

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HUM INDUSTRIAL TECHNOLOGY, INC.
Petitioner

v.

PATENT OWNER 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.

**DECLARATION OF STEVEN RICCA
IN SUPPORT OF PETITIONER'S OPPOSITION TO PATENT OWNER'S
REVISED MOTION TO AMEND**

I. INTRODUCTION

1. I, Steven Ricca, hereby declare that the following is true and correct. I previously provided a declaration filed as Ex. 1003 in support of Paper No. 1, Petition for *Inter Partes* Review (“Petition”), and my testimony from that first Declaration remains the same. I am competent to make this Declaration based upon my personal knowledge and technical expertise, which I addressed in my first declaration. If called to testify, I could and would testify honestly, under oath, to the matters set forth herein.

2. I have been asked to provide my opinion on whether the substitute claims of Patent Owner’s Revised Motion to Amend and Request for Preliminary Guidance for the ’673 Patent (the “Motion”) are unpatentable over certain prior art references. As explained below, it is my opinion that each of substitute claims 23–43 is unpatentable because each would have been obvious to a PHOSITA in view of the prior art.

3. I have also been asked to provide opinions regarding whether certain limitations of the substitute claims are supported by the original disclosure of the ’673 Patent.

II. MATERIALS CONSIDERED

4. In preparing this Declaration, I have considered all the material filed through the date of this Declaration in this proceeding and any other materials cited

in this Declaration.

III. OVERVIEW OF THE SUBSTITUTE CLAIMS

5. The substitute claims that I considered are reproduced in the table below. In this table, I understand that deletions from the original '673 Patent claims are struck or double bracketed, and newly added limitations are underlined.

6. For ease of reference, I have adopted a shorthand numbering for the claims, and individual claim limitations that is similar to the shorthand numbering I adopted in my first declaration for the original claims of the '673 Patent. For example, as indicated in the table below, I may use "Limitation 23(b)" as a shorthand reference to the limitation "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" in claim 23.

Claim Limitation	Claim Language
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 said <u>an</u> operational characteristic <u>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 an <u>said</u> operational characteristic of said railcar, <u>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</u>

Claim Limitation	Claim Language
	heuristic to said received data to determine deviations from nominal operating conditions, <u>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 claim 1 <u>claim 23</u> , wherein steps (a) through (d) can be carried out at different event engines distributed among at least two of said sensors <u>sensing</u> units, a communication management unit, and a mobile or land base station.
Claim 25	The method of claim 1 <u>claim 23</u> , further comprising the initial step of establishing wireless communication with said one or more remote sensing units.
Claim 26	The method of claim 2 <u>claim 25</u> , wherein said one or more remote sensing units form a mesh network.
Claim 27	The method of claim 2 <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 claim 4 <u>claim 27</u> , wherein said processing unit located on said railcar is a part of said <u>a</u> mesh network.

Claim Limitation	Claim Language
Claim 29	The method of claim 2 <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 claim 2 <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 claim 2 <u>claim 25</u> , further comprising the steps of: receiving <u>acceleration</u> data from a plurality of railcars;
Limitation 31(b)	applying a <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 a <u>the</u> severity level to said deviations from nominal operating conditions;
Limitation 31(d)	determining an <u>the</u> alarm condition based on said assigned severity level; <u>and</u>
Limitation 31(e)	transmitting said <u>a</u> raised alarm to a display unit on a train of which said plurality of railcars are a part, <u>said raised alarm 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 claim 6 <u>claim 29</u> , further comprising the steps of 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:

Claim Limitation	Claim Language
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 of the part sensed in step (a) and <u>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 an <u>the acceptable range 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 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 claim 10 <u>claim 33</u> , further comprising the step of determining a <u>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

Claim Limitation	Claim Language
	desired part of a railcar in accordance with claim 10 <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 on said railcar</u> ;
Limitation 36(b)	b. heuristically analyzing said received data to: (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</u>; and (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</u>; and (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</u>; and
Limitation 36(c)	c. <u>determine an alarm condition based on data collected by the one or more sensing units, wherein said alarm condition defines a specific action to be taken with regard to the bearing based on said assigned severity level</u> ;
Limitation 36(d)	ed. <u>communicating the results of said analysis performed in step (b) to an off-railcar location.</u>
Claim 37	The method of claim 14 <u>claim 36</u> , wherein each of said sensing units can make a said determination of an alarm condition based on data collected by the sensing unit, said method further comprising the step of : a. wirelessly receiving notice of said alarm condition from said sensing unit; and b. communicating said alarm condition to an off-railcar

Claim Limitation	Claim Language
	location.
Limitation 38(a)	The method of claim 14 <u>claim 36</u> , further comprising the steps of: a. making a said 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 claim 14 <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 claim 14 <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 system <u>method</u> of claim 14 <u>claim 36</u> , further comprising the steps of: 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 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

Claim Limitation	Claim Language
	to (i) determine if an actual failure exists and (ii) to 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)	<u>d. 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)	<u>e. 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 claim 21 <u>claim 42</u> , 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 collected data 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.

