

Patent No. 10,137,915  
Petition for *Inter Partes* Review

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*

Patent No. 10,137,915  
Issue Date: November 27, 2018  
Title: SYSTEM AND METHOD FOR DETECTING OPERATIONAL  
ANOMALIES IN TRAIN CONSISTS AND RAILCARS

---

*Inter Partes* Review No. IPR2023-00540

---

**PETITION FOR *INTER PARTES* REVIEW OF  
U.S. PATENT NO. 10,137,915  
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42**

**TABLE OF CONTENTS**

|                                                                                                      | <b><u>Page</u></b> |
|------------------------------------------------------------------------------------------------------|--------------------|
| TABLE OF CONTENTS.....                                                                               | I                  |
| TABLE OF AUTHORITIES .....                                                                           | VII                |
| EXHIBIT INDEX .....                                                                                  | IX                 |
| LISTING OF CLAIMS.....                                                                               | X                  |
| I. FORMALITIES .....                                                                                 | 1                  |
| A. Mandatory Notices (37 C.F.R. § 42.8(a)(1)).....                                                   | 1                  |
| 1. Real Party in Interest (37 C.F.R. § 42.8(b)(1)).....                                              | 1                  |
| 2. Designation of Lead and Backup Counsel (37 C.F.R. § 42.8(b)(3)) .....                             | 1                  |
| 3. Notice of Service (37 C.F.R. § 42.8(b)(4)).....                                                   | 2                  |
| 4. Related Proceedings (37 C.F.R. § 42.8(b)(2)) .....                                                | 2                  |
| B. Grounds for Standing (37 C.F.R. § 42.104(a)) .....                                                | 3                  |
| C. Procedural Statements .....                                                                       | 3                  |
| II. INTRODUCTION .....                                                                               | 3                  |
| III. STATEMENT OF THE PRECISE RELIEF REQUESTED AND THE REASONS THEREFOR (37 C.F.R. § 42.22(a)) ..... | 5                  |
| IV. U.S. PATENT NO. 10,137,915 (“THE ’915 PATENT”) (EX1001).....                                     | 7                  |
| A. Specification and Claims.....                                                                     | 7                  |
| B. Prosecution History of the ’915 Patent .....                                                      | 9                  |
| V. BACKGROUND OF RAILCAR AND TRAIN MONITORING AND THE PRIOR ART REPLIED UPON IN THIS PETITION .....  | 10                 |
| 1. Armitage.....                                                                                     | 10                 |
| 2. Barone .....                                                                                      | 11                 |
| 3. LeFebvre .....                                                                                    | 13                 |
| 4. Winfree.....                                                                                      | 14                 |
| VI. A PERSON HAVING ORDINARY SKILL IN THE ART .....                                                  | 15                 |
| VII. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(b)(3) .....                                         | 15                 |
| VIII. DISCRETION UNDER § 325(d) .....                                                                | 16                 |

|     |                                                                                                                                    |    |
|-----|------------------------------------------------------------------------------------------------------------------------------------|----|
| 1.  | Barone and Winfree .....                                                                                                           | 16 |
| 2.  | Armitage.....                                                                                                                      | 17 |
| 3.  | LeFebvre .....                                                                                                                     | 17 |
| a.  | First Prong of <i>Advanced Bionics</i> .....                                                                                       | 17 |
| b.  | Second Prong of <i>Advanced Bionics</i> .....                                                                                      | 17 |
| IX. | DISCRETION UNDER § 314(a) .....                                                                                                    | 19 |
| X.  | GROUND FOR UNPATENTABILITY .....                                                                                                   | 20 |
| A.  | Ground 1: Claims 1, 22, 24-25, 27-30, 36, and 37 are unpatentable<br>under 35 U.S.C. § 103(a) in view of Armitage and Barone ..... | 20 |
| 1.  | Obviousness in View of Armitage and Barone .....                                                                                   | 20 |
| 2.  | Independent Claim 1 .....                                                                                                          | 21 |
| a.  | Limitation 1(a).....                                                                                                               | 21 |
| b.  | Limitation 1(b) .....                                                                                                              | 23 |
| c.  | Limitation 1(c).....                                                                                                               | 23 |
| d.  | Limitation 1(d) .....                                                                                                              | 25 |
| e.  | Limitation 1(e).....                                                                                                               | 30 |
| f.  | Limitation 1(f).....                                                                                                               | 30 |
| g.  | Limitation 1(g) .....                                                                                                              | 32 |
| 3.  | Dependent Claim 22 .....                                                                                                           | 34 |
| 4.  | Dependent Claim 24 .....                                                                                                           | 34 |
| a.  | Limitation 24(a).....                                                                                                              | 34 |
| b.  | Limitation 24(b) .....                                                                                                             | 34 |
| c.  | Limitation 24(c).....                                                                                                              | 34 |
| d.  | Limitation 24(d) .....                                                                                                             | 34 |
| e.  | Limitation 24(e).....                                                                                                              | 35 |
| 5.  | Dependent Claim 25 .....                                                                                                           | 36 |
| a.  | Limitation 25(a).....                                                                                                              | 36 |
| b.  | Limitation 25(b) .....                                                                                                             | 36 |
| c.  | Limitation 25(c).....                                                                                                              | 36 |
| d.  | Limitation 25(d) .....                                                                                                             | 37 |

|     |                                                                                                               |    |
|-----|---------------------------------------------------------------------------------------------------------------|----|
| 6.  | Dependent Claim 27 .....                                                                                      | 38 |
| 7.  | Dependent Claim 28 .....                                                                                      | 38 |
| 8.  | Dependent Claim 29 .....                                                                                      | 38 |
| 9.  | Independent Claim 30 .....                                                                                    | 38 |
|     | a. Limitation 30(a).....                                                                                      | 38 |
|     | b. Limitation 30(b) .....                                                                                     | 38 |
|     | c. Limitation 30(c).....                                                                                      | 39 |
|     | d. Limitation 30(d) .....                                                                                     | 39 |
|     | e. Limitation 30(e).....                                                                                      | 39 |
|     | f. Limitation 30(f) .....                                                                                     | 39 |
| 10. | Independent Claim 36 .....                                                                                    | 39 |
|     | a. Limitation 36(a).....                                                                                      | 39 |
|     | b. Limitation 36(b) .....                                                                                     | 39 |
|     | c. Limitation 36(c).....                                                                                      | 39 |
|     | d. Limitation 36(d) .....                                                                                     | 39 |
|     | e. Limitation 36(e).....                                                                                      | 39 |
|     | f. Limitation 36(f) .....                                                                                     | 39 |
|     | g. Limitation 36(g) .....                                                                                     | 40 |
| 11. | Dependent Claim 37 .....                                                                                      | 40 |
|     | a. Limitation 37(a).....                                                                                      | 40 |
|     | b. Limitation 37(b) .....                                                                                     | 40 |
|     | c. Limitation 37(c).....                                                                                      | 40 |
|     | d. Limitations 37(d)-(g).....                                                                                 | 40 |
|     | (1) <u>Limitations 37(e) and 37(f)</u> .....                                                                  | 41 |
|     | (2) <u>Limitation 37(g)</u> .....                                                                             | 43 |
| B.  | Ground 2: Claim 21 is unpatentable under 35 U.S.C. § 103(a) in<br>view of Armitage, Barone, and LeFebvre..... | 44 |
|     | 1. Dependent Claim 21 .....                                                                                   | 44 |
| C.  | Ground 3: Claims 23 and 26 under 35 U.S.C. § 103(a) in view of<br>Armitage, Barone, and Winfree .....         | 45 |

|    |                                                                                                                                   |    |
|----|-----------------------------------------------------------------------------------------------------------------------------------|----|
| 1. | Dependent Claim 23 .....                                                                                                          | 46 |
| a. | Limitation 23(a).....                                                                                                             | 46 |
| b. | Limitation 23(b) .....                                                                                                            | 48 |
| 2. | Dependent Claim 26 .....                                                                                                          | 49 |
| D. | Ground 4: Claims 1, 21-22, 25, 27-30, 36, and 37 are unpatentable<br>under 35 U.S.C. § 103(a) in view of LeFebvre and Barone..... | 49 |
| 1. | Obviousness in View of LeFebvre and Barone .....                                                                                  | 49 |
| 2. | Independent Claim 1 .....                                                                                                         | 51 |
| a. | Limitation 1(a).....                                                                                                              | 51 |
| b. | Limitation 1(b) .....                                                                                                             | 52 |
| c. | Limitation 1(c).....                                                                                                              | 52 |
| d. | Limitation 1(d) .....                                                                                                             | 54 |
| e. | Limitation 1(e).....                                                                                                              | 58 |
| f. | Limitation 1(f).....                                                                                                              | 58 |
| g. | Limitation 1(g) .....                                                                                                             | 60 |
| 3. | Dependent Claim 21 .....                                                                                                          | 61 |
| 4. | Dependent Claim 22 .....                                                                                                          | 61 |
| 5. | Dependent Claim 25 .....                                                                                                          | 62 |
| a. | Limitation 25(a).....                                                                                                             | 62 |
| b. | Limitation 25(b) .....                                                                                                            | 63 |
| c. | Limitation 25(c).....                                                                                                             | 63 |
| d. | Limitation 25(d) .....                                                                                                            | 65 |
| 6. | Dependent Claim 27 .....                                                                                                          | 66 |
| 7. | Dependent Claim 28 .....                                                                                                          | 66 |
| 8. | Dependent Claim 29 .....                                                                                                          | 66 |
| 9. | Independent Claim 30 .....                                                                                                        | 66 |
| a. | Limitation 30(a).....                                                                                                             | 66 |
| b. | Limitation 30(b) .....                                                                                                            | 66 |
| c. | Limitation 30(c).....                                                                                                             | 66 |
| d. | Limitation 30(d) .....                                                                                                            | 66 |

|     |                                                                                                                           |    |
|-----|---------------------------------------------------------------------------------------------------------------------------|----|
| e.  | Limitation 30(e).....                                                                                                     | 67 |
| f.  | Limitation 30(f).....                                                                                                     | 67 |
| 10. | Independent Claim 36.....                                                                                                 | 67 |
| a.  | Limitation 36(a).....                                                                                                     | 67 |
| b.  | Limitation 36(b) .....                                                                                                    | 67 |
| c.  | Limitation 36(c).....                                                                                                     | 67 |
| d.  | Limitation 36(d) .....                                                                                                    | 67 |
| e.  | Limitation 36(e).....                                                                                                     | 67 |
| f.  | Limitation 36(f) .....                                                                                                    | 67 |
| g.  | Limitation 36(g) .....                                                                                                    | 67 |
| 11. | Dependent Claim 37 .....                                                                                                  | 67 |
| a.  | Limitation 37(a).....                                                                                                     | 67 |
| b.  | Limitation 37(b) .....                                                                                                    | 68 |
| c.  | Limitation 37(c).....                                                                                                     | 68 |
| d.  | Limitation 37(d)-(g) .....                                                                                                | 68 |
| (1) | <u>Limitation 37(e)</u> .....                                                                                             | 69 |
| (2) | <u>Limitations 37(f)-(g)</u> .....                                                                                        | 70 |
| E.  | Ground 5: Claims 24 and 37 are unpatentable under 35 U.S.C.<br>§ 103(a) Over LeFebvre in View of Barone and Armitage..... | 72 |
| 1.  | Dependent Claim 24 .....                                                                                                  | 72 |
| a.  | Limitation 24(a).....                                                                                                     | 72 |
| b.  | Limitation 24(b) .....                                                                                                    | 73 |
| c.  | Limitation 24(c).....                                                                                                     | 73 |
| d.  | Limitation 24(d) .....                                                                                                    | 73 |
| e.  | Limitation 24(e).....                                                                                                     | 73 |
| 2.  | Dependent Claim 37 .....                                                                                                  | 74 |
| a.  | Limitation 37(a).....                                                                                                     | 74 |
| b.  | Limitation 37(b) .....                                                                                                    | 74 |
| c.  | Limitation 37(c).....                                                                                                     | 75 |
| d.  | Limitation 37(d)-(g) .....                                                                                                | 75 |

|     |                                                                                                                          |    |
|-----|--------------------------------------------------------------------------------------------------------------------------|----|
|     | (1) <u>Limitation 37(e)-(f)</u> .....                                                                                    | 75 |
|     | (2) <u>Limitations 37(g)</u> .....                                                                                       | 76 |
| F.  | Ground 6: Claims 23 and 26 are unpatentable under 35 U.S.C.<br>§ 103(a) Over LeFebvre in View of Barone and Winfree..... | 77 |
| 1.  | Dependent Claim 23 .....                                                                                                 | 77 |
| a.  | Limitation 23(a).....                                                                                                    | 77 |
| b.  | Limitation 23(b) .....                                                                                                   | 79 |
| 2.  | Dependent Claim 26 .....                                                                                                 | 80 |
| XI. | CONCLUSION.....                                                                                                          | 80 |

## **TABLE OF AUTHORITIES**

|                                                                                                                        | Page(s) |
|------------------------------------------------------------------------------------------------------------------------|---------|
| <b>Cases</b>                                                                                                           |         |
| <i>Advanced Bionics LLC v. MED-EL Elektromedizinische Geräte GmbH</i> ,<br>IPR2019-01469, Paper 6 (Feb. 13, 2020)..... | 16, 17  |
| <i>Becton, Dickinson &amp; Co. v. B. Braun Melsungen AG</i> ,<br>IPR2017-01586, Paper 8 (PTAB Dec. 15, 2017).....      | 17      |
| <i>HTC Corp. v. Cellular Communications Equip., LLC</i> ,<br>877 F.3d 1361 (Fed. Cir. 2017) .....                      | 15      |
| <i>In re Bigio</i> ,<br>381 F.3d 1320 (Fed. Cir. 2004) .....                                                           | 20, 49  |
| <i>KSR International Co. v. Teleflex Inc.</i> ,<br>550 U.S. 398 (2007) .....                                           | passim  |
| <i>Phillips v. AWH Corp.</i> ,<br>415 F.3d 1303 (Fed. Cir. 2005) .....                                                 | 15      |
| <i>Wellman, Inc. v. Eastman Chem. Co.</i> ,<br>642 F.3d 1355 (Fed. Cir. 2011) .....                                    | 16      |
| <b>Statutes</b>                                                                                                        |         |
| 35 U.S.C. § 102(a)(1).....                                                                                             | 6       |
| 35 U.S.C. § 102(a)(2).....                                                                                             | 6       |
| 35 U.S.C. § 103 .....                                                                                                  | 19      |
| 35 U.S.C. § 103(a) .....                                                                                               | passim  |
| 35 U.S.C. § 314(a) .....                                                                                               | 5, 19   |
| 35 U.S.C. § 325(d) .....                                                                                               | 16, 17  |
| 35 U.S.C. §§ 311-319 .....                                                                                             | 1       |
| <b>Regulations</b>                                                                                                     |         |
| 37 C.F.R. § 42 .....                                                                                                   | 1       |

Patent No. 10,137,915  
Petition for *Inter Partes* Review

|                               |    |
|-------------------------------|----|
| 37 C.F.R. § 42.10(b) .....    | 3  |
| 37 C.F.R. § 42.100(b) .....   | 16 |
| 37 C.F.R. § 42.104(a).....    | 3  |
| 37 C.F.R. § 42.104(b)(3)..... | 15 |
| 37 C.F.R. § 42.106(a).....    | 3  |
| 37 C.F.R. § 42.22(a).....     | 5  |
| 37 C.F.R. § 42.63(e).....     | 3  |
| 37 C.F.R. § 42.8 .....        | 82 |
| 37 C.F.R. § 42.8(a)(1) .....  | 1  |
| 37 C.F.R. § 42.8(b)(1).....   | 1  |
| 37 C.F.R. § 42.8(b)(2).....   | 2  |
| 37 C.F.R. § 42.8(b)(3).....   | 1  |
| 37 C.F.R. § 42.8(b)(4).....   | 2  |
| 83 FR 51340.....              | 16 |

**Other Authorities**

|                                                                                                                                          |        |
|------------------------------------------------------------------------------------------------------------------------------------------|--------|
| MPEP 2111.02(II).....                                                                                                                    | 22, 51 |
| MPEP 2141.01(a).....                                                                                                                     | 20, 49 |
| <i>Interim Procedure for Discretionary Denials in AIA Post-Grant</i><br><i>Proceedings with Parallel District Court Litigation</i> ..... | 19     |

**EXHIBIT INDEX**

| <b>Ex #</b> | <b>Exhibit Description</b>                                                                                                                                                                     |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1001        | U.S. Patent No. 10,137,915 (“the ’915 Patent”)                                                                                                                                                 |
| 1002        | Prosecution History of the ’915 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 No. 7,706,213 to Winfree et al. (“Winfree”)                                                                                                                                        |
| 1009        | Bonnie Baker, <u>Filtering? Before or After?</u> , EDN (February 20, 2003), <a href="https://www.edn.com/filtering-before-or-after/">https://www.edn.com/filtering-before-or-after/</a>        |
| 1010        | Potting and Encapsulation, Master Bond Inc., <a href="https://www.masterbond.com/applications/potting-and-encapsulation">https://www.masterbond.com/applications/potting-and-encapsulation</a> |
| 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        | <i>Intentionally Omitted</i> <sup>1</sup>                                                                                                                                                      |
| 1014        | <i>Intentionally Omitted</i>                                                                                                                                                                   |
| 1015        | <i>Intentionally Omitted</i>                                                                                                                                                                   |
| 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                                                                                                                                              |

---

<sup>1</sup> The Exhibits have been numbered to maintain consistency with the concurrently filed Petitions directed to U.S. Patent Nos. 9,365,223 B2 and 9,981,673 B2, which are discussed in Section I.A.4 below.

