-component." *Cutsforth*, 643 Fed. App'x at 1012-13. In *Comcast*, the Petitioner "mapped the 'speech recognition system' and the 'wireline node' to a single element [*i.e.*, "to remove server 108]." *Comcast*, 838 Fed. Appx. at 552-553; *see also* IPR2018-00345, Paper No. 20 (Final Decision) at 22. Here, Petitioner maps the assembly and circuit board to separate elements. *See* Section II.C.

B. "each of the plurality of stator elements including a coil wound around a magnetic core" (Limitation 1(g))

Ouster argues that this phrase requires that each coil have its own, separate magnetic core. POR, 11. But the plain meaning of the claim language does not require that each coil be wound around its own magnetic core. Rather, it recites only that each stator element includes a coil and that the coil is wound around a core (whether it be a core that is shared with other coils or one that is not). EX1050, ¶32.

Ouster points to no lexicography or disclaimer that would justify deviating from the plain meaning. *See, e.g., Thorner v. Sony Comput. Ent. Am. LLC*, 669 F.3d

1362, 1367-1368 (Fed. Cir. 2012). Ouster’s reliance on Figure 6D (POR, 10-11), which shows each coil with its own core, is misplaced because this figure is an “example” used in “some embodiments.” EX1001, 26:15-18, 30:15-23, 31:12-19. The Board should not import limitations of an embodiment. *See Hill-Rom Servs, Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371-72 (Fed. Cir. 2014).

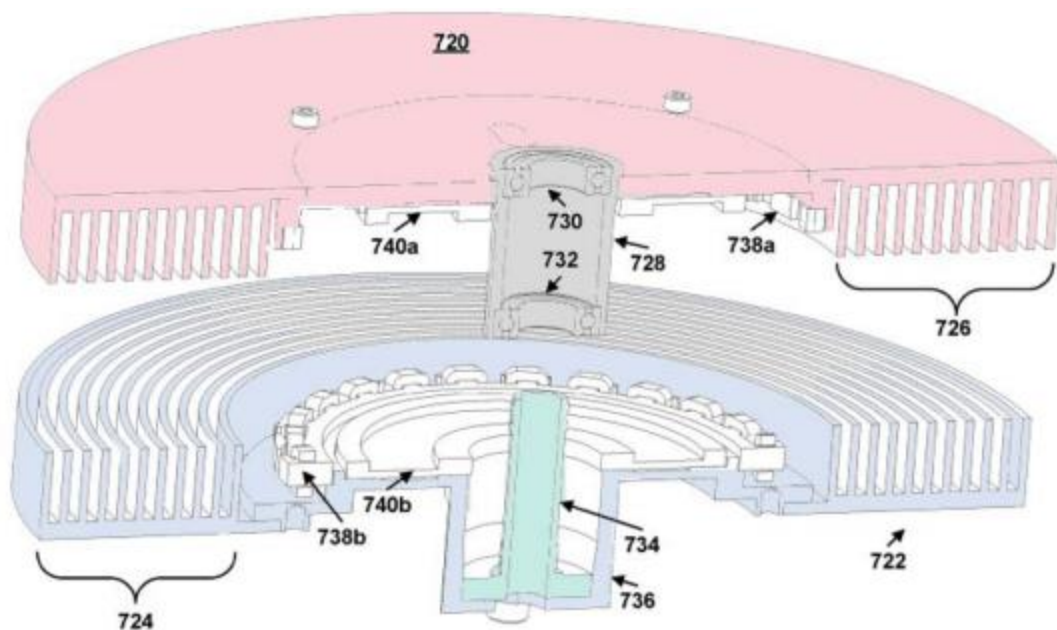
II. INDEPENDENT CLAIMS 1 AND 14 ARE UNPATENTABLE¹

Claims 1 and 14 are similar. Ouster argues that the combination of Pacala-Johnson-Pardhan-Zhang (Ground 1) does not render obvious: [1] a “support component” comprising “a sleeve fitted over the shaft,” [2] that the support component includes a “plurality of arms,” and [3] “a stator assembly... coupled to the stator circuit board.” For Claim 1, Ouster additionally argues that the combination does not render obvious “...each of the plurality of stator elements including a coil wound around a magnetic core.” Ouster’s arguments lack merit.

¹ Petitioner presented two grounds challenging Claims 1 and 14: Grounds 1 and 8. Ground 8 substituted Pacala-2017 (EX1013) for Pacala (EX014). Because Ouster does not challenge Pacala’s disclosure of any limitation, the differences between these grounds are immaterial and this Reply focuses on the Pacala grounds.

A. Ouster’s arguments against combining Pardhan to arrive at a “support component” mischaracterizes the prior art and misapplies the law

Petitioner relies upon Pardhan for one element of Claim 1: “a support component rotationally coupled to the shaft and comprising a sleeve fitted over the shaft.” Limitation 1[e].² Pardhan discloses a “thermal rotary link” comprising a bearing housing (728) for assembling a rotor-stator structure that that is rotationally coupled to a shaft and comprises a sleeve fitted over the shaft (734):



Pet., 24-25. Ouster concedes Pardhan discloses a “support component,” but mischaracterizes the prior art and misapplies the law in an attempt to argue that a POSITA would not have combined Pardhan with Pacala-Johnson. EX1050, ¶¶4-25.

² Limitations 14[e]-[f] recite substantially the same “support component.”

1. Pardhan does not “teaches away” from Pacala-Johnson

Ouster concedes that a POSITA would have combined Pacala’s teaching of a spinning LiDAR device with Johnson’s teaching of an integrated motor built on circuits boards to provide for a compact motor that efficiently uses space. Pet. at 42 (citing EX1045, 4:1-6); EX1003, ¶¶84, 91. However, Ouster contends that “such motivation is negated” when “Pacala-Johnson is further combined with Pardhan” because Pardhan “teaches away” from “a compact design.” POR, 15-16.

