



December 17, 2024

HESAI TECHNOLOGY CO., LTD., Petitioner
v.
OUSTER, INC., Patent Owner

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



Agenda

- Brief introduction of the '515 Patent
- Independent claims not obvious in view of Pacala-Johnson-Pardhan-Zhang
- Dependent claims are patentable
- Secondary considerations





The '515 Patent



LIDAR Development History



HDL-64E



VLS-128



Ouster OS1

Ex. 2004, ¶¶ 74, 112.

Ex. 2004, ¶¶ 75, 265.

POR, 1, 19, 77; Sur-reply, 9, 77



The '515 Patent



Janét

Ouster's '515 Patent further reduced the form factor to "smaller than that of a coffee mug."

Ex. 2004, ¶¶ 75, 265.

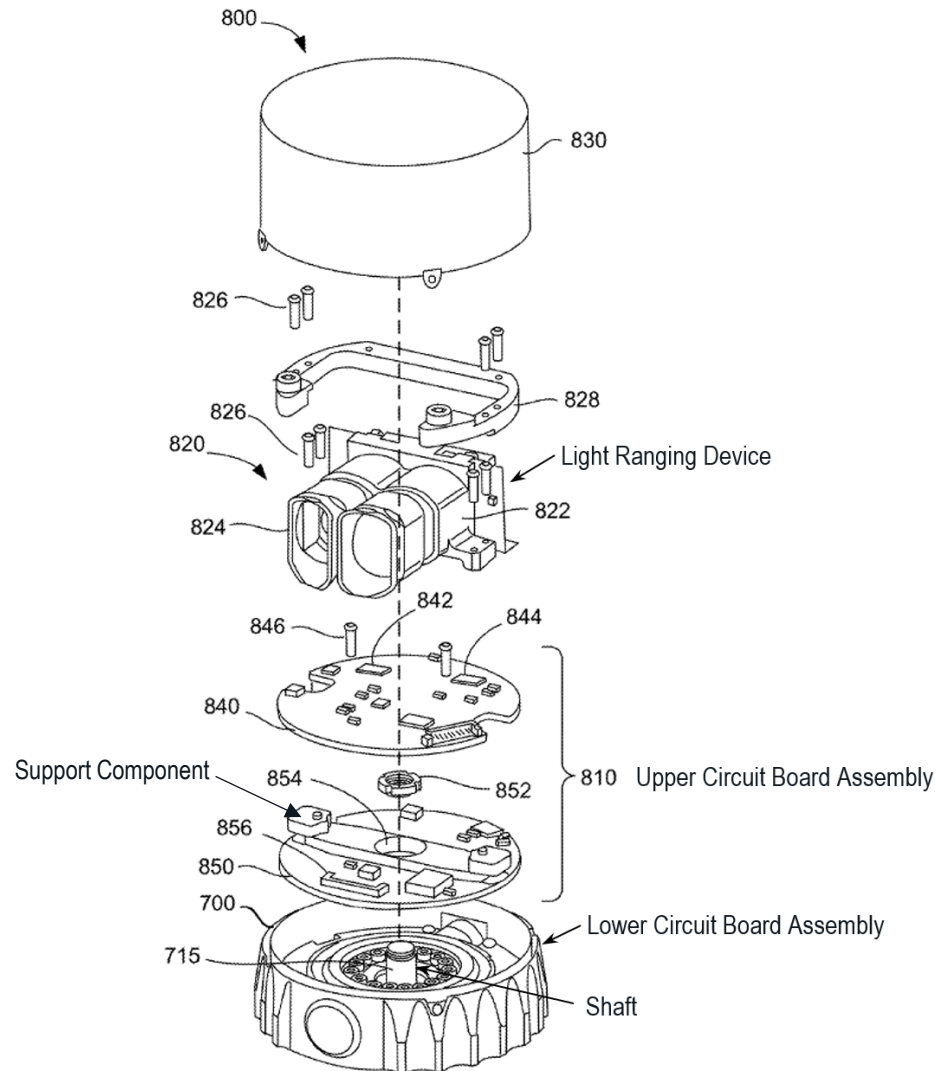


Janét

. . . Ouster's OS1 sensor, which embodies the claimed invention of the '515 Patent . . . has less than half the volume of [the predecessor products] . . .

Ex. 2004, ¶ 80.

The '515 Patent



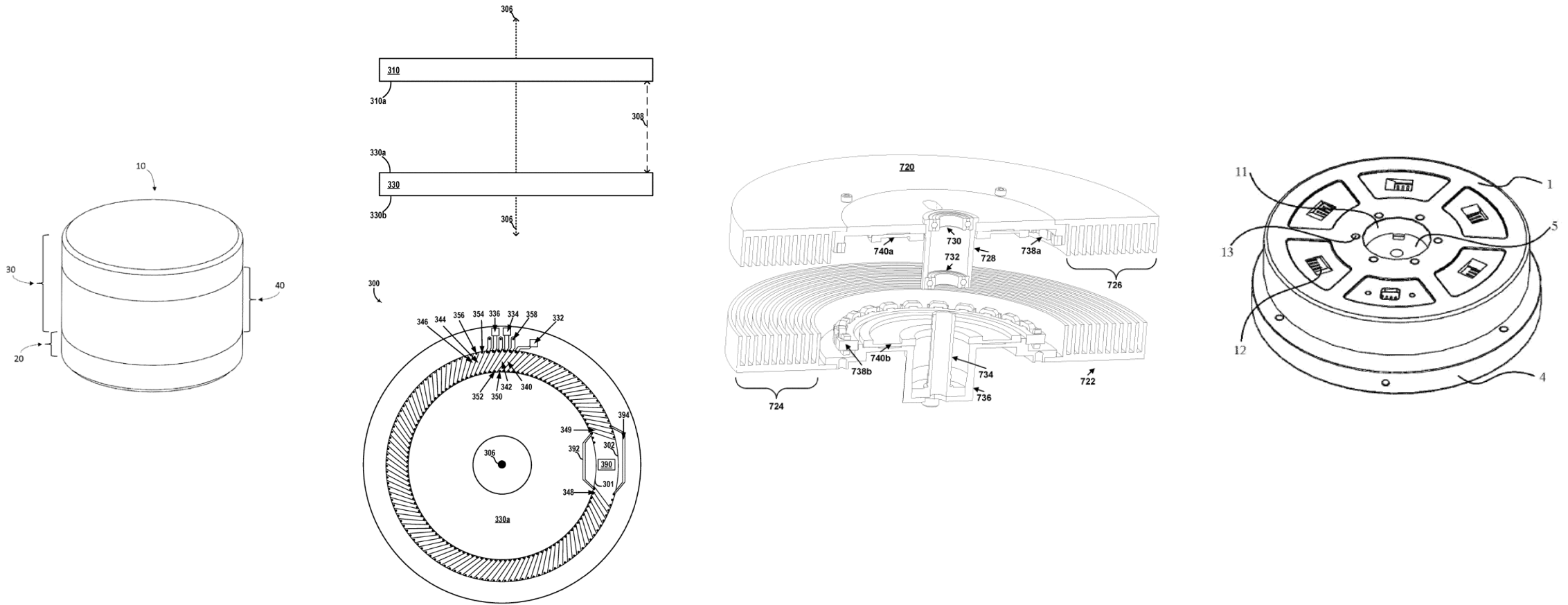
- 14(a) 14. A light ranging system comprising:
- 14(b) an enclosure having a base, a top cover and an optically transparent window disposed between the base and the top cover and extending fully around a periphery of the enclosure;
- 14(c) a shaft disposed within the enclosure and defining an axis of rotation;
- 14(d) a stator circuit board disposed within the enclosure along a first plane perpendicular to the axis of rotation and fixedly coupled to the base of the enclosure;
- 14(e) a support component comprising a sleeve fitted over the shaft and a plurality of arms extending away from the sleeve;
- 14(f) one or more bearings coupled between the shaft and the support component allowing the support component to rotate around the axis of rotation;
- 14(g) a rotor circuit board coupled to rotate with the support component and disposed within the enclosure along a second plane parallel to the first plane and between the first plane and the top cover;
- 14(h) a stator assembly coupled to the stator circuit board and comprising a plurality of stator elements arranged annularly about the axis of rotation, each of the plurality of stator elements including a coil;
- 14(i) a rotor assembly coupled to the rotor circuit board, the rotor assembly including an annular arrangement in which a plurality of magnetic poles surround the axis of rotation in an alternating pattern such that each magnetic pole has a polarity opposite a polarity of its adjacent magnetic poles; and
- 14(j) a light ranging device coupled to rotate with the rotor circuit board within the enclosure, the light ranging device comprising a transmit module comprising a bulk transmitting optic and an illumination source operable to transmit pulses of electromagnetic radiation through the bulk transmitting optic and through the window to objects in a surrounding environment, and an receive module comprising a bulk receiver optic and detector circuitry operable to detect reflected portions of the electromagnetic radiation pulses received through the window that are reflected from the objects in the surrounding environment; and
- 14(k) a stator driver circuit disposed within the enclosure and configured to provide a drive signal to the plurality of stator elements, thereby imparting an electromagnetic force on rotor assembly to drive a rotation of the rotor circuit board and the light ranging device about the shaft.

Three thin, red, curved lines originate from the left edge of the slide and sweep upwards and to the right, ending near the top right corner, framing the main text.

All Independent Claims Are Patentable



Ground 1: Pacala-Johnson-Pardhan-Zhang



Pacala's LIDAR

Ex. 1004, Fig. 1

+

Johnson's PCB Motor

Ex. 1005, Figs. 3A, 3C

+

Pardhan's Finned Rotating
Heat Sink

Ex. 1006, Fig. 7B

+

Zhang's Heat Dissipation
Structures

Ex. 1007, Fig. 1 POR, 14

Independent Claims are All Patentable

- Johnson does not disclose elements of claims 1 and 14:
 - “a stator assembly coupled to the stator circuit board”
 - “each of the plurality of stator elements including a coil wound around a magnetic core”
- No motivation to combine Pacala-Johnson-Pardhan-Zhang:
 - Pacala – Johnson – Pardhan
 - Pardhan modified with Zhang





Johnson Does Not Disclose Limitations 1(g) or 14(h)



Johnson Does Not Disclose Two Limitations for Which It Is Relied Upon by the Petition

- 1. Johnson does not disclose “a stator assembly coupled to the stator circuit board”**
2. Johnson does not disclose “each of the plurality of stator elements including a coil wound around a magnetic core”



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

- Plain meaning of “**coupled to**” requires the stator assembly be separate from, and not a sub-component of, the stator circuit board
- Consistent with Federal Circuit’s holding in *Cutsforth, Inc. v. Motivepower, Inc.*, No. 2015-1314, 2016 WL 1358628, at *3-4 (Fed. Cir. Apr. 6, 2016) (“It goes beyond the plain meaning of ‘coupled’ to say that a subcomponent . . . is ‘coupled to’ the component as a whole . . .”)
- Consistent with Federal Circuit’s holding in *Wi-LAN Inc. v. Sharp Electronics Corporation*, 992 F.3d 1366, 1378 (Fed. Cir. 2021)



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

- Hesai cites *Dicar, Inc. v. Stafford Corrugated Products, Inc.*, 2010 WL 988548, *8 (D.N.J. 2010).
- *Dicar* is inapposite
 - Written description expressly used “coupled” to describe joining subcomponents of the same structural element.
 - The ’515 Patent does not.



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

- Ouster’s construction aligns with the ***specification’s*** consistent use of the phrase “coupled to” to refer to components that are not subcomponents of each other, such as:
 - “a bearing system coupled to the hollow shaft” (Ex. 1001, 5:11-13)
 - “a second circuit board assembly rotationally coupled to the shaft” (*id.*, 4:57-59)
 - “a first circuit board assembly disposed within and coupled to the housing” (*id.*, 5:42-44),
 - “a light ranging device electrically connected to and coupled to rotate with the second circuit board assembly” (*id.*, 5:56-57)



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

- No alternative embodiment in the '515 Patent where the stator assembly is not “coupled to” the stator circuit board.
- Even if there were, “coupled to” must be given weight. *Comcast Cable Commc'ns,, LLC v. Promptu Sys. Corp.*, 838 Fed. Appx. 551, 533 (Fed. Cir. 2021).



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

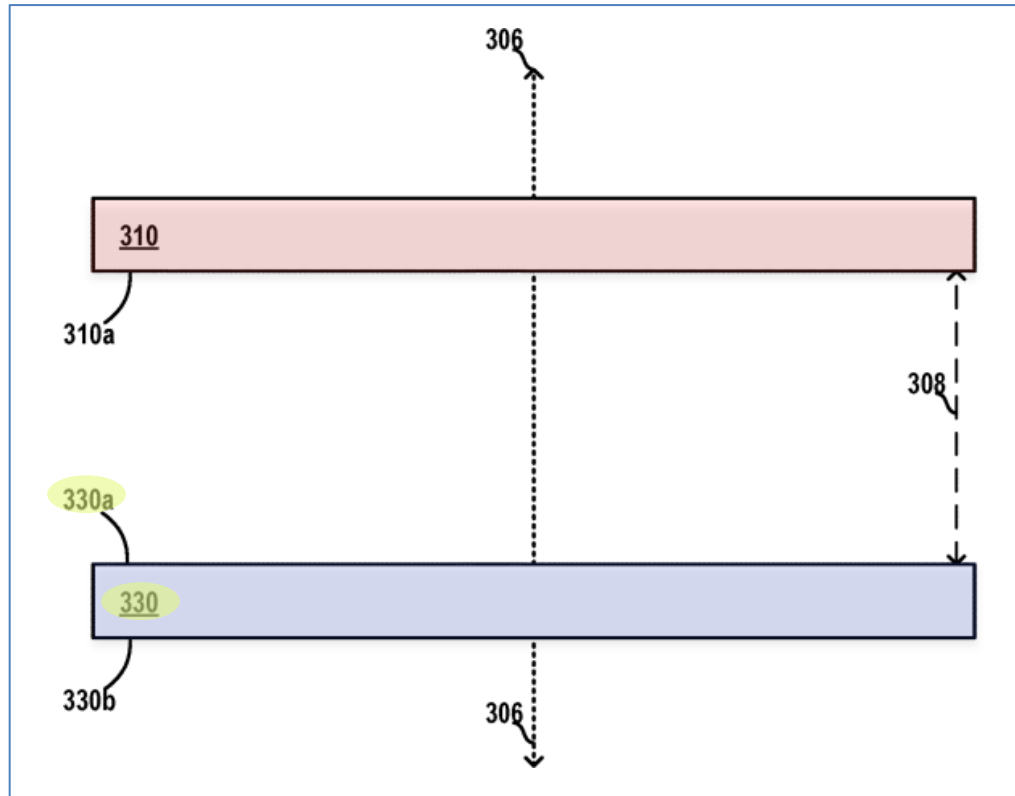
- The Federal Circuit decision in *Wi-LAN Inc. v. Sharp Electronics Corporation*, 992 F.3d 1366, 1378 (Fed. Cir. 2021) is on point:

Claim language	Claim Construction
"a multimedia processor, coupled to the data rate analyzer."	"a multimedia processor connected to the data rate analyzer, where the multimedia processor is separate from, and not a sub-component of , the data rate analyzer."

