

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

HUM INDUSTRIAL TECHNOLOGY, INC.  
*Petitioner*

v.

AMSTED RAIL COMPANY, INC.  
*Patent Owner*

Case IPR2023-00539  
Patent No. 9,981,673

---

Before JAMES P. CALVE, KEVIN W. CHERRY, and MICHAEL L. WOODS,  
*Administrative Patent Judges.*

---

**PETITIONER'S OPPOSITION TO PATENT OWNER'S  
REVISED MOTION TO AMEND**

## TABLE OF CONTENTS

|                                                                                                                                                                                                                                                                                        | <u>Page</u> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| TABLE OF CONTENTS.....                                                                                                                                                                                                                                                                 | i           |
| TABLE OF AUTHORITIES .....                                                                                                                                                                                                                                                             | v           |
| EXHIBIT INDEX .....                                                                                                                                                                                                                                                                    | vii         |
| I. SUBSTITUTE CLAIMS 23–43 LACK WRITTEN DESCRIPTION.....                                                                                                                                                                                                                               | 1           |
| A. Claim 23: “mounted on a sidewall of a bearing adapter” .....                                                                                                                                                                                                                        | 2           |
| B. Claim 23: “a plurality of defined severity levels that are each<br>assignable based on respective possible values for a magnitude of<br>the deviations of one or more numeric values from nominal<br>operating conditions for the bearing during operation of the railcar”<br>..... | 4           |
| C. Claim 23: “numeric values derived from the data or processed<br>information” .....                                                                                                                                                                                                  | 6           |
| D. Claims 27, 28, 30, and 31: “accelerometer”/“acceleration data”.....                                                                                                                                                                                                                 | 7           |
| E. Claim 30: “and performing steps b-d at said location remote from<br>said railcar”.....                                                                                                                                                                                              | 8           |
| F. Claim 33: “calibrated correlations...”.....                                                                                                                                                                                                                                         | 8           |
| G. Claim 33: “temperatures”/“temperature value(s)” .....                                                                                                                                                                                                                               | 9           |
| H. Claim 33: “transmitting an alarm” .....                                                                                                                                                                                                                                             | 11          |
| I. Claim 36: “on a sidewall of a bearing adapter,” “a plurality of<br>possible values indicative of the condition of the bearing” .....                                                                                                                                                | 11          |
| J. Claim 42: “on a sidewall of a bearing adapter,” “three or more<br>defined severity levels based on the one or more numeric values” ....                                                                                                                                             | 12          |
| K. Dependent Claims 24–32, 34, 35, 37–41, and 43 .....                                                                                                                                                                                                                                 | 12          |
| II. SUBSTITUTE CLAIMS 23–43 ARE INVALID UNDER 35 U.S.C. §<br>112 .....                                                                                                                                                                                                                 | 12          |
| A. Indefiniteness.....                                                                                                                                                                                                                                                                 | 12          |
| 1. Claim 33: “temperatures”/“temperature value(s)”.....                                                                                                                                                                                                                                | 12          |
| 2. Claim 33(d): “alarm condition” .....                                                                                                                                                                                                                                                | 13          |
| 3. Claim 42: “one of three or more defined severity levels based on<br>the one or more numeric values” .....                                                                                                                                                                           | 13          |

|      |                                                                                                                                                                                                                                                                                                                       |    |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| B.   | Enablement.....                                                                                                                                                                                                                                                                                                       | 13 |
| 1.   | Claim 23: “determining the condition of the bearing by applying a heuristic” .....                                                                                                                                                                                                                                    | 13 |
| 2.   | Claim 23: “assigning a severity level”.....                                                                                                                                                                                                                                                                           | 15 |
| 3.   | Claims 27, 28, 30, and 31: “accelerometer”/“acceleration data” .....                                                                                                                                                                                                                                                  | 15 |
| 4.   | Claim 33: “calibrated correlations...” .....                                                                                                                                                                                                                                                                          | 15 |
| 5.   | Claim 33: “temperatures”/“temperature value(s)”.....                                                                                                                                                                                                                                                                  | 16 |
| 6.   | Claim 36: “determine a condition of the bearing,” “assign a severity level” .....                                                                                                                                                                                                                                     | 16 |
| 7.   | Claim 42: “determine a condition of the bearing,” “assigning a severity level to the condition of the bearing” .....                                                                                                                                                                                                  | 17 |
| 8.   | Dependent Claims 24–32, 34, 35, 37–41, and 43 .....                                                                                                                                                                                                                                                                   | 17 |
| III. | SUBSTITUTE CLAIMS 23–43 ARE INVALID UNDER 35 U.S.C. § 103 .....                                                                                                                                                                                                                                                       | 17 |
| A.   | Claim 23 .....                                                                                                                                                                                                                                                                                                        | 18 |
| 1.   | Limitation 23(a): “wherein the operational characteristic is a condition of a bearing proximate to the bearing adapter” .....                                                                                                                                                                                         | 19 |
| 2.   | Limitation 23(a): “mounted on a sidewall of a bearing adapter” .....                                                                                                                                                                                                                                                  | 19 |
| 3.   | Limitation 23(b): “determining the condition of a bearing by applying a heuristic...wherein the heuristic correlates one or more numeric values derived from the data or processed information to the condition of the bearing” .....                                                                                 | 21 |
| 4.   | Limitation 23(c): “wherein said severity level is one of a plurality of defined severity levels that are each assignable based on respective possible values for a magnitude of the deviations of one or more numeric values from nominal operating conditions for the bearing during operation of the railcar” ..... | 22 |
| 5.   | Limitation 23(d): “wherein said alarm condition defines one or more recommended actions to be taken with regard to the detected deviation from nominal operating conditions”.....                                                                                                                                     | 23 |
| B.   | Claims 24–32.....                                                                                                                                                                                                                                                                                                     | 25 |
| C.   | Claim 33 .....                                                                                                                                                                                                                                                                                                        | 26 |

|     |                                                                                                                                                                                                                                                                                                                                                                                    |    |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1.  | Limitation 33(b): “calibrated correlations between a plurality of temperature values for the desired part and a plurality of temperatures that are expected for the part during standard operations of the railcar” .....                                                                                                                                                          | 27 |
| 2.  | Limitation 33(c): “determining if said temperature of the desired part is outside an acceptable range of temperatures indicating operating conditions expected for the desired part during the operation of the railcar by comparing the temperature of the desired part determined in step (b) and at least one defined temperature value associated with the desired part” ..... | 28 |
| 3.  | Limitation 33(d): “a plurality of severity levels defined by a deviation of said temperature from a predetermined reference temperature value, wherein said deviation indicates a severity of a detected condition of the desired part” .....                                                                                                                                      | 30 |
| 4.  | Limitation 33(d): “transmitting an alarm...wherein said alarm condition defines one or more recommended actions to be taken with regard to the detected condition of the desired part” .....                                                                                                                                                                                       | 30 |
| D.  | Claims 34–35 .....                                                                                                                                                                                                                                                                                                                                                                 | 30 |
| E.  | Claim 36 .....                                                                                                                                                                                                                                                                                                                                                                     | 31 |
| 1.  | Limitation 36(a): “on a sidewall of a bearing adapter” .....                                                                                                                                                                                                                                                                                                                       | 31 |
| 2.  | Limitation 36(b): “determine a condition of a bearing proximate to the bearing adapter based on correlations between the data and a plurality of possible values indicative of the condition of the bearing” .....                                                                                                                                                                 | 31 |
| 3.  | Limitation 36(b): “assign a severity level to said determined actual failure or said predicted potential or imminent failures, wherein the severity level is based on deviations of the condition of the bearing from an expected condition of the bearing” .....                                                                                                                  | 31 |
| 4.  | Limitation 36(c) .....                                                                                                                                                                                                                                                                                                                                                             | 31 |
| F.  | Claims 37–41 .....                                                                                                                                                                                                                                                                                                                                                                 | 31 |
| G.  | Claim 42 .....                                                                                                                                                                                                                                                                                                                                                                     | 32 |
| H.  | Claim 43 .....                                                                                                                                                                                                                                                                                                                                                                     | 32 |
| IV. | SUBSTITUTE CLAIMS 23–43 ARE INVALID UNDER 35 U.S.C. § 101 .....                                                                                                                                                                                                                                                                                                                    | 32 |
| 1.  | Alice Step 1 .....                                                                                                                                                                                                                                                                                                                                                                 | 33 |

Case No. IPR2023-00539

Patent No. 9,981,673

|    |                   |    |
|----|-------------------|----|
| 2. | Alice Step 2..... | 35 |
| V. | CONCLUSION.....   | 35 |

**TABLE OF AUTHORITIES**

|                                                                                                                    | Page(s) |
|--------------------------------------------------------------------------------------------------------------------|---------|
| Cases                                                                                                              |         |
| <i>ABS Glob., Inc. v. Inguran, LLC</i> ,<br>914 F.3d 1054 (7th Cir. 2019) .....                                    | 14      |
| <i>Alcon Rsch., Ltd. v. Apotex Inc.</i> ,<br>687 F.3d 1362 (Fed. Cir. 2012) .....                                  | 14, 16  |
| <i>Alice Corp. Pty. Ltd. v. CLS Bank Int’l</i> ,<br>573 U.S. 208 (2014) .....                                      | 33, 35  |
| <i>Amgen Inc. v. Sanofi</i> ,<br>598 U.S. 594 (2023) .....                                                         | 13      |
| <i>Ariad Pharms., Inc. v. Eli Lilly &amp; Co.</i> ,<br>598 F.3d 1336 (Fed. Cir. 2010) .....                        | 1, 2, 7 |
| <i>Bancorp Servs., L.L.C. v. Sun Life Assurance Co. of Canada (U.S.)</i> ,<br>687 F.3d 1266 (Fed. Cir. 2012) ..... | 33      |
| <i>BSG Tech LLC v. Buyseasons, Inc.</i> ,<br>899 F.3d 1281 (Fed. Cir. 2018) .....                                  | 35      |
| <i>Chamberlain Group, Inc. v. Techtronic Indus. Co.</i> ,<br>935 F.3d 1341 (Fed. Cir. 2019) .....                  | 35      |
| <i>Clarilogic, Inc. v. FormFree Holdings Corp.</i> ,<br>681 F. App’x 950 (Fed. Cir. 2017) .....                    | 34      |
| <i>D Three Enters., LLC v. SunModo Corp.</i> ,<br>890 F.3d 1042 (Fed. Cir. 2018) .....                             | 8, 9    |
| <i>FWP IP ApS v. Biogen MA, Inc.</i> ,<br>749 F. App’x 969 (Fed. Cir. 2018) .....                                  | 1       |

