

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CATERPILLAR INC.,
Petitioner,

v.

WIRTGEN AMERICA, INC.,
Patent Owner.

IPR2022-01310
Patent 8,424,972 B2

Before BARRY L. GROSSMAN, JAMES J. MAYBERRY, and
RICHARD H. MARSCHALL, *Administrative Patent Judges*.

MARSCHALL, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

Caterpillar Inc. challenges claims 1, 12, 15, 16, 22, 23, and 26 of U.S. Patent No. 8,424,972 B2 (Ex. 1001, the “’972 patent”), which is assigned to Wirtgen America, Inc. We have jurisdiction under 35 U.S.C. § 6, and we issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 (2022). For the reasons set forth below, we determine that Petitioner has shown that claims 1, 15, 16, 22, and 26 are unpatentable and has not shown that claims 12 or 23 are unpatentable.

INTRODUCTION

A. Background and Summary

Caterpillar Inc. (“Petitioner”) filed a Petition requesting *inter partes* review of the challenged claims. Paper 1 (“Pet.”). Wirtgen America, Inc. (“Patent Owner”) filed a Preliminary Response to the Petition. Paper 11 (“Prelim. Resp.”). Pursuant to 35 U.S.C. § 314, we instituted an *inter partes* review as to all challenged claims and all grounds raised in the Petition. Paper 12 (“Institution Decision” or “Inst. Dec.”).

After institution, Patent Owner filed a Response (Paper 18, “PO Resp.”), Petitioner filed a Reply (Paper 21, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 27, “PO Sur-reply”). An oral hearing was held on October 30, 2023, and a transcript is included in the record. Paper 34 (“Tr.”).

B. Real Parties-in-Interest

Caterpillar identifies itself as well as its subsidiaries Caterpillar Paving Products, Inc. and Caterpillar Prodotti Stradali S.r.L. as real parties-in-interest. Pet. 83. Wirtgen America identifies itself and Wirtgen GmbH as real parties-in-interest. Paper 9, 2.

C. Related Matters

Petitioner and Patent Owner identify the following district court proceeding as a related matter: *Wirtgen Am., Inc. v. Caterpillar, Inc.*, Case No. 17-770-RGA (D. Del.). Pet. 86; Paper 9, 2.

Petitioner and Patent Owner also identify the following pending *inter partes* review proceeding as a related matter: IPR2022-01278 challenging additional claims of the '972 patent. Pet. 83; Paper 9, 2; *see* IPR2022-01278. We issue the Final Written Decision in IPR2022-01278 concurrently with this Decision. We also note that IPR2022-01264 and IPR2022-01277 between the same parties contain similar claims and challenges.

D. The '972 Patent

The '972 patent, titled “Road Milling Machine and Method for Positioning the Machine Frame Parallel to the Ground,” issued April 23, 2013, from an application filed December 21, 2007. Ex. 1001, codes (22), (45), (54). The '972 patent ultimately claims priority to a German application filed December 22, 2006. *Id.*, code (30).

The '972 patent relates to “a self-propelled road milling machine, especially a cold milling machine, as well as a method for positioning the machine frame parallel to the ground.” Ex. 1001, 1:7–10. The '972 patent explains that there are several known problems with road milling machines where the machine frame does not extend parallel to the ground. The '972 patent explains that “if the machine frame does not extend parallel to the ground, the stripping means will not rest on the ground with sufficient exactness behind the milling roller to allow for a residue-free stripping process to be performed on the surface under treatment.” *Id.* at 1:33–38. The '972 patent further states that “if the machine frame is not arranged

parallel to the ground, . . . material which has been milled off may intrude into the region between the band shoe and the still untreated ground surface.” Ex. 1001, 1:38–43. Additionally, the ’972 patent explains that in known machines “the milling depth can not be controlled accurately enough and that, for this reason, the milling depth has to be measured repeatedly by hand during the milling operation.” *Id.* at 1:46–49.

The ’972 patent purports to address these problems, in one embodiment, through “the control device [that] automatically controls the lifting condition of at least one rear and/or front lifting column, as seen in the traveling direction, for positioning the machine frame parallel to the ground or traffic surface or for positioning the machine frame at a predetermined milling level.” *Id.* at 2:1–6. Figure 1 of the ’972 patent is reproduced below.

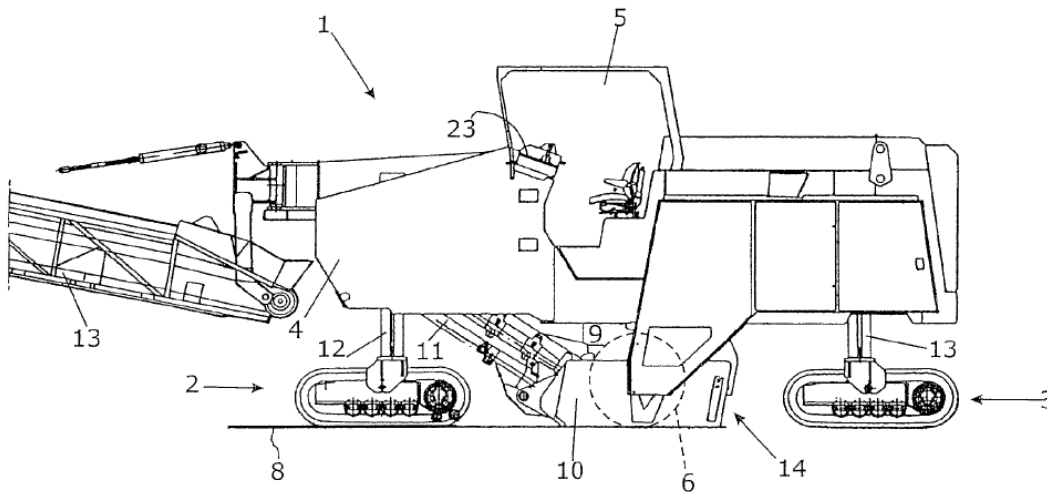


Fig.1

Figure 1 “shows a cold milling machine.” Ex. 1001, 6:42. The milling machine includes machine frame 4 supported by a track assembly having two front chain tracks 2 and at least one rear chain track 3 through

lifting columns 12, 13. *Id.* at 6:66–7:3. Lifting columns 12, 13 allow machine frame 4 to be moved to a predetermined inclined position with respect to the ground or traffic surface 8. Ex. 1001, 7:5–8. Machine frame 4 supports milling roll 6, and arranged behind milling roll 6 is height-adjustable stripping means 14 which, in operation, has stripping plate 15 that engages milling track 17 formed by milling roll 6. *Id.* at 7:16–21. Driver's stand 5 is arranged above milling roller 6 and provides a control panel for the vehicle operator that includes control means 23 for controlling the milling depth of the milling roller 6. *Id.* at 7:22–26. Position sensors measure the displacements of side plates 10, beam 20, or stripping plate 15 with respect to machine frame 4 or relative to each other. *Id.* at 7:39–43.

Figure 3 of the '972 patent is reproduced below.

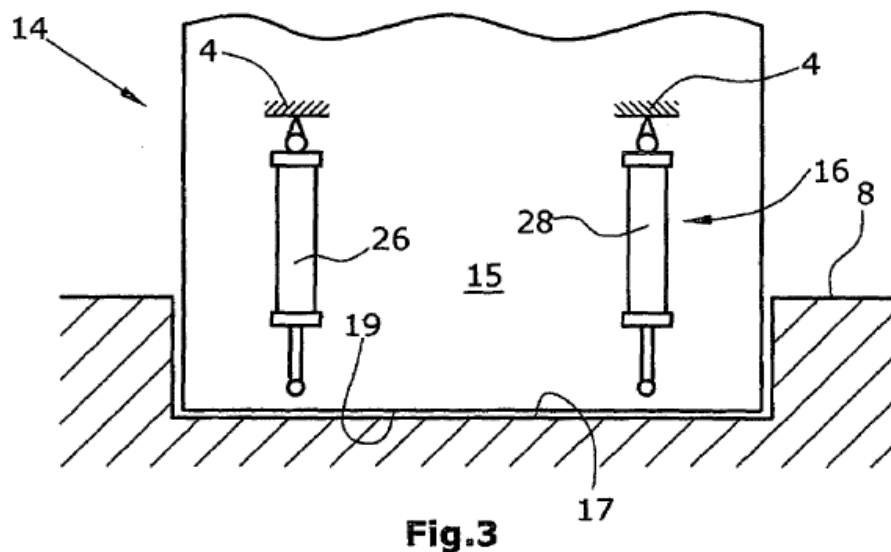


Fig.3

Figure 3 depicts an embodiment of the claimed invention wherein hydraulic pistons or cylinders 26, 28 lift and lower stripping plate 15 of stripping means 14. *Id.* at 7:61–64. The depicted hydraulic cylinders have an integrated position sensing system that generate a position signal and

have one end connected to machine frame 4 and the other to stripping plate 15. Ex. 1001, 7:63–8:3. The '972 patent explains that “control means 23 can calculate the current milling depth at the level of the milling roller axis from the position sensing signals received” and that “control means 23 can automatically control the lifted condition of the front and/or rear lifting column 13 . . . to establish parallelism between the machine frame 4 and the ground.” *Id.* at 9:21–30.