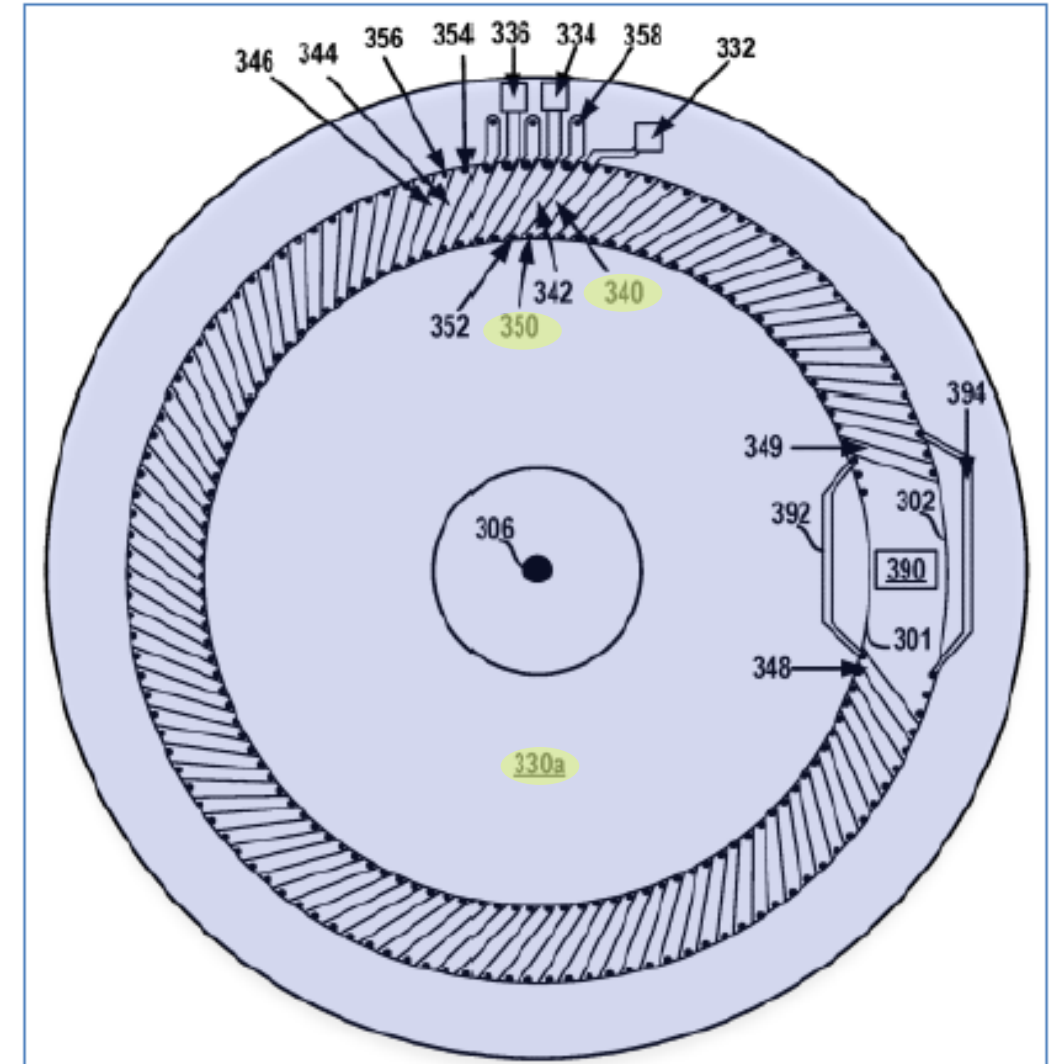
- Construction “based on the patent's consistent use of ‘coupled’ ‘to refer to components that are not sub-components of each other’”
- Construction did not “improperly extracted a limitation from the specification”



Petition's Reliance on Johnson's PCB Motor



Petition at 13



Petition at 32

Johnson's Coils Are, in Fact, "Patterned Along" Layers of the Printed Circuit Board

platform **330** (e.g., outer layer, etc.). In one implementation, platform **330** can be physically implemented as a multi-layer circuit board (e.g., PCB) or may comprise a multi-layer PCB embedded therein. To that end, 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 one or more components shown in FIG. 3D may correspond to electrically conductive material(s) patterned along a second layer of the PCB. Other implementations are possible as well.

Ex. 1005 (Johnson) at 12:8-17

Thus, for instance, structures **340, 342, 344, 346, 348, 349**, etc., can be **formed as patterned conductive tracks** along a single layer of a circuit board (e.g., PCB).

Ex. 1005 (Johnson) at 12:57-59



Johnson ***Does Not*** Teach “a Stator Assembly Coupled to the Stator Circuit Board” When Properly Construed

. . . Johnson’s multi-layer PCB implemented as platform 330 is a single component that includes the conductive material patterned into it . . .



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Ex. 2004, ¶ 139.



Johnson ***Excludes*** Electromagnetic Coils as Components that Can Be Mounted to a PCB

remaining within a given distance to platform **230**. As shown, platform **230** includes a controller **234**, a communication interface **236**, a power interface **238**, **an electromagnetic coil 240, circuitry 250**, and a magnetic field sensor **290**. To that end, platform **230** can be formed from any combination of solid materials suitable for supporting the various components mounted or otherwise coupled to platform **230**. In some examples, platform **230** may comprise a circuit board that **mounts** one or more components (e.g., **interfaces 236, 238, sensor 290**, etc.) of device **200**.

Ex. 1005 (Johnson) at 8:58-67



Johnson ***Does Not*** Teach “a Stator Assembly Coupled to the Stator Circuit Board”

Because Johnson discloses those other devices are “mounted to” the printed circuit board and does *not* describe any of the conductive structures forming the toroidal coil windings as being “mounted to” the printed circuit board, this further confirms Johnson’s coils form part of platform 330 (i.e., they are “components” of the printed circuit board) and are not “coupled to” it.



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Ex. 2004, ¶ 141.



Johnson ***Does Not*** Teach “a Stator Assembly Coupled to the Stator Circuit Board”

Unlike mounted components that can be removed from the printed circuit board . . . [the conductive structures] are subcomponents of the printed circuit board that cannot be removed without destroying the printed circuit board itself.



Janét

Ex. 2004, ¶ 141.



The Reply's Distinction Between the Stator Circuit Board's "Mounting Surface" and the "Stator Assembly" Is Unavailing

- The reply asserts "the stator assembly is distinct from the mounting surface of the circuit board and both are coupled" (i.e., two subcomponents of the stator circuit board are coupled)
- The claims require the "stator assembly" to be "coupled to," and thus distinct from, the "stator circuit board" not a "mounting surface."
- Petitioner's attempt to rewrite the claim must be rejected.



The Reply's Untimely Pivot To a New Embodiment

- Petitioner now cites an alternative embodiment of Johnson “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.” Reply, 14-15.
- Petitioner failed to explain:
 - Any motivation to combine this PCB-less design with the other references
 - How the PCB-less embodiment would meet the claim limitations



Johnson Does Not Disclose Two Limitations for Which It Is Relied Upon by the Petition

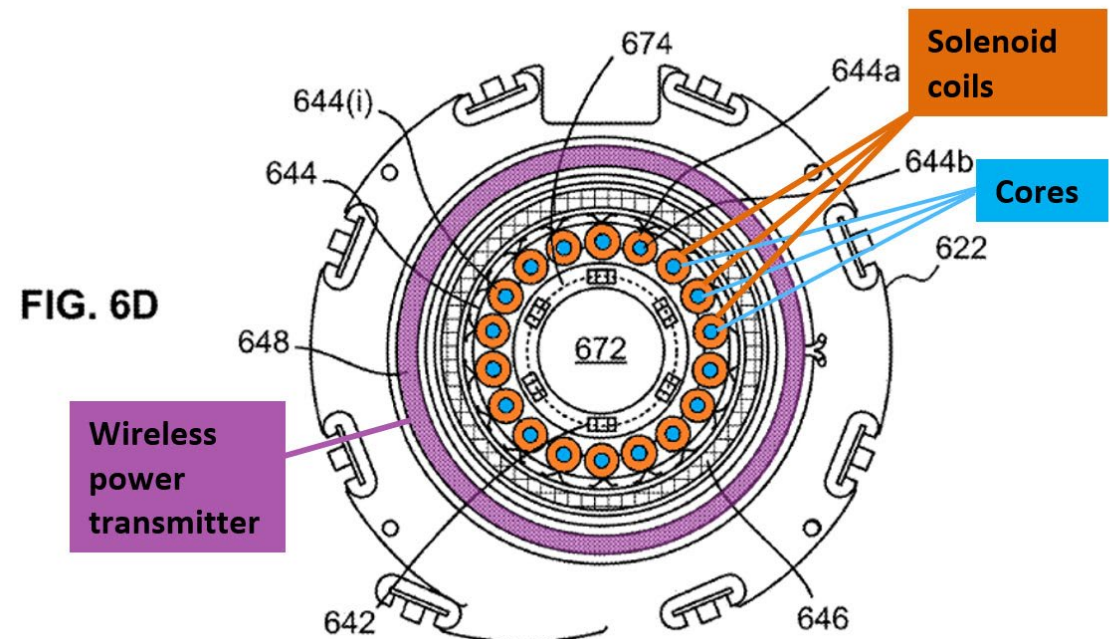
1. Johnson does not disclose “a stator assembly coupled to the stator circuit board”
- 2. Johnson does not disclose “each of the plurality of stator elements including a coil wound around a magnetic core”**



“each of the plurality of stator elements including a coil wound around a magnetic core” (1(g))

- Board should apply the ***plain meaning*** of the claim language.
- Hesai’s proposal to read out the requirement that each of the stator elements include a magnetic core, improperly broadens the claims and is at odds with the specification.

is not required for LIDAR system 600. For example, referring back to FIG. 6D, stator assembly 644 can include an annular arrangement of multiple stator elements 664(i), e.g., vertically oriented solenoids (having their longitudinal axes perpendicular to the surface of the board) that are affixed (e.g., using an adhesive) to a board of the lower circuit board assembly 620 (e.g., board 622) or to a soft magnetic core that is then affixed to the lower circuit board assembly 620. Examples of the stator elements are shown in the top view of FIG. 6D. Each stator element 644(i) can include a solenoid coil 644a wound around a core 644b of magnetic material, e.g., ferrite or the like. The coils are oriented such



'595 patent, 30:15-26.

POR, 10-12; Sur-reply, 4-5, 19



Johnson Discloses a Single, Ring-shaped Core, Which Does Not Teach Limitation 1(g)

However, in other examples, device **300** may include a magnetically permeable core (not shown) between the two layers of FIGS. 3C and 3D to direct or focus the generated strator-platform magnetic field. For instance, a middle layer (not shown) of platform **330** may include a conductive material (e.g., ring shaped copper trace, etc.) disposed between the conductive structures of FIGS. 3C and 3D. To that end, the conductive material in the middle layer may act as a magnetic core that enhances the strator-platform magnetic field therein.





No Motivation to Combine Pacala- Johnson-Pardhan- Zhang



Ground 1 Fails to Render Any Claim Unpatentable

- Johnson does not disclose “a stator assembly coupled to the stator circuit board”
- Johnson does not disclose “each of the plurality of stator elements including a coil wound around a magnetic core”
- **No motivation to combine Pacala and Johnson**
- No motivation to combine Pacala-Johnson and Pardhan
- No motivation to combine Pardhan and Pacala-Johnson
- No motivation to modify Pardhan with Zhang’s “arms”





No Motivation to Combine Pacala with Johnson



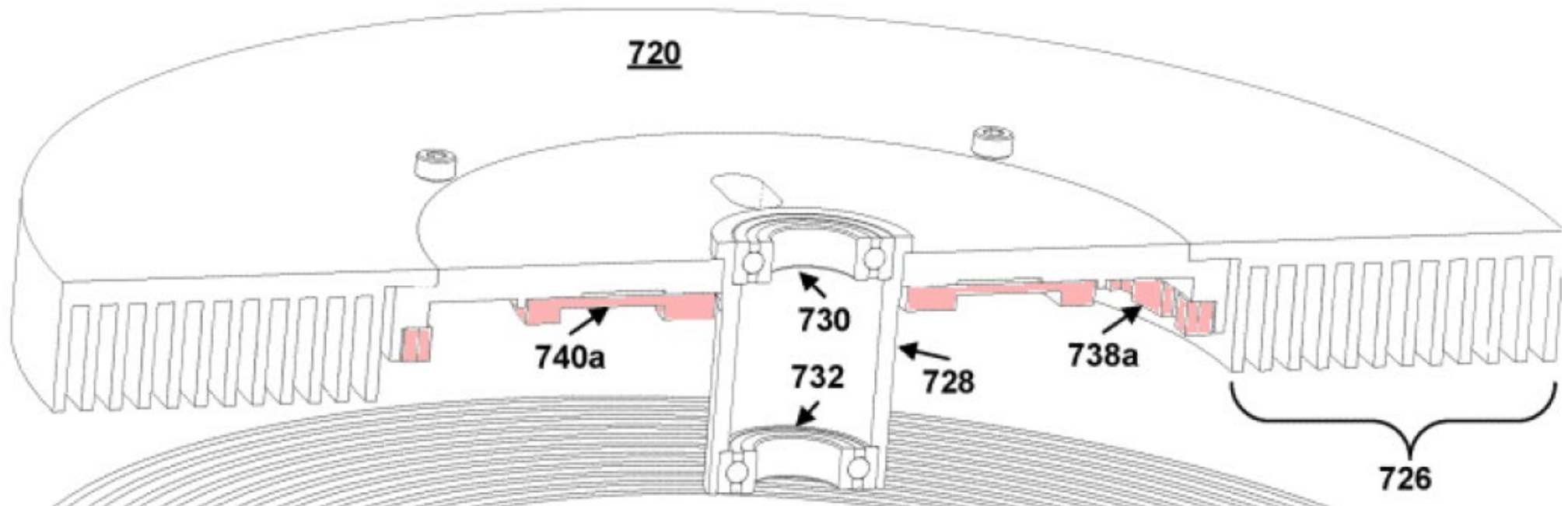
The Petition Provides No Valid Rationale for Combining Pacala With Johnson

- **The alleged motivation to combine Pacala with Johnson for *compactness* is negated by combination with Pardhan.**
- The Petition did not assert Johnson would improve the *operating life* of Pacala.
- Johnson, like Pardhan, does not provide the details for the rotating structure of Pacala.



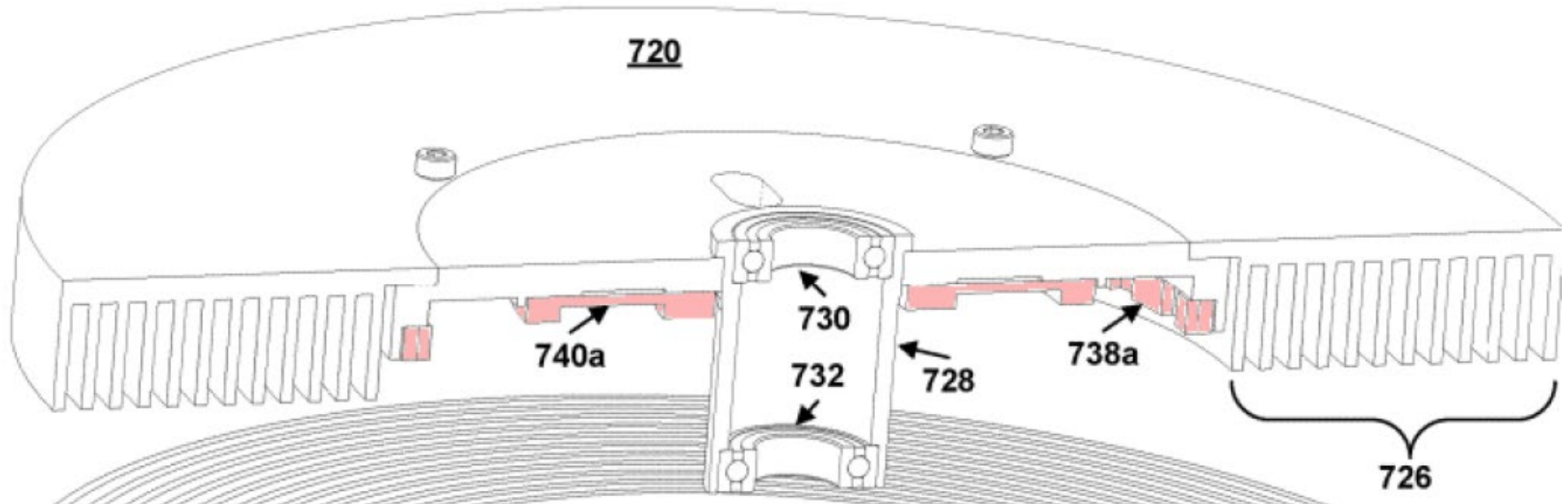
The Alleged Motivation to Combine Pacala With Johnson Is Negated by Combination With Pardhan

- Petitioner claims Johnson's PCB motor would improve Pacala by providing "a more compact design and/or efficient use of space." Ex. 1003, ¶152



The Alleged Motivation to Combine Pacala With Johnson Is Negated by Combination With Pardhan

- Placement of Johnson entirely within Pardhan's large, rotating heat sink offers no such improvement.