Pardhan—which like Johnson is a Waymo patent—does not teach away. EX1050, ¶¶4-7. Rather, Pardhan discloses that “a motor configured to drive the rotor (and the heat source [*i.e.*, LiDAR] connected thereto) with respect to the stator may be disposed within the cavity” of a heat sink. EX1006, 21:4-6, Claim 11. Pardhan places no restriction on the size or type of the motor, and illustrates its system using a motor that, like Johnson, integrates the rotor-stator components onto the rotor-stator platforms. EX1006, Fig. 7B, Claim 11. Moreover, Ouster’s premise—that Pardhan teaches a “larger volume design” (POR, 15-16)—is inaccurate. EX1050, ¶¶5-6. And in any event, a POSITA would have scaled components to meet any size objectives. *Id.*, ¶18.

Ouster relies upon the following disclosure: “[t]he inability to dissipate heat at a sufficient rate may stem from, for example, a density with which the electrical and optical components of the LiDAR device are packaged inside the LiDAR device

housing.” POR, 16 (citing EX1006, 4:63-67). This disclosure does not teach away. *See Gator Tail, LLC v. Mud Buddy LLC*, 618 Fed. Appx. 992 (Fed. Cir. 2015) (statement that “horizontal engine motors that were on the market at the time took up too much space” did not teach away “from the use of horizontal motors”). Stating that LiDAR devices may be densely packaged does not counsel against using an integrated motor or towards a non-compact motor.

In fact, this disclosure provides an express motivation to combine. The sentence that follows the one Ouster cites teaches that Pardhan’s thermal rotary link should be used with densely packaged devices to “transfer excess heat away from the LiDAR.” EX1006, 4:67-5:7. It also teaches that the structures of the thermal rotary link should be used to “provide for rotation of the LiDAR device with respect to the vehicle or structure to which the LiDAR device is mounted [*i.e.*, rotor].” *Id.*

2. Pardhan renders obvious a support component comprising a sleeve fitted over a shaft

Outer argues that [1] there is “no reason” to use Pardhan’s thermal rotary link with Pacala (POR, 18-19), and [2] that bodily incorporating Johnson’s rotor-stator structure into Pardhan’s thermal rotary link would result in “negative effects” (POR, 23-28). Ouster’s arguments are not supported by evidence and misapply the law.

a) *Ouster’s argument that there is “no reason” to utilize
Pardhan’s thermal rotary link is inaccurate*

Ouster’s argument is premised on a faulty assumption: that Pacala does not need to address overheating because it uses “a multichannel TDC approach” to operate at lower power levels. POR, 19. Ouster relies solely on its experts uncorroborated testimony which is contradicted by the evidence. Indeed, LiDAR devices from Pacala that use a multichannel TDC approach use heat sinks. See EX1050, ¶¶11. The same is true for LiDAR devices the assignee of Pacala. *Id.*

Moreover, Pardhan teaches that its thermal rotary link is useful for dissipating heat generated while the LiDAR is operating above and below a threshold power level: “The example thermal rotary links... maintain the LiDAR device at stable operating temperatures even when the LiDAR device is operating above the threshold power level.” EX1006, 4:67-5:8 (emphasis added). In other words, heat dissipation was a known issue for LiDAR devices of all power levels. EX1050, ¶¶8-10. Ouster itself concedes that devices of all power levels may be prone to “overheating” due to densely packaged electrical components. POR, 16.

b) *Ouster’s arguments regarding “negative effects”
misapplies the law*

Ouster’s argument that there would be “negative effects” if a POSITA physically substituted Johnson’s motor within the cavity of Pardhan’s heat sink misapplies the law and is inaccurate.

“[W]hether one reference can be incorporated in another is ‘**basically irrelevant**’ since the test for obviousness is ‘not whether the references could be physically combined but whether the claimed inventions are rendered obvious by the teaching of the prior art as a whole.’” *Intel Corporation v. PACT XPP Schweiz AG*, 2023 WL 2198649, *2–*4 (Fed. Cir. 2023); *Facebook, Inc. v. Windy City Innovations, LLC*, 973 F.3d 1321, 1343 (Fed. Cir. 2020) (Board “correctly rejected Windy City’s argument about the difficulty of physically creating the combination”) (quoting *Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016)); *Elbrus International Limited v. Samsung Electronics Co., Ltd.*, 738 Fed. Appx. 694, 698-699 (Fed. Cir. 2018).

Ouster’s argument also ignores the Supreme Court’s admonition that obviousness is evaluated according to “a person of ordinary creativity, not an automaton.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1742 (2007). Ouster’s assertion that a POSITA would need to consider power losses, thermal analysis and torsional analysis, fluid dynamics, and gyroscopic forces does not negate obviousness because the considerations Ouster identifies are part of the design process. EX1050, ¶23; *see also* EX1051, 13:1-14:1 (“tools used in the industry” POSITA “could employ” to analyze these considerations), 21:4-13. A POSITA would understand their impact on LiDAR design and be able to design a thermal rotary link that accounts for these impacts. EX1050, ¶¶13-18, 20-24. For example,

Ouster claims that Pardhan and Johnson are not combinable because Figure 7B of Pardhan illustrates a radial-flux motor, while Johnson illustrates an axial-flux motor. POR, 23-24. A POSITA would recognize the functional equivalence of radial and axial flux motors. EX1050, ¶21. Ouster also argues that the combination “could generate eddy currents” in the heat sink. POR, 24-25. A POSITA would have been familiar with eddy current and their impact on LiDAR design, and, to the extent needed, would have designed structures that shield surrounding areas. EX1050, ¶22. Similarly, Ouster needlessly raises an alarm about the volume of the heat sink and gyroscopic forces. POR, 26. But Pardhan says nothing about the size of its heat sink and gyroscopic forces, which are proportional to rotational speed, are likely to be insignificant given that Pardhan rotates at 10 Hz. EX1050, ¶¶13-17. Rather, Pardhan and Johnson both teach a LiDAR should include a rotary joint device that rotates the rotor relative to a stator. EX1005, 6:49-59; EX1006, 11:7-10; EX2004, ¶205. They are directed to similar systems with compatible characteristics.

