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571-272-7822

Entered: February 25, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TETRA TECH CANADA INC.,
Petitioner,

v.

GEORGETOWN RAIL EQUIPMENT COMPANY,
Patent Owner.

IPR2019-01581
Patent 8,081,320 B2

Before HUBERT C. LORIN, JENNIFER S. BISK, and KRISTINA M. KALAN, *Administrative Patent Judges*.

BISK, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Tetra Tech Canada Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–17 of U.S. Patent No. 8,081,320 B2 (Ex. 1001, "the '320 patent"). Paper 1 ("Pet."). Georgetown Rail Equipment Company ("Patent Owner"), identified as the owner of and real party in interest to the '320 patent (Paper 5, 2), did not file a Preliminary Response.

Institution of an *inter partes* review is authorized by statute when "the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a) (2012). Based on our review of the record, we conclude that Petitioner is reasonably likely to prevail with respect to each of the challenged claims.

II. BACKGROUND

A. Related Matters

The parties identify a district court case in which the '320 patent was previously asserted, but later was withdrawn from the proceeding. Pet. 5; Paper 5, 2. Petitioner adds that related patents, U.S. 7,616,329 (the "'329 patent") and U.S. 9,441,956 (the "'956 patent") remain in that proceeding. Pet. 5. In addition, Canadian national stage entries of the '320 and '329 patents were the subject of Canadian litigation. Pet. 4. Finally, Petitioner notes that both the '329 and '956 patents, as well as related patent U.S. 8,209,145, are the subject of petitions for *inter partes* review. *Id.* at 5 (citing IPR2019-00619, IPR2019-00620, IPR2019-00662, and IPR2019-01409).

B. The '320 Patent

The '320 patent, titled "Tilt Correction System and Method for Rail Seat Abrasion," issued December 20, 2011. Ex. 1001, [codes (45), (54). The '320 patent relates generally to inspecting railroad surfaces. *Id.* at 1:26–29. In particular, the '320 patent addresses the problem of rail seat abrasion, which is wear at the point of a railroad track where the two parallel rails are attached to the crossties. *Id.* at 1:52–59. According to the '320 patent, previous methods of measuring and monitoring this wear "have proved either unreliable, hazardous, labor-intensive, requiring extensive equipment installation, or having a major impact on the availability of railroads to train traffic." *Id.* at 2:6–12.

In response to these difficulties, the '320 patent describes a railroad inspection vehicle with mounted lasers, cameras, and processors that take precise measurements of the height of the rail and the tie. *Id.* at 2:22–42. The '320 patent then describes "adjusting these measurements for any expected tilt encountered." *Id.*

The '320 patent describes an example of determining the wear of the rails using image data. Figures 7A and 7B are reproduced below.

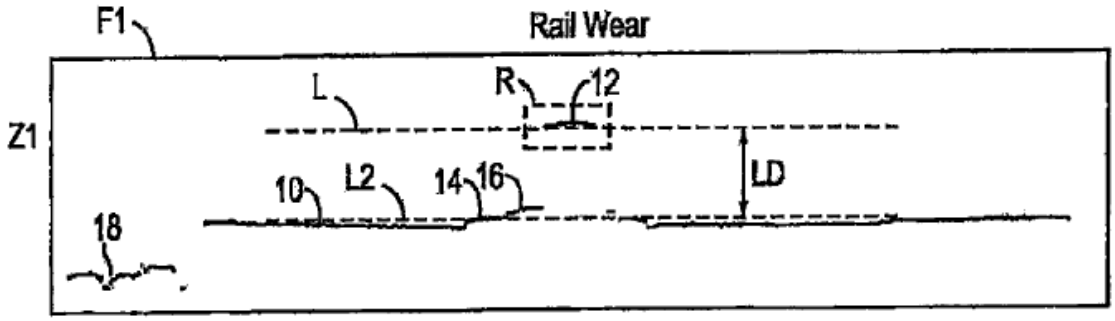

FIG. 7A

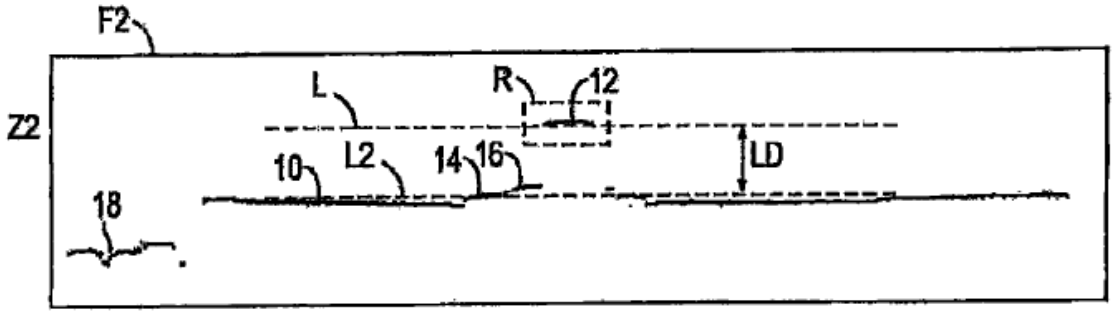

FIG. 7B

Figures 7A and 7B, above, "illustrate example [image data] frames of railroad track obtained with the disclosed inspection system for determining wear of the rail." *Id.* at 3:4–6. Figure 7A shows frame F1 at position Z1 along the track, and Figure 7B shows frame F2 at position Z2. *Id.* at 9:35–39, 9:43–44, 9:51–52. Each frame shows rail 12 lying within a region of interest R and at a level L above a reference level L2, which may be the height of a tie plate—measurement LD. *Id.* at 9:43–47. Figure 7B shows that "[a]t position Z2, the distance LD is less between the contour of the rail 12 and level L2 than at position Z1" and "[t]hus, frame F2 may indicate wear of the rail 12 at the position Z2 along the track." *Id.* at 9:52–55.