IV. LEGAL PRINCIPLES

7. In forming my opinions and considering the subject matter of the '673 Patent and substitute claims 23–43, I am relying on certain legal principles that counsel in this case has explained to me. My understanding of these concepts is summarized below.

A. **Written Description**

8. Counsel has informed me that substitute claims must be supported by the written description of the original application, and may not introduce new subject matter. I have been informed that 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. Thus, a claim fails to satisfy the written description requirement if it includes a limitation that is not disclosed by the original specification of the '673 Patent.

B. Indefiniteness

9. Counsel has informed me that a claim is indefinite if, when read in light of the patent specification and its prosecution history, it fails to inform those skilled in the art about the scope of the invention with reasonable certainty. In particular, I have been informed that a claim is indefinite if a PHOSITA could not clearly understand what is covered by the claim in order to avoid infringement.

C. Enablement

10. Counsel has informed me that, to satisfy the enablement requirement, the original specification must enable any person skilled in the art to make and use the claimed invention without undue experimentation. I have been informed that many factors may be considered when determining whether a claim satisfies the enablement requirement and whether any necessary experimentation is “undue.” I have been informed that these factors include, but are not limited to, the following:

- (A) The breadth of the claims;
- (B) The nature of the invention;
- (C) The state of the prior art;
- (D) The level of one of ordinary skill;
- (E) The level of predictability in the art;

- (F) The amount of direction provided by the inventor;
- (G) The existence of working examples; and
- (H) The quantity of experimentation needed to make or use the invention based on the content of the disclosure.

I have also been informed that a patent is not required to disclose concepts that are well-known in the art in order to satisfy the enablement requirement.

D. Obviousness

11. I have applied the same legal principles of obviousness as in my first declaration, and I incorporate them by reference here. EX1003, ¶¶ 55–65.

V. LEVEL OF ORDINARY SKILL IN THE ART

12. In my first declaration, I provided my opinion on the level of ordinary skill in the art. EX1003, ¶¶ 44–46. In my opinion, the same level of ordinary skill in the art applies to the proposed substitute claims.

VI. CLAIM CONSTRUCTION

13. I have been informed that in a proceeding for *inter partes* review, claims terms in an unexpired patent are to be given their plain and ordinary meaning, as understood by a person having ordinary skill in the art, in view of the patents' specification. *See* 42 CFR § 42.100(b); 83 FR 51340; *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

14. It is my understanding that Patent Owner has not proposed a construction of any new words or phrases that have been added to the substitute

claims.

15. It is my opinion that all claim terms, for the purposes of *inter partes* review can be given their plain and ordinary meaning.

VII. UNPATENTABILITY

A. Written Description

16. In my opinion, substitute claims 23-43 each include limitations that are not supported by the specification of the '673 Patent.

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

17. Substitute claim 23 claims “one or more sensing units, each mounted on a sidewall of a bearing adapter.”

18. The '673 Patent does not specify any particular location on the railcar where the sensing units must be mounted. A PHOSITA would understand that many of the sensors listed in the '673 Patent would serve no purpose if mounted on a bearing adapter. For example, a PHOSITA would understand that strain gauges, gyroscopes, reed switches, and limit switches (to name a few) would not serve any purpose if mounted on the sidewall of a bearing adapter. The specification states that “[a]s 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.” EX1001, 4:49–51. A PHOSITA would understand this statement to mean that different sensors will require different housing configurations and mounting locations, which is an obvious concept that would have been familiar to

a person of ordinary skill.

19. Additionally, a PHOSITA would understand that a bearing adapter has multiple surfaces suitable for mounting sensor devices. The sidewall of a bearing adapter is a common, obvious mounting location because it is easily accessible from outside the train. However, sensors can be mounted to other surfaces. LeFebvre, for example, discloses sensors mounted to “the upper rectangular surface of the bearing adapter.” EX1005, ¶ [0020].

20. I understand that Patent Owner cites to the embodiment disclosed in Figs. 3 and 3A of the '673 Patent. The embodiment of Figs. 3 and 3A is expressly described 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 specification does not indicate that the embodiment of Figs. 3 and 3A comprises any type of sensor other than a temperature sensor.

21. I understand that Patent Owner also cites to the table spanning cols. 7–12 of the '673 Patent, which includes two examples that reference an “adapter mounted accelerometer.” Neither example states that the accelerometer is mounted specifically to the sidewall of a bearing adapter. As I have discussed above, other mounting locations are possible, such as the upper surface of the bearing adapter.

2. 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”

22. Claim limitation 23(c) requires “a plurality of defined severity levels,” wherein each defined severity level is “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.”