E. Illustrative Claim

Among the challenged claims, claim 1 is independent. Independent claim 1 is illustrative and is reproduced below.

1. A self-propelled road milling machine, comprising:
 - [1a] a machine frame;
 - [1b] at least two front ground engaging supports, and at least one rear ground engaging support, with reference to a direction of travel;
 - [1c] front and rear lifting columns supporting the frame from the ground engaging supports;
 - [1d] a milling roller supported from the frame for treatment of a ground surface;
 - [1e] first and second height adjustable side plates arranged on opposite sides of the milling roller;
 - [1f] a height adjustable stripping plate arranged behind the milling roller and operable to be lowered, during operation, into a milling track generated by the milling roller;
 - [1g] at least one ground engaging sensor; and,
 - [1h] a controller operably associated with the at least one ground engaging sensor, the controller being configured to automatically control a lifting condition of at least one of the lifting columns to establish a parallel orientation of the machine frame relative to the ground surface in the direction of travel.

Ex. 1001, 11:63–12:17 (bracketed nomenclature added by Petitioner).

F. Prior Art and Asserted Ground

Petitioner asserts that the challenged claims are unpatentable on the following grounds:

Claims Challenged	35 U.S.C. §¹	Basis
1, 15, 16, 22, 23, 26	103(a)	OMM, ² Sehr, ³ Samuelson ⁴
1, 12	103(a)	OMM, Sehr, Matsuda ⁵

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 296–07 (2011), took effect on September 16, 2011. The changes to 35 U.S.C. §§ 102 and 103 in the AIA do not apply to any patent application filed before March 16, 2013. Because neither part disputes that the application for the patent at issue in this proceeding has an effective filing date before March 16, 2013, we refer to the pre-AIA version of the statute.

² Caterpillar, “PM-465 Cold Planer, Operation & Maintenance Manual” (Ex. 1002, hereinafter “OMM” for consistency with the Petition). The parties somewhat confusingly refer to OMM and “PM-465” interchangeably because OMM (the reference as a whole) describes the PM-465 model of milling machine. *See, e.g.*, Pet. 1 (defining the reference as “*OMM*”), 5 (referring to “PM-465 *OMM*”), 7 (“The PM-465 *OMM* describes the PM-465 road-milling machine. *See OMM*, 2. The PM-465 has . . .”). We will generally refer to the reference as OMM to remain consistent with the Petition, but the parties’ (and any of our own) references to what the PM-465 machine includes should be read as what OMM teaches or suggests, not as a distinct prior art reference.

³ US 5,309,407, issued May 3, 1994 (Ex. 1037, “Sehr”).

⁴ US 6,450,048 B1, issued Sept. 17, 2002 (Ex. 1004, “Samuelson”).

⁵ Rough Terrain Robot with 4 Turn-over Track Frames – a feasibility study on the mechanism, Tomoo Matsuda, et al., IEEE SMC ’99 Conference Proceedings. 1999 IEEE International Conference on Systems, Man, and Cybernetics (Cat. No.99CH37028) Vol.4, p.842-847 (Ex. 1015, “Matsuda”).

Pet. 6.

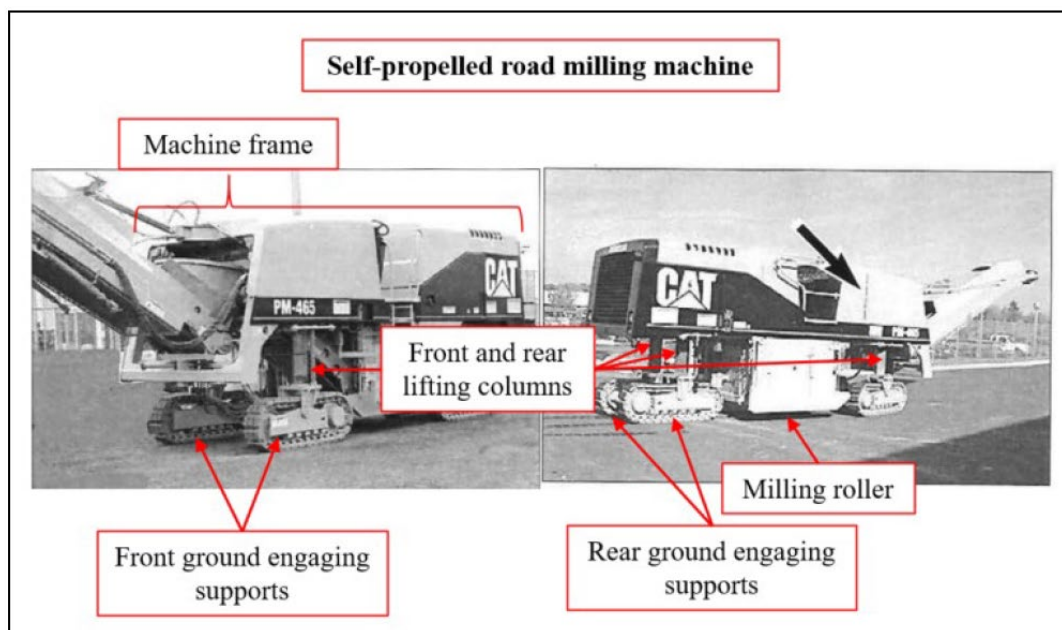
Petitioner also relies on the declaration testimony of Dr. William Singhose. *See* Ex. 1006 (providing the Declaration). Patent Owner relies on the declaration of Dr. John Lumkes. *See* Ex. 2020.

The following subsections provide brief descriptions of the asserted prior art references.

1. OMM (Ex. 1002)

OMM is an operation and maintenance manual for the PM-465 cold planer that is used for cold milling pavement. Ex. 1002, Title, 2.⁶

We reproduce below Petitioner's annotated versions of the images depicted on pages 2 and 40 of OMM.



⁶ When referencing OMM, we follow Petitioner's practice of citing the pagination of the manual, rather than the exhibit. When discussing prior art references, Petitioner typically italicizes the name of the reference. When we quote the Petition, we do not italicize the name.

The images on pages 4 and 42 of OMM are annotated by Petitioner to denote uncontested components of the milling machine. Pet. 8; *see also* Prelim. Resp. 9–11. In particular, Petitioner adds the title, “Self-propelled road milling machine” placed inside a red rectangle. *Id.* Petitioner also denotes the “machine frame,” “milling roller,” “front and rear lifting columns,” “front ground engaging supports,” and “rear ground engaging support,” by placing these terms in red rectangles and using a lead arrow that extends from a rectangle to its respective component. *Id.* OMM’s machine also includes Caterpillar’s “Grade and Slope Electronic Control System,” which includes, an “Electronic Control Module,” “grade/slope controllers on the left and/or right side of the operator's console, the grade/slope controllers at ground level in front and/or behind the mandrel, a contacting or a non[-]contacting sensor on each side of the machine, [and] a slope sensor at the center of the machine.” Ex. 1002, 32. According to OMM, the contacting sensor can include a grade slope wheel as depicted in the image on page 49 of OMM, reproduced below.



The image on page 49, on the left-hand side of the page, includes a black arrow denoting a grade slope wheel adjacent to the side plate of machine. Ex. 1002, 49. OMM explains that “[t]he grade slope wheel sends signals to the controller as the ground elevation varies.” *Id.* According to OMM, “[i]f the machine uses the non-contacting method of measuring the grade, a sonic sensor is attached. The sonic grade sensor uses sound waves to monitor the distance from a fixed point on the machine to a grade reference point (such as: finished surface, curb, gutter, or stringline).” *Id.* OMM notes that “[t]he sensors should be positioned on the centerline of the rotor to achieve an accurate cut. The further away from the center of the rotor, the less accurate the reading on the readout and the potential for less accurate cuts.” *Id.* at 48.

2. *Samuelson (Ex. 1004)*

Samuelson, titled “Hydraulic Cylinder Monitoring Apparatus,” issued September 17, 2002. Ex. 1004, codes (54), (45). Samuelson relates to “a hydraulic cylinder monitoring apparatus for a welded construction-type hydraulic cylinder.” *Id.* at 1:15–17. Samuelson discloses that hydraulic cylinders are used in various industries including “mobile equipment.” *Id.* at 1:35–40. Samuelson recognizes the importance of protecting the position measuring structure, e.g. transducer, of the cylinders, while being able to interchange “dumb” cylinders without transducers to “smart” cylinders. *Id.* at 1:45–60. Figures 5 and 6 of Samuelson are reproduced below.