Using data such as that shown in Figures 7A and 7B, the '320 patent explains that "rail seat abrasion may be predicted with a high level of accuracy" using "algorithms that adjust for vehicle tilt." *Id.* at 12:49–53. Vehicle tilt occurs when inspection system 30 moves through curves or

bends in the track resulting in "a suspension lean of the system 30" and "the railroad track itself leaning either to the left or right in the field of the cameras." *Id.* at 12:53–59. Figure 17 is reproduced below.

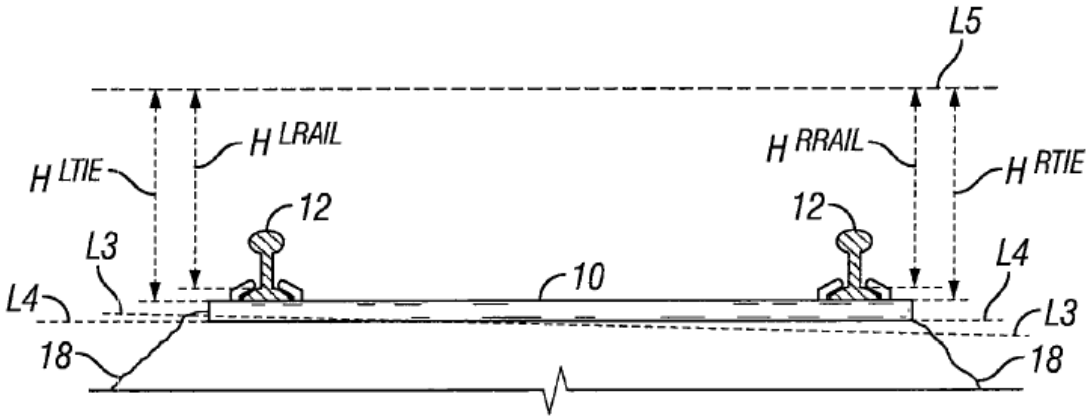

FIG. 17

Figure 17, above, "illustrates a profile image of a rail road track tilted [within a curve] according to an exemplary embodiment of the present invention." Ex. 1001, 3:27–29. In Figure 17, "left and right rails 12 are illustrated laying atop concrete tie 10." *Id.* at 12:66–13:1. "Line L3 represents level ground" and line L4 shows the angular tilt of cross ties 10. *Id.* at 13:1–5. To determine whether rail seat abrasion is present, height measurement of each rail is taken, however, a tilt in the camera may cause one rail to appear higher than another. For example, in Figure 17, because the track is tilting slightly to the left, "the height of right rail 12 would appear taller then left rail 12, resulting in skewed data measurements." *Id.* at 13:5–10. The '320 patent states that empirical and mathematical research has determined that a standard tilt correction factor of 0.12 is incorporated into algorithms to adjust for tilt. *Id.* at 13:11–17. Figure 18, "a flow chart illustrating a method of determining rail seat abrasion," is reproduced below. *Id.* at 3:30–31.