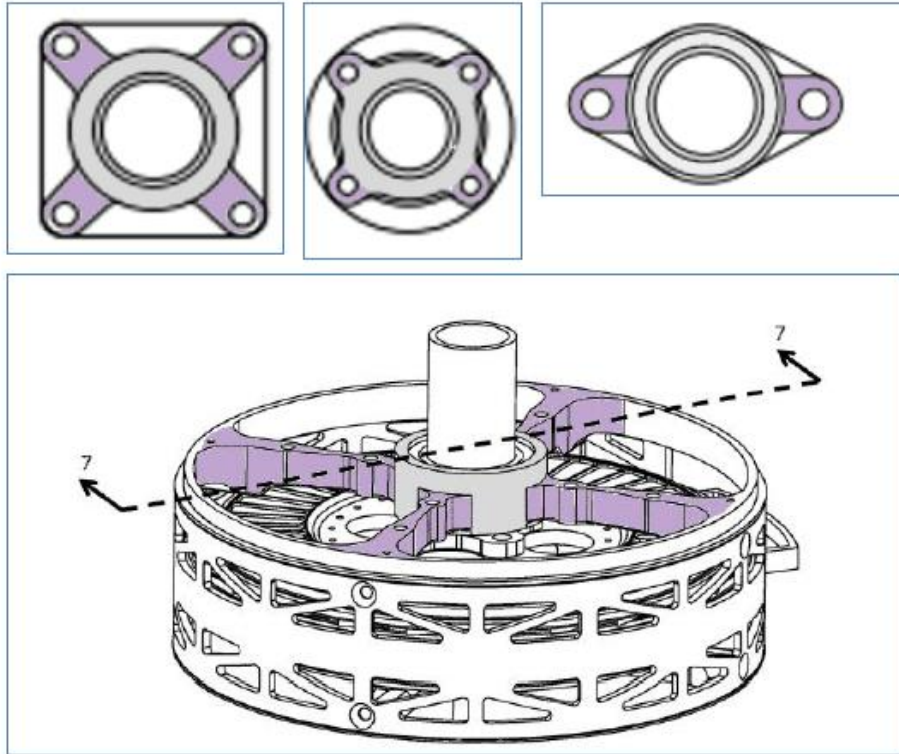
Ouster’s arguments are also premised on a POSITA bodily incorporating the *entirety* of Pardhan’s thermal rotary link, particularly its heat sink. However, the claims of the ’515 patent do not require a heat sink and a POSITA would use their engineering judgment to identify those aspects of Pardhan to utilize in the combined design. EX1050, ¶25. For example, Ouster admits that Pardhan discloses a “bearing housing [that] is coupled to Pardhan’s rotor platform 720” and “used to assemble the

rotor and stator structure” to “offer rotation about the shaft” (EX1051, 21:22-23:3) and that the “bearing housing” is a “support component” (EX1051, 11:19-12:8; *see also* POR, 69, 75). Petitioner showed that Johnson “does not expressly disclose the details regarding the shaft and support structure that couples the stator and rotor,” such that a POSITA would have looked to references like Pardhan that describe those details. Pet., 51-53. Ouster does not dispute that a POSITA would recognize that a rotor-stator structure may be assembled using a bearing housing (EX1051, 12:12-22) and Pardhan provides a motivation to do so, teaching that its structures should be utilized to “provide for rotation of the LiDAR device with respect to the... structure to which the LiDAR device is mounted [*i.e.*, the rotor].” EX1006, 5:4-7; *see also* EX1050, ¶19.

B. Petitioner also showed that it was obvious for the support component to include a “plurality of arms”

Limitations 1[e] and 14[e] further recites that the support component includes “a plurality of arms extending away from the sleeve.” Petitioner acknowledged that Pardhan’s bearing housing does not include arms, but showed that arms were obvious for two reasons. Pet., 26-27.

First, it was obvious to “utiliz[e] one of various prior art bearing assembly designs that included arms which extend away from the sleeve and provide firm attachment to the rotor platform,” such as the designs below:

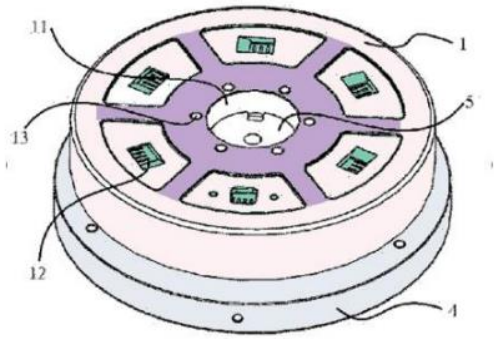


EX1003, ¶¶163-164, 141-141, 60-62; Pet., 26; EX1033, 16 (top); EX1042, Fig. 6 (bottom). A POSITA would have been motivated to use “a bearing housing with arms” to hold the shaft in “position firmly” and “minimize vibrations and movements.” EX1003, ¶¶253, 62; Pet., 26-27, 53-54.³

³ Ouster argues that this argument was not made for Ground 1. POR, 60. But in fact this argument is very clearly made for Ground 1. Pet. at 25-26. At deposition Ouster’s expert agreed that Ground 1 disclosed this “theory.” EX1051, 52:9-54:17.

Ouster fails to rebut Petitioner’s showing. POR, 60-61; EX2004, ¶221; EX1050, ¶¶35-36. Ouster argues that “arms of the ’515 Patent are cantilevered, whereas what the Petitioner erroneously identified as ‘arms’ from Ex. 1042 are actually not cantilevered.” EX2004, ¶221. Ouster’s contention that arms must be cantilevered is unsupported. *See also* EX1055. Ouster’s bodily incorporation arguments for the bearing housing designs in EX1033 are irrelevant. For example, Ouster claims that the bearing housings are “unnecessarily heavy” because they are made of “iron and/or steel,” but a POSITA would have designed them to meet any weight constraints. EX1050, ¶35.