Case No. IPR2023-00539

Patent No. 9,981,673

|                                                                                                    |                |
|----------------------------------------------------------------------------------------------------|----------------|
| <i>Hyatt v. Dudas</i> ,<br>492 F.3d 1365 (Fed. Cir. 2007) .....                                    | 4              |
| <i>In re TLI Commc'ns Patent Litig.</i> ,<br>823 F.3d 607 (Fed. Cir. 2016) .....                   | 35             |
| <i>Intamin Ltd. v. Magnetar Techs., Corp.</i> ,<br>483 F.3d 1328 (Fed. Cir. 2007) .....            | 14             |
| <i>Intel Corp. v. Alacritech, Inc.</i> ,<br>IPR2017-01391, Paper 81 (P.T.A.B. Nov. 26, 2018) ..... | 6              |
| <i>Lockwood v. Am. Airlines, Inc.</i> ,<br>107 F.3d 1565 (Fed. Cir. 1997) .....                    | 7, 10          |
| <i>McRO, Inc. v. Bandai Namco Games Am. Inc.</i> ,<br>837 F.3d 1299 (Fed. Cir. 2016) .....         | 34             |
| <i>Nautilus, Inc. v. Biosig Instruments, Inc.</i> ,<br>572 U.S. 898 (2014) .....                   | 12             |
| <i>Novozymes A/S v. DuPont Nutrition Biosciences APS</i> ,<br>723 F.3d 1336 (Fed. Cir. 2013) ..... | 2, 3           |
| <i>Purdue Pharma L.P. v. Faulding Inc.</i> ,<br>230 F.3d 1320 (Fed. Cir. 2000) .....               | 4, 7           |
| <i>RecogniCorp, LLC v. Nintendo Co.</i> ,<br>855 F.3d 1322 (Fed. Cir. 2017) .....                  | 35             |
| Statutes                                                                                           |                |
| 35 U.S.C. § 101 .....                                                                              | 32, 33         |
| 35 U.S.C. § 103 .....                                                                              | 17             |
| 35 U.S.C. § 112 .....                                                                              | 12             |
| 35 U.S.C. § 316(d) .....                                                                           | 1              |
| Regulations                                                                                        |                |
| 37 C.F.R. §42.121(d)(2) .....                                                                      | 17, 18, 20, 22 |

**EXHIBIT INDEX**

| <b>Ex #</b> | <b>Exhibit Description</b>                                                                                                        |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 1001        | U.S. Patent No. 9,981,673 (“the ’673 Patent”)                                                                                     |
| 1002        | Prosecution History of the ’673 Patent                                                                                            |
| 1003        | Expert Declaration of Steven Ricca                                                                                                |
| 1004        | <i>Curriculum Vitae</i> for Steven Ricca                                                                                          |
| 1005        | U.S. Patent Publication No. 2007/0152107 A1 to LeFebvre et al. (“LeFebvre”)                                                       |
| 1006        | U.S. Patent Publication No. 2011/0282540 A1 to Armitage et al. (“Armitage”)                                                       |
| 1007        | U.S. Patent Publication No. 2007/0208841 A1 to Barone et al. (“Barone”)                                                           |
| 1008        | U.S. Patent Application Publication No. 2008/0195265 to Searle et al. (“Searle”)                                                  |
| 1009        | U.S. Patent No. 6,339,397 to Baker et al. (“Baker”)                                                                               |
| 1010        | U.S. Patent No. 6,487,478 to Azzaro et al. (“Azzaro”)                                                                             |
| 1011        | Amsted Rail Company, Inc.’s Complaint filed against Hum Industrial Technology, Inc. (ECF No. 1) filed on April 18, 2022           |
| 1012        | Waiver of the Service of Summons upon Hum Industrial Technology, Inc. (ECF No. 4) dated June 14, 2022                             |
| 1013        | U.S. Provisional Application No. 61/661,661 (“the ’661 Provisional”)                                                              |
| 1014        | U.S. Patent Application No. 12/861,713 (“the ’713 Application”)                                                                   |
| 1015        | U.S. Patent No. U.S. 7,688,218 to LeFebvre et al. (“LeFebvre ’218”)                                                               |
| 1016        | Third Generation On-Board Monitoring and Control System Based on Controller Area Network Technology Dr. John Donelson III, et al. |
| 1017        | Defendants' Stipulation of Invalidity Contentions                                                                                 |
| 1018        | U.S. Patent Application Publication No. 2005/0194497 to Matzan (“Matzan”)                                                         |
| 1019        | <i>Intentionally Omitted</i>                                                                                                      |
| 1020        | Transcript of Conference Call Before James P. Calve, Kevin W. Cherry, and Michael L. Woods (June 8, 2023)                         |

| <b>Ex #</b> | <b>Exhibit Description</b>                                                                                         |
|-------------|--------------------------------------------------------------------------------------------------------------------|
| 1021        | Expert Declaration of Steven Ricca in Support of Petitioner’s Opposition to Patent Owner’s Motion to Amend         |
| 1022        | U.S. Patent No. 6,672,681 to Moretti et al. (“Moretti”)                                                            |
| 1023        | International Publication No. WO 82/00805 to Sinha (“Sinha”)                                                       |
| 1024        | U.S. Patent No. 6,539,293 to Bächtiger et al. (“Bächtiger”)                                                        |
| 1025        | U.S. Patent No. 2,818,508 to Johanson et al. (“Johanson”)                                                          |
| 1026        | U.S. Patent No. 5,149,025 to Utterback et al. (“Utterback”)                                                        |
| 1027        | U.S. Patent No. 5,331,311 to Doctor et al. (“Doctor”)                                                              |
| 1028        | Hum’s First Supplemental Counter-Infringement Contentions                                                          |
| 1029        | Declaration of Eric J. Rakestraw in Support of Petitioner’s Reply                                                  |
| 1030        | Expert Declaration of Steven Ricca in Support of Petitioner’s Reply                                                |
| 1031        | U.S. Provisional Application No. 61/333,428 to Armitage et al. (“Armitage Provisional”)                            |
| 1032        | Proposed Corrected Reply to Patent Owner’s Response*                                                               |
| 1033        | Proposed Corrected Reply to Patent Owner’s Response (Redacted)                                                     |
| 1034        | Proposed Corrected Opposition to Patent Owner’s Motion to Amend                                                    |
| 1035        | Expert Declaration of Steven Ricca in Support of Petitioner’s Opposition to Patent Owner’s Revised Motion to Amend |
| 1036        | U.S. Patent No. 7,551,063 to Inbarajan (“Inbarajan”)                                                               |
| 1037        | U.S. Patent No. 7,359,777 to Betters et al. (“Betters”)                                                            |
| 1038        | U.S. Patent No. 7,089,099 to Shostak et al. (“Shostak”)                                                            |

\* Filed under seal

Amsted's Revised Motion to Amend (Paper 32 ("Mot.")) should be denied because substitute claims 23–43 lack written description support, fail to meet the enablement standard of 35 U.S.C. § 112, are directed to ineligible subject matter under 35 U.S.C. § 101, and are obvious under 35 U.S.C. § 103.

## **I. SUBSTITUTE CLAIMS 23–43 LACK WRITTEN DESCRIPTION**

Substitute claims must be supported by the written description of the original application, and may not introduce new subject matter. *See* 35 U.S.C. § 316(d); 37 C.F.R. § 42.121(A)(2)(ii). To satisfy the written description requirement, “the description must clearly allow persons of ordinary skill in the art to recognize that the inventor invented what is claimed.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (cleaned up). “The written description requirement is particularly important when, as here, claims are added later during prosecution in response to development by others.” *FWP IP ApS v. Biogen MA, Inc.*, 749 F. App'x 969, 974 (Fed. Cir. 2018).

Patent Owner presents a claim chart purporting to show where each individual limitation of the substitute claims may be found in the specification. *See* Mot., 6–25. As discussed below, several of the added limitations are not, in fact, disclosed anywhere in the specification. But even if Patent Owner could successfully identify support for each individual limitation, “an amalgam of disclosures plucked selectively from the [original] application” does not satisfy the

written description requirement. *Novozymes A/S v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1349 (Fed. Cir. 2013); *accord Ariad Pharms.*, 598 F.3d at 1352. Rather, the specification must support each claim “as an integrated whole rather than as a collection of independent limitations.” *Novozymes*, 723 F.3d at 1349. As discussed in detail below, Patent Owner cannot make this showing.

**A. Claim 23: “mounted on a sidewall of a bearing adapter”**

The ’673 Patent is broadly directed to a monitoring system comprising sensing units “mounted on a railcar.” EX1001, (57) Abstract. For example, the specification states broadly that its sensing units can comprise “any type of sensor,” and provides a laundry list of different sensor types. EX1001, 4:51–58.

The ’673 Patent does not specify any particular location on the railcar where the sensing units must be mounted. To the contrary, the specification expressly recognizes that different sensors will require different housing configurations and mounting locations. EX1001, 4:49–51 (“As one of ordinary skill would recognize, the configuration of the motes 10 with respect to the sensor 20 is dependent upon the type of sensor and the type of data desired.”). EX1035, ¶ 18.

Consistent with this disclosure, claim 1 of the ’673 Patent does not require the sensing unit to be mounted at any particular location on the railcar. Proposed substitute claim 23, however, has been amended to require a sensing unit mounted at a *specific* location—namely, on the sidewall of a bearing adapter.