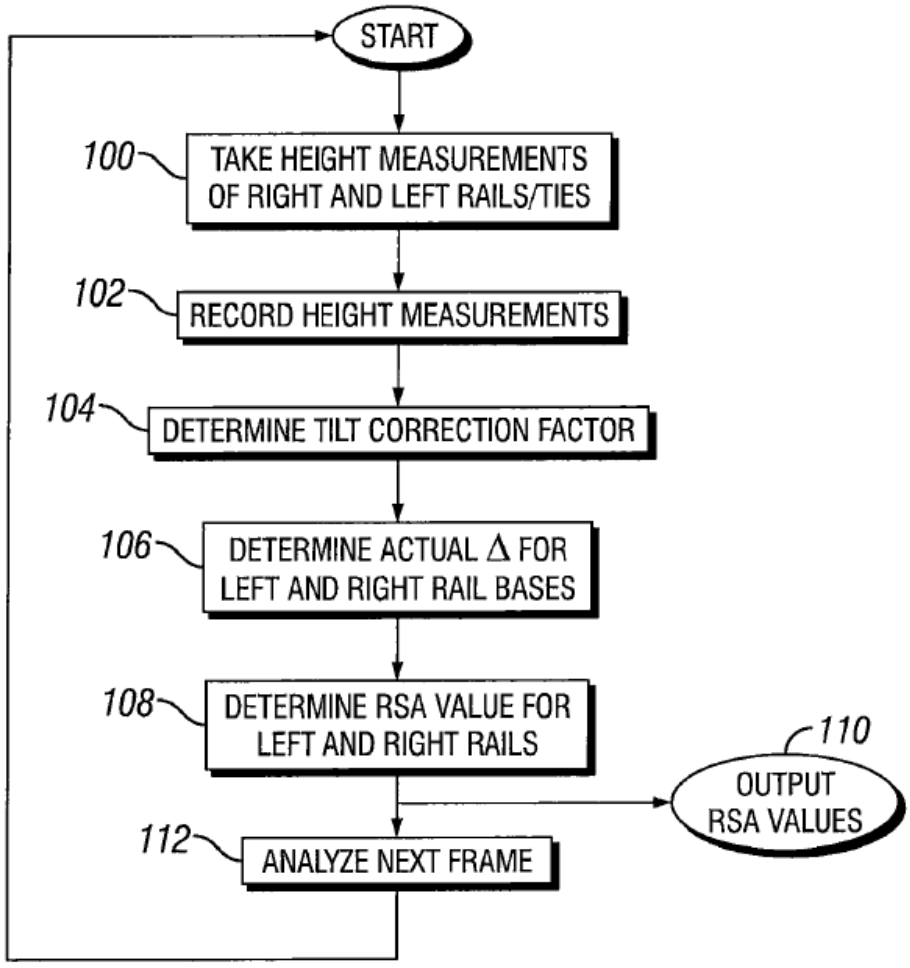

FIG. 18

Figure 18, above, shows a flow chart for a tilt correction algorithm. *Id.* at 13:18–20. Step 100 describes taking measurements of the rail base height of each rail from the image data received from the cameras and, in step 102, the inspection system records those measurements. *Id.* at 13:18–44. In step 104, the inspection system derives the tilt correction factor and step 106 determines the actual difference between the right and left rail bases. *Id.* at 13:45–60. Finally, in step 108, the rail seat abrasion value for the right and left rail bases is determined, after which those values are output

(step 110) and the next frame is analyzed (step 112) using the algorithm starting in step 100. *Id.* at 13:61–14:13.

C. Illustrative Claim

Claims 1, 7, and 12 are independent. Claim 1 is illustrative of the subject matter at issue and reads as follows:

> 1. [preamble] A system for determining rail seat abrasion of a rail road track, the system comprising:
>
> [a] at least one light generator positioned adjacent the rail road track, the light generator adapted to project a beam of light across the rail road track;
>
> [b] at least one camera positioned adjacent the rail road track for receiving at least a portion of the light reflected from the rail road track and for generating at least one image representative of a profile of at least a portion of the rail road track;
>
> [c] at least one processor adapted to perform the steps comprising:
>
> [d] analyzing the at least one image; and
>
> [e] determining whether rail seat abrasion is present along the rail road track,
>
> [f] wherein, when determining whether rail seat abrasion is present, the at least one processor compensates for a tilt of the rail road track.

Ex. 1001, 15:38–55 (bracketing added consistent with Petitioner's analysis of claim limitations "[preamble]–[f]"; *see* Pet. 32–54).

D. Proposed Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability, each based

on 35 U.S.C. § 103(a)[1]:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1, 2, 5–7, 10–13, 16, 17	103	Villar,[2] Choros, [3] Casagrande, [4] and Szwilski[5]
3, 8, 14	103	Villar, Choros, Casagrande, Szwilski, and Khattak[6]
4, 9, 15	103	Villar, Choros, Casagrande, Szwilski, and Andersson[7]

Pet. 8, 19–63. Petitioner also relies on the Declaration of Nikos Papanikolopoulos, Ph.D. (Ex. 1004).

III. ANALYSIS

A. Level of Skill in the Art

The level of skill in the art is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *See Al-Site Corp. v. VSI Int'l, Inc.*, 174 F.3d 1308, 1323 (Fed. Cir. 1999) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966)). The level of skill in

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[1] Because the application from which the '320 patent issued was filed before March 16, 2013, the effective date of the relevant amendment, he pre-AIA version of § 103 applies. The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103.
[2] U.S. 2006/0017911 A1 (published Jan. 26, 2006) (Ex. 1005).
[3] John Choros et al., *Prevention of Derailments due to Concrete Tie Rail Seat Deterioration*, 2007 ASME/IEEE Joint Rail Conference & Internal Combustion Engine Spring Technical Conference (2007) (Ex. 1007, 4–17).
[4] U.S. 2003/0140509 A1 (published July 31, 2003) (Ex. 1008).
[5] WO 2005/036199 A2 (published Apr. 21, 2005) (Ex. 1009).
[6] U.S. 4,899,296 (issued Feb. 6, 1990) (Ex. 1010).
[7] U.S. 5,787,815 (issued Aug. 4, 1998) (Ex. 1011).

the art also informs the claim construction analysis. *See Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 135 S. Ct. 831, 841 (2015) (explaining that claim construction seeks the meaning "a skilled artisan would ascribe" to the claim term "in the context of the specific patent claim" (emphasis omitted)). Petitioner asserts that a person of ordinary skill in the art "would have a bachelor's degree in electrical engineering, computer engineering, mechanical engineering, computer science, physics, or a related field, and at least four years of experience (or the academic equivalent) in the field of computer or machine vision." Pet. 16–17 (citing Ex. 1004 ¶ 29). Because Patent Owner did not file a Preliminary Response, Patent Owner does not offer an alternate contention.

We determine that it is unnecessary to ascribe a particular level of skill in deciding the relevant issues in this case at this time. We see no reason why the level of ordinary skill in the art is not adequately reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978).

B. Claim Construction

For petitions filed on or after November 13, 2018, such as the one in this case, we interpret claims in the same manner used in a civil action under 35 U.S.C. § 282(b), "including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b) (2019). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the

controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

Petitioner does not offer any constructions for any terms of the challenged claims, and indicates that "[t]he terms from the claims of the '320 patent should be given their plain and ordinary meaning." Pet. 17. Having filed no response, Patent Owner does not offer any constructions of its own.

At this time, we determine that no express construction of any terms of the challenged claims is necessary. We note that this determination does not preclude the parties from arguing any proposed constructions of the claims during trial. Indeed, the parties are hereby given notice that claim construction, in general, is an issue to be addressed at trial. A final determination as to claim construction will be made at the close of the proceeding, after any hearing, based on all the evidence of record. The parties are expected to assert all of their claim construction arguments and evidence in the Petition, Patent Owner's Response, Petitioner's Reply, or otherwise during trial, as permitted by our rules.