## **LISTING OF CLAIMS**

U.S. Patent No. 10,137,915 (Claims 1, 21-30, 36, and 37)

| <b>Claim Designation</b>              | <b>Claim Language</b>                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Claim 1 Preamble<br>(Limitation 1(a)) | A system for detecting operational anomalies on a train consist or railcar comprising:                                                                                                                                                                                                                                                                 |
| Limitation 1(b)                       | (a) one or more communication management units mounted on one or more railcars;                                                                                                                                                                                                                                                                        |
| Limitation 1(c)                       | (b) one or more sensors located on said one or more railcars configured to sense an operational parameter of said one or more railcars, said sensors being in communication with said one or more communication management units, wherein the one or more sensors comprise one or more sensors configured to measure accelerations of the railcar; and |
| Limitation 1(d)                       | (c) one or more filters configured to filter at least a portion of the accelerations,                                                                                                                                                                                                                                                                  |
| Limitation 1(e)                       | wherein said communication management units perform the functions of:<br>(i) collecting data regarding said one or more railcar operational parameters;                                                                                                                                                                                                |
| Limitation 1(f)                       | (ii) analyzing said collected data for trends or events indicative of an anomalous operational condition; and                                                                                                                                                                                                                                          |
| Limitation 1(g)                       | (iii) communicating a message to a remote receiver when said trend or event is detected.                                                                                                                                                                                                                                                               |
|                                       |                                                                                                                                                                                                                                                                                                                                                        |
| Claim 21                              | The system of claim 1 wherein at least one of said communication management units includes at least one of said sensors.                                                                                                                                                                                                                               |
|                                       |                                                                                                                                                                                                                                                                                                                                                        |
| Claim 22                              | The system of claim 1 further comprising a powered wireless gateway configured to control a train-based network that includes said powered wireless gateway and a plurality of said communication management units.                                                                                                                                    |
|                                       |                                                                                                                                                                                                                                                                                                                                                        |

| <b>Claim Designation</b> | <b>Claim Language</b>                                                                                                                                                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Limitation 23(a)         | The system of claim 1, wherein the one or more filters comprise one or more mechanical filters that include a resilient material configured to filter out undesirable accelerations from the accelerations,      |
| Limitation 23(b)         | wherein the one or more mechanical filters are disposed to remove the undesirable accelerations before the undesirable accelerations reach the one or more sensors that are configured to measure accelerations. |
|                          |                                                                                                                                                                                                                  |
| Limitation 24(a)         | The system of claim 1, further comprising one or more wireless sensor nodes in communication with at least one of the communication management units,                                                            |
| Limitation 24(b)         | wherein the one or more sensors form part of the one or more wireless sensor nodes,                                                                                                                              |
| Limitation 24(c)         | wherein one or more of the wireless sensor nodes comprise a protective housing,                                                                                                                                  |
| Limitation 24(d)         | wherein the one or more sensors are mounted within the protective housing,                                                                                                                                       |
| Limitation 24(e)         | wherein the protective housing comprises potting material configured to tune the wireless sensor nodes by absorbing at least a portion of undesirable accelerations.                                             |
|                          |                                                                                                                                                                                                                  |
| Limitation 25(a)         | The system of claim 1, further comprising one or more wireless sensor nodes in communication with at least one of the communication management units,                                                            |
| Limitation 25(b)         | wherein the one or more sensors form part of the one or more wireless sensor nodes,                                                                                                                              |

| <b>Claim Designation</b>             | <b>Claim Language</b>                                                                                                                                                                                                                           |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Limitation 25(c)                     | wherein one or more of the wireless sensor nodes comprises a microprocessor configured to execute firmware to control operation of the one or more of the wireless sensor nodes,                                                                |
| Limitation 25(d)                     | wherein the firmware comprises one or more software filters configured to isolate one or more types of accelerations.                                                                                                                           |
|                                      |                                                                                                                                                                                                                                                 |
| Claim 26                             | The system of claim 1, wherein the one or more filters comprise one or more mechanical filters.                                                                                                                                                 |
|                                      |                                                                                                                                                                                                                                                 |
| Claim 27                             | The system of claim 1, wherein the one or more filters comprise one or more electronic filters.                                                                                                                                                 |
|                                      |                                                                                                                                                                                                                                                 |
| Claim 28                             | The system of claim 1, wherein the one or more filters comprise one or more digital filters.                                                                                                                                                    |
|                                      |                                                                                                                                                                                                                                                 |
| Claim 29                             | The system of claim 1 wherein said remote receiver is located off-train.                                                                                                                                                                        |
|                                      |                                                                                                                                                                                                                                                 |
| Claim 30<br>Preamble/Limitation 1(a) | A method for detecting operational anomalies on a train consist or railcar comprising the steps of:                                                                                                                                             |
| Limitation 30(b)                     | sensing, by one or more sensors located on one or more railcars, one or more operational parameters of the one or more railcars, wherein the one or more operational parameters comprise one or more accelerations of the one or more railcars; |
| Limitation 30(c)                     | filtering, by one or more filters, at least a portion of the accelerations; and                                                                                                                                                                 |
| Limitation 30(d)                     | by one or more communication management units associated with the one or more railcars: collecting data regarding said one or more railcar operational parameters;                                                                              |
| Limitation 30(e)                     | analyzing said collected data for trends or events indicative of an anomalous operational condition; and                                                                                                                                        |

| <b>Claim Designation</b>              | <b>Claim Language</b>                                                                                                                                                                                                                                                                                                 |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Limitation 30(f)                      | communicating a message to a remote receiver when said trend or event is detected.                                                                                                                                                                                                                                    |
|                                       |                                                                                                                                                                                                                                                                                                                       |
| Claim 36<br>Preamble/Limitation 36(a) | A system for detecting operational anomalies on a railcar that is part of a train consist comprising:                                                                                                                                                                                                                 |
| Limitation 36(b)                      | (a) at least one communication management unit (CMU) mounted on the a railcar in said train consist;                                                                                                                                                                                                                  |
| Limitation 36(c)                      | (b) at least two sensors located on the said railcar for configured to sense operational parameters of the railcar, said sensors being in communication with said communication management unit, wherein the one or more sensors comprise one or more sensors configured to measure accelerations of the railcar; and |
| Limitation 36(d)                      | (c) one or more filters configured to filter at least a portion of the accelerations,                                                                                                                                                                                                                                 |
| Limitation 36(e)                      | wherein said communication management unit performs the following functions:<br>(i) receiving data from said sensors;                                                                                                                                                                                                 |
| Limitation 36(f)                      | (ii) drawing inferences from the data received from at least two of the sensors regarding the performance of the railcar; and                                                                                                                                                                                         |
| Limitation 36(g)                      | (iii) communicating a message to a remote receiver when an anomaly is detected.                                                                                                                                                                                                                                       |
|                                       |                                                                                                                                                                                                                                                                                                                       |
| Limitation 37(a)                      | The system of claim 36,                                                                                                                                                                                                                                                                                               |
| Limitation 37(b)                      | wherein said sensors comprise accelerometers positioned at different locations of the railcar,                                                                                                                                                                                                                        |
| Limitation 37(c)                      | wherein said step of drawing inferences comprises the comparison of data from two or more of said accelerometers,                                                                                                                                                                                                     |
| Limitation 37(d)                      | wherein said accelerometers are positioned on the railcar to provide data for carrying out one or more of the following functions:                                                                                                                                                                                    |

| Claim Designation | Claim Language                                                                                                                                                                                                    |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Limitation 37(e)  | i) compare accelerations from one railcar wheel with that of another railcar wheel on the same axle but opposite side of the railcar,                                                                             |
| Limitation 37(f)  | ii) compare accelerations from one railcar wheel with that of at least one other wheel on the same side of said railcar, and                                                                                      |
| Limitation 37(g)  | iii) compare accelerations from one railcar wheel with that of at least one other railcar wheel on the same side of said one railcar wheel and which other wheel is on another railcar of the same train consist. |

**I. FORMALITIES**

**A. Mandatory Notices (37 C.F.R. § 42.8(a)(1))**

**1. Real Party in Interest (37 C.F.R. § 42.8(b)(1))**

Petitioner Hum Industrial Technology, Inc. (“Hum” or “Petitioner”) is a real party-in-interest in this petition.

Dr. Brent Wilson, an employee of Hum who has been named as a separate defendant in *Amsted Rail Company, Inc. v. Hum Industrial Technology, Inc. et al*, Case No. 4:22-cv-00445-AGF (United States District Court for the Eastern District of Missouri), is also a real party-in-interest in this petition. *See* Section I.A.4, *infra*.

**2. Designation of Lead and Backup Counsel (37 C.F.R. § 42.8(b)(3))**

| Lead Counsel                                                                                                                                                                                                          | Backup Counsel                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Eric J. Rakestraw, Reg. No. 68,740<br>HUSCH BLACKWELL LLP<br>190 Carondelet Plaza, Suite 600<br>St. Louis, MO 63105<br>(314) 480-1500 Telephone<br>(314) 480-1505 Facsimile<br>PTAB-<br>ERakestraw@huschblackwell.com | Andrea L. Shoffstall, Reg. No. 75,426<br>HUSCH BLACKWELL LLP<br>1801 Wewatta Street, Suite 1000<br>Denver, CO 80202<br>303.749.7200 Telephone<br>303.749.7272 Facsimile<br>PTAB-<br>AShoffstall@huschblackwell.com |
|                                                                                                                                                                                                                       | Backup Counsel                                                                                                                                                                                                     |
|                                                                                                                                                                                                                       | Daisy Manning<br>Reg. No. 66,369<br>Husch Blackwell LLP<br>190 Carondelet Plaza, Suite 600<br>St. Louis, MO 63105<br>(314) 480-1500 Tel<br>(314) 480-1505 Fax<br>PTAB-<br>DManning@huschblackwell.com              |

**3. Notice of Service (37 C.F.R. § 42.8(b)(4))**

Please direct all correspondence to lead counsel at the above address.

Petitioner also consents to email service at the above email addresses for lead and back-up counsel and hand delivery at the above addresses for lead and backup counsel.

**4. Related Proceedings (37 C.F.R. § 42.8(b)(2))**

U.S. Patent No. 10,137,915 is presently asserted in *Amsted Rail Company, Inc. v. Hum Industrial Technology, Inc. et al*, Case No. 4:22-cv-00445-AGF (United States District Court for the Eastern District of Missouri). The complaint (EX1011) was considered served pursuant to the Waiver of the Service of Summons dated June 14, 2022 (EX1012). Thus, this Petition is filed within one year after Hum was served with a complaint for infringement. Hum has not filed a separate civil action challenging the validity of the claims of the '915 Patent.

This petition is one of three petitions that Petitioner has filed concurrently, requesting *inter partes* review of U.S. Patent Nos. 9,365,223 B2, 9,981,673 B2, and 10,137,915 B2. Docket numbers for those P.T.A.B. proceedings are not yet available, but each of these petitions could affect, or be affected by, a decision in either of the other two proceedings.

**B. Grounds for Standing (37 C.F.R. § 42.104(a))**

Petitioner hereby certifies the '915 Patent is available for *inter partes* review, and Petitioner is not barred or estopped from requesting an *inter partes* review challenging the patent claims on the Grounds identified in the petition.

**C. Procedural Statements**

This Petition is filed in accordance with 37 C.F.R. § 42.106(a). A Power of Attorney (37 C.F.R. § 42.10(b)) and Exhibit List (37 C.F.R. § 42.63(e)) are filed concurrently with this Petition. The fee is being paid via Deposit Acct. No. 11-0160. The United States Patent and Trademark Office is authorized to charge any fee deficiency, or credit any overpayment, to Deposit Acct. No. 11-0160.

**II. INTRODUCTION**

Hum Industrial Technology, Inc. (“Hum” or “Petitioner”) respectfully requests the Board institute *inter partes* review of U.S. Patent No. 10,137,915 (“the '915 Patent”), which is assigned to Amsted Rail Company, Inc. (“Amsted” or “Patent Owner”).

The claims generally recite a system for processing data to monitor the operation of railcars and trains. EX1001, Abstract. The claims disclose the processing of data at least three different levels within a wireless system. EX1001, 1:59-65. The components in the wireless system can communicate with each other in real-time, to alert the user of issues promptly. EX1001, 1:13-17.

None of this is new, and none was invented by Amsted. As discussed below, railcar monitoring systems using various communicating components in a wireless system were in widespread use for years prior to the filing date of the '915 Patent. *See generally* EX1003, ¶¶ 26-37. The '915 Patent does no more than describe the use of well-known processes and tools (including but not limited to sensors, communication management units, gateways, and wireless networks) to yield predictable results that railcar engineers and operators have employed for decades. EX1003, ¶ 26. There is nothing new about collecting data, filtering the data, analyzing the data, and sending messages through a wireless communication system to promptly inform a user of anomalous conditions of a railcar or train. *Id.*

Amsted was surely aware of the numerous prior art references disclosing all limitations of the '915 Patent, including the named inventors' own prior art. Indeed, the sole reason for allowance during prosecution was Amsted's insertion of a filtering limitation—which was well-known in the art—into the independent claims. EX1002, p. 531; EX1003, ¶ 52. The Examiner, however, failed to evaluate the prior art of record disclosing the filtering limitation, and allowed the '915 Patent claims without consideration of these disclosures or any other prior art references or combinations. EX1002, pp. 496-515; EX1003, ¶ 52. Had the Examiner done so, they would have found filtering of data is a common practice, well-known to a PHOSITA and abundantly found in the prior art. EX1003, ¶ 53.

A petition for *inter partes* review must demonstrate “a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a). The Petition meets this threshold.

**III. STATEMENT OF THE PRECISE RELIEF REQUESTED AND THE REASONS THEREFOR (37 C.F.R. § 42.22(a))**

Petitioner respectfully requests a final written decision that Claims 1, 21-30, 36, and 37 of the '915 Patent are invalid under 35 U.S.C. § 103(a). Of these challenged claims, Claims 1, 30, and 36 are independent.

Petitioner requests *inter partes* review of the '915 Patent based on the following patents and patent publications, all of which were filed, issued, or published prior to the earliest priority date of the '915 Patent, which is December 24, 2013. The prior art relevant to this Petition includes: U.S. Patent Pub. No. 2011/0282540 to Armitage et al. (“Armitage”) (EX1006), filed on May 11, 2011 and published on Nov. 17, 2011; U.S. Patent Pub. No. 2007/0208841 to Barone et al. (“Barone”) (EX1007), filed on Jan. 19, 2007 and published on Sept. 6, 2007; U.S. Patent Pub. No. 2007/0152107 to LeFebvre et al. (“LeFebvre”) (EX1005), filed on Dec. 22, 2006 and published on July 5, 2007; and U.S. Patent No. 7,706,213 to Winfree et al. (“Winfree”) (EX1008), filed on Oct. 23, 2007 and issued on Apr. 27, 2010. Armitage, Barone, LeFebvre, and Winfree are prior art to the '915 Patent under AIA 35 U.S.C. §§ 102(a)(1) and 102(a)(2).

This Petition further relies upon the Declaration of Steven Ricca (“Ricca Decl.”) (EX1003); Ricca curriculum vitae (EX1004)), which is relevant to the skill, knowledge, and experience of a person having original skill in the art (“PHOSITA”) at the time of the invention and how that person would have understood and applied the prior art. The statutory grounds on which the challenge is based are:

- 1) Claims 1, 22, 24-25, 27-30, 36, and 37 are unpatentable under 35 U.S.C. § 103(a) in view of Armitage and Barone.
- 2) Claim 21 is unpatentable under 35 U.S.C. § 103(a) in view of Armitage, Barone, and LeFebvre.
- 3) Claims 23 and 26 are unpatentable under 35 U.S.C. § 103(a) in view of Armitage, Barone, and Winfree.
- 4) Claims 1, 21-22, 25, 27-30, 36, and 37 are unpatentable under 35 U.S.C. § 103(a) in view of LeFebvre and Barone.
- 5) Claims 24 and 37 are unpatentable under 35 U.S.C. § 103(a) over LeFebvre in view of Barone and Armitage.
- 6) Claims 23 and 26 are unpatentable under 35 U.S.C. § 103(a) over LeFebvre in view of Barone and Winfree.

**IV. U.S. PATENT NO. 10,137,915 (“THE ’915 PATENT”) (EX1001)**

### A. Specification and Claims

The '915 Patent claims generally recite a system for processing data to monitor the operation of railcars and trains. EX1001, Abstract; EX1003, ¶ 20. The claims disclose the processing of data at three different levels within a wireless system. EX1001, 1:59-65, Fig. 1; EX1003, ¶ 20. The components in the wireless system can continuously collect data and communicate with each other in real-time, to alert the user of issues promptly. EX1001, 1:13-17; EX1003, ¶ 20. Fig. 2 of the '915 Patent shows the structure of the disclosed wireless system.

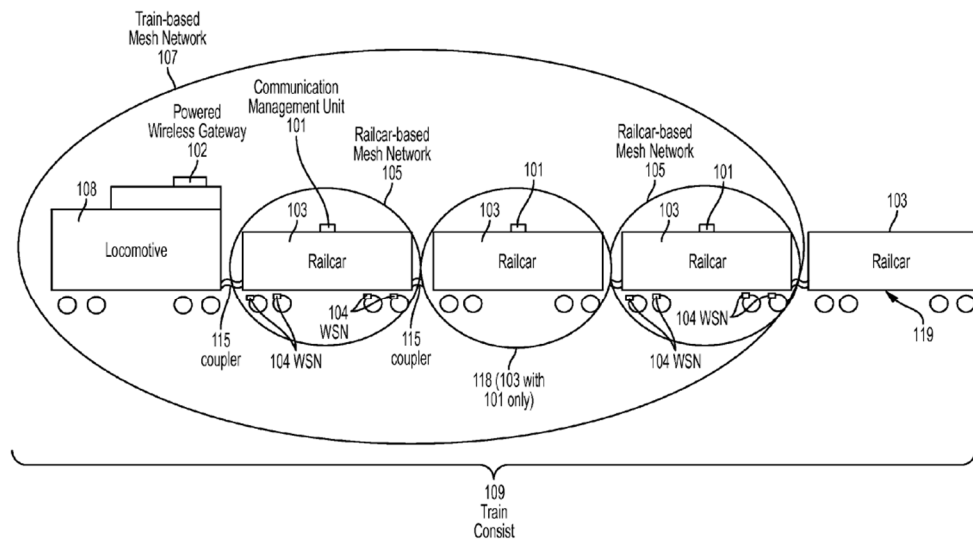


FIG. 2

As shown above in Fig. 2, each railcar contains at least one wireless sensor, communication management unit (“CMU”), and a wireless network including a gateway. *Id.*, 1:66-2:4, Fig. 2; EX1003, ¶ 21. The CMU contains a processor,

power source, global navigation system (i.e., GPS), and wireless communication capability—in other words, the CMU is a wireless processor. EX1001, 1:22-36; EX1003, ¶ 21. The system includes the sensors collecting the data, the sensors sending the data to the CMU(s), which further filters and processes the data to ultimately be sent to the gateway—all part of a wireless network. EX1001, 2:4-25; EX1003, ¶ 21.