Johnson Does Not Provide the Details for Pacala's LIDAR

- The Petition and Dr. Lebby incorrectly assert that Johnson (a Waymo patent) teaches the “details” of Pacala (a Quanergy patent).
- As with Pardhan, the Petition misinterprets *Wavetronix LLC v. Smart Microwave Sensors GmbH*, 746 Fed. Appx. 984, 987, 991 (Fed. Cir. 2018) as permitting *any* prior art to provide “details” for a primary reference.
 - That is not *Wavetronix's* holding; *KSR* still applies.



The Petition Did Not Assert Johnson Would Improve the Operating Life of Pacala

- The Institution Decision acknowledged the contradiction in the proffered motivation to combine Pacala and Johnson based on compactness.
- However, the Institution Decision gave credit to a potential motivation to combine to “increase operating life of the rotating structure.”



The Petition Did Not Assert Johnson Would Improve the Operating Life of Pacala

- The Petition's only mention of an "increase" in "operating life" pertained to the use of Zhang's heat dissipation techniques.

thermal conductivity" to avoid overheating. EX1006, 18:6-19. Zhang's heat dissipation techniques are also complementary with and can be implemented in addition to those in Pardhan to further improve the thermal design of the combined device. EX1003, ¶252. Thus, a POSITA would have been **motivated to combine** the teachings of **Pardhan and Zhang into Johnson's** rotor-stator structure to improve heat dissipation and ventilation and **increase operating life**. *Id.*



The Petition Did Not Assert Johnson Would Improve the Operating Life of Pacala

- This is not only incorrect. It also does not provide a motivation to combine ***Pacala*** with ***Johnson***.

thermal conductivity” to avoid overheating. EX1006, 18:6-19. Zhang’s heat dissipation techniques are also complementary with and can be implemented in addition to those in Pardhan to further improve the thermal design of the combined device. EX1003, ¶252. Thus, a POSITA would have been **motivated to combine** the teachings of **Pardhan and Zhang into Johnson**’s rotor-stator structure to improve heat dissipation and ventilation and **increase operating life**. *Id.*



Ground 1 Fails To Render Any Claim Unpatentable

- Johnson does not disclose “a stator assembly coupled to the stator circuit board”
- Johnson does not disclose “each of the plurality of stator elements including a coil wound around a magnetic core”
- No motivation to combine Pacala and Johnson
- **No motivation to combine Pacala-Johnson and Pardhan**
- No motivation to combine Pardhan and Pacala-Johnson
- No motivation to modify Pardhan with Zhang’s “arms”





No Motivation to Combine Pacala- Johnson-Zhang With Pardhan



No Motivation to Include Pardhan's "Thermal Rotary Link"

- **Pardhan does not suggest use of its thermal rotary links with low-power devices like Pacala's LIDAR**
- Petition relies on Pardhan for a "support component," which includes its "rotor plate 720 (with fins)"
- Petition overlooked Pardhan's numerous drawbacks
- Pardhan does not provide the details for Pacala's LIDAR



Pardhan's "Threshold Power Level"

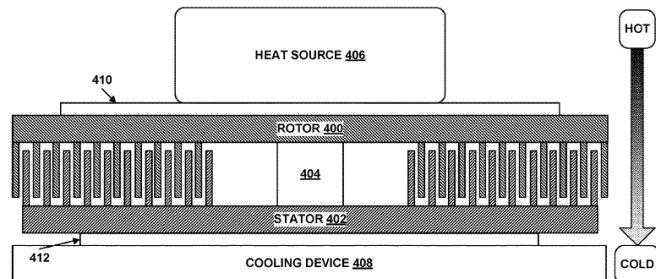


US010749308B2

(12) United States Patent Pardhan et al.	(10) Patent No.: US 10,749,308 B2 (45) Date of Patent: Aug. 18, 2020
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(54) THERMAL ROTARY LINK (71) Applicant: Waymo LLC, Mountain View, CA (US) (72) Inventors: Rahim Pardhan, San Francisco, CA (US); William McCann, San Francisco, CA (US); Drew Ulrich, San Francisco, CA (US); Pierre-yves Droz, Los Altos, CA (US) (73) Assignee: Waymo LLC, Mountain View, CA (US) (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 609 days. (21) Appl. No.: 15/295,573 (22) Filed: Oct. 17, 2016 (65) Prior Publication Data US 2018/0109061 A1 Apr. 19, 2018 (51) Int. Cl. H01S 3/04 (2006.01) H01S 3/067 (2006.01) (Continued) (52) U.S. Cl. CPC H01S 3/0405 (2013.01); G01S 7/4813 (2013.01); G01S 7/4817 (2013.01); G01S 17/931 (2020.01); H01S 3/067 (2013.01) (58) Field of Classification Search CPC H01S 3/0405; H01S 3/067; G01S 7/4813; F04D 17/127; F28F 5/04; F28F 13/12; F28D 11/00 (Continued)	(56) References Cited U.S. PATENT DOCUMENTS 3,253,300 A * 5/1966 Gove B01F 7/00758 165/64 3,844,341 A * 10/1974 Bimshas, Jr. F28D 11/02 165/86 (Continued) FOREIGN PATENT DOCUMENTS WO WO-2015027004 A1 * 2/2015 G06F 1/20 OTHER PUBLICATIONS International Searching Authority, International Search Report and the Written Opinion of the International Searching Authority dated Jul. 24, 2018, issued in connection with International Application No. PCT/US2017/056526, filed Oct. 13, 2017, 13 pages. (Continued) Primary Examiner — Tho V Duong Assistant Examiner — Rabesena R Malik (74) Attorney, Agent, or Firm — McDonnell Boehnen Hulbert & Berghoff LLP (57) ABSTRACT An example apparatus may include a first plate having a first side. A first plurality of fins may be integral with the first side of the first plate and protruding perpendicularly therefrom. The first plurality of fins may be arranged in first concentric circles separated radially by a first distance. The apparatus may also include a second plate having a first side. The second plate may be rotatably coupled to the first plate. A second plurality of fins may be integral with the first side of the second plate and protruding perpendicularly therefrom. The second plurality of fins may be arranged in second concentric circles separated radially by the first distance. Each fin of the second plurality of fins may interpose between adjacent fins of the first plurality of fins to transfer heat between the second plate and the first plate.
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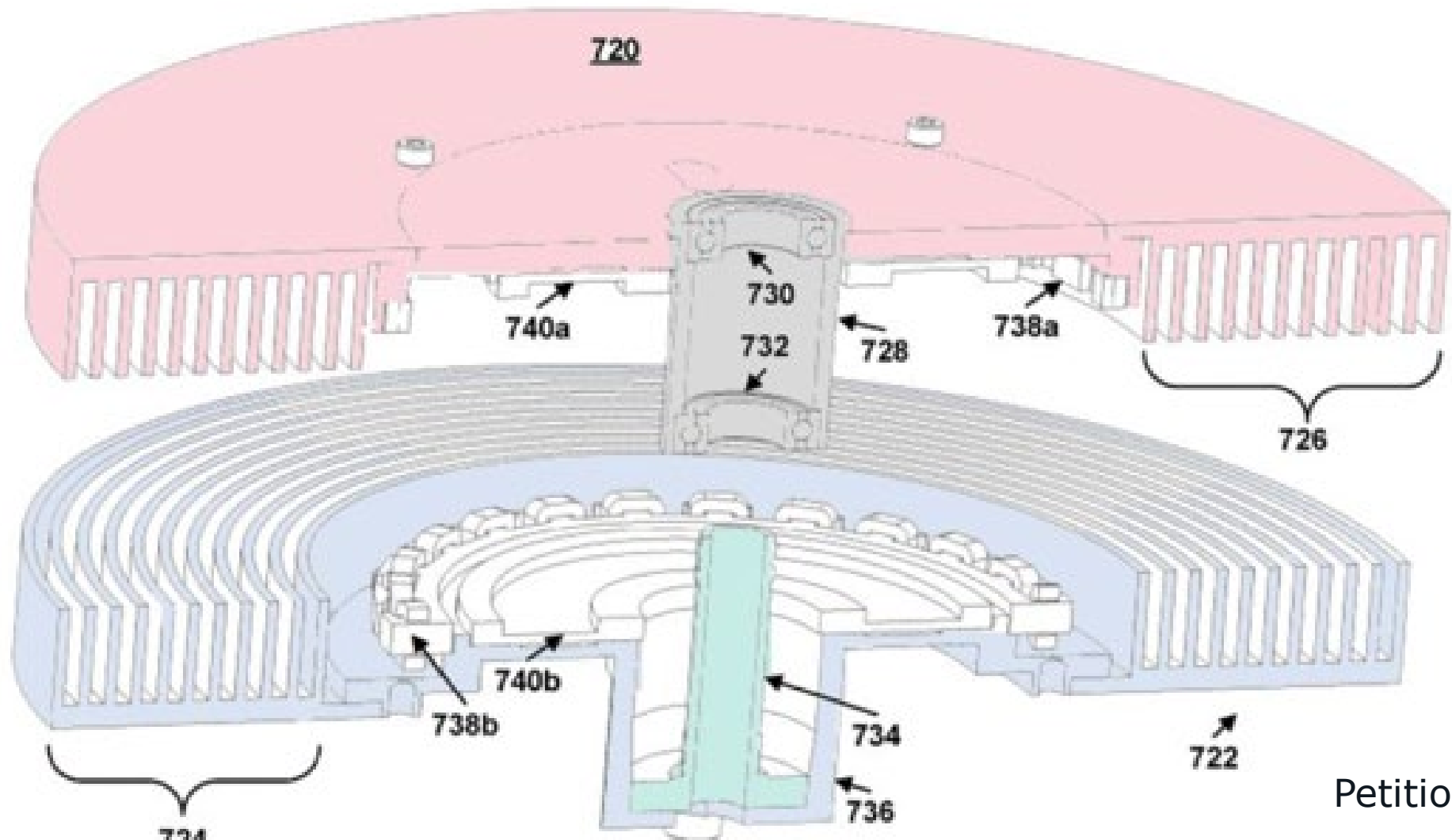
18 Claims, 16 Drawing Sheets



surrounding the LIDAR device. In order to acquire scans with a sufficient resolution or signal-to-noise ratio, the power with which the LIDAR device is operated might need to be above a threshold power level. However, **operating the LIDAR device above the threshold power level may generate excess heat that the LIDAR device might not be able to dissipate at a rate sufficient to maintain the LIDAR device within a safe operating temperature range.** The inability to

Pardhan (Ex. 1006), 4:59-64

Pardhan's Thermal Rotary Link



Petition at 15.



Pardhan's "Threshold Power Level"



US010749308B2

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

(10) **Patent No.:** US 10,749,308 B2
(45) **Date of Patent:** Aug. 18, 2020

(54) **THERMAL ROTARY LINK**

(71) Applicant: **Waymo LLC**, Mountain View, CA (US)

(72) Inventors: **Rahim Pardhan**, San Francisco, CA (US); **William McCann**, San Francisco, CA (US); **Drew Ulrich**, San Francisco, CA (US); **Pierre-yves Droz**, Los Altos, CA (US)

(73) Assignee: **Waymo LLC**, Mountain View, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 609 days.

(21) Appl. No.: 15/295,573

(22) Filed: Oct. 17, 2016

(65) **Prior Publication Data**
US 2018/0109061 A1 Apr. 19, 2018

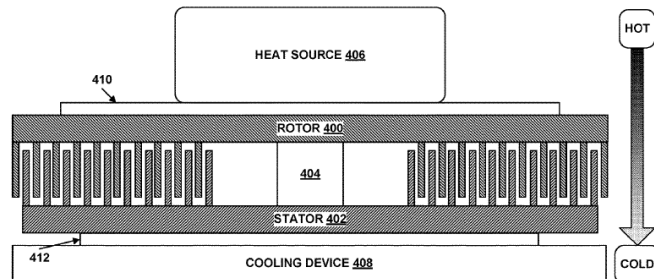
(51) **Int. Cl.**
H01S 3/04 (2006.01)
H01S 3/067 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **H01S 3/0405** (2013.01); **G01S 7/4813** (2013.01); **G01S 7/4817** (2013.01); **G01S 17/931** (2020.01); **H01S 3/067** (2013.01)

(58) **Field of Classification Search**
CPC H01S 3/0405; H01S 3/067; G01S 7/4813; F04D 17/127; F28F 5/04; F28F 13/12; F28D 11/00
(Continued)

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3,844,341 A * 10/1974 Bimshas, Jr. F28D 11/02 165/86
(Continued)
FOREIGN PATENT DOCUMENTS
WO WO-2015027004 A1 * 2/2015 G06F 1/20
OTHER PUBLICATIONS
International Searching Authority, International Search Report and the Written Opinion of the International Searching Authority dated Jul. 24, 2018, issued in connection with International Application No. PCT/US2017/056526, filed Oct. 13, 2017, 13 pages.
(Continued)
Primary Examiner — Tho V Duong
Assistant Examiner — Rabecna R Malik
(74) Attorney, Agent, or Firm — McDonnell Boehnen Hulbert & Berghoff LLP
(57) **ABSTRACT**
An example apparatus may include a first plate having a first side. A first plurality of fins may be integral with the first side of the first plate and protruding perpendicularly therefrom. The first plurality of fins may be arranged in first concentric circles separated radially by a first distance. The apparatus may also include a second plate having a first side. The second plate may be rotatably coupled to the first plate. A second plurality of fins may be integral with the first side of the second plate and protruding perpendicularly therefrom. The second plurality of fins may be arranged in second concentric circles separated radially by the first distance. Each fin of the second plurality of fins may interpose between adjacent fins of the first plurality of fins to transfer heat between the second plate and the first plate.

18 Claims, 16 Drawing Sheets



surrounding the LIDAR device. In order to acquire scans with a sufficient resolution or signal-to-noise ratio, the power with which the LIDAR device is operated might need to be above a threshold power level. However, operating the LIDAR device above the threshold power level may generate excess heat that the LIDAR device might not be able to dissipate at a rate sufficient to maintain the LIDAR device within a safe operating temperature range.

Pardhan (Ex. 1006), 4:59-64

POR, 18-21; Sur-reply, 8

Pardhan's Use of Large, High-powered LIDAR

Pardhan ... teaches an optical lens . . . with “dimensions of approximately 10 cm x 5 cm as well as a focal length of approximately 35 cm” as well as an additional optical lens for its second receiver 112. . . Pardhan's first lens alone was too large to fit in the prior art Velodyne VLP-16 . . .

Ex. 2004, ¶ 112.