C. Claims 1, 2, 5–7, 10–13, 16, and 17

Petitioner contends that claims 1, 2, 5–7, 10–13, 16, and 17 of the '320 patent are unpatentable, because their subject matter would have been obvious over the combined disclosures of Villar, Choros, Casagrande, and Szwilski. Pet. 20–63. At this stage of the proceeding, Patent Owner does not address Petitioner's arguments and evidence that the combination of Villar, Choros, Casagrande, and Szwilski renders the claims obvious. Thus, we choose claim 1 as a representative claim for the focus of our analysis below. For the reasons that follow, we determine that Petitioner

establishes a reasonable likelihood that it would prevail in showing that claim 1 would have been obvious to one of ordinary skill in the art in view of the combination of Villar, Choros, Casagrande, and Szwilski.

1. *Overview of Villar*

Villar is titled "System and Method for Inspecting Railroad Track." Ex. 1005, code (54). The named inventors of Villar—Christopher M. Villar, Steven C. Orrell, and John Anthony Nagle, II—are the same as those named in the '320 patent, and both Villar and the '320 patent claim priority to U.S. provisional application No. 60/584,769, filed June 30, 2004.[8] Ex. 1001, code (60); Ex. 1005 ¶ 1. In fact, Villar and the '320 patent appear to share much of the same written description, and Villar's twelve figures appear to be identical to the first twelve figures of the '320 patent. *Compare* Ex. 1001 Figs. 1–12 and 1:24–10:52 *with* Ex. 1005 Figs. 1–12 and ¶¶ 1–56. Petitioner explains that "[b]ecause the application which matured into [U.S. 7,516,329] published more than one year before the filing date of the '320 patent, the '329 patent's application publication (*Villar*) is prior art to the '320 patent." Pet. 6–7 n.4 (citing *In re Chu*, 66 F.3d 292, 297 (Fed. Cir. 1995); *Santarus, Inc. v. Par Pharm., Inc.*, 694 F.3d 1344, 1352 (Fed. Cir. 2012)). At this point in the proceeding, Patent Owner has not made any arguments to the contrary.

[8] The '320 patent is a continuation-in-part of application No. 12/465,473, filed on May 13, 2009, which is a continuation-in-part of application No. 11/172,618, filed on June 30, 2005, now Patent No. 7,616,329 (the "'329 patent"). The '329 patent also claims priority to provisional application No. 60/584,769, filed June 30, 2004. U.S. 7,616,329 B2, code (60).

Specifically, Villar describes a system, similar to the '320 patent's railroad inspection vehicle system, with mounted lasers, cameras, and processors that can analyze the captured images to determine various measurable aspects of the railroad track. Ex. 1005 ¶ 8. Villar also describes the example in the '320 patent of determining the wear of rails using image data. Ex. 1005 Figs. 7A, 7B, ¶¶ 17, 50. Villar, however, does not explicitly discuss rail seat abrasion or contain a description of algorithms that adjust for vehicle tilt, as does the '320 patent. *See* Ex. 1001 Figs. 17, 18, 12:49–14:14.

2. *Overview of Choros*

Choros is titled "Prevention of Derailments Due to Concrete Tie Rail Seat Deterioration." Ex. 1007, 7. It describes "research on rail seat abrasion/deterioration [(RSA)] and methods to measure and prevent derailments." *Id.* Choros describes collecting data using "geometry cars" or inspectors using "an abrasion measurement gauge." *Id.* at 11; *see also id.* at 13 ("As measurement methodologies improve, either from automated inspection vehicles or hand held devices, then the curve given in Figure 9 and values in Table 2 can be adjusted to reflect the new field data.").

Figure 8, reproduced below, shows "rail rotation due to rail seat abrasion . . . for the five possible cases of concrete tie rail seat abrasion that are found in high curvature track." *Id.* at 11.

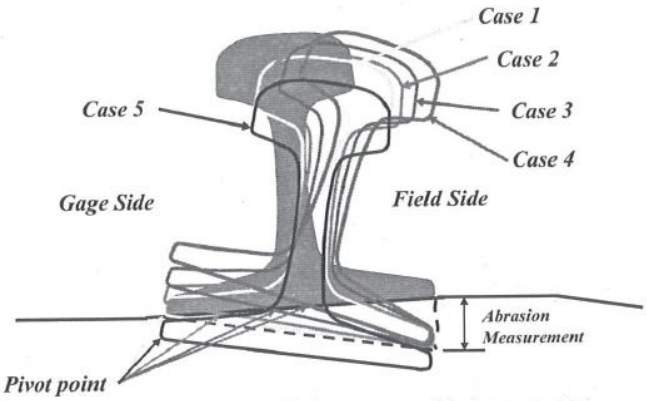

Figure 8. Five possible cases of concrete tie abrasion.

Figure 8, above, shows a rail with the left labeled "Gage Side" and the right labeled "Field Side." *Id.* at 12. It labels five cases (labeled "Case 1" through "Case 5") of potential abrasion measurements taken at the field side between the rail base and the concrete tie, with each case showing an outline of the associated rotation of the rail due to the RSA. *Id.* at 11. "Two readings are required one on each side of the concrete tie as viewed from the field side to the centerline of the track." *Id.* In addition, the label "Pivot point" on the lower left of the rail shows the related pivot point for each of the five cases and the label "Abrasion Measurement" shows the amount of displacement between the rail and tie. *Id.* at 12.