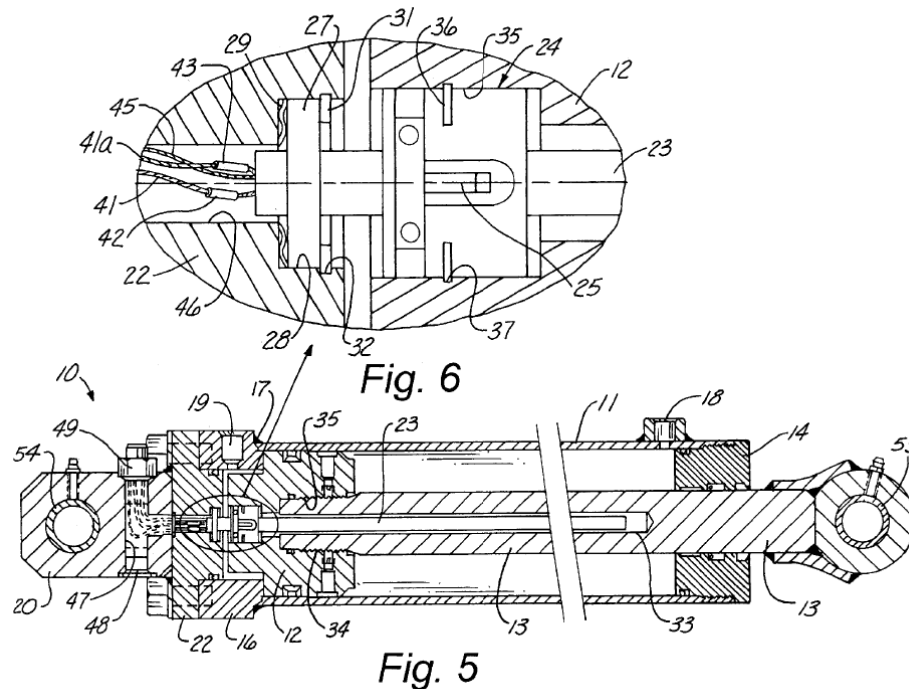


Figure 5 is a cross sectional view of a hydraulic cylinder having a monitoring apparatus disposed therein, and Figure 6 is an enlarged view of the circled portion shown in Figure 5. Ex. 1004, 2:53–57. Samuelson discloses that in operation, hydraulic cylinder 10 is connected at ends 53 and 54 to two objects that need to be selectively controlled by being separated and then moved back together while the relative spacing is monitored by the transducer structure 23 and 24. *Id.* at 4:17–21.

Samuelson explains that in Figure 5, a controller, not shown, is sensing the position of piston 12 with respect to cap 22 through reference supply and/or ground return wires 41 and 41a, which have fixed resistors. *Id.* at 4:22–26. Similarly, output wire 45 is connected to the controller. *Id.* at 4:27–28. According to Samuelson, when pressurized hydraulic oil is directed into port 19, cylinder 12 moves to the right and follower 24 will move with it, which will change the resistance. *Id.* at 4:29–33.

“Consequently, the position of the piston (12) and/or rod (13) can readily be monitored as the piston (12) and rod (13) move from one position to another within the cylinder (11).” *Id.* at 4:41–44. Samuelson notes that “[b]ecause the fixed resistors (42) and (43) are disposed within the steel confines of the supplemental cap (22) and its flange (20), there is very little chance that they can be damaged during the use of the device.” *Id.* at 4:48–51.

3. Sehr (Ex. 1037)

Sehr, titled “Ultrasonic Control Unit for a Traveling Cutter,” issued May 3, 1994. Ex. 1037, codes (54), (45). Sehr “relates to an ultrasonic control unit for a travelling cutter.” *Id.* at 1:5–6. We reproduce Sehr’s Figure 1, below.

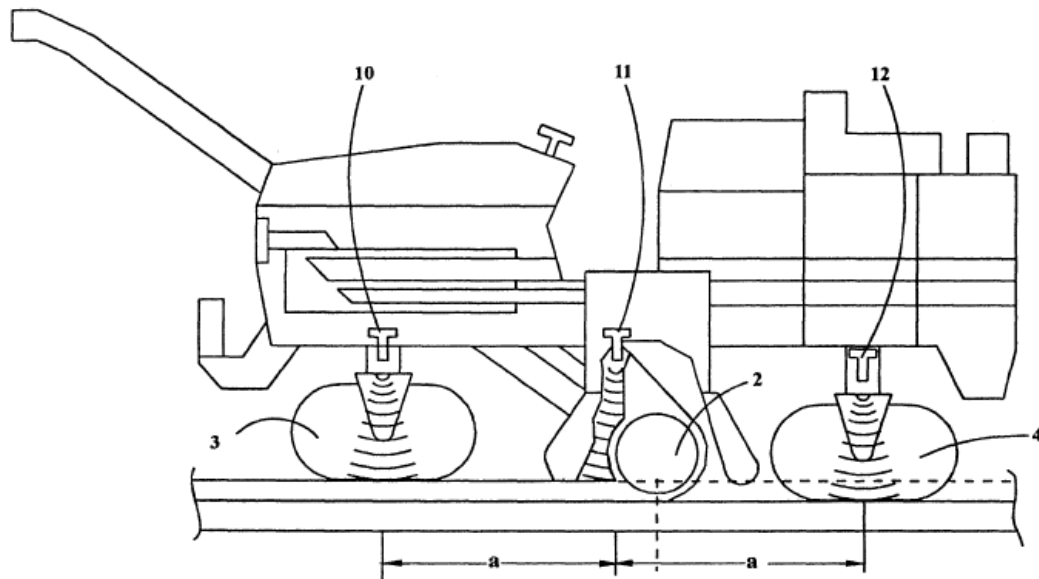


Fig.1

Figure 1 depicts a “a road grooving machine” with a “cutter drum 2, which is rotatably supported on the road grooving machine, as well as front and rear travelling gears 3, 4” and “at least three ultrasonic sensors 10, 11, 12, which are arranged one behind the other essentially in the direction of movement of the road grooving machine 1.” *Id.* at 2:7–10, 2:24–27. The

ultrasonic sensors in Sehr sample a “reference plane” with their “sound cones,” and the sampled plane “is normally a marginal strip of a road whose surfacing has to be removed by cutting down to a predetermined depth.” *Id.* at 2:27–31. Sehr further discloses that the control unit “compensates substantially for the waviness of the reference plane, and it facilitates the work of the operator of the road grooving machine by holding the road grooving machine in a parallel position.” *Id.* at 3:53–60.

4. Matsuda (Ex. 1015)

Matsuda discloses “a mobile robot capable of traveling over rough terrain [using] a non-interference infinitely turning 4-crawler track mechanism.” Ex. 1015, 3. Matsuda further discloses a machine that utilizes “automatic posture change and motor coordination control . . . in order to overcome ground obstacles.” *Id.* Matsuda claims that its “vehicle can infinitely turn around with the front and rear crawler tracks free from interference.” *Id.* at 4. Matsuda further states that “[e]ach crawler is composed of a track frame, a drive sprocket, idler, rotary wheels and rubber track. *Id.* We reproduce Figure 3 of Matsuda below.

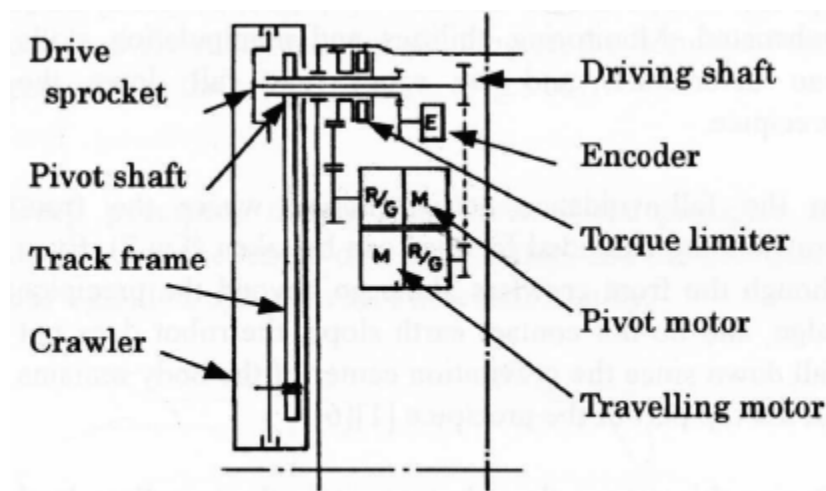


Fig. 3 Driving mechanism for the crawler

Figure 3 depicts a drive mechanism for the crawler system with a traveling rotary shaft that extends into the robot body and is rotated by a traveling motor. Ex. 1015, 4. Matsuda employs a pivot shaft described as “a hollow cylindrical shaft in which the travelling rotary shaft is enclosed” that “connects the track frame to the track frame turnover motor through a reduction gear and torque limiter.” *Id.* A rotary encoder attached to the pivot shaft “detect[s] the rotational position of the pivot shaft or pivoting position of the track frame” and “monitors the posture exchange sequence.” *Id.*

ANALYSIS

A. Legal Standards

To prevail in its challenges, Petitioner must prove unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d). “In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burdens of proof in an *inter partes* review).