23. I understand that, to support the claimed “severity levels,” Patent Owner relies on passages in the ’673 Patent that relate to “tiered alarm levels.” 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.” EX1001 at 12:57-58. In my opinion, this passage does not support the “severity levels” limitation that has been added to substitute claim 23. For example, it is not clear which criteria are used to define the “tiered alarm levels.” The ’673 Patent does not state (or even suggest) that the tiered alarm levels are “assignable based on respective possible values for a magnitude of the deviations of one or more numeric values from nominal operating conditions” as required by claim 23.

24. I understand that Patent Owner also cites a general statement that “[t]he action required to be taken by the locomotive driver varies based on the severity of the alert.” EX1001, 12:44-47. While this concept is obviously true and

would be understood by anyone skilled in the art, it does not provide support for “severity levels” having the specific features required by claim 23.

25. I understand that Patent Owner also relies on the “Bearing Fault Indicator” heuristic, which appears in col. 9 of the ’673 Patent. 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. In my opinion, nothing in this passage relates to the assignment of severity levels.

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

26. Claim 23 introduces a new claim term: “numeric values derived from the data or processed information.” This term does not appear in the specification, and the shorter term “numeric values” does not appear either. In my opinion, this new limitation is not supported by the disclosure of the ’673 Patent.

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

27. As I already 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.” See Section VII.A.1, *supra*, which is incorporated here by reference. As discussed above, the specification only discloses a single embodiment with a *temperature* sensor mounted to the sidewall of a bearing adapter. In my opinion, the specific combination of sensing unit

comprising an *accelerometer* mounted to the *sidewall* of a bearing adapter is not disclosed by the specification of the '673 Patent.

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

28. In support of this limitation, Patent Owner cites to col. 11:52–54, which states only that heuristics “may be performed by either mobile base station 42 or land-based based station 44.” EX1001, 11:52–54. The specification does not disclose any embodiment in which all three of the steps required by claim 30 are performed at a remote location.

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

29. Claim 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 and it also does not disclose any correlations between them. I cannot find in the specification anything that describes “standard operations of the railcar,” or anything that describes temperatures that are “expected” for a desired part under those conditions.

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

30. Limitation 33(c) introduces a new claim term, “an acceptable range of temperatures,” which seems to include two different definitions in the claim: (1) a

range “indicating operating conditions expected for the desired part during the operation of the railcar” and (2) “a defined range of temperatures expected during normal operation of the railcar.” I cannot locate any disclosure in the specification that provides clarity on these definitions and Patent Owner has not identified anything in the specification that discloses “an acceptable range of temperatures” as claimed.

31. For the limitation “a predetermined reference temperature value,” which appears in Limitation 33(d), I reviewed the citations provided by Patent Owner, and none of them relate to “a predetermined reference temperature value.”

8. Claim 33: “transmitting an alarm”

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

Claim	Term
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 defined severity levels defined by a deviation of said temperature from a predetermined reference temperature value”

33. In my opinion, there is nothing in the specification that 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).

9. Claim 36: “on a sidewall of a bearing adapter”

34. See my discussion of the same terms in Section VII.A.1, *supra*, which is incorporated here by reference.

10. Claim 42: “on a sidewall of a bearing adapter”

35. See my discussion of the same terms in Section VII.A.1, *supra*, which is incorporated here by reference.

B. Indefiniteness

36. In my opinion, claims 23-43 each include language that is ambiguous or unclear. As I will explain below, a PHOSITA would not be able to determine, with reasonable certainty, what is required by these claims or how to avoid infringement.

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

37. Claim 33 includes the following five terms relating to temperature:

Claim	Term
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”

38. See the discussion of the same terms with respect to written description in Sections VII.A.6, VII.A.7, and VII.A.8, *supra*, which are

incorporated here by reference. As discussed above, claim 33 includes a number of terms relating to “temperatures” and “temperature values” that do not appear in the specification. In my opinion, it is not clear how each term relates to the various concepts and examples that are disclosed the ’673 Patent. It is also unclear how the terms relate to one another.

C. Enablement

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

39. Claim 23 broadly encompasses using any possible “heuristic” to correlate any possible “operational characteristic” of a wheel bearing with the condition of the bearing. In my opinion, the ’673 Patent does not enable a PHOSITA to practice the full scope of this claim.

40. As an example, the ’673 Patent does not disclose any teaching or examples that would enable methods of monitoring *acceleration* as required by dependent claims 27, 28, 30, and 31. To the extent the specification provides examples that involve *temperature* monitoring, it is my opinion that those examples do not enable the claimed methods of monitoring *acceleration*. Temperature is a single, measurable value that changes relatively slowly. Acceleration, in contrast, occurs in three axes and rapidly changes in both its magnitude and its direction—often thousands of times per second. Similarly, the ’673 Patent does not enable a PHOSITA to practice methods of monitoring other

operational characteristics (other than temperature or acceleration) that are encompassed by the broad scope of claim 23.