Table 1 provides a description of each of the five cases shown in Figure 8 (*id.* at 11–12) and Table 2 describes maximum abrasion for various classes of track found on the track safety standards for case 4, the worst case scenario (*id.* at 13–14).

3. *Overview of Casagrande*

Casagrande is titled "Apparatus for Monitoring the Rails of a Railway or Tramway Line." Ex. 1008, code (54). It describes "[a] laser apparatus

for monitoring the rails of a railway or tramway line" mounted on a railway carriage to monitor wear of the rail. *Id.* at code (57), ¶ 9. The measurement devices described by Casagrande are able to gather data that allow the processor unit to calculate various parameters of the track, including the gauge, the radius of curvature, the horizontal alignment, the vertical alignment, and the skew. *Id.* Fig. 5, ¶¶ 30–35. Casagrande also describes compensating "for the errors due to elastic deformation of the railway or tramway carriage." *Id.* ¶ 36. Specifically, Casagrande states that "[l]ack of alignment results in a signal which by means of suitable software is able to automatically compensate the resultant measurement errors." *Id.*

4. *Overview of Szwilski*

Szwilski is titled "Railroad Surveying and Monitoring System." Ex. 1009, code (54). It discloses a system mounted on a mobile platform for "surveying, monitoring, and analyzing rail position and superstructure and terrain substructure of railroad tracks or other structures" to "monitor track displacements during track inspection in real time." *Id.* at code (57). Szwilski states: "Position data of the rail will not be accurate if there is inclination of the track 120a, b, unless the vertical error 310 and the horizontal error 312 is accounted for." *Id.* at 18.[9] Figure 3, reproduced below, "shows a cross-section view of a preferred mobile platform 102 and

[9] For purposes of this Decision, we refer to the page numbers on the bottom left of Exhibit 1009.

demonstrates the vertical error 310 and horizontal error 312 due to track inclination." *Id.*

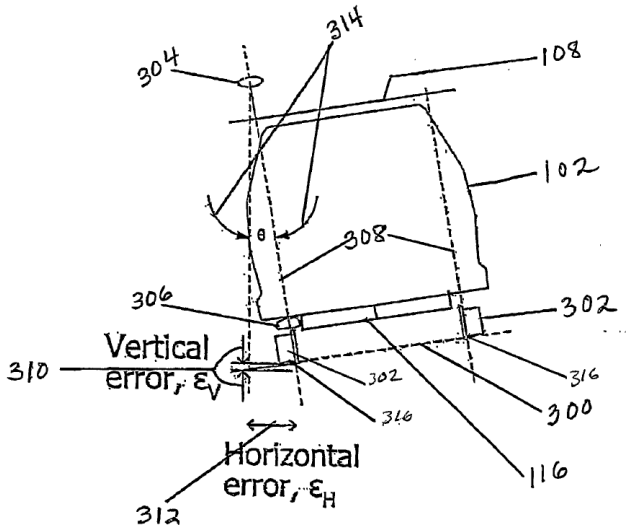

Figure 3

Figure 3 shows "track inclination angle Θ 314 of the cross level 300 of the track 120a,b," which "can be determined by basic application of trigonometry." *Id.* at 18. On the left side of Figure 3, 310 is labeled "Vertical error, ε_v" and 312 is labeled "Horizontal error, ε_H" due to track inclination or lift. *Id.* Fig. 3. Figure 3 also shows mobile platform 102 comprising wheels 302 to roll along rails 120a,b, of the track. Szwilski discloses that the system can be used for "determining rail displacement 234 or other rail 120a,b defects and for even non-railroad applications." *Id.* at 22.

5. *Independent Claim 1*

Petitioner relies on Villar for teaching or suggesting the preamble and limitations (a) through (d) of claim 1. Pet. 32–37. Because Villar does not explicitly discuss RSA, Petitioner relies on Choros for teaching or suggesting limitation 1(e)—"determining whether rail seat abrasion is

present along the rail road track." *Id.* at 37–45. According to Petitioner, "one of ordinary skill in the art would have understood that *Choros* discloses measuring RSA at each of the left rail/tie . . . and right rail/tie . . . seats." *Id.* at 38 (citing Ex. 1007 Fig. 8; Ex. 1004 ¶ 65). Petitioner adds that it would have been obvious "to implement *Villar's* automated railroad track inspection vision system with *Choros*'s method of measuring RSA (i.e., measuring a vertical distance between rail base and crosstie top surface heights) to automatically determine whether RSA is present along a railroad track." *Id.* at 39 (citing Ex. 1004 ¶ 66). Petitioner goes on to provide detailed analysis of how and why a person of ordinary skill in the art would have combined the two systems. *Id.* at 39–45. For example, Petitioner cites Villar as teaching that "[e]valuating and comparing contour features of an image to determine potential defects through various image processing tools . . . was well-known and within the skill of one of ordinary skill in the art at the relevant time." *Id.* at 41 (quoting Ex. 1004 ¶ 70) (citing Ex. 1005 ¶¶ 43, 47, 52, 55).