Petitioner relies on obviousness in its challenges. Pet. 6. A claim is unpatentable as obvious under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a

person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations, also known as objective indicia of nonobviousness.⁷ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

An obviousness analysis must include a reason, based upon some rational underpinning, why a person of ordinary skill would have been motivated to modify the prior art to achieve the claimed invention. *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016) (“To satisfy its burden of proving obviousness, a petitioner . . . must . . . articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” (citing *KSR*, 550 U.S. at 418)). The requirement of a reason to combine is a safeguard against hindsight bias, which is characterized by the “temptation to read into the prior art the teachings of the invention in issue.” *KSR*, 550 U.S. at 421 (quoting *Graham*, 383 U.S. at 36).

B. Level of Ordinary Skill in the Art

The level of skill in the art is “a prism or lens” through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). “This reference point prevents . . . factfinders from using their own insight or, worse yet, hindsight, to gauge obviousness.”

⁷ The parties do not address any objective indicia of nonobviousness in this proceeding.

Id. Factors pertinent to a determination of the level of ordinary skill in the art include: (1) educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of workers active in the field. *Env't Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.* Moreover, these factors are not exhaustive but are merely a guide to determining the level of ordinary skill in the art. *Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007). In determining a level of ordinary skill, we also may look to the prior art, which may reflect an appropriate skill level. *Okajima*, 261 F.3d at 1355.

Petitioner asserts that a person of ordinary skill in the art (“POSITA”) would have had “at least a four-year degree in mechanical engineering or a closely related field and at least two years of experience designing, developing, servicing or operating heavy machinery, including their components and control systems.” Pet. 6 (citing Ex. 1006 ¶ 23). Petitioner also states that “[a]dditional education could substitute for professional experience, and significant work experience—such as working with, servicing, or operating heavy machinery in the field—could substitute for formal education.” *Id.*

“Patent Owner does not dispute the Petition’s definition” of the level of ordinary skill. PO Resp. 17.

Based on the prior art, the sophistication of the technology at issue, and Dr. Singhose’s declaration testimony, we adopt Petitioner’s undisputed definition of the level of ordinary skill. *See* Ex. 1006 ¶ 23; *see, e.g.*, Exs. 1002, 1003 (providing information on the PM-465 Cold Planer); Ex. 1004; Ex. 1005; Ex. 1037.

C. Claim Construction

We construe each claim “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). Under this standard, claim terms are generally given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc) (“We have frequently stated that the words of a claim ‘are generally given their ordinary and customary meaning.’” (citations omitted)).

Petitioner contends that “[t]he prior art renders all challenged claims unpatentable under the plain and ordinary meaning of the claims.” Pet. 6.⁸ Patent Owner does not believe that any claim terms need construction to resolve the grounds raised in the Petition, but in its claim construction section it previews a claim construction argument relevant to dependent claim 15. PO Resp. 17–18. We address that issue in the context of claim 15 below.

⁸ Petitioner “notes that the parties exchanged preliminary claim constructions in the parallel litigation,” and provides the construction for two terms from that litigation, “controller” and “ground engaging sensor,” but argues that “[t]hose constructions are irrelevant to the outcome here and the Board thus need not address them.” Pet. 6–7.

We determine that we need not expressly construe any claim terms to resolve the parties' disputes on the record before us. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms that . . . are in controversy, and only to the extent necessary to resolve the controversy.'") (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). To the extent that the scope of any particular claim term requires discussion, however, we provide it in our assessment of the challenges, which we turn to next. For example, we address explicit and implicit claim construction issues in the context of claims 15 and 23 below.

D. Obviousness of Claims 1, 15, 16, 22, 23, and 26 Based on OMM, Sehr, and Samuelson

Petitioner contends that the combination of OMM, Sehr, and Samuelson teaches or suggests each limitation of claims 1, 15–16, 22–23, and 26. Pet. 7, 20–68. Patent Owner raises a number of arguments against Petitioner's challenges. *See* PO Resp. 18–61. We will address each challenged claim below.

1. Independent Claim 1

The closely related IPR2022-01278 addresses claims 1–10, 25, 27, 30, 31, 33, 34, and 36–40 of the '972 patent. Because Petitioner challenges additional claims in this proceeding that ultimately depend from claim 1, Petitioner addresses claim 1 again in this proceeding as a predicate for its challenge to those dependent claims. *See* Pet. 7–57. The arguments and evidence Petitioner and Patent Owner rely on as to claim 1 in IPR2022-01278 largely mirrors the argument and evidence submitted in this proceeding for this Ground based on OMM, Sehr, and Samuelson. *See id.* at

7–57; PO Resp. 18–51; IPR2022-01278, Papers 1 (Petition), 7–50; Paper 18 (Patent Owner Response), 13–46. In the Final Written Decision in IPR2022-01278, which we issue concurrently with this Decision, we found that the combination of OMM, Sehr, and Samuelson renders claim 1 obvious.

Because we already found claim 1 of the '972 patent unpatentable based on the same combination asserted here and based on the same arguments from the parties, we do not repeat that analysis in this Decision. Instead, we incorporate our analysis of claim 1 of the '972 patent in IPR2022-01278 into this Decision. Based on that analysis, we find that Petitioner proves by a preponderance of the evidence that claim 1 would have been obvious based on a combination of OMM, Sehr, and Samuelson.

2. Dependent Claim 15

Claim 15 depends from claim 1 and further recites: “the controller is configured to detect and control a milling depth of the milling roller; and the controller is configured to control the parallel orientation of the machine frame independently of control of the milling depth of the milling roller.” Ex. 1001, claim 15.

Petitioner argues that “[t]he controller of the PM-465 is configured to detect and control the milling depth of the milling roller.” Pet. 57 (citing Ex. 1006 ¶ 154). Petitioner also contends that OMM discloses a PM-465 with two grade sensors, one on each side of the machine, and that the “PM-465’s automatic grade-and-slope system adjusts ‘heights of the legs’ based on the information received from the grade-and-slope sensors to ‘control the grade and slope of the cut surface.’” *Id.* at 57–58 (citing Ex. 1002, 32, 48). Petitioner further asserts that “OMM explains that grade (or depth of cut) on either side of the machine “is controlled by the difference of the heights

between the front and rear legs.” *Id.* at 58 (citing Ex. 1002, 48). According to Petitioner, a “POSITA would understand from these disclosures that the controller is configured to detect and control the milling depth of the milling roller.” *Id.* As to maintaining parallelism, Petitioner contends that it was a well-known principle to promote comfort and stability and that this functionality would be used even when not performing milling operations and therefore independently of milling depth control as claim 15 requires. *Id.* at 58–59 (citing Ex. 1006 ¶ 156).

Patent Owner argues that Dr. Singhose, and Petitioner, incorrectly views “independently” controlling parallel orientation in claim 15 as “automatic control of parallelism of the machine frame relative to the ground even when not performing milling operations (i.e., independently of control of the milling depth of the milling roller).” PO Resp. 52–53 (citing Pet. 58–59). According to Patent Owner, a “POSITA would have understood that the additional limitations of claim 15 are only meaningful in the milling context.” *Id.* at 53 (citing Ex. 2020 ¶ 157). Patent Owner relies on the first limitation of claim 15 requiring that “the controller is configured to detect and control a milling depth of the milling roller” and concludes that “when the machine is not milling, the controller is no longer configured to control milling depth.” *Id.* (citing Ex. 2020 ¶ 158). Patent Owner concludes that “[c]orrectly construed, claim 15 requires both the configuration to detect and control milling depth and the configuration to control parallel orientation independently of milling depth control, all during the milling process.” *Id.* at 53–54 (citing Ex. 2020 ¶¶ 157–160). Petitioner’s approach, in Patent Owner’s view, would render “independently” meaningless. *Id.* at 54. Patent Owner also argues that “Petitioner has not explained how the proposed

combination's controller establishes PTS when not milling" because Petitioner's proposed combination using leg signals would only work "so long as the ground remains level and no obstacles are encountered." *Id.* (citing Ex. 2020 ¶ 161).

In its Reply, Petitioner argues that Patent Owner misconstrues claim 15 to require (1) the detecting and controlling milling depth functionality and (2) the controlling parallel orientation functionality "to both occur during milling." Pet. Reply 15. Petitioner contends that the language of claim 15 fails to support that position and Patent Owner fails to cite any disclaimer or definitional language in support of its construction. *See id.* Petitioner also relies on dependent claim 13 as evidence that Patent Owner knew how to restrict its claims to operations that occur during milling. *See id.* Patent Owner does not directly address claim 15 or Petitioner's Reply arguments in its Sur-reply.