All of the independent claims of the '915 Patent require at least one sensor to collect data (i.e., accelerometer), CMU, and filter. EX1001, 17:48-22:37; EX1003, ¶ 22. All of these components are part of a wireless system and are located on the railcar or locomotive. EX1001, 2:4-25, 2:32-41, 4:4-32, Figs. 1-2; EX1003, ¶ 22. These components were all used in the prior art detection systems (i.e., wayside systems); the '915 Patent simply arranges these components wirelessly on the railcar/train consist instead of at fixed points on the railroad network. EX1001, 1:21-28; EX1003, ¶ 22.

In Claim 1, the CMU has three functions. EX1001, 17:48-18:2; EX1003, ¶ 23. The first function of the CMU is to collect data regarding operational parameters of the railcar. EX1001, 17:63-64; EX1003, ¶ 23. The second function of the CMU is to analyze the collected data for a trend or event, and the final function of the CMU is to communicate a message to a remote receiver (i.e., gateway) regarding a detected trend or event. EX1001, 17:65-18:2; EX1003, ¶ 23.

Independent Claims 30 and 36 (also challenged in this Petition) contain the same or similar elements as Claim 1. EX1003, ¶ 23.

**B. Prosecution History of the '915 Patent**

The '915 Patent, issued on November 27, 2018 from a provisional application filed on December 24, 2013. EX1002, p. 675. The '915 Patent claims priority to a provisional application dated December 24, 2013. EX1002, p. 31. As previously discussed, the claims of the '915 Patent disclose a system to detect abnormalities on a train consist or railcar, using sensors, CMUs, gateway, and a wireless network. EX1001, 1:66-2:4, Fig. 2; EX1003, ¶ 24. The CMUs perform the functions of collecting data, analyzing data, and communicating a message to a remote receiver (i.e., gateway) when an event is detected. EX1001, 2:4-25; EX1003, ¶ 24.

During prosecution of the '915 Patent, Claims 1-30, 33-34, 46, 48-50, and 60-65 were rejected as anticipated by U.S Patent No. 7,668,218 (the "'218 Patent"). EX1002, pp. 496-497; EX1003, ¶ 25. The Examiner found that the '218 Patent disclosed all limitations in the independent claims. EX1002, pp. 496-515. Specifically, the Examiner found that the CMUs of the '218 Patent performed the functions of collecting data, analyzing data, and communicating the data—just like the '915 Patent. EX1002, pp. 496-498. Additionally, the Examiner found the '218 Patent disclosed the use of one or more wireless sensors to collect the data. *Id.*

In response, Amsted first noted that the claims considered by the Examiner appear to be the originally filed claims and not the claims of the Preliminary Amendment which amended and canceled certain claims. EX1002, pp. 527-528. Then, the claims were amended by Amsted to import a limitation requiring “one or more filters configured to a filter at least a portion of the accelerations.” EX1002, p. 531. In making these claim amendments, Amsted argued the ’218 Patent does not teach filtering of the data (i.e., accelerations). EX1002, p. 528. The Examiner accepted Amsted’s filtering claim amendments over the ’218 Patent, without conducting additional prior art searches or further analysis of this well-known and obvious limitation taught by the prior art reference on which the Examiner based their initial rejection of claims. EX1002, pp. 546, 626, 649-651; EX1003, ¶ 26. As a result of this oversight, the claims of the ’915 Patent were allowed. EX1002, p. 675.

## **V. BACKGROUND OF RAILCAR AND TRAIN MONITORING AND THE PRIOR ART REPLIED UPON IN THIS PETITION**

### **1. Armitage**

Armitage, titled “Dynamic monitoring of mobile railway car undercarriage,” broadly discloses a mobile railway car monitoring system. EX1006, Abstract. More specifically, Armitage teaches a “railway car monitoring system” including “sensor nodes” (wireless sensors), “control node” (CMU), and “communication

network” (wireless communication network). EX1003, ¶ 49; EX1006, Abstract, ¶ [0012]. The “control node” and “communication network” in Armitage communicate wirelessly. EX1003, ¶ 49; EX1006, ¶ [0012]. Armitage discloses filtering of the data collected by the sensors (i.e., accelerometers). EX1003, ¶ 49; EX1006, ¶ [0045]. As shown in Figure 1 of Armitage, all the components of the system are located on the railcar and/or train consist. EX1003, ¶ 49; EX1006, Fig. 1. The Figure below further shows the similarities between the system in the railcar monitoring system claimed in ’915 Patent and the monitoring system claimed in Armitage.

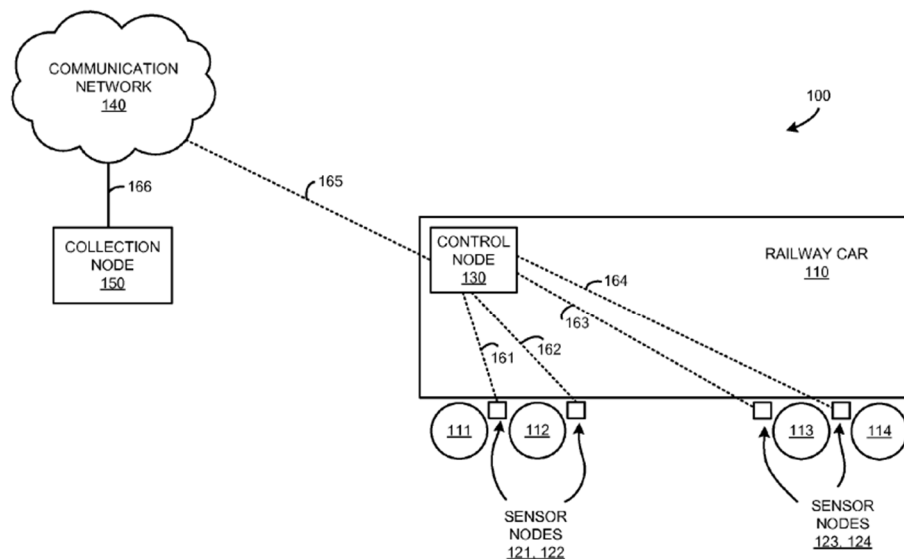


**FIGURE 1**

## **2. Barone**

Barone, titled “Self-assembling wireless network, vehicle communications system, railroad wheel and bearing monitoring system and methods therefor,”

broadly discloses a low power self-organizing network (wireless communication network) made up of wireless communication nodes containing sensors and communicating wirelessly with each other, similar to the '915 Patent. EX1003, ¶ 50; EX1007, ¶ [0029], Abstract. Barone collects data for physical parameters of the railcar. EX1003, ¶ 50; EX1007, Abstract, ¶¶ [0024], [0029], [0033]-[0034]. When processing the data, the system in Barone utilizes a number of different algorithms known in the art to detect operational anomalies. EX1003, ¶ 50; EX1007, ¶¶ [0037]-[0041]. Barone explicitly teaches output of an “accelerometer 171” being transmitted to “signal conditioning 178”, where the analog signals are amplified and/or filtered. EX1003, ¶ 50; EX1007, ¶¶ [0114]-[0115], Fig. 8.

As shown in Fig. 1 below, all the components of the wireless system in Barone are located on the railcar and/or train consist. EX1003, ¶ 51.

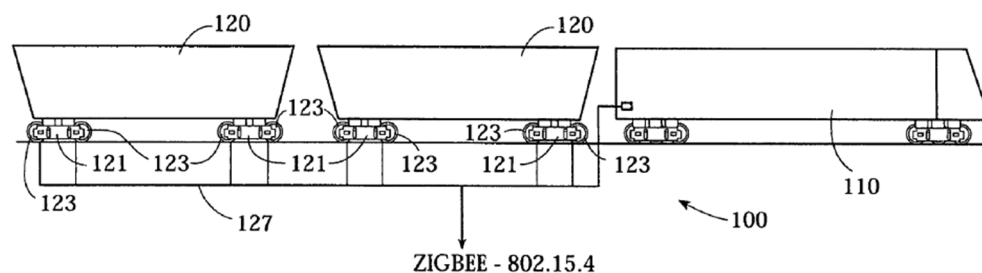
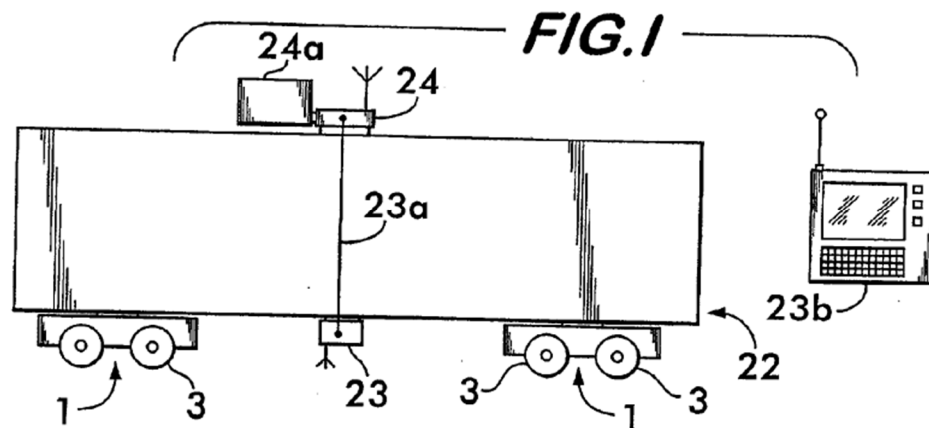


FIG. 1

### 3. LeFebvre

LeFebvre, titled “Railroad train monitoring system,” discloses railcar monitoring utilizing instrumented, flexible pads located on the railcar. EX1005, Abstract. LeFebvre teaches a wireless system of continuously monitoring the behavior and condition of trucks, wheels, and bearings of a railroad car. EX1003, ¶ 52; EX1005, ¶ [0006]. Specifically, LeFebvre’s system includes a multiplicity of sensor devices, and a “data control unit”/“communications device” which can be contiguous (i.e., a CMU)—all of which communicate wirelessly and can send alarm messages (e.g., to the locomotive) to notify the railcar engineer immediately of problem railcars. EX1003, ¶ 52; EX1005, ¶¶ [0024]-[0025], Fig. 1. As shown below in Fig. 1, all of the components of the wireless system in LeFebvre are located on the railcar and/or train consist. EX1003, ¶ 53.



#### 4. Winfree

Winfree, titled “Mechanical filter for sensors,” broadly discloses a filter for mechanical waves entering a sensor. EX1008, Abstract. More specifically, Winfree teaches a “structure of one or multiple layers of material placed between a sensor and its environment.” EX1003, ¶ 54; EX1008, 2:24-29. Winfree further teaches enabling the isolation of a sensor from “incident frequencies” that are undesirable, and can be applied to a variety of sensors, including accelerometers. EX1003, ¶ 54; EX1008, 2:30-33, 2:42-45. Figure 1 of Winfree further shows the similarities between the mechanical filter claimed in ’915 Patent (Fig. 4) and the mechanical filter claimed in Winfree. EX1003, ¶ 54.

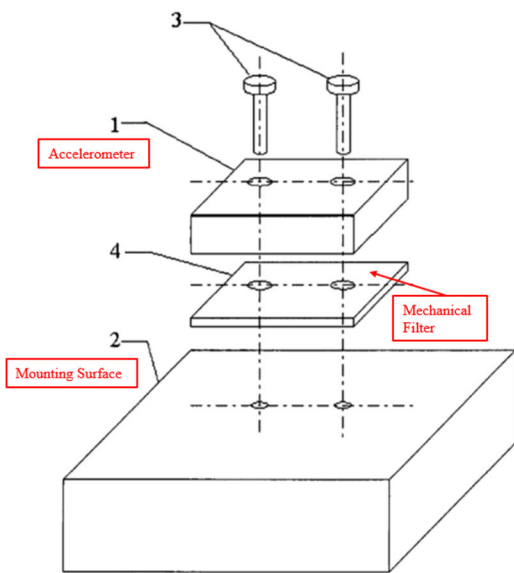


FIG. 1

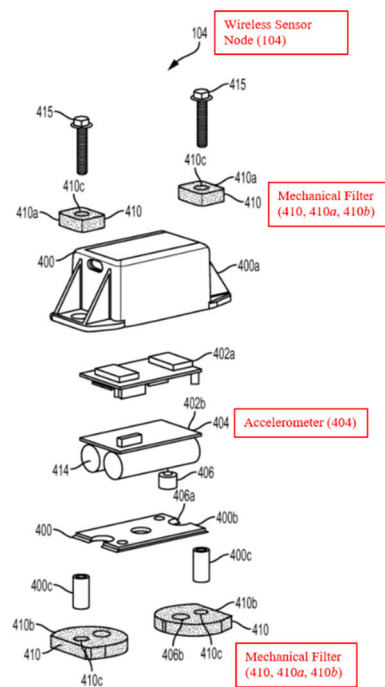


FIG. 4

**VI. A PERSON HAVING ORDINARY SKILL IN THE ART**

The prior art and the Ricca Declaration demonstrate a PHOSITA, at the time the '915 Patent was filed, would have been a person with at least a B.S. degree in electrical or mechanical engineering or a related field with at least two years' experience designing railcar, train, vehicle, or any other similar monitoring systems for similar industrial equipment with rotating components. Less work experience may be compensated by a higher level of education, such as a master's degree, and vice versa. EX1003, ¶ 45.

**VII. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(b)(3)**

Unless otherwise addressed herein, the terms of the unexpired '915 Patent's claims are to be given their plain and ordinary meaning, as understood by one of ordinary skill in the art, in view of the '915 Patent's specification. *See* 37 C.F.R. § 42.100(b); 83 FR 51340; *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

Petitioner does not believe any construction would have an impact on the invalidity analyses set forth herein. *See HTC Corp. v. Cellular Communications Equip., LLC*, 877 F.3d 1361, 1367–68 (Fed. Cir. 2017) (affirming the Board absent an express construction of a term). Based on the evidence below and the prior art's description of the claimed elements being similar to that of the '915 Patent specification, Petitioner submits there are no formal claim constructions necessary

in this proceeding because “claim terms need only be construed to the extent necessary to resolve the controversy.” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) (internal quotations omitted).

### **VIII. DISCRETION UNDER § 325(d)**

The Board uses a two-prong test to determine whether to exercise its discretion in denying institution under 35 U.S.C. § 325(d): (1) whether the same or substantially the same prior art or arguments were previously presented to the Office; and (2) if the first prong is met, whether the Office erred in evaluating the art or arguments. *Advanced Bionics LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (Feb. 13, 2020) (Precedential). In view of this standard, the Board should institute IPR of all challenged claims.

#### **1. Barone and Winfree**

Prior art references Barone and Winfree, which are relied on in this Petition, were not previously considered by the USPTO. EX1001, References Cited. Nor are these references substantially the same as the references considered during prosecution. Because the references Barone and Winfree, and arguments presented herein, are not the same or substantially similar to those considered by the Examiner, the second prong of *Advanced Bionics* does not apply.

## **2. Armitage**

Armitage was cited in an IDS and in the Notice of References Cited during prosecution, but never actually relied upon by the Examiner in rejecting any claims. EX1002, p. 519. Grounds based on a reference cited in an IDS but not considered at any length should not serve as the basis for denying institution under 35 U.S.C. § 325(d). *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17-18 (PTAB Dec. 15, 2017) (Precedential). Therefore, the second prong of *Advanced Bionics* does not apply.

## **3. LeFebvre**

### **a. First Prong of *Advanced Bionics***

The remaining prior art reference, LeFebvre, was considered during prosecution of the '915 Patent. Therefore, an analysis of the second prong of *Advanced Bionics* is required, which includes consideration of *Becton Dickinson* factors (c), (e), and (f) to determine whether there was a material error by the Examiner. *Becton, Dickinson*, IPR2017-01586, Paper 8, at 117-18.

### **b. Second Prong of *Advanced Bionics***

LeFebvre led to issued U.S. Patent No. 7,668,218 (the "'218 Patent"). The '218 Patent was relied on by the Examiner during prosecution of the '915 Patent. However, the grounds of this Petition do not present the same or substantially the same arguments considered by the Examiner. EX1003, ¶ 55; EX1002, pp. 496-518.

Moreover, the Examiner materially erred in failing to apply the '218 Patent to the limitations subsequently added to the independent claims when the '218 Patent explicitly discloses the added filtering limitation. EX1003, ¶ 55; Section X.D.2.d, *infra*.

The '218 Patent was relied upon by the Examiner as disclosing all limitations of the independent claims. EX1003, ¶ 56; EX1002, pp. 496-518. In response, Amsted amended and canceled certain claims, adding a limitation requiring “one or more filters configured to filter at least a portion of the accelerations” into the independent claims. EX1003, ¶ 56; EX1002, p. 531. The Examiner accepted Amsted’s arguments and claim amendments incorporating the filtering limitation and erred materially by: (1) not applying the '218 Patent to the filtering limitation and (2) not considering further obviousness grounds or other prior art references in combination with the '218 Patent to address the filtering limitation. EX1003, ¶ 56; *see generally*, EX1002. In other words, the Examiner failed to address the additional filtering limitations imported by Amsted into the independent claims.

Petitioner further challenges the '915 Patent claims based on LeFebvre in combination with Barone, which is *not* the same rejection set forth by the Examiner during prosecution. EX1002, pp. 496-518. Had the Examiner conducted additional prior art searches for the newly added filtering limitation in the

independent claims, they would have found Barone provides a detailed disclosure of the claimed filtering limitation in a similar railcar monitoring system, and would have rejected the claims as obvious under § 103. Accordingly, the Examiner further erred in a manner material to patentability of the '915 Patent claims by failing to consider the '218 Patent in combination with another reference expressly disclosing the filtering limitations. EX1002, pp. 496-518.