Janét



Pardhan's Use of Large, High-powered LIDAR

[A] POSITA would have recognized Pardhan's LIDAR device as being similar to the then-antiquated, bucket-sized Velodyne HDL-64 design from many years prior, which had large power requirements. Compare Ex. 2028 at 2 (showing the older, larger HDL-64 required **64W**) to Ex. 2029 at 31 (showing the newer, more compact VLP-16 required **only 8W**).

Ex. 2004, ¶ 112.



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Pacala's Low-power LIDAR Did Not Need Pardhan's Thermal Rotary Link

Pacala teaches operating within the threshold power level, not above it. . . Unlike Pardhan, Pacala teaches a LIDAR system employing a multi-channel TDC (time-to-digital converter) with individually adjustable voltage thresholds, allowing for the detection of weak return signals just above the noise level without necessitating an increase in transmit power. . . A POSITA would recognize that use of Pacala's sensitive multichannel TDC receiver would avoid the need to operate the LIDAR device at the high power levels described in Pardhan in the first place.



Janét

Ex. 2004, ¶ 114 (citing Ex. 1004 at [0014]).



There Is No Motivation to Combine Pacala's LIDAR With Pardhan's "Thermal Rotary Link"

- Pardhan does not suggest use of its thermal rotary links with low-power devices like Pacala's LIDAR
- **Petition relies on Pardhan for a "support component," which includes its "rotor plate 720 (with fins)"**
- Petition overlooked Pardhan's numerous drawbacks
- Pardhan does not provide the details for Pacala's LIDAR



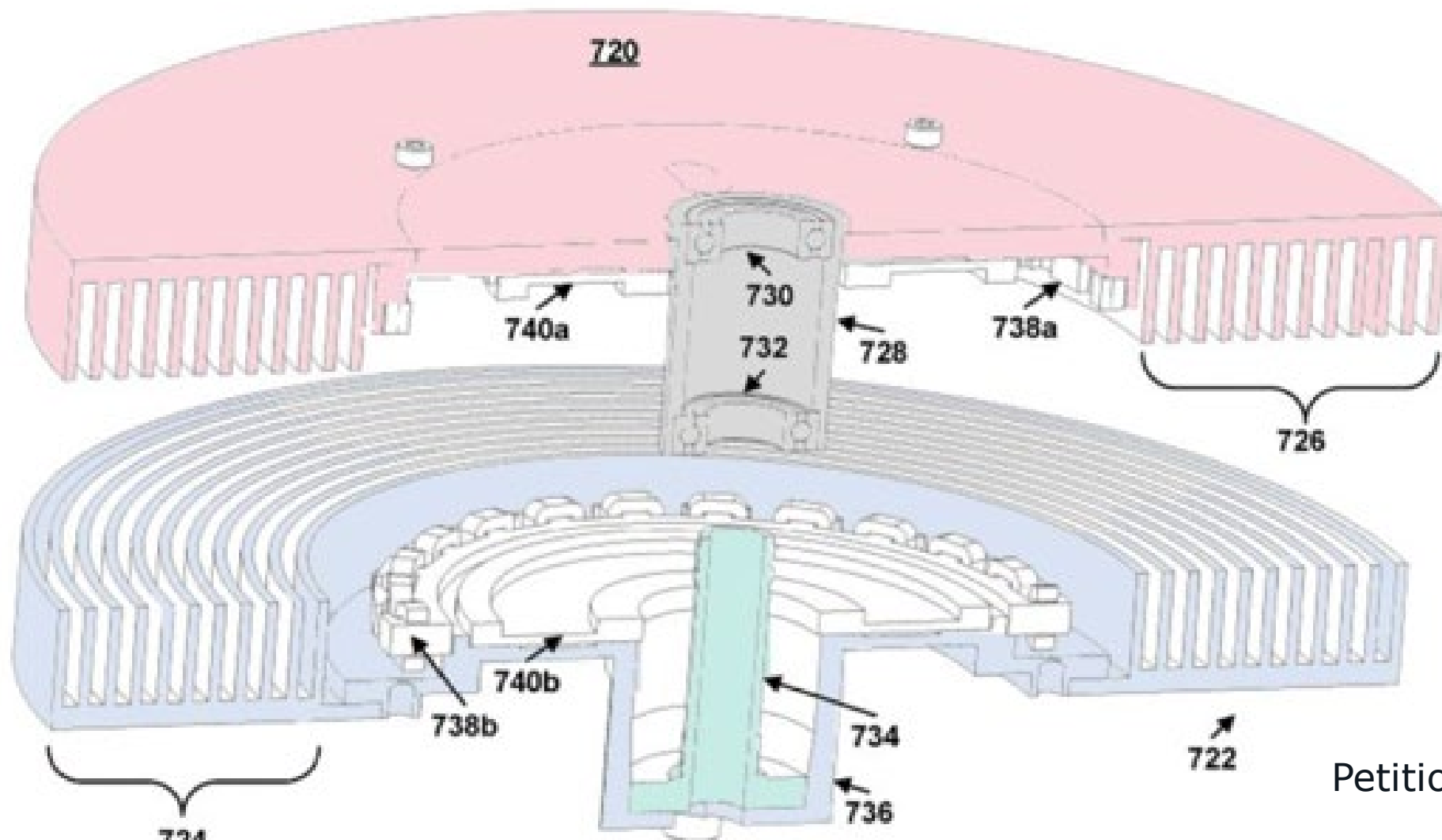
The Petition Adds Pardhan’s “Support Component” to Pacala’s LIDAR

implemented via a support structure on Johnson’s rotor. Indeed, Pardhan, like Johnson, teaches a rotor-stator structure, but further adds a support component which includes a rotor plate 720 (with fins) made from a “metallic material with high thermal conductivity” to avoid overheating. EX1006, 18:6-19. Zhang’s heat

Petition at 53.

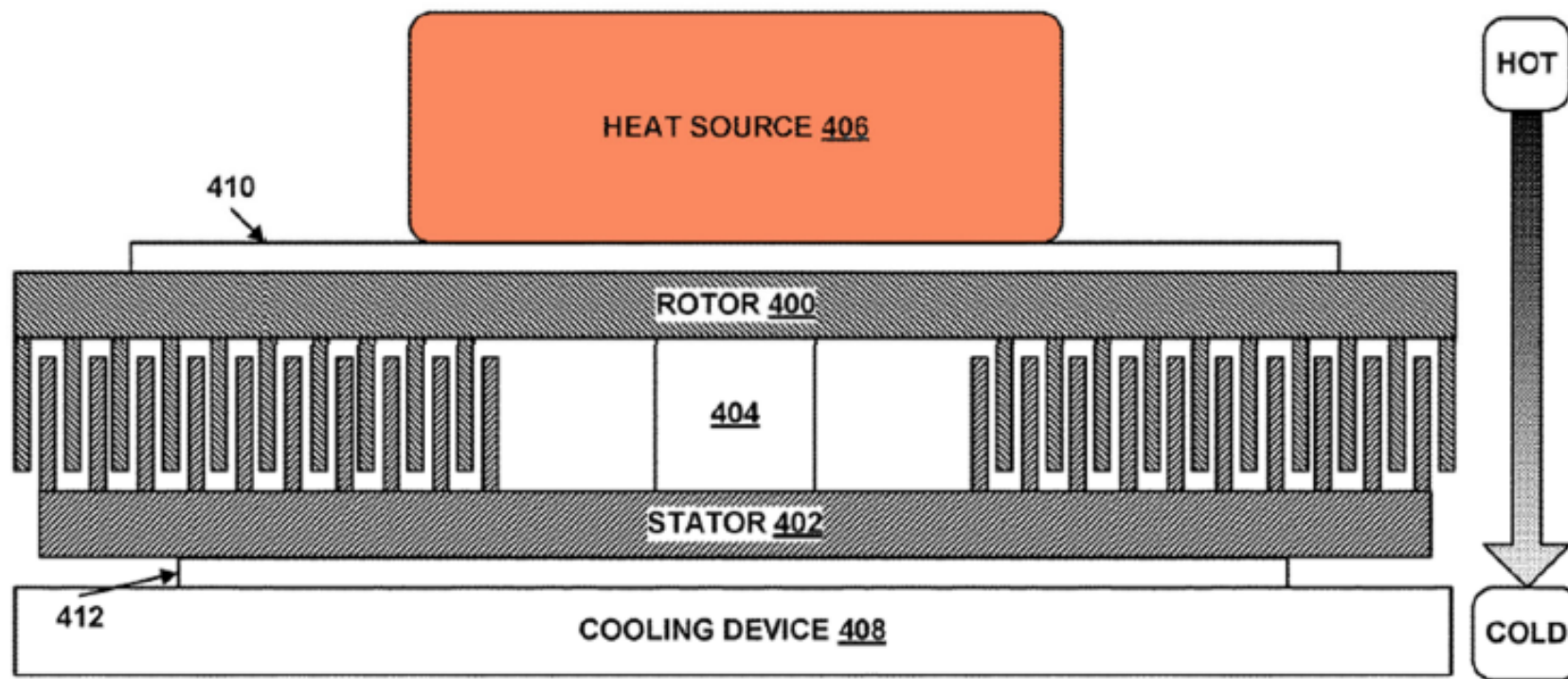


Pardhan's "Support Component" Per Petition



Petition at 15.

Pardhan's Heat Transfer Scheme



Pardhan (Ex. 1006), Fig. 4.

There Is No Motivation to Combine Pacala's LIDAR With Pardhan's "Thermal Rotary Link"

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- **Petition overlooked Pardhan's numerous drawbacks**
- Pardhan does not provide the details for Pacala's LIDAR



The Petition Overlooked Pardhan's Drawbacks

Dr. Janét identified numerous disadvantages and complications from the proposed combination:

- “minimal clearance between rotor fins and complementary stator fins for operation would increase mechanical complexity and potential failure points.” (Ex. 2004, ¶ 115)
- “motor inefficiencies as well as stability issues that raise the risk of catastrophic failure to the system” (Ex. 2004, ¶ 117)
- “increased stresses on the system due to centrifugal forces and would also make gyroscopic effects . . . more pronounced” (Ex. 2004, ¶ 117)
- “warping, and even risk potential collisions between the rotor and stator fins” (Ex. 2004, ¶ 117)
- “reduced performance, increased wear and tear, and a higher risk of catastrophic failure.” (Ex. 2004, ¶ 117)
- “the rotating heat sink would be a major additional complication . . . without any countervailing benefit.” (Ex. 2004, ¶ 116)



The POSITA Requires Some LIDAR Design Experience

LIDAR systems are electromechanical systems with both digital-to-analog and analog-to-digital conversions built into multiple points of a system where tracking the timings of the components is crucial. . . . [I]n my experience, it typically requires a person to have one year working with systems with rotating LIDAR devices to grasp all of the concepts involved with the rotating structure of the LIDAR. At that point, in my opinion, they would be a person of ordinary skill in the art.

Ex. 2004, ¶ 68



Janét



Dr. Lebby Lacks the Requisite LIDAR Design Experience

- Dr. Lebby has never before “worked on a completed LiDAR system.” Ex. 2005 at 36:19-37:10
- At his deposition, Dr. Lebby could not recall ever having “been involved in the design of those types of rotorstator 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.
- Due to his lack of expertise, Lebby was unaware of and/or disregarded the difficulties imposed by his proposals.



There Is No Motivation to Combine Pacala's LIDAR With Pardhan's "Thermal Rotary Link"

- Pardhan does not suggest use of its thermal rotary links with low-power devices like Pacala's LIDAR
- Petition relies on Pardhan for a "support component," which includes its "rotor plate 720 (with fins)"
- Petition overlooked Pardhan's numerous drawbacks
- **Pardhan does not provide the details for Pacala's LIDAR**



Pardhan Does Not Provide the Details For Pacala's LIDAR

- Petitioner and Dr. Lebby incorrectly assert that Pardhan (a Waymo patent) teaches the “details” of Pacala (a Quanergy patent).
- Petitioner misinterprets *Wavetronix LLC v. Smart Microwave Sensors GmbH*, 746 Fed. Appx. 984, 987, 991 (Fed. Cir. 2018) as permitting *any* prior art to provide “details” for a primary reference.
- Pacala and Pardhan are directed to fundamentally different LIDAR systems.





Hesai's Untimely Reply Arguments

surrounding the LIDAR device. In order to acquire scans with a sufficient resolution or signal-to-noise ratio, the power with which the LIDAR device is operated might need to be above a threshold power level. However, **operating the LIDAR device above the threshold power level may generate excess heat that the LIDAR device might not be able to dissipate at a rate sufficient to maintain the LIDAR device within a safe operating temperature range.** The 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. The example thermal rotary links herein described may be used to transfer excess heat away from the LIDAR device to **maintain the LIDAR device at stable operating temperatures even when the LIDAR device is operating above the threshold power level.** At the same time, the thermal rotary link may provide for rotation of the

Pardhan (Ex. 1006), 4:59-64

Sur-reply, 7-8

Dr. Lebby Relies on Quanergy's M8 Sensor to Assert Pacala Needs a Heat Sink

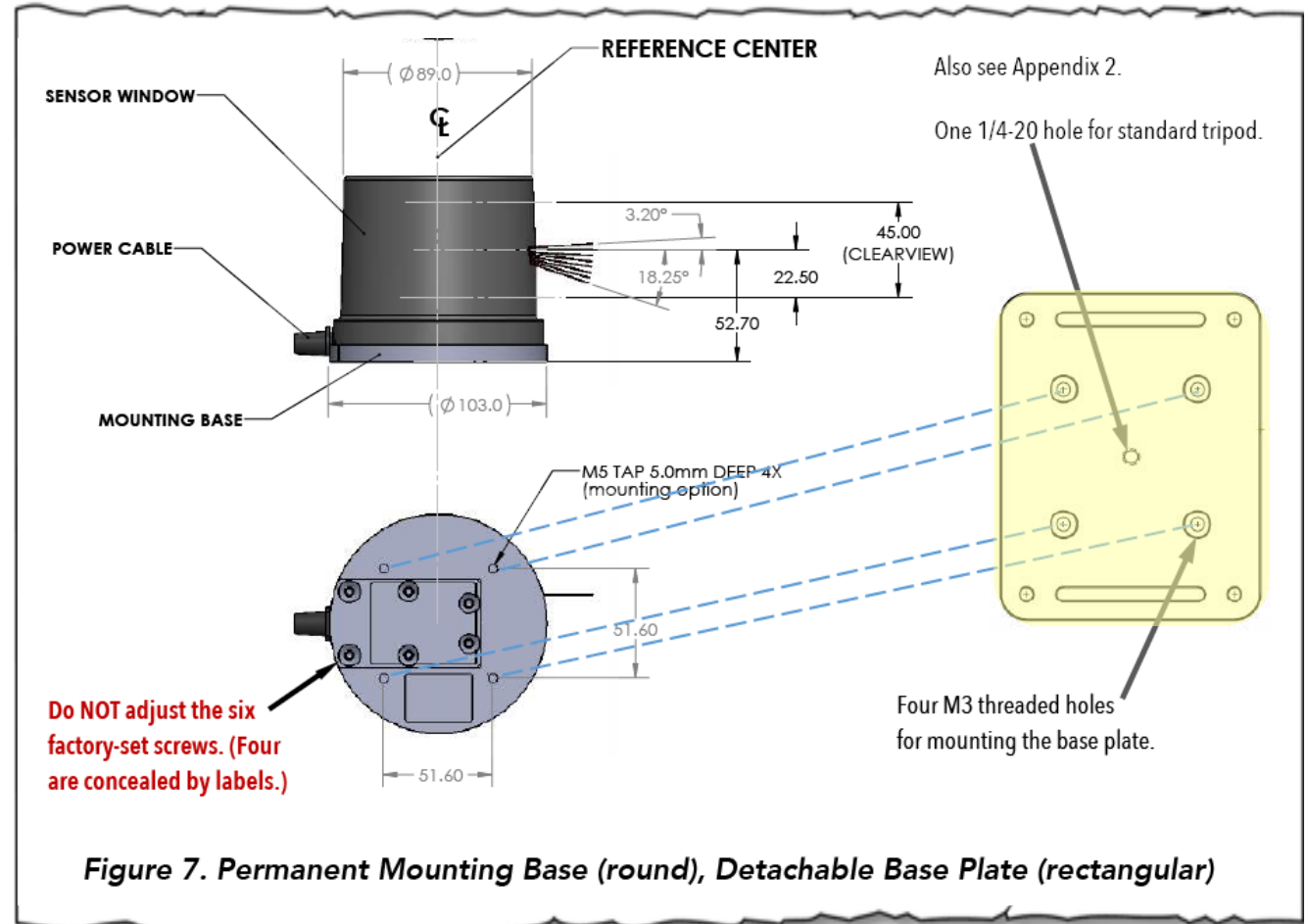


Lebby

The assignee of the Pacala patent, Quanenergy [sic], also used heat sinks with its LiDAR. EX1054, 22 ("The rectangular base plate provides a platform for the sensor and dissipates heat produced by the sensor's electronics and motor. It must remain attached unless exchanged for an equivalent heat sink.")