Based on our review of the record, we find that Petitioner proves by a preponderance of the evidence that its proposed combination of OMM, Sehr, and Samuelson discloses the limitations of claim 15. As Petitioner correctly notes, OMM teaches a controller "configured to detect and control a milling depth of the milling roller" and Petitioner's proposed combination teaches a controller "configured to control the parallel orientation of the machine frame." *See* Pet. 57–58. Patent Owner does not dispute these assertions. Patent Owner also does not dispute Petitioner's assertion that in the proposed combination, the milling depth and the parallel orientation can be controlled independently in the sense that one can be adjusted without impacting the other, an assertion we also find persuasive for the reasons provided by Petitioner. *See id.*; PO Resp. 52.

The only dispute is whether “independently” means that the milling depth and parallel orientation must be controlled *during milling* as Patent Owner contends. *See* PO Resp. 53–54. We agree with Petitioner that the language of claim 15 does not require or suggest that the two functionalities occur during milling. *See* Pet. Reply 15. While Patent Owner correctly notes that the first limitation of claim 15 refers to the controller’s ability to detect and control milling depth, that says nothing about when the two different functionalities must be operational. *See* PO Resp 53. We also disagree with Patent Owner’s assertion that its narrower construction must be adopted to give any meaning to “independently”—the term still means controlling milling depth or parallel orientation without impacting the other parameter while doing so. *See id.* at 54.

Finally, we are not persuaded by Patent Owner’s argument that the proposed combination lacks explanation or support because the parallel orientation may only persist “so long as the ground remains level and no obstacles are encountered.” PO Resp. 54. The claim does not require maintaining the claimed parallel orientation during any specific situation, and doing so on flat ground with no obstacles present satisfies claim 15. To the extent Patent Owner presumes a narrower construction of the claim, it should have presented additional argument and evidence in support of such a construction. *See Chef America, Inc. v. Lamb-Weston, Inc.*, 358 F. 3d 1371, 1374 (Fed. Cir. 2004) (“Thus, in accord with our settled practice we construe the claim as written, not as the patentees wish they had written it.”).

Based on the foregoing, we find that Petitioner proves by a preponderance of the evidence that claim 15 would have been obvious based on a combination of OMM, Sehr, and Samuelson.

3. *Dependent Claim 22*

a) *The Parties' Positions*

Claims 22 depends from claim 1 and further recites: “at least one hydraulic piston and cylinder unit arranged to lift and lower at least one of the side plates or the stripping plate, the hydraulic piston and cylinder unit including an integrated path sensing system.” Ex. 1001, claim 22.

Petitioner argues that OMM discloses various “position sensors,” including contacting and noncontacting grade sensors “on both sides of the machine that generate position signals representing the distance between the milling machine and the ground.” Pet. 61⁹ (citing Ex. 1002, 32, 48–49). Petitioner asserts that “a POSITA would have been motivated to consider different grade sensors that were not grade slope wheels or ultrasonic sensors” because the “prior art explained that mechanical wheel sensors (like the grade slope wheel) were ‘easily . . . damaged under the rough conditions which normally exist in road repair work’” and “ultrasonic sensors were easily compromised.” *Id.* (citing Ex. 1005, 1:23–45, 1:52–68). Petitioner contends that “Samuelson solved this problem by disclosing its robust sensor-integrated cylinder, which could be easily incorporated onto the PM-465’s side plates in a way that monitored ground position.” *Id.* at 62. Petitioner also contends that it was well known to use side plates themselves to actuate sensors in a grade-and-slope control system. *Id.*

⁹ Petitioner’s argument includes references back to earlier portions of the Petition addressing these issues, including a section providing motivations to use Samuelson’s sensor-integrated cylinders on side plates. *See* Pet. 34–40; 61–65 (referencing previous sections of the Petition for support).

Next, Petitioner argues that the PM-465 already included two hydraulic cylinders on each side plate to lift and lower the side plates and that one of ordinary skill in the art would have been motivated to replace those cylinders with Samuelson's sensor-integrated cylinders such that "both side plates would include two hydraulic piston and cylinder units with integrated path sensing systems" that measure the distance between the machine frame and the ground. Pet. 62–64 (citing Ex. 1006 ¶¶ 166–167). According to Petitioner, a "POSITA would have been motivated to make this sensor-integrated cylinder modification because it provides for a *robust* ground sensing device that *directly contacts the ground*." *Id.* at 64 (citing Ex. 1006 ¶ 168).

Patent Owner argues that Petitioner provides three rationales for replacing the PM-465's side-plate cylinders with Samuelson's sensor-integrated cylinders, and all lack merit. *See* PO Resp. 56–59. First, Patent Owner contends that "the Petition provides no evidence that the PM-465 grade wheel suffered from robustness problems, let alone that it was any less robust than Samuelson's sensor-integrated cylinders." *Id.* at 56 (citing Ex. 2020 ¶¶ 165–172). Patent Owner takes issue with the Petition's citation to Zarniko¹⁰ for support, because Zarniko published nine years before OMM and "says nothing about the PM-465 grade wheel, whose components were protected by a housing." *Id.* at 56–57 (citing Ex. 2020 ¶ 169). Patent Owner also notes that Mr. Netka's testimony that Petitioner relies on only states that the grade sensors could be damaged, not "that they would be damaged." *Id.*

¹⁰ US 4,943,119, issued July 24, 1990 (Ex. 1005, "Zarniko").

at 57 (citing Ex. 2007, 66:10–67:4; Ex. 2008, 63:3–64:4; Ex. 2020 ¶¶ 48). Patent Owner contends that because “the components of the PM-465’s grade slope wheel, including its transducer, are enclosed in a protective housing” like Samuelson’s sensors, “[t]here is no evidence of a robustness problem.” *Id.* (citing Ex. 2007, 55:7–57:18, 57:2–18, 63:3–64:16; Ex. 2020 ¶¶ 165–174).

Second, Patent Owner argues that “a grade averaging ski was already available for the PM-465 and, even so, the Petition is wrong that its proposed combination would provide ‘grade averaging.’” PO Resp. 57–58 (citing Ex. 1009, 498–499; Ex. 2020 ¶¶ 173–174, 178–180). Patent Owner contends that “the Petition’s proposed two-sensor configuration would not implement grade averaging” because “[g]rade averaging uses the multiple contacts of the sensing mechanism, which, by creating a mechanical average, reduces the noise created by a single contact point.” *Id.* at 58 (citing Ex. 2020 ¶¶ 178–192).

Third, Patent Owner asserts that “the Petition provides no evidence that human error was a problem, and, even if it was, the proposed mathematical averaging approximates the height at the midpoint of the side plate not the centerline of the milling drum.” PO Resp. 58–59 (citing Ex. 2008, 91:11–16; Ex. 2020 ¶¶ 191–192). According to Patent Owner, “simply average[ing] the measurements from the two cylinders would only approximate height at the midline of the side plate, which does not correspond to the centerline of the drum,” violating OMM’s instruction to position the sensors as close to the centerline of the rotor as possible. *Id.* at 59 (citing Pet. 39; Ex. 1002, 52, 60; Ex. 2020 ¶¶ 186–187).

In its Reply, Petitioner argues that Patent Owner “myopically confines its robustness arguments on the grade slope wheel to the transducer enclosed within a protective housing” and fails to address testimony as to unprotected aspects of the grade slope wheel components with reliability problems that would motivate a POSITA to pursue other designs. Pet. Reply 16–17 (citing Ex. 1071, 16:11–16, 34:1–11, 40:1–4; Ex. 1072, 28:14–29:8; Ex. 2007, 66:10–67:4; Ex. 2008, 32:13–34:12). These allegedly exposed wheel components include the wheel itself, with its 180 degree swivel feature, and the exposed coil cord, both of which may be damaged and compromise the accuracy of the grade slope wheel. *Id.* at 17–18; *see also id.* at 18 (noting potential for human error when manually inputting position values). Petitioner also asserts that the evidence shows that the PM-465 was meant to be modified, supporting Petitioner’s position that a POSITA would have looked to other designs beyond those in OMM, such as sensor and grade averaging and its benefits over the grade slope wheel and ski sensors in the PM-465. *Id.* at 19–21 (citing Ex. 1006 ¶¶ 83–85, 91–92). Petitioner contends that having “sensor redundancy in the road-milling industry is customary, including for the PM-465 machine.” *Id.* at 21 (citing Ex. 1006 ¶¶ 51–52).