**IX. DISCRETION UNDER § 314(a)**

The Office's June 21, 2022 Memorandum<sup>2</sup> ("Guidance Memo") states "the PTAB will not discretionarily deny institution of an IPR or PGR in view of parallel district court litigation where a petitioner stipulates not to pursue in a parallel district court proceeding the same grounds as in the petition or any grounds that could have reasonably been raised in the petition." Guidance Memo at 7. In accordance with this guidance, Petitioner has offered Amsted a stipulation that, if IPR is instituted, it will not pursue in the District Court Litigation any ground raised or that could have been reasonably raised in an IPR with respect to claims 1, 21-30, 36, and 37 of the '915 Patent. EX1017.

---

<sup>2</sup> *Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation*, available at [www.uspto.gov/sites/default/files/documents/interim\\_proc\\_discretionary\\_denials\\_aia\\_parallel\\_district\\_court\\_litigation\\_memo\\_20220621\\_.pdf](http://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf).

**X. GROUND FOR UNPATENTABILITY**

Petitioner requests cancellation of the challenged claims on the following Grounds.

**A. Ground 1: Claims 1, 22, 24-25, 27-30, 36, and 37 are unpatentable under 35 U.S.C. § 103(a) in view of Armitage and Barone**

**1. Obviousness in View of Armitage and Barone**

Armitage and Barone are related to the same field of endeavor (i.e., a system to monitor railcars and train consists to predict and/or detect component failure) and describe a similar device with similar components. EX1006, Abstract; EX1007, Abstract. Furthermore, Armitage and Barone both use sensors, CMUs, and a wireless network to solve the same problem, namely, to determine anomalous conditions of a railcar in real-time and wirelessly report the anomalous conditions to determine a fault condition (e.g., degree of wear on wheel bearings of railroad cars). EX1006, Abstract, ¶¶ [0003], [0019], [0020], [0027], [0028], [0029], [0037], [0038], [0048], [0049]; EX1007, Abstract, ¶¶ [0002], [0006]. *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004); MPEP 2141.01(a). Thus, Armitage and Barone are analogous art.

Armitage discloses filtering through sampling of data, which a PHOSITA would understand requires a filter. EX1006, ¶ [0045]. A PHOSITA would understand it is general knowledge filtering means excluding or amplifying certain ranges of data (or signals) within a data set—and would require an actual filter to

achieve said filtering. EX1003, ¶ 66. To the extent Armitage does not explicitly disclose a filter, Barone shows filtering accelerations with an electronic or digital filter was well-known in the art and conventionally used in the field at the time of the invention. EX1003, ¶ 66; EX1007, Fig. 8, ¶¶ [0114]-[0115], [0150], [0172]-[0185]. Barone explicitly discloses filtering data, and a PHOSITA would have been motivated to include the filter taught by Barone with Armitage because the advantage of filtering is to remove unwanted data and/or amplify particularly relevant data, and the purpose of both systems is to analyze data in a train monitoring system to accurately predict anomalous conditions and avoid false or inaccurate data processing. EX1003, ¶ 67; *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Combining the sampling of data (i.e., filtering) in Armitage and the electronic and digital filtering taught in Barone would have predictably resulted in the filtering of accelerations data. EX1003, ¶ 67.

## **2. Independent Claim 1**

### **a. Limitation 1(a)<sup>3</sup>**

This preamble merely states an intended use of detecting operational anomalies on a train consist or railcar, which does not instill patentable weight.

---

<sup>3</sup> Because Petitioner included the full claim language of the '915 Patent in the Listing of Claims, Petitioner does not reproduce the full claim language here. The Board is encouraged to reference the Listing of Claims to see the full claim language, if necessary.

*Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999);  
*See also Rowe v. Dror*, 112 F.3d 473, 478 (Fed. Cir. 1997); MPEP 2111.02(II);  
EX1003, ¶ 68.

To the extent the preamble is limiting, Armitage teaches a mobile railway car monitoring system which utilizes a plurality of sensor nodes coupled to an undercarriage portion of a railway car and a control node coupled to the railway car which receives information, determines a fault condition, and wirelessly reports the fault condition to a collection system. EX1003, ¶ 69; EX1006, Abstract, ¶¶ [0003], [0019], [0020], [0027], [0028], [0029], [0037], [0038], [0048], [0049].

Specifically, Armitage teaches a “railway car monitoring system 100”, which includes a “railway car 110” and “sensor nodes 121-124” with a wireless transceiver for communication with “control node 130.” EX1003, ¶ 70; EX1006, Figs. 1, 3, 5, ¶¶ [0012], [0014], [0020].

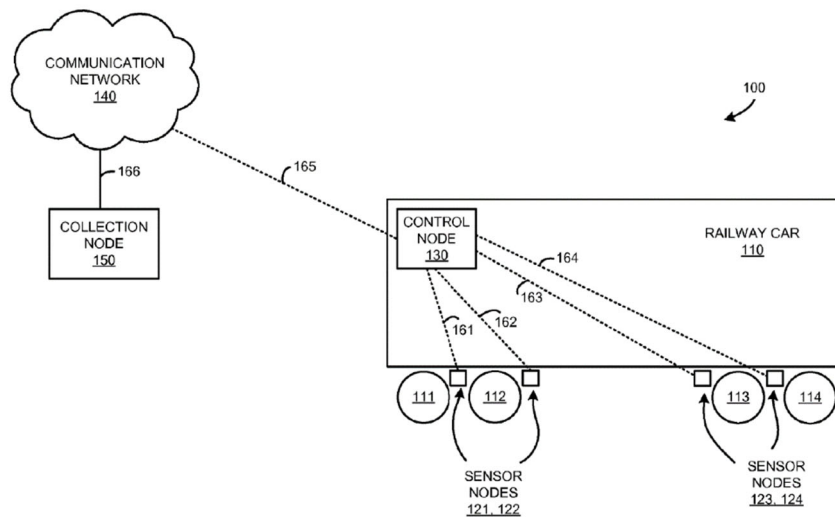


FIGURE 1

Thus, even though the preamble should not be given patentable weight, Armitage teaches the preamble. EX1003, ¶ 71.

b. **Limitation 1(b)**

Armitage teaches one or more “control nodes 130” (i.e., a communication management unit) coupled to one or more railway cars. EX1003, ¶ 72; EX1006, Figs. 1, 3, 5, ¶¶ [0004], [0012] (“FIG. 1 is a system diagram illustrating railway car monitoring system 100. System 100 includes railway car 110...control node 130”), [0014], [0017] (“**Control node 130 is attached or coupled to railway car 110.**”), [0020], [0026], [0036], [0038].

c. **Limitation 1(c)**

Armitage teaches a plurality of “sensors nodes 121-124” located on one or more railway cars, which contain a “sensor portion” and is configured to sense

operational parameters of one or more railcars. EX1003, ¶ 73; EX1006, Figs. 1, 3, 5, ¶¶ [0004], [0014]. Figure 1 of Armitage depicts an exemplary embodiment, with four sensor nodes 121–124 attached to a railcar 110. EX1003, ¶ 73; EX1006, ¶ [0012], Fig. 1.

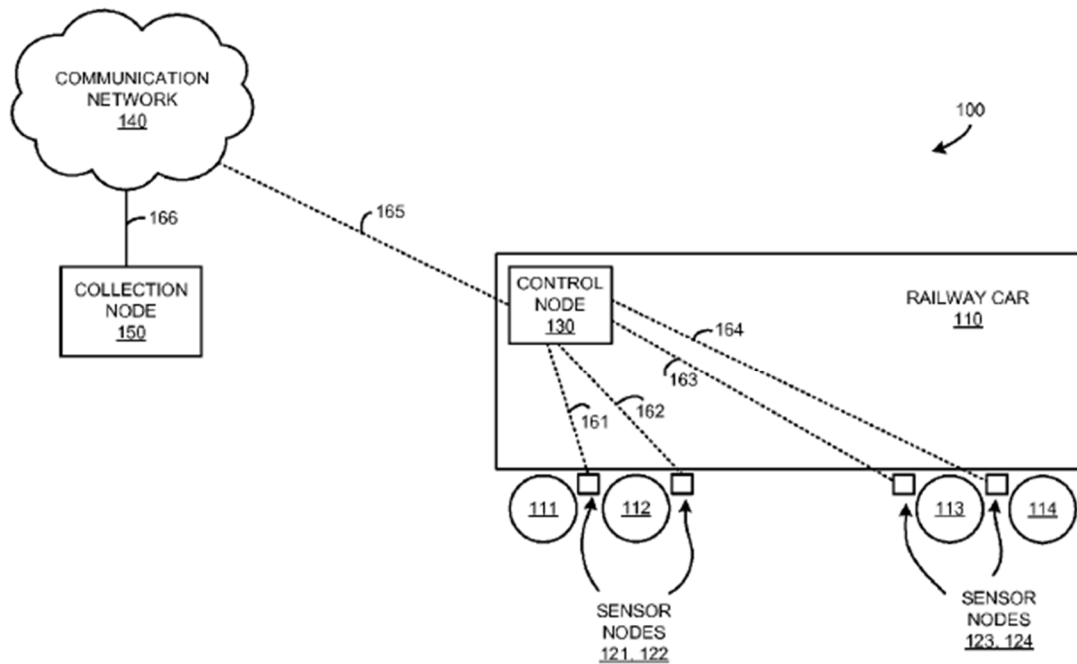


**FIGURE 1**

The sensor nodes are separate from one another, and each node is attached to a separate undercarriage element of the railcar. EX1006, ¶ [0012].

Armitage’s system also includes a “control node” on each railcar. EX1006, ¶¶ [0004], [0012], Figs. 1, 3, 5. The control node receives “sensor information, or modified sensor information” collected by each of the sensor nodes on the same railcar. EX1006, ¶ [0027]; EX1003, ¶ 74. The sensor nodes and the control node communicate over a wireless network. EX1006, ¶¶ [0014], [0033], [0054];

EX1003, ¶ 74. For example, in the embodiment of Figure 1, control node 130 communicates with each of sensor nodes 121–124 via wireless links 161–164, respectively. The wireless links can utilize, for example, WiFi or Bluetooth, both of which provide two-way communications. EX1006, ¶ [0021]; EX1003, ¶ 74. The sensor portion of the “sensor nodes 121-124” in Armitage can be accelerometers for measuring accelerations. EX1003, ¶ 74; EX1006, ¶¶ [0014], [0033], [0045], [0046], [0056].

A PHOSITA would therefore understand in Armitage’s system, the control node on each railcar receives data from one or more sensor nodes, said sensor nodes comprising one or more sensors configured to measure accelerations, located on the railcar. EX1003, ¶ 75.

d. **Limitation 1(d)**

Armitage teaches samplings of the accelerometer data at the CMU level, which equate to the ’915 Patent’s filtering at least a portion of the accelerations. EX1003, ¶ 76; EX1006, ¶ [0045]. Specifically, Armitage teaches sampling accelerations for only a portion of a wheel rotation, and filters out radial accelerations. EX1006, ¶¶ [0045] (“...**the sampling** only occurs for a portion of a wheel rotation, and radial **acceleration** or vibration (x-axis or y-axis) data could be ignored.”), [0046]. The filtering in Armitage is conducted while the control node (i.e., CMU) is processing the data collected by the sensors (i.e., accelerometers).

EX1006, ¶¶ [0026]-[0027], [0045]; EX1003, ¶ 76. A PHOSITA would understand Armitage's teachings of sampling data and ignoring radial accelerations equates to filtering at least a portion of accelerations. EX1003, ¶ 76.

Additionally, Armitage discloses filtering at the sensor level. EX1003, ¶ 77. Armitage's "sensor 630" can include "amplifiers, analog-to-digital-converters, [and] microcontrollers." EX1006, ¶ [0056]. A PHOSITA would understand Armitage's teachings of amplifiers, analog-to-digital-converters, and microcontrollers in the sensor would mean the sensor is capable of filtering at least a portion of accelerations. EX1003, ¶ 77.

Filtering data was well-known in the art and a PHOSITA would have understood the Armitage system filters sensor data. EX1003, ¶¶ 78, 79 (citing EX1009). A PHOSITA would have understood the meaning of filtering is excluding some portion of a data set, and it is desirable to include a filter in any data collection and processing system to get rid of unwanted data, and/or to identify and amplify particularly relevant data. EX1003, ¶ 78. In this field, filtering data can be accomplished by choice of the sensor that has a specific range or resolution, through physical methods (i.e., mechanical filtering), electronic filtering, or digital filtering. *Id.* Electronic filtering is a type of filtering which utilizes electrical circuits to process signals (i.e., analog signals), and includes a number of different types of filters. *Id.* Mechanical filtering is another type of

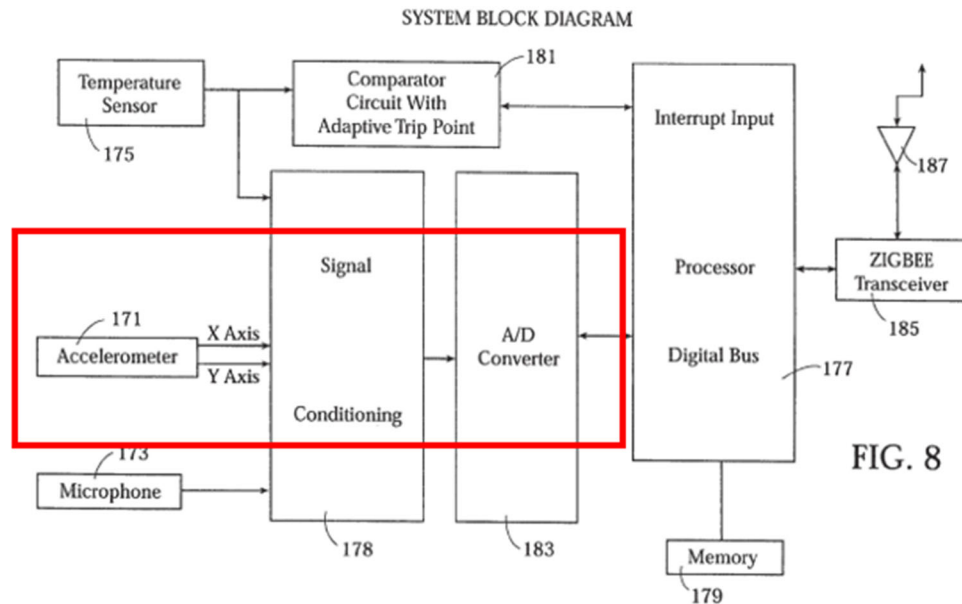
signal processing filtering, that relies on physical parameters to remove unwanted high and low frequencies from a signal of interest. *Id.* Digital filtering uses software to manipulate and filter data to decrease unwanted signals and increase signals from a particular area of interest. *Id.* In summary, in any data collection analysis, data is almost always filtered in some manner, and the system can utilize the various types of filters alone or in combination to achieve the most effective filtering of data to achieve more accurate and/or targeted data analysis for detection of fault conditions. EX1003, ¶ 79. A PHOSITA would understand Armitage’s teachings of sampling and ignoring certain data points equates to filtering data in the ’915 Patent. *Id.*

To the extent Armitage does not explicitly disclose a “filter”, Barone shows filtering acceleration data was well-known in the art and conventionally used in the field at the time of the invention. EX1003, ¶ 80; EX1006, Fig. 8, ¶¶ [0114]-[0115], [0150], [0172]-[0185]. Specifically, Barone explicitly teaches output of an “accelerometer 171” being transmitted to “signal conditioning 178”, where the analog signals are amplified and/or filtered as appropriate (electronic filter), and then routed to analog to digital (A/D) converters for wide bandwidth calculations and data manipulations (digital filter). EX1003, ¶ 80; EX1006, ¶¶ [0114]-[0115], Fig. 8. The filtering in Barone occurs in the sensor. EX1003, ¶ 80; EX1006, ¶¶ [0114]-[0115], Fig. 8. A PHOSITA would have understood filtering of data can

take place anywhere in the system—including in either the CMU or sensor.

EX1003, ¶ 80. Further, a PHOSITA would understand various considerations impact where the filtering takes place in a data processing system. *Id.* For example, Barone emphasizes the importance of a low power system, so a PHOSITA would understand power consumption can impact where filtering takes place. *Id.*; EX1007, Abstract, ¶¶ [0026], [0030], [0107], [0116], [0129].

Barone further teaches the use of a high-pass, low-pass, and/or band-pass filters, all of which can utilize both electronic and digital filters. EX1003, ¶ 81; EX1007, ¶¶ [0172]-[0185]. Barone explicitly discloses filtered data (both digital and electronic), which shows filtering accelerations was well-known in the art and a PHOSITA would be motivated to include the filtering taught by Barone to remove unwanted data and/or amplify particularly relevant accelerations data. EX1003, ¶ 81. Again, filtering could occur at various points within the system. *Id.*



Because Barone explicitly discloses filtering data, a PHOSITA would have been motivated to include the filtering taught by Barone with Armitage because the advantage of filtering is to remove unwanted data and/or amplify particularly relevant data, and the purpose of both the Armitage and Barone systems is to analyze data in a train monitoring system to accurately predict anomalous conditions and avoid false or inaccurate data processing. EX1003, ¶ 82; *KSR*, 550 U.S. at 416. Combining the sampling of data (i.e., filtering) in Armitage and the electronic and digital filtering taught in Barone would have predictably resulted in the filtering of accelerations data. EX1003, ¶ 82.

e. **Limitation 1(e)**

Armitage teaches a “control node[s] 130” which collects data from a plurality of sensors on the railcar regarding one or more railcar operational parameters. EX1003, ¶ 84; EX1006, ¶¶ [0012], [0020].

As previously discussed, each sensor node contains one or more sensors that collect data regarding the railcar, and wirelessly transmits the collected data to the “control node 130.” *See* Section X.A.2.c; EX1003, ¶ 85. The “control node 130” collects this data and analyzes it to determine whether a fault condition is present. Specifically:

The information received could include sensor information, or modified sensor information, from each of sensors 121-124 received over wireline or wireless links. **Control node 130 processes (204) the information to determine a fault condition for the undercarriage portion.**

EX1006, ¶ [0027]. If a fault condition is detected, the “control node 130” wirelessly reports it (i.e., sends an alarm message) to a collection system. EX1006, ¶ [0028]; EX1003, ¶ 85.

f. **Limitation 1(f)**

Armitage teaches a “control node 130” (i.e., CMU), which can include “user interface systems, memory devices, computer-readable storage mediums, software,

processing circuitry” for analyzing data. EX1003, ¶ 86; EX1006, ¶ [0016].