Because neither Villar nor Choros explicitly discusses compensating for a tilt of a railroad vehicle when determining whether RSA is present, Petitioner relies on Casagrande and Szwilski for teaching or suggesting limitation 1(f)—"wherein, when determining whether rail seat abrasion is present, the at least one processor compensates for a tilt of the railroad track." *Id.* at 46–54. Petitioner contends that a person of ordinary skill in the art would understand that Casagrande's system "detects a vertical alignment error between each triangulation reading device caused by, e.g., a vertical deviation of the railway and/or tramway carriage." *Id.* at 48 (citing Ex. 1008 ¶ 36; Ex. 1004 ¶ 81). Moreover, Petitioner adds that it would have

been obvious to add this tilt compensation software with the combined Villar and Choros system for automated RSA railroad track inspection in order to compensate for the tilt of the system when going around a curve. *Id.* at 49. According to Petitioner, "[t]o the extent *Casagrande* does not explicitly disclose compensating an RSA measurement for vertical tilt error, *Casagrande* describes compensating imaged rail profile and other measured geometric parameters . . . for vertical alignment errors" and "Villar appreciates that 'other measurable aspects of the railroad track can be determined or detected from the image data of the track bed.'" *Id.* at 49–50 (citing Ex. 1005 ¶¶ 8, 23, 43, 47, 50, 52, claims 1, 15, 23; Ex. 1004 ¶ 83).

Petitioner also relies on Szwilski as teaching or suggesting "accounting for vertical track inclination errors to accurately represent imaged railroad component position data when determining rail defects." *Id.* at 50. According to Petitioner,

> in light of Szwilski's teachings extending vertical tilt compensation corrections to 'other rail [] defects,' it would have been obvious and well within the skill of one of ordinary skill in the art to implement *Villar* and *Choros*' automated RSA railroad track inspection system to account for vertical track inclination errors to accurately represent the imaged railroad component position data.

Id. at 51–52 (alteration in original). Petitioner goes on to provide detailed analysis of how and why a person of ordinary skill in the art would have combined the Villar and Choros system with the tilt compensating teachings of Casagrande and Szwilski. *Id.* at 52–54.

After reviewing Petitioner's arguments and information, including Dr. Papanikolopoulos's Declaration, which are not addressed by Patent Owner at this stage of the proceeding, we are persuaded that Petitioner

demonstrates, for purposes of this Decision on Institution, that the combination of Villar, Choros, Casagrande, and Szwilski teaches claim 1's preamble[10] and limitations. Moreover, we are persuaded that Petitioner provides a reasonable rationale for combining the four references. Thus, we determine that Petitioner establishes a reasonable likelihood that it would prevail in showing that claim 1 would have been obvious to one of ordinary skill in the art in view of the combination of Villar, Choros, Casagrande, and Szwilski.

6. *Independent Claims 7 and 12*

Independent claim 7 is a method claim that recites:

> 7. [preamble] A method for determining rail seat abrasion of a rail road track, the method comprising the steps of:
>
> (a) determining a height of a left rail base, right rail base, left crosstie and right crosstie;
>
> (b) recording the heights of the left rail base, right rail base, left crosstie and right crosstie;
>
> (c) determining a tilt correction factor;
>
> (d) determining an actual delta for the right and left rail bases; and
>
> (e) determining a rail seat abrasion value for the right and left rail bases.

Ex. 1001, 16:16–26 (bracketing added consistent with Petitioner's analysis of the claim limitation "[preamble]"; *see* Pet. 59).

The preamble of claim 7 differs from the preamble of claim 1 only in that it recites a method as opposed to a system. *Compare* Ex. 1001, 15:38–39 *with id.* at 16:16–17. For claim 7's limitation (a), Petitioner relies on the

[10] In light of this finding, we need not, and thus do not, reach whether claim 1's preamble is limiting.

combined teachings of Villar and Choros in the same manner as for claim 1's limitation (e)—"determining whether rail seat abrasion is present along the rail road track"—for teaching or suggesting the subject matter recited by claim 7's limitation (a). Pet. 37–45, 59–60.

Petitioner relies on the combined teachings of Villar, Choros, Casagrande, and Szwilski in the same manner as for claim 1's limitation (f)—"wherein, when determining whether rail seat abrasion is present, the at least one processor compensates for a tilt of the rail road track"—for teaching or suggesting the subject matter recited by claim 7's limitation (b). *Id.* at 54–55, 59–60. Similarly, Petitioner relies on the combined teachings of Villar, Choros, Casagrande, and Szwilski in the same manner as for claim 1's limitation (f) for teaching or suggesting the subject matter recited by claim 7's limitation (c). *Id.* 55, 59–60. For claim 7's limitations (d) and (e), Petitioner asserts that the combined disclosures of Villar and Choros render the claimed subject matter obvious because the combination "determines the distance or difference between the left rail base and crosstie heights, and the right rail base and crosstie heights," "determines an 'actual delta' for the right and left rail bases," "determines any tilt correction error, based on the vertical alignment of the left and right rails," and "compensates for any tilt correction error when determining the RSA value for the right and left rail bases." Pet. 55–56 (citing Ex. 1004 ¶¶ 97–100).

Independent claim 12 is a method claim that recites:

> 12. [preamble] A method for determining rail seat abrasion of a rail road track, the method comprising the steps of:
>
> (a) moving an inspection system along the track;
>
> (b) receiving image data corresponding to at least a portion of the track;
>
> (c) determining a measurement of the rail seat abrasion for the portion of the track, wherein the measurement are [sic] adjusted for tilt encountered as the inspection system moves along the track; and
>
> (d) determining whether rail seat abrasion exists based upon the adjusted measurement.

Ex. 1001, 16:42–52 (bracketing added consistent with Petitioner's analysis of the claim limitation "[preamble]"; *see* Pet. 61).