In its Sur-reply, Patent Owner argues that both Samuelson and the grade slope wheel in the PM-465 place the transducer inside a housing for protection, while other components are exposed, which undermines the alleged superiority of Samuelson’s design. PO Sur-reply 21. Patent Owner contends that Petitioner shifts its argument in its Reply by arguing that other components such as the grade wheel and coil cord had reliability problems. *Id.* (citing Pet. Reply 16–18). Patent Owner asserts that Petitioner’s citations

do not support its arguments and that Samuelson's cylinders also have exposed parts outside the width of the machine and would encounter the same issues. *Id.* at 21–22. Patent Owner also states that Petitioner's argument based on problems with the swiveling feature of the grade wheel is new and improper and fails to explain Petitioner's proposed comprehensive modification. *Id.* at 22. Finally, Patent Owner contends that Petitioner gets its sensor-redundancy argument wrong because the different grade and slope sensors have different purposes and Sehr spaces its sensors "not for redundancy but to avoid faulty measurements." *Id.* at 22–23 (citing Ex. 2016, 142–147; Ex. 2020 ¶ 73).

b) Discussion

Based on our review of the complete record, we find that Petitioner has demonstrated, by a preponderance of the evidence, that a person having ordinary skill in the art would have been motivated to modify the teachings of OMM with Samuelson's teaching of sensor-integrated cylinders attached to each side plate, such that the resulting OMM/Sehr/Samuelson combination teaches or suggests all of the limitations in claim 22.

First, we agree with Petitioner that a person having ordinary skill in the art would have had reason to consider sensors other than the PM-465's grade slope wheel and Sehr's ultrasonic sensors due to issues with those approaches. *See* Pet. 61 (citing Ex. 1002, 32, 48–49; Ex. 1005, 1:23–45, 1:52–68); *see also* Pet. Reply 17–18. Petitioner also persuasively argues that Samuelson addresses these concerns with a more robust sensor-integrated cylinder that monitors ground position. Pet. 61–62 (citing Ex. 1005, 1:23–45, 1:52–68). Zarniko discloses that a prior art "height control device has a mechanical sensor for sensing the level height of the bearing frame with

respect to the unmachined road surfacing. This mechanical sensor in prior art height control devices constitutes, for example, a sensing wheel with height adjustment.” Ex. 1005, 1:24–29. That is, a grade slope wheel such as that disclosed in OMM. Zarniko continues that “[a] . . . problem of . . . [this] height control device is that the mechanical sensor for sensing the road surfacing can easily be damaged under the rough conditions which normally exist in road repair work.” *Id.* at 1:41–45. This evidence directly underpins Petitioner’s reasoning.

Second, we agree with Petitioner that it was known to use side plates themselves to actuate such sensors. *See* Pet. 62 (citing Ex. 1002, 32, 48–49; Ex. 1006 ¶ 165). The System Operation Testing and Adjusting Manual (“SOTA”¹¹) suggests using the side plates for grade monitoring. *Id.* (citing Ex. 1003, 15); Ex. 1003, 15 (“The method for measuring grade that contacts a reference surface uses a grade position sensor. The sensor can be actuated by one of the following devices: wheel, ski, and *side plate of the machine.*” (emphasis added)). Once Samuelson’s sensor-integrated cylinders are added to the combination, with two on each side, the piston and cylinder unit provides an integrated path system, and all of the limitations of claim 22 are present in the combination. *See* Pet. 62–64.¹²

¹¹ SOTA is a manual for the PM-465 Cold Planer Caterpillar Grade and Slope Electronic Control System, where the PM-465 Cold Planar is the machine disclosed in OMM. *See* Ex. 1003, cover; Ex. 1002, cover. When citing to SOTA, we follow Petitioner’s convention to cite to the page number of the manual, rather than the exhibit page number.

¹² Patent Owner does not argue that the proposed combination fails to teach or suggest any specific limitation in claim 22, and instead attacks the stated rationales for the combination. *See* PO Resp. 55–59.

Third, we agree with Petitioner that its proposed combination “provides for a *robust* ground sensing device that *directly contacts the ground*” and “measures the side plates’ changes in vertical position as they float along the ground.” Pet. 64 (citing Ex. 1006 ¶ 168). This arrangement enables “more accurate sensing through grade averaging of the two sensor signals from each side,” further motivating one of ordinary skill in the art to make Petitioner’s proposed modification. *See id.* at 65.

We credit Dr. Singhose’s testimony concerning robustness, as it is consistent with the evidence of record. *See, e.g.,* Ex. 1006 ¶¶ 165, 168; Ex. 1005, 1:24–45 (Zarniko disclosing that mechanical sensors such as those like OMM’s grade slope wheel “for sensing the road surfacing can easily be damaged under the rough conditions which normally exist in road repair work.”).

We have considered Patent Owner’s arguments and supporting evidence and determine, on the complete trial record, that the preponderance of the evidence support’s Petitioner’s reasoning with respect to combining OMM and Samuelson. *See* PO Resp. 55–59; PO Sur-reply 21–23. With respect to Patent Owner’s arguments directed to the robustness of OMM’s unmodified sensors, we do not agree with Patent Owner that Zarniko’s filing date being nine years before OMM’s publication date weighs against its express statements concerning a grade slope wheel mechanical sensor and its tendency to be damaged. *See* PO Resp. 56–57. A person having ordinary skill in the art is presumed to be aware of the prior art and would understand that Zarniko is criticizing the type of grade slope wheel disclosed in OMM.

With respect to Mr. Netka’s testimony that he has no personal knowledge of any actual damage occurring to grade slope wheels, Mr. Netka

does testify that “contact grade sensors . . . could be damaged by debris [and] other types of obstacles,” recognizing that that road conditions could damage the sensor. *See* PO Resp. 57 (quoting Mr. Netka’s testimony). The lack of any actual damage in the record is not sufficient to overcome the evidence that a person having ordinary skill in the art would have recognized that a wheel moving along the roadway and connected to the milling machine by a thin rod *could* be damaged, motivating moving the entire sensing apparatus to a hydraulic cylinder. *See* Ex. 1002, 52 (providing an image of the grade slope wheel), 62 (same).

Petitioner’s proposed modification to use the side panels, in conjunction with sensor-integrated cylinders, as grade slope sensors is nothing more than combining the teachings of known elements to yield predictable results. *Cf. KSR*, 550 U.S. at 416 (“The Court recognized that when a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.”).

As for Patent owner’s argument that the grade slope wheel encloses its sensor in a housing just like Samuelson’s sensor, undermining any robustness advantage for the Samuelson sensor, we disagree. *See* PO Resp. 57. The fact that Samuelson teaches that that the *transducer* is protected inside the cylinder is inapposite. Once Samuelson’s teaching is applied to OMM as Petitioner proposes, the sensor configuration becomes OMM’s hydraulic cylinders containing transducers and attached to a floating side panel. Samuelson provides a motivation for including the transducers inside the cylinders. Other motivations, including the express disclosures in SOTA and Zarniko and the advantages of mechanical grade-slope averaging

and sensor averaging, underpins Petitioner’s reasons for its overall modification. In addition, the fact that Samuelson’s approach and the grade slope wheel approach have some commonalities does not undermine Petitioner’s position that Samuelson’s approach is more robust and that the grade slope wheel has more potential damage concerns. *See* Pet. Reply 17; PO Sur-reply 21–22.

Patent Owner points to OMM’s ski as a preferred way to provide grade averaging, but the fact that OMM also had the opportunity to use a ski to measure grade slope, which would provide mechanical grade averaging, does not demonstrate a deficiency in Petitioner’s position. *See* PO Resp. 57–58. As noted above, the side plates are also identified as a possible mechanical grade slope sensor of the machine disclosed in OMM. We also agree with Petitioner that employing the side panels as the mechanical grade slope sensors would provide for grade averaging, such that the machine would not perform overreactive height adjustments because of minor undulations in the ground surface experienced by the grade slope wheel. *See* Pet. 65 (referencing Pet. 38–39); Pet. Reply 19–20 (citing Ex. 1006 ¶ 91); *see also id.* at Pet. 38–39 (citing Ex. 1006 ¶ 91); Ex. 1006 ¶ 91.

As for Patent Owner’s argument that averaging the values from the two sensors would not account for the centerline of the milling drum (PO Resp. 58–59), we find that accounting for the centerline would represent “simple geometry” within the level of ordinary skill. We credit Dr. Singhose’s testimony. *See* Ex. 1006 ¶ 92 (“A [person having ordinary skill in the art] would recognize that . . . the PM-465’s control system would know the position of milling rotor’s centerline relative to the two sensor-integrated cylinders on the side plates (through simple geometry), which

means a grade-averaged value factoring in the centerline of the machine could be used.” (cited at Pet. 39; Pet. Reply 20)).

We also find that Patent Owner’s argument that there is no evidence of actual human error in positioning OMM’s grade slope wheel does not demonstrate a deficiency in Petitioner’s position. We understand Petitioner’s position to be that an operator must position the grade slope wheel and that, under Petitioner’s proposed modification, this manual operation would not be necessary. And, as such, a *potential* avenue for human error is eliminated. *See* Pet. 39 (“Further, using sensor-integrated cylinders as described eliminates the *potential* error caused by humans positioning grade sensors on the machine before milling” (emphasis added)); Ex. 1006 ¶ 92; Pet. Reply 18.