Armitage teaches the “control node[s] 130” analyzes the collected data for trends or events indicative of an anomalous operational condition. EX1003, ¶ 86; EX1006, ¶¶ [0016], [0040] (“Control node 330...could **analyze information or data from each of sensor nodes...**”).

The control node can also perform statistical analysis on the collected data to detect failure conditions, such that it is “drawing inferences” regarding the performance of the railcar.<sup>4</sup> EX1003, ¶ 87. Armitage describes drawing inferences to determine both the presence and nature of a fault condition. For example, Armitage discloses “[a] single wheel sensor anomaly might ... indicate a ‘wheel out of round’ or ‘flat spot’ condition, where a non-round geometry of a wheel can cause vibrations or shocks at a certain portion of each rotation of a wheel.” EX1006, ¶ [0042]. Conversely, “outliers for sensor nodes on an entire side of railway car 310 could indicate a cornering failure, or an off-track condition.” *Id.* A PHOSITA would understand these are examples of “drawing inferences” from the data. EX1003, ¶ 87.

---

<sup>4</sup> Petitioner notes Limitation 1(f) does not claim the CMU “drawing inferences from the data received from at least two of the sensors regarding the performance of the railcar”, and this limitation instead appears in Claim 36. For efficiency, Petitioner addresses this limitation here because Limitation 36(f) (*infra*) has very similar, overlapping limitations.

The control node can “process the sensor information to determine anomalies from an average, such as an anomaly from a running average of the temperature of all wheels on railway car.” EX1006, ¶ [0029]. Armitage also discloses the use of a “moving average and trend analysis” to detect “statistically significant deviations” that are indicative of failure. EX1006, ¶ [0030]; EX1003, ¶ 88; *see also* EX1006, ¶ [0045] (describing “time series analysis” and statistical sampling of accelerometer data). Armitage indicates its system can distinguish between potential failures (which warrant maintenance) and actual failures (which require immediate service). EX1003, ¶ 88; EX1006, ¶ [0044] (describing a “health scorecard” that distinguishes “yellow conditions” from “red conditions”).

**g. Limitation 1(g)**

Armitage discloses the control node on each railcar (i.e., communication management unit) wirelessly transmits information, such as sensor data and alarm messages, to a collection node (i.e., a base unit). EX1003, ¶ 89; EX1006, ¶¶ [0004], [0019]–[0020], [0038], Fig. 1. In Armitage’s system, if the control node detects a fault condition, it wirelessly reports the fault (i.e., sends an alarm message). EX1006, ¶ [0028]; EX1003, ¶ 89. See, for example, step 205 in Figure 2 of Armitage:

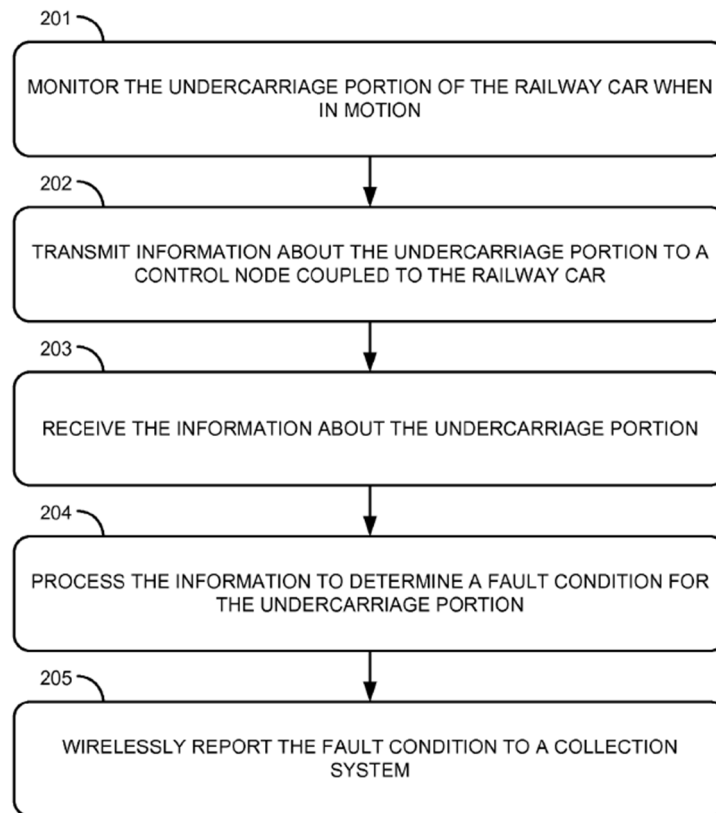


**FIGURE 2**

Armitage further discloses the collection node can be in a remote location located off the train (i.e., remote). For example, the collection node can be “a rail-side or handheld device.” EX1006, ¶ [0039]; EX1003, ¶ 90. Alternatively, the collection node may comprise “application servers,” “web servers,” and other computing equipment. EX1006, ¶¶ [0019], [0039]. A PHOSITA would understand “rail side” devices, “web servers,” and “application servers” would not be located on the train, and therefore, would serve as “remote receivers”. EX1003, ¶ 90.

### 3. **Dependent Claim 22**

Armitage discloses a “wireless communication network” and “communication network 140”, which further “include[s] **base stations... gateways**, or other wireless communication systems, including combinations thereof.” EX1003, ¶ 91; EX1006, ¶¶ [0016], [0018]. Further, Armitage discloses the wireless communication occurring between the “control node[s] 130” (i.e., CMUs) and “base station” of the wireless network, through the use of equipment such as a cellular communication device, satellite, mobile phone, etc. *Id.*

### 4. **Dependent Claim 24**

#### a. **Limitation 24(a)**

*See* Section X.A.2.c; EX1003, ¶ 92.

Armitage teaches “control node[s] 130” in communication with the “sensors nodes 121-124.” EX1003, ¶ 93; EX1006, ¶¶ [0012], [0014], [0016], [0018], [0033].

#### b. **Limitation 24(b)**

Armitage teaches “sensors nodes 121-124” having a “sensor portion.” EX1003, ¶ 93; EX1006, ¶¶ [0014], [0033].

#### c. **Limitation 24(c)**

Armitage teaches “sensor nodes 121-124...encased in a weatherproof or sealed enclosure” (i.e., housing). EX1003, ¶ 95; EX1006, ¶¶ [0015], [0034].

#### d. **Limitation 24(d)**

*See* Section X.A.4.c; EX1003, ¶ 96.

e. **Limitation 24(e)**

*See* Sections X.A.2.d and X.A.4.c; EX1003, ¶ 97.

Armitage teaches “sensor nodes” are encased in a “potted” enclosure. EX1006, [0015], [0034]; EX1003, ¶ 98. A PHOSITA would understand the “potted” enclosure in Armitage would equate to a housing comprising potting material to absorb undesirable accelerations. EX1003, ¶ 98.

Potting materials and thin layer conformal coatings are used to protect circuit board and electronic components—such as sensors. EX1003, ¶ 99 (citing EX1010). Potting has been used for decades to isolate components, keep wires from vibrating until they break, as well as provide environmental isolation. *Id.* Potting material is frequently used in conjunction with mechanical and electrical filters to ensure the data is properly filtered and absorbs unwanted data. *Id.* Electrical filters benefit from potting because it helps the circuits stay dry and clean to avoid corrosion. *Id.* For mechanical filters, potting can help absorb physical signals so less “noise” gets to the sensor. *Id.* Therefore, a PHOSITA would understand a “potted enclosure” refers to potting material placed within a housing that encases sensors (i.e., accelerometers) to tune said sensors by absorbing undesirable accelerations, as it is the nature of potting material to protect components of an electrical or mechanical system by absorbing unwanted outside factors. EX1003, ¶ 100.

**5. Dependent Claim 25**

**a. Limitation 25(a)**

*See* Sections X.A.2.c and X.A.4.a; EX1003, ¶ 101.

Armitage teaches “control node[s] 130” in communication with the “sensors nodes 121-124.” EX1003, ¶ 102; EX1006, ¶¶ [0012], [0014], [0016], [0018], [0033].

**b. Limitation 25(b)**

*See* Section X.A.4.b; EX1003, ¶ 103.

Armitage teaches “sensors nodes 121-124” having a “sensor portion.” EX1003, ¶ 104; EX1006, ¶¶ [0014], [0033].

**c. Limitation 25(c)**

In one embodiment, Armitage teaches the sensor nodes include “processing system 620” configured to execute “software 622” which can include “firmware” for the purpose of controlling the sensor nodes, sensor 630, and power system 640.” EX1003, ¶ 105; EX1006, ¶¶ [0053]-[0056], Fig. 6. Specifically, paragraph 55 of Armitage states:

Software 622 may include an operating system, logs, utilities, drivers, networking software, and other software typically loaded onto a computer system. *Software 622 could contain* an application program, *firmware*, or some other form of computer-readable processing instructions. When executed by processing system 620, *software 622 directs processing system 620 to operate as described herein*, such as

monitor sensor 630, process the sensor information, and transfer sensor information or data.

EX1006, ¶ [0055]. A PHOSITA would understand firmware's purpose is to control hardware within a device (i.e., sensors). EX1003, ¶ 105. Therefore, Armitage discloses every element of this limitation.

d. **Limitation 25(d)**

*See* Sections X.A.2.d and X.A.5.c; EX1003, ¶ 106.

As previously discussed, Armitage in combination with Barone discloses digital (i.e., software) filters for purposes of filtering or isolating data. *See* Section X.A.2.d. Specifically, Barone's disclosure of high, low, and band-pass filters means certain ranges of data are *isolated* depending on what type of digital filtering is executed by the software. EX1003, ¶ 107; EX1007, ¶¶ [0172]-[0185].

As previously discussed in Limitation 1(d), a PHOSITA would understand filtering can occur in various components within the system (i.e., CMUs or sensors).

EX1003, ¶ 107.

A PHOSITA would understand firmware is often considered to be more closely related to the hardware (or physical components) of a system (i.e., making a measurement or detecting a switch position), while software is the layer of programming evaluating rules and making complex decisions. EX1003, ¶ 108. One type of filtering firmware can execute is identifying and isolating certain types of

data—in this case, accelerations data. *Id.* In contrast, software is described as programing that acts on the data; in other words, software performs post data collection algorithms—which is different from the functions of firmware. *Id.* Therefore, a PHOSITA would understand firmware and software have different functions, and a software filter would be required in combination with the firmware to execute the filtering of the accelerations data. *Id.* Even further, a PHOSITA would understand a function of filtering data by a software filter can be isolating or excluding certain types of accelerations data - based on programming that would be present in the software filter. *Id.*

**6. Dependent Claim 27**

*See* Sections X.A.2.d and X.A.5.d; EX1003, ¶ 109.

**7. Dependent Claim 28**

*See* Sections X.A.2.d and X.A.5.d; EX1003, ¶ 110.

**8. Dependent Claim 29**

*See* Section X.A.2.g; EX1003, ¶ 111.

**9. Independent Claim 30**

**a. Limitation 30(a)**

Armitage teaches a method for detecting operational anomalies on a train consist or railcar. *See* Section X.A.2.a; EX1003, ¶¶ 112-113.

**b. Limitation 30(b)**

*See* Section X.A.2.c; EX1003, ¶ 114.

c.     **Limitation 30(c)**

*See* Section X.A.2.d; EX1003, ¶ 115.

d.     **Limitation 30(d)**

*See* Section X.A.2.e; EX1003, ¶ 116.

e.     **Limitation 30(e)**

*See* Section X.A.2.f; EX1003, ¶ 117.

f.     **Limitation 30(f)**

*See* Section X.A.2.g; EX1003, ¶ 118.

**10. Independent Claim 36**

a.     **Limitation 36(a)**

*See* Section X.A.2.a; EX1003, ¶ 119.

b.     **Limitation 36(b)**

*See* Section X.A.2.b; EX1003, ¶ 120.

c.     **Limitation 36(c)**

*See* Section X.A.2.c; EX1003, ¶ 121.

d.     **Limitation 36(d)**

*See* Section X.A.2.d; EX1003, ¶ 122.

e.     **Limitation 36(e)**

*See* Section X.A.2.e; EX1003, ¶ 123.

f.     **Limitation 36(f)**

*See* Section X.A.2.f; EX1003, ¶ 124.

g. **Limitation 36(g)**

*See* Section X.A.2.g; EX1003, ¶ 125.

**11. Dependent Claim 37**

a. **Limitation 37(a)**

*See* Section X.A.2.a; EX1003, ¶ 126.

b. **Limitation 37(b)**

*See* Section X.A.2.c; EX1003, ¶ 127.

c. **Limitation 37(c)**

*See* Section X.A.2.f; EX1003, ¶ 128. For example, Armitage discloses *comparing* sensor data collected from multiple sensor nodes on the same side of a rail car to detect potential cornering failure or an off-track condition. EX1006, ¶ [0042].

d. **Limitations 37(d)-(g)**

Armitage teaches a plurality of “sensors nodes 121-124” located on one or more railway cars, which contain a “sensor portion” and is configured to sense operational parameters of one or more railcars. EX1003, ¶ 129; EX1006, Figs. 1, 3, 5, ¶¶ [0004], [0014]. This limitation precedes the next three limitations (Limitations 37(e), (f), and (g)), and only requires one of the three limitations to be present to satisfy the claim. *See* EX1001, Claim 37 (...wherein said accelerometers are positioned on the railcar to provide data **for carrying out one or more of the following functions...**”).

(1) Limitations 37(e) and 37(f)

Armitage discloses both Limitations 37(e) and 37(f). EX1003, ¶ 130. Figure 3 of Armitage shows the location on the railcar of various sensors (sensors 320-327).

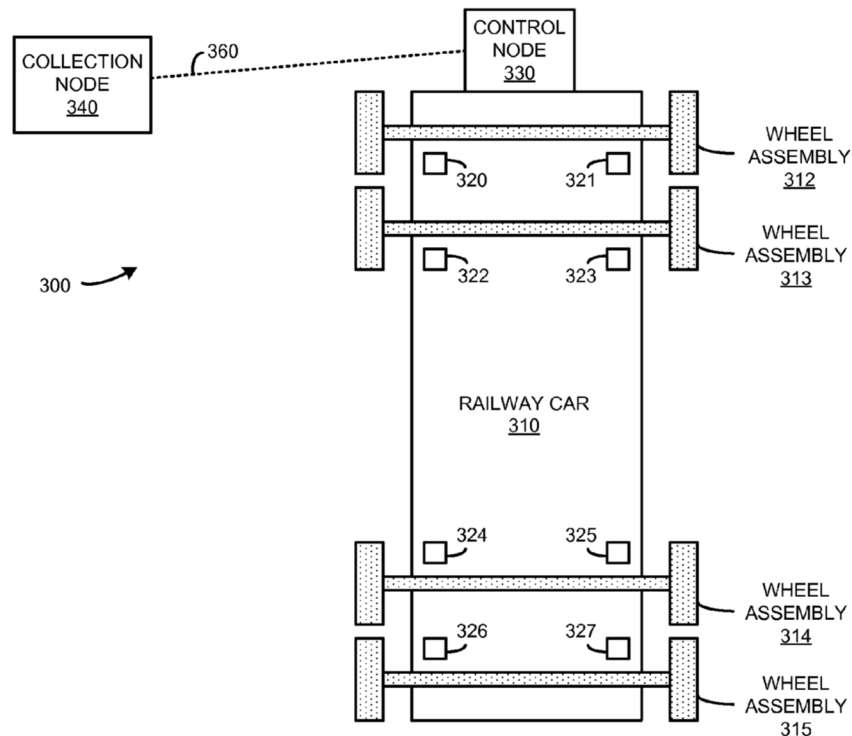


**FIGURE 3**

Paragraph 42 of Armitage states the following:

Failure alerts could be tailored to the number of sensor nodes 320-327 which become outliers, or based on the value of the monitored parameter if outside of expected norms. For example, when only one of sensor nodes 320-327 indicates outlier data as shown in FIG. 4, it could be determined that a wheel bearing or hotbox condition for a single wheel has occurred. A single wheel sensor anomaly might also indicate

a ‘wheel out of round’ or ‘flat spot’ condition, where a non-round geometry of a wheel can cause vibrations or shocks at a certain portion of each rotation of a wheel. Taking sensor node 325 as an outlier in this example, then the right wheel of wheel assembly 314 could have a failure. **In examples where two outliers occur for the same wheel assembly, then a failure of the entire wheel assembly could be determined, such as when an axle is damaged or brake applied mistakenly. Likewise, outliers for sensor nodes on an entire side of railway car 310 could indicate a cornering failure, or an off-track condition.** Wheel assemblies can be referred to as ‘trucks’ in some examples, where two trucks are included on a railcar, each truck including four wheels on two axles. **If four sensors, all on the same truck, deviate from the other four sensors on a railcar, a truck bearing failure condition could be determined.** Other failure modes could be determined based on outlier data determined by any of sensor nodes 320-327.

EX1006, ¶ [0042]. Armitage teaches, “where two outliers occur for the same wheel assembly, then a failure of the entire wheel assembly could be determined...” EX1006, ¶ [0042]. A PHOSITA would understand, based on the disclosure in Armitage, that comparing data to determine outliers for the same wheel assembly would equate to comparing accelerations from one railcar wheel with that of another railcar wheel on the same axle but opposite side of the railcar. EX1003, ¶ 131.

Further, Armitage teaches “outliers for sensor nodes on an entire side of railway car 310 could indicate a cornering failure, or an off-track condition.” EX1006, ¶ [0042]. A PHOSITA would understand, based on the disclosure in Armitage, that comparing data to determine outliers on the same side of a railway car would equate to comparing accelerations from one railcar wheel with that of at least one other wheel on the same side of said railcar. EX1003, ¶ 132. Therefore, Armitage discloses all elements of Limitations 37(e) and 37(f), and renders the entirety of Claim 37 obvious.