Pardhan's Risky Design Was **Not** Needed

- base plate provides a platform for the sensor and dissipates heat produced by the sensor's electronics and motor



Ex. 1054, 22

Sur-reply at 8



There Is No Motivation to Combine Pacala's LIDAR With Pardhan's "Thermal Rotary Link"



Affirming Board's finding of no motivation to combine the references "because of [the] significant problems it would create" to implement the combination as proposed.
Medtronic, Inc. v. Teleflex Innovations S.a.r.l., 70 F. 4th 1331, 1346-47 (Fed. Cir. 2023).



Affirming Board's finding that a POSITA would have "lacked motivation to combine the references and modify them" because of "the increased complexity" posed.
Provisur Technologies, Inc. v. Weber, Inc., 2022 WL 17688071, *5 (Fed. Cir. 2022).



"The benefits, *both lost and gained*, should be weighed against one another."
Henny Penny Corp. v. Frymaster LLC, 938 F. 3d 1324 (Fed. Cir. 2019).

Ground 1 Fails to Render Any Claim Unpatentable

- Johnson does not disclose “a stator assembly coupled to the stator circuit board”
- Johnson does not disclose “each of the plurality of stator elements including a coil wound around a magnetic core”
- No motivation to combine Pacala and Johnson
- No motivation to combine Pacala-Johnson and Pardhan
- **No motivation to combine Pardhan and Pacala-Johnson**
- No motivation to modify Pardhan with Zhang’s “arms”





No Reason to Replace Pardhan's Motor with Johnson's



There Is No Reason to Replace Pardhan's Motor With Johnson's

- Petition incorrectly asserts a singular "rotor-stator structure taught by Johnson-Pardhan" collectively.
- Dr. Lebby did not understand the fundamental differences between the Johnson and Pardhan references.
- Due to his errors, Dr. Lebby mistakenly believed combining the two would be a "simple substitution" and failed to address the drawbacks of the combination with the Petition.
- Hesai's untimely gap-filler in the Reply does not cure the Petition's deficiencies



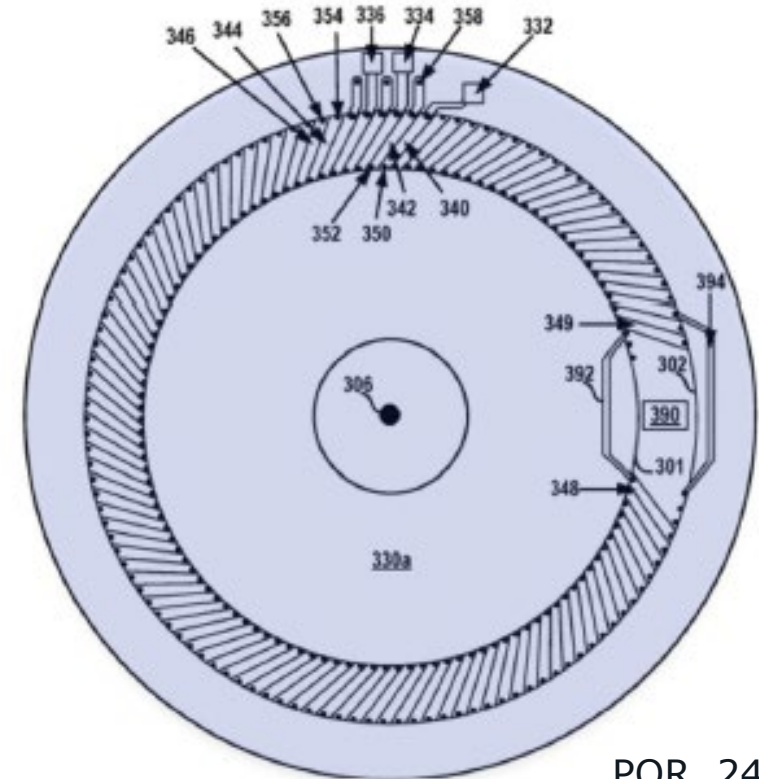
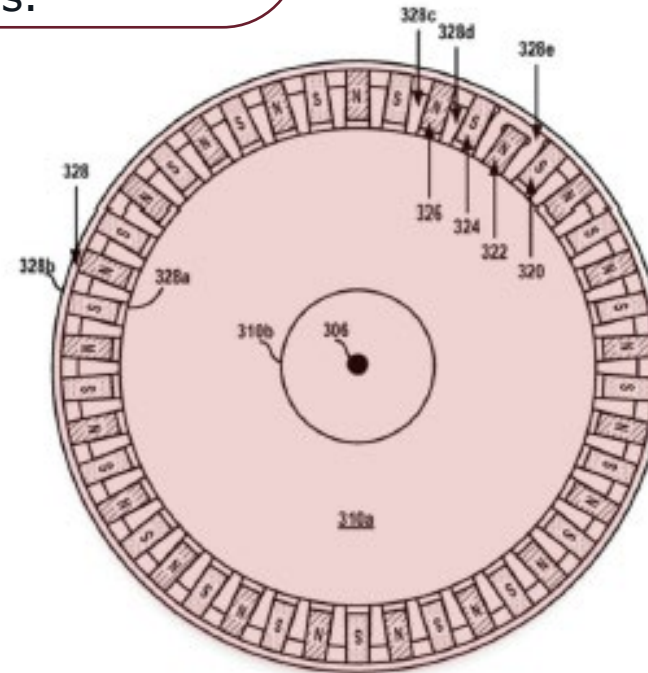
Johnson's Motor Is an Axial Flux Design

Johnson utilizes an axial-flux design where the rotor magnets are spaced axially above the toroidal coil windings of its PCB stator. As shown in Johnson's Fig. 3B and 3C below, Johnson's rotor PCB is positioned on top of its stator PCB so that the rotor magnets and stator coil windings are on opposing faces.

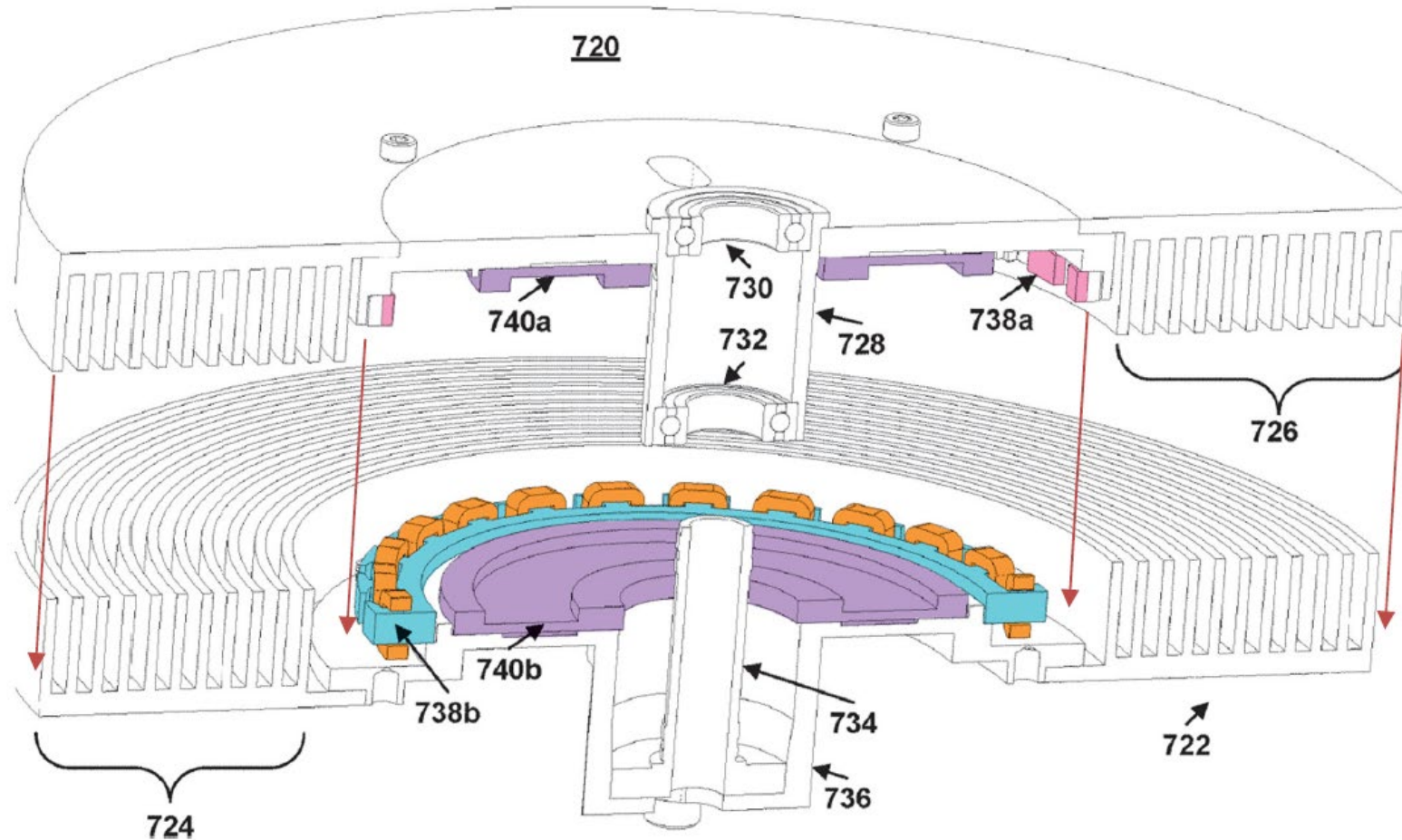


Janét

Ex. 2004, ¶ 129



Pardhan's Motor Is a Radial Flux Design



Ex. 2004, ¶ 128 (annotating Pardhan's Fig. 7B)

Pardhan's Motor Is a Radial Flux Design

Pardhan's design is a radial flux motor that—when assembled per the red arrows—positions the rotor magnets 738a (pink) laterally 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 rotating outwards from those motor windings

Ex. 2004, ¶ 128



Janét

Lebby Can't Differentiate Between Axial and Radial Flux Machines

Dr. Lebby, are you able to determine from this figure whether Pardhan's motor is axial flux or radial flux?

A. As you can see from my declaration, which is Exhibit 1003, on page 29, Paragraph 55, I show the simple differences between axial flux and radial flux machines in Paragraph 55. The axial flux motor is shown on the right.

And if we look at Figure 7B from Pardhan, it certainly resembles an axial flux motor.



Replacing Pardhan's Motor with Johnson's Motor Would Have Resulted in Significant Problems

- Dr. Janét identified numerous disadvantages and complications from the proposed combination:
 - significant waste heat due to eddy currents induced in the metal plates of Pardhan (Ex. 2004, ¶ 130)
 - difficulties in generating sufficient torque (Ex. 2004, ¶ 132)
 - mechanical complexity, gyroscopic forces, warping, increased cost, failure points, reduced performance, increased wear and tear (Ex. 2004, ¶¶ 117, 133)



Hesai's Untimely Reply Arguments

- The Petition failed to meet its burden to explain **how** the references could be combined and **how** they would operate.
- Hesai's reply vaguely asserts that shielding could be added to address the waste heat due to eddy currents and the automated design software of "today" **could** create a working device.
 - The untimely and unsupported assertions are further evidence of the Petition's failure to meet its burden of proof. These issues should have been addressed in the Petition.
 - *See Medtronic, Inc. v. Teleflex Innovations S.a.r.l.*, 70 F.4th 1331, 1346-47 (Fed. Cir. 2023).



Ground 1 Fails to Render Any Claim Unpatentable

- Johnson does not disclose “a stator assembly coupled to the stator circuit board”
- Johnson does not disclose “each of the plurality of stator elements including a coil wound around a magnetic core”
- No motivation to combine Pacala and Johnson
- No motivation to combine Pacala-Johnson and Pardhan
- No motivation to combine Pardhan and Pacala-Johnson
- **No motivation to modify Pardhan with Zhang’s “arms”**





No Reason to Modify Pardhan to Include Zhang's "Arms"



The Support Component

1(e)	a support component ... comprising a plurality of arms extending away from the sleeve
14(e)	a support component comprising ... a plurality of arms extending away from the sleeve
22(e.i)	a support component having ... a plurality of arms extending away from the sleeve ...



Petition Failed to Show it Was Obvious to Modify Pardhan to Include Zhang's "Arms"

- Zhang does not teach arms.
- Zhang's "arms" would not reduce vibration.
- Zhang's heat dissipation structures would be counter-productive to Pardhan's design.
- Dr. Lebby's contentions were hindsight-driven.



The Petition's Reliance on Zhang's "arms"

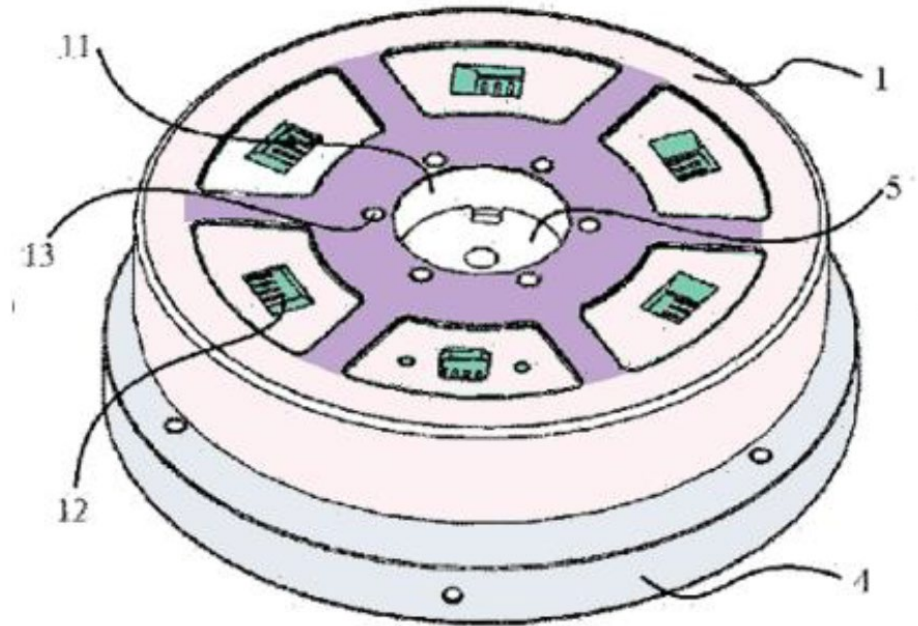
the end face of rotor.”). In view of Zhang, a POSITA would have combined Pardhan's support component that includes sleeve 728 and bearings 730/732 with Zhang's arms on the upper surface of the support component to prevent overheating.