In summary, we determine, on the complete trial record, that Petitioner has provided sufficient reasoning, supported by a preponderance of the evidence, that a person having ordinary skill in the art would have been motivated to modify OMM’s hydraulic cylinders with Samuelson’s sensor-integrated cylinders, and use OMM’s side plates as grade slope sensors, and that the resulting OMM/Sehr/Samuelson combination teaches or suggests all of the limitations of claim 22. *Cf. KSR Int’l Co.*, 550 U.S. at 418 (stating that, to facilitate the analysis of an obviousness position, the proponent should provide “some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”). Based on the foregoing, we find that Petitioner proves by a preponderance of the evidence that claim 22 would have been obvious based on a combination of OMM, Sehr, and Samuelson.

4. *Dependent Claim 23*

Claim 23 depends from claim 22 and further recites

the at least one hydraulic piston and cylinder unit includes a first hydraulic piston and cylinder unit connected to one of the side plates, and a second hydraulic piston and cylinder unit connected to the stripping plate, and the integrated path sensing systems provide path sensing signals relative to the machine frame to the controller for computing a current milling depth.

Ex., 1001, claim 23.

Petitioner argues that its combination teaches the additional limitations of claim 23 once the PM-465 hydraulic cylinders are replaced by Samuelson’s sensor-integrated cylinders, with two cylinder units on each side plate, which each including an integrated path sensing system. Pet. 65 (citing Ex. 1006 ¶¶ 170–171). Petitioner contends that the proposed combination “also discloses a second hydraulic piston and cylinder unit connected to the stripping plate” because “OMM discloses a moldboard (i.e., ‘stripping plate’) with two height-adjustable cylinders that raise and lower it.” *Id.* at 65–66. Petitioner also asserts that cylinders modified with Samuelson’s design “would include an integrated path sensing system and provide signals.” *Id.* at 66 (citing Ex. 1006 ¶¶ 172–173).

Patent Owner argues that the “Petition fails to allege all elements of claim 23 by failing to allege that the proposed combination would disclose or teach sensor-integrated cylinders attached to the stripping plate.” PO Resp. 60. Patent Owner asserts that claim 23 requires a “hydraulic piston and cylinder unit” that “includes (1) a first unit connected to one of the side plates and (2) a second unit connected to the stripping plate” while claim 22 requires “the hydraulic piston and cylinder unit including an integrated path sensing system.” *Id.* According to Patent Owner, “the claim requires a

sensor-integrated cylinder to be attached to the stripping plate” but the “Petition merely alleges that the PM-465 had hydraulic cylinders that attached to the stripping plate and does not allege any modification to the stripping plate.” *Id.* (citing Pet. 48–51, 61–66).

In its Reply, Petitioner argues that “neither claim 22 nor claim 23 (which depends from claim 22) requires ‘a sensor-integrated cylinder to be attached to the stripping plate.’” Pet. Reply 21. In Petitioner’s view, “claim 22’s disjunctive ‘or’ means the ‘at least one hydraulic piston and cylinder unit’ can be ‘arranged to lift and lower at least one of the side plates’ but need not be arranged to also lift and lower the stripping plate.” *Id.*

In its Sur-reply, Patent Owner argues that “claim 23 recites ‘the integrated path sensing systems,’ plural, for providing signals to compute a milling depth.” PO Sur-reply 23. In Patent Owner’s view, “[u]se of the plural refers to the claimed cylinder-integrated path sensing system of ‘one of the side plates’ and of ‘the stripping plate.’” *Id.* Patent Owner contends that Petitioner admits that it “has not addressed the limitation requiring the cylinder-integrated path sensing system of the stripping plate.” *Id.*

The dispute here concerns the interpretation of claim 23, read in light of claim 22 from which it depends. Petitioner does not assert that it proposes using Samuelson’s sensor-integrated cylinders to both connect the side plates and connect the stripping plate; Petitioner contends that claim 23 only requires connecting one of those structures with a sensor-integrated cylinder that provides a path sensing system due to the “or” in claim 22. *See* Pet. Reply 21. Patent Owner contends that the cylinder unit connected to the side plate *and* the stripping plate must include Samuelson’s sensor-

integrated cylinders because both must provide integrated path sensing systems. *See* PO Sur-reply 23.

Based on our review of the record, Patent Owner has the stronger position. Claim 23 refers to “the integrated path sensing systems provide path sensing signals” and the parties appear to agree that Samuelson’s sensor-integrated cylinders provide path sensing systems, but the PM-465’s existing cylinders do not. *See* Pet. Reply 21; PO Sur-reply 23. Because claim 23 refers to the integrated path sensing “systems” in plural form, it supports Patent Owner’s position that two such systems are required by claim 23. Petitioner relies on the “or” in claim 22, but the broader claim 22 does not define the number of path sensing systems in the narrower claim 23. *See* Pet. Reply 21. Instead, the “or” merely reinforces that claim 22 only requires “at least one” unit “arranged to lift and lower at least one of the side plates or the stripping plate,” and claim 22 requires only one integrated path sensing system. *See* Ex. 1001, claim 22. Claim 23, on the other hand, requires piston and cylinder units connected to both a side plate and the stripping plate, and integrated path sensing systems associated with both of those units. *See id.* at claim 23. Accordingly, Petitioner’s failure to allege that Samuelson’s sensor-integrated cylinders are used to connect both a side plate and the stripping plate means that Petitioner’s proposed combination cannot satisfy all of the limitations of claim 23. *See* Pet. 65–66 (relying on OMM’s existing cylinders attached to the moldboard/stripping plate, not Samuelson’s design); PO Sur-reply 23.

Based on the foregoing, we find that Petitioner has not proved by a preponderance of the evidence that claim 23 would have been obvious based on a combination of OMM, Sehr, and Samuelson.

5. Dependent claims 16 and 26

Claims 16 and 26 depend from claim 1. *See* Ex. 1001, claims 16, 26. Petitioner argues that the combination of OMM, Sehr, and Samuelson teaches or suggests all of the limitations of claims 16 and 26. Pet. 59–60, 66–68. Petitioner points to the aspects of the proposed combination that teach or suggest each claim limitation, and cites to its expert testimony for support. *See id.*

Aside from the arguments already addressed above, Patent Owner does not address Petitioner’s arguments and evidence as to these claims or argue that the proposed combination does not disclose any of these limitations. *See* PO Resp. 18–61. We find Petitioner’s arguments and evidence as to claims 16 and 26 persuasive, and adopt Petitioner’s argument and evidence as our own.¹³ *See* Pet. 59–60, 66–68.

E. Obviousness of Claims 1 and 12 Based on OMM, Sehr, and Matsuda

Petitioner asserts that claims 1 and 12 would have been obvious over OMM, Sehr, and Matsuda. *See* Pet. 68–79. Petitioner provides a rationale for combining the references as well as a limitation-by-limitation analysis of

¹³ Aside from adopting Petitioner’s arguments and evidence as our own, we do not set forth separate formal findings as to Petitioner’s undisputed assertions. *See In re NuVasive, Inc.*, 841 F.3d 966, 974 (Fed. Cir. 2016) (“Although the Board did not make findings as to whether any of the other claim limitations (such as fusion apertures or anti-migration teeth) are disclosed in the prior art, it did not have to: NuVasive did not present arguments about those limitations to the Board. . . . The Board, having found the only disputed limitations together in one reference, was not required to address undisputed matters.”); Paper 13, 9 (“Patent Owner is cautioned that any arguments not raised in the response may be deemed waived.”).

claims 1 and 12. *See id.* Claim 12 depends from claim 1. *See* Ex. 1001, claim 1. Petitioner's allegations as to claim 12 build off of and depend on the success of its allegations as to claim 1. *See* Pet. 68–79. Although we already found claim 1 unpatentable based on Petitioner's previous challenge, to find claim 12 unpatentable based on a combination of OMM, Sehr, and Matsuda we would need to determine whether that same combination renders claim 1 obvious. We need not reach that issue, however, because, for the reasons provided below, we find that Petitioner has not proven that claim 12 would have been obvious even if claim 1 would have been obvious.

Claim 12 recites:

12. The road milling machine of claim 1, wherein:
the ground engaging supports comprise track assemblies; and
the at least one ground engaging sensor comprises at least one of the track assemblies and further comprises *a relative angle detector configured to detect a relative angle* between at least one of the lifting columns extending orthogonally to the frame and the track assembly associated with the at least one of the lifting columns when the track assembly engages and extends parallel to the ground surface.

Ex. 1001, claim 12 (emphasis added).

Petitioner's analysis of claim 12 refers back to similar limitations in claim 1. *See* Pet. 79 (citing previous arguments addressing claim elements 1b, 1g, and 1h and Ex. 1006 ¶¶ 226–228). As part of its motivation to combine argument, Petitioner argues that

A POSITA . . . would have been motivated to use Matsuda's pivoting tracks and associated track-angle sensors to provide the means to achieve and maintain that track orientation. Matsuda's track rotary encoder provides the rotational position or angle of the track relative to the component it is fixed to (in the case of Matsuda, the machine body). A POSITA would have understood

that when such a track and associated rotary encoder was incorporated into the PM-465 described in OMM, the track would rotate (up or down vertically) relative to the lifting column (as in the PM-465) and the rotary encoder would correspondingly provide the angle of the track relative to the lifting column.