To support this amendment, Patent Owner relies heavily on an embodiment disclosed in Figs. 3 and 3A of the '673 Patent. But the embodiment of Figs. 3 and 3A is expressly described in the specification as a *temperature* sensing device. EX1001, 5:44–47. (“As an example, FIGS. 3 and 3A show a temperature sensing mote 10 of the type described above mounted to a bearing adapter...”). The '673 Patent does not indicate that this embodiment comprises any type of sensor other than a temperature sensor. EX1035, ¶ 20. Indeed, a PHOSITA would understand that many of the listed sensor types (e.g., strain gauges, gyroscopes, reed switches, limit switches) would serve no purpose if mounted on the sidewall of a bearing adapter. *Id.*, ¶ 18. More generally, no other type of sensor is described in the application as suitable for mounting on the sidewall of a bearing adapter. *Id.*

Patent Owner also relies on the table spanning cols. 7–12, which includes two examples that reference an “adapter mounted accelerometer.” But neither example states that the accelerometer is mounted specifically to the *sidewall* of a bearing adapter as expressly required by the claim. EX1035, ¶ 21. A PHOSITA would understand that a bearing adapter has multiple surfaces suitable for mounting sensor devices. *Id.*, ¶ 19. LeFebvre, for example, discloses sensors mounted to “the upper rectangular surface of the bearing adapter.” EX1005, ¶ [0020]. Claim 23, however, expressly requires mounting on the *sidewall*.

Substitute claim 23 is therefore directed to a specific combination of features

that are not linked in the specification. The patent includes a general disclosure that a sensor device may be mounted on a railcar, and it includes a specific example of a *temperature* sensor mounted on the sidewall of a bearing adapter. But it does not disclose what is now claimed, which is *any* type of sensor mounted *specifically* on the sidewall of a bearing adapter. The specification contains no blaze marks directing a PHOSITA to this combination of features. *See Hyatt v. Dudas*, 492 F.3d 1365, 1371 (Fed. Cir. 2007) (upholding a rejection for lack of written description where “each element [was] *individually* described in the specification,” but patent owner failed to “provide support for the *linkage of the claimed elements* creating the embodiment”) (emphasis in original); *Purdue Pharma L.P. v. Faulding Inc.*, 230 F.3d 1320, 1326–1327 (Fed. Cir. 2000) (“one cannot disclose a forest in the original application, and then later pick a tree out of the forest and say here is my invention. In order to satisfy the written description requirement, the blaze marks directing the skilled artisan to that tree must be in the originally filed disclosure”).

**B. Claim 23: “a plurality of defined severity levels that are each assignable based on respective possible values for a magnitude of the deviations of one or more numeric values from nominal operating conditions for the bearing during operation of the railcar”**

Limitation 23(c) requires more than simply “a plurality of defined severity levels.” Instead, *each* defined severity level must be “assignable based on respective possible values for a magnitude of the deviations of one or more

numeric values from nominal operating conditions for the bearing during operation of the railcar.” These additional limitations are not supported by the specification.

Patent Owner relies primarily upon three passages in the specification to support this amendment. *See* Mot. 10-11. First, Patent Owner argues that the specification “explicitly describes the ‘severity levels’ as ‘tiered alarm levels.’” Mot., 10 (citing EX1001 at 12:57-58). The cited passage reads: “For example, speed restrictions can be placed on the operation of the train at tiered alarm levels so that the train would be allowed to proceed to a siding or other appropriate stoppage point, allowing other traffic to continue on the mainline without inordinate delays or costs.” This is the only mention of “tiered alarm levels” in the ’673 Patent, and it does not support the proposed amendment. There is no disclosure of *any* criteria used to define the “alarm levels,” much less that the alarm levels are “assignable” using the criteria required by claim 23. EX1035, ¶ 23.

Second, Patent Owner cites the ’673 Patent at 12:44-47, which states that “[t]he action required to be taken by the locomotive driver varies based on the severity of the alert.” *See* Mot., 10 Nothing in the cited passage discloses a plurality of severity levels having the features required by claim 23. EX1035, ¶ 24.

Third, Patent Owner cites the “Bearing Fault Indicator” heuristic. Mot., 10. The cited passage reads: “An FFT can be used on data sets and plotted over time to isolate dominant modes and any shifting or relative amplification. Amplification at

rolling frequency indicates a likely fault.” EX1001, col. 9. None of this relates, even generally, to the assignment of severity levels. EX1035, ¶ 25.

Patent Owner’s claim chart also includes a handful of string citations to other portions of the specification, many of which are incorporated by reference from its discussion of previous limitations. *See* Mot., 6–7. The Board has repeatedly held that “mere string citations without explanation are insufficient to meet [Patent Owner’s] threshold burden of production” to show written description support for proposed substitute claims. *Intel Corp. v. Alacritech, Inc.*, IPR2017-01391, Paper 81 at 42 (P.T.A.B. Nov. 26, 2018) (collecting cases). It is not Petitioner’s duty, nor the Board’s, to review string citations in search of potential written description support that Patent Owner has not identified in its briefing.

In sum, there is no support in the specification for a “plurality of severity levels” that are “assignable” in the particular manner required by claim 23.

**C. Claim 23: “numeric values derived from the data or processed information”**

The term “numeric values” does not appear in the specification, and it is unclear how the term corresponds to the original disclosure. EX1035, ¶ 26. In support of this amendment, Patent Owner relies primarily upon the table of example heuristics that spans columns 7-12 of the specification. *See* Mot., 9–10. Patent Owner’s argument appears to be that a PHOSITA could generalize from the

disclosed examples of “heuristics” and conclude that “many implementations” of “numeric values” are within the scope of the invention. *Id.*

Even if Patent Owner were correct, however, that argument would not satisfy the written description requirement. Written description support “does not extend to subject matter which is not disclosed, but would be obvious over what is expressly disclosed. It extends only to that which is disclosed.” *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571–72 (Fed. Cir. 1997). *See also Ariad Pharms.*, 598 F.3d at 1351 (“a description that merely renders the invention obvious does not satisfy the requirement.”) Specific examples of “heuristics” cannot provide support for a more general concept of “numeric values” that is not disclosed in the application. “One shows that one is ‘in possession’ of *the invention* by describing *the invention*, with all its claimed limitations, not that which makes it obvious.” *Lockwood*, 107 F.3d at 1572 (emphasis in original). Here, there is no description of the “numeric values” that Patent Owner now seeks to claim.

**D. Claims 27, 28, 30, and 31: “accelerometer”/“acceleration data”**

As discussed above, independent claim 23 requires, *inter alia*, “receiving data or processed information” from one or more sensing units “***mounted on the sidewall of a bearing adapter.***” Claim 27 is dependent upon claim 23, and additionally requires data “obtained by an ***accelerometer*** in said sensing unit at the bearing adapter.” Claim 28 depends from claim 27 and therefore includes the same

limitations. Claims 30 and 31 are also dependent upon claim 23, and require an “accelerometer” (claim 30) or “acceleration data” (claim 31). As discussed above, the specification only discloses a single embodiment with a *temperature* sensor mounted to the sidewall of a bearing adapter. *See* Section I.A, *supra*. Claims 27, 28, 30, and 31 are directed to a specific combination of features—a sensing unit comprising an *accelerometer* mounted to the *sidewall* of a bearing adapter—that is disclosed nowhere in the specification of the ’673 Patent. EX1035, ¶ 27.

**E. Claim 30: “and performing steps b-d at said location remote from said railcar”**

To support this added limitation, Patent Owner cites a generic statement that heuristics “may be performed by either mobile base station 42 or land-based based station 44.” EX1001, 11:52–54. But the specification does not describe any embodiment wherein *all three* of the specific steps required by claim 30 are performed at a remote location. EX1035, ¶ 28. “Boilerplate language” that the specification encompasses various combinations “is not sufficient to show adequate disclosure of the actual combinations” that are now claimed. *D Three Enters., LLC v. SunModo Corp.*, 890 F.3d 1042, 1050–51 (Fed. Cir. 2018).

**F. Claim 33: “calibrated correlations...”**

Limitation 33(b) requires the use of “calibrated correlations between a plurality of temperature values for the desired part and a plurality of temperatures

that are expected for the part during standard operations of the railcar.” The specification does not disclose any such temperatures, not does it disclose any correlations between them. EX1035, ¶ 29. It also fails to disclose or describe “standard operations of the railcar,” nor does it disclose or describe temperatures that are “expected” for a desired part under those conditions. *Id.*

**G. Claim 33: “temperatures”/“temperature value(s)”**

Claim 33 includes the following five terms relating to temperature:

| <b>Claim</b> | <b>Term</b>                                                                                                                          |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 33(b)        | “a plurality of temperature values for the desired part”                                                                             |
| 33(b)        | “a plurality of temperatures that are expected for the part during standard operations of the railcar”                               |
| 33(c)        | “an acceptable range of temperatures indicating operating conditions expected for the desired part during the operation of the rail” |
| 33(c)        | “at least one defined temperature value associated with the desired part”                                                            |
| 33(d)        | “a predetermined reference temperature value”                                                                                        |

It is not clear how these terms relate to one another or how they correspond with what is disclosed in the specification. For example, Patent Owner cites several passages in the specification which disclose “a predetermined bearing temperature,” or similar language, apparently as support for “an acceptable range of temperatures.” Mot., 18. No support for the other added limitations is indicated.

With respect to the first two terms in the table, written description support is lacking for the reasons discussed above in Section I.F, *supra*. With respect to “an acceptable range of temperatures,” Limitation 33(c) appears to include two different definitions of this term: first, a range “indicating operating conditions

expected for the desired part during the operation of the railcar,” and second, “a defined range of temperatures expected during normal operation of the railcar.”

Neither of these definitions is provided in the specification. In any case, under either definition, Patent Owner has not identified any disclosure of “an acceptable range of temperatures” as claimed. EX1035, ¶ 30. Instead, Patent Owner argues that a PHOSITA could piece together disconnected passages—most of which relate to temperature *threshold values*, and none of which describe temperature *ranges*—and conclude that temperature ranges are part of the invention. *See* Mot., 17-18. But written description does not extend to obvious variants of the disclosure—it extends only to what is actually disclosed. *Lockwood*, 107 F.3d at 1571-72. Here, there is no disclosure of “an acceptable range of temperatures.”