Second, Petitioner showed that Zhang discloses a rotor plate comprising arms (with heat dissipation holes between). EX1003, ¶¶165, 142; Pet., 26-27, 52-53. Ouster claims Zhang does not disclose “arms” (POR, 32-33), but fails to explain why the plain meaning of “arms” does not encompass Zhang’s structures (purple). *See* EX1055 (“arm” defined as “a slender part of a structure, machine, or an instrument projecting from a main part, axis, or fulcrum.”). In the section of Ouster’s POR entitled “Petitioner’s copying,” Ouster identifies a rotor plate similar to the one in Zhang as the “support component” with “arms”:



Compare Pet., 27 (citing EX1007, Fig. 1) with EX2004, ¶251 and EX2015, 3.

Ouster also argues that a POSITA would not combine Zhang with Pardhan because Zhang’s heat dissipation structures allegedly release heat “upwards” while Pardhan’s heat sink “pull[s] heat... down.” POR, 36. But Dr. Lebby explained that this is no different than Zhang’s existing structure, which allows some heat to escape through the heat dissipation holes while also pulling other heat downwards to the metallic base. EX2005, 78:24-80:21. Ouster’s expert does not dispute this fact (EX2004, ¶157) and there is no incompatibility. EX1050, ¶¶37-38. Zhang discloses dissipation structures that use heat convection for heat transfer, while Pardhan uses heat conduction of the rotor-stator platform. *Id.* These forms of heat transfer are complimentary. *Id.* Moreover, by forming heat dissipation holes, Zhang’s design reduces weight as compared to a solid or fully enclosed rotor plate. EX1050, ¶38. This bodily incorporation argument also lacks merit.

Ouster’s assertion that the combination would have required a POSITA to perform “thermal analysis,” “torsional analysis,” and “other possible analyses” also

does not negate obviousness. POR, 39. A POSITA would have been familiar with these types of analyses and more than capable of performing them. EX1050, ¶39.

C. Ouster’s argument that Petitioner has not shown a “stator assembly... coupled to the stator circuit board” is based on erroneous claim construction and is inaccurate

Ouster argues that Johnson’s stator assembly and circuit board are not “distinct elements” and thus not “coupled to” one another. POR, 28-29. Ouster’s argument is premised on an incorrect claim construction that seeks to preclude the stator assembly from being built onto the circuit board. *See* Section I.A.

Petitioner showed that Johnson discloses a stator assembly comprising conductive structures (leads and electrical contacts) that are interconnected to form a plurality of coil windings (lead-to-lead). EX1003, ¶¶178-180; Pet., 31-32. Johnson teaches that the conductive structure “can be disposed along a mounting surface (*e.g.*, top or bottom layer) of a circuit board” (EX1005, 3:57-64), such that the stator assembly is distinct from the mounting surface of the circuit board and both are coupled. EX1050, ¶¶27-29. Ouster’s arguments to the contrary improperly seek to exclude stator assemblies built onto the circuit board. EX1001, 4:28-31, 4:19-22; *see also* Section I.A.

In any event, the claims are also unpatentable under Ouster’s construction. In addition to embodiments where the stator assembly may be built onto the circuit board (EX1005, 3:40-45), Johnson teaches embodiments where the stator assembly

is comprised of wires wound around a magnetic core, rather than interconnected conductive structures built onto a multi-layer circuit board (EX1005, 3:30-39, 5:7-17; 4:56-5:7). EX1050, ¶30. Implementing the stator assembly in this way was a known configuration that satisfies Ouster’s construction. *Id.*

D. Ouster’s argument that Petitioner has not shown “...each of the plurality of stator elements including a coil wound around a magnetic core” is based on erroneous claim construction and is inaccurate

It is undisputed that Johnson discloses “a plurality of coil windings wound around a single, ring-shaped core.” EX1051, 65:12-66:7. Ouster nevertheless claims that Limitation 1(g) excludes winding coils around a “core shared by all coil windings.” POR, 31. Ouster’s argument is premised on an erroneous claim construction. *See* Section I.B; EX1050, ¶32.

III. DEPENDENT CLAIM 4 IS UNPATENTABLE

Dependent claim 4 requires “a third circuit board” and “a fourth circuit board.” The Petition demonstrated that the number of circuit boards was a straightforward design choice that was obvious [1] in view of Johnson alone and the knowledge of a POSITA (Ground 1) or [2] in further view of Cai (Ground 2). Pet., 41-43, 61-63. Ouster’s rebuttal does not negate Petitioner’s obviousness showing.

A. Johnson renders obvious four circuit boards

The Institution Decision “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 this limitation was obvious. It is. EX1050, ¶¶40-43.