2. Claim 23: “assigning a severity level”

41. Limitation 23(c) requires “assigning a severity level to said deviations from nominal operating conditions....” As I have discussed above with respect to written description in Section VII.A.2, *supra*, the specification does not disclose any “severity level” having the characteristics required. In my opinion, a PHOSITA could not implement the claimed severity levels without undue experimentation.

42. Also, as I already discussed in Section VII.C.1, *supra*, claim 23 is not limited to methods of monitoring bearing temperature, but broadly encompasses using any type of heuristic to correlate any possible characteristic of a railcar wheel bearing with the condition of the bearing. In my opinion, the specification does not enable a PHOSITA to assign a “severity level” based on any possible operational characteristic. As one example, the specification does not disclose appropriate “severity levels” for use in acceleration monitoring, and in my opinion a PHOSITA would not be enabled to identify appropriate severity levels without undue experimentation.

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

43. *See* Sections VII.C.1 and VII.C.2, *supra*.

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

44. *See* the discussion of the same terms with respect to written

description in Section VII.A.6. 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.” No temperature correlations are disclosed in the ’673 Patent, and the specification does not teach a PHOSITA how to develop the temperature correlations needed to practice this claim without undue experimentation.

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

45. See the discussion of the same terms with respect to written description in Sections VII.A.6, VII.A.7, and VII.A.8, *supra*, and with respect to indefiniteness in Section VII.B.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. Also, the specification does not disclose any “predetermined reference value” or “defined temperature value” that could be used to practice this claim without undue experimentation.

6. Claim 36: “determine a condition of the bearing...”

46. See Section VII.C.1, *supra*.

7. Claim 36: “assign a severity level”

47. See Section VII.C.2, *supra*.

8. Claim 42: “determine a condition of the bearing...”

48. See Section VII.C.1, *supra*.

9. Claim 42: “assigning a severity level to the condition of the bearing”

49. See Section VII.C.2, *supra*.

D. Obviousness

50. As I explained in my first declaration in this proceeding (EX1003), original claims 1–18 and 20–22 of the ’673 Patent are obvious in view of LeFebvre (EX1005), Armitage (EX1006), and Barone (EX1007). Specifically, I explained that:

- 1) Claims 1–7, 10–18, and 20–22 are obvious over LeFebvre;
- 2) Claims 8 and 9 are obvious over LeFebvre in view of Barone;
- 3) Claims 1, 2, 4, 6–11, and 13 are obvious over Armitage; and
- 4) Claims 3, 5, 12–18, and 20–22 are obvious over Armitage in view of LeFebvre.

The same limitations present in original claims 1–18 and 20–22 also appear in substitute claims 23–43. My analysis of these original claim limitations does not differ from my first declaration, EX1003, and I incorporate that analysis here by reference.

51. In my opinion, the newly added limitations of substitute claims 23–43 merely recite specific features (e.g., mounting a sensor on the sidewall of a bearing adapter) that were conventional, obvious, and well-known in the prior art. Specifically, it is my opinion that the substitute 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). I will explain in detail below where each of these features may be found in the prior art.

1. Motivation to Combine

52. 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.

53. Two additional prior art references, Inbarajan, and Betters, disclose monitoring systems involving multiple “severity levels” and confirm that these concepts were well-understood by a PHOSITA. 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 include methods and techniques that are broadly applicable to a variety of vehicle types, including railcars. Armitage, LeFebvre, Barone, Moretti, Inbarajan, and Betters are therefore analogous art. A PHOSITA would have been motivated to combine the teachings of these references for the reasons I will address in detail below with respect to each substitute claim.

2. Claim 23

54. Ground 1: Most limitations of claim 23, including all limitations present in original claim 1, are disclosed by Armitage. I addressed these limitations in my first declaration, which is incorporated here by reference. *See* EX1003, ¶¶ 188–203.

55. Ground 2: Most limitations of claim 23, including all limitations present in original claim 1, are disclosed by LeFebvre. I addressed these limitations in my first declaration, which is incorporated here by reference. *See* EX1003, ¶¶ 70–86.

56. The new limitations of claim 23, which I have not previously

addressed in this proceeding, are discussed in detail below.