With respect to “a predetermined reference temperature value,” Patent Owner provides only a handful of citations in support of Limitation 33(d), none of which relate to “a predetermined reference temperature value.” *See* Mot., 17. EX1035, ¶ 31. The specification also fails to provide support for “at least one defined temperature value associated with the desired part” in Limitation 33(c). It is not clear what portion of the specification could provide disclosure of a “defined temperature value” *in addition to* “a predetermined reference temperature value” *and* “an acceptable range of temperatures” *and* the other terms listed above. Even if the specification provided support for each term individually—and it does not—

support for the *combination* of limitations required by claim 33 is entirely absent.

#### **H. Claim 33: “transmitting an alarm”**

Limitation 33(c) includes two requirements for “transmitting an alarm”:

| <b>Claim</b> | <b>Term</b>                                                                                                                                                                                                                                                                                      |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 33(c)        | “transmitting an alarm if in step (c) it is determined that the temperature of the desired part is outside the acceptable range of temperatures”                                                                                                                                                 |
| 33(c)        | “transmitting an alarm if in step (c) it is determined that the temperature of the desired part is outside the acceptable range of temperatures and is within one of a plurality of severity levels defined by a deviation of said temperature from a predetermined reference temperature value” |

In other words: if the temperature is outside the “acceptable range of temperatures”

but not “within one of a plurality of defined severity levels,” only the first alarm is

sent. If the temperature is outside the “acceptable range of temperatures” and

“within one of a plurality of defined severity levels,” *both* alarms are sent.

Nothing in the specification provides support for simultaneously sending multiple alarms, much less multiple alarms that are triggered by the specific set of conditions recited in Limitation 33(c). EX1035, ¶ 33. Additionally, the specification does not provide support for the claimed “plurality of severity levels” for substantially the same reasons as discussed above in Section I.B, *supra*.

#### **I. Claim 36: “on a sidewall of a bearing adapter,” “a plurality of possible values indicative of the condition of the bearing”**

With respect to “on a sidewall of a bearing adapter,” see the discussion of the same terms in Section I.A, *supra*. With respect to “a plurality of possible values indicative of the condition of the bearing,” written description is lacking for the

same reasons discussed with respect to “numeric values” in Section I.C, *supra*.

**J. Claim 42: “on a sidewall of a bearing adapter,” “three or more defined severity levels based on the one or more numeric values”**

With respect to “on a sidewall of a bearing adapter,” see the discussion of the same terms in Section I.A, *supra*. With respect to “three or more defined severity levels based on the one or more numeric values,” written description is lacking for the same reasons discussed in Sections I.B and I.C, *supra*.

**K. Dependent Claims 24–32, 34, 35, 37–41, and 43**

Dependent claims 24–32, 34, 35, 37–41, and 43 lack written description for at least the same reasons as the independent claims from which they depend.

**II. SUBSTITUTE CLAIMS 23–43 ARE INVALID UNDER 35 U.S.C. § 112**

**A. Indefiniteness**

**1. Claim 33: “temperatures”/“temperature value(s)”**

*See* the discussion of the same terms with respect to written description in Section I.G, *supra*. As discussed above, claim 33 includes a multiplicity of terms relating to “temperatures” and “temperature value(s)” that do not appear in the specification, and it is not clear what each term represents or how the terms relate to one another. EX1035, ¶ 38. Given this lack of clarity, the claim “fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). Dependent claims 34 and 35 lack written description for at least the same reasons.

2. Claim 33(d): “alarm condition”

Limitation 33(d) refers to “said alarm condition,” which lacks antecedent basis. It is therefore unclear which “alarm condition” is being referenced.

3. Claim 42: “one of three or more defined severity levels based on the one or more numeric values”

Limitation 42(d) requires “assigning a severity level...wherein said severity level is one of three or more defined severity levels based on the one or more numeric values.” There is no antecedent basis for “the one or more numeric values,” and it is unclear which “numeric values” are being referenced.

**B. Enablement**

1. Claim 23: “determining the condition of the bearing by applying a heuristic”

“[T]he specification must enable the full scope of the invention as defined by its claims. The more one claims, the more one must enable.” *Amgen Inc. v. Sanofi*, 598 U.S. 594, 610 (2023). Substitute claim 23 does not meet this standard.

Limitation 23(a) broadly encompasses monitoring *any* “operational characteristic” of a railcar. The following limitation, 23(b), requires “determining the condition of the bearing by applying a heuristic,” wherein the heuristic “correlates one or more numeric values derived from the data or processed information to the condition of the bearing.” The scope of claim 23 therefore extends far beyond the enabling disclosure of the ’673 Patent. Claim 23 is not

limited to any particular technique for correlating any particular type of measurement (e.g., temperature) with the condition of a bearing. To the contrary, claim 23 broadly encompasses using *any possible heuristic* to correlate *any possible characteristic* of a wheel bearing with the condition of the bearing. The '673 Patent does not enable a PHOSITA to practice the full scope of this claim.

As a concrete example, the specification of the '673 Patent is primarily directed to monitoring temperature. It does not provide any teaching or examples that would enable methods of monitoring *acceleration* as required by dependent claims 27, 28, 30, and 31. EX1035, ¶¶ 39–40. As an independent claim, claim 23 is *at least* as broad as its dependent claims—and in this case, is substantially broader than non-enabled dependent claims 27, 28, 30, and 31. *See Intamin Ltd. v. Magnetar Techs., Corp.*, 483 F.3d 1328, 1335 (Fed. Cir. 2007) (“An independent claim impliedly embraces more subject matter than its narrower dependent claim.”); *Alcon Rsch., Ltd. v. Apotex Inc.*, 687 F.3d 1362, 1367 (Fed. Cir. 2012) (“It is axiomatic that a dependent claim cannot be broader than the claim from which it depends.”). Claim 23 therefore lacks enablement for at least the same reasons as dependent claims 27, 28, 30, and 31. *See ABS Glob., Inc. v. Inguran, LLC*, 914 F.3d 1054, 1072–73 (7th Cir. 2019) (“The Federal Circuit has indicated that for purposes of enablement, independent and dependent claims must live or die together.” (citing *Alcon*, 687 F.3d at 1368.))

2. Claim 23: “assigning a severity level”

Limitation 23(c) requires “assigning a severity level to said deviations from nominal operating conditions....” As discussed above with respect to written description in Section I.G, *supra*, the specification does not disclose any “severity level” having the required characteristics, and therefore does not enable a PHOSITA to practice this claim without undue experimentation. EX1035, ¶ 41.

Additionally, as discussed above in Section II.B.1, claim 23 is not limited to methods of monitoring bearing temperature, but broadly encompasses using a heuristic to correlate any possible characteristic of a railcar wheel bearing with the condition of the bearing. The specification does not enable a PHOSITA to assign a “severity level” based on *any possible* operational characteristic. For example, the specification does not disclose “severity levels” for use in acceleration monitoring, and does not enable a PHOSITA to identify appropriate severity levels without undue experimentation. EX1035, ¶ 42. *See* Section II.B.1, *supra*.

3. Claims 27, 28, 30, and 31: “accelerometer”/“acceleration data”

*See* Sections II.B.1 and II.B.2, *supra*.

4. Claim 33: “calibrated correlations...”

*See* the discussion of the same terms with respect to written description in Section I.F, *supra*. Limitation 33(b) requires the use of “calibrated correlations between a plurality of temperature values for the desired part and a plurality of

temperatures that are expected for the part during standard operations of the railcar.” The evidence of record indicates that a team of academic researchers at UTRGV worked diligently for several years to develop a set of temperature correlations for use with the monitoring system claimed in the ’673 Patent. *See* EX2013 at ¶ 9 (work began “in the 2008 and 2009 timeframe”); ¶ 41 (referencing May 18, 2011 call regarding ongoing “node temperature calibration and data analysis”); ¶ 44 (“by at least August 2, 2011, we believed the condition monitoring system would work”). The temperature correlations developed by UTRGV are not disclosed in the ’673 Patent, and the specification does not enable a PHOSITA to develop the required correlations without undue experimentation. EX1035, ¶ 44.

5. Claim 33: “temperatures”/“temperature value(s)”

*See* the discussion of the same terms with respect to written description in Section I.G, *supra*, and with respect to indefiniteness in Section II.A.1, *supra*. The specification of the ’673 Patent does not disclose any “acceptable range of temperatures” that could be used by a PHOSITA to practice this claim without undue experimentation. EX1035, ¶ 45. Similarly, the specification does not disclose any “predetermined reference value” or defined temperature value” that could be used to practice this claim without undue experimentation. *Id.*

6. Claim 36: “determine a condition of the bearing,” “assign a severity level”

*See* Sections II.B.1 and II.B.2, *supra*.

7. Claim 42: “determine a condition of the bearing,” “assigning a severity level to the condition of the bearing”

*See* Sections II.B.1 and II.B.2, *supra*.

8. Dependent Claims 24–32, 34, 35, 37–41, and 43

Dependent claims 24–32, 34, 35, 37–41, and 43 lack enablement for at least the same reasons as the independent claims from which they depend.

### **III. SUBSTITUTE CLAIMS 23–43 ARE INVALID UNDER 35 U.S.C. § 103**

The Motion should be denied pursuant to 37 C.F.R. §42.121(d)(2) because the claims are unpatentable over Armitage in view of LeFebvre, Barone, Moretti, Inbarajan, and Betters (Ground 1) and/or LeFebvre in view of Armitage, Barone, Moretti, Inbarajan, and Betters (Ground 2). EX1035, ¶ 51.