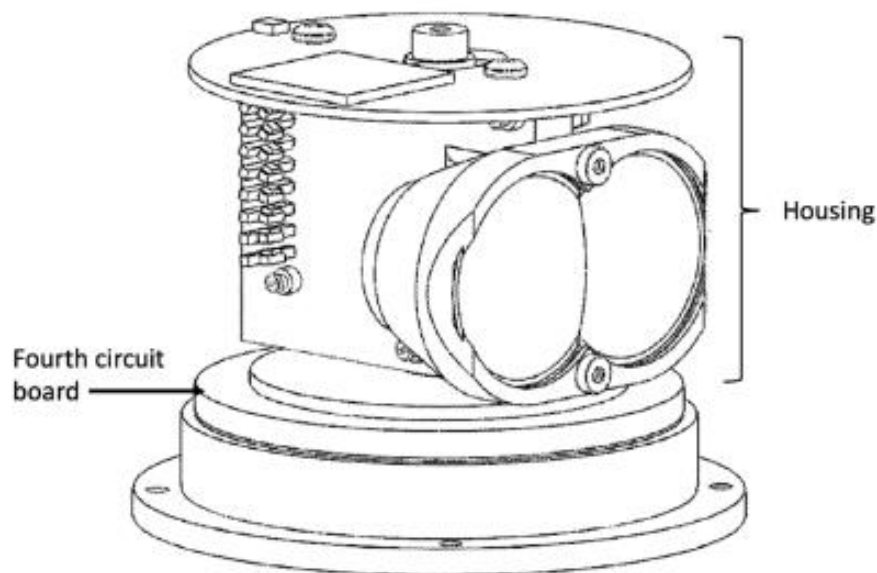
Johnson teaches that a LiDAR device may include components that are not shown (EX1003, ¶220; EX1005, 10:36-48, 11:61-62) and Petitioner showed that a POSITA would have been motivated to utilize third and fourth circuit boards to mount these components (EX1003, ¶223). The Petition presented prior art that reflect this understanding of a POSITA. For instance, Nubling (EX1043) discloses a LiDAR device with rotor (red) and stator circuit board (blue) and explains that the LiDAR device can include “more circuit boards” (*e.g.*, purple and gray) to provide “sufficient space and capacity” for mounting electronics:

Figure 6C shows a cross-sectional view of a device 10. The device features a trapezoidal housing 12. Inside, a vertical assembly 20 is centered, containing a rod 22 and a lens-like element 24. Below this, a horizontal assembly 30 includes a pink bar 34 and two black circular components 36. At the base, there are blue bars 42 and 44, and a purple bar 48. Other labeled parts include 14, 16, 18, 28, 32, 38, 40, 46, 50, and 52.

- 17 -

choice. EX1043, 6:6-8. Indeed, Johnson already discloses multi-layer circuit boards that are arranged in parallel. EX1005, Fig. 3A.

Ouster also claims that Pardhan “teaches away from placing a [fourth] circuit board in Petitioner’s proposed location” because placement of the fourth circuit board would “disrupt the heat flow” POR, 44. This improper bodily incorporation argument is not supported by the evidence. For instance, Petitioner showed that the fourth circuit board may be “a control board for the ranging device” that is coupled in parallel to the rotor circuit board in the orientation shown below:



POR, 43 (citing Pet., 44). Petitioner also provided evidence of this known configuration. EX1003, ¶220, ¶347 (discussing Yan’s disclosure of control board). Ouster does not cite any disclosure in Pardhan that precludes the use of a control board disposed above the rotor surface, and does not articulate any reason why

placing a control board for the ranging device in this orientation would “disrupt the heat flow” of Pardhan’s heat sink. Ouster’s argument conflicts with the ’515 patent, which illustrates the fourth circuit board (yellow) in this configuration:

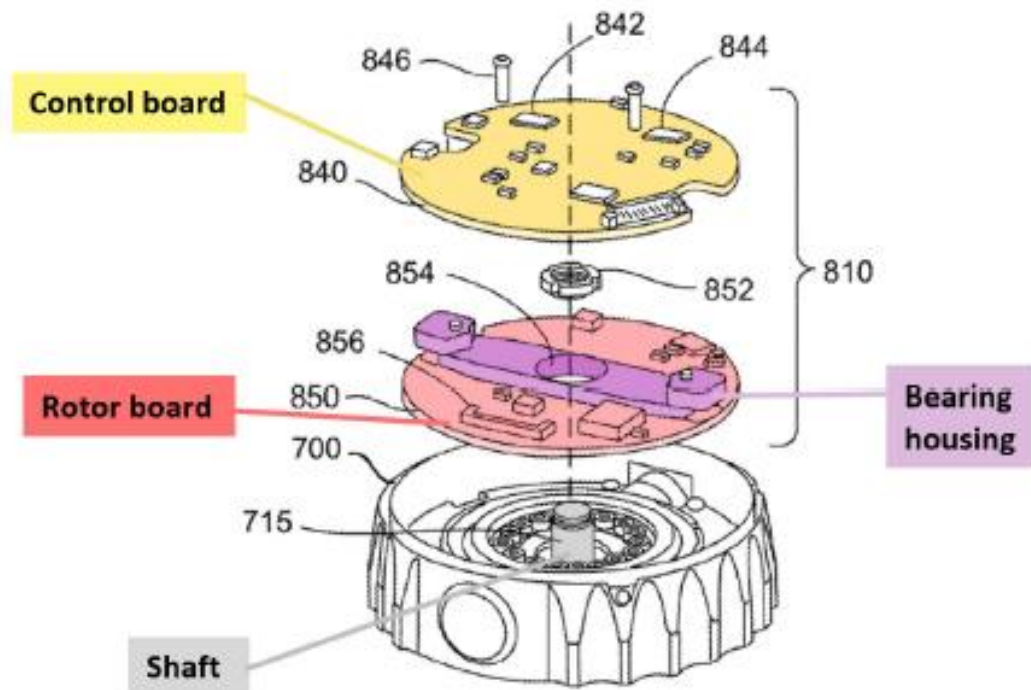


FIG. 8A

EX2004, ¶78. Ouster provides no reason why this design would present overheating issues in the context of the prior art but not in the ’515 patent. EX1050, ¶43.

B. It would have also been obvious to utilize four circuit boards in view of Cai

Petitioner also showed that Cai renders this limitation obvious by teaching that the third and fourth circuit boards may be circuit boards for the transceiver. Pet.

at 61-63; EX1003, ¶¶266-269. In particular, Johnson discloses that its system may include communication interfaces (216/236) and Cai discloses that there are advantages to implementing those communication interfaces on separate transceiver boards (113/124) that are positioned above the rotor-stator circuit boards. *Id.*

Ouster argues that the combination would involve a “redundant feature” because Johnson “already teaches” a “communications interface on the circuit boards.” POR, 54. Petitioner did not propose implementing a redundant set of communication interfaces. Rather, Petitioner argued that Cai renders obvious implementing those communication interfaces on separate circuit boards above and below the rotor-stator circuit boards. Pet. at 61-63; EX1003, ¶¶266-269; EX1050, ¶¶44-45.