Petition at 27



Petitioner's Misrepresentation

- Petitioner selectively colors Zhang's Fig. 1 to misrepresent heat dissipation structures (green) as creating "arms."



Petition at 16

Zhang's Disclosure

- Zhang does not mention or teach "arms."

Compared with the prior art, the technical advantages of the present utility model are as follows:

- 1) In the present utility model, the stator, rotor, and bearing parts of the rotary system are integrated into a shaft system, which prevents the interference of magnetic force between the rotor and the stator during installation, simplifies the installation step, and improves the accuracy of installation.
- 2) The present utility model installs the signal transmission structure and the electrical power transmission structure on the inner side of the shaft system integrated with stator, rotor, and bearing parts to prevent interference with the power transmission. When the radar is operated at high speed, it can ensure the smoothness of the rotating shaft while having high impact resistance.
- 3) The present utility model configures the rotor as an outer casing structure, which encases the stator and bearing and their internal signal transmission and electrical power transmission structures and increases the electromagnetic immunity of the rotating structure.



Zhang's Disclosure

[T]he Institution Decision found that “[f]rom Zhang’s Figure 1, the alleged arms appear thicker, and thus stronger, than the areas defining the heat dissipation structures.” Paper 13 at 36. I disagree with this assessment. A POSITA would not expect any alleged “arms” that purportedly emerge from viewing Zhang’s Fig. 1 to “strengthen attachment” or “minimize vibration” as the Petition contends.



Janét

Ex. 2004, ¶¶ 148-149



Zhang's Alleged "Arms" Would Weaken Pardhan's Rotor Plate

Zhang's alleged arms are formed through "thinning of the end face of [the] rotor" (Ex.1007, 9), so ... Pardhan's rotor plate would be thinner and thus weaker after the heat dissipation structures are added.

Ex. 2004, ¶ 151



Janét



Zhang's Alleged "Arms" Would Decrease Operating Life

A POSITA would expect that implementing the heat dissipation structures of Zhang onto Pardhan's rotor plate would add more stress and vibration to the system further decreasing the operating life.

Ex. 2004, ¶ 152



Janét

Dr. Lebby has not shown that a POSITA would have a reasonable expectation of success in implementing Zhang's heat dissipation structures on Pardhan's rotor plate.

Ex. 2004, ¶ 159

POR, 35, 37-39; Sur-reply, 17



Zhang's Heat Dissipation Scheme Counters Pardhan's

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. 2004, ¶ 154



Janét

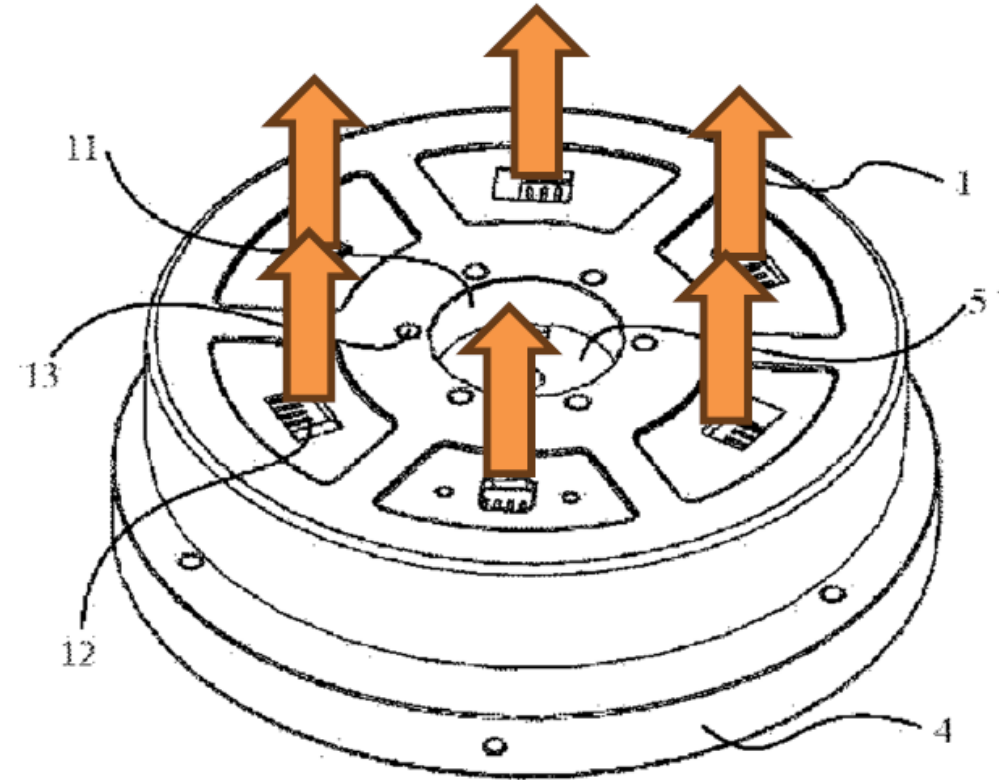


Fig. 1

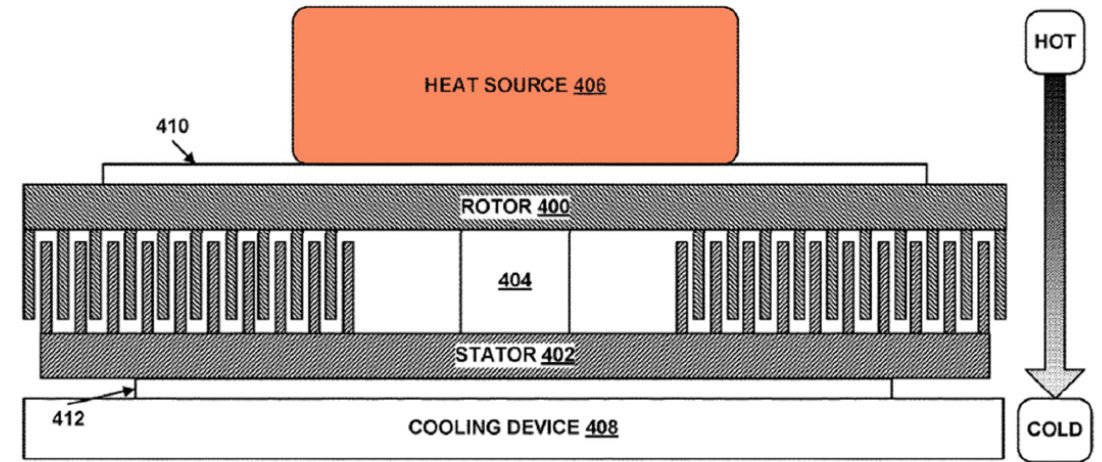
Zhang's Heat Dissipation Scheme Counters Pardhan's

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.

Ex. 2004, ¶ 155



Janét



Zhang's Heat Dissipation Scheme Counters Pardhan's

Even if Dr. Lebby 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 as indicated in Zhang, there would still be no reason to implement Zhang's heat dissipation structures on Pardhan's support component in the first place because it would be **counter-productive** to Pardhan's design.

Ex. 2004, ¶ 157



Janét



Hesai's Untimely Reply Arguments

- Hesai's reliance on Exhibits 1033 and 1042 as "prior art" for use in some new combination is untimely.
- The Petition failed to even ***allege*** that these exhibits were analogous art.



Exhibit 1031 Does Not Support Hesai's Claim That Arms Reduce Vibration

- The Petition's only evidentiary support for Dr. Lebby's claims that arms extending from a sleeve minimize vibration is Exhibit 1031.
 - The exhibit teaches "Prevention of Bearing Axial Movement."
 - None of the methodologies taught in Exhibit 1031 include arms extending away from a sleeve.





Dependent Claim 4 Is Patentable



The Petition Incorrectly Asserts Each Layer of a Multi-layer PCB Is a Separate “Circuit Board”

A POSITA would have considered each layer of a multi-layer PCB to be a separate circuit board; however, in the alternative, it would have been obvious to use multiple separate circuit boards instead of a single multi-layer PCB. *See* Section IX.E.4; EX1003, ¶332.

Petition at 86



Hesai's Reply Concedes Johnson Does Not Disclose Four Circuit Boards

- The Petition asserts the “bottom layer of the PCB (on the bottom side of [Johnson’s] stator platform) would be a ‘third circuit board.’” (Petition at 41.)
- The Institution Decision (at 43) rejected this assertion.
- Hesai’s Reply (at 15-19) now asserts only that Johnson renders obvious four circuit boards



Splitting Johnson's Stator PCB Also Fails

"A POSITA would not have had a reasonable expectation of success in distributing Johnson's stator PCB amongst multiple distinct circuit boards and would not have been motivated to attempt this modification."

Ex. 2004, ¶ 177



Janét



Dependent Claim 4 Is Patentable

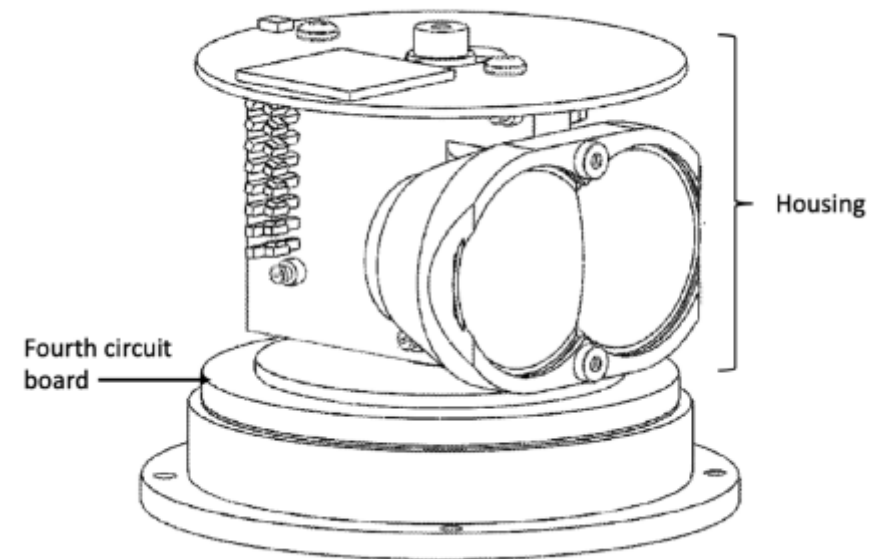
- Johnson does not render obvious four circuit boards
- Nubling, Hall, and Pardhan teach away
- Neither Cai nor Yan discloses four circuit boards or overcomes the conflict with Pardhan's heat dissipation scheme

*Independent Claim 22 also recites a configuration with four circuit boards



Nubling And Hall Teach Away

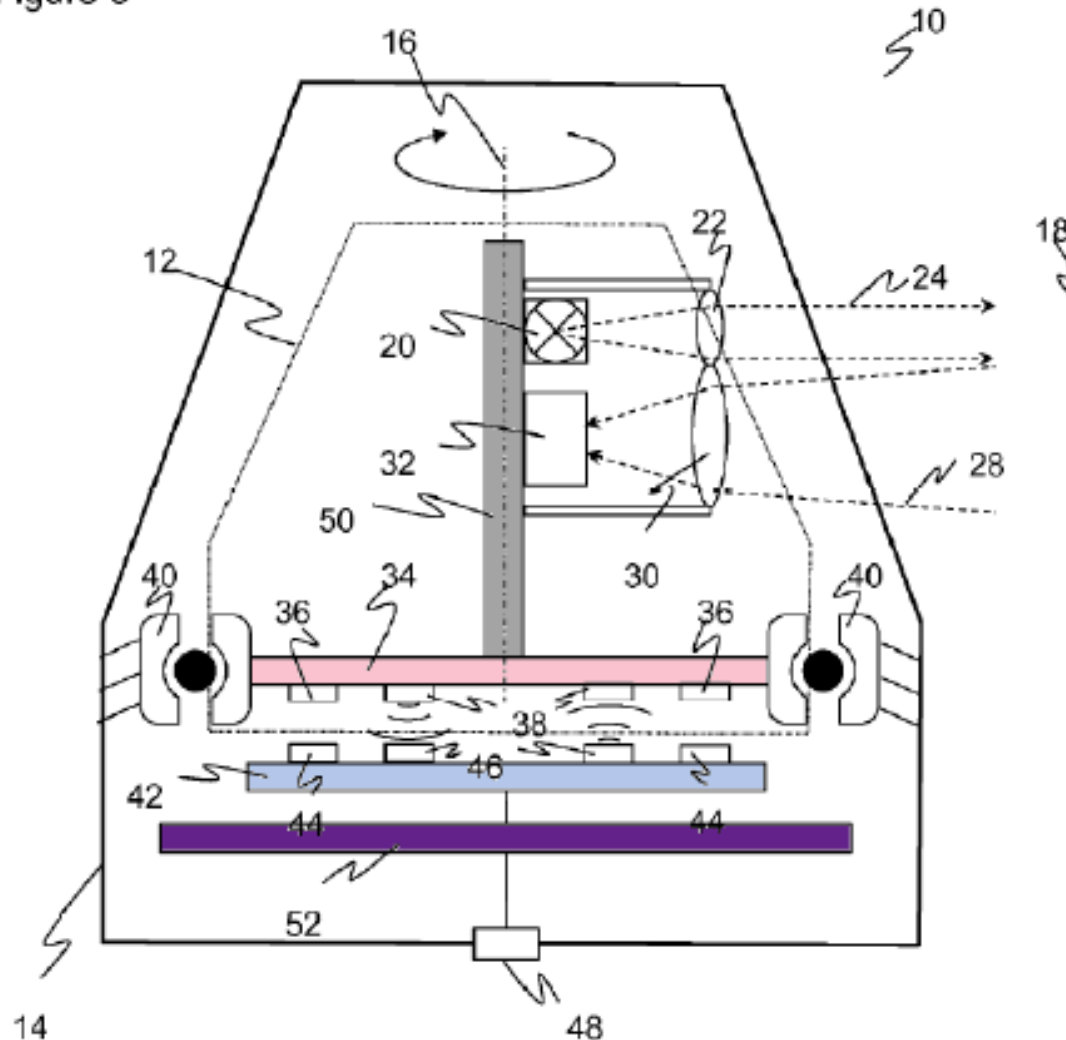
- Hesai's Reply relies on Nubling to assert Johnson renders obvious placing a fourth circuit board parallel to the stator circuit board.
- This placement is depicted in the Petition's annotated figure to the right.



Petition at 44.

Nubling And Hall Teach Away

Figure 3



Reply at 17 (citing Nubling, Fig. 3)

A POSITA would recognize this additional circuit board is arranged to provide mechanical support for Nubling's optics.