A PHOSITA would have found it obvious to combine the disclosures of Armitage, LeFebvre, Barone, and Moretti. All four references describe systems for wirelessly monitoring railcars, and utilize nearly identical components that function in a similar way. *See* EX1005, (57) Abstract; EX1006, (57) Abstract; EX1007, (57) Abstract; EX1022, (57) Abstract. Specifically, each reference discloses a system that utilizes a plurality of sensors to monitor the wheel bearings on a railcar, wherein the sensors communicate with a control unit located on the railcar. *Id.* Each reference discloses that collected data is analyzed to determine, for example, if bearing failure is approaching or imminent. EX1005, ¶¶ [0058]–

[0059]; EX1006, ¶¶ [0013]–[0015], [0025]; EX1007, ¶¶ [0201]–[0220]; EX1022, 3:57–62. And each reference discloses that an alarm should be raised when a failure condition is detected. EX1005, ¶¶ [0055]–[0056], [0095]; EX1006, ¶¶ [0042]–[0043]; EX1007, ¶ [0045]; EX1022, 4:8–12. EX1035, ¶ 52.

Inbarajan is directed to a vehicle email notification method and system that is applicable to a variety of vehicle types. EX1036, (57) Abstract, 5:58–65. Betters is directed to an aircraft monitoring system that enables “problems [to] be predicted and addressed earlier than is possible by using conventional methodology.” EX1037, 1:12–15. A PHOSITA would have understood that the monitoring and reporting systems described by Inbarajan and Betters are broadly applicable to a variety of vehicle types, including railcars. EX1035, ¶ 53. Armitage, LeFebvre, Barone, Moretti, Inbarajan, and Betters are therefore analogous art, and PHOSITA would have been motivated to combine their teachings for the reasons discussed in detail below. *Id.*

### **A. Claim 23**

Ground 1: Most limitations of claim 23, including all limitations present in original claim 1, are disclosed by Armitage. *See* Petition, 50–57; EX1003, ¶¶ 188–203; EX1035, ¶ 54. Ground 2: Most limitations of claim 23, including all limitations present in original claim 1, are disclosed by LeFebvre. *See* Petition, 18–24; EX1003, ¶¶ 70–86; EX1035, ¶ 55. New limitations of claim 23 not previously

addressed in this proceeding with respect to claim 1 are discussed in detail below.

1. Limitation 23(a): “wherein the operational characteristic is a condition of a bearing proximate to the bearing adapter”

Grounds 1 and 2: Armitage, LeFebvre, Barone, and Moretti each disclose sensor nodes for monitoring operational characteristics of a railcar wheel bearing such as vibration, temperature, or a combination thereof. EX1006, ¶¶ [0013]–[0015]; ¶ [0025] (“The information monitored could include undercarriage element **temperature**, ambient temperature, **vibration**, noise, among other information.”); ¶ [0027]; EX1005, claim 12 (“at least one sensing device being a **temperature** sensor”), claim 21 (a “second sensing device being a **vibration** sensing device”); EX1007, ¶ [0045] (disclosed system “monitors bearing **temperature**, bearing **vibration**...”); EX1022, 3:57–62. It therefore would have been obvious to monitor at least temperature and vibration because both characteristics were known indicators of bearing damage. EX1035, ¶ 57.

2. Limitation 23(a): “mounted on a sidewall of a bearing adapter”

Ground 1: It would have been obvious to mount Armitage’s sensor node to the sidewall of a bearing adapter. Armitage discloses that its sensor nodes are “attached or coupled to the associated undercarriage element,” which may be a “bearing or bearing box,” and can include a variety of sensor types including “thermometers” and “accelerometers.” EX1006, ¶¶ [0013]–[0015]. The sensor

node is preferably attached to a “non-rotating structure,” such as a “bearing mount.” *Id.*, ¶ [0034]. While Armitage does not expressly identify the *sidewall* of the bearing adapter, a PHOSITA would have understood that both thermometers and accelerometers can be mounted to the sidewall of a bearing adapter to measure heat and vibrations, respectively, emanating from the bearing. EX1035, ¶ 58. For example, Barone expressly discloses a sensor node comprising accelerometers and mounted on the sidewall of a bearing adapter. EX1007, ¶¶ [0289]–[0293], Figs. 11–13. Moretti teaches that it is preferable to mount a vibration sensor on the bearing box wall “at a position vertically aligned with the axis of rotation of the bearing, where the vibrations are more intense.” EX1022, 3:22–28; EX1035, ¶ 59. A PHOSITA would have been motivated to mount a sensing unit on the sidewall of a bearing adapter because it is an obvious, accessible, non-rotating surface that transmits both heat and vibrations emanating from the bearing. EX1035, ¶ 60.

Ground 2: LeFebvre discloses that its sensor unit can include a load sensor to “monitor vibrations emitted from the bearing (transmitted through the roller bearing adapter).” EX1005, ¶ [0059]. Although LeFebvre’s preferred embodiment is mounted on the upper surface of the bearing adapter, a PHOSITA would have understood that the shape, size, or location of the housing could be changed (e.g., to accommodate mounting a sensor device in a different location on the railcar) without affecting the operation of the sensors or electronic circuitry. EX1035, ¶ 61.

For example, a PHOSITA would have modified LeFebvre’s device to extend down the sidewall of the bearing adapter in order to place an accelerometer on the sidewall at the location identified by Barone, and Moretti identifies as optimal.

EX1007, ¶¶ [0289]–[0293], Figs. 11–13; EX1022, 3:22–28; EX1035, ¶ 62.

3. Limitation 23(b): “determining the condition of a bearing by applying a heuristic...wherein the heuristic correlates one or more numeric values derived from the data or processed information to the condition of the bearing”

Grounds 1 and 2: As explained in the Petition, both LeFebvre and Armitage perform calculations (or “heuristics”) on collected sensor data, which result in “numeric values” which represent the operational state of the bearing. *See* EX1005, claim 9 (“**values** indicative of critical departures of the performance criteria”), claim 12 (“**values** derived by said sensors”); EX1006, ¶ [0045] (calculating averages, minimums, and maximums based on acceleration data); EX1035, ¶ 63. *See also* Petition, 18–24, 50–57; EX1003, ¶¶ 70–86, 188–203.

Patent Owner argues that LeFebvre fails to disclose this limitation because it “discloses comparing relative temperatures (at different instrumented pads) to infer well-being of a bearing.” Mot., 31 (discussing EX1005 at ¶¶ 36, 56, 58–59). Patent Owner appears to be making a distinction that is not reflected in the claim language. As discussed above with respect to enablement, claim 23 does not limit—in any way—the manner in which the heuristic correlates the numeric

values to the condition of the bearing. *See* Sections II.B.1 and II.B.2, *supra*. Patent Owner attempts to distinguish Armitage on a similar basis, arguing that Armitage’s use of “dynamic normalization results in a change of the range of operational values for an undercarriage element in real time.” Mot., 32–33 (discussing EX1006 at ¶¶ 42, 44). Again, nothing in claim 23 excludes this method (or *any* method) of correlating numeric values with the condition of a bearing.

In any case, to the extent required by claim 23, it would have been obvious to correlate a measured value (e.g., bearing temperature) with a predetermined, fixed reference value (or set of values) to determine the condition of the bearing as discussed below with respect to Limitation 33(c). *See* Section III.C.2, *infra*.

4. Limitation 23(c): “wherein said severity level is one of a plurality of defined severity levels that are each assignable based on respective possible values for a magnitude of the deviations of one or more numeric values from nominal operating conditions for the bearing during operation of the railcar”

Grounds 1 and 2: It was well-understood—both in the context of railcar monitoring, and in general—that as a defect in a mechanical part increases in severity, it results in progressively larger deviations from normal operating conditions (e.g., temperature and vibration). A large deviation from expected conditions indicates a potentially serious underlying problem; a small deviation from expected conditions indicates a smaller, less serious issue. EX1035, ¶¶ 64–65.

A PHOSITA would have understood that “severity levels” can be used to

communicate the severity of a problem condition in a simple, understandable way.

EX1035, ¶¶ 66–67; *see* EX1036, 18:60–64. LeFebvre, for example, sends a report only when a deviation is detected and “the magnitude is sufficient to cause alarm.”

EX1005, ¶ [0055], [0095]. Armitage uses a color-coded system (corresponding to a “plurality of defined severity levels”) to indicate the severity of a detected condition. EX1006, ¶¶ [0043]–[0044] (“The event ranking could include a ‘yellow’ condition which indicates that a railway car requires service, and a ‘red’ condition which indicates...a serious deviation...that requires immediate service.”).

Inbarajan discloses a similar, color-coded system including three severity levels: red, yellow, and green. EX1036, 18:67–19:11, claim 4. Betters discloses yet another vehicle monitoring system having multiple defined severity levels.

EX1037, claim 1 (“determining...a severity level of the aircraft system operating condition with respect to a plurality of possible aircraft system operating condition severity levels”). The severity levels are determined with respect to the “degree of deviation” from the manufacturer’s “operating specification.” *Id.*, claim 4.

Accordingly, to whatever extent not already disclosed by Armitage and LeFebvre, a PHOSITA would have been motivated to utilize a plurality of severity levels as disclosed by Armitage, Inbarajan, and/or Betters to clearly communicate the severity of a problem condition. EX1035, ¶ 68.

5. Limitation 23(d): “wherein said alarm condition defines one or more

recommended actions to be taken with regard to the detected deviation from nominal operating conditions”

As discussed above, a PHOSITA would have understood that the appropriate response to a problem on a vehicle depends on the severity of the underlying problem. EX1035, ¶ 69. For example, alerts that include recommended corrective actions are commonplace on modern automobiles. EX1038, 2:7–18 (“For example, if the oil pressure drops below some predetermined level, the driver is warned to stop his vehicle immediately.”); EX1036, 17:8–16 (“For example, a lower severity diagnostic result might be accompanied by a notification of the problem and a link to more information, whereas a higher severity diagnostic result might be accompanied by a stronger warning and a link to a dealer to schedule servicing.”). *See also* EX1037, claim 2. In the context of railcar monitoring, Armitage describes a “railway car health scorecard,” which recommends a course of action based on the level of the alarm that is raised. EX1006, ¶ [0044]; EX1003, ¶ 225. Barone discloses a system that prompts a human to take appropriate action when a problem is detected. EX1007, ¶ [0036] (“If the estimated time to bearing failure permits, a maintenance action can be scheduled. If failure is estimated to be imminent, the train can be diverted or stopped before catastrophic bearing failure and derailment.”), ¶ [0164], ¶ [0191] (The system “generates an appropriate alarm or indication to prompt a human user to take remedial action.”). *See also* EX1024,

8:46–57. A PHOSITA would therefore have been motivated to send alarms that indicate both the severity of the underlying condition and the appropriate corrective action, because some conditions warrant immediate, urgent action (e.g., stopping the train) to avoid serious damage or injury—while other, less urgent conditions can be addressed by scheduling routing maintenance. EX1035, ¶ 70.