The majority of the limitations of claim 12 are substantively similar to those recited by claims 1 and 7. In particular, the preamble of claim 12 is identical to that in claim 7. *Compare* Ex. 1001, 15:38–39 *with id.* at 16:42–43. Claim 12's limitation (b) is similar to claim 1's limitation (b), which recites "generating at least one image representative of a profile of at least a portion of the rail road track." *Compare* Ex. 1001, 15:43–47 *with id.* at 16:45–46; *see also* Pet. 61–62. Claim 12's limitations (c) and (d) are similar to the combination of claim 1's limitations (e) and (f), which recite "determining whether rail seat abrasion is present," wherein tilt of the rail is compensated for. *Compare* Ex. 1001, 15:51–55 *with id.* at 16:47–52; *see also* Pet. 62. In addition, Petitioner relies on Villar as teaching or suggesting the subject matter recited by claim 12's limitation (a). Pet. 61 (citing Ex. 1005 ¶¶ 26, 28).

After reviewing Petitioner's arguments and information, including Dr.

Papanikolopoulos's Declaration, which are not addressed by Patent Owner at this stage of the proceeding, we are persuaded that Petitioner demonstrates, for purposes of this Decision on Institution, that the combination of Villar, Choros, Casagrande, and Szwilski teaches the limitations recited by independent claims 7 and 12. Moreover, we are persuaded that Petitioner, on this record, provides a reasonable rationale for combining the four references. Thus, we determine that Petitioner establishes a reasonable likelihood that it would prevail in showing that claims 7 and 12 would have been obvious to one of ordinary skill in the art in view of the combination of Villar, Choros, Casagrande, and Szwilski.

8. *Dependent Claims 2, 5, 6, 10, 11, 13, 16, and 17*

After reviewing Petitioner's arguments and information, including Dr. Papanikolopoulos's Declaration, which are not addressed by Patent Owner at this stage of the proceeding, we are persuaded that Petitioner demonstrates, for purposes of this Decision on Institution, that the combination of Villar, Choros, Casagrande, and Szwilski teaches the limitations recited by dependent claims 2, 5, 6, 10, 11, 13, 16, and 17.

For example, the limitations of claims 2 (which depends from claim 1) and 13 (which depends from claim 12) are substantively similar to those recited by independent claim 7, and, therefore, are subject to a similar analysis. *Compare* Ex. 1001, 15:56–65 and 16:53–60 *with id.* at 16:16–26; *see also* Pet. 54–56, 62–63. Claims 5 (which depends from claim 2), 10 (which depends from claim 7), and 16 (which depends from claim 13) recite "wherein the step of determining the actual delta is accomplished based upon the tilt correction factor." Ex. 1001, 16:10–12, 16:37–38, 17:5–7. Petitioner explains that "[i]t would have been obvious to one of ordinary

skill in the art to integrate the determined tilt correction factor into each actual delta to correct the coordinate position of the imaged data." Pet. 57 (citing Ex. 1004 ¶ 101), 60, 63. Petitioner also points to Szwilski's disclosure as supporting this conclusion. *Id.* (citing Ex. 1009 Fig. 9, 12–14, 16–20). We are persuaded that Petitioner demonstrates, for purposes of this Decision on Institution, that the combination of Villar, Choros, Casagrande, and Szwilski teaches the limitations recited by independent claims 2, 5, 10, 13, and 16.

Claims 6 (which depends from claim 2), 11 (which depends from claim 7), and 17 (which depends from claim 13) recite "wherein the step of determining the rail seat abrasion value is accomplished based upon the actual delta." Ex. 1001, 16:13–15, 16:39–41, 18:1–3. Petitioner explains that, as discussed with respect to claim 2's limitation (e), "*Villar* and *Choros'* RSA railroad inspection vision system" discloses this subject matter. Pet. 56 (citing Ex. 1004 ¶ 100), 58, 61, 63. We are persuaded that Petitioner demonstrates, for purposes of this Decision on Institution, that the combination of Villar, Choros, Casagrande, and Szwilski teaches the limitations recited by independent claims 6, 11, and 17.

Moreover, we are persuaded that Petitioner provides a reasonable rationale for combining the four references. *See* Pet. 25–32, 39–45, 49–54. Thus, we determine that Petitioner establishes a reasonable likelihood that it would prevail in showing that claims 2, 5, 6, 10, 11, 13, 16, and 17 would have been obvious to one of ordinary skill in the art in view of the combination of the Villar, Choros, Casagrande, and Szwilski.

D. Claims 3, 8, and 14

Petitioner contends that claims 3, 8, and 14 of the '320 patent are unpatentable because their subject matter would have been obvious over the combined disclosures of Villar, Choros, Casagrande, Szwilski, and Khattak. Pet. 64–73.

1. *Overview of Khattak*

Khattak is titled "Pavement Distress Survey System." Ex. 1010, code (54). It describes a pavement inspection apparatus that determines the size and shapes of surface distress features in pavement, such as potholes, using video and infrared cameras. *Id.* at code (57). Khattak discloses that its video camera "produces a first set of frames of raw electrical video pixel signals or data, concerning . . . the magnitude of the light radiation reflected by the pavement and received by the camera in an X-Y array (multiple pixel line)." *Id.* at 5:21–26. Khattak also discloses a "pixel reference means for determining the pixel to surface distance relationship, ratio, or correlation on a real time basis and to adjust or calibrate the raw pixel accordingly" by "count[ing] or measure[ing] the number of pixels within a video frame between two mixed or defined reference points and determin[ing] if the number varies between frames to maintain a real time correlation of the surface to pixel relationship." *Id.* at 6:32–45.

2. *Analysis*

Claims 3, 8, and 14 depend from claims 2, 7, and 13 and recite "determining vertical pixel counts for each of the heights of the left rail base, right rail base, left crosstie and right crosstie" and "normalizing the vertical pixel counts based upon a measurement index." Ex. 1001, 16:1–5, 16:29–33, 16:62–67.