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

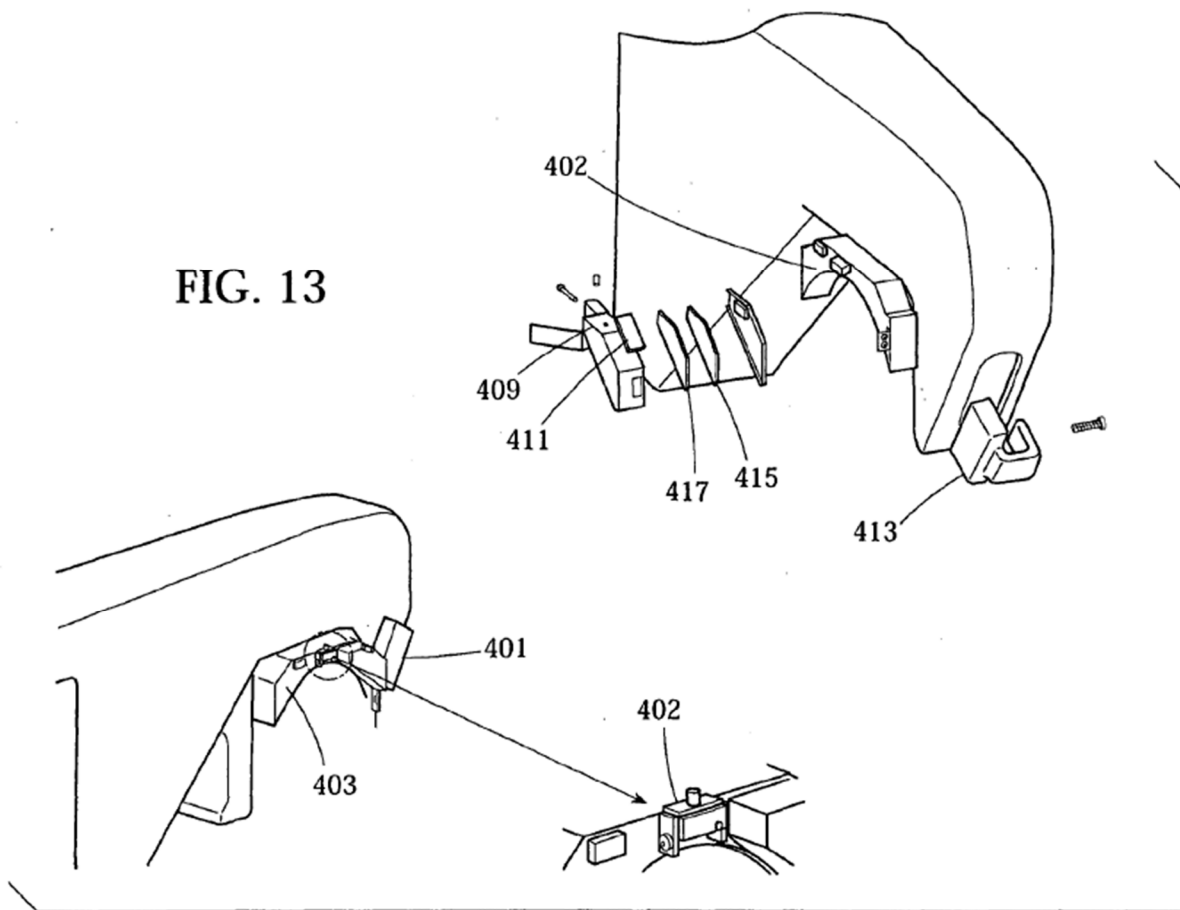
57. Grounds 1 and 2: Armitage, LeFebvre, Barone, and Moretti each disclose sensor nodes for monitoring wheel bearings that may include a variety of different sensors, including accelerometers, temperature sensors, or a combination thereof. EX1006, ¶¶ [0013]–[0015]; ¶ [0025] (“The information monitored could include undercarriage element **temperature**, ambient temperature, **vibration**, noise, among other information.”); ¶ [0027] (“The fault condition could include conditions such as hotbox conditions...bearing **temperature**, **vibration** signatures...”); EX1005, claim 12 (“at least one sensing device being a **temperature** sensor disposed on the pads adjacent a bearing for sensing bearing temperature,”), claim 21 (a system according to claim 12 having a “second sensing device being a **vibration** sensing device”); EX1007, ¶ [0045] (disclosed system “monitors bearing **temperature**, bearing **vibration**...and reports critical situations back to the central monitoring station, thus allowing continuous monitoring and true trending data analysis”); EX1022, 3:57–62 (“In a preferred embodiment, besides the **vibration** and motion sensors, also a **temperature** sensor (not shown) is included for signalling the occurrence of temperatures higher than those of normal operation and indicating that the friction within the bearing is exceeding a pre-set threshold value of admissibility.”). In a sensor unit for monitoring a wheel

bearing, a PHOSITA would have found it obvious to include both a temperature sensor and a vibration sensor because both temperature and vibration are known indicators of bearing degradation and damage. In fact, combined accelerometer/temperature sensors are in common use and have been commercially available since at least the early 2000s.

b. Limitation 23(a): “mounted on a sidewall of a bearing adapter”/“wherein the operational characteristic is a condition of a bearing proximate to the bearing adapter”

58. 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]. Armitage does not expressly identify the *sidewall* of the bearing adapter as required by claim 23. However, a PHOSITA would have understood that both thermometers and accelerometers can be mounted to the sidewall to measure heat and vibrations emanating from the bearing. This is commonplace in the railroad industry, and there are many examples in the prior art. 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. Figure 13 of Barone is reproduced below, and clearly shows the sensor unit **401** mounted (using mounting bracket **402**) on the sidewall of the bearing adapter **403**.