(2) Limitation 37(g)

Armitage also teaches the “[c]ontrol node 130 could process the sensor information to determine anomalies from an average, such as an anomaly *from a running average of the temperature of all wheels on railway car 110*”, and further, notes a “dynamic threshold” could be determined as conditions (i.e., accelerations) change across a railcar. EX1006, ¶ [0029]. First, a PHOSITA would understand this running average analysis across all wheels on a railcar could be for acceleration measurements (not just temperature), and could also incorporate sensor data from railcar wheels on the same side but on different railcars. EX1003, ¶ 133.

A PHOSITA would know sensors located on the same side of the railcar, but on different railcars, could be used to compare acceleration data and determine the

status of the railcar and events. EX1003, ¶ 134. For example, detecting vertical and lateral accelerations to determine hunting in a locomotive was well-known in the art at least as far back as 2007, and it would have been obvious to a PHOSITA to place sensors on the same side of different railcars to detect these accelerations and ultimately determine railcar and train consist events. *Id.* (citing EX1016). A PHOSITA would further understand vertical or lateral acceleration measurements from sensors on the same side of different railcars can be analyzed and compared to detect vertical or lateral hunting events. *Id.* Therefore, a PHOSITA would understand Armitage renders this limitation obvious.

**B. Ground 2: Claim 21 is unpatentable under 35 U.S.C. § 103(a) in view of Armitage, Barone, and LeFebvre**

Like Armitage and Barone, LeFebvre teaches monitoring components of a railcar to predict and/or detect component failure and describes a system for monitoring railcar and train consist operational parameters. EX1005, Abstract; EX1003, ¶ 135. Therefore, LeFebvre is analogous art.

**1. Dependent Claim 21**

LeFebvre discloses a “control unit 23” (i.e., communication management unit) which can include a “triaxial accelerometer” (i.e., sensor). EX1005, ¶¶ [0037] (“the data control units 23 or the communications device 24 may contain a triaxial

accelerometer...”), [0093] (“The commands can be influenced by the measured accelerations at the data control unit...”); EX1003, ¶ 136.

A PHOSITA would have been motivated to include an accelerometer within the communication management unit in view of the disclosure of LeFebvre in combination with the systems of Armitage and Barone. EX1003, ¶ 137.

Specifically, a PHOSITA would include the sensor (i.e., accelerometer) in the communication management unit, as disclosed in LeFebvre, because of the efficiency, space, and power benefits. EX1003, ¶ 137. As previously discussed, Barone emphasizes the importance of a low power system, so by including the sensor within the CMU, a PHOSITA would understand the system saves power by combining the two components into one physical device. EX1003, ¶ 137; EX1007, Abstract, ¶¶ [0026], [0030], [0107], [0116], [0129]. Placing the sensor within the CMU would also save space on the railcar for other components, and also shorten the line of communication between the sensor and CMU, increasing the efficiency and accuracy of data processing. EX1003, ¶ 137.

**C. Ground 3: Claims 23 and 26 under 35 U.S.C. § 103(a) in view of Armitage, Barone, and Winfree**

As explained in detail in Ground 1, a PHOSITA would have been motivated to include the filter taught by Barone in Armitage’s system because the advantage of filtering is to remove unwanted data and/or amplify particularly relevant data.

EX1003, ¶ 138; *KSR*, 550 U.S. at 416. Likewise, Winfree teaches a mechanical filter for accelerometers, and a PHOSITA would be motivated to combine the teachings of Armitage and Barone with Winfree to add another layer of filtering—with a mechanical filter—to filter out undesirable accelerations data in the system. EX1003, ¶ 138. As discussed in more detail below, a PHOSITA could have arrived at the claimed solution by combining prior art elements according to known methods to yield predictable results. *Id.*

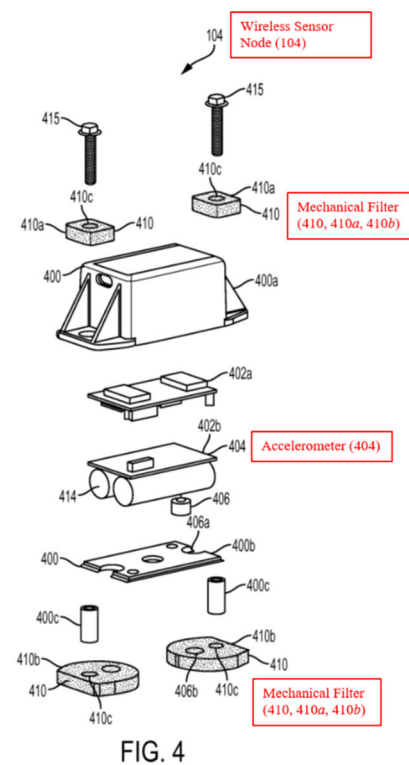
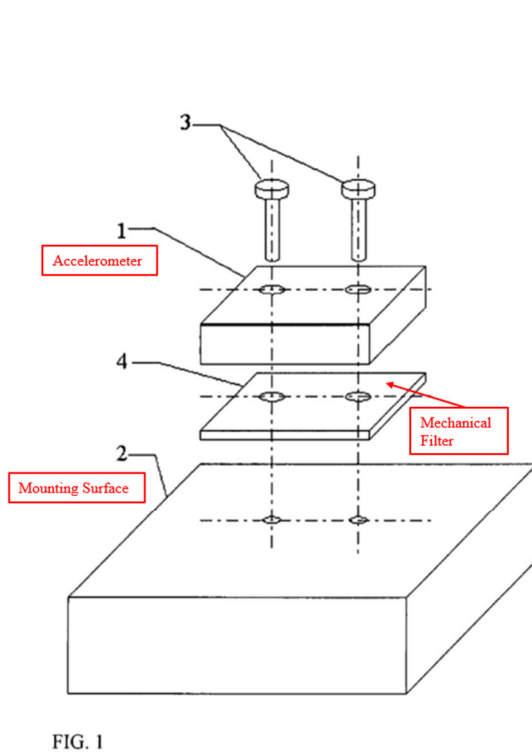
**1. Dependent Claim 23**

**a. Limitation 23(a)**

As discussed in previous limitations, Armitage in combination with Barone discloses a filter for filtering accelerations—specifically, electronic and digital filters. *See* Section X.A.2.d. While Armitage and Barone don’t explicitly disclose a “mechanical filter”, it would have been obvious to modify Armitage in view of Barone to further include the mechanical filter of Winfree. EX1003, ¶ 139; EX1008, Abstract. A PHOSITA would have had a reasonable expectation of success adding the mechanical filter in Winfree with Armitage and Barone. EX1003, ¶ 139.

Using mechanical, digital and/or electronic filters in the data collection process was well known in the art. EX1003, ¶ 140. According to Winfree, it is desirable for a mechanical filter to be comprised of a resilient material (i.e.,

magnesium alloy) to block the transmission of unwanted frequencies during data collection. EX1008, 4:33-41, 5:10-16, Figs. 1, 2. As can be seen below, the similarities between the mechanical filters in Fig. 1 in Winfree and Fig. 4 in the '915 Patent are evident.



A PHOSITA would have been motivated to use a mechanical filter in combination with an electric or digital filter, because it is typically preferred to “double down” on the filtering of the data with two (or more) filters having different characteristics. EX1003, ¶ 141; EX1008, 5:35-42. An accelerometer mounted on top of a wheel bearing would be likely to experience unwanted

vibrations (i.e., vibrations unrelated to the health of the bearing), and a PHOSITA would have understood a mechanical filter is useful to remove unwanted data and/or amplify particularly relevant data at a first level of filtering. EX1003, ¶ 141. Bracket materials for the mechanical filter, shape, and length can also have large effects on the filtering of data, and can even resonate and add to the signal at certain frequencies or subtract at other frequencies. *Id.* Therefore, a PHOSITA would understand using a mechanical filter as a first level of filtering the accelerations before sending the data to an electronic or digital filter would be desirable to filter and minimize effects from the physical environment on the data. *Id.*

**b. Limitation 23(b)**

As explained in Section X.C.1.a above, a PHOSITA would have been motivated to incorporate a mechanical filter made of resilient material to achieve predictable benefits, such as filtering out undesirable accelerations. EX1003, ¶ 142. According to Winfree, it is desirable for a mechanical filter to be comprised of a resilient material (i.e., magnesium alloy) to block the transmission of unwanted frequencies before they even reach the accelerometer. EX1008, 4:33-41, 5:10-16, Figs. 1, 2. Winfree teaches isolating the accelerometer for purposes of minimizing damage to the accelerometer or some other undesirable events. EX1008, 2:30-33.

Further, a PHOSITA would understand it would be desirable to remove the undesirable accelerations with the mechanical filter before those accelerations even reach the sensors, for example: (1) not overloading the processor with unusable data and (2) not wanting to harm or destroy the sensor (i.e., shock absorption).

EX1003, ¶ 143; EX1008, 2:30-33.

## **2. Dependent Claim 26**

*See* Section X.C.1.a; EX1003, ¶ 144.

### **D. Ground 4: Claims 1, 21-22, 25, 27-30, 36, and 37 are unpatentable under 35 U.S.C. § 103(a) in view of LeFebvre and Barone**

#### **1. Obviousness in View of LeFebvre and Barone**

LeFebvre and Barone are related to the same field of endeavor (i.e., monitoring components of a railcar to predict and/or detect component failure) and describe the same device: a system for monitoring railcar and train consist operational parameters. EX1005, Abstract; EX1007, Abstract. Furthermore, LeFebvre and Barone both use sensors, CMUs, and a wireless network to solve the same problem, namely, to determine anomalous conditions of a railcar in real-time and wirelessly report the anomalous conditions to determine a fault condition (e.g., degree of wear on wheel bearings of railroad cars). EX1005, Abstract, ¶¶ [0021], [0024], [0025], [0036]-[0037], [0093]; EX1007, Abstract, ¶¶ [0002], [0006]. *In re Bigio*, 381 F.3d at 1325; MPEP 2141.01(a). Moreover, LeFebvre, which shares a named inventor with the '915 Patent, expressly admits systems with the relevant

topology were well-known at least as of 2006 when the application leading to the publication of LeFebvre was filed. *See* EX1005, Abstract, ¶ [0005]; EX1003, ¶ 145. Thus, use of the relevant topology was a known method that would yield predictable results and could be combined with the arrangement disclosed in Barone with relative ease. EX1003, ¶ 145. Thus, LeFebvre and Barone are analogous art.

Further, LeFebvre discloses the periodic sampling of frequencies from sensors depending on the type of behavior being monitored (i.e., accelerations), which a PHOSITA would understand requires an electronic or digital filter. EX1003, ¶ 146; EX1005, ¶¶ [0034]-[0035]. A PHOSITA would understand it is general knowledge filtering means excluding or amplifying certain ranges of data (or signals) within a data set—and would require an actual filter to achieve said filtering. EX1003, ¶ 146. To the extent LeFebvre does not explicitly disclose a filter, Barone shows filtering accelerations with an electronic or digital filter was well-known in the art and conventionally used in the field at the time of the invention. EX1003, ¶ 146; EX1007, Fig. 8, ¶¶ [0114]-[0115], [0150], [0172]-[0185]. Barone explicitly discloses filtering data, and a PHOSITA would have been motivated to include the filter taught by Barone with LeFebvre because the advantage of filtering is to remove unwanted data and/or amplify particularly relevant data, and the purpose of both systems is to analyze data in a train

monitoring system to accurately predict anomalous conditions and avoid false or inaccurate data processing. EX1003, ¶ 146; *KSR*, 550 U.S. at 416. Combining the preliminary analysis and sampling of data in LeFebvre using an electronic filter and the filter taught in Barone would have predictably resulted in the electronic or digital filtering of accelerations data. EX1003, ¶ 146.

## **2. Independent Claim 1**

### **a. Limitation 1(a)**

This preamble merely describes an intended use of detecting operational anomalies on a train consist or railcar, which does not instill patentable weight. *Pitney Bowes*, 182 F.3d at 1305; *Rowe*, 112 F.3d at 478; MPEP 2111.02(II); EX1003, ¶ 147.

To the extent the preamble is limiting, LeFebvre teaches a system for detecting operational anomalies on a railcar. EX1003, ¶ 148; EX1005, Abstract. Specifically, LeFebvre teaches railcar monitoring for processing information received from sensors and reporting departures of performance variables. EX1003, ¶ 148; EX1005, Abstract, ¶¶ [0003], [0006].

Thus, even though the preamble should not be given patentable weight, LeFebvre teaches the preamble. EX1003, ¶ 149.

**b. Limitation 1(b)**

LeFebvre teaches a “communications device 24” mounted on a railcar and “data control unit 23” linked by a “cable 23a” to the “communications device 24.” EX1003, ¶ 150; EX1005, ¶¶ [0008], [0024], Fig. 1. The “communications device 24” and “data control unit 23” can be contiguous. EX1005, ¶ [0024], Fig. 1. “Indeed, the two devices may well be combined or their functions shared so the distinction could become unnecessary.” EX1005, ¶ [0068].

The “data control unit 23” communicates with pads on the railcar. EX1003, ¶ 151; EX1005, ¶ [0024]-[0026]. Therefore, LeFebvre discloses one or more communication management units mounted on one or more railcars. EX1003, ¶ 151; EX1005, ¶¶ [0008], [0024]-[0026], [0068].

**c. Limitation 1(c)**

LeFebvre discloses a railcar monitoring system comprising a plurality of “instrumented pads 16”, each of which comprises one or more sensors that measure operational parameters of the railcar. EX1005, ¶¶ [0019], [0023], [0052]; EX1003, ¶ 152. LeFebvre further discloses “a plurality of sensors 5” located on one or more railcars in communication with the “communications device 24” and “data control unit 23.” EX1003, ¶ 152; EX1005, ¶¶ [0021], [0036]. LeFebvre further claims the sensors in the instrumented pads measure accelerations. EX1003, ¶ 152; EX1005, Claims 28, 30.

Each “instrumented pad 16” in LeFebvre is a separate device mounted on the railcar. Specifically, each pad is mounted upon the upper surface of a wheel bearing adapter 4, as shown in Fig. 4. EX1005, ¶ [0019]; EX1003, ¶ 153.

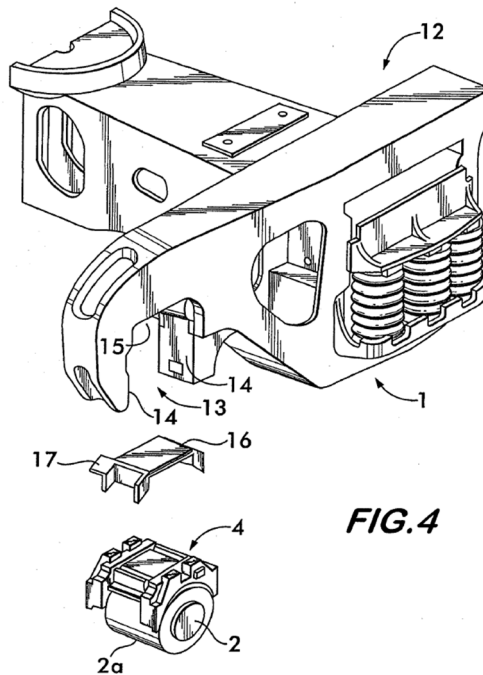
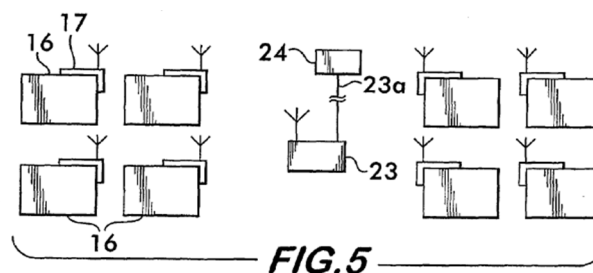


Figure 5 of LeFebvre depicts an exemplary embodiment with a plurality of instrumented pads 16, where each instrumented pad is attached to a different wheel bearing adapter. EX1005, ¶ [0039], Fig. 5; EX1003, ¶ 154.



Each instrumented pad 16 communicates wirelessly with a data control unit 23, which is mounted on the railcar body. EX1005, ¶ [0024]; Fig. 5; EX1003, ¶ 155.

LeFebvre's data control unit therefore is in communication with and receives information from the instrumented pads (i.e., sensors), as required by Limitation 1(c). EX1003, ¶ 155. The data control unit also performs steps (d)–(f) of claim 1, as will be discussed in further detail below.

**d. Limitation 1(d)**

LeFebvre teaches filtering at both the sensor and CMU level for purposes of identifying “essential indicative information” from a large data set. EX1003, ¶ 156; EX1005, ¶ [0053]. First, LeFebvre discloses a “preliminary analysis” performed by the “microprocessor” within the instrumented pad which samples frequencies from sensors depending on the type of behavior being monitored (i.e., accelerations). EX1003, ¶ 156; EX1005, ¶¶ [0034]–[0036]. A PHOSITA would understand LeFebvre's preliminary analysis equates to filtering at least a portion of accelerations. EX1003, ¶ 156.

Second, LeFebvre teaches the microprocessors within the instrumented pads and the “data control unit 23” serve the important functions of processing and filtering the raw data to only send “essential indicative information.” EX1003, ¶ 157; EX1005, ¶ [0053]. A PHOSITA would understand LeFebvre's processing of

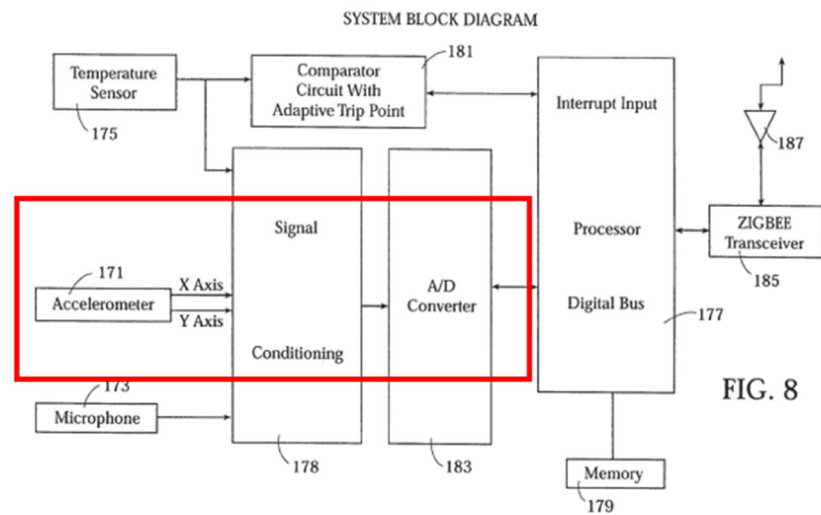
data to identify and send essential indicative information equates to filtering at least a portion of accelerations. EX1003, ¶ 157.