Petitioner contends that one of ordinary skill in the art would understand that Villar's disclosure of "assess[ing] [railroad track] components for defects via contour line-fitting and orientation comparison algorithms" is done through "determining and comparing the vertical pixel counts of the imaged contoured railroad track components." Pet. 65 (citing Ex. 1005 Fig. 7A, ¶¶ 47, 50, 52; Ex. 1004 ¶ 121). Petitioner also contends that "it would have been obvious to one of ordinary skill in the art to implement Villar's system . . . by determining and comparing vertical pixel counts in the image for the left and right rail base heights . . . and left and right crosstie heights" because it would "provide another track component defect for *Villar's* vision system to automatically identify and correct in furtherance of increasing railroad safety." *Id.* at 66–67 (citing Ex. 1007 Fig. 8; Ex. 1004 ¶ 123).

Petitioner also points to Khattak's disclosure of "converting (or normalizing) the pixel counts based upon a measurement index, providing a surface distance to pixel correlation in terms of inches/pixel[s]" and "dynamically determining the pixel to surface distance relationship, ratio, or correlation on a real time basis" and adjusting or calibrating "the raw pixel accordingly to provide a much more accurate and dynamic (real time) determination of the surface distance to pixel correlation." Pet. 68–70 (citing Ex. 1010 Fig. 4, 5:21–26, 5:48–67, 6:31–58).

Finally, Petitioner explains that "[i]t would have been obvious to one of ordinary skill in the art to implement the automated RSA railroad track inspection vision system to convert (or normalize) pixel counts based upon a measurement index, as taught by *Khattak*" in order "to provide useful real-world information regarding the shape, size, contours, and position of

imaged components relative to each other." Pet. 71 (citing Ex. 1010, 14:44–62; Ex. 1004 ¶ 130).

We have reviewed Petitioner's explanations and supporting evidence regarding claims 3, 8, and 14 for this asserted ground, and, on the current record, we find them persuasive for purposes of institution. *See* Pet. 64–73. Petitioner, therefore, has shown a reasonable likelihood that it would prevail on its assertion that Villar, Choros, Casagrande, Szwilski, and Khattak's combined teachings render claims 3, 8, and 14 obvious.

E. Claims 4, 9, and 15

Petitioner contends that claims 4, 9, and 15 of the '320 patent are unpatentable because their subject matter would have been obvious over the combined disclosures of Villar, Choros, Casagrande, Szwilski, and Andersson. Pet. 73–76.

3. *Overview of Andersson*

Andersson is titled "Storage of Track Data in a Position-Controlled Tilt System." Ex. 1011, code (54). It describes a method and device "for tilting a car body of a vehicle in a trackbound train when the train passes through a track curve." *Id.* at code (57). Andersson discloses calculating and storing the current curve geometry the first time a train passes over a certain route. *Id.* at 5:16–19. On subsequent passes of that same route, Andersson discloses that the previously stored curve geometry is used to calculate "correct reference values for tilting of the car body for curves within the track section." *Id.* at 5:66–6:4. Moreover, Andersson states that "[t]o reduce the dependence on accidental occurrences during an individual running, the mean value of the two or three immediately preceding stored reference-value profiles may alternatively be used." *Id.* at 6:12–19.

4. *Analysis*

Claims 4, 9, and 15 depend from claims 2, 7, and 13 and recite "the tilt correction factor is accomplished based upon the left and right rail base heights and a standard tilt correction factor." Ex. 1001, 16:7–9, 16:34–36, 17:2–4.

Petitioner points to Andersson as disclosing "that the first time a train travels over a curved section of a track, the control system measures the geometry of the curve and stores the curve geometry in the memory of the control system." Pet. 74 (citing Ex. 1011, 5:16–19). "The next time the train travels over a certain track section, the previously measured and stored curve geometry is used to calculate 'correct reference values for tilting of the car body for curves within the track section'" using "the mean value of the two or three immediately preceding stored reference-value profiles may alternatively be used." *Id.* at 74–75 (citing Ex. 1011, 5:66–6:4, 6:12–18). According to Petitioner, it would have been obvious to one of ordinary skill in the art to use the "standard tilt correction factor, as taught by *Andersson*, to pre-emptively compensate imaged measurements for known vertical alignment tilt errors associated with an upcoming track geometry" to allow for "faster image processing of the data and thus, faster identification of potential RSA issues." *Id.* at 75 (citing Ex. 1004 ¶ 136).

We have reviewed Petitioner's explanations and supporting evidence regarding claims 4, 9, and 15 for this asserted ground, and, on the current record, we find them persuasive for purposes of institution. *See* Pet. 73–76. Petitioner, therefore, has shown a reasonable likelihood that it would prevail on its assertion that Villar, Choros, Casagrande, Szwilski, and Andersson's combined teachings render claims 4, 9, and 15 obvious.

IV. CONCLUSION

For the reasons expressed above, we determine that Petitioner has demonstrated a reasonable likelihood of showing that claims 1–17 of the '320 patent would have been obvious over Petitioner's proposed grounds. Accordingly, we institute an *inter partes* review of all challenged claims of the '320 patent on all grounds alleged by Petitioner.

We note that this Decision does not reflect a final determination on the patentability of any claim, and that the burden remains on Petitioner to prove unpatentability of each challenged claim. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

V. ORDER

For the reasons given, it is:

ORDERED that *inter partes* review is instituted of claims 1–17 of the '320 patent with respect to all grounds of unpatentability set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(a), *inter partes* review of the '320 patent is instituted commencing on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is given of the institution of a trial.

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