59. Moretti teaches that it is preferable to mount a vibration sensor “at a position vertically aligned with the axis of rotation of the bearing, where the vibrations are more intense,” and preferably “at 12 o'clock, i.e. in correspondence of the zone where the rolling bodies of the bearing undergo the maximum load.”

EX1022, 3:22–28. The mounting location disclosed by Figure 13 of Barone is

therefore an optimal (or nearly optimal) location on the sidewall of the bearing adapter that is consistent with Moretti's teachings.

60. In my opinion, 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. A sensor mounted on the sidewall of a bearing adapter is also less likely to collect rain, snow, and other environmental contaminants than a sensor mounted in most other locations on the railcar.

61. 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 contained within the housing.

62. For example, a PHOSITA could 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 optimal location identified by Barone. EX1007, ¶¶ [0289]–[0293], Figs. 11–13. In practice, LeFebvre's instrumented pad could easily be

extended over the edge of the bearing adapter, and a short distance down the sidewall, to accommodate placing a sensor at this optimal location.

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

63. Grounds 1 and 2: As explained in my declaration submitted with the Petition, both LeFebvre and Armitage perform calculations (or “heuristics”) on collected sensor data, which naturally results 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); *see also* Petition, pp. 18–24, 50–57; EX1003, ¶¶ 70–86, 188–203.

d. 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”

64. Grounds 1 and 2: A large deviation from normal operating conditions (e.g., temperature and vibration) usually indicates the presence of a larger, more severe problem. Conversely, a small deviation from normal operating conditions usually indicates the presence of a smaller, less severe problem. This is a simple concept that would have been obvious to a PHOSITA.

65. This simple concept is also reflected in the prior art. EX1006, ¶ [0043]

(“The degree to which any specific sensor deviates from this population is indicative of the severity of the mechanical condition of the component.”), EX1005, ¶ [0055] (“If such behavior is inferred at the instrumented pad **and the magnitude is sufficient to cause alarm...**”), ¶ [0095]. *See also* EX1024, 8:46–57 (“Given sudden changes of smaller scale which are recognized as defects to a bogie 1, the maximum speed can be reduced. Given sudden changes of larger scale, a vehicle stop and an inspection of the affected bogie 1 should be performed.”).

66. The appropriate response to a problem on a railcar depends on the severity of the problem. This is also a simple concept that would have been obvious to a PHOSITA, and it is reflected in the prior art. EX1006, ¶ [0044] (“The event ranking could include a ‘yellow’ condition which indicates that a railway car requires service, and a ‘red’ condition which indicates that a sensor has detected a serious deviation from normal operations that requires immediate service.”); 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] (“Thus, continual monitoring of the same bearing with respect to a constant sensor location allows true trending analysis, allowing for reporting of the bearing condition to a user by an appropriate display device, to arrange for appropriate remediation.”), ¶ [0191] (“The locomotive computer system, responsive to that

data then generates an appropriate alarm or indication to prompt a human user to take remedial action.”).

67. A PHOSITA would have understood that “severity levels” can be used to communicate the severity of a problem condition in a simple, understandable way. *See* EX1036, 18:60–64. Armitage, for example, uses a color-coded system (corresponding to a “plurality of defined severity levels”) to indicate the severity of a detected condition. EX1006, ¶ [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.”

68. In the context of a railcar monitoring and alarm system, a PHOSITA would therefore have been motivated to use a plurality of severity levels as disclosed by Armitage, Inbarajan, and/or Betters to clearly communicate the severity of a problem condition.

e. 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”

69. As I already noted above, a PHOSITA would have understood that the appropriate response to a problem on a vehicle depends on the severity of the underlying problem. 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 (“The method of claim 1 wherein...determining the analytical characterization of the aircraft system operating condition includes determining a performance trend for the aircraft system operating condition; and the performance trend provides indication of a potential need for implementing a corrective action to address the aircraft system operating condition.”).

70. In the context of railcar monitoring, 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.

3. Claims 24–32

71. Ground 1: The limitations added by dependent claims 24, 25, 27, and 29–32, which correspond to original claims 13, 2, 4, and 6–9 respectively, are disclosed by Armitage. I addressed these limitations in my first declaration, which is incorporated here by reference. *See* EX1003, ¶¶ 204–215, 240–242. The additional limitations of claims 26 and 28, which correspond to original claims 3 and 5, are disclosed by Armitage in view of LeFebvre. *See* EX1003, ¶¶ 250–253.