Ex. 2004, ¶ 177

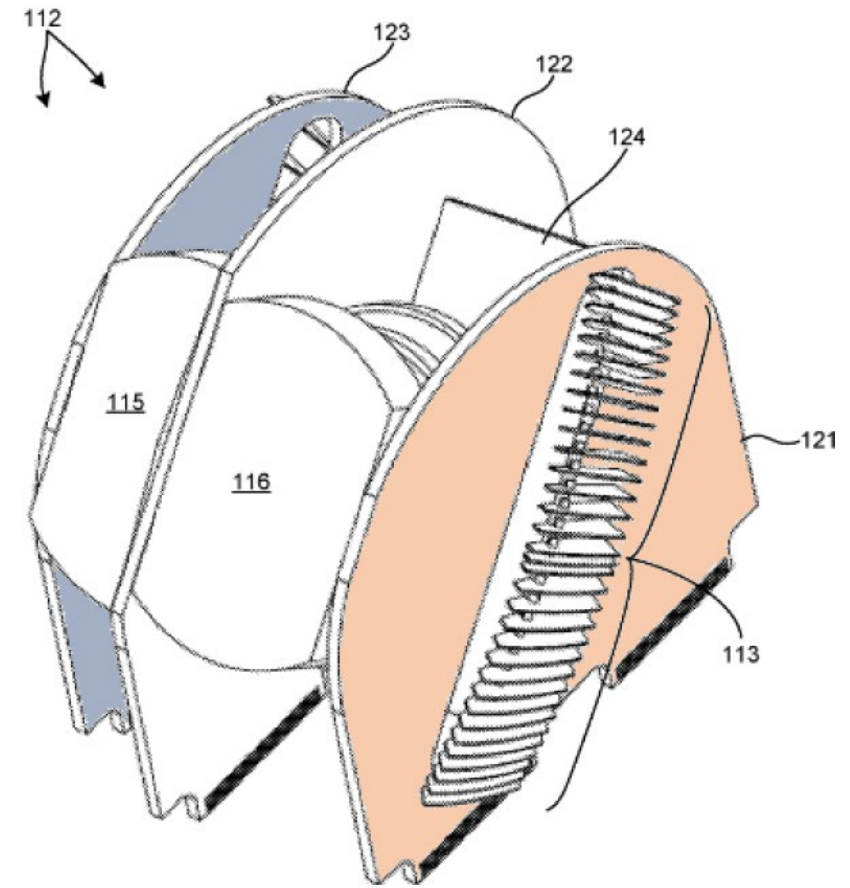


Janét

POR, 42; Sur-reply, 19

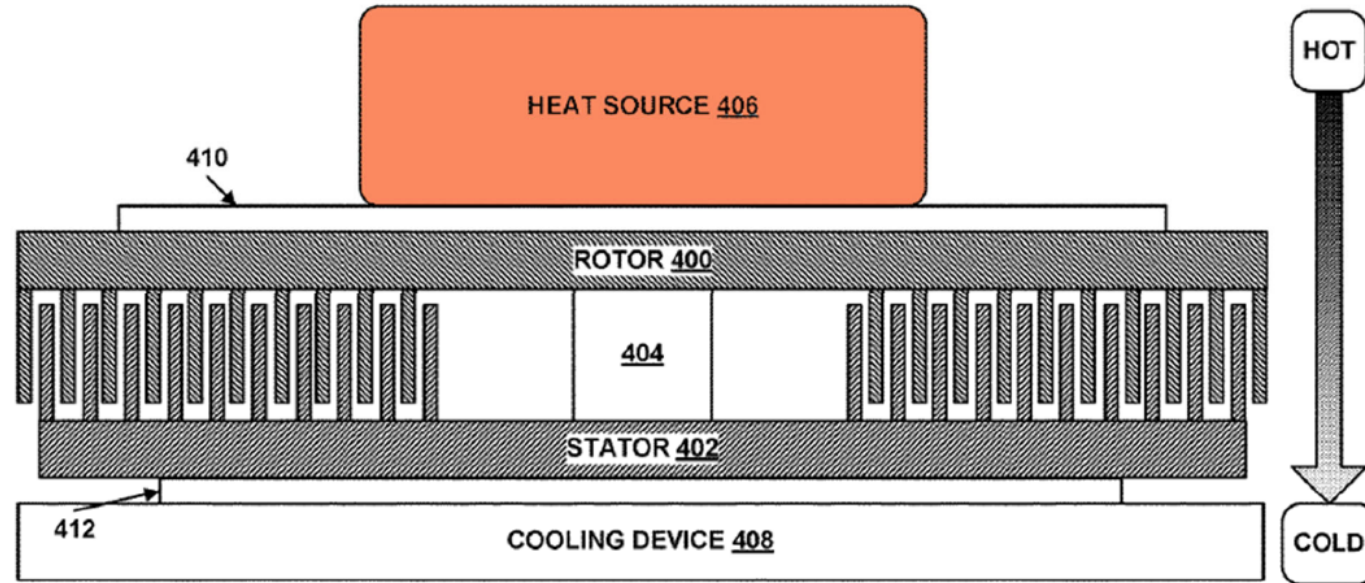
Nubling And Hall Teach Away

- The Petition relies on Hall for claim 6's fifth and sixth circuit boards (red and blue).
- Like Nubling, Hall teaches that circuit boards above the rotor should "provide mechanical support" for the optics. Ex. 1009, 7:3-8; Fig. 4.
- Hesai ignores this teaching for claim 4.



Petition at 72.

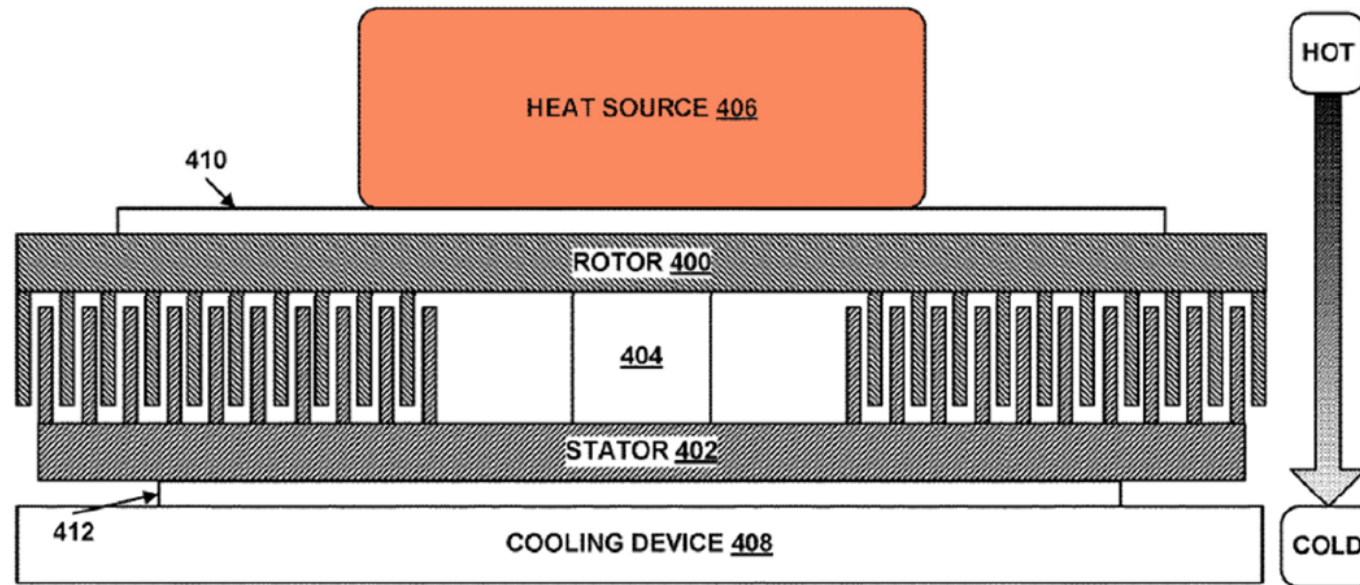
Pardhan Teaches Away From Proposed Modification



- Hesai's proposed combination places the fourth circuit board precisely where Pardhan expressly teaches placement of its low-thermal impedance coupling 410



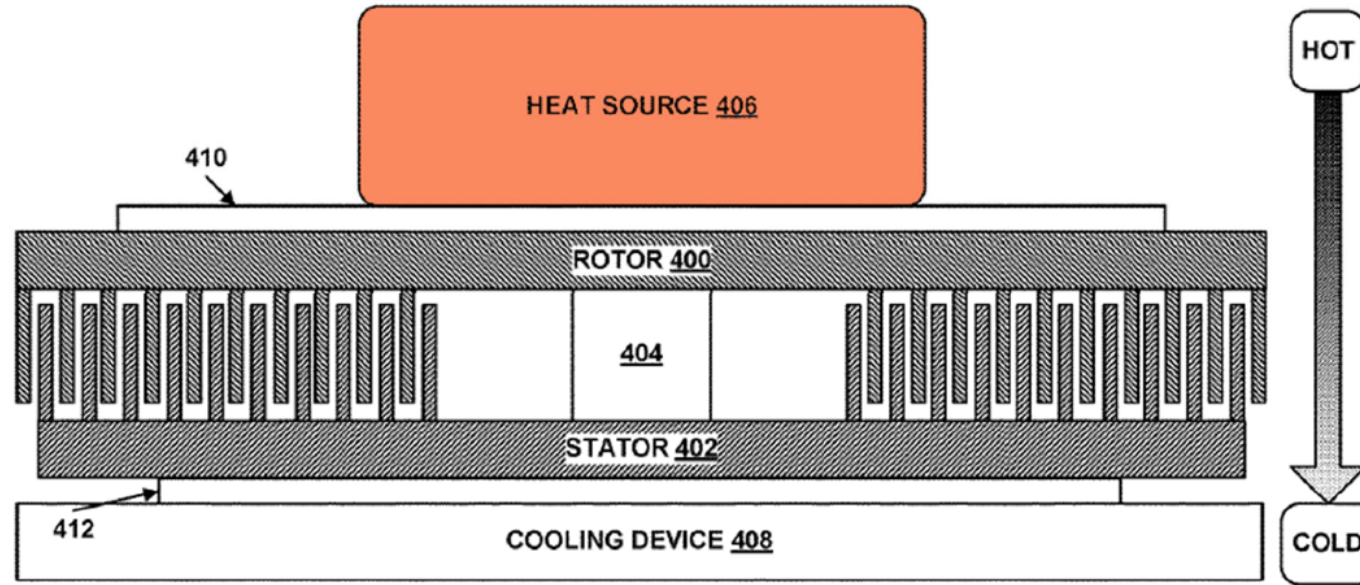
Pardhan Teaches Away From Proposed Modification



Janét

[B]ecause of basic thermo-fluid mechanics, the placement of another heat source between 406 and the heat sink would not be efficient. . . would arrest heat flow from heat source 406 to heat sink, likely resulting in heat source 406 overheating.

Pardhan Teaches Away From Proposed Modification



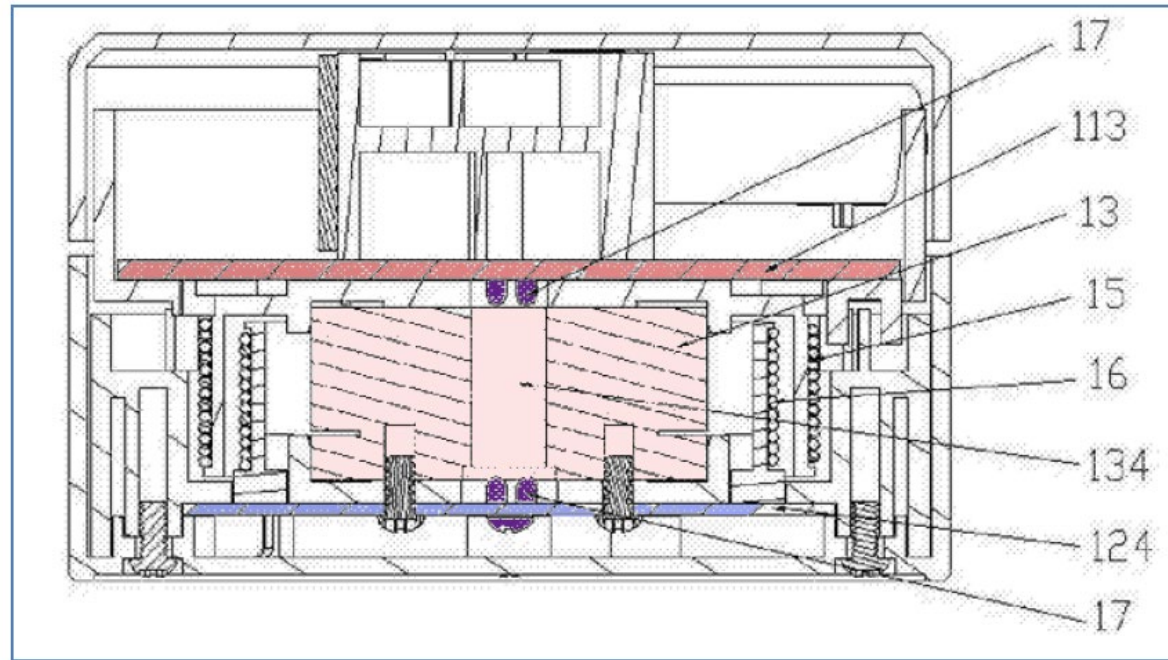
Janét

... doing so would prevent the LIDAR device from being “maintained at a stable operating temperature,” which is Pardhan’s primary concern.

Ex. 2004, ¶ 179

Neither Cai Nor Yan Teaches Four Circuit Boards

- Cai, like Johnson, teaches only two circuit boards:



Pet. at 62.

- Also incompatible with Pardhan



Neither Cai Nor Yan Combines With Pardhan

- Yan relates to “an automatic sweeping robot.”
 - “low power consumption requirements of 2 W or less.”
 - Yan thus includes no discussion of any overheating risks.

Ex. 1012 at [0004], [0075]-[0076]; Ex. 1016 at [0027]



Neither Cai Nor Yan Combines With Pardhan

Yan's circuit board was capable of being placed under its lower power consumption detecting device without risk of overheating whereas a circuit board could **not** be placed under Pardhan's overhea[t]ing LIDAR device.

Ex. 2004, ¶ 225



Janét





Dependent Claim 17 Is Patentable



Dependent Claim 17 Is Patentable

17. The light ranging system of claim 14 further comprising a **wireless power transformer integrated directly onto the stator and rotor circuit boards**, the wireless power transformer 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 in an opposing relationship with the first annular transformer coil, wherein the first transformer coil is concentric with and **positioned outside an outer perimeter of the plurality of stator elements** and the second transformer coil is concentric with and **positioned outside an outer perimeter of the rotor assembly annular arrangement**



- 

POR, 46-47

Zhang Teaches Away From Claim 17

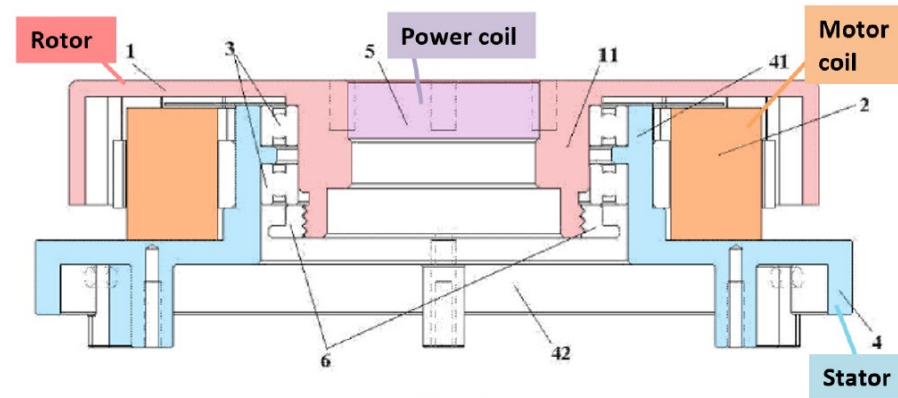


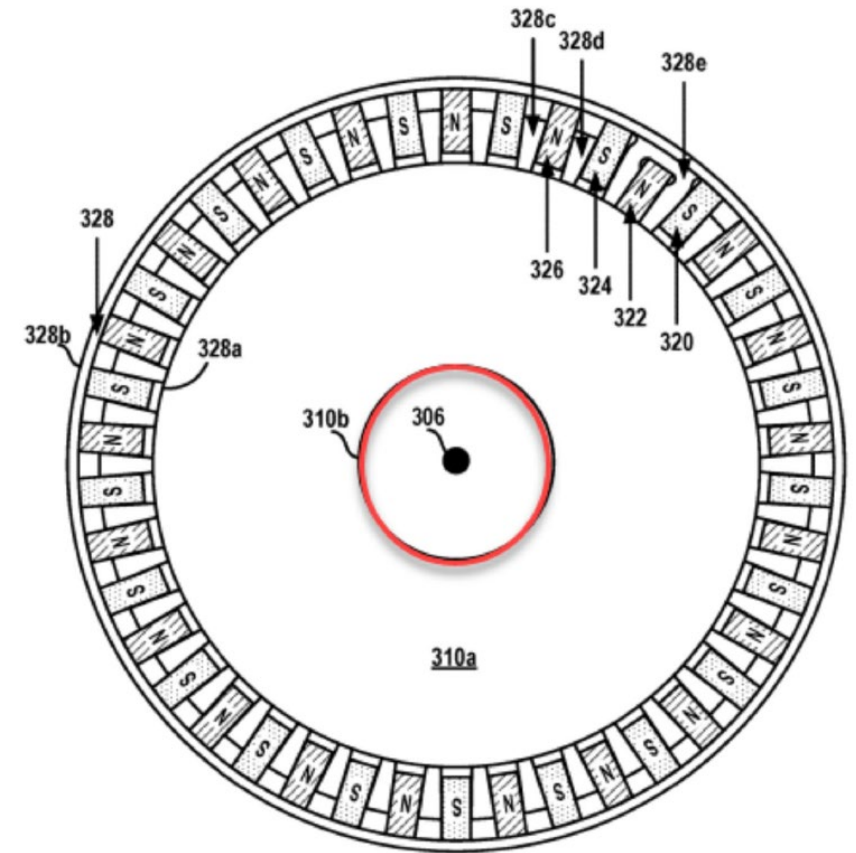
Figure 2

Compared with the prior art, the technical advantages of the present utility model are as follows:

- 2) The present utility model installs the signal transmission structure and the electrical power transmission structure on the inner side of the shaft system integrated with stator, rotor, and bearing parts to prevent interference with the power transmission. When the radar is operated at high speed, it can ensure the smoothness of the rotating shaft while having high impact resistance.