**B. Claims 24–32**

Ground 1: The limitations of dependent claims 24, 25, 27, and 29–32, corresponding to original claims 13, 2, 4, and 6–9 respectively, are disclosed by Armitage. *See* Petition, 58–68; EX1003, ¶¶ 204–215, 240–242; EX1035, ¶ 71. Claims 26 and 28, corresponding to original claims 3 and 5, are disclosed by Armitage in view of LeFebvre. *See* Petition, 70–71; EX1003, ¶¶ 250–253.

Ground 2: The limitations added by dependent claims 24–30, which correspond to original claims 13 and 2–7 respectively, are disclosed by LeFebvre. *See* Petition, 24–27, 33–34; EX1003, ¶¶ 87–99, 120–122; EX1035, ¶ 72. The limitations of claims 31 and 32, which correspond to original claims 8 and 9, are disclosed by LeFebvre and Barone. *See* Petition, 42–50; EX1003, ¶¶ 165–183.

With respect to “performing steps b-d at said location remote from said railcar” in claim 30, Armitage teaches that the collection node can apply heuristics to data aggregated from multiple control units and railcars. EX1006, ¶¶ [0038], [0043], [0044]; EX1003, ¶¶ 217–218. More generally, it would have been obvious

for a PHOSITA to apply heuristics at a remote receiver (i.e., in the locomotive or at a central data handling location) to take advantage of increased access to power and computing resources, and to detect potentially serious issues involving multiple railcars; it also would have been obvious to raise an alarm if any serious issues were detected. *See* Petition, 43–46, 62–63 (discussing Limitation 8(b)); EX1003, ¶¶ 167–172. With respect to Limitation 31(e), which requires a “raised alarm comprising the specific action to be taken with regard to the bearing based on the assigned severity level,” *see* Section III.A.5, *supra*. With respect to claims 27, 28, 30, and 31, which require an “accelerometer” or “acceleration data,” there is nothing inventive about using an accelerometer to measure vibrations emanating from a wheel bearing. It was known in the railroad industry as early as the 1980s that “vibrations of bearing boxes change their nature when faults arise.” EX1023, 3:17–19; EX1035, ¶ 74. As discussed above, Armitage, LeFebvre, Barone, and Moretti each disclose sensor nodes for monitoring wheel bearings that may include accelerometers. *See* Sections III.A.1 and III.A.2, *supra*; EX1035, ¶ 75.

### **C. Claim 33**

Ground 1: Most limitations of claim 33, including all limitations present in original claim 10, are disclosed by Armitage. *See* Petition, 65–67; EX1003, ¶¶ 227–235; EX1035, ¶ 76. Ground 2: Most limitations of claim 33, including all limitations present in original claim 10, are disclosed by LeFebvre. *See* Petition,

28–31; EX1003, ¶¶ 100–110; EX1035, ¶ 77. New limitations of claim 33 not previously addressed with respect to claim 10 are discussed below.

1. Limitation 33(b): “calibrated correlations between a plurality of temperature values for the desired part and a plurality of temperatures that are expected for the part during standard operations of the railcar”

Ground 1: As discussed with respect to Limitation 23(a) *supra*, Armitage discloses a sensor node that measures bearing temperature and is preferably attached to a “non-rotating structure,” such as a bearing mount. *See* EX1006, ¶ [0034]; Petition, 65–66. A PHOSITA would understand that measuring bearing temperature indirectly—Armitage’s preferred embodiment—requires correlating the temperature of the bearing itself (the part of interest) with the temperature of the non-rotating component that is directly measured. EX1035, ¶ 79. In other words, a PHOSITA would understand that the “calibrated correlations” of claim 33 are also used by Armitage’s preferred embodiment. With respect to the required “plurality of temperatures,” it would have been obvious to utilize temperature correlations over the full range of temperatures that the railcar part could reasonably expect to encounter while in operation. *Id.*

Ground 2: As shown in Figure 4, LeFebvre’s instrumented pad **16** measures the temperature of wheel bearing adapter **4**, which can be used to infer the temperature of wheel bearing **2a**. EX1005, ¶ [0019], Fig. 4. *See* Petition, 28–29. A PHOSITA would understand that measuring bearing temperature using this

arrangement requires a correlation between the temperature of the bearing (the part of interest) and the temperature of the bearing adapter (the part that is directly measured). EX1035, ¶ 80. In other words, a PHOSITA would understand that the “calibrated correlations” of claim 33 are also used in LeFebvre’s monitoring system. With respect to the required “plurality of temperatures,” it would have been obvious to utilize temperature correlations over the full range of temperatures that a part could reasonably expect to encounter while in operation. *Id.*

2. Limitation 33(c): “determining if said temperature of the desired part is outside an acceptable range of temperatures indicating operating conditions expected for the desired part during the operation of the railcar by comparing the temperature of the desired part determined in step (b) and at least one defined temperature value associated with the desired part”

A PHOSITA would understand that comparing a measured value (or a calculated value, such as an average of previous measurements) to a predefined range or threshold is the simplest way to detect a defect or failure. EX1021, ¶ 81.

For example, conventional trackside “hotbox detectors,” which were in common use by the 1940s, would calculate the bearing adapter temperature and generate an alarm if it exceeded a predetermined threshold. EX1035, ¶ 82.

Following the same principle, the systems disclosed by Barone and Moretti expressly disclose comparing measured temperature values with predetermined reference values, which are correlated with the maximum safe operating

temperatures of the bearing. EX1007, ¶ [0241] (“The microcontroller 177 thus triggers an alert action when the temperature detected for its associated wheel exceeds a pre-selected threshold temperature.”), ¶ [0253] (“Similarly, when the absolute temperature or the temperature rate of change exceeds a pre-selected threshold trigger value, a bearing defect or imminent failure may be determined to exist, and appropriate alert action taken responsive to the determination.”), claim 37; EX1022, 3:57–62, 4:8–12 (“When at least one of the signals related to one of the monitored parameters exceeds a predetermined threshold level, the processing unit generates an alarm signal that allows to intervene at the right moment to remove the defect and restore conditions of safe and correct operation.”). *See also* EX1008, ¶ [0104] (“If the filtered temperature exceeds the prescribed alarm level an alarm is triggered...”). The Martin Declaration admits, and Mr. Ricca agrees, that standard temperature thresholds for railcar wheel bearings were known in the art. EX2013, ¶ 15 (“The temperature thresholds that we were using during this project was roughly the same as industry standard thresholds used for analyzing train bearings.”); EX1035, ¶ 83. It therefore would have been obvious for a PHOSITA to compare a measured numeric value of a wheel bearing—for example, a temperature—with predetermined values that correlate with known, standard temperature thresholds for the bearing. *Id.* A PHOSITA have been motivated to do so because comparing a measured value (or a calculated value, such as an average

of previous measurements) to a predetermined threshold is a simple and reliable way to detect a defect or failure. EX1035, ¶ 85. A PHOSITA would have understood that this heuristic could be used in the systems described by LeFebvre and Armitage—for example, to detect dangerously high bearing temperatures.

EX1035, ¶ 86. Additionally, a PHOSITA would have understood that threshold-based heuristics can be used in parallel with more complex heuristics if desired. *Id.*

3. Limitation 33(d): “a plurality of severity levels defined by a deviation of said temperature from a predetermined reference temperature value, wherein said deviation indicates a severity of a detected condition of the desired part”

*See* Sections III.A.4 and III.A.5, *supra*.

4. Limitation 33(d): “transmitting an alarm...wherein said alarm condition defines one or more recommended actions to be taken with regard to the detected condition of the desired part”

*See* Sections III.A.4 and III.A.5, *supra*.

#### **D. Claims 34–35**

Ground 1: The limitations added by dependent claim 34, corresponding to original claim 11, are disclosed by Armitage. *See* Petition, 67–68; EX1003, ¶¶ 236–239; EX1035, ¶ 88. The limitations added by dependent claim 35, corresponding to original claim 12, are disclosed by Armitage in view of LeFebvre. *See* Petition, 71–72; EX1003, ¶¶ 254–259. Ground 2: The limitations added by dependent claims 34 and 35 are disclosed by LeFebvre. *See* Petition, 31–33; EX1003, ¶¶ 111–119; EX1035, ¶ 89.

**E. Claim 36**

Ground 1: Most limitations of claim 36, including all limitations present in original claim 14, are obvious over Armitage and LeFebvre. *See* Petition, 73–74; EX1003, ¶¶ 261–268; EX1035, ¶ 90. Ground 2: Most limitations of claim 36, including all limitations present in original claim 14, are disclosed by LeFebvre. *See* Petition, 35–38; EX1003, ¶¶ 123–132; EX1035, ¶ 91. New limitations of claim 36 not previously addressed with respect to claim 14 are addressed below.

1. Limitation 36(a): “on a sidewall of a bearing adapter”

*See* Section III.A.2, *supra*.

2. Limitation 36(b): “determine a condition of a bearing proximate to the bearing adapter based on correlations between the data and a plurality of possible values indicative of the condition of the bearing”

*See* Sections III.A.1, III.A.3, and III.C.2, *supra*.

3. Limitation 36(b): “assign a severity level to said determined actual failure or said predicted potential or imminent failures, wherein the severity level is based on deviations of the condition of the bearing from an expected condition of the bearing”

*See* Sections III.A.4 and III.A.5, *supra*.

4. Limitation 36(c)

*See* Sections III.A.4 and III.A.5, *supra*.