As explained above in Section X.A.2.d, filtering data was well-known in the art and a PHOSITA would have been familiar with electrical, mechanical, and digital filters—as well as the benefits and advantages of using such filters. EX1003, ¶¶ 158-159. It is desirable to include a filter in any data collection and processing system to get rid of unwanted data, and/or to identify and amplify particularly relevant data. *Id.* A PHOSITA would therefore have understood the LeFebvre system filters sensor data. *Id.* Specifically, a PHOSITA would understand LeFebvre’s teachings of conducting a preliminary analysis and identifying essential indicative information equates to filtering data in the ’915 Patent. *Id.*

To the extent LeFebvre does not explicitly require a “filter”, Barone shows filtering accelerations was well-known in the art and conventionally used in the field at the time of the invention. EX1003, ¶ 160; EX1007, Fig. 8, ¶¶ [0114]-[0115], [0150], [0172]-[0185]. Specifically, Barone explicitly teaches output of an “accelerometer 171” being transmitted to “signal conditioning 178”, where the analog signals are amplified and/or filtered as appropriate (electronic filter), and then routed to analog to digital (A/D) converters for wide bandwidth calculations and data manipulations (digital filter). EX1003, ¶ 160; EX1007, ¶¶ [0114]-[0115],

Fig. 8. The filtering in Barone occurs in the sensor. EX1003, ¶ 160; EX1007, ¶¶ [0114]-[0115], Fig. 8. A PHOSITA would have understood filtering of data can take place anywhere in the system—including in either the CMU or sensor. EX1003, ¶ 160. A PHOSITA would understand various considerations impact where the filtering takes place in a data processing system. *Id.* For example, Barone emphasizes the importance of a low power system, so a PHOSITA would understand power consumption could impact where filtering takes place. *Id.*; EX1007, Abstract, ¶¶ [0026], [0030], [0107], [0116], [0129].

Barone further teaches the use of a high-pass, low-pass, and/or band-pass filters, all of which can utilize both electronic and digital filters. EX1003, ¶ 161; EX1007, ¶¶ [0172]-[0185]. Barone explicitly discloses filtered data (both digital and electronic), which shows filtering accelerations was well-known in the art and a PHOSITA would be motivated to include the filtering taught by Barone to remove unwanted data and/or amplify particularly relevant accelerations data. EX1003, ¶ 161. Again, filtering could occur at various points within the system. *Id.*



Because Barone explicitly discloses filtering data, a PHOSITA would have been motivated to include the filtering taught by Barone with LeFebvre because the advantage of filtering is to remove unwanted data and/or amplify particularly relevant data, and the purpose of both the LeFebvre and Barone systems is to analyze data in a train monitoring system to accurately predict anomalous conditions and avoid false or inaccurate data processing. EX1003, ¶ 162; *KSR*, 550 U.S. at 416. Combining the filtering at both the sensor and CMU level to identify “essential indicative information” in LeFebvre with the electronic and digital filtering taught in Barone would have predictably resulted in the filtering of accelerations data. *Id.*

Therefore, LeFebvre and Barone render this limitation obvious. EX1003, ¶ 162.

e. **Limitation 1(e)**

LeFebvre teaches a “data control unit 23” and “communications device 24” (which can be contiguous). EX1003, ¶ 163; EX1005, ¶¶ [0024], [0036]. The “data control unit 23” (CMU) compares information it receives from the instrumented pads regarding one or more railcar operational parameters to determine the status of the railcar. EX1003, ¶ 163; EX1005, ¶¶ [0024], [0036]. Therefore, LeFebvre discloses a communication management unit for collecting data regarding said one or more railcar operational parameters. EX1003, ¶ 163; EX1005, ¶¶ [0024], [0036].

f. **Limitation 1(f)**

The system in LeFebvre processes raw sensor data to look for anomalous operational conditions—with analysis occurring in the “data control unit 23” to recognize faults. EX1003, ¶ 164; EX1005, ¶¶ [0024], [0036], [0053]. In LeFebvre’s system, the data control unit acts as an “aggregator of information,” collecting data from each of the instrumented pads on the railcar. EX1005, ¶¶ [0036], [0056], [0095]; EX1003, ¶ 164. And as discussed above, each of the instrumented pads contains one or more sensors that collect data about the railcar.

The data control unit then uses “inference engine techniques” (i.e., “drawing inferences”) to analyze the collected data. EX1005, ¶¶ [0036], [0056], [0095]; EX1003, ¶ 165. “As an aggregator of information, it is programmed to compare information from all of the trucks on the railcar and draws inferences from them as

to the status of the car, for example, the data control unit uses inference engine techniques to identify unsatisfactory behavior such as swaying, bouncing or even partial derailment.” EX1005, ¶ [0036]. “Given that more than one instrumented pad may report misbehavior, then the components of the inference engine in the data control unit take responsibility for making assessments for the whole truck and ultimately for the freight car.” EX1005, ¶ [0056]. “When serious trouble is inferred, then messages are sent via the communications link **23a, 24** to the locomotive, etc.” *Id.*; *see also* EX1005, ¶ [0095].

The “inference engine” techniques used by the data control unit include, for example, statistical analysis of the collected data. EX1005, ¶¶ [0058]–[0066]; EX1003, ¶ 166. For example, the data control unit may detect a wheel derailment condition by looking for a high frequency, periodically repeating load and “a similar signal from both wheels in the wheel set.” EX1005, ¶¶ [0060]–[0061]. Similarly, the data control unit may detect track defects by “monitoring the vertical loads in the instrumented pads and comparing these between wheel sets.” EX1005, ¶ [0066].

The data control unit is ultimately responsible for determining the presence of an alarm condition relating to the railcar as a whole. EX1005, ¶ [0095]; EX1003, ¶ 167. If an alarm condition is present, the data control unit is responsible for

sending an alarm message upstream (i.e., to the locomotive and/or a remote data handling location). *Id.*

g. **Limitation 1(g)**

LeFebvre discloses, “the data control unit 23 passes messages on to the communications device 24 for onward transmission to the locomotive or to other remote receivers.” EX1005, ¶ [0038]; EX1003, ¶ 168. For communication with remote sources, the communications device may comprise, for example, “a cellular or satellite radio system.” EX1005, ¶ [0025]; EX1003, ¶ 168. The remote receiver may be, for example, a “remote data handling service” (EX1005, ¶ [0052]) or a “central data handling location” (*id.*, ¶ [0095]).

In LeFebvre, the data control unit is ultimately responsible for determining whether an alarm message should be generated:

The data control unit then performs the assessments described above for the inference engine to check if the freight car, its trucks or wheels or axles are behaving *sufficiently poorly* that a report to the central data handling location or owner or operator or locomotive is needed. If so, then the report can be sent.

EX1005, ¶ [0095] (emphasis added); EX1003, ¶ 169.

If the detected condition is sufficiently severe that an alarm is warranted, the data control unit will send an alarm message upstream (i.e., to the locomotive

and/or a remote data handling location). EX1005, ¶ [0095]; *see also* EX1005, ¶ [0056] (“When serious trouble is inferred, then messages are sent via the communications link **23a**, **24** to the locomotive, etc.”); EX1003, ¶ 170.

### **3. Dependent Claim 21**

LeFebvre discloses a “data control unit 23” (i.e., communication management unit) which can include a “triaxial accelerometer” (i.e., sensor). EX1005, ¶¶ [0037] (“the data control units 23 or the communications device 24 may contain a triaxial accelerometer...”), [0093] (“The commands can be influenced by the measured accelerations at the data control unit...”); EX1003, ¶ 171.

### **4. Dependent Claim 22**

A PHOSITA would have been motivated to modify LeFebvre’s system to include the “network coordinator” disclosed by Barone to meet all limitations of this claim. The system in Barone includes a “network coordinator” in the locomotive. EX1007, ¶¶ [0087]-[0089], [0267]-[0278], [0280]. This qualifies as a “powered wireless gateway,” because Barone’s “network coordinator” supports long-range communications (i.e., cellular or satellite communications) for communicating railcar status and data to a remote system. EX1003, ¶ 172; EX1007, ¶¶ [0087]-[0089]. A PHOSITA would understand Barone’s network coordinator is a gateway because it connects the sensors to a remote system off of

the train. EX1003, ¶ 172. By definition, a gateway is an entry and exit point for a network through which all data must pass through before being routed to, for example, a remote system. *Id.* Further, a PHOSITA would understand the benefit of Barone’s “network coordinator” enables the entire train to use a *single* communications link with the outside world, which is more cost efficient. *Id.* Therefore, LeFebvre in combination with Barone renders this claim obvious. *Id.*

## **5. Dependent Claim 25**

### **a. Limitation 25(a)**

*See* Sections X.D.2.c, *supra*, and X.E.1.a, *infra*; EX1003, ¶ 173.

LeFebvre discloses a railcar monitoring system comprising a plurality of “instrumented pads 16.” EX1005, ¶¶ [0019], [0023], [0052]; EX1003, ¶ 174. Each “instrumented pad 16” in LeFebvre is a separate device mounted on the railcar. *Id.* Specifically, each pad is mounted upon the upper surface of a wheel bearing adapter 4, as shown in Fig. 4. EX1005, ¶ [0019], Fig. 4; EX1003, ¶ 174. Each “instrumented pad 16” communicates wirelessly with a “data control unit 23”, which is mounted on the railcar body. EX1005, ¶ [0024]; Fig. 5. LeFebvre’s data control unit therefore is in communication with and receives information from the instrumented pads (i.e., sensors). EX1003, ¶ 174.

**b. Limitation 25(b)**

LeFebvre discloses a plurality of “instrumented pads 16,” each of which comprises one or more sensors that measure operational parameters of the railcar. EX1005, ¶¶ [0019], [0023], [0052]; EX1003, ¶ 175. The “plurality of sensors 5” located within the instrumented pads are located on one or more railcars and are configured to sense “a variety of car body motions” in communication with the “communications device 24” and “data control units 23.” EX1003, ¶ 175; EX1005, ¶¶ [0021], [0036], [0037], [0093]. LeFebvre further claims the sensors in the instrumented pads measure accelerations. EX1003, ¶ 175; EX1005, Claims 28, 30. Each instrumented pad 16 communicates wirelessly with a data control unit 23, which is mounted on the railcar body. EX1005, ¶ [0024]; Fig. 5; EX1003, ¶ 175.

**c. Limitation 25(c)**

Lefebvre discloses the “instrumented pad 16” (wireless sensor node) having a “microprocessor” which controls the sensors within the instrumented pad. EX1003, ¶ 176; EX1005, ¶¶ [0021], [0024], [0034], [0036], [0039]-[0041]. A PHOSITA would understand firmware’s purpose is to control hardware within a device (i.e., sensors). EX1003, ¶ 176. A PHOSITA would therefore understand the microprocessor contained in LeFebvre’s instrumented pad executes firmware to control operation of the instrumented pad. *Id.* Alternatively, it would have been obvious to incorporate firmware into the instrumented pad because firmware is a

standard and essential component of a modern computing device software developers would expect to be present. *Id.*

To the extent LeFebvre does not explicitly disclose a microprocessor within the wireless sensor node with firmware to control the wireless sensor node, a PHOSITA would be motivated to combine the teachings of LeFebvre with Barone. Barone discloses a “microprocessor” within the sensor nodes, which analyzes information to control the sensor nodes. EX1003, ¶ 177; EX1007, ¶¶ [0024]-[0026]. Specifically, Barone discloses the following:

The microprocessor has memory storing software configured to cause the microprocessor to analyze the electrical signals and derive therefrom bearing condition data corresponding to a degradation condition of bearings of the associated wheel axle assembly. A rotation sensor is operatively associated with the circuitry and supplies thereto a rotation frequency signal corresponding to the rate of rotation of the wheel. **The circuitry is configured to assemble the node into a network communicating wirelessly via the low-power transceiver wherein the network is made up of nodes traveling in a train together with a locomotive node to which the nodes transmit the bearing condition data, and the nodes are retained in the network only if the rotation rate of the associated wheel is consistent with the railcars moving together in the train.**

EX1007, ¶ [0026]. LeFebvre, in view of Barone, therefore renders obvious this element of Claim 25. EX1003, ¶ 177.

d. **Limitation 25(d)**

LeFebvre discloses an “instrumented pad 16” which includes a microprocessor and firmware. *See* Section X.D.5.c; EX1003, ¶ 178. Further, LeFebvre in combination with Barone discloses filtering accelerations—including the use of a digital filter. *See* Section X.D.2.d; EX1003, ¶ 178.

A PHOSITA would understand firmware and software have different purposes and functions, but both can execute the filtering of accelerations data. EX1003, ¶ 179. As discussed in Section X.D.2.d, LeFebvre discloses filtering in the instrumented pad, which a PHOSITA would understand requires a microprocessor and firmware to execute. A PHOSITA would understand firmware is often considered to be more closely related to the hardware (or physical components) of a system (i.e., making a measurement or detecting a switch position), while software is the layer of programming evaluating rules and making complex decisions. *Id.* One type of filtering firmware can execute is identifying and isolating certain types of data—in this case, accelerations data. *Id.* In contrast, software is described as programing that acts on the data; in other words, software performs post data collection algorithms—which is different from the functions of firmware. *Id.* A PHOSITA would understand a function of filtering data by a

software filter can be isolating or excluding certain types of accelerations data (i.e., “essential indicative information”) - based on programming that would be present in the software filter. *Id.* Therefore, a PHOSITA would understand LeFebvre in combination with Barone discloses this limitation. *Id.*

**6. Dependent Claim 27**

*See* Sections X.D.2.d and X.D.5.d; EX1003, ¶ 180.

**7. Dependent Claim 28**

*See* Sections X.D.2.d and X.D.5.d; EX1003, ¶ 181.

**8. Dependent Claim 29**

*See* Section X.D.2.g; EX1003, ¶ 182.

**9. Independent Claim 30**

**a. Limitation 30(a)**

LeFebvre teaches a method for detecting operational anomalies on a train consist or railcar. *See* Section X.D.2.a; EX1003, ¶¶ 183-184.

**b. Limitation 30(b)**

*See* Section X.D.2.c; EX1003, ¶ 185.

**c. Limitation 30(c)**

*See* Section X.D.2.d; EX1003, ¶ 186.

**d. Limitation 30(d)**

*See* Section X.D.2.e; EX1003, ¶ 187.

e. **Limitation 30(e)**

*See* Section X.D.2.f; EX1003, ¶ 188.

f. **Limitation 30(f)**

*See* Section X.D.2.g; EX1003, ¶ 189.

**10. Independent Claim 36**

a. **Limitation 36(a)**

*See* Section X.D.2.a; EX1003, ¶ 190.

b. **Limitation 36(b)**

*See* Section X.D.2.b; EX1003, ¶ 191.

c. **Limitation 36(c)**

*See* Section X.D.2.c; EX1003, ¶ 192.

d. **Limitation 36(d)**

*See* Section X.D.2.d; EX1003, ¶ 193.

e. **Limitation 36(e)**

*See* Section X.D.2.e; EX1003, ¶ 194.

f. **Limitation 36(f)**

*See* Section X.D.2.f; EX1003, ¶ 195.

g. **Limitation 36(g)**

*See* Section X.D.2.g; EX1003, ¶ 196.

**11. Dependent Claim 37**

a. **Limitation 37(a)**

*See* Section X.D.2.a; EX1003, ¶ 197.

b. **Limitation 37(b)**

*See* Section X.D.2.c; EX1003, ¶ 198.

c. **Limitation 37(c)**

*See* Section X.D.2.f; EX1003, ¶ 199. Specifically, LeFebvre’s data control unit “is programmed to *compare information* from all of the trucks on the railcar.” EX1005, ¶ [0036]. Each truck comprises one or more instrumented pads (i.e., sensors). *See, e.g.*, EX1005, ¶ [0062], Fig. 2.

d. **Limitation 37(d)-(g)**

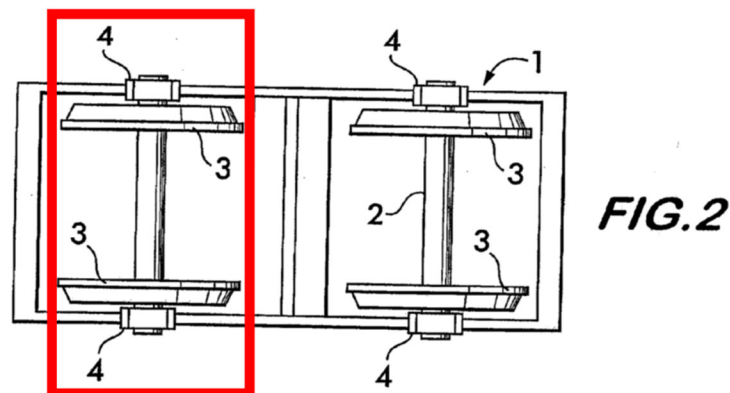
LeFebvre discloses a railcar monitoring system comprising a plurality of “instrumented pads 16”, each of which comprises one or more sensors that measure operational parameters of the railcar. EX1005, ¶¶ [0019], [0023], [0052]; EX1003, ¶ 200. LeFebvre further discloses “a plurality of sensors 5” located on one or more railcars in communication with the “communications device 24” and “data control units 23.” EX1005, ¶¶ [0021], [0036]. LeFebvre further claims the sensors in the instrumented pads measure accelerations. EX1003, ¶ 200; EX1005, Claims 28, 30. Each instrumented pad 16 communicates wirelessly with a data control unit 23, which is mounted on the railcar body. EX1005, ¶ [0024]; Fig. 5; EX1003, ¶ 200. This limitation precedes the next three limitations (Limitations 37(e), (f), and (g)), and only requires one of the three following limitations to be

met in order to satisfy the claim. *See* EX1001, Claim 37 (...wherein said accelerometers are positioned on the railcar to provide data **for carrying out one or more of the following functions...**").