Ouster also provides a conclusory assertion that a POSITA would not make the combination because it would “increase the size of the system.” POR, 55. Ouster does not provide any basis for its contention that the combination would result in a larger system. Even accepting this assertion as true, that there are simultaneous advantages and disadvantages in making the proposed combination does not negate the motivation to combine. *See Allied*, 825 F.3d at 1381. Here, Cai teaches that implementing separate transceiver boards allows the transceivers to be mounted within the center region so that data can be exchanged wirelessly through a hollow shaft, thereby preventing signal interferences and improving reliability of the signal

transmission. EX1003, ¶¶277-278 (citing EX1007 and EX1008). The additional circuit boards would allow for the transceivers to be mounted in the center region. EX1003, ¶278. Ouster does not dispute any of these motivations.

IV. DEPENDENT CLAIM 17 IS UNPATENTABLE

Dependent claim 17 recites a “wireless transform comprising 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,” wherein the first and second transformer coils are “positioned outside an outer perimeter of the plurality of stator elements and... an outer perimeter of the rotor assembly.” The Petition showed that dependent claim 17 was obvious [1] in view of Johnson alone and the knowledge of a POSITA (Ground 1) or [2] in further view of Cai (Ground 2). Pet., 48-51, 63-65. Ouster fails to meaningfully rebut Petitioner’s showing.

A. Johnson renders obvious positioning the transformer coils outside the rotor and stator elements

Both parties agree that Johnson discloses a wireless transformer comprising first and second annular transformer coil disposed on the surface of the circuit boards. EX1003, ¶¶244-246. The sole dispute is whether it was obvious to position the wireless transformer coils on the outside, as opposed to the inside, of the stator-rotor elements. POR, 45-53. Although Johnson shows its transformer coils on the inside of the rotor-stator elements in Figures 3B-3C, Johnson states “[o]ther configurations are possible as well.” Pet. at 54 (citing EX1005, 7:64-8:15).

Petitioner showed that positioning the transformer coils on the outside of the rotor-stator elements was a known configuration and an obvious design choice, particularly given the limited number of options (inside or outside). Pet., 50-51, EX1003, ¶247. Petitioner also showed that a POSITA would have been motivated to make this modification because it would result in greater power and transfer distances and due to limited space in the center region. Pet., 54-55; EX1003, ¶247.

Ouster wrongly claims that there is no room within the cavity of Pardhan's heat sink to position the transformer coils on the outside of the stator-rotor elements. POR, 52. This is another improper bodily incorporation argument. It is also inaccurate because a POSITA would have used their engineering judgment to design a heat sink that meets any spacing requirements. EX1050, ¶¶46-50. In fact, a POSITA would have understood that coils could be moved to the outside without expanding the size of the rotor platform. *Id.*

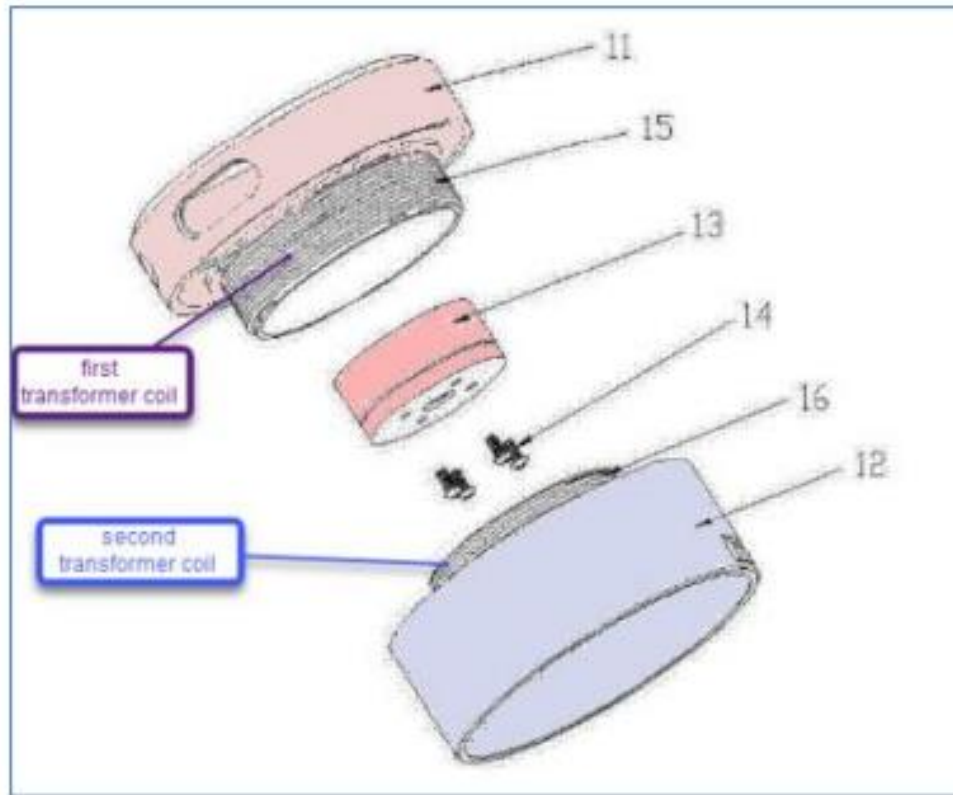
Ouster also claims that expanding the size of the transformer coils by placing them outside the rotor and stator elements would “run counter to Johnson's compact design.” POR, 50-51. But Johnson does not place any limits on the size of its rotor or stator circuit boards or the transformer coils that are integrated on them. In fact, Johnson states that its components may be implemented in “any suitable combination and location.” EX1005, 19:66-20:4. Moreover, Johnson's “compact”

design refers to its teaching that motor elements can be integrated onto circuit boards, not to the positioning of the coils. EX1003, ¶84.