Johnson Teaches Away From Claim 17

- Johnson also teaches coil windings on the **stator** thus allowing for a smaller rotary transformer.
- Johnson's small rotary transformer (red) is inside the outer perimeter of the rotor magnets—as in Pardhan and Zhang.



Petition at 50

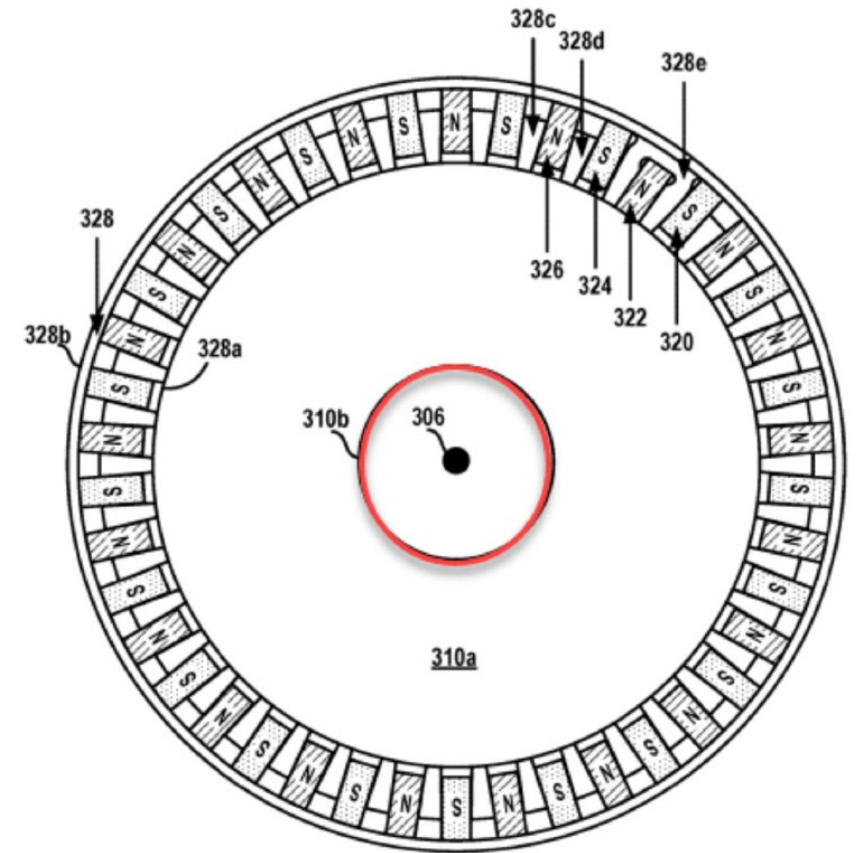
Johnson Teaches Away From Claim 17

A POSITA would understand that this positioning of toroidal coil windings and rotor magnets would maximize the torque produced while maintaining a compact design.

Ex. 2004, ¶ 187



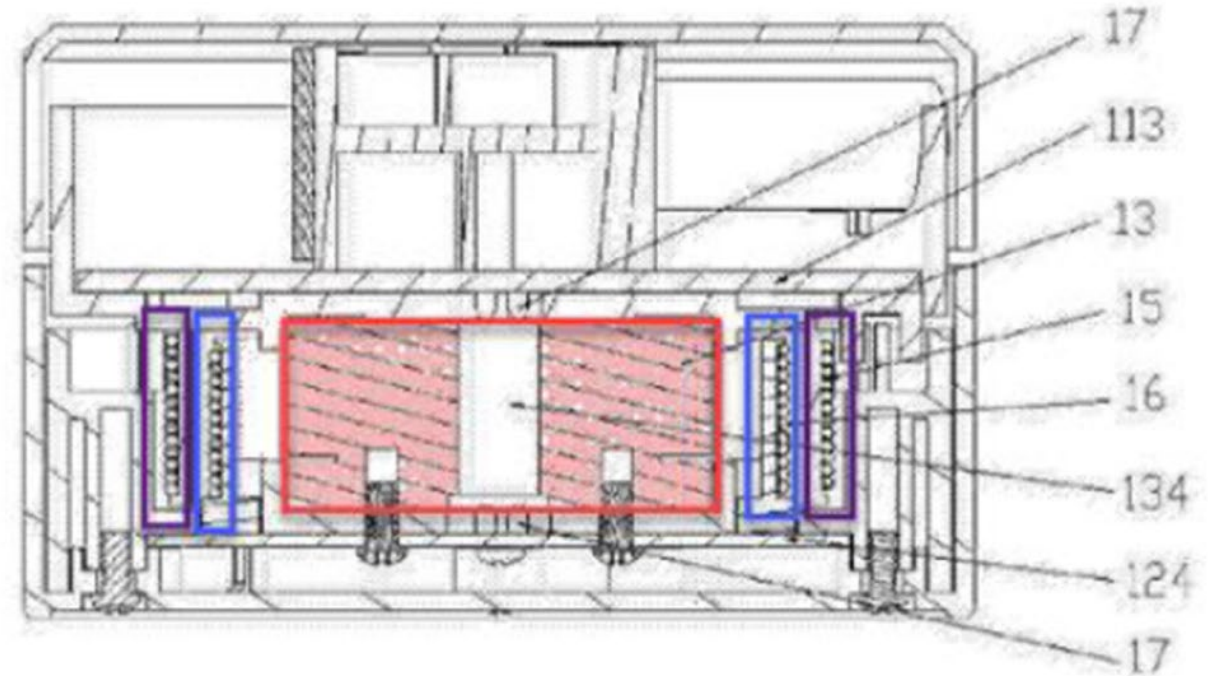
Janét



Petition at 50

Cai Teaches Vertically-extended Transformer Coils Positioned “Outside The Motor”

- Claim 17 requires a “wireless power transformer **integrated directly onto** the stator and rotor circuit boards.”
- Cai teaches vertically-extended transformer coils (**purple, blue**) placed ***outside*** the motor (**red**).



Petition at 64

Hesai's Claims of Only Two Design Choices Fails

- Factually:
 - Cai demonstrates a configuration where the transformer coils are entirely outside the motor.
- Legally:
 - *See Samsung Electronics Co. v. Neonode Smartphone LLC*, No. 223-1464, 2024 WL 3451828, at *3 (Fed. Cir. July 18, 2024) (rejecting propriety of “design choice” argument contending “two possible choices” of “relocating” a feature or “not relocating” it)



Hesai Provides No Rational Explanation to Modify Johnson

- The prior art as a whole teaches away from claim 17.
- Petitioner provides conjecture that in other systems, a POSITA “may” want larger transformer coils.
- The evidence shows Pacala-Johnson-Pardhan-Zhang did not need larger transformer coils.
 - Ex. 1005 (Johnson), 11:51-60, Fig. 3; Ex. 1006 (Pardhan), 21:9-13, Fig. 7B; Ex. 1007 (Zhang), 6, Fig. 2





Dependent Claims 13 & 21 Are Patentable



Dependent Claims 13 and 21 Are Patentable

- Hesai proposes combination of Ground 5 in view of Droz
- No evidence of a reasonable expectation of success
- Hesai admits Droz's waveguides would be required
- Droz makes no reference to the use of its waveguides for any applications involving scanning or rotation
- Droz's waveguides were designed solely for stationary use





Dependent Claim 23 Is Patentable



Claim 23

23. The light ranging system of claim 22 wherein the plurality of stator elements and the annular arrangement of the plurality of magnetic segments are each disposed **between** a surface of the second circuit board and a surface of the third circuit board.



Petitioner Failed To Show Claim 23 Is Obvious

- The Petition merely points to Sections XIV.B.1.e and XIV.B.1.i without explanation of how claim 23 is met under either of its circuit board theories.

A POSITA would have considered each layer of a multi-layer PCB to be a separate circuit board; however, in the alternative, it would have been obvious to use multiple separate circuit boards instead of a single multi-layer PCB. *See Section*

Pet. at 86





Secondary Considerations



Secondary Considerations

- 1. Industry Praise**
2. Hesai's Copying



Industry Praise

Before the '515 Patent, bulkier LIDAR sensors were used with large drones to perform functions such as surveying of power lines from a large distance. Now, lighter, more 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.

Ex. 2004, ¶¶ 263-264



Janét



Nexus

- Ouster's OS Sensor **is** the '515 patent (i.e., the patented invention is not merely a subcomponent), so nexus is presumed. *See e.g., Quanergy Sys., Inc. v. Velodyne Lidar USA, Inc.*, 24 F. 4th 1406, 1419 (Fed. Cir. 2022).
- Moreover, the industry praise was the result of the lightweight and compact design of the OS Sensor achieved by the claimed invention.



Secondary Considerations

1. Industry Praise
- 2. Hesai's Copying**



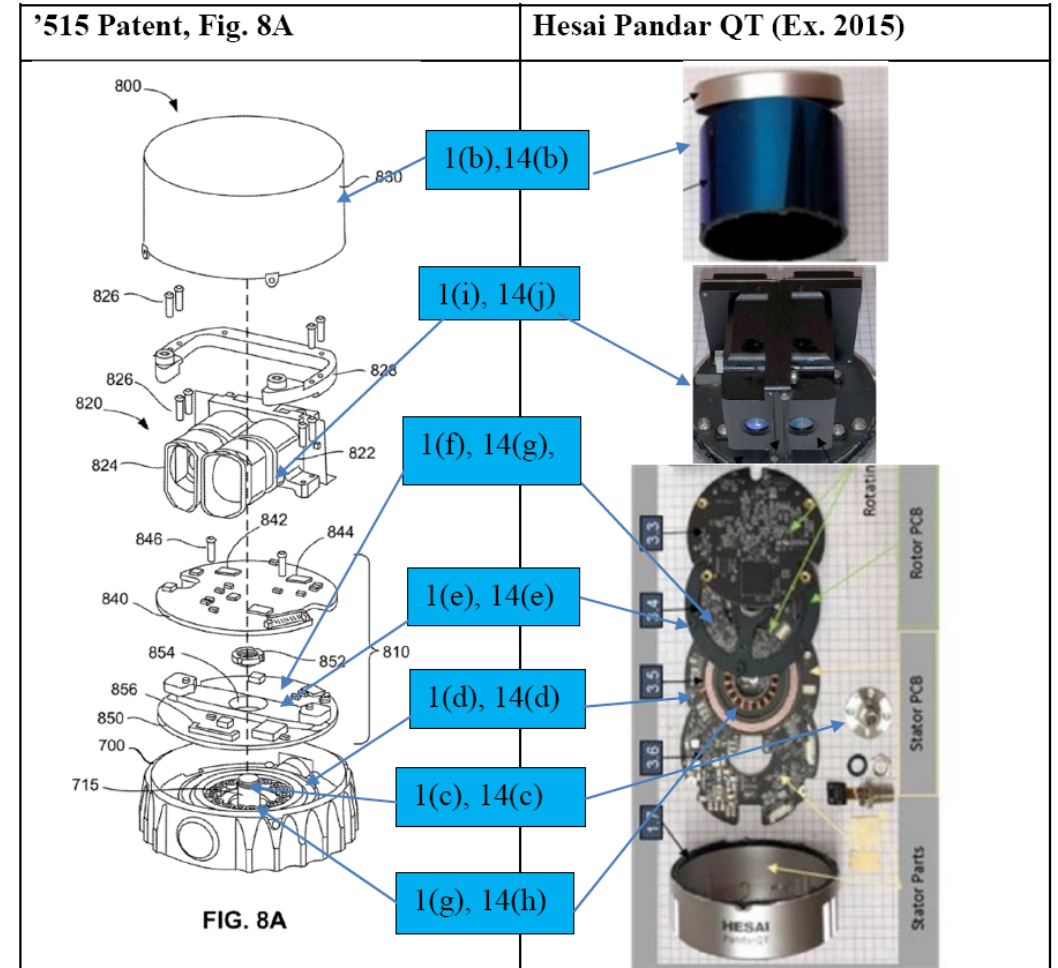
Hesai Copied the Fig. 8A Embodiment

In my opinion the Hesai PandarQT bears such striking similarities to Fig. 8A of the '515 Patent that that copying can be inferred.

Ex. 2004, ¶ 254



Janét



POR 73-77; Sur-reply 26-27

Circumstantial Evidence Is Sufficient

- *Medtronic, Inc. v. Teleflex Innovations Sarl*, 70 F.4th 1331, 1339-40 (Fed. Cir. 2023)
 - The Board may “**infer copying**” based on the “**substantial similarity**.”
 - Showing features were in the prior art is “unavailing because the copying product did not merely apply th[at] idea . . . but instead reproduced the **entire combination** of features that were assembled for the first time by the [Patent Owner’s] products.”
 - “[T]here is more than sufficient circumstantial evidence to support the Board's finding of copying” where the Parties’ “products, **when considered as a whole**, are substantially similar in design.”



Hesai's Copying Confirms the '515 Patent's Inventiveness



“The prior art was open to the Rubber Company. That ‘art was crowded,’ it says, . . . And yet the Rubber Company uses the Grant tire. It gives the tribute of its praise to the prior art; it gives the Grant tire the tribute of its imitation as others have done. And yet the narrowness of the claims seemed to make legal evasion easy. Why, then, was there not evasion by a variation of the details of the patented arrangement? . . . We can find no answer except that given by the Tire Company: ‘The patented organization must be one that is essential. Its use in the precise form described and shown in the patent must be inevitably necessary.’” *Diamond Rubber Co. of N.Y. v. Consol. Rubber Tire Co.*, 220 U.S. 428, 441 (1911).

Conclusion

- The Petition fails to show all limitations are in the prior art
- The Petition fails to show a motivation to combine the prior art and a reasonable expectation of success
- Objective evidence further proves the non-obviousness of the challenged claims
- All challenged claims are patentable