72. 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* EX1003, ¶¶ 87–99, 120–122. The additional limitations of claims 31 and 32, which correspond to original claims 8 and 9, are disclosed by LeFebvre and Barone. *See* EX1003, ¶¶ 165–183.

73. 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* my discussion of Limitation 23(d) in Section VII.D.2.e, *supra*.

74. 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. Using an accelerometer to measure vibrations emanating from a wheel bearing is commonplace in the railroad industry. It was known as early as the 1980s that “vibrations of bearing boxes change their nature when faults arise.” EX1023, 3:17–19. Accelerometers were originally invented in the 1920s, and the type of accelerometer commonly used today (piezoelectric) was in common use by the late 1950s/early 1960s. Accelerometers are used in many types of rotating applications, from balancing items (turbines, satellites, tires, train wheels) to monitoring rotating equipment (wheels, fans, power plant generators, pumps) and the like.

75. As I discussed above with respect to Limitation 23(a), Armitage, LeFebvre, Barone, and Moretti each disclose sensor nodes for monitoring wheel bearings that may include accelerometers, either alone or in combination with temperature sensors. *See* Sections VII.D.2.a and VII.D.2.b, *supra*.

4. Claim 33

76. Ground 1: Most limitations of claim 33, including all limitations present in original claim 10, are disclosed by Armitage. I addressed these limitations in my first declaration, which is incorporated here by reference. *See* EX1003, ¶¶ 227–235.

77. Ground 2: Most limitations of claim 33, including all limitations present in original claim 10, are disclosed by LeFebvre. *See* EX1003, ¶¶ 100–110.

78. The new limitations of claim 33, which I have not previously addressed in this proceeding, are addressed below.

a. 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”

79. Ground 1: As discussed with respect to Limitation 23(a) above, 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]. Measuring bearing temperature indirectly—as in Armitage’s preferred embodiment—requires correlating the temperature of the bearing with the temperature of the non-rotating component that is being directly measured (for example, the bearing mount). In other words and in my opinion, Armitage’s preferred embodiment implicitly involves the use of “calibrated correlations” as required by claim 33. In my experience, bearing mount manufacturers provide

threaded mounting locations for precisely this purpose—the railroad industry has been practicing this type of monitoring for more than a century. 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.

80. 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 itself (the component of interest) and the temperature of the bearing adapter (the component that is directly measured). In other words, a PHOSITA would understand that the “calibrated correlations” are inherently used in LeFebvre’s monitoring system as required by claim 33. For the claimed “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.

b. 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”

81. Comparing a measured value to a predetermined threshold is the *simplest* way to detect a defect or failure. In my opinion, that is an obvious fact that would be understood by anyone skilled in the art.

82. 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. *See* EX1026 (Utterback), 2:16-21 (“In hot box detectors this signal triggers a warning output if the signal indicates that the temperature of a wheel journal exceeds a predetermined value (generally about 70 degrees C. above the ambient temperature), i.e., if a hot box is detected.”); EX1027 (Doctor), claim 1 (“generating an alarm signal when said temperature indicative signals exceed a preselected limit characterizing an abnormal condition for said wheel”); EX1025 (Johanson), claim 4 (hotbox detector including a means for indicating “bearings having a measured temperature in excess of a predetermined value”). Following the same principle, the systems disclosed by Barone and Moretti disclose comparing measured temperature values with predetermined reference values. 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 (“In a preferred embodiment, besides the vibration and motion sensors, also a temperature sensor (not shown) is included for signalling the occurrence of temperatures higher than those of normal operation and indicating that the friction within the bearing is exceeding a pre-set threshold value of admissibility.”), 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...”).

83. I understand that Andrew Martin, in a declaration submitted in this proceeding, admitted 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.”). I agree with Mr. Martin that standard temperature thresholds for railcar wheel bearings were known in the art.

84. The prior art also discloses comparing a measured acceleration value with a predetermined reference value. EX1022, 3:57–62, 4:8–12. *See also* EX1008,

¶ [0105] (“If the filtered acceleration exceeds the prescribed alarm level, then an alarm is generated.”); EX1024, 2:54–61.

85. In summary, comparing a measured value (or a calculated value, such as an average of previous measurements) to a predefined threshold (or a plurality of thresholds) is the simplest way to detect a potential failure, and a PHOSITA would have understood that this heuristic could be used in the systems described by LeFebvre and Armitage to detect dangerously high bearing temperatures and/or vibrations. In my opinion, a PHOSITA would have been motivated to use threshold-based comparisons because they are simple, straightforward to implement, and effective. A PHOSITA would also have understood that threshold-based heuristics can be used in parallel with more complex types of heuristics. These methods were well established in the rotating machinery monitoring industries generally, and a PHOSITA would have had access to many publications, training courses, and other materials that disclose the same principles I have discussed above with respect to the prior art.

c. 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”

86. See my discussion of Limitations 23(c) and 23(d) in Sections VII.D.2.d and VII.D.2.e, *supra*.

d. 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”

87. See my discussion of Limitations 23(c) and 23(d) in Sections VII.D.2.d and VII.D.2.e, *supra*.

5. Claims 34–35

88. Ground 1: The limitations added by dependent claim 34, corresponding to original claim 11, are disclosed by Armitage. I addressed these limitations in my first declaration, which is incorporated here by reference. See EX1003, ¶¶ 236–239. The limitations added by dependent claim 35, corresponding to original claim 12, are disclosed by Armitage in view of LeFebvre. See EX1003, ¶¶ 254–259.