(1) Limitation 37(e)

For Limitation 37(e), LeFebvre teaches the comparing of data from accelerometers of each of the wheel sets (i.e., wheels on the same axle) for determining wheel derailment. EX1003, ¶ 201; EX1005, ¶ [0061], Fig. 2.

Annotated Figure 2 from LeFebvre shows the orientation of a “wheel set”:



Paragraph 61 of LeFebvre states:

Wheel derailment--Using the same instrumentation as for the Wheel Condition, but **looking for a higher frequency and a similar signal from both wheels in the wheel set**. Identifying when a wheel set has derailed prevents a possible full derailment and possible catastrophic consequences.

EX1005, ¶ [0061]. Because LeFebvre discloses the comparison of data across both wheels in a wheel set, it would be obvious to a PHOSITA to compare the accelerations data from one railcar wheel on one side of the axle, with the wheel on the other side of the railcar. EX1003, ¶ 201.

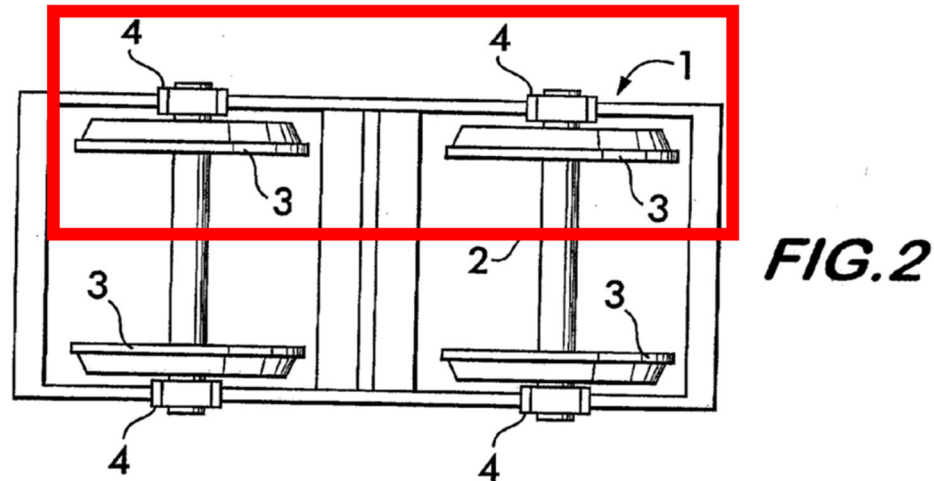
(2) Limitations 37(f)-(g)

Paragraph 62 of LeFebvre discloses both Limitations 37(f) and 37(g):

**Truck Hunting--Using load sensors mounted in the instrumented pad so as to detect longitudinal, lateral and yawing forces, monitor rapidly changing loads (and hence the angle of attack of the wheel set) indicative of axle or truck hunting. By analyzing such loads monitored from both wheel sets on a truck, and both trucks on a car, truck and axle hunting as well as truck warp can be identified. Additionally by assessing the angle of attack of wheel sets on each truck, high rotational friction caused by binding side bearings or dry center bowls can be identified.**

EX1005, ¶ [0062]. For Limitation 37(f), LeFebvre teaches the comparison of data from accelerometers of different wheel sets on the same side of the railcar for determining truck hunting. EX1003, ¶ 202; EX1005, ¶ [0062], Fig. 2. Therefore, a PHOSITA would understand LeFebvre's teachings of comparing accelerations data from wheels across both wheel sets would include comparing data from an accelerometer on a railcar wheel within a first wheel set with at least one other

wheel on the same side of the railcar but within the second wheel set. EX1003, ¶ 202.



With respect to limitation 37(g), paragraph 66 of LeFebvre also teaches the comparison of data across multiple wheel sets. (“**Monitoring the vertical loads in the instrumented pads and comparing these between wheel sets** gives car owners insight into track defects that may cause damage to freight cars or their lading.”). EX1003, ¶ 203; EX1005, ¶¶ [0066]. A PHOSITA would understand that, for the purpose of detecting track defects, comparing data collected from wheel sets on *different* railcars would be particularly useful, because a track defect would be expected to affect *all* railcars in a similar way as they pass over the section of track having the defect. EX1003, ¶ 203. To the extent LeFebvre does not expressly disclose comparing accelerations from one railcar wheel with accelerations from

another railcar wheel on the same side of the track, but on a different railcar, doing so would have been obvious at least for the purpose of detecting track defects. *Id.*

**E. Ground 5: Claims 24 and 37 are unpatentable under 35 U.S.C. § 103(a) Over LeFebvre in View of Barone and Armitage**

As previously discussed, LeFebvre, Barone, and Armitage all teach monitoring components of a railcar to predict and/or detect component failure and describe a system for monitoring railcar and train consist operational parameters. Therefore, they are analogous art.

**1. Dependent Claim 24**

**a. Limitation 24(a)**

*See* Sections X.D.2.c and X.D.5.a; EX1003, ¶ 205.

LeFebvre discloses a railcar monitoring system comprising a plurality of “instrumented pads 16”, each of which comprises one or more sensors that measure operational parameters of the railcar. EX1005, ¶¶ [0019], [0023], [0052]; EX1003, ¶ 206. LeFebvre further discloses “a plurality of sensors 5” located on one or more railcars in communication with the “communications device 24” and “data control units 23.” EX1003, ¶ 206; EX1005, ¶¶ [0021], [0036]. LeFebvre further claims the sensors in the instrumented pads measure accelerations. EX1003, ¶ 206; EX1005, Claims 28, 30. Each instrumented pad 16 communicates wirelessly with a data control unit 23, which is mounted on the railcar body. EX1005, ¶ [0024]; Fig. 5; EX1003, ¶ 206.

b. **Limitation 24(b)**

*See* Section X.D.5.b; EX1003, ¶ 207.

LeFebvre’s “instrumented pads 16” comprise one or more sensors that measure operational parameters of the railcar. EX1005, ¶¶ [0019], [0023], [0052]; EX1003, ¶ 208.

c. **Limitation 24(c)**

The instrumented pad in LeFebvre “is preferably comprised of a cast or injected molded *elastomeric polymer*,” in other words, a PHOSITA would understand that the instrumented pad is mounted within a protective housing. EX1005, ¶¶ [0019]; EX1003, ¶ 209.

d. **Limitation 24(d)**

*See* Section X.E.1.c; EX1003, ¶ 210.

e. **Limitation 24(e)**

*See* Sections X.D.2.d and X.E.1.c; EX1003, ¶ 211.

As noted above, LeFebvre’s instrumented pad has a protective housing comprised of an elastomeric polymer. EX1003, ¶ 212. LeFebvre teaches the elastomeric polymer “allow[s] for limited relative movement between the bearing and the pedestal pocket and provid[es] *damping of shock and abrasion*.” EX1005, Claim 12; EX1003, ¶ 212. A PHOSITA would further understand an “elastomeric polymer” *is* a “potting material,” and is commonly used in potting applications for

precisely the reason LeFebvre states—namely, its ability to dampen shock and vibration. EX1003, ¶ 212. Accordingly, a PHOSITA would understand LeFebvre’s instrumented pad (i.e., wireless sensor node) comprises a protective housing comprising a “potting material” as required by Limitation 24(e). *Id.*

To whatever extent LeFebvre does not disclose a wireless sensor node comprising a potting material, Armitage teaches “sensor nodes” being encased in a “potted” enclosure. EX1006, ¶¶ [0015], [0034]; EX1003, ¶ 213. A PHOSITA would understand the “potted” enclosure in Armitage would equate to a protective housing comprising potting material to absorb undesirable accelerations. EX1003, ¶ 213.

As explained in Section X.A.4.e above, a PHOSITA would have been familiar with potting materials and could have incorporated them into LeFebvre’s protective housing—for the purpose of absorbing or damping unwanted vibrations—with a reasonable expectation of success. EX1003, ¶ 214.

**2. Dependent Claim 37**

**a. Limitation 37(a)**

*See* Sections X.A.2.a and X.D.2.a; EX1003, ¶ 215.

**b. Limitation 37(b)**

*See* Sections X.A.2.c and X.D.2.c; EX1003, ¶ 216.

c. **Limitation 37(c)**

*See* Sections X.A.2.f and X.D.2.f; EX1003, ¶ 217.

d. **Limitation 37(d)-(g)**

*See* Sections X.A.11.d and X.D.11.d; EX1003, ¶ 218.

As discussed previously, both Armitage and LeFebvre disclose Limitation 37(d). This limitation precedes the next three limitations (Limitations 37(e), (f), and (g)), and only requires one of the three following limitations to be met in order to satisfy the claim. *See* EX1001, Claim 37 (...wherein said accelerometers are positioned on the railcar to provide data **for carrying out one or more of the following functions...**").

(1) Limitation 37(e)-(f)

*See* Sections X.A.11.d(1), X.D.11.d(1), and X.D.11.d(2); EX1003, ¶ 220.

To the extent LeFebvre does not explicitly disclose these limitations, a PHOSITA would be motivated to combine the teachings of LeFebvre with Armitage. EX1003, ¶ 221. Specifically, Armitage teaches “where two outliers occur for the same wheel assembly, then a failure of the entire wheel assembly could be determined...” EX1006, ¶ [0042]; *see* Section X.A.11.d(1). A PHOSITA would understand, based on the disclosure in Armitage, comparing data to determine outliers for the same wheel assembly would equate to comparing

accelerations from one railcar wheel with that of another railcar wheel on the same axle but opposite side of the railcar. EX1003, ¶ 221.

Additionally, Armitage discloses “outliers for sensor nodes on an entire side of railway car 310 could indicate a cornering failure, or an off-track condition.”

EX1003, ¶ 222; EX1006, ¶ [0042]; *see* Section X.A.11.d(1). A PHOSITA would understand, based on the disclosure in Armitage, that comparing data to determine outliers on the same side of a railway car would equate to comparing accelerations from one railcar wheel with that of at least one other wheel on the same side of said railcar. EX1003, ¶ 222. Therefore, Armitage discloses all elements of Limitations 37(e) and 37(f), therefore, renders the entirety of Claim 37 obvious.

(2) Limitations 37(g)

*See* Sections X.A.11.d(2) and X.D.11.d(2); EX1003, ¶ 223.

To the extent LeFebvre does not explicitly disclose this limitation, a PHOSITA would be motivated to combine the teachings of LeFebvre with Armitage. Armitage teaches the “[c]ontrol node 130 could process the sensor information to determine anomalies from an average, such as an anomaly *from a running average of the temperature of all wheels on railway car 110*”, and further, notes a “dynamic threshold” could be determined as conditions change (i.e., accelerations) across a railcar. EX1003, ¶ 224; EX1006, ¶ [0029]; *see* Section X.A.11.d(2). For reasons discussed *supra*, a PHOSITA would understand sensors

located on the same side of the railcar wheels and/or axles, but on different railcars, could be used to compare accelerations data and determine railcar status and events. *See* Section X.A.11.d(2).

Therefore, LeFebvre in combination with Armitage meets each of Limitation 37(e)-(g) and renders all of Claim 37 obvious. EX1003, ¶ 224.

**F. Ground 6: Claims 23 and 26 are unpatentable under 35 U.S.C. § 103(a) Over LeFebvre in View of Barone and Winfree**

As explained in detail in Ground 4, Section X.D above, a PHOSITA would have been motivated to include the filter taught by Barone in LeFebvre's system because the advantage of filtering is to remove unwanted data and/or amplify particularly relevant data. EX1003, ¶ 225; *KSR*, 550 U.S. at 416. Likewise, Winfree (EX1008) teaches a mechanical filter for accelerometers, and a PHOSITA would be motivated to combine the teachings of LeFebvre and Barone with Winfree to add an additional filter step—with a mechanical filter—to filter out undesirable accelerations data in the system. EX1003, ¶ 225.

**1. Dependent Claim 23**

**a. Limitation 23(a)**

As previously discussed *supra*, LeFebvre in combination with Barone meets all limitations of independent claim 1. Also previously discussed, LeFebvre in combination with Barone discloses a filter for filtering accelerations—specifically, electronic and digital filters. *See* Section X.D.2.d; EX1003, ¶ 226. While LeFebvre

and Barone don't explicitly disclose a "mechanical filter", it would have been obvious to modify LeFebvre in view of Barone to further include the mechanical filter of Winfree. EX1003, ¶ 226; EX1008, Abstract. A PHOSITA would have had a reasonable expectation of success adding the mechanical filter in Winfree with LeFebvre and Barone. EX1003, ¶ 226.

Using mechanical, digital and/or electronic filters in the data collection process was well known in the art. EX1003, ¶ 227. According to Winfree, it is desirable for a mechanical filter to be comprised of a resilient material (i.e., magnesium alloy) to block the transmission of unwanted frequencies during data collection. EX1008, 4:33-41, 5:10-16, Figs. 1, 2. As can be seen below, the similarities between the mechanical filter in Fig. 1 of Winfree and Fig. 4 in the '915 Patent are evident.

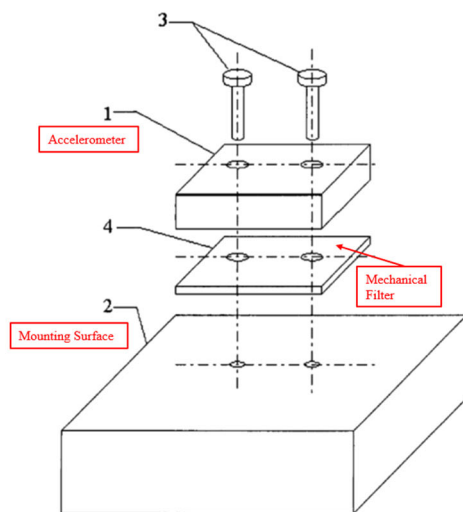


FIG. 1

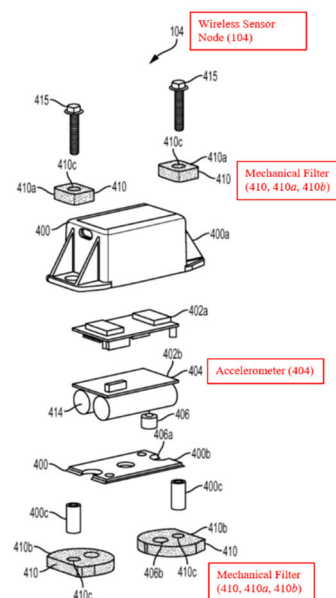


FIG. 4

For the same reasons discussed in Section X.C.1.a above, a PHOSITA would have been motivated to use a mechanical filter in combination with an electric or digital filter, because it is typically preferred to “double down” on the filtering of the data with two (or more) filters having different characteristics. EX1003, ¶ 228; EX1008, 5:35-42. An accelerometer mounted on top of a wheel bearing would be likely to experience unwanted vibrations (i.e., vibrations unrelated to the health of the bearing), and a PHOSITA would have understood a mechanical filter is useful to remove unwanted data and/or amplify particularly relevant data at a first level of filtering. EX1003, ¶ 228. Bracket materials for the mechanical filter, shape, and length can also have large effects on the filtering of data, and can even resonate and add to the signal at certain frequencies or subtract at other frequencies. *Id.* Therefore, a PHOSITA would understand using a mechanical filter as a first level of filtering the accelerations before sending the data to an electronic or digital filter would be desirable to filter and minimize effects from the physical environment on the data. *Id.*

**b. Limitation 23(b)**

As explained in Sections X.C.1.a and X.F.1.a above, a PHOSITA would have been motivated to use a mechanical filter made of resilient material to filter out undesirable accelerations. EX1003, ¶ 229. According to Winfree, it is desirable for a mechanical filter to be comprised of a resilient material (i.e., magnesium

alloy) to block the transmission of unwanted frequencies before they even reach the accelerometer. EX1008, 4:33-41, 5:10-16, Figs. 1, 2. Winfree teaches isolating the accelerometer for purposes of minimizing damage to the accelerometer or some other undesirable events. EX1008, 2:30-33.

Further, a PHOSITA would understand it would be desirable to remove the undesirable accelerations with the mechanical filter before those accelerations even reach the sensors, for example: (1) not overloading the processor with unusable data or (2) not wanting to harm or destroy the sensor (i.e., shock absorption). EX1003, ¶ 230.; EX1008, 2:30-33.

Therefore, LeFebvre in view of Barone and Winfree renders this claim obvious. EX1003, ¶ 230.

## **2. Dependent Claim 26**

*See* Section X.F.1.a; EX1003, ¶ 231.

## **XI. CONCLUSION**

Petitioner has demonstrated in this Petition that Claims 1, 21-30, 36, and 37 of the '915 Patent are unpatentable. Petitioner respectfully requests institution of an *inter partes* review of the '915 Patent and Claims 1, 21-30, 36, and 37 be cancelled.

Patent No. 10,137,915  
Petition for *Inter Partes* Review

Respectfully submitted,

Dated: January 31, 2023

By: /Eric J. Rakestraw/  
Eric J. Rakestraw, Reg. No. 68,740  
Daisy Manning, Reg. No. 66,369  
HUSCH BLACKWELL LLP  
190 Carondelet Plaza, Suite 600  
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***

**CERTIFICATION**

The Petition excluding the caption, Table of Contents, Table of Exhibits, Mandatory Notices under 37 C.F.R. § 42.8, and this Certification contains 13,996 words.

Respectfully submitted,

Dated: January 31, 2023

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

Patent No. 10,137,915  
Petition for *Inter Partes* Review

**CERTIFICATE OF SERVICE**

Pursuant to 37 C.F.R. § 42.105, Petitioner certifies that this Petition for Inter Partes Review and supporting evidence was served by Federal Express®, on January 31, 2023, to the Patent Owner of U.S. Patent No. 10,137,915 at their correspondence address of record according to USPTO records:

Gary A. Hecht  
Fox Rothschild LLP  
997 Lenox Drive  
Lawrenceville, NJ 08684

*With courtesy copy to:*  
Jeff E. Schwartz  
Fox Rothschild LLP  
2020 K Street NW  
Suite 500  
Washington, DC 20006

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