The claims also do not include any restriction on the size of the device or the circuit boards within the device. Because positioning transformer coils on the outside of the rotor-stator elements was an obvious design choice with clear benefits (*e.g.*, greater power and transfer distance) claim 17 is unpatentable.

B. Cai renders obvious positioning the transformer coils outside the rotor and stator elements

Cai also renders obvious positioning the transformer coils outside of the rotor and stator elements. Pet., 63-64; EX1003, ¶¶272-275. Johnson states that its configuration in which transformer coils are inside of the rotor and stator elements is an “example” and that “other configurations are possible as well” (Pet. at, 66 (citing EX1005 at 8:4-15)), and Cai discloses an alternative configuration where transformer coils are positioned outside of the perimeter of the rotor-stator elements:



Pet. at 63-65. Ouster does not dispute that Cai’s transformer coils are positioned outside the rotor-stator elements and that this configuration increases power transmission. *See also* EX1051 at 78:8-22. But Ouster argues that there is no “room in the Johnson-Pardhan combination to move the transformer coils” to the outside. POR, 55. This bodily incorporation argument lacks merit. *See* Section IV.A.

Ouster argues that Cai cannot render claims 17 obvious because it does not disclose transformer coils “integrated directly onto the stator and rotor circuit boards.” POR, 56-57. Ouster’s argument is a strawman. Petitioner relied upon Johnson for its teaching that transformer coils may be integrated directly onto the circuit boards, and Cai only to show that the transformer coils may be positioned on

the outside of the stator-rotor elements. The combination renders claim 17 obvious. EX1050, ¶¶51-52.

V. DEPENDENT CLAIMS 13 AND 21 ARE UNPATENTABLE

A. Ouster’s argument that Droz does not render obvious a plurality of SPADs mischaracterize the prior art and misapplies the law

Ground 5 of the Petition showed that Pacala discloses that the pixels in its LiDAR device may comprise SPAD arrays, and that Droz further discloses that “each pixel in the plurality of pixels comprises a plurality of single photon avalanche diodes (SPADs),” as recited in claims 13 and 21. Pet., 79-81. Ouster make a passing assertion that Droz does not teach a plurality of SPADs. POR, 58. Ouster’s argument is contradicted by Droz’s disclosures. Pet., 79; EX1003, ¶¶313; EX1050, ¶55.

Ouster additionally argues that there is no motivation to combine Droz because its “waveguides are bulky structures” and its LiDAR is for “stationary applications.” POR, 57. Ouster does not identify any disclosure in Droz that requires a particular size, weight, or material, and the challenged claims certainly do not impose any such requirement. Nor does Ouster identify any disclosure in Droz that restricts its teachings to stationary applications. EX1050, ¶56. Optical structures, such as the waveguide in Droz, are designed to minimize optical crosstalk, which exists with respect to both stationary and rotating LiDAR. EX1050, ¶54. Further, in one embodiment, each waveguide has a length of 200 μm —*i.e.*, a

fraction of a millimeter. EX1011, 3:49-58. Ouster does not explain why a POSITA would be incapable of adding a component fractions of a millimeter in size to Pacala.

Ouster's criticism of Dr. Lebby for not computing the dimensions and weights of the combined system misapplies the law. See Ex2004, ¶¶211-214. Such computations are not required in an obviousness analysis and Ouster's bodily incorporation argument are irrelevant. What is relevant is that Ouster does not dispute the benefits of the combination. Pet., 80-81.

Finally, Ouster provides a conclusory assertion that a "a POSITA utilizing light detectors configured to achieve increased sensitivity [as in Droz] would not have been motivated to use Pardhan's thermal rotary link because overheating would not have been expected." POR, 58. But heat dissipation is a known issue for LiDAR devices. EX1050, ¶¶8-11. The amount of heat generated by LiDAR is also not directly related to the sensitivity of the detector, and may result from other aspects of the device (*e.g.*, the electronics and their packaging). *Id.*

VI. DEPENDENT CLAIMS 2, 5-9, 11-12, 14, 16, 19-20 ARE UNPATENTABLE

Each of these claims depends from independent Claims 1 or 14. Ouster does not raise any additional argument for these claims beyond those it presented for the independent claims. Thus, these claims are unpatentable for the same reasons.

VII. INDEPENDENT CLAIMS 22 IS UNPATENTABLE

Ouster raises the same arguments for Claim 22 that it did for Claims 1 and 14. POR, 59 (“Ground 6 fails for the same reasons described in Section V.B). Additionally, Claim 22 includes limitations that are similar to those found in claims 4, 13 and 17. *See* Limitation 22(d.i)-(d.ii), and 22(e.ii)-(e.iii). Ouster’s arguments for these limitations fail for the reasons discussed in connection with claims 1, 4, 13-14 and 17.

VIII. DEPENDENT CLAIMS 23-25 ARE UNPATENTABLE

Ouster does not raise additional arguments for these claims, which depend on Claim 22. These claims are unpatentable for the same reasons.