89. Ground 2: The limitations added by dependent claims 34 and 35 are disclosed by LeFebvre. See EX1003, ¶¶ 111–119.

i. Claim 36

90. Ground 1: Most limitations of claim 36, including all limitations present in original claim 14, are obvious over Armitage in view of LeFebvre. I addressed these limitations in my first declaration, which is incorporated here by reference. See EX1003, ¶¶ 261–268.

91. Ground 2: Most limitations of claim 36, including all limitations present in original claim 14, are disclosed by LeFebvre. EX1003, ¶¶ 123–132.

92. The new limitations of claim 36, which I have not previously addressed in this proceeding, are addressed below.

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

93. See my discussion of Limitation 23(a) in Section VII.D.2.b, *supra*.

b. 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”

94. See my discussion of Limitations 23(a), 23(b), and 33(c) in Sections VII.D.2.a, VII.D.2.c, and VII.D.4.b, *supra*.

c. 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”

95. See my discussion of Limitations 23(c) and 23(d) in Sections VII.D.2.d and VII.D.2.e, *supra*.

d. Limitation 36(c): “determine an alarm condition based on data collected by the one or more sensing units, wherein said alarm condition defines a specific action to be taken with regard to the bearing based on said assigned severity level”

96. See my discussion of Limitations 23(c) and 23(d) in Sections VII.D.2.d and VII.D.2.e, *supra*.

i. Claims 37–41

97. 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. I addressed these limitations in my first declaration, which is incorporated here by reference. See EX1003, ¶¶ 269–281.

98. Ground 2: The limitations added by dependent claims 37–41 are

disclosed by LeFebvre. *See* EX1003, ¶¶ 133–145.

i. Claim 42

99. Ground 1: Most limitations of claim 42, including all limitations present in original claim 21, are obvious over Armitage in view of LeFebvre. I addressed these limitations in my first declaration, which is incorporated here by reference. *See* EX1003, ¶¶ 282–286.

100. Ground 2: Most limitations of claim 42, including all limitations present in original claim 21, are disclosed by LeFebvre *See* EX1003, ¶¶ 149–153. The new limitations of claim 42, which I have not previously addressed in this proceeding, are addressed below.

101. New Limitations: For Limitation 42(a), *see* Sections VII.D.2.a and VII.D.2.b, *supra*. For Limitation 42(c), *see* VII.D.2.a, VII.D.2.c, and VII.D.4.b, *supra*. For Limitations 42(d) and 42(e), *see* Sections VII.D.2.d and VII.D.2.e, *supra*.

102. Claim 43

103. Ground 1: The limitations added by dependent claim 43, corresponding to original claim 22, are disclosed by Armitage in view of LeFebvre. I addressed these limitations in my first declaration, which is incorporated here by reference. *See* EX1003, ¶¶ 287–289.

104. Ground 2: The limitations added by dependent claim 43 are disclosed

by LeFebvre. *See* EX1003, ¶¶ 154–156.

105. New Limitations: *See* my discussion of Limitations 23(a), 23(b), and 33(c) in Sections VII.D.2.a, VII.D.2.c, and VII.D.4.b, *supra*.

E. Eligibility Under 35 U.S.C. § 101

106. In my opinion, the Board correctly found that claims 23–43 are directed to an abstract idea. The claims utilize generic, conventional physical components to perform mathematical calculations on collected data, and are not limited to any particular technical implementation of a “heuristic.”

107. For example, step (a) of claim 23 recites generic, conventional components that are commonly used in the railcar industry; “sensing units,” “a bearing adapter,” “a bearing proximate to the bearing adapter,” and the other physical components recited in step (a) are commonplace and have been used in the industry for decades. 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.

108. In my opinion, all three of steps (b)–(d) could be mentally performed by a human. A human could, for example, read the output of a temperature sensor to determine the temperature of a bearing; a human could determine whether the bearing temperature falls within standard temperature thresholds known in the art; a human could assess the severity of the bearing’s condition based on its

temperature (e.g., a bearing that is running very hot and outside of standard thresholds is likely damaged); and a human could determine whether the bearing's condition is sufficiently severe to warrant an alarm.

* * *

As provided in 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on: April 4, 2024



STEVEN RICCA