**F. Claims 37–41**

Ground 1: The limitations added by dependent claims 37–41, corresponding to original claims 15–18 and 20, are disclosed by Armitage in view of LeFebvre.

*See* Petition, 74–77; EX1003, ¶¶ 269–281; EX1035, ¶ 97. Ground 2: The limitations added by dependent claims 37–41 are disclosed by LeFebvre. *See* Petition, 38–41; EX1003, ¶¶ 133–145; EX1035, ¶ 98.

**G. Claim 42**

Ground 1: Most limitations of claim 42, including all limitations present in original claim 21, are obvious over Armitage and LeFebvre. *See* Petition, 77; EX1003, ¶¶ 282–286; EX1035, ¶ 99. Ground 2: Most limitations of claim 42, including all limitations present in original claim 21, are disclosed by LeFebvre. *See* Petition, 41; EX1003, ¶¶ 149–153; EX1035, ¶ 100. New Limitations: For Limitation 42(a), *see* Sections III.A.1 and III.A.2, *supra*. For Limitation 42(c), *see* Sections III.A.1, III.A.3, and III.C.2, *supra*. For Limitations 42(d) and 42(e), *see* Sections III.A.4 and III.A.5, *supra*.

**H. Claim 43**

Ground 1: The limitations of claim 43 are disclosed by Armitage and LeFebvre. *See* Petition, 77; EX1003, ¶¶ 287–289; EX1035, ¶ 103. Ground 2: The limitations of claim 43 are disclosed by LeFebvre. *See* Petition, 41; EX1003, ¶¶ 154–156; EX1035, ¶ 104. *See also* Sections III.A.1, III.A.3, and III.C.2, *supra*.

**IV. SUBSTITUTE CLAIMS 23–43 ARE INVALID UNDER 35 U.S.C. § 101**

As the Board correctly found in its Preliminary Guidance (Paper 29) (“PG”), substitute claims 23–43 are not directed to patent-eligible subject matter.

“Laws of nature, natural phenomena, and abstract ideas are not patentable” under 35 U.S.C. § 101. *Alice Corp. Pty. Ltd. v. CLS Bank Int’l*, 573 U.S. 208, 216 (2014). *Alice* establishes a two-step framework under which the Board must first determine whether a claim is “directed to” a patent ineligible abstract idea. *Id.* at 217. If a claim is directed to an abstract idea, the Board must then consider whether the claim includes additional elements that “transform the nature of the claim” into a patent-eligible application. *Id.* Claims 23–43 fail both steps of the *Alice* test.

1. *Alice* Step 1

The Board correctly found that claims 23–43 are directed to an abstract idea under *Alice* step one. *See* PG, 18. The claims utilize generic, conventional physical components to perform mathematical calculations on collected data, and are not limited to any particular technical implementation. Claim 23 provides a representative example. Step (a) recites generic, conventional components that are commonly used in the railcar industry (e.g., “sensing units,” “a bearing adapter,” “a bearing proximate to the bearing adapter”). EX1035, ¶ 107. Steps (b)–(d), meanwhile, are each directed to abstract concepts—“determining the condition of the bearing by applying a heuristic,” “assigning a severity level,” and “determining an alarm condition,” respectively. All three of steps (b)–(d) could be performed, in principle, by a human. *Id.* at ¶ 108. *See Bancorp Servs., L.L.C. v. Sun Life Assurance Co. of Canada (U.S.)*, 687 F.3d 1266, 1277-78 (Fed. Cir. 2012).

Claim 23, viewed as a whole, is therefore directed to an abstract idea. The claimed method utilizes generic, conventional components to collect data, perform mathematical operations on the collected data, and report the results of the mathematical calculations. Claims 24–43 are directed to the same abstract concepts as claim 23, with only minor variations. For example, claim 33 additionally requires that the report include unspecified “recommended actions to be taken.”

An additional deficiency, which underscores the abstract nature of the claims, is that they are directed to **results**, rather than defining **how** the abstract concepts are carried out. For example, claim 23 does not limit which “operational characteristic” is measured, or how the “heuristic” goes about correlating collected data to the condition of the bearing, or which “possible values” should be used to define the severity levels, or what “recommended actions” should be taken in response. *See* Section II.B, *supra* (discussing the same deficiencies in the context of enablement). The substitute claims are thus similar to those held invalid in *Clarilogic, Inc. v. FormFree Holdings Corp.*, 681 F. App’x 950 (Fed. Cir. 2017), which required collecting data and then validating data “by applying an algorithm engine.” *Id.* at 952. The claims were held ineligible because “the algorithm engine mentioned in the claim is not claimed, identified, or explained.” *Id.* at 954.

Claims 23–43 also fail to recite any “specific means or method that improves” upon the hardware used to implement the claimed process. *McRO, Inc.*

*v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1314 (Fed. Cir. 2016). Reciting generic physical components “is not enough to save the claims from abstractness, where the claimed advance is directed to . . . using off-the-shelf technology for its intended purpose.” *Chamberlain Group, Inc. v. Techtronic Indus. Co.*, 935 F.3d 1341, 1348 (Fed. Cir. 2019); *see also In re TLI Commc’ns Patent Litig.*, 823 F.3d 607, 615 (Fed. Cir. 2016) (holding claims ineligible where “the recited physical components behave exactly as expected according to their ordinary use”).

2. Alice Step 2

“To save a patent at step two, an inventive concept must be evident in the claims.” *RecogniCorp, LLC v. Nintendo Co.*, 855 F.3d 1322, 1327 (Fed. Cir. 2017). The inventive concept must supply “significantly more” than the abstract idea itself, *BSG Tech LLC v. Buyseasons, Inc.*, 899 F.3d 1281, 1289–90 (Fed. Cir. 2018), and must comprise more than “well-understood, routine, conventional” or “purely functional” claim elements. *Alice*, 573 U.S. at 224–26. Here, the abstract idea is the only feature of claims 23–43 that allegedly distinguishes the prior art. *See Mot.*, 30–35. The recited physical elements are conventional, are used in a conventional way, and are fully disclosed by the prior art. *See Section III, supra.*

**V. CONCLUSION**

Petitioner respectfully requests that the Board deny the Revised Motion to Amend.

Case No. IPR2023-00539

Patent No. 9,981,673

Respectfully submitted,

Dated: April 4, 2024

By: /Eric J. Rakestraw/

Eric J. Rakestraw, Reg. No. 68,740

Daisy Manning, Reg. No. 66,369

HUSCH BLACKWELL LLP

8001 Forsyth Blvd., Suite 1500

St. Louis, MO 63105

(314) 480-1500 Telephone

(314) 480-1505 Facsimile

PTAB-ERakestraw@huschblackwell.com

PTAB-DManning@huschblackwell.com

Andrea L. Shoffstall, Reg. No. 75,426

HUSCH BLACKWELL LLP

1801 Wewatta Street, Suite 1000

Denver, CO 80202

303.749.7200 Telephone

303.749.7272 Facsimile

PTAB-AShoffstall@huschblackwell.com

*Attorneys for Petitioner*

**CERTIFICATE OF SERVICE**

I hereby certify that on this 4th day of April, 2024, the foregoing was served via electronic mail to the attorneys of record for the '673 Patent at the following address:

|                                                                                                                                                                                                     |                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jeff E. Schwartz<br>Reg. No. 39,019<br>Fox Rothschild LLP<br>2020 K Street N.W., Suite 500<br>Washington, DC 20006<br>Tel: 202.696.1470<br>Fax: 202.461.3102<br>Email: jeschwartz@foxrothschild.com | Gary A. Hecht<br>Reg. No. 36,826<br>Fox Rothschild LLP<br>2000 Market Street, 20th Floor<br>Philadelphia, PA 19103-3222<br>Tel: 215.299.2416<br>Fax: 215.299.2150<br>Email: ghecht@foxrothschild.com      |
| P. Marshall Ticer<br>Reg. No. 74,653<br>Fox Rothschild LLP<br>2020 K Street N.W., Suite 500<br>Washington, DC 20006<br>Tel: 202.794.1237<br>Fax: 202.461.3102<br>Email: mticer@foxrothschild.com    | Ryan North Miller<br>Reg. No. 68,262<br>Fox Rothschild LLP<br>2000 Market Street, 20th Floor<br>Philadelphia, PA 19103-3222<br>Tel: 215.299.2901<br>Fax: 215.299.2150<br>Email: rmiller@foxrothschild.com |

By: /Eric J. Rakestraw/  
Eric J. Rakestraw, Reg. No. 68,740  
Lead Counsel for Petitioner

**LISTING OF CLAIMS**

| <b>Claim Limitation</b> | <b>Claim Language</b>                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Claim 23 Preamble       | A method of monitoring operational characteristics of a railcar comprising the steps of:                                                                                                                                                                                                                                                                                                                                                |
| Limitation 23(a)        | a. receiving data or processed information regarding <del>said an</del> <u>operational characteristic of a railcar</u> from one or more sensing units, <u>each mounted on a sidewall of a bearing adapter</u> on said railcar, said sensing units monitoring <del>an</del> <u>said operational characteristic of said railcar, wherein the operational characteristic is a condition of a bearing proximate to the bearing adapter;</u> |
| Limitation 23(b)        | b. <u>determining the condition of the bearing by applying a heuristic to said received data to determine deviations from nominal operating conditions, wherein the heuristic correlates one or more numeric values derived from the data or processed information to the condition of the bearing;</u>                                                                                                                                 |
| Limitation 23(c)        | c. assigning a severity level to said deviations from nominal operating conditions, <u>wherein said severity level is one of a plurality of defined severity levels that are each assignable based on respective possible values for a magnitude of the deviations of one or more numeric values from nominal operating conditions for the bearing during operation of the railcar; and</u>                                             |
| Limitation 23(d)        | d. determining an alarm condition based on said assigned severity level, <u>wherein said alarm condition defines one or more recommended actions to be taken with regard to the detected deviation from nominal operating conditions.</u>                                                                                                                                                                                               |
| Claim 24                | The method of <del>claim 1</del> <u>claim 23</u> , wherein steps (a) through (d) can be carried out at different event engines distributed among at least two of said <del>sensors</del> <u>sensing</u> units, a communication management unit, and a mobile or land base station.                                                                                                                                                      |
| Claim 25                | The method of <del>claim 1</del> <u>claim 23</u> , further comprising the initial step of establishing wireless communication with said one or more remote sensing units.                                                                                                                                                                                                                                                               |