Pet. 73 (citations to Ex. 1006 ¶ 217 omitted). When addressing the claim limitations, Petitioner argues that “Matsuda’s tracks and rotary encoders are ‘at least one ground engaging sensor’ as they are sensors that include a sensing element (rotary encoder) that contacts the ground through the track and produces a signal indicating a position of the sensing element.” *Id.* at 78 (citing Ex. 1006 ¶ 223). Petitioner also argues that implementing Matsuda’s track angle sensor into the tracks of the PM-465 “would provide the angle of the tracks relative to the lifting column extending orthogonal to the frame.” *Id.* (citing Ex. 1006 ¶ 224).

Patent Owner argues that (1) Matsuda’s disaster recover robot is not analogous art; (2) the Petition fails to explain how a POSITA would have modified the PM-465 to replace its hydraulically-driven tracks with Matsuda’s mechanical tracks; (3) a POSITA would not have looked to Matsuda’s robot to modify OMM and Sehr; and (4) the Petition fails to support its proposed modifications. *See* PO Resp. 65–76. We focus on aspects of Patent Owner’s second argument because we find it dispositive. *See id.* at 69–73. Patent Owner contends that the “Petition has not explained how a POSITA would have replaced PM-465’s hydraulically driven tracks with Matsuda’s mechanically driven tracks, let alone contemplated any modifications necessary to arrive at the claimed invention.” *Id.* at 69; *see also id.* at 70–72 (explaining how the PM-465 and Matsuda designs work and differ). Patent Owner asserts that the “Petition does not explain how ‘Matsuda’s pivoting tracks and associated track-angle sensors’ would have

been incorporated at the bottom of PM-465's legs to arrive at the claimed invention." *Id.* at 72. According to Patent Owner, the Petition's failure to explain "whether its proposed combination utilizes Matsuda's 'driving shaft' or PM-465's propel pump and hydraulic motors" "is dispositive, particularly where Matsuda's rotary encoder implementation requires Matsuda's mechanical drive to detect track rotation." *Id.* at 72–73 (citing Ex. 2020 ¶¶ 223–225).

In its Reply, Petitioner argues that it never argued that a POSITA would remove OMM's entire hydraulic system and replace it with Matsuda's mechanical system for driving tracks. Pet. Reply 24. Such "wholesale incorporation of Matsuda's mechanical drive system and motor" would not have been necessary, according to Petitioner, because "the PM-465 already had pivoting tracks." *Id.* at 25 (emphasis omitted). Petitioner contends that it "did not rely on Matsuda's mechanical motor" and that "Matsuda discloses that its encoder is attached to a pivot shaft, which Dr. Lumkes agreed is the shaft about which the track pivots." *Id.* (citing Ex. 1071, 175:9–176:10). Petitioner further contends that "[a] road-milling machine's pivoting tracks would have a similar pivot point" and that the "Petition identified the pivot pin about which the PM-465's track pivots." *Id.* (citing Ex. 1006 ¶ 217; Pet. 73–74). Petitioner also asserts that Matsuda's "motor is not required to use its encoder." *Id.* (citing Ex. 1071, 178:10–179:9).

In its Sur-reply, Patent Owner argues that Petitioner improperly shifts its position in its Reply by "associating a rotary encoder with the 'pivot pin' of PM-465's tracks." See PO Sur-reply 23–24. Patent Owner contends that the Petition "does not identify a pin, and Dr. Singhose's identification of a

pin was limited to a parenthetical supporting the proposition that “[i]t was well known in the art to have tracks on milling machines capable of pivoting up and down.” *Id.* at 24 (citing Ex. 1006 ¶ 217). According to Patent Owner, the “Petition never proposed implementing rotary encoders on the pins of PM-465’s tracks.” *Id.* Patent Owner views Petitioner’s belated attempt to introduce this argument for the first time in its Reply as improper and argues that we should not consider the argument. *Id.*

Patent Owner also argues that Petitioner’s new argument “fails to explain how a POSITA would have incorporated Matsuda’s rotary encoders into the PM-465.” *Id.* at 24. Patent Owner contends that “Matsuda’s track is rigidly fixed to the pivot shaft” while the PM-465’s “tracks rotate relative to the pins.” *Id.* at 25. Based on these differences, Patent Owner asserts that Petitioner’s proposed combination would not work: “[a] rotary encoder like Matsuda’s detects angular position by measuring shaft rotation” and “[b]ecause the PM-465 ‘pivot pin’ does not rotate, a rotary encoder like Matsuda’s would not detect any relative angle.” *Id.* at 27.

We agree with Patent Owner that Petitioner’s arguments in its Reply depart in significant ways from the Petition. The Petition sets forth reasons to combine Matsuda with OMM, but provides scant detail as to the nature of the resulting combination and how Matsuda’s mechanical system would work OMM’s hydraulic system. *See* Pet. 73–74. Even if Petitioner did not intend a “wholesale incorporation of Matsuda’s mechanical drive system and motor” into OMM, under these circumstances, more detail was necessary to explain which parts of Matsuda would be used in the resulting combination if less than all of the mechanical system was necessary, and how those parts would work together. Pet. Reply 25; PO Resp. 69–73.

Petitioner attempts to supply some of that missing explanation in its Reply, but in doing so relies on “the pivot pin about which the PM-465’s track pivots” when attempting to explain how the Matsuda’s encoder, but not its motor, would be incorporated into the PM-465. *See* Pet. Reply 25. Petitioner was making the argument that both Matsuda’s encoder and a road milling machine like the PM-465 would have tracks that pivot around a point. *See id.* Petitioner alleges that the Petition “identified the pivot pin,” but it did not. *See id.* (citing Pet. 73–74; Ex. 1006 ¶ 217). The cited portion of the Petition at pages 73 to 74 never mentions the pivot pin. *See* Pet. 73–74. The cited expert testimony mentions the pivot pin in a parenthetical addressing a parts manual, but only to support the position that in the PM-465, “the crawler tracks can pivot up and down.” Ex. 1006 ¶ 271 (citing Ex. 1009, 332–348, 378–381). The cited testimony does not try to make the new argument in the Reply based on the similarity between Matsuda’s encoder pivot point and the pivot point in the PM-465. *See id.*; Pet. Reply 25. Under these circumstances, where the Reply introduces a new argument relying on structure never identified in the Petition, and based on a “state-of-the-art reference” only cited in an expert declaration, we decline to consider the new argument. *See Wasica Fin. GmbH v. Cont’l Auto. Sys., Inc.*, 853 F.3d 1272, 1286–87 (Fed. Cir. 2017).

Moreover, even if we did consider Petitioner’s argument, Patent Owner’s Sur-reply credibly points to a number of unresolved questions that remain as to the nature of Petitioner’s proposed combination and whether it would work. For example, given that “Matsuda’s track is rigidly fixed to the pivot shaft” while the PM-465’s “tracks rotate relative to the pins,” according to Patent Owner, more explanation was necessary to establish that

adding Matsuda's encoder to the PM-465 would result in an operable machine that could detect relative angles as Petitioner intends. *See* PO Sur-reply 24–25. Patent Owner asserts that Petitioner's proposed combination would not work. *See id.* 27. We do not view the record as sufficiently developed on these issues to make that determination, in part because the issue was raised too late by Petitioner, but the presence of these unresolved issues underscores the lack of argument and evidence explaining the nature of the combination in the Petition and the failure of Petitioner to meet its burden here.

Based on the complete record, we find that Petitioner has not proved by a preponderance of the evidence that claim 12 would have been obvious based on a combination of OMM, Sehr, and Matsuda.

CONCLUSION¹⁴

We determine that Petitioner has shown that claims 1, 15, 16, 22, and 26 are unpatentable and has not shown that claims 12 or 23 are unpatentable.

¹⁴ Should Patent Owner wish to pursue amendment of the Challenged Claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding, 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. §§ 42.8(a)(3), (b)(2).

In summary:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 15, 16, 22, 23, 26	103(a)	OMM, Sehr, Samuelson	1, 15, 16, 22, 26	23
1, 12	103(a)	OMM, Sehr, Matsuda		12
Overall Outcome			1, 15, 16, 22, 26	12, 23

ORDER

Accordingly, it is:

ORDERED that Petitioner has proven by a preponderance of the evidence that claims 1, 15, 16, 22, and 26 of U.S. Patent No. 8,424,972 B2 are unpatentable;

FURTHER ORDERED that Petitioner has not proven by a preponderance of the evidence that claims 12 or 23 of U.S. Patent No. 8,424,972 B2 are unpatentable;

FURTHER ORDERED that, pursuant to 35 U.S.C. § 318(b), upon expiration of the time for appeal of this decision, or the termination of any such appeal, a certificate shall issue canceling claims 1, 15, 16, 22, and 26 of U.S. Patent No. 8,424,972 B2; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2022-01310
Patent 8,424,972 B2

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