IX. DR. LEBBY DOES NOT LACK EXPERIENCE WITH LiDAR

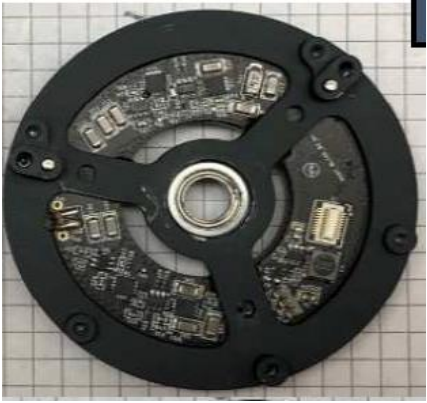
Ouster argues that Dr. Lebbby lacks “relevant experience with LiDAR systems” because he has not been involved in the design of a “completed LiDAR system.” POR, 12-13. But Dr. Lebbby has been qualified as an expert in multiple LiDAR cases. EX1003, ¶¶5, 41. In fact, Dr. Lebbby has inspected, analyzed, and generated simulation and modeling of prior art LiDAR devices from Waymo (the assignee of prior art in this proceeding), whereas Ouster’s expert has not. EX1050, ¶63; EX1051, 7:22-8:2. Dr. Lebbby also has LiDAR experience outside of litigation and has decades of experience working on component technologies that go into LiDAR, including rotor-stator structures. EX1003, ¶¶6, 41; EX1050, ¶¶63-64. Dr. Lebbby need not have designed a complete LiDAR system to be a POSITA. In any

event, Ouster’s definition of a POSITA states that “less work experience may be compensated by a higher level of education,” and Dr. Lebby’s level of education far exceeds the “undergraduate degree” that Ouster proposes. EX1003, ¶9.

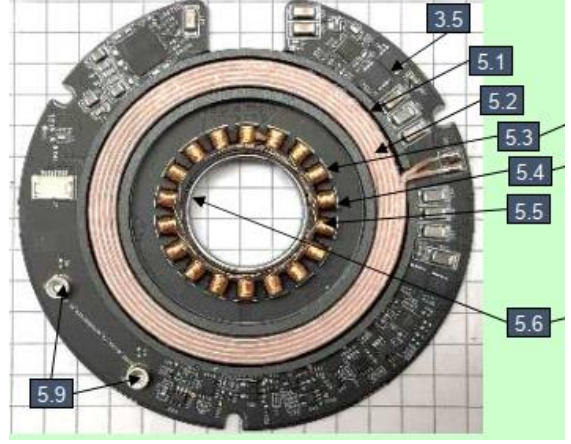
X. SECONDARY CONSIDERATIONS

A. “Petitioner’s Copying”

Ouster contends that “Petitioner’s copying” supports a finding of non-obviousness. POR, 73-77. There is no evidence that Petitioner was aware of the ’515 patent, and Ouster’s alleged commercial embodiment of the ’515 patent is different than Petitioner’s. *Compare* EX2024 (teardown of OS1-64) *with* EX2015 (Hesai Schematic); EX1050, ¶¶57-60. For example, the alleged “support component” is different, with Petitioner’s component being similar to prior art (*see* Section II.B):

Ouster OS1-64 (EX2024)	Hesai’s Pandar QT (EX2025)
	

As another example, the stator assembly and stator circuit boards are different:

Ouster OS1-64 (EX2024)	Hesai's Pandar QT (EX2025)
	

The differences between these devices are too many to detail here. The overlap that Ouster relies upon merely reflect the fact that the '515 patent combines known structures in a predictable manner (*e.g.*, both designs use stators, rotors, have an enclosure, *etc.*).

B. “Industry Praise”

Ouster’s allegation that there was “industry praise for the claimed invention of the '515 patent” also lacks merit. POR, 77-78. “Evidence of commercial success, or other secondary considerations, is only significant if there is a nexus.” *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1311–12 (Fed.Cir.2006). Here, Ouster has not established any nexus. For instance, Ouster claims that the '515 patent “opened the door to new uses for drones,” but this assertion is conclusory and not tethered to the alleged invention. EX2004, ¶¶263-265. Similarly, none of the other

publications Ouster relies upon establish the required nexus or mention the '515 patent. EX1050, ¶¶61-62 (discussing exhibits). Because Ouster has not established any nexus, its evidence of secondary considerations should be given no weight.

XI. CONCLUSION

Petitioner requests that the Board cancel the challenged claims.

Date: September 26, 2024

By: /s/ Jared Newton

Jared W. Newton

Registration No. 65,818

jarednewton@quinnemanuel.com

QUINN EMANUEL URQUHART &

SULLIVAN LLP

1300 I Street NW, 9th Floor

Washington, DC 20005

Tel: (202) 538-8000

Fax: (202) 538-8100

Counsel for Petitioner

CERTIFICATE OF LENGTH (37 C.F.R. §§ 42.24(D))

The undersigned hereby certifies that, according to the word-processing system used to prepare the foregoing document, this document has 5,550 words and thus complies with the applicable word limit.

Date: September 26, 2024

By: /s/ Jared W. Newton

Jared W. Newton

Registration No. 65,818

jarednewton@quinnemanuel.com

QUINN EMANUEL URQUHART &
SULLIVAN LLP

1300 I Street NW, 9th Floor

Washington, DC 20005

Tel: (202) 538-8000

Fax: (202) 538-8100

Counsel for Petitioner

CERTIFICATE OF SERVICE (37 C.F.R. §§ 42.6(E), 42.105(A))

The undersigned hereby certifies that on September 26, 2024 a copy of this reply and supporting exhibits were served upon the following lead and backup counsel for Patent Owner via electronic mail:

Megan Bussey Registration No. 63,789 mbussey@kilpatricktownsend.com Kilpatrick Townsend & Stockton LLP	Phillip Morton Registration No. 57,835 pmorton@cooley.com Cooley LLP
Nicoletta Kennedy Registration No. 68,161 nkennedy@kilpatricktownsend.com	Eamonn Gardner Registration No. 63,322 egardner@cooley.com COOLEY LLP
Matthew Meyer Registration No. 75,249 mmeyer@ktslaw.com	

Date: September 26, 2024

By: /s/ Jared W. Newton
Jared W. Newton
Registration No. 65,818
jarednewton@quinnemanuel.com
QUINN EMANUEL URQUHART &
SULLIVAN LLP
1300 I Street NW, 9th Floor
Washington, DC 20005
Tel: (202) 538-8000
Fax: (202) 538-8100

Counsel for Petitioner