| Claim Limitation | Claim Language                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Claim 26         | The method of <del>claim 2</del> <u>claim 25</u> , wherein said one or more remote sensing units form a mesh network.                                                                                                                                                                                                                                                                                                                                                          |
| Claim 27         | The method of <del>claim 2</del> <u>claim 25</u> , <u>wherein the received data or processed information includes one or more numeric values based on data obtained by an accelerometer in said sensing unit at the bearing adapter and</u> wherein steps a-d are executed by a processing unit located on said railcar.                                                                                                                                                       |
| Claim 28         | The method of <del>claim 4</del> <u>claim 27</u> , wherein said processing unit located on said railcar is a part of <del>said</del> <u>a</u> mesh network.                                                                                                                                                                                                                                                                                                                    |
| Claim 29         | The method of <del>claim 2</del> <u>claim 25</u> , further comprising the step of transmitting said alarm condition to a location remote from said railcar.                                                                                                                                                                                                                                                                                                                    |
| Claim 30         | The method of <del>claim 2</del> <u>claim 25</u> , further comprising the step of transmitting said data <u>or processed information</u> received from said one or more sensing units to a location remote from said railcar <u>and performing steps b-d at said location remote from said railcar, wherein said data or processed information includes one or more numeric values based on data obtained by an accelerometer in said sensing unit at the bearing adapter.</u> |
| Limitation 31(a) | The method of <del>claim 2</del> <u>claim 25</u> , further comprising the steps of:<br>receiving <u>acceleration</u> data from a plurality of railcars;                                                                                                                                                                                                                                                                                                                        |
| Limitation 31(b) | applying <del>a</del> <u>the</u> heuristic to said received <u>acceleration</u> data to determine <u>the</u> deviations from nominal operating conditions;                                                                                                                                                                                                                                                                                                                     |
| Limitation 31(c) | assigning <del>a</del> <u>the</u> severity level to said deviations from nominal operating conditions;                                                                                                                                                                                                                                                                                                                                                                         |
| Limitation 31(d) | determining <del>an</del> <u>the</u> alarm condition based on said assigned severity level; <u>and</u>                                                                                                                                                                                                                                                                                                                                                                         |
| Limitation 31(e) | transmitting <del>said a</del> raised alarm to a display unit on a train of which said plurality of railcars are a part, <u>said raised alarm</u>                                                                                                                                                                                                                                                                                                                              |

| Claim Limitation  | Claim Language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | <u>comprising the specific action to be taken with regard to the bearing based on the assigned severity level.</u>                                                                                                                                                                                                                                                                                                                                                                                                    |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Limitation 32(a)  | The method of <del>claim 6</del> <u>claim 29</u> , further comprising the steps of<br>a. determining a recommended course of action based on said alarm condition; and                                                                                                                                                                                                                                                                                                                                                |
| Limitation 32(b)  | b. transmitting said recommended course of action to a display unit on a train of which said railcar is a part.                                                                                                                                                                                                                                                                                                                                                                                                       |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Claim 33 Preamble | A method of monitoring a temperature <u>and condition</u> of a desired part of a railcar, comprising:                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Limitation 33(a)  | (a) sensing the temperature of a part of the railcar other than the desired part by use of a temperature sensor in thermal communication with said other part;                                                                                                                                                                                                                                                                                                                                                        |
| Limitation 33(b)  | (b) determining the temperature of the desired part by use of the temperature <u>of the part</u> sensed in step (a) <u>and calibrated correlations between a plurality of temperature values for the desired part and a plurality of temperatures that are expected for the part during standard operations of the railcar;</u>                                                                                                                                                                                       |
| Limitation 33(c)  | (c) determining if said temperature of the desired part is outside an acceptable range of temperatures <u>indicating operating conditions expected for the desired part during the operation of the railcar by comparing the temperature of the desired part determined in step (b) and at least one defined temperature value associated with the desired part, wherein an acceptable range of temperatures is a defined range of temperatures expected during normal operation of the railcar;</u> and              |
| Limitation 33(d)  | (d) transmitting an alarm if in step (c) it is determined that the temperature of the desired part is outside <del>an</del> <u>the</u> acceptable range <u>of temperatures and transmitting an alarm if in step (c) it is determined that the temperature of the desired part is outside the acceptable range of temperatures and is within one of a plurality of severity levels defined by a deviation of said temperature from a predetermined reference temperature value, wherein said deviation indicates a</u> |

| Claim Limitation | Claim Language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | <u>severity of a detected condition of the desired part, wherein said alarm condition defines one or more recommended actions to be taken with regard to the detected condition of the desired part.</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Claim 34         | A method of monitoring a temperature <u>and condition</u> of a desired part of a railcar in accordance with <del>claim 10</del> <u>claim 33</u> , further comprising the step of determining <u>a the</u> temperature of the ambient air, which temperature is used in the determination of step (b).                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Claim 35         | A method of monitoring a temperature <u>and condition</u> of a desired part of a railcar in accordance with <del>claim 10</del> <u>claim 33</u> , wherein steps (a) through (d) are carried out by a single unit attached to said railcar.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Claim 36         | A method for monitoring the operation of a railcar performed by a communication management unit disposed on said railcar comprising the steps of:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Limitation 36(a) | a. wirelessly receiving data from one or more sensing units which periodically collect readings from one or more sensors disposed <u>on a sidewall of a bearing adapter</u> on said railcar;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Limitation 36(b) | b. heuristically analyzing said received data to: <ul style="list-style-type: none"> <li>(i) <u>determine a condition of a bearing proximate to the bearing adapter based on correlations between the data and a plurality of possible values indicative of the condition of the bearing; and</u></li> <li>(ii) <u>determine if an actual failure exists on said railcar or to predict potential or imminent failures based on a statistical analysis of said received data; and</u></li> <li>(iii) <u>assign a severity level to said determined actual failure or said predicted potential or imminent failures, wherein the severity level is based on deviations of the condition of the bearing from an expected condition of the bearing; and</u></li> </ul> |
| Limitation 36(c) | c. <u>determine an alarm condition based on data collected by the one or more sensing units, wherein said alarm condition</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| Claim Limitation | Claim Language                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | <u>defines a specific action to be taken with regard to the bearing based on said assigned severity level;</u>                                                                                                                                                                                                                                                                                                                         |
| Limitation 36(d) | <u>ed. communicating the results of said analysis performed in step (b) to an off-railcar location.</u>                                                                                                                                                                                                                                                                                                                                |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Claim 37         | The method of <del>claim 14</del> <u>claim 36</u> , wherein each of said sensing units can make a <u>said</u> determination of an alarm condition based on data collected by the sensing unit, said method further comprising <del>the step of:</del><br><del>a. wirelessly receiving notice of said alarm condition from said sensing unit; and</del><br><del>b. communicating said alarm condition to an off-railcar location.</del> |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Limitation 38(a) | The method of <del>claim 14</del> <u>claim 36</u> , further comprising the steps of:<br>a. making a <u>said</u> determination of an alarm condition based on data received from two or more of said sensing units; and                                                                                                                                                                                                                 |
| Limitation 38(b) | b. communicating said alarm condition to an off-railcar location.                                                                                                                                                                                                                                                                                                                                                                      |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Claim 39         | The method of <del>claim 14</del> <u>claim 36</u> , further comprising the step of placing said one or more sensing units in a stand-by state when said one or more sensing units is not reading data from any of said sensors or transmitting data.                                                                                                                                                                                   |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Claim 40         | The method of <del>claim 14</del> <u>claim 36</u> , further comprising the step of joining a mesh network consisting of one or more sensing units located on said railcar.                                                                                                                                                                                                                                                             |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Limitation 41(a) | The <del>system</del> <u>method</u> of <del>claim 14</del> <u>claim 36</u> , further comprising the steps of:<br>a. saving data received from said one or more sensing units in memory; and                                                                                                                                                                                                                                            |
| Limitation 41(b) | b. comparing data received with said saved data to identify trends or deviations from normal readings of said data stored in memory.                                                                                                                                                                                                                                                                                                   |

| Claim Limitation | Claim Language                                                                                                                                                                                                                                                                                                                       |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Claim 42         | A method for monitoring the operation of a railcar comprising:                                                                                                                                                                                                                                                                       |
| Limitation 42(a) | a. collecting data at periodic intervals about one or more operating parameters of said railcar using one or more sensor units provided <u>on a sidewall of a bearing adapter on said railcar, wherein the one or more operating parameters comprise a condition of a bearing proximate to the bearing adapter;</u>                  |
| Limitation 42(b) | b. communicating said collected data to a communication management unit;                                                                                                                                                                                                                                                             |
| Limitation 42(c) | c. analyzing said collected data by applying heuristics thereto to (i) determine if an actual failure exists and (ii) <del>to</del> predict potential or imminent failures based on a statistical analysis of said collected data, <u>wherein application of the heuristics correlates the data to the condition of the bearing;</u> |
| Limitation 42(d) | d. <u>assigning a severity level to the condition of the bearing, wherein said severity level is one of three or more defined severity levels based on the one or more numeric values; and</u>                                                                                                                                       |
| Limitation 42(e) | e. <u>determining an alarm condition, wherein said alarm condition defines a specific action to be taken with regard to the bearing based on said assigned severity level.</u>                                                                                                                                                       |
| Limitation 43(a) | The method of <del>claim 21</del> claim 42, wherein the collected data <u>includes one or more numeric values based on data obtained at the bearing adapter, further comprising the steps of: assessing the <del>collected data</del> one or more numeric values to determine if an alarm condition exists;</u>                      |
| Limitation 43(b) | and wirelessly communicating said alarm condition to an off railcar location.                                                                                                                                                                                                                                                        |