UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FREIGHTCAR AMERICA, INC.,

Petitioner

v.

NATIONAL STEEL CAR LIMITED,

Patent Owner

U.S. Patent No. 8,132,515

IPR Case No. IPR2025-01047

DECLARATION OF MARK J. VIZ PH.D., P.E. UNDER 37 C.F.R. § 1.68

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I, Mark J. Viz, Ph.D., P.E, being over the age of 18 and competent to make the statements herein, hereby declare the following:

1. I am a citizen of the United States.

2. I understand that FreightCar America Inc. ("FreightCar," or "Petitioner") has filed a Petition for Inter Partes Review ("IPR" No. IPR2025-01047) asserting that claims 1-44 ("the Asserted Claims") of U.S. Patent No. 8,132,515 ("the '515 Patent") are invalid. I also understand that the owner of the '515 Patent, National Steel Car Limited ("National Steel Car," or "Patent Owner") denies that the Asserted Claims are invalid and asserts that the claims are valid and enforceable.

3. I have been retained by counsel Ice Miller LLP to provide my opinion on technical matters concerning the validity of the Asserted Claims of the '515 Patent. My employer, Exponent, Inc. ("Exponent"), is being compensated for my time at my normal consulting rate in 2025 of $690 per hour. My compensation is not tied to the outcome of this matter.

4. Neither I nor Exponent have a business interest or other conflict of interest with respect to either of FreightCar or National Steel Car.

I. Background and Qualifications

5. My *curriculum vitae* is attached hereto as Appendix A.

A. Educational Background

6. I hold a Doctorate (Ph.D.) in Theoretical and Applied Mechanics from Cornell University, and a Bachelor of Science (B.S.) in Aeronautics and Astronautics from the Massachusetts Institute of Technology (MIT).

B. Professional Background

1. Industry Experience

7. I have extensive experience in the performance evaluation and mechanical analysis of railcar and aircraft structures. I have 25 years of experience investigating the mechanical / dynamic performance, reliability, and conformance to design specifications of railcar and railway structures, both freight and passenger. Prior to my employment at Exponent Inc., I was a Specialist Engineer (in Structural Damage Technology) at the Boeing Commercial Aircraft Company (Renton, Washington), a Senior Engineer at GATX Rail (Chicago, Illinois) and the Director of Applied Mechanics at Packer Engineering (Naperville, Illinois). While at GATX Rail I performed analysis and field support for a range of mechanical performance matters involving GATX's fleet of over 80,000 railcars; many of these analyses and field support activities involved both covered and open-top

hopper railcars. Also, during my time at GATX Rail, I had engineering responsibilities that included aspects of new rail car design and development, budget and schedule management, and leasing and marketing support. I was also heavily involved in the regulatory environment concerning the transportation of hazardous materials in rail tank cars.

8. As a Principal Engineer with Exponent for the last almost 23 years, I have been involved in well over one hundred engagements involving railcar performance, from investigations involving claims of out-of-specification or improper structural performance, hunting and aggressive wear of trucks (bogies) and truck components, derailment investigations, ride quality issues and other wheel-rail interface problems. I have performed damage assessments of light rail vehicles involved in accident / incident claims, and I have overseen repair work on behalf of insurers for other light rail systems that have been damaged and then repaired. I have testified in rail matters in deposition, trial and arbitrations, both in the US and internationally (including Canada), and my work on fugitive coal dust emissions from coal railcars has been presented to the US Surface Transportation Board in various tariff disputes between two Class I railroads and various coal shippers.

9. I have been the project lead for approximately 35 major derailment investigations over the last almost 23 years at Exponent. I was on the ground for

weeks in Lac-Mégantic, Québec in 2013 after a 70-car unit train derailed releasing over 1.5 million gallons of crude oil and causing the deaths of 47 people. I have investigated derailments that have involved the rupture of tank cars and subsequent loss of hazmat containment, as well as derailments caused by anomalous structural and/or dynamic behavior of railcars, such as truck hunting, and track bed / rail defects. In just about all of these matters, quality and performance issues of the mechanical equipment, whether the railcars, track structures, or both, have typically been central aspects of the investigations.

10. In passenger rail, I have investigated railcar performance and/or derailments for engagements including but not limited to passenger rail systems in Dallas, Texas; Portland, Oregon; San Francisco, California; Los Angeles, California; London (England); and Manila (Philippines). I have also performed railcar mechanical analyses and design specification reviews for various manufacturers of light-rail / passenger rail vehicles. In the specialty rail area, I was involved in lengthy projects involving the performance of the Las Vegas monorail and the Seattle monorail when the latter was involved in a collision in 2005.

11. I have performed static strength, fatigue, and damage tolerance analyses of railcar structures and components using commercial finite element analysis codes such as Abaqus and Ansys. These analyses have involved many varieties of railcars, including open-top hoppers (including steel and aluminum

coal cars), covered hoppers, pressure differential cars, tank cars, mill gondolas, and various passenger cars, including those with CEM (crash energy management) provisions. Many of these analyses have included the incorporation of field data and measurements into the various models to capture the mechanical response of the railcars in their "as-is" rather than "as-designed" condition.

12. I have been involved in a number of engagements that have involved the performance of rail castings, axles, and bearings. These have included projects involving casting quality of truck bolsters and ride quality issues involving the dynamic response of trucks (bogies) and related components. These projects have also typically involved the development and implementation of non-destructive examination procedures for both on-car and off-car examination, cyclic fatigue testing, mechanical and metallurgical testing, engineering evaluation of test results with respect to mechanical performance, and development of engineering plans to manage fleet components over the projected remaining useful service life. For some of these engagements, I have presented findings on behalf of clients to the Association of American Railroads (AAR).

13. I am currently a Principal Engineer in the Mechanical Engineering group at Exponent, Inc., with my office being in Chicago, Illinois.

14. I am a Licensed Professional Engineer in the State of Illinois, license no. 062.062247.

15. Additional details about my career history and relevant qualifications are provided in the current version of my curriculum vitae, attached as Appendix A.

2. Academic Experience

16. Both my Bachelor of Science degree from MIT as well as my Doctorate from Cornell University involved successful completion of extensive coursework in areas directly involving and/or otherwise related to engineering design from a mechanics and materials perspective. During both my undergraduate and graduate terms, I was also regularly involved in a number of "hands-on" projects that involved various aspects of metal working and structural fabrication techniques. I received additional instruction in these various "hands-on" techniques during my time at Boeing and during extensive time spent in repair facilities owned and operated by GATX Rail in Indiana, Texas, Georgia, and various locations in Canada.

17. Additional details about my experience in academia are provided in the attached current version of my curriculum vitae. See Appendix A.

3. Publications

18. My publication list is provided in the attached current version of my curriculum vitae. See Appendix A.

4. Expert Evidence History

19. A listing of cases in which I have testified within the last eight years is found following my curriculum vitae. See Appendix B.

C. Scope of Assignment

20. I have been retained to provide my technical opinions regarding certain challenged claims of the ’515 Patent (claims 1-44, or “the challenged claims”).

21. This declaration presents analysis as to whether certain published prior art references identified in IPR2025-01047 disclose the subject matter recited in the claims of the ’515 Patent. I have been asked to review the declaration of Petitioner’s technical expert, Dr. Mehdi Ahmadian (Ex. 1003, hereinafter “Dr. Ahmadian Decl.”), and assess whether the Petition and Dr. Ahmadian have presented a likelihood that any of the challenged claims of the ’515 Patent are anticipated by, or would have been obvious to a person of ordinary in the art based on the prior art cited in the Petition and declaration.

II. INFORMATION CONSIDERED

22. My opinions are based on my 28 years of professional industry experience in mechanical engineering, the numerous and various investigations that I have detailed above, and other matters on which I have given expert testimony. In forming my opinions, I have considered the materials submitted as exhibits accompanying the Petition (*See* Petition at Exhibit List 1-2), including:

A. The Certified File History of U.S. Patent No. 8132515 (Exhibit 1002 to IPR2025-01047)

B. The Declaration of Mehdi Ahmadian in Support of Inter Partes Review of U.S. Patent No. 8,132,515 (Exhibit 1003 to IPR2025-01047)

C. Excerpts from 1946 Car Builders' Cyclopedia, 17th ed. ("1946 Cyclopedia") (Ex. 1004)

D. U.S. Patent No. 1,321,928 ("Lindström") (Ex. 1005)

E. U.S. Patent No. 4,941,411 ("Wong") (Ex. 1006)

F. Excerpts from Lancashire & Yorkshire Wagons, Vol. II, by Noel Coates, Copyright 2006 ("Coates") (Ex. 1007)

G. U.S. Patent No. 992,192 ("Hart") (Ex. 1008)

H. Excerpts from The Car Builders' Dictionary, 1906 Edition ("1906 Cyclopedia") (Ex. 1009)

I. U.S. Patent No. 1,537,051 ("Campbell '051") (Ex. 1012)

J. U.S. Patent No. 3,710,729 ("Schuller") (Ex. 1014)

K. Excerpts from COAL CARS: The First Three Hundred Years, by Martin Robert Karig III, Copyright 2007 ("Karig") (Ex. 1016)

L. Excerpts from Modern Private Owner Wagons on British Rail, by David Ratcliffe, Copyright 1989 ("Ratcliffe 1") (Ex. 1017)

23. Additional information may become available which would further support or modify the conclusions that I have reached to date. Accordingly, I reserve the right to modify or expand this opinion or the bases thereof upon consideration of any further discovery, testimony, or other evidence, including any issues raised by any expert or witness of the Petitioner, or based upon interpretations of any claim term different than those proposed in this declaration.

III. LEGAL PRINCIPLES

24. In expressing my opinions and considering the subject matter of the claims of the ’515 Patent, I am relying on certain legal principles that have been explained to me by counsel for Patent Owner. Accordingly, I have considered and applied the following standards in providing my analysis in this Declaration.

25. I understand that for an invention claimed in a patent to be found patentable, it must be, among other things, new and not obvious from what was known before the invention was made. I understand the information that is used to evaluate whether an invention is new and not obvious is generally referred to as “prior art.” I understand that prior art to the ’515 patent includes patents and printed publications in the relevant art that predate September 11, 2009, the priority date of the ’515 patent. I understand that an assessment of the claims of the ’515 patent should be taken from the perspective of a POSITA as of the September 11, 2009 priority date.

26. I understand that in this proceeding, for the purposes of institution, Petitioner has the burden of proving that there is a reasonable likelihood that the Petitioner would prevail with respect to at least one of the claims challenged in the Petition.

27. I understand that there are two ways in which prior art may render a patent claim unpatentable. The prior art can be shown to "anticipate" the claim or it can be shown to have made the claim "obvious."

28. I understand that anticipation of a claim requires that every element of a claim be disclosed, explicitly or inherently, in a single prior art reference, and that the elements are arranged in the prior art reference as arranged in the claim.

29. I understand that a patent claim is invalid as obvious if the differences between the claimed subject matter and the prior art are such that the claimed subject matter as a whole would have been obvious before the effective filing date of the claimed subject matter to a person of ordinary skill in the art.

30. I understand that an obviousness analysis requires an understanding of the scope and content of the prior art, any differences between the claimed invention and the prior art, and the level of ordinary skill in evaluating the pertinent art.

31. I further understand that certain factors may support a finding of nonobviousness of a claim. I understand that such secondary considerations include, among other things, commercial success of the patented invention, skepticism of those of ordinary skill in the art at the time of the claimed invention, unexpected results of the invention, any long-felt but unmet needs in the art that was satisfied by the invention, the failure of others to make the invention, industry

praise of the invention by those of ordinary skill in the art, and copying of the invention by others in the field. I understand that there must be a nexus (i.e., a connection) between any such secondary considerations and the claimed invention. I also understand that contemporaneous and independent invention by others is a secondary consideration tending to show nonobviousness.

32. I understand that patent drawings are not to be interpreted to scale unless so indicated in the specification of the patent.

IV. OPINIONS

A. Level of Skill of a Person Having Ordinary Skill in the Art

33. I was asked by counsel for National Steel Car to provide my opinion by considering each of the '515 Patent claims through the eyes of a "person of ordinary skill in the art" ("POSITA") before the effective filing date of the claimed invention, which I have been advised is September 11, 2009.

34. In considering the characteristics of a hypothetical POSITA, I was advised to consider factors, such as the educational level and experience of people working the field at the time of the invention, the types of problems faced in the art and the solutions found to those problems, the pace at which innovations are made in the field, and the sophistication of the technology in the field. With this in mind, I placed myself back in the time frame of the effective filing date of the claimed invention, namely, in the September 2009 time frame.

35. I understand that in the parallel District Court litigation related to the '515 Patent (*National Steel Car Limited v. FreightCar America, Inc., et al.*, C.A. No. 1:24-cv-00594-JLH, D.Del.), National Steel Car has contended that a POSITA in the field of the '515 Patent would have at least a bachelor's degree in a discipline related to mechanical engineering, physics, structural design, or an equivalent discipline, and at least two years of experience designing or analyzing

rail cars. I agree that this definition adequately captures the background of a POSITA at the time of the '515 Patent filing.

36. There are a number of reasons why I am able to place myself in the position of a POSITA in the September 2009 time frame. First, I have skills of at least a POSITA relevant to the technology of the '515 Patent, and therefore I have an understanding what a POSITA would have known and what a POSITA would have learned from studying prior art documents. Second, I had supervised engineers by this time of my career. Third, I was also a Teaching Assistant ("T.A.") in a Solid Mechanics class during my graduate studies at Cornell University and worked directly with students as they became skilled in the art. I also taught after-work classes to program-level staff engineers while employed at Boeing; these classes would address certain aspects of structural design involving static strength, fatigue, and damage tolerance calculations. By teaching students, I understood to various degrees what they learned at different stages, how they reviewed documents they had not yet seen, and what conclusions they drew from these various documents. Fourth, while employed at GATX Rail prior to September 2009, I performed design and analysis work / calculations involving certain structural aspects of both open-top and covered hopper railcars as well as tank cars. Accordingly, I was at least a POSITA in the September 2009 timeframe.

37. My opinions regarding the state of the art and the understanding of a POSITA provided in this Declaration are made before September 2009, unless expressly stated otherwise. For the ease of reading, I may use a verb in this Declaration or any deposition or testimony in its present tense, such as, for example, "would reasonably understand," "does not teach, suggest, or render obvious," or other verbs using their present tense, but this should be understood and construed to mean a POSITA before the effective filing date of the claimed invention, that is, September 2009, unless expressly stated otherwise. I may also present a statement, analysis, or my opinion without mentioning a "POSITA," but such statement, analysis, and opinion should be understood, and construed, to be from, and include the perspective, of a POSITA.

38. In my opinion, a slight change to the time frame for the POSITA, such as to 2008 or 2010, would not alter my opinions in this Declaration.

39. I understand that FreightCar contends that a POSITA for the '515 Patent would have had "at least a bachelor's degree in a discipline related to mechanical engineering, physics, structural design, or an equivalent discipline, and at least two years of experience designing or analyzing rail cars or similar vehicles." See, for example, Dr. Ahmadian Decl. ¶30. While this definition is substantially similar to the definition put forward by National Steel Car, I disagree with the inclusion of "or similar vehicles" as design or analysis experience with

other industrial wheeled vehicles would not necessarily be applicable to the art of the ’515 Patent. However, I am also not aware of any substantive way in which my opinions would be altered should FreightCar’s definition of a POSITA be adopted.

40. In addition, in my opinion, although Dr. Ahmadian’s background includes academic research in multi-body railcar truck dynamics, which is relevant to the dynamic performance of a railcar, Dr. Ahmadian’s background does not include actual industry experience with railcar structures. As a result, in my opinion, Dr. Ahmadian makes the wrong conclusions and conflates various concepts that a POSITA with practical industry experience and knowledge of rail cars would not. I will point out Dr. Ahmadian’s wrong conclusions and conflated concepts in following sections.

B. Overview of the ’515 Patent

41. I disagree with the characterization of the ’515 patent in the Dr. Ahmadian Decl. ¶25. In particular, a POSITA would not understand the hopper’s forward and rear walls to be “called ‘slope sheets.’” Instead, the POSITA would understand the forward and rear walls to include slope sheets. Also, the characterization that by supporting the slope sheets with transverse beams the space below the slope sheets is not encumbered by support structures fails to take into consideration other claimed elements of the claimed railroad hopper car that contribute to the hopper car having a machinery space free of any other primary

structure, as recited in claims 1 or 2. The POSITA would understand that all of the features, as well as the interactions of those features, of the claimed hopper car must be considered. For example, a POSITA in the relevant time frame would recognize the novel arrangement of the claimed structure of the '515 Patent claims allows the entire hopper assembly to act as a large box beam of sorts, providing stiffness to the overall hopper assembly that then alleviates the need for all sorts of other structure at the ends of the car. This more integral and novel design approach allows for the claimed open machinery space.

42. I disagree with the characterization of the '515 patent in the Dr. Ahmadian Decl. ¶26. In particular, the declaration does not identify what "features are used in the claimed hopper car just as they have always been used in the prior art." Since a rail car has many features, each of which serves a different purpose, a POSITA would understand that such features cannot be simply incorporated or used in a car without affecting the structural integrity, performance, or characteristics, such as design for a specific set of commodities, of the car. Therefore, contrary to Dr. Ahmadian's statement, the POSITA would understand that each feature would need to be considered individually and as part of the overall design and structure that makes the car.

43. I disagree with the characterization of the prior art in the Dr. Ahmadian Decl. ¶35. In particular, a POSITA would not understand the prior art

hopper cars discussed by Dr. Ahmadian, from their unclear drawings and descriptions alone, to use reinforcement beams that extend along the underside of what Dr. Ahmadian terms "the slope sheet, either crosswise or longitudinally," to keep their machinery spaces unobstructed in the manner of the '515 Patent. Dr. Ahmadian has not identified any mention or suggestion in any of the asserted art that supports this statement.

44. Dr. Ahmadian's Declaration's characterization of the L&Y hopper car in ¶36 and ¶37 is speculative. Based on the hopper car illustrated in ¶36 and ¶37, a POSITA could have reasonably concluded the purpose of what Dr. Ahmadian calls the "crosswise beam" was to fasten the hopper to the car underframe, and that the area below the end wall of the hopper was not a machinery space

45. Dr. Ahmadian's Declaration's characterization of the Kilbourne & Jacobs Hopper Car (1912) in ¶38 is speculative. To the extent that no machinery is visible in the claimed "open machinery space" of the hopper car illustrated in ¶38 (which only shows one end of the Kilbourne & Gregg Co. Hopper Car in its entirety), a POSITA could have reasonably concluded the purpose of what Dr. Ahmadian calls the "beam" was for a purpose other than to facilitate what he identifies the "open machinery space". As seen in the illustration in ¶38, "machinery" appears to be positioned along the side of, and below, the hopper, outside of what is annotated as the "open machinery space".

46. Dr. Ahmadian's Declaration's characterization of the Kilbourne & Gregg Co. Hopper Car (1922) in ¶38 is speculative. To the extent that no machinery is visible in the claimed "open machinery space" of the hopper car illustrated in ¶38 (which only shows one end of the Kilbourne & Gregg Co. Hopper Car in its entirety), a POSITA could have reasonably concluded the purpose of what Dr. Ahmadian calls the "beams" was for a purpose other than to facilitate what he identifies the "open machinery space". To the extent that no machinery is visible in the claimed "open machinery space" of the hopper car in ¶38, the area annotated "open machinery space" is in fact not a machinery space as recited in any of the '515 Patent claims since the "machinery" appears to be located on the side of and below the hopper car.

47. Dr. Ahmadian's Declaration's characterization of the BR Shildon Hopper Car (1963) in ¶38 is speculative. Based on the hopper car illustrated in ¶38 (which only show one end of the BR Shildon Hopper Car), a POSITA could have reasonably concluded the purpose of what Dr. Ahmadian calls the "beams" was for a purpose other than to facilitate what he identifies the "open machinery space" on the depicted end of the car. As seen in the illustration in ¶38, the area annotated "open machinery space" is in fact not a machinery space as recited in any of the '515 Patent claims since any "machinery" would appear to be located elsewhere in the hopper car. That said, given that only one side of the car is depicted in the

presented photos, I cannot definitively comment on the presence of machinery on the end of the car not shown in the presented photos.

48. Dr. Ahmadian's Declaration's characterization of the M&SP Ore Car in ¶38 is speculative. Based on the hopper car illustrated in ¶38, a POSITA could have reasonably concluded the purpose of what Dr. Ahmadian calls the "crosswise beams" was for a purpose other than to facilitate what he identifies the "open machinery space". As seen in the illustration in ¶38, the area annotated "open machinery space" is in fact not a machinery space as recited in any of the '515 Patent claims since the "machinery" appears to be located on the side of and below the hopper car. Moreover, it is unclear from the illustration in ¶38 that the annotated area is clear of any structure. In addition, from the rendering shown at ¶38 in Ahmadian 047, this specific railcar appears to me manufactured from timber, not metal. Since design and manufacture with timber involves many different concepts and techniques as compared to design and manufacture with metal, this specific car is of little to no value for purposes of any consideration of prior art.

49. Dr. Ahmadian's Declaration's characterization of the BP Chemicals Hopper Car (1971) and British Steel Hopper Car (1971) in ¶38 is speculative. Based on the cars illustrated in ¶38 (which only show one end of the BP Chemicals Hopper Car), a POSITA could have reasonably concluded the purpose of what Dr.

Ahmadian calls the "beams" was for a purpose other than to facilitate what he identifies the "open machinery space" on the depicted end of the car. As seen in the illustrations in ¶38, the areas annotated "open machinery space" are in fact not a machinery space as recited in any of the '515 Patent claims since any "machinery" appears to be located elsewhere. That said, given that only one side of the car is depicted in the presented photos, I cannot definitively comment on the presence of machinery on the end of the car not shown in the presented photos.

50. Dr. Ahmadian's Declaration's characterization of the Marcroft Hopper Car (1194 Conversion) in ¶38 is speculative. Based on the hopper car illustrated in ¶38 (which only show one end of the Marcroft Car), a POSITA could have reasonably concluded the purpose of what Dr. Ahmadian calls the "beams" was for a purpose other than to facilitate what he identifies the "open machinery space" on the depicted end of the car. As seen in the illustration in ¶38, the area annotated "open machinery space" is in fact not a machinery space as recited in any of the '515 Patent claims since any "machinery" would appear to be located elsewhere. Moreover, the area annotated as "open machinery space" includes additional structures, the purpose of which can be understood from the illustration. That said, given that only one side of the car is depicted in the presented photos, I cannot definitively comment on the presence of machinery on the end of the car not shown in the presented photos.

51. Dr. Ahmadian's Declaration's characterization of the Steetley Hopper Car (1971) in ¶38 is speculative. Based on the hopper car illustrated in ¶38 (which only show one end of the Steely Hopper Car), a POSITA could have reasonably concluded the purpose of what Dr. Ahmadian calls the "beams" was for a purpose other than to facilitate what he identifies the "open machinery space" on the depicted end of the car. As seen in the illustration in ¶38, the area annotated "open machinery space" is in fact not a machinery space as recited in any of the '515 Patent claims since any "machinery" would appear to be located elsewhere. That said, given that only one side of the car is depicted in the presented photos, I cannot definitively comment on the presence of machinery on the end of the car not shown in the presented photos.

52. I disagree with Dr. Ahmadian's Declaration's characterization of transferring loads and forces in ¶¶47-49. The characterization of "action and reaction forces" in ¶49 only considers the axial forces along a connection of two coplanar members and fails to take into consideration other forces that are likely to be applied to the structures during use, such as, for example, commodity inside the hopper pressing against the walls of the hopper and other forces and/or moments that can lead to transverse shear loads as well as bending moments about other axes. Any analysis and, therefore, conclusions based on this simplistic, incomplete characterization of the forces applied to the structures will be critically flawed

since the other forces experienced by the structure are not taken into consideration and in fact these other forces and moments could be far greater in magnitude than the moment that Ahmadian states would occur due to the two members not being coplanar. In other words, the moment "M" that he suggests, which would exist in the situation he explains, could be so small as to be effectively meaningless in the overall design. A POSITA in the relevant time frame would certainly understand and appreciate this.

53. I disagree with Dr. Ahmadian's Declaration's characterization in ¶53 of "side-wall stiffeners" having "web continuity". A POSITA would not have understood the structures illustrated in ¶53—namely, the 1946 Cyclopedia NSC Car, the 1946 Cyclopedia Enterprise Car, and the 1946 Cyclopedia Pressed Steel Car—to have "web continuity" as recited in any of the '515 patent claims. As seen in the illustrations, each of the asserted art structures use L-brackets fastened to a wall structure or relies upon stiffening members that have a "U" shape. Regardless of these specific shapes, none of the stiffening elements in the three railcars cited by Ahmadian 047 actually use a "web" design, which is a concept specific to an I-beam type of structural member. The '515 patent describes this concept, where the sidewall is assumed to be the "flange" of an I-beam while the stiffener is assumed to be the "web." A POSITA in the relevant time frame would have certainly understood the advantages of using an I-beam like structure because of the manner

in which an I-beam, with a web and a flange, supports shear and bending loads most efficiently. The L-brackets do not have web continuity as recited in the '515 Patent claims because L-brackets by definition do not have "webs" as a POSITA would understand the use of that term, which is contrary to Dr. Ahmadian's characterization of "web continuity" in ¶¶47-49 of the Ahmadian 047 Declaration.

C. Ground 1

54. Petitioner asserts that claims 1 and 2 of the '515 Patent are obvious over Hart and the 1906 Cyclopedia. Based on my analysis of the '892 Patent, Hart and the 1906 Cyclopedia, I disagree. It is my opinion that Hart and the 1906 Cyclopedia, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render obvious claims 1 or 2.

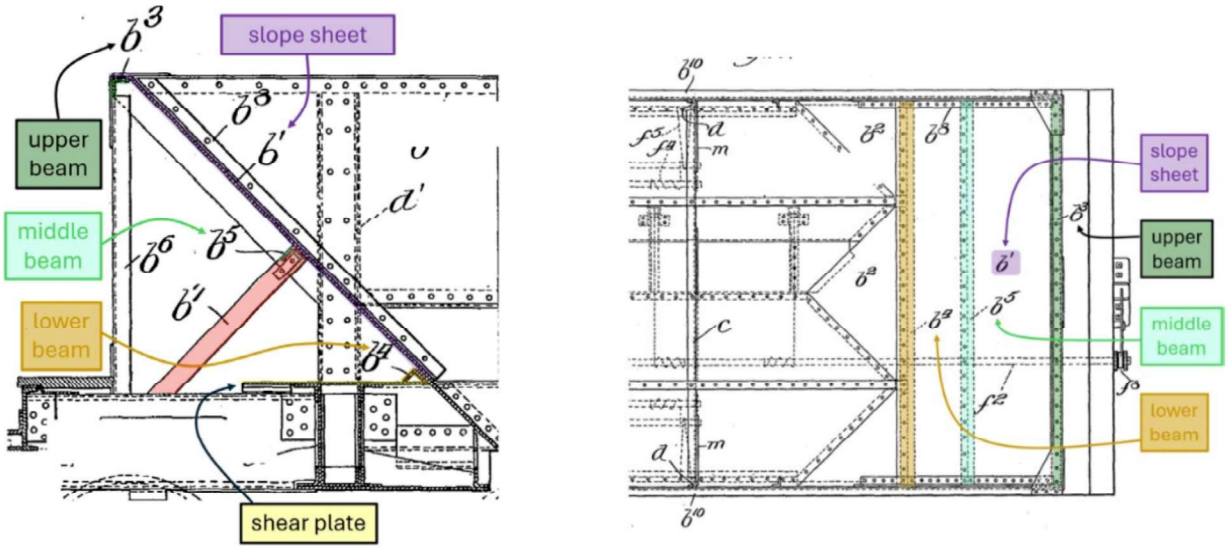
1. Claim Limitation 1e ("said hopper car being free of primary structure directly above said shear plate of said first end section under said overhang of said first end slope sheet of said hopper")

55. Petitioner relies on strut b^7 as allegedly being primary structure that is not "directly above said shear plate" and "under said overhang of said first end slope sheet." However, the Petition fails to show that this is the case.

56. In his declaration, Dr. Ahmadian uses Hart as a primary reference that purportedly discloses a lack of primary structure within the end section of its rail car. However, Dr. Ahmadian does not provide adequate basis with which to reach

these conclusions about Hart. The renderings provided in the Hart patent, precisely because they do not show the section cut lines for the various views in the figures, cannot be interpreted in the singular and unique way that Ahmadian interprets them. A POSITA in the relevant time frame would take this same position.

57. For example, in his analysis of claim 1, Dr. Ahmadian provides annotated images of Hart as shown below in the below Figure:



Dr. Ahmadian Decl. ¶¶68-69 (annotated to emphasize diagonal strut b[7].)

58. Based on these images, Dr. Ahmadian concludes "Hart's slope sheet is not supported by elephant ears (such as, for example, triangular longitudinal plates, struts, transverse plates, or any other primary structure directly above the shear plate and below the slope sheet," and further identifies three structures at the

end of the rail car: "(corner) post b^6, (side) post d', and inclined brace b^7." Dr. Ahmadian Decl. ¶ 69. Inclined brace (i.e. diagonal strut) b^7 is highlighted in red in the annotated Figure shown above, in ¶57.

59. Dr. Ahmadian concludes (emphasis added): "Inclined brace b^7 is mounted to the side sill and extends upwards in a vertical plane, without extending laterally inward into the machinery space or above the shear plate. *First, if inclined brace b^7 extended laterally inward, it would be visible in Fig. 2, an upper plan view of the hopper car. Id. But it is not shown there.*" Dr. Ahmadian Decl. at ¶72. However, Dr. Ahmadian's conclusion regarding the visibility of diagonal strut b^7 lacks adequate basis as the "upper plan view" does not show any significant structural details (in dashed line) that would be below the end slope sheet in this rendering. Therefore, his conclusion above is without basis and merit.

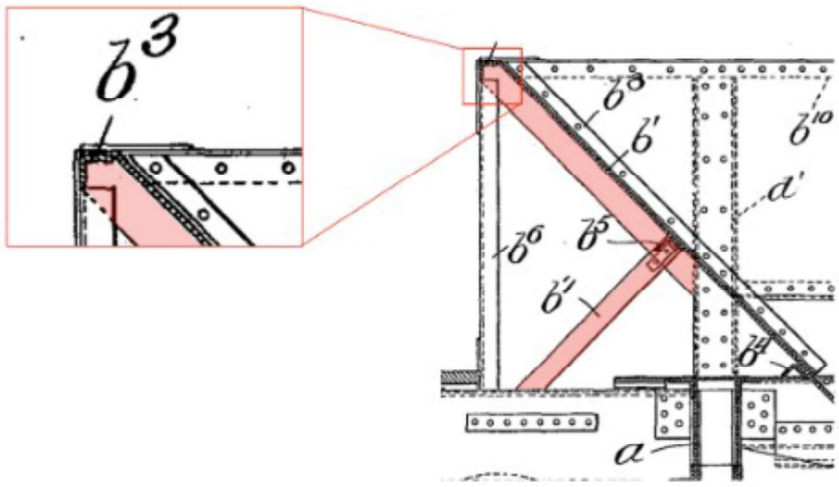
60. As Dr. Ahmadian admits, annotated Figure 2 of Hart (shown on the right-hand side above, in ¶57) is a plan view looking downward onto the end slope sheet which would not show any structure underneath the slope sheet unless specifically called out with hidden lines (such as is the case for elements b^3, b^4, and b^5 in Hart's Figure 2, which appropriately are shown using dashed lines, as is the convention for hidden details). It is not the case that inclined brace b^7 would necessarily be visible in Hart's Figure 2 if it was disposed laterally inward into the machinery space (such as, for example, disposed in the center so as to most

effectively support the slope sheet). And clearly other details are missing that one would expect in this plan view, like the cross-section of the d′ side post.

61. Indeed, Dr. Ahmadian does not address why, if Hart's Figure 2 must show inclined brace b^7, that the brace is not shown in Hart's Figure 2 mounted to the side sill and extending only upwards (not laterally inwards) as Dr. Ahmadian opines (nor does he address why the corner post b^6 is also not shown in Hart's Figure 2). Dr. Ahmadian's analysis does not demonstrate that it is more likely than not that the inclined brace b^7 is not disposed laterally inward, as opposed to other possibilities such as, most simply, the brace b^7 is not visible at all in Hart's Figure 2.

62. Furthermore, even if, for argument's sake, Dr. Ahmadian is assumed to be correct that the inclined brace b^7 is coupled to the side sill, Figure 1 from Hart still shows that there is "primary structure within the machinery space" as the '515 Patent defines it. For example, with reference to annotated Figure 1 (enlarged partial view shown below), Dr. Ahmadian identifies that corner post b^6 is "longitudinally outboard of the shear plate at the corner of the railcar." Dr. Ahmadian Decl. ¶ 70. However, it can also be seen that inclined brace b^7 is coupled to a beam running diagonally along the outside surface of the end slope sheet (red highlights in annotated partial view of annotated Figure 1) and this beam is

disposed laterally inward from the corner post b^6 as shown in hidden lines in the upper left corner of annotated Figure 1.



Hart Fig. 1 (annotated).

63. The "machinery space" is defined by the '515 Patent as "bounded by (a) the first slope sheet; (b) the shear plate of the first end section; (c) the end post; and (d) the corner posts," this means that the beam running diagonally along the edge of the end slope sheet (as well as possibly the inclined brace b^7) is inboard from the corner post b^6 and thus would be primary structure within the space bounded by the shear plate and below the end slope sheet, which is explicitly excluded in claim 1 of the '515 Patent.

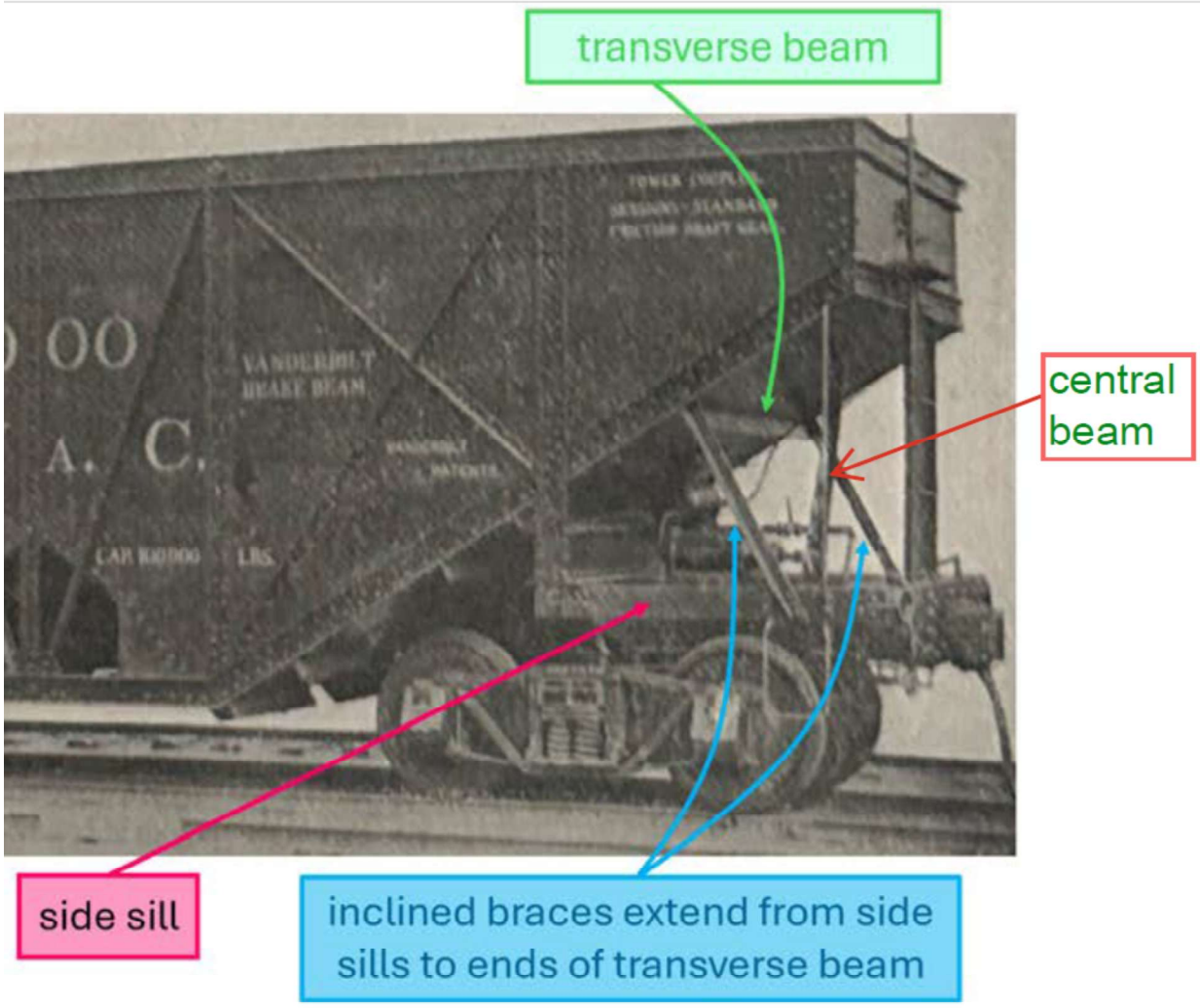
64. It should be noted that this interpretation of the positioning of various components relies on Hart's use of hidden lines which, in turn, relies on the assumption that Hart's use of hidden lines comports with how a POSITA would

understand the meanings of these lines. While it cannot be confirmed that Hart's use of hidden lines comports with what a POSITA would understand hidden lines to represent, at a minimum, the figures discussed above introduce ambiguity into the interpretation of the placement of structures within Hart. Dr. Ahmadian does not address this ambiguity in his analysis, and therefore his conclusions regarding Hart are not reliable.

65. As shown above with respect to claim 1, there are similar claim requirements in other independent claims of the '515 Patent (i.e., claims 7, 18, 20, and 24). Ahmadian relies on Hart as the primary reference for his invalidity analysis for all of the independent claims of the patent, however, he does not supplement his analysis of any of independent claims 7, 18, 20, or 24, with a further explanation as to how Hart discloses a machinery space free of primary structure; I note that, as described elsewhere in this declaration, Dr. Ahmadian does not analyze the limitations regarding a lack of primary structure in the machinery space for claims 7, 18, 20, or 24, which renders his analysis moot regardless of the prior art cited.

66. Dr. Ahmadian recognizes the ambiguities in ¶73 surrounding the brace b^7 in Hart, as he relies on "the Cambria Steel car" (EX1009 at 13, Fig. 53) to show "inclined braces such as b^7 were often used to support ends of a transverse beam," ignoring the use of the pair of crisscrossing central beams in the machine

space of the same car, as seen in the enlarged partial view of the annotated illustration below. As understood from the annotated illustration, positioning the braces b^7 in Hart as proposed by Dr. Ahmadian would necessitate additional support structure in the machinery space, thereby teaching against Dr. Ahmadian's proposed interpretation of what Hart teaches.



Dr. Ahmadian Decl. ¶73. In addition, Dr. Ahmadian's claim in ¶73 are also nonsensical from an engineering perspective. Assuming that diagonal braces b^7 are at the lateral outboard locations as assumed by Dr. Ahmadian, no POSITA would tie those into the slope sheet leaving such a short ligament between that connection and where the vertical side posts d´ are located. In other words, a POSITA would understand that it would make sense to tie together, maybe using a large reinforcing plate, the terminations of b^7 and b^5 with vertical side posts d´. But Hart does not show that, so it is likely from an engineering argument that the diagonal struts b^7 are in directly in the middle of the machinery space.

67. I disagree with Dr. Ahmadian's contention in ¶75 that "Even if Hart did not disclose that its inclined brace is laterally outboard of the shear plate, it would have been obvious to mount the brace to the outside of the side sill, as [in "the Cambria Steel car" shown] in the 1906 Cyclopedia, so that it would not be directly above the shear plate or in the machinery space." Dr. Ahmadian does not provide any reason for making such a change to Hart, and, in my view, cannot because a POSITA would understand that positioning the braces as Dr. Ahmadian suggest would require additional supporting members such as the crisscrossing central beams shown in the annotated photo above, in my ¶66. In addition, Dr. Ahmadian's statement in ¶75 of 047 is incorrect. He states: "Additionally, separating the braces as far apart as possibly offers the most resistance to warping

and torsional distortion." This may be so, but doing so offers the least resistance to bending of beam b5, which will be under a significant bending load when the car is loaded with commodity. Dr. Ahmadian's analysis is overly simplistic and therefore of no value in ascertaining the position of brace b^7 in Hart.

68. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or would have rendered this claim limitation obvious to a POSITA.

2. Claim Limitation 1f ("one of: (a) said first end slope sheet has an upper margin and said hopper car includes an end post extending upwardly from said draft sill to said upper margin of said first end slope sheet; and (b) said first end slope sheet has an upper margin terminating at an end wall, and said hopper car includes an end post extending upwardly from draft stub sill to said end wall")

69. Hart does not teach or suggest this claim limitation, and Petitioner and Dr. Ahmadian rely on the 1906 Cyclopedia's Cambria Steel car to disclose portion (b). The Petition and Dr. Ahmadian state that a POSITA would combine the Cambria Steel car with Hart to reach the present invention. Petition at 41-45; Ex. 1003 at ¶¶ 76-81. I disagree.

70. The "end post" on the Cambria Steel car terminates at the end wall, not to and including the end wall as required by the claims of the '515 Patent. This is an important difference that a POSITA in the relevant time frame would understand and appreciate because the end post in the '515 Patent contributes to

the overall "box beam" that the entire car structure affords, with the end post adding significant stiffness to the entire car body precisely because it is tied into the end wall and end top chord.

71. Dr. Ahmadian states that Hart could be modified by increasing the overall height of the hopper. Ex. 1003 at ¶ 77; Petition at 42. However, rail cars are based on standard sizes or profiles and AAR-limiting clearance plates, which they cannot exceed. Rail cars are also specifically designed with their geometries, load capacities, and intended commodity in mind. A POSITA would not, on a whim and without more, simply increase the height of a hopper car like Hart. For example, this could leave an ore car ineffectual for its intended purpose because it would not be able to carry a full load due to the increased weight of the car caused by making it taller.

72. Dr. Ahmadian also states that by reducing the inclination of the slope sheets so that their outboard ends terminate at a lower height (i.e., lower along the end wall). Ex. 1003 at ¶ 77; Petition at 42. Rail cars are specifically designed with their geometries, load capacities, and intended commodity in mind. Lowering the slope sheet would change load distribution, potentially necessitating changes to other structures in the rail car. Moreover, it may lower the effectiveness of the rail car when dumping its load because the lower angle may not be sufficient to gravity discharge all its contents.

73. I disagree with Dr. Ahmadian in ¶77 that it would have been obvious to modify Hart to add an end wall supported by an end post, as in the Cambria Steel car (which does not have the same end post defined in '515). A POSITA would have recognized that adding only the end post would not be sufficient without also using engineering methods to evaluate whether adding the crisscrossing central beams of the Cambria Steel car or other structural members in the machine space would have been necessary, shown in the annotated illustration in my ¶66.

74. In ¶78, Dr. Ahmadian fails to consider that modifying Hart to incorporate an end wall supported by the proposed end post would also require that an engineering analysis be performed to determine if incorporation of the crisscrossing central beams of the Cambria Steel car in the machine space would be needed, and if so, would be sufficient. A POSITA would understand from studying the Cambria Steel car that such analyses would need to be performed and that making the changes stated by Ahmadian in ¶78 without performing such analyses is simply guesswork; this is not how a POSITA would approach this issue.

75. In ¶79, Dr. Ahmadian reproduces illustrations of Figures 50 and 52-65 from the 1906 Cyclopedia, but in each instance ignores the fact that each of the illustrated cars includes additional support structures in the machine space, thereby

teaching against incorporating only the end post to support the end wall. A POSITA would understand that each of the illustrated cars require additional support structures in the machine space to support the end wall.

76. For at least these reasons, the combination would not be one of a finite number of well-understood options or a routine design choice. Petition at 45; Ex. 1003 at ¶ 80. Instead, the Petition and Dr. Ahmadian are merely engaging in more improper hindsight and picking and choosing pieces of the prior art that may meet the claimed invention. This is shown by the different rail car designs that Petitioner relies on as allegedly showing other rail cars with end walls, wherein Dr. Ahmadian provides no meaningful description of the process by which a POSITA would start in view of one rail car and end up in view of the others. Ex. 1003 at ¶ 79; Petition at 43-45.

77. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim limitation.

3. Claim Limitation 1g (said shear plate has a longitudinally outboard margin and said draft sill has a striker located outboard of said longitudinally outboard margin of said shear plate, and said end post is one of: (a) rooted to said draft sill adjacent to said striker; (b) rooted to said shear plate adjacent to said longitudinally outboard margin of said shear plate")

78. The Petition and Dr. Ahmadian take the position that a combination of Hart and the 1906 Cyclopedia's Cambria Steel car meets this claim limitation, and specifically subpart (a). The Petition and Dr. Ahmadian do not argue that the end

post is "(b) rooted to said shear plate adjacent to said longitudinally outboard margin of said shear plate." Ex. 1003 ¶¶ 82-90; Petition at 46-48.

79. However, neither the Petition nor Dr. Ahmadian explain how the added end post in the combination is "rooted to said draft sill adjacent to said striker." In fact, as I explained above in Section IV.C.2, a POSITA would not be motivated to add an "end post" to Hart, let alone one "rooted to said draft sill adjacent to said striker."

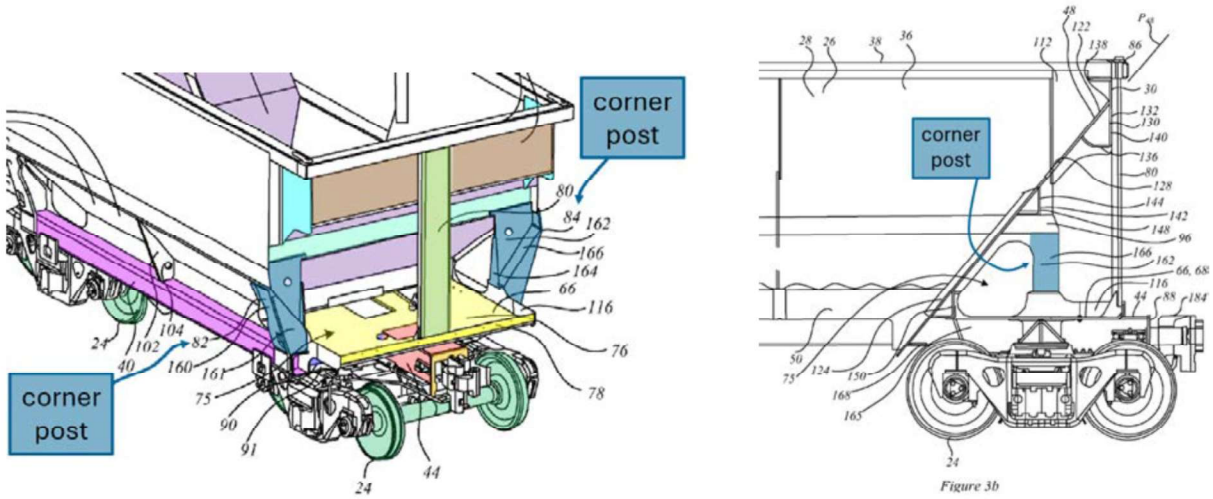
80. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim limitation.

4. Claim Limitation 1h ("said bolster has first and second laterally outboard distal ends, and said hopper car has corner posts extending upwardly from said distal ends of said bolster to said first end slope sheet; and")

81. The Petition and Dr. Ahmadian rely on Hart as allegedly disclosing this claim feature. In my opinion, the Petitioner has not met its burden.

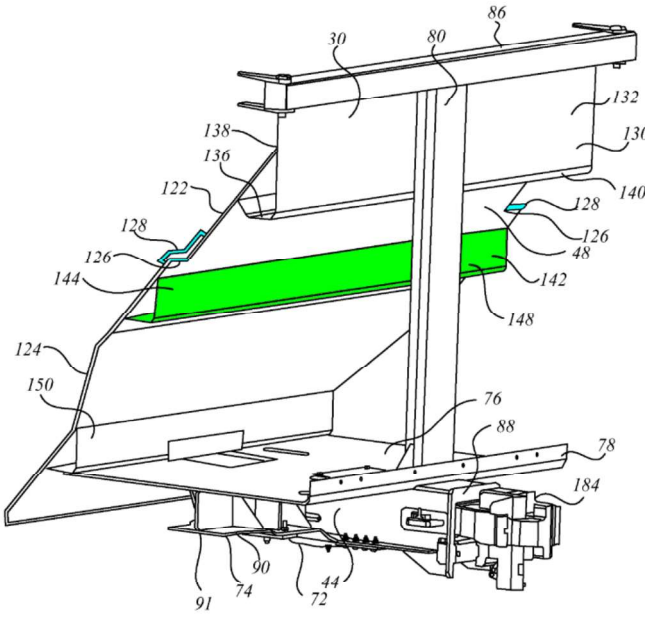
82. As an initial matter, Hart does not call d´ a "corner post" but simply a "post" or "stake." A POSITA in the relevant time frame would realize that there is a difference between a "corner post" (which is typically understood to be at the physical corner of the hopper, which is not the case in Hart) and a standard "post" or "stake." Corner posts typically have a "beefier" design (i.e., more cross-sectional area) because they are more aggressively loaded than typical side posts.

83. In addition, Dr. Ahmadian and the Petition inconsistently identify the claimed "corner posts" in the figures of the '515 Patent. Dr. Ahmadian uses the following images to identify the corner posts in his discussion of claim limitation 91:

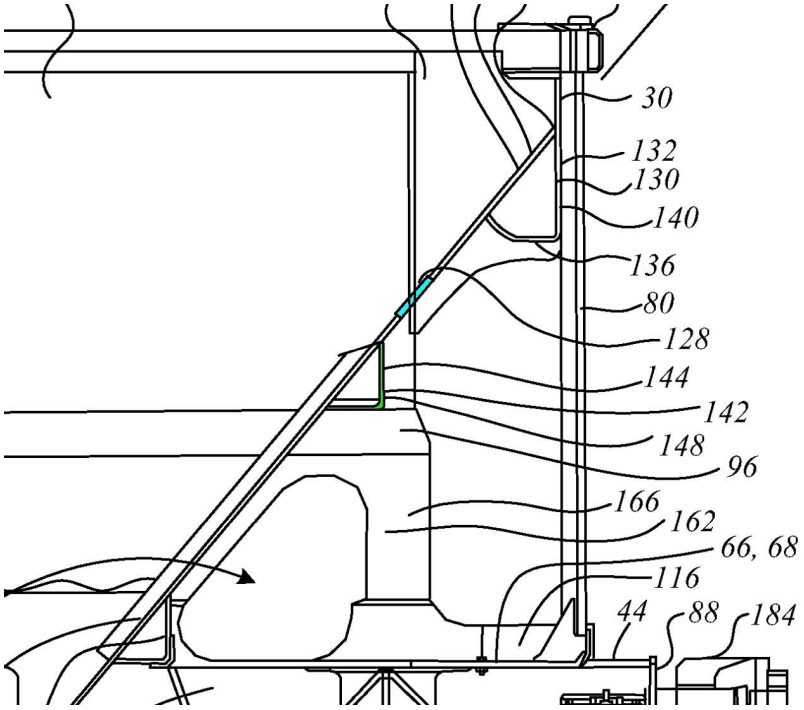


Dr. Ahmadian Decl. ¶ 91. Figure 3b is a cut-away view, and a POSITA would understand that it looks from the center of the car towards the inside of the shown corner post.

84. As the '515 Patent explains: "[u]pper member 122 has notches 126 formed therein to accommodate corresponding corner posts 82, 84 as may be, with local reinforcement doublers 128 at the junction." Notches 126 and local reinforcement doublers 128 are shown as being above angle 142, in both Figure 3b as used by Dr. Ahmadian and Petitioner, and in Figure 3a:



’515 Patent Fig. 3a (showing notches 126 and local reinforcement doublers 128 in blue and angle 142 in green).



’515 Patent Fig. 3a (showing local reinforcement doublers 128 in blue and angle 142 in green). Thus, the claimed corner posts extend above angle 142, to notches 126, and not below it, as Petitioner and Dr. Ahmadian suggest.

85. This is an important distinction because the alleged corner posts identified by Petitioner and Dr. Ahmadian extend to Hart’s top chord b10, and not to its end slope sheet.

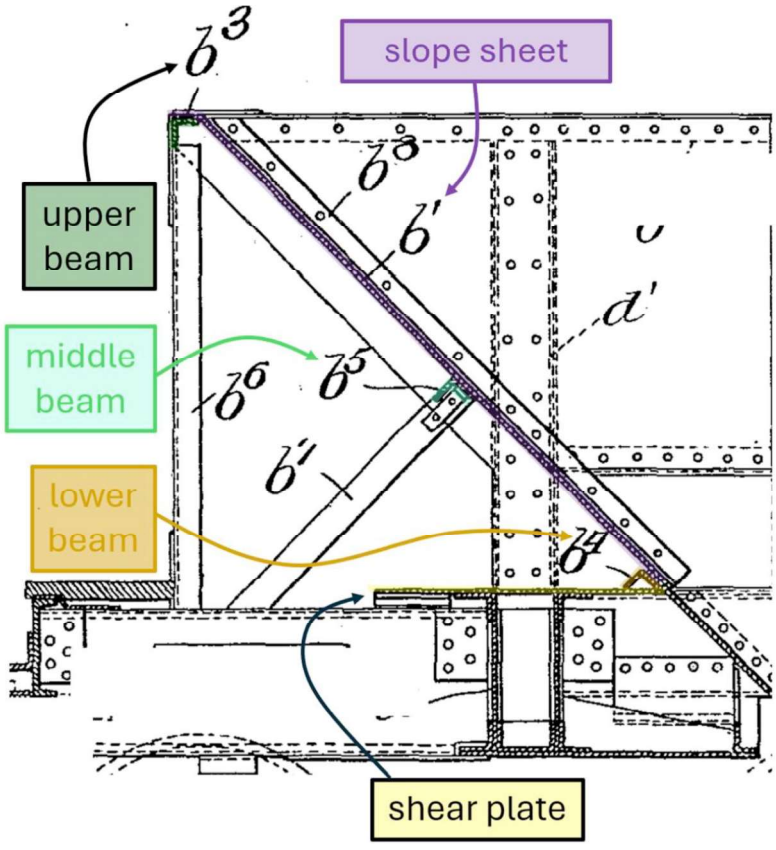
86. Thus, Dr. Ahmadian and Petitioner have not shown that the alleged “corner posts” in Hart “extend[] upwardly from said distal ends of said bolster to said first end slope sheet.”

87. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim limitation.

5. Claim Limitation 1i (“said hopper car has a machinery space bounded by (a) said first end slope sheet; (b) said shear plate of said first end section; (c) said end post; and (d) said corner posts, and said machinery space is free of any other primary structure.”)

88. Hart does not teach or suggest the claimed “machinery space.” As explained above, Petitioner and Dr. Ahmadian fail to provide any teaching or suggestion in the asserted art as to why a POSITA would add an “end post” to Hart, or why Hart’s alleged “corner posts” meet the limitations of the claims. Without the features of the claims that “bound” the “machinery space,” such a machinery space cannot exist.

89. Moreover, even assuming that there would be an "end post" and "corner post" in Hart, as explained above in Section IV.C.1, the Petition and Dr. Ahmadian do not show that what they identify as the "machinery space" in Hart is free of primary structure. Specifically, post b^7 and the un-numbered beam to which it attaches may be in the area in Hart that Petitioner and Dr. Ahmadian identify as the machinery space; Hart provides insufficient information to definitively determine where strut b^7 and the unnumbered beam are actually located. Dr. Ahmadian and Petitioner identified the slope sheet in the following image:



Ex. 1003 ¶ 68; Petition at 38.

90. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim limitation.

D. Ground 2

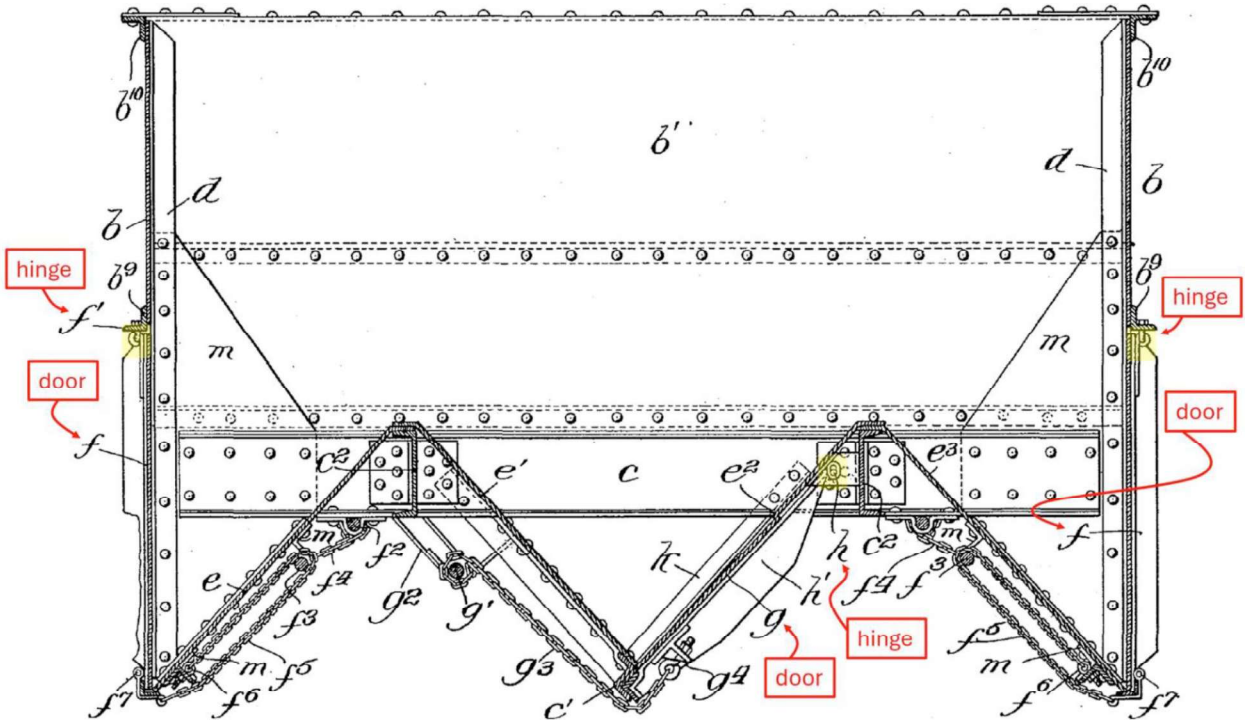
91. Petitioner asserts that claim 3 of the ’515 Patent is obvious over Hart, the 1906 Cyclopedia, and Schuller. Based on my analysis of the ’515 Patent, Hart, the 1906 Cyclopedia, and Schuller, I disagree. It is my opinion that Hart, the 1906 Cyclopedia, and Schuller, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render obvious claim 3.

1. Claim 3 (“The railroad hopper car of claim 1 wherein: said hopper car has at least one longitudinally hinged discharge door, said discharge door being movable cross-wise between open and closed positions; and a longitudinally acting pneumatic actuator is at least partially lodged in said machinery space directly above said draft sill”)

92. For the reasons discussed above with respect to claim limitation 1i, the Petition fails to show that the asserted art teaches or suggests the claimed “machinery space,” as discussed in Section IV.C.5. Thus, claim 3’s “longitudinally acting pneumatic actuator” cannot be “at least partially lodged in said machinery space directly above said draft sill.”

93. A POSITA would not be motivated to combine Schuller’s mechanism into Hart because the proposed combination would render Hart unsatisfactory for its intended purpose. A POSITA would understand that the crux of Hart is to

provide a convertible rail car with both side and bottom discharge. Hart's door opening mechanism is specifically designed to open either the side or bottom doors of its rail car, as recognized by Dr. Ahmadian and Petitioner:



Ex. 1003 at ¶ 95; Petition at 51.

94. Accordingly, Petitioner and Dr. Ahmadian have not shown that a POSITA would be motivated to make their proposed modifications.

95. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim.

E. Ground 3

96. Petitioner asserts that claim 4 of the '515 Patent is obvious over Hart, the 1906 Cyclopedia, Schuller, and Karig. Based on my analysis of the '515 Patent,

Hart, the 1906 Cyclopedia, Schuller, and Karig, I do not agree. It is my opinion that Hart, the 1906 Cyclopedia, and Schuller, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render obvious claim 4.

1. Claim 4 ("The railroad hopper car of claim 3 wherein a brake reservoir is also at least partially lodged in said machinery space.")

97. For the reasons discussed above with respect to claim limitation 1i, the Petition fails to show that the asserted art teaches, suggests, or renders obvious the claimed "machinery space," as discussed in Section IV.C.5. Thus, claim 4's "brake reservoir" cannot be "at least partially lodged in said machinery space directly above said draft sill."

98. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim.

F. Ground 4

99. Petitioner asserts that claims 5 and 6 of the '515 Patent are obvious over Hart, the 1906 Cyclopedia, and Campbell '652. Based on my analysis of the '515 Patent, Hart, the 1906 Cyclopedia, and Campbell '652, I disagree. It is my opinion that Hart, the 1906 Cyclopedia, and Campbell '652, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render obvious claims 5 or 6.

1. Claim Limitations 5d ("said side sill has an upper flange, said upper flange of said side sill being substantially co-planar with, and connected to, said shear plate") and 5e ("said side sill has a lower flange, said lower flange of said side sill being substantially co-planar with a respective one of said distal end portions of said lower flange of said main bolster")

100. Petitioner and Dr. Ahmadian rely on Campbell '652 for these claim features because "Hart's figures do not show the vertical position of the flanges of the side sills." Ex. 1003 at 104; Petition at 57.

101. Petitioner and Dr. Ahmadian provide no justification for combining Campbell '652 and Hart, other than "to facilitate their interconnection to form a single strong undercarriage structure." However, Petitioner and Dr. Ahmadian do not state that Hart has a weak undercarriage structure, or provide any support for their position that having flanges on different planes would not provide a strong undercarriage structure. Instead, the Petitioner and Dr. Ahmadian appear to be motivated by the '515 patent to pick and choose features from the asserted art solely for combination, without considering any other reason for such a combination, or even whether such a combination would have been successful. Absent a reason that justifies making an expensive engineering analysis of whether the Hart would have a stronger or weaker undercarriage structure with or without the teachings of Campbell '051, the Petitioner and Dr. Ahmadian propose, I do not see why a POSITA would have made the proposed changes.

102. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim limitation.

2. Claim 6 ("The railroad hopper car of claim 5 wherein said shear plate defines an upper flange of said draft sill whereby said draft sill upper flange, said shear plate and said side sill upper flange are all substantially co-planar.")

103. Petitioner relies only on its discussion of claim limitation 5d for this claim limitation. Petition at 58. Dr. Ahmadian provides no opinions regarding this claim limitation. Accordingly, for the reasons I discuss above regarding claim limitation 5d in Section IV.F.1, the asserted art does not teach, suggest, or render obvious this claimed feature, either alone or in combination.

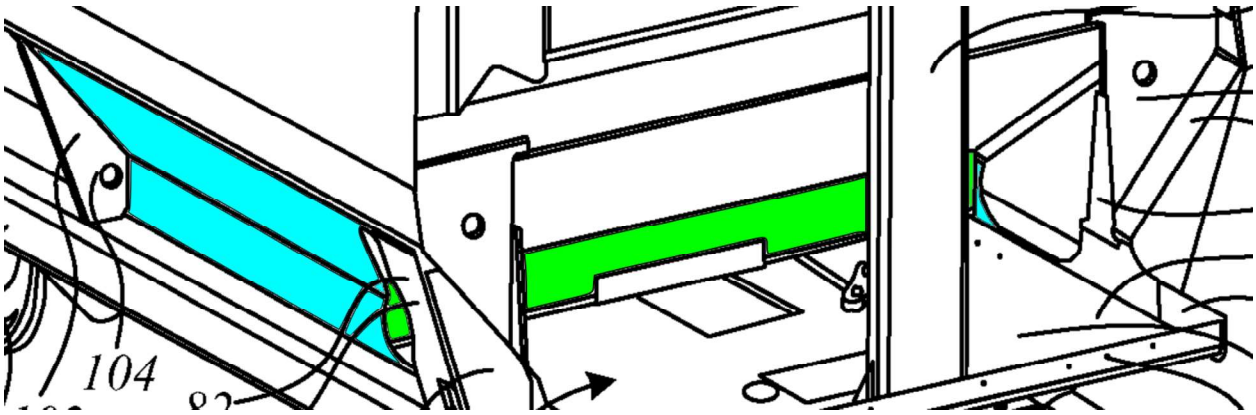
104. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim.

G. Ground 5

105. Petitioner asserts that claims 7–16, 20, 23, 24–28, and 30–31 of the '515 Patent are obvious over Hart in view of the 1906 Cyclopedia and Wong. I disagree. Based on my analysis of the '515 Patent and asserted art, it is my opinion that Hart, the 1906 Cyclopedia, and Wong, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render obvious any of claims 7–16, 20, 23, 24–28, or 30–31.

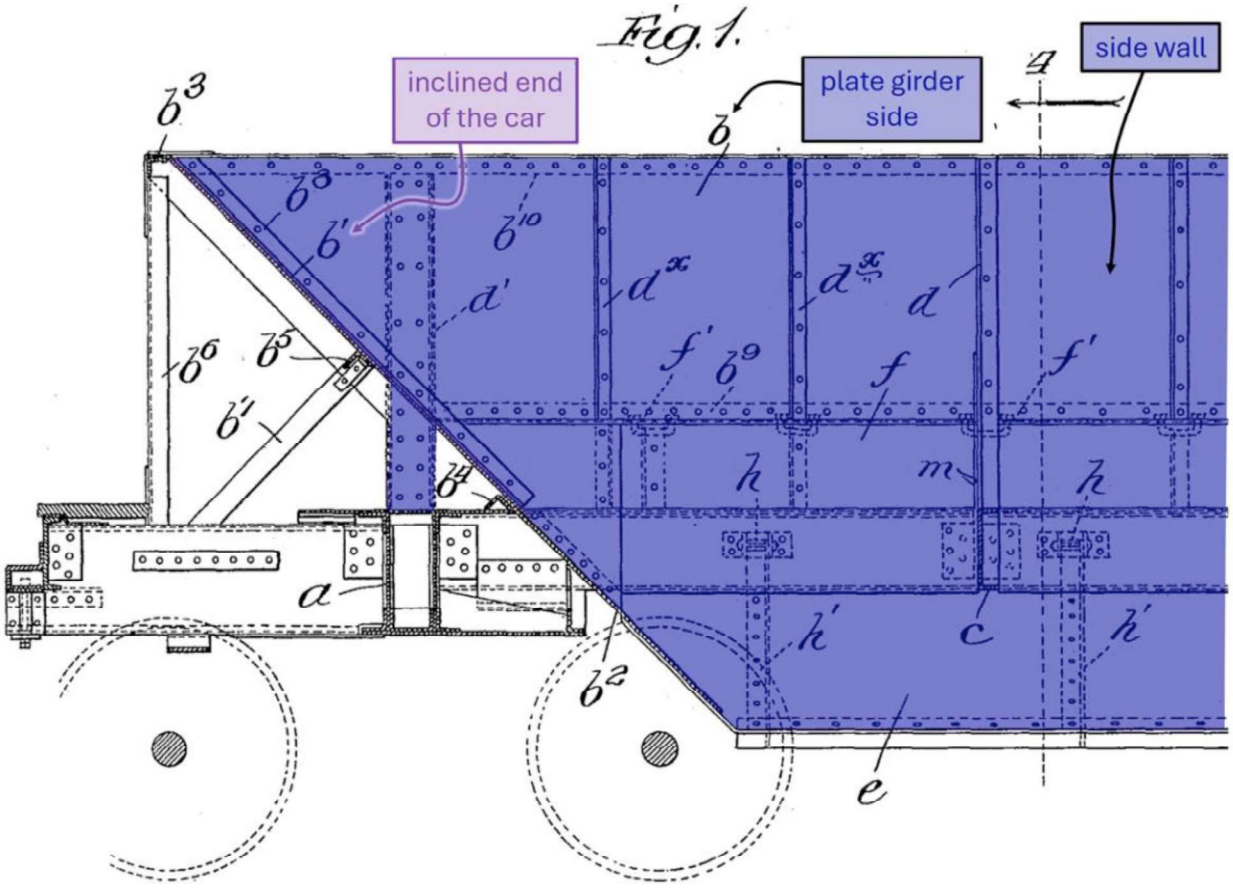
1. Claim Limitation 7f ("a first laterally extending reinforcement mounted cross-wise to said first end slope sheet adjacent to said shear plate; said shear plate of said first end section being connected to said first laterally extending reinforcement; said first end slope sheet of said first end section being connected to said first laterally extending reinforcement; said first laterally extending reinforcement defining part of a first hollow section beam extending across said hopper car between said first and second side walls")

106. As disclosed in the '515 Patent and claimed in this claim limitation, the "first hollow section beam extending across said hopper car between said first and second side walls." As shown in the annotated enlarged partial view of Figure 1 reproduced below, angle 150 extends between the first and second side walls:



'515 Patent Fig. 1 (showing portions of side walls in blue and angle 150 in green).

107. As can clearly be seen in the Petition's interpretation of Hart, crosswise beam b4 in Hart does not extend between the side walls.



Petition at 59. Dr. Ahmadian provides no analysis as to why the structure b4 meets the limitation "a first hollow section beam extending across said hopper car between said first and second side walls."

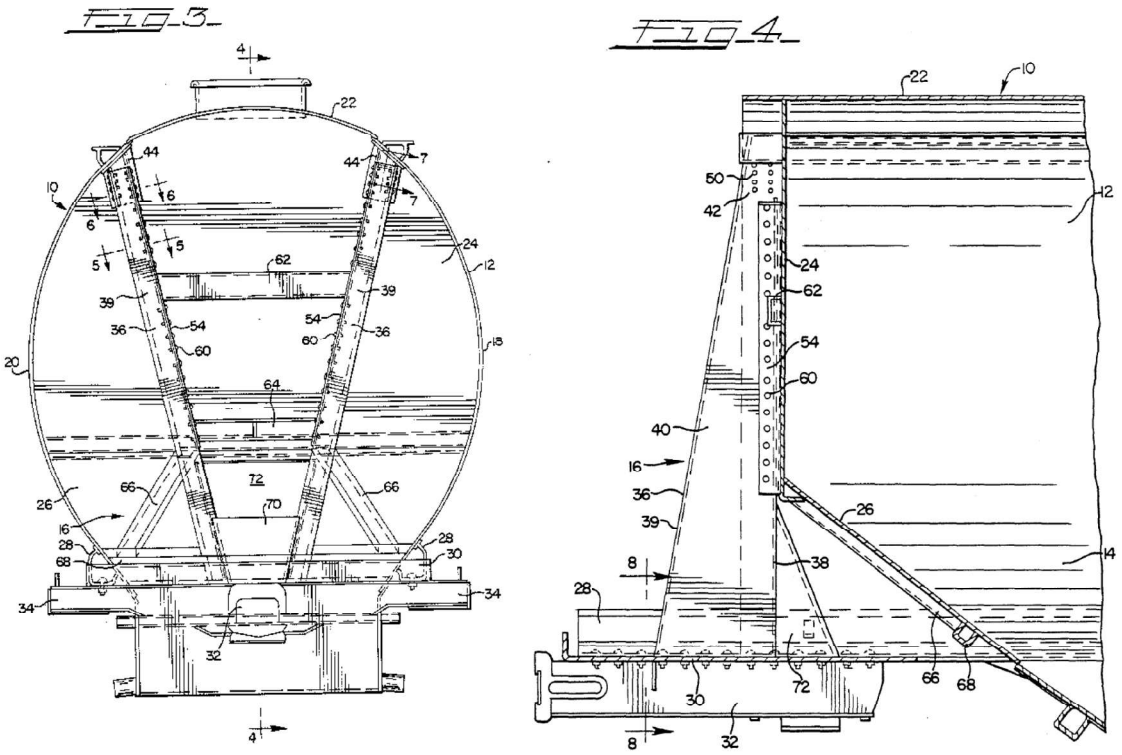
108. In addition, claim limitation 7f states that the crosswise beam must be connected to the shear plate ("said shear plate of said first end section being connected to said first laterally extending reinforcement"). Figure 2 in Hart does not show this connection since there is only one line of fasteners, and these fasten the crosswise beam to the slope sheet, not to the shear plate. Because all of Hart's figures show fastened structure (i.e., not welded, and welded structure would not be expected in 1911) whereas crosswise beam in the '515 patent (item 150) would

be expected to be welded along its length, 150 is connected to the shear plate. This is different than what is represented in Hart.

109. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches, suggests, or renders obvious this claim limitation.

2. Claim Limitation 7h ("said hopper car has a first end wall member running cross-wise between said first and second side walls; said first end slope sheet has an upper margin that meets said first end wall member at a first junction; said first end wall member extends upwardly from said first junction; said first end wall member has a lower portion extending downward of said first junction; said lower portion of said first end wall member and said upper margin of said first end slope sheet co-operate to define portions of the cross-section of a second hollow section beam extending crosswise across said hopper car between said first and second side walls")

110. The Petition and Dr. Ahmadian state that a POSITA would combine Hart with Wong to add a first cross-wise extending beam. I disagree. Wong teaches an aluminum closed hopper rail car with a steel end structure:



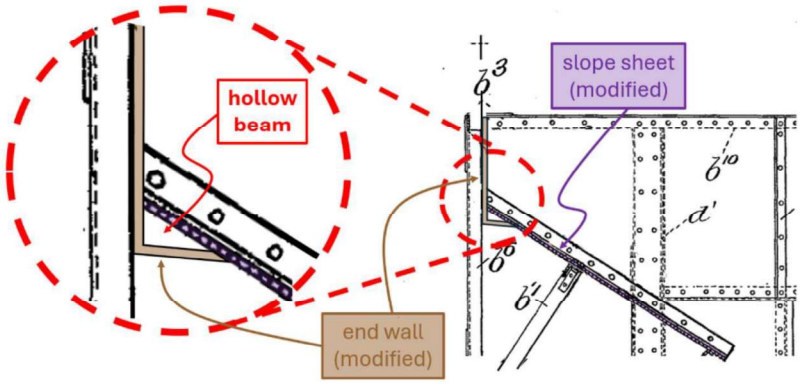
Ex. 1006, Wong Figs. 3, 4.

111. Wong teaches how to combine steel and aluminum structure to get needed strength while avoiding the corrosion issues that arise because steel and aluminum are galvanically coupled and will corrode if in contact with each other. Wong is far less concerned regarding lateral reinforcing beams. The L-shaped detail on the bottom edge of the end wall shown in Wong is not similar to the claimed "first crosswise beam" in the '515 Patent because it is the joint where the slope sheet is connected to the end vertical sheet. Wong does not provide reinforcement, but simply shows two sheets being connected for lading containment and load transfer. The claimed "first crosswise beam" in the '515 Patent provides reinforcement to the slope sheet; a POSITA in the relevant time

frame would understand and appreciate this difference. Accordingly, in my opinion, a POSITA would not look towards Wong to improve the end structure of Hart.

112. Accordingly, in my opinion, a POSITA would not look towards Wong to improve the end structure of Hart.

113. In fact, the proposed combination of the Hart and Wong is unsatisfactory for either rail car's intended purpose. Hart already has structure for holding up what the Petitioner and Dr. Ahmadian identify as the end slope sheet. It is not clear how the proposed cross-wise beam in Hart would transfer load down from the end slope sheet to the undercarriage of the car:



Petition at 63, Ex. 1003 at ¶ 108.

114. In my opinion, it would not have been obvious to a POSITA to combine the teachings of, and the Petitioner and Dr. Ahmadian have not shown

that, the asserted art teaches, explicitly or inherently, or would have rendered obvious to a POSITA this claim limitation.

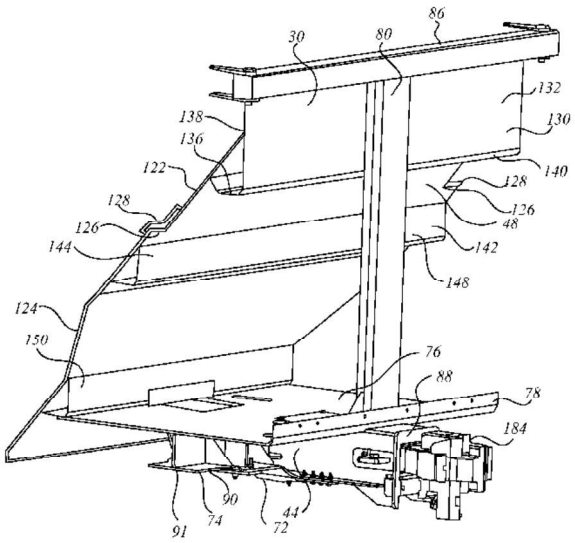
3. Claim 9 ("The railroad hopper car of claim 7 wherein said laterally extending member has a pair of first and second spaced apart toes, and said laterally extending member is mounted toes-in against said first end slope sheet, whereby said first hollow section beam is defined by said laterally extending reinforcement and said first end slope sheet")

115. The Petition admits that Hart's brace member b^4 is mounted "against the shear plate, rather than against the slope sheet." Petition at 65. The Petition relies on Wong in an attempt to show that which Hart does not teach.

116. A POSITA would thus not look to combine Hart and Wong to reach the present invention. Instead, a POSITA would take a wholistic view of the rail cars to determine if additional strengthening is required, and if so, look to incorporate an entire design, not specific elements; and with such a wholistic view, the POSITA would not have attempted to much less combine Hart and Wong as proposed by the Petition.

117. Moreover, the proposed modification is not "very simple . . . involv[ing] re-orienting the angle iron" as suggested by Petitioner and Dr. Ahmadian. Petition at 65-66; Ex. 1003 at ¶ 110. In fact, it is unclear how the modified angle in Hart would be mounted.

118. Notably, the ’515 Patent discloses, and a POSITA would understand, that space needs to be left to weld the angle iron to the shear plate and end slope sheet:



’515 Patent at Fig. 3a (showing space to make welds).

119. In my opinion, the proposed combination suggested by the Petitioner and Dr. Ahmadian would not have been obvious to a POSITA, and the proposed combination of the asserted art does not teach, suggest, or render obvious this claim limitation.

4. Claim 12 (“The railroad hopper car of claim 7 wherein said lower portion of said first end wall member has a lower margin that is bent to meet said upper margin of said first end slope sheet at a location lower than said first junction”)

120. The Petition alleges that this limitation is met by the combination of Hart and Wong discussed in connection with limitation 7h. Dr. Ahmadian provides

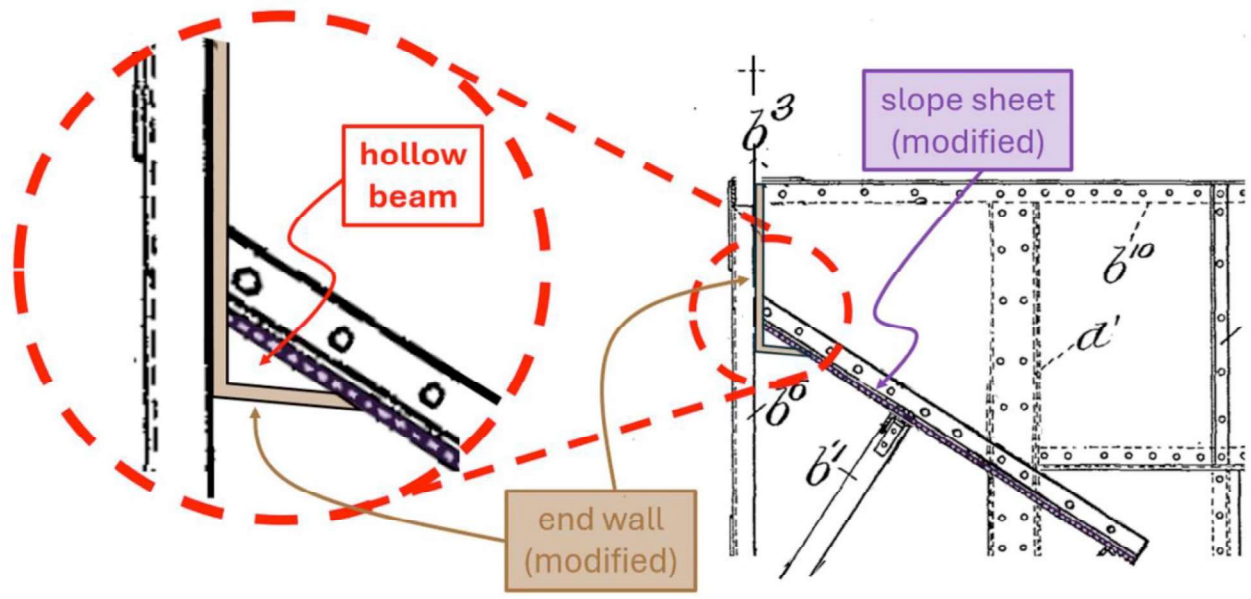
no opinions regarding claim 12 or its limitations. In my opinion, a POSITA would not look towards Wong to modify Hart, as discussed above in Section IV.G.2.

121. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

5. Claim 13 ("The railroad hopper car of claim 7 wherein said first end wall member has an upper margin that terminates at a top chord, said top chord extending from side to side of said hopper car.")

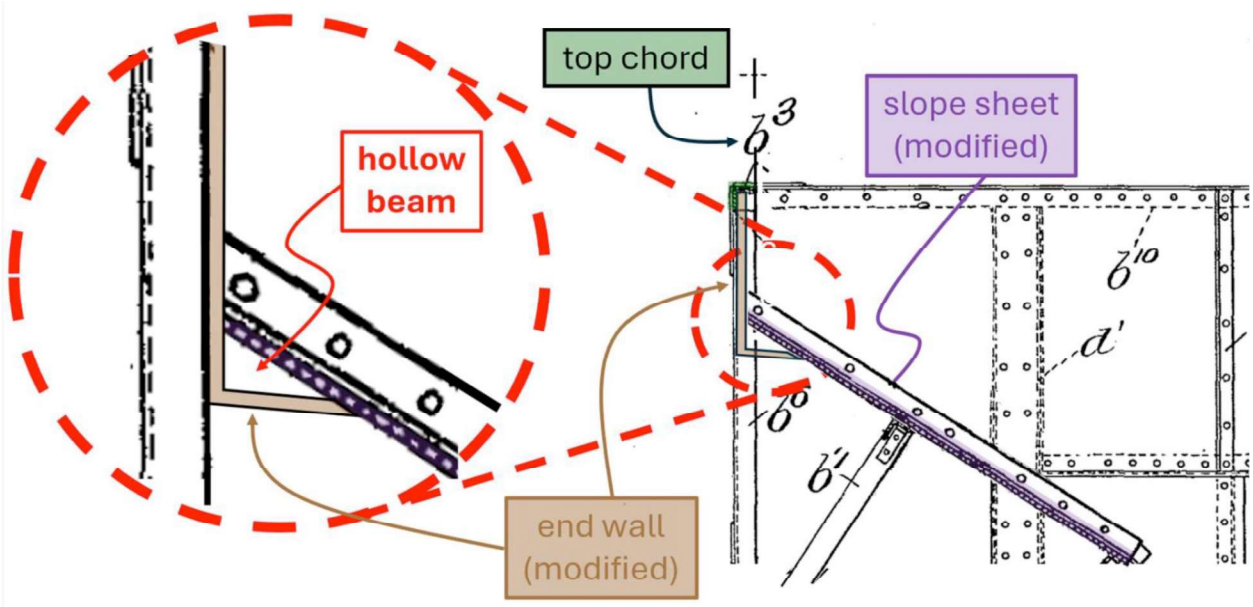
122. The Petition claims that "Hart, as previously modified by Wong, discloses the elements of Claim 13." Petition at 68. Dr. Ahmadian provides no opinions regarding claim 13.

123. Petitioner's arguments are entirely inconsistent with its own argument of claim limitation 7h. There, Petitioner and Dr. Ahmadian discuss removing top chord b3 and replacing it with Wong's transverse beam. Petition at 63 ("This suggests using a transverse beam like Wong's in the modified Hart design, in which the slope sheet is no longer supported by the upper beam b3."). Petitioner's combination of Hart and Wong thus requires the removal of the top chord b3 as shown in Petitioner's modified drawing showing the combination:



Petition at 64 (showing b^3 removed, despite the label being present); Ex. 1003 at ¶ 108.

124. Contrarily, and for reasons unknown, Petitioner changes its argument to re-add top chord b^3 back into its proposed modification, as shown below:



Petition at 68 (showing b^3 added back in). Petitioner provides no justification for its change in position, and I see none. Dr. Ahmadian provides no opinions regarding this claim. It is evident from Petitioner's change in position, however, that this claim limitation is not taught by the asserted art.

125. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim.

6. Claim 14 ("The railroad hopper car of claim 7 wherein said car includes an upstanding end post, said end post being mounted over said draft sill longitudinally outboard of said main bolster and extending upwardly therefrom to meet said first end wall member")

126. The Petition asserts that claim 14 is obvious over Hart in view of the 1906 Cyclopedia's Cambria Steel Car and incorporates its arguments from limitation 1f. I disagree, for the reasons provided above in Section IV.C.2. Moreover, a POSITA would realize that the end post in the Cambria Steel Car is not at all equal to the end post claimed here because the end post in the Cambria Steel Car terminates at the lower vertical extent of the end wall, while the claimed end post extends all the way to the top chord and is connected to the same. A POSITA would recognize that these are different structures taken on the whole.

127. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed

combination of the asserted art teach, suggest, or render obvious this claim limitation.

7. Claim 15 ("The railroad hopper car of claim 7 wherein an intermediate beam extends across said first end slope sheet between said first and second side walls at a position intermediate said first hollow section beam and said second hollow section beam")

128. Petitioner states that Hart discloses the claimed intermediate beam, but shows a modified picture of Hart that includes top chord b3, despite Petitioner and Dr. Ahmadian removing that same top chord b3 in their discussion of claim 7. See Section IV.G.5; Petition at 64. Accordingly, it is not clear what combination Petitioner is referring to for this claim, especially since claim 15 depends on claim 7 and, therefore, includes all of the subject matter recited in claim 7.

129. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

8. Claim 16 ("The railroad hopper car of claim 15 wherein said intermediate beam includes a cross-wise extending structural member mounted toes-in against said first end slope sheet to define a closed hollow section")

130. The Petition and Dr. Ahmadian allege that the combination of Hart and Wong meets this claim limitation. I disagree.

131. A POSITA would find no motivation in view of Hart or Wong to modify Hart as suggested by Petitioner. First, Wong does not have an intermediate beam. Instead, it has a number of "channel stiffener members" that are used as part of a larger structure to transfer load from what the Petitioner identifies as the end slope sheet to the end stiffener member 36. In fact, of the channel stiffener members identified by Petitioner, only one of them, labeled 68, is on what the Petitioner identifies as the end slope sheet; the others are on the end wall and the door. Thus, a POSITA would not look towards Wong to modify Hart's intermediate beam.

132. Moreover, Dr. Ahmadian is wrong in his position that Wong is showing as a beam at the juncture of the slope sheet and end wall. It is not a beam, but simply a 90-degree formed edge of the lower vertical extent of the end wall. Such a formed edge cannot be "re-oriented" because it is part of the end wall. A POSITA in the relevant time frame would certainly understand this.

133. In addition, the proposed combination would be unsatisfactory for the intended purpose of any of the asserted art in the combination. Hart's beam b7 provides support to the intermediate beam b5. Both beams b7 and b5 support the slope sheet from the hydrostatic pressure load provided by the commodity when the car is full. .Orienting it the way Petitioner and Dr. Ahmadian suggest would

make it unable to do so and render it useless. Neither Petitioner nor Dr. Ahmadian address this concern.

134. The proposed combination shows that randomly selected elements from Wong are selected and used to modify Hart without a reasonable engineering analysis being performed, which a POSITA in the relevant time frame certainly would have done before suggesting that any of the changes proposed by the Petitioner and/or Ahmadian be made.

135. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

9. Claim Limitation 20f ("a first laterally extending reinforcement mounted cross-wise to said first end slope sheet adjacent to said shear plate; said shear plate of said first end section being connected to said first laterally extending reinforcement; said first end slope sheet of said first end section being connected to said first laterally extending reinforcement; said first laterally extending reinforcement defining part of a first hollow section beam extending across said hopper car between said first and second side walls")

136. The Petition relies on its discussion of limitation 7f for this claim limitation. For the reasons I discuss above in Section IV.G.1, the asserted art does not teach, suggest, or render obvious this claim limitation.

137. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

10. Claim Limitation 20h ("said main bolster of said first end section of said railroad hopper car has first and second ends at laterally outboard extremities thereof; said hopper car has first and second corner posts mounted at said first and second ends of said main bolster of said first end section, said corner posts extending upwardly from said main bolster to said first end slope sheet")

138. The Petition relies on its discussion of limitation 1h for this claim limitation. For the reasons I discuss above in Section IV.C.4, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

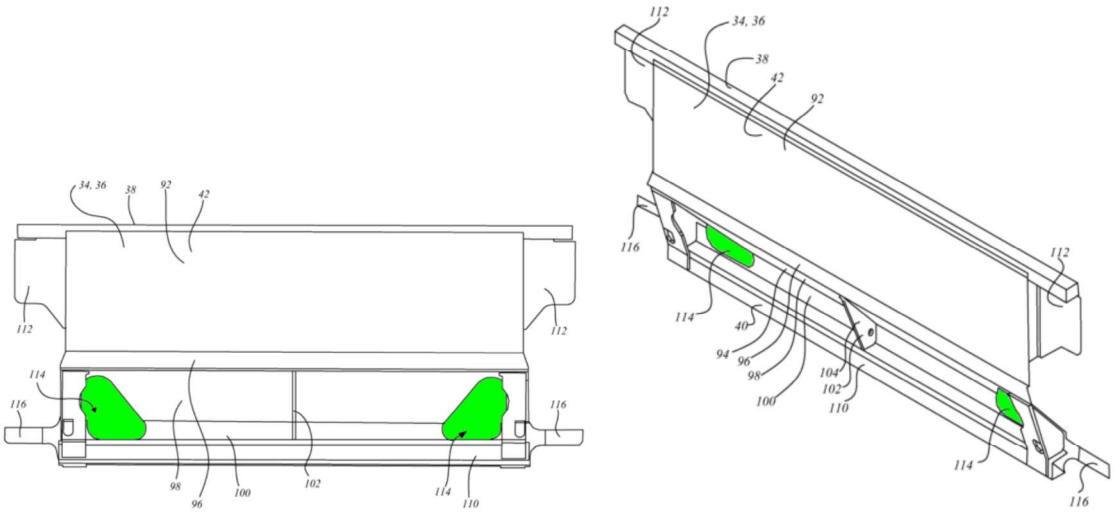
11. Claim Limitation 20j ("a machinery space is defined above said shear plate, below said first end slope sheet, longitudinally inboard of said end post, and between said corner posts; and said machinery space is free of any other primary structure")

139. The Petition relies on its discussion of limitation 1i for this claim limitation. For the reasons the reasons I discuss above in Section IV.C.5, the asserted art does not teach, suggest, or render obvious this claim limitation. In my

opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

12. Claim 23 ("The railroad hopper car of claim 20 wherein said first and second side walls of said car have openings defined therein longitudinally inboard of said respective corner posts, above said shear plate, and below said first end slope sheet.")

140. Petitioner asserts that Hart discloses this claim. Dr. Ahmadian provides no opinions regarding this claim.



141. '515 Patent Figs. 2b and 2a (shown above with annotations to show apertures 114 in green). As explained in the specification, "[t]he lower region of the main sidewall sheet also includes lightening apertures 114, in the space between the corner posts and the slope of the end slope sheets." '515 Patent at 16:26-30. As such, a POSITA would understand that the claimed "openings" are the apertures in the sidewall sheet.

142. Petitioner, ignoring what a POSITA would find to be the clear meaning of the claim, considers the claimed "corner posts" part of the claimed "side wall." Nowhere in the specification or the claims are the corner posts called part of the "side wall." The only support that Petitioner can muster is from the brief description of the drawings, where Fig. 2b is described as showing "a side view of the sidewall" and includes portions of the corner posts.

143. Moreover, the "apertures" would be considered by a POSITA to be somewhat like a stiffening web for the laterally outboard surface of the corner posts. Just like the shear plate forms the top flange of the draft sill beam, the side wall apertures would be understood by a POSITA to form the outer flange of the corner post columns. Thus, they not only lighten the structure, but also provide structural benefits. They may lighten the structure overall, but a POSITA would also recognize these as a unique feature that also provides structural benefits. Such features do not exist in Hart.

144. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

13. Claim Limitation 24f ("there being a first end wall extending between said first and second side walls; said first end slope sheet having an uppermost margin, said uppermost margin meeting said first end wall at a first junction; said hopper car having a first beam extending cross-wise between said first and second side walls at said first junction of said uppermost margin of said first end slope sheet and said first end wall, said first beam being a beam of hollow section; said first end wall has an upper portion and a lower portion; said upper portion of said first end wall extends upwardly of said first junction of said uppermost margin of said first end slope sheet and said first end wall; said lower portion of said end wall extends downwardly of said first junction of said uppermost margin of said first end slope sheet and said first end wall; and said lower portion of said first end wall forms part of said first beam")

145. The Petition relies on its discussion of limitation 7h for this claim limitation. For the reasons I discuss above in Section IV.G.2, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

14. Claim Limitation 24i ("said lower portion of said first end wall has a margin, and said margin is bent to mate with said first end slope sheet as a second junction distant from the first junction, said lower portion of said first end wall and said uppermost margin of said first end slope sheet cooperating to define said first beam")

146. The Petition relies on its discussion of limitation 7h for this claim limitation. For the reasons I discuss above in Section IV.G.2, the asserted art does

not teach, suggest, or render obvious this claim limitation. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim limitation.

15. Claim 25 ("The railroad hopper car of claim 24 wherein an end post is mounted over said draft sill outboard of said main bolster, said end post extending upwardly to meet said first beam")

147. The Petition relies on its discussion of claim 14 for this claim limitation. For the reasons I discuss above in Section IV.G.15, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim.

16. Claim 26 ("The railroad hopper car of claim 25 wherein: said upper portion of said first end wall extends upwardly of said first junction to end at a top chord; said top chord extends across said hopper car between said first and second side walls; and said end post extends past said first beam to terminate at said top chord.")

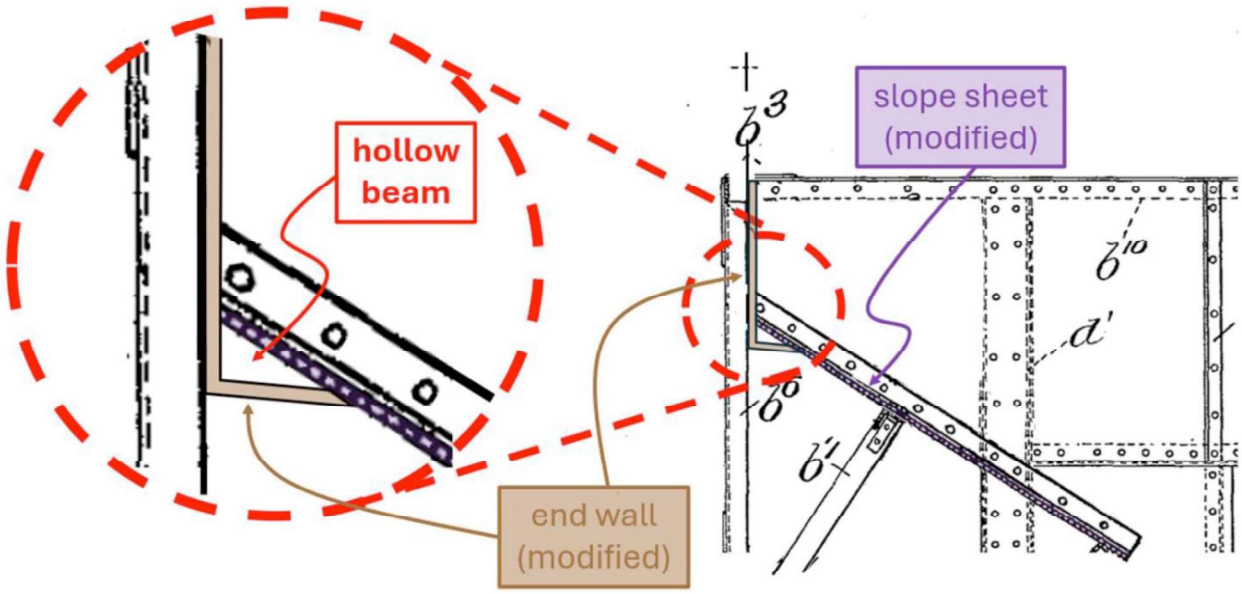
148. The Petition relies on its discussion of claim 1f for this claim limitation. For the reasons I discuss above in Section IV.C.2, the asserted art does not teach, suggest, or render obvious this claim limitation.

149. The Petition cites Dr. Ahmadian's Declaration for its discussion of claim 19, not claim 26. Petition at 79-80 (citing ¶ 116 of Dr. Ahmadian's Declaration and closing "The modified Hart design, shown below, would embody Claim 19."). The Petition never establishes that claims 19 and 26 have the same limitations or would be considered the same by a POSITA.

150. The Petition admits that what it identifies as the end post in the Cambria Steel Car does not extend to what it identifies as the top chord. EX1009 at 13, Fig. 53. The Petition picks one of the other eight cars shown on the selected pages of the 1906 Cyclopedia to argue that this limitation would be met if ***that*** car was combined with the combination of Hart and the Cambria Steel car. I do not see any reason or basis for the Petition and Dr. Ahmadian picking and choosing structures from other cars and adding them to Hart—that is, other than in an attempt to meet the claim limitation.

151. Moreover, the Cambria Steel car that the Petitioner and Dr. Ahmadian reference shows not an end post, but a vertical end ladder that would have been accessed to actuate the hand brake wheel which is clearly shown at the top of the car. Petition at 79; Ex. 1009 at 14. Railcars built then had hand brake wheels horizontally oriented at the top of the car, not on the end of the car vertically mounted as today. A POSITA would have clearly recognized that a ladder stile is not an end post because structural requirements for each are vastly different.

152. As discussed with respect to claim 13, Petitioner's addition of an end wall to Hart explicitly removes the structure b^3 that Petitioner identifies as the top chord. Petition at 63 ("This suggests using a transverse beam like Wong's in the modified Hart design, in which the slope sheet is no longer supported by the upper beam b^3.").



Petition at 64 (showing b^3 removed, despite the label being present). Now, for claim 26, the structure b^3 identified by Petitioner as the top chord as added back into Hart without any basis or explanation.

153. A POSITA would not add and remove structure from a rail car without the benefit of performing even a basic engineering analysis of the effects these changes would have on how the railcar responds to loads. In addition, a POSITA would not have been motivated to attempt much less make the combination proposed by Petitioner. A POSITA would have recognized the

structure of Hart, as disclosed, was likely to be sound and did not need further reinforcement, though an engineering analysis would need to be performed to confirm this.

154. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim.

17. Claim 27 ("The railroad hopper car of claim 25 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom.")

155. The Petition relies on its discussion of claim limitation 1h for this claim limitation. For the reasons I discuss above in Section IV.C.4, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim.

18. Claim 28 ("The railroad hopper car of claim 27 wherein: a machinery space is defined above said shear plate, in the lee of said first end slope sheet, longitudinally inboard of said end post and between said first and second corner posts; and said machinery space is free of any other primary structure")

156. The Petition relies on its discussion of claim limitation 1i for this claim limitation. For the reasons I discuss above in Section IV.C.5, the asserted art

does not teach, suggest, or render obvious this claim limitation. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim.

19. Claim 30 ("The railroad hopper car of claim 24 wherein a second beam is mounted across said first end slope sheet adjacent said shear plate.")

157. The Petition relies on its discussion of claim limitation 7h for this claim limitation. For the reasons I discuss above in Section IV.G.2, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, a POSITA would not have been motivated to make the combination proposed by the Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim.

20. Claim 31 ("The railroad hopper car of claim 30 wherein a third beam is mounted across said first end slope sheet intermediate said first and second beams, and said third beam is formed of a structural member mounted toes-in against said first end slope sheet to define an hollow section.")

158. The Petition relies on its discussion of claim 16 for this claim limitation. For the reasons I discuss above in Section IV.G.8, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, a POSITA would not have been motivated to make the combination proposed by the

Petitioner and Dr. Ahmadian, nor would the proposed combination of the asserted art teach, suggest, or render obvious this claim.

H. Ground 6

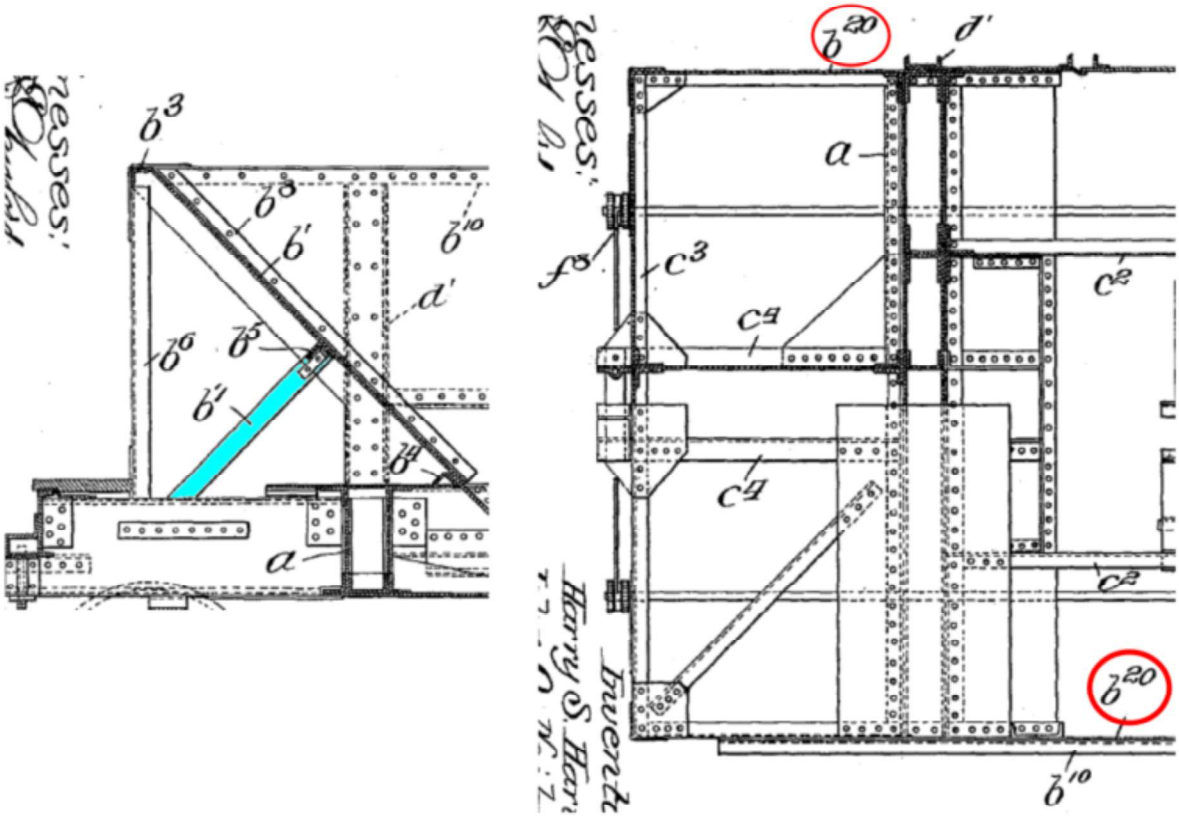
159. Petitioner asserts that claims 17-19 of the '515 Patent are obvious over Hart in view of the 1906 Cyclopedia, Wong, and Campbell '051. Based on my analysis of the '515 Patent, Hart, the 1906 Cyclopedia, Wong, and Campbell '051. I disagree. It is my opinion that Hart, the 1906 Cyclopedia, Wong, and Campbell '051, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render obvious any of claims 17-19.

1. Claim 17 ("The railroad hopper car of claim 7 wherein said first and second side walls of said hopper car define sidewalls of said hopper, and said first and second side walls include end portions that are stepped laterally inboard, and said second hollow section beam extends between said end portions of said first and second side walls that are stepped laterally inboard.")

160. Petitioner asserts that the combination of Hart and Campbell '051 meets this claim limitation. As recognized by Petitioner, Campbell '051 includes an "offset section 18 for the purpose of accommodating the usual ladder rungs 23 within the permissible overall width of the car," Ex. 1012 at 1:90-94; Petition at 69.

161. However, Petitioner does not explain how incorporating Campbell '051's stepped sections would impact the operation, performance, or other

characteristics of the rail car of Hart. Petitioner takes the position that Hart's inclined brace b^7 is located on side sill b^{20}. Petition at 40 ("inclined brace b^7 is mounted to the side sill and extends upwards in a vertical plane, without extending laterally inward into the machinery space or above the shear plate.").



Ex. 1008 at Figs. 1, 3 (blue highlighting to show b7, red circles to show b20).

162. If Petitioner's proposed modification were to be adopted, incorporating Campbell '051's stepped sections into Hart would require the movement of inclined brace b^7 based on where the Petitioner and Ahmadian believe the brace b^7 is located. A POSITA would not have expected the modification of moving and reconfiguring the structural supports in Hart, as

proposed by Petitioner, because the Hart car did not need safety appliances such as end or side ladders because the entire railcar itself was not that tall. In other words, personnel could access the top most portions of the car by standing on the longitudinally outboard extent of the draft sill or other related outboard features and would be able to easily access all top-most components of the railcar. No POSITA would consider making such a change to the railcar defined by Hart.

163. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

2. Claim Limitation 18f ("a first laterally extending reinforcement mounted cross-wise to said first end slope sheet adjacent to said shear plate; said shear plate of said first end section being connected to said first laterally extending reinforcement; said first end slope sheet of said first end section being connected to said first laterally extending reinforcement; said first laterally extending reinforcement defining part of a first hollow section beam extending across said hopper car between said first and second side walls")

164. The Petition relies on its discussion of claim limitation 7f for this claim limitation. For the reasons I discuss above in Section IV.G.1, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

3. Claim Limitation 18h ("said hopper car has second, and third hollow section beams as well as said first hollow section beam, said first, second and third hollow section beams extending thereacross between said first and second side walls thereof; said first end slope sheet has an uppermost margin, and said second hollow section beam runs along said uppermost margin of said first end slope sheet; said third hollow section beam is located intermediate said first and second hollow section beams")

165. The Petition relies on its discussion of claim 16 for this claim limitation. For the reasons I discuss above in Section IV.G.8, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

4. Claim Limitation 18i ("said hopper car has an end post mounted over said draft sill, said end post being located longitudinally outboard of said main bolster of said first end section; said end post extends upwardly to meet said second hollow section beam")

166. The Petition relies on its discussion of claim limitation 1f and claim 14 for this claim limitation. For the reasons I discuss above in Section IV.C.2, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

5. Claim 19 ("The railroad hopper car of claim 18 wherein: there is an end wall that extends from sidewall to sidewall; said end wall has an upper portion that has an upper margin terminating at a top chord of said end wall; said first end slope sheet has an uppermost margin, said uppermost margin of said first end slope sheet meeting said end wall along a first juncture; said end wall has a lower portion extending below said first juncture, said lower portion being bent to define a portion of said second hollow section beam; and said end post extends past said second hollow section beam along said end wall to mate with said top chord of said end wall")

167. The Petition relies on its discussion of claim 26 for this claim limitation. For the reasons I discuss above in Section IV.G.16, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

I. Ground 7

168. Petitioner asserts that claims 21, 22, and 29 of the '515 Patent are obvious over Hart in view of the 1906 Cyclopedia, Wong, and Schuller. Based on my analysis of the '515 Patent, Hart, the1906 Cyclopedia, Wong, and Schuller, I disagree. It is my opinion that Hart, the 1906 Cyclopedia, Wong, and Schuller, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render any of claims 21, 22, or 29 obvious.

1. Claim 21 ("The railroad hopper car of claim 20 wherein: said hopper has a movable door by which egress of lading is governed; said hopper car has an actuator and a drive train, said drive train being connected between said actuator and said door, said actuator being operable to move said door; and said actuator is mounted in said machinery space")

169. The Petition relies on its discussion of claim 3 for this claim limitation. For the reasons I discuss above in Section IV.D.1, the asserted art does not teach, suggest, or render obvious this claim limitation. In addition, as discussed with respect to claim 1, neither Hart nor any of the asserted art teaches the claimed "machinery space." *See* Section IV.C.5.

170. The Petition and Dr. Ahmadian provide no rationale for why a POSITA would understand the pneumatic actuator would "need to be mounted in the machinery space." Petition at 88; Ex. 1003 at ¶ 117. For example, Schuller mounts its pneumatic actuator at the end of its rail car, which decidedly does not have the claimed "machinery space."

171. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

2. Claim 22 ("The railroad hopper car of claim 21 wherein said first side wall has an aperture formed therein at a location higher than said shear plate, lower than said first end slope sheet, and longitudinally inboard of said first corner post")

172. The Petition relies on its discussion of claim 23 for this claim limitation. For the reasons I discuss above in Section IV.G.12, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

3. Claim 29 ("The railroad hopper car of claim 28 wherein: said first side wall has an aperture formed therein in a location that is longitudinally inboard of said first corner post, above said shear plate, and leeward of said first end slope sheet; said hopper has a movable gate operable to govern egress of lading from said hopper; there is an actuator mounted in said machinery space, and a drive train connecting said actuator to said gate.")

173. The Petition relies on its discussion of claims 21 and 22 for this claim limitation. For the reasons I discuss above in Sections IV.I.1 and IV.I.2, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

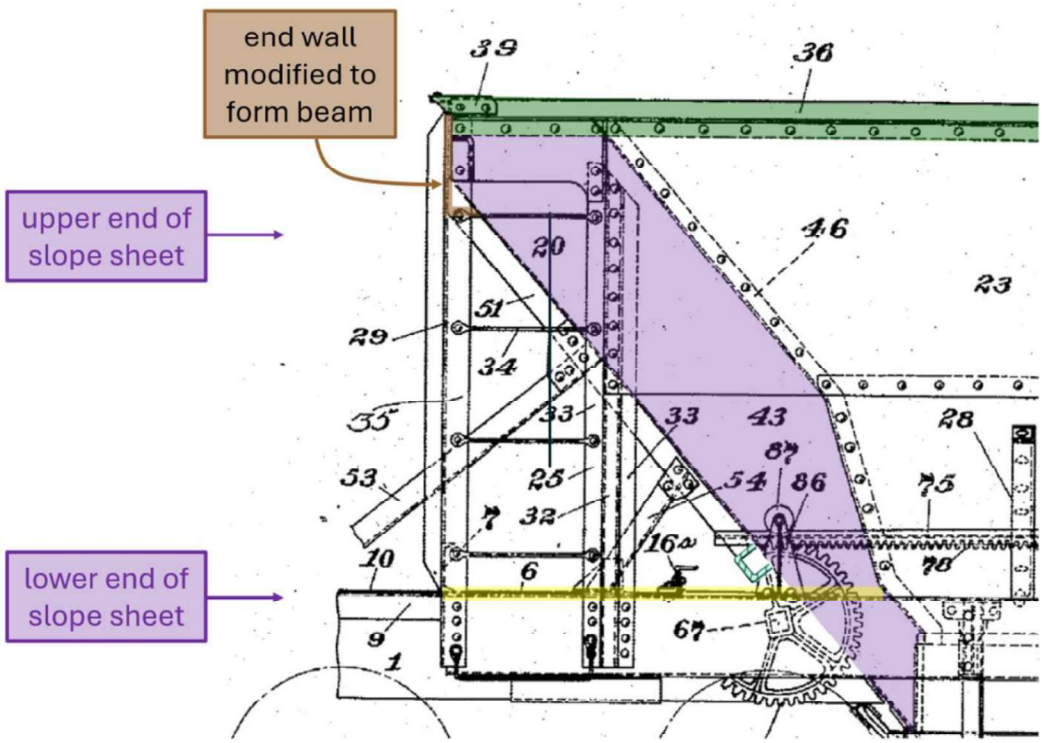
J. Ground 8

174. Petitioner asserts that claims 32-34 of the '515 Patent are obvious over Lindström in view of Wong, Ratcliffe 1, and Hart. Based on my analysis of the '515 Patent, Lindström, Wong, Ratcliffe 1, and Hart, I disagree. It is my opinion that Lindström, Wong, Ratcliffe 1, and Hart, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render obvious any of claims 32-34.

1. Claim Limitation 32g ("there being a first end wall extending between said first and second side walls; said first end slope sheet having an uppermost margin, said uppermost margin meeting said first end wall at a first junction; said hopper car having a first beam extending cross-wise between said first and second side walls at said first junction of said uppermost margin of said first end slope sheet and said first end wall, said first beam being a beam of hollow section")

175. As I explain above in Section IV.G.2, a POSITA would not look towards Wong to improve the end structure of Lindström.

176. A POSITA would not have "slightly lengthened and bent" Lindström's end wall based on Wong as proposed by the Petition. Petition at 95-97; Ex. 1003 at ¶¶ 125-28. Neither Petitioner or Dr. Ahmadian explain, nor would it bet clear to a POSITA, how this would have been accomplished given that outwardly extending stiffening flanges 51 appear to be directly in the way of the proposed modification:



Petition at 107. Additionally, items 29, 53 and 54 would need to be changed or re-dimensioned according to Figure 2.

177. A POSITA would not, and would not be motivated to, simply pick and choose pieces from the asserted art in the manner suggested by Petitioner and Dr. Ahmadian, nor would there be any reasonable expectation of success in any resultant modification. Wong's end structure is a complex, interrelated structure that transfers forces through the interrelated structure, including the beams 36, thereby informing a POSITA not to take a single bent feature from that complex structure and incorporate it into Lindström, which uses a different structure based on struts 53 and 54. Additionally, the proposed modification fails to take into consideration the other modifications Petitioner and Dr. Ahmadian propose making

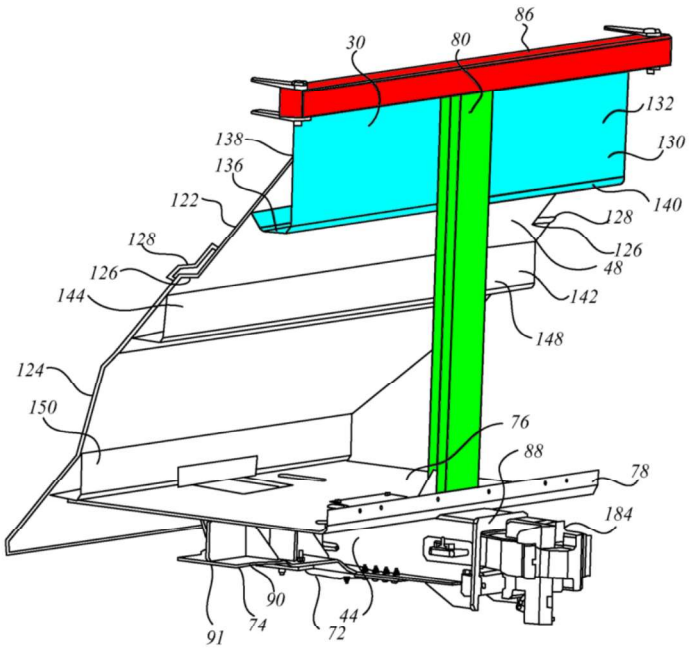
to Lindström in view of Ratcliffe 1 and Hart and the impact or effect of those modifications taken together with incorporation of the bent feature in Lindström that Petitioner and Dr. Ahmadian propose.

178. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

2. Claim Limitation 32i ("said first end section includes an end post extending upwardly of said draft sill, said end post being mounted above said draft sill distant from said truck center and proximate said striker end; said end post extending upwardly to meet said first beam and said top chord")

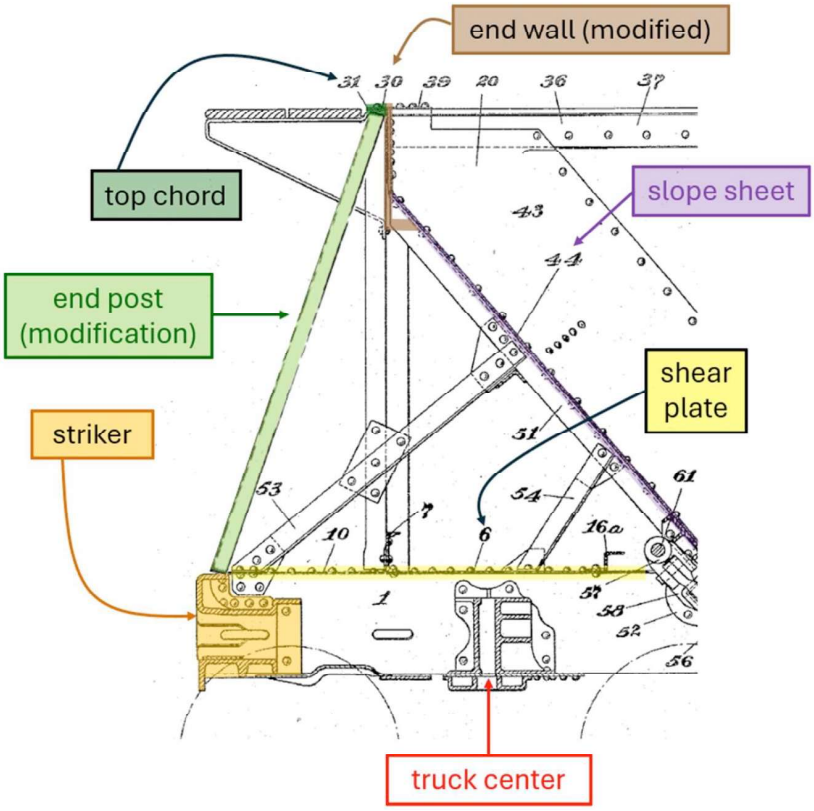
179. Petitioner's proposed modification of Lindström with Ratcliffe 1's Tarmac Stone Hopper does include an "end post extending upwardly to meet said first beam and said top chord." The Ratcliffe car (Dr. Ahmadian Decl. at 85) does not have an end post that connects to such a lateral beam because such a lateral beam is neither present in Ratcliffe nor could likely fit given all of the other structure towards the top.

180. The '515 Patent explains that vertical leg 132 and bent flange 136 form a substantially triangular closed section defining a laterally extending end slope sheet reinforcement beam 140:



'515 Patent at Fig. 3a (annotated to highlight end post 80 in green, beam 140 in blue, and top chord 86 in red); *id.* at 16:41-53. End post 80 is welded to vertical leg 132 of beam 140. '515 Patent at 16:52-53.

181. The modified version of Lindström proposed by Petitioner does not have an "end post extending upwardly to meet said first beam." Instead, the structure that Petitioner identifies as an end post meets the structure that Petitioner identifies as a top chord and a closed portion of what Petitioner identifies as the end wall, not any structure that could be understood to correspond to the claimed first beam. Neither the Petitioner nor Dr. Ahmadian address this issue. Petition at 98-100; Ex. 1003 at 130-31.

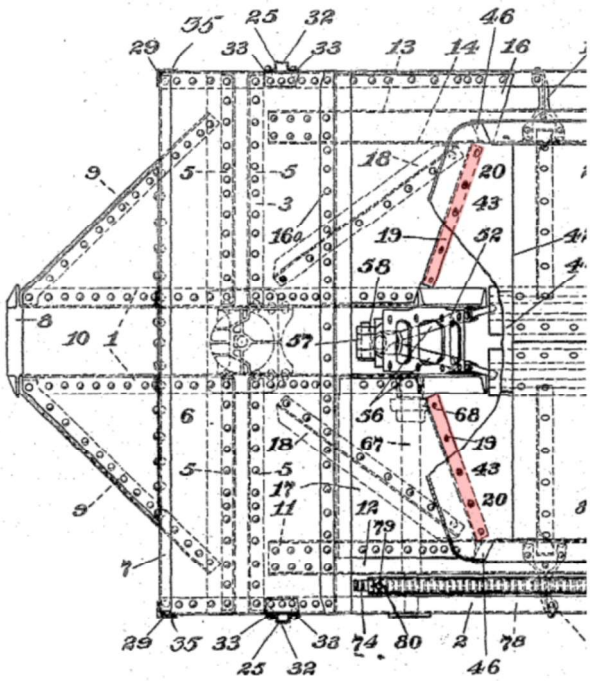


182. It is unclear why Petitioner makes this modification to Lindström since strut 53 is present in Lindström and prevents a combination where an end post could meet both the first beam and the top chord. Moreover, the proposed end post added to Lindström does not run flush against the end wall nor is it connected to the end wall.

183. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

3. Claim Limitation 32k ("said hopper car having a second beam extending cross-wise between said first and second side walls, said second beam being a beam of hollow section; and said second beam being connected to said shear plate")

184. Petitioner picks the hollow beam b4 from Hart to add into Lindström. As recognized by Petitioner, the beam b4 would need to be split to accommodate the structure of Lindström. Petition at 101-02 ("The beam could be formed of two parts and placed just longitudinally outboard of the flanges 19 that connect the slope sheet and the shear plate."). However, such a combination would not result in a "second beam extending cross-wise between said first and second side walls." Instead, as discussed by Petitioner, it would be only along flanges 19, which do not extend between the first and second side walls:



Ex. 1005 at Fig 3 (highlighting flanges 19 of the structure Petitioner identifies as the shear plate, longitudinally interior of where Petitioner would put the structure that Petitioner identifies as the second beam, in red).

185. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art teaches or suggests this claim limitation.

4. Claim 33 ("The railroad hopper car of claim 32 wherein a third beam is mounted across said first end slope sheet intermediate said first and second beams.")

186. Petitioner and Dr. Ahmadian propose taking a third crosswise beam from Hart or Wong to presumably incorporate that into Lindström, despite not explicitly stating this and showing a picture of Hart. For the reasons discussed above, with respect to claims 15 and 16, a POSITA would not look towards the structures of Hart or Wong and seek to combine them with Lindström. *See* Sections IV.G.7 and IV.G.8. Moreover, Petitioner and Dr. Ahmadian do not provide an explanation, or an illustration that would explain, how they propose to modify Lindström. Instead, they show a modified version of Hart and cite to Wong. Petition at 103; Ex. 1003 at ¶ 134. Therefore, it is unclear how they propose to modify, or where the modification would be made in, Lindström (or if a third beam would even fit). They also do not explain why a POSITA would choose to incorporate a third beam in Lindström. Petitioner's proposed modifications to the asserted art are unclear, and it is unclear from the proposed modifications, how all

the modifications to the asserted art would, or could, come together to arrive at a resultant rail car, much less the invention of claim 33.

187. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

5. Claim 34 ("The railroad hopper car of claim 33 wherein said third beam is formed of a structural member mounted toes-in against said first end slope sheet to define an hollow section.")

188. For the reasons I discuss above with respect to claims 15 and 16, a POSITA would not look towards the structures in Wong and seek to combine them with Lindström. *See* Sections IV.G.7 and IV.G.8. Having reviewed the Petitioner and Dr. Ahmadian's declaration, I see no reasonable basis for a POSITA to make the proposed combination.

189. As explained in Section IV.J.4, the Petitioner and Dr. Ahmadian fail to explain how they propose to modify that asserted art – for example, where in Lindström the proposed third beam would/could be placed, or that a third beam would even fit. This conclusion cannot be made by looking at poor quality incomplete drawings and arcane descriptions. Having reviewed the Petition and Dr. Ahmadian's declaration it remains unclear to me why a POSITA would choose to incorporate the proposed third beam in Lindström. Petitioner, with no opinions from Dr. Ahmadian regarding this claim, does not describe or explain why the

third beam added to Lindström would be mounted toes-in and define a hollow section.

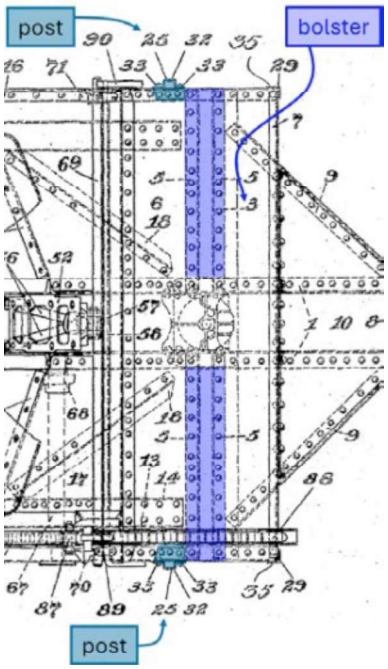
190. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

K. Ground 9

191. Petitioner asserts that claims 35-44 of the '515 Patent are obvious over Lindström in view of Wong, Ratcliffe 1, Hart, and the 1946 Cyclopedia. Based on my analysis of the '515 Patent, Lindström, Wong, Ratcliffe 1, Hart, and the 1946 Cyclopedia, I disagree. It is my opinion that Lindström, Wong, Ratcliffe 1, Hart, and the 1946 Cyclopedia, whether taken alone or in the combination proposed by Petitioner, do not teach, suggest, or render obvious any of claims 35-44.

1. Claim 35 ("The railroad hopper car of claim 32 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom to meet said first end slope sheet")

192. Petitioner and Dr. Ahmadian admit that Lindström's posts are "positioned immediately adjacent the bolster ends," not "mounted to said first and second ends of said main bolster and extend upwardly therefrom to meet said first end slope sheet" as the claim requires:

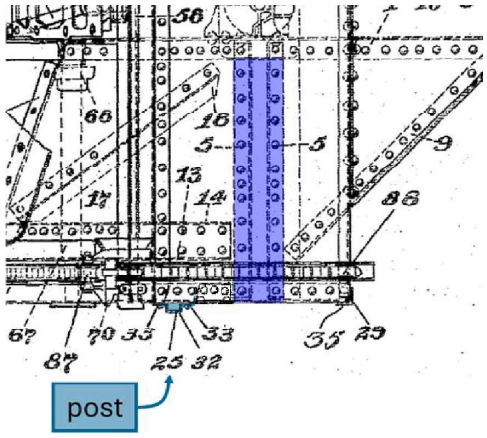


Petition at 104-05; Ex. 1003 at ¶ 135. It is unclear why the Petition and Dr. Ahmadian shaded the top of the sill behind the post 25 as part of the post 25. This appears to improperly suggest the post 25 is "adjacent" to the bolster, which it clearly is not.

193. Petitioner and Dr. Ahmadian suggest that a POSITA would understand that Lindström's posts 25 "extend upwardly from the ends of the bolster." Petition at 106; Ex. 1003 ¶ 138. However, Petitioner and Dr. Ahmadian provide no support for this conclusory statement. In fact, nothing in the '515 Patent would suggest that a POSITA would consider Lindström's posts as extending upwardly from the ends of the bolster. Lindström Figure 3 clearly shows that said corner posts do not line up with the bolster, in contradiction to the clear language of claim 35 and contrary to Dr. Ahmadian's position that "it would have been

obvious … to move Lindström's posts 25 slightly inward longitudinally." This is neither obvious nor trivial as such a move upsets the load transfer between these members as intended by Lindström. It is also unclear from the figures in Lindström if such an inward move could even be made without significantly changing the rest of the end of car structure.

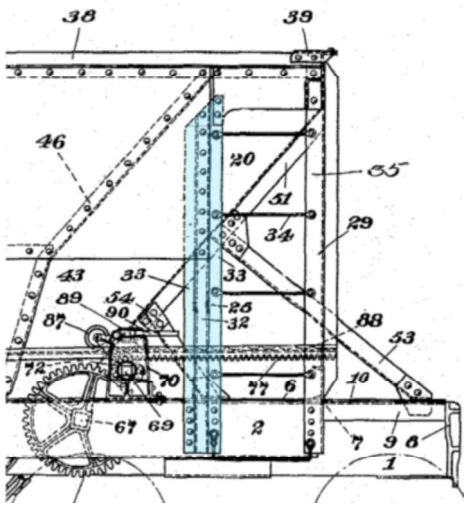
194. Recognizing the problem with Lindström, Petitioner and Dr. Ahmadian suggest moving Lindström's posts "slightly inward longitudinally." Petition at 106; Ex. 1003 at ¶ 138. Such a modification would exacerbate the problem with Lindström, as shown below:



Ex. 1005 Fig. 3 (modified).

195. To the extent that Petitioner intended to suggest mounting the post over the bolster, it provides no motivation to make this change based on Hart or any of the other asserted art. A POSITA would not seek to make this modification because it would reduce the width of Lindström's ladder, which would make it

difficult and dangerous to use, and would run afoul of safety regulations and conventions setting ladder dimensions:



Ex. 1005 at Fig. 2 (annotated to highlight post 25).

196. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

2. Claim 37 ("The railroad hopper car of claim 35 wherein: a machinery space is defined above said shear plate and under said first end slope sheet; said first side wall has an aperture formed therein in a location that is longitudinally inboard of said first corner post, above said shear plate, and leeward of said first end slope sheet; said hopper has a movable gate operable to govern egress of lading from said hopper; there is an actuator mounted in said machinery space, and a drive train connecting said actuator to said gate")

197. Petitioner takes the position, without expert opinions from Dr. Ahmadian, that Lindström discloses the claimed aperture. However, as I discussed

above in Section IV.G.12, Petitioner is incorrect in its assumption that a POSITA would understand the corner post is part of the sidewall. I see no reasonable basis for Petitioner's assertion.

198. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

3. Claim 38 ("The railroad hopper car of claim 32 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom; said first side wall has an opening formed therein, said opening being located longitudinally inboard of said first corner post, upward of said shear plate, leeward of said first end slope sheet")

199. The Petition relies on its discussion of claim 37 for this claim. For the reasons I discuss above in Sections IV.K.2, the asserted art does not teach, suggest, or render obvious this claim limitation. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim.

200. Petitioner does not explain, and I see no reason, why "said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom." For the reasons I discuss above, with respect to claim 35, it does not. *See* Section IV.K.1.

201. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

4. Claim 39 ("The railroad hopper car of claim 32 wherein said draft sill has a longitudinally outboard end, and a striker plate mounted at said longitudinally outboard end; and said draft sill has a length between said truck center and said striker plate that is less than 50 inches")

202. Petitioner and Dr. Ahmadian suggest modifying Lindström to have the 1946 NSC Ore Car's striker length. A POSITA would not seek to modify Lindström to have the specific distance between NSC Ore Car's striker and truck center. Contrary to Ahmadian's position on pages 102-103 of his report, "making necessary adjustments" to force this dimension to either be a certain value (like from the NSC Ore Car) or to be less than 50 inches as defined in claim 39 is neither a "routine design choice" nor would it be a trivial exercise. The distance between the striker and centerline of the truck affects railcar curve negotiation. The centerline of the truck also must coincide with the centerline of the body bolster, which is not easy to move unless the entire length dimension of the railcar can be altered without other issues arising. Dr. Ahmadian's claim is hand-waving at best and no POSITA would do as he suggests.

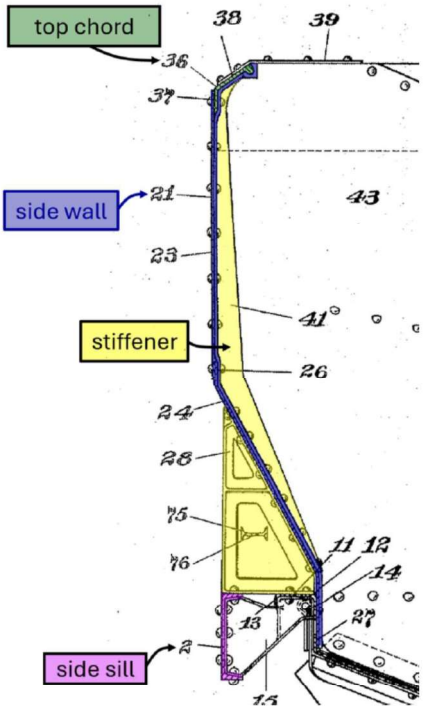
203. First, the designs of the Lindström and the NSC Ore Car's end sections are completely different, with Lindström's tapering out to the end and the

NSC Ore Car having a boxed end. Second, Dr. Ahmadian and Petitioner overlook the significant adjustments that would need to be made to modify Lindström to include the NSC Ore Car's dimensions. Lindström uses a much longer end section than the NSC Ore car, presumably to accommodate strut 53 whose bottom end connects near the end of the car. Moreover, the '515 Patent calls out the "abnormally short distance[s] from the striker 88 to the truck center," informing a POSITA that it is not the "routine design choice" asserted by Petitioner and Dr. Ahmadian.

204. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

5. Claim Limitation 40b ("said first and second side walls each have a respective side sill and a top chord; said first side wall extends from said side sill to said top chord")

205. The Petition and Dr. Ahmadian do not establish, and do not provide any reasonable basis to conclude, that the claimed "first side wall extends from said side sill to said top chord" is taught by Lindström. Instead, as shown in the figures depicted in and relied on by the Petition, the structure that the Petition identifies as the sidewall in the asserted art never meets the structure it identifies as the side sill:



Lindström Fig. 5

Lindstrom Fig. 5 (annotated).

206. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or the proposed combination, teaches, suggests, or renders obvious this claim limitation.

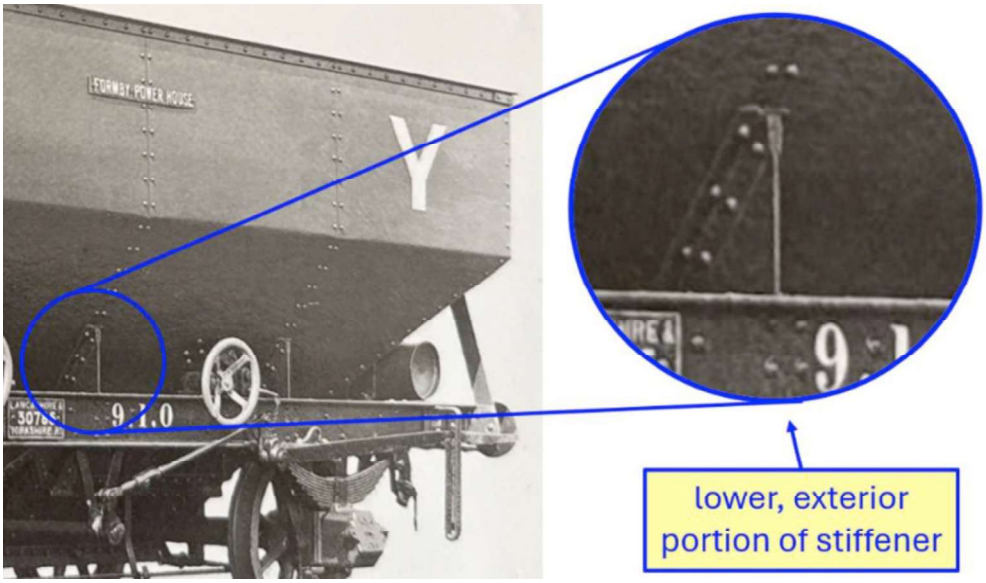
6. Claim Limitation 40h ("said side wall stiffener having web continuity between said first and second portions thereof.")

207. The Petition appears to assert that "web continuity" only requires that claim elements be "in the same vertical plane." However, I am unable to find any support in the Petition or Dr. Ahmadian's declaration for this proposition.

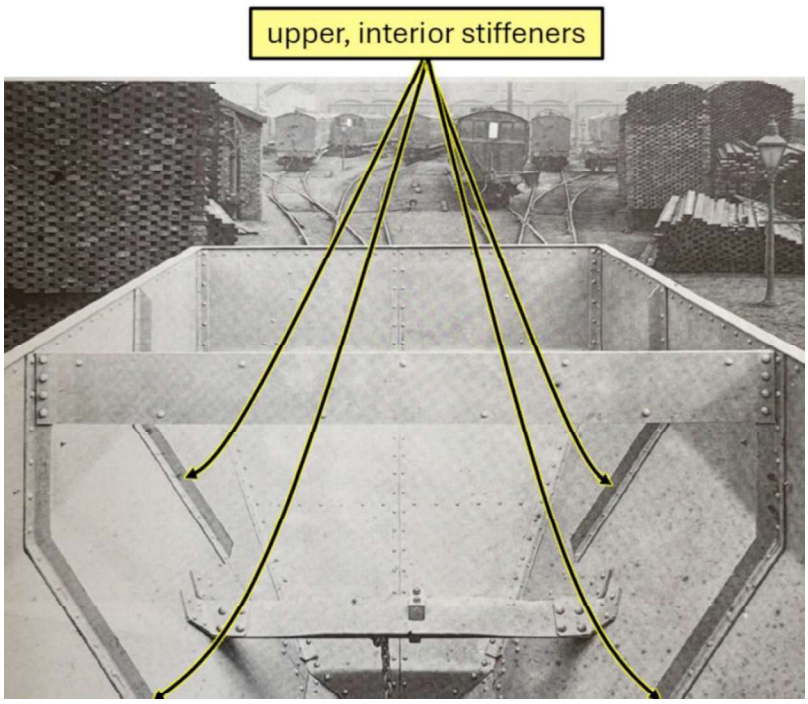
208. The sidewall stiffening elements from Lindström and the NSC Ore Car do not have webs. The drawings of both Lindström and the NSC Ore Car

appear to have hat sections that are fastened to the side wall. There is no concept of a web that is perpendicular to the flange that would be considered to be side sheet of the car. *See* '515 Patent at 15:59-62 ("In this arrangement, the vertical stiffener, 102, acts as the web of a T-section, and the local region of the wall section to which it is joined functions as the flange of that T-section."). A POSITA would not conflate or otherwise suggest that what is rendered in the Lindström and the NSC Ore Car is the same thing as what is claimed in the '515 Patent. The '515 Patent teaches that the web of the stiffener is matched to the side wall as if the side wall were the flange of an I-beam, which is unique to the '515 Patent compared to the asserted art to the extent the drawings can be properly interpreted.

209. The L&Y Ore Car described in Coates shows an example of the same general type of L-brackets used in Lindström and the NSC Ore Car:



Ex. 1007 at 1 (annotated).



Ex. 1007 at 1 (annotated).

210. After reading the Petition and Dr. Ahmadian's report in their entireties, and analyzing the asserted art, I am unable to find any basis that would reasonably suggest to a POSITA that any combination of the asserted art teaches, explicitly or inherently, or would have rendered obvious the claimed "sidewall stiffener having web continuity" in concert with the description of how the stiffener web is linked to the side sheet as flange, together with the remaining elements and limitations this claim.

211. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

7. Claim 41 ("The railroad hopper car of claim 40 wherein said first and second portions of said side wall stiffener are substantially co-planar, and are substantially vertically aligned when seen in a sectional view looking along the car.")

212. Petitioner relies on Lindström for this claim, however, it appears that Petitioner explicitly doubted that Lindstrom's side wall stiffeners are substantially co-planar and vertically aligned in its discussion of claim limitation 40h. *See* Section IV.K.6.

213. Because Petitioner has not established, and a POSITA would not have any reasonable basis to conclude, that Lindström teaches or suggests substantially co-planar and vertically aligned sidewall stiffeners, there is no reasonable basis to conclude that Lindström, alone or in any of the proposed combinations, teaches this claim limitation.

214. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

8. Claim 42 ("The railroad hopper car of claim 41 wherein said first side wall has a third region intermediate said first and second regions, said third region including a side sheet transition portion passing across said side wall stiffener from an inboard margin thereof to an outboard margin thereof, and said stiffener having vertical web continuity through said transition portion")

215. For the reasons I discuss above with respect to claim 40, the Petition never establishes, and a POSITA would have no reasonable basis to conclude, that the structures in Lindström's Petitioner identifies as sidewall stiffeners have "webs". *See* Section IV.K.6.

216. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

9. Claim 43 ("The railroad hopper car of claim 40 wherein: said first side wall has a third region intermediate said first and second regions, said third region including a side sheet transition portion passing across said side wall stiffener from an inboard margin thereof to an outboard margin thereof; said hopper includes first and second sloped side sheets; and said first sloped side sheet meets said first side wall at said transition portion")

217. A POSITA would understand that the claimed sloped side sheet would be a separate feature from the claimed side wall. As discussed in the '515 Patent, "The upper margin of the side slope sheet 50 of the hopper discharge section is welded to the lower margin of the inclined or sloped portion 98, such that the

structure presents a continuous sloped surface for containing, and then slidingly discharging, particulate lading." '515 Patent at 15:51-55.

218. This understanding is confirmed by Figs. 2b and 3b of the '515 Patent (reproduced below with annotations). Figure 2b is a view of the sidewall of the railcar from the outside, and shows the bottom flange 100 of the side sheet (shown in light blue) in line with the apertures 114 (red):

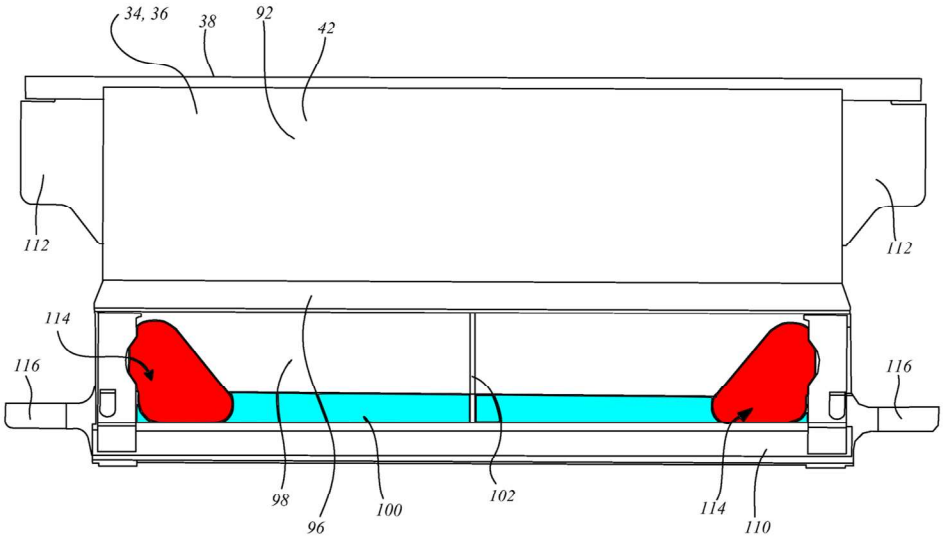


Figure 2b

('515 Patent at Figs. 2b, showing bottom lower leg 100 in blue and apertures 114 in red.) Figure 3b, is a cross-sectional view through the middle of the railcar and shows side slope sheet 50 (shown in green), with aperture 114 (red):

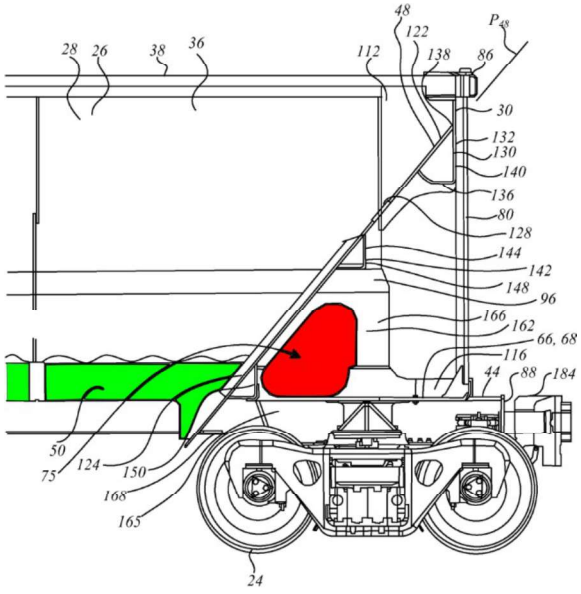


Figure 3b

('515 Patent at Figs. 3b, showing side slope sheet 50 in green, apertures 114, annotated in red.) As seen by comparing Figure 2b and 3b, the upper margin of the lower leg 100 in Figure 2b is at the same height as the upper margin of the side slope sheet 50 in Figure 3b because both are at the same height when compared to aperture 114 (annotated in red). This is consistent with the placement of the side slope sheet as shown in modified Figure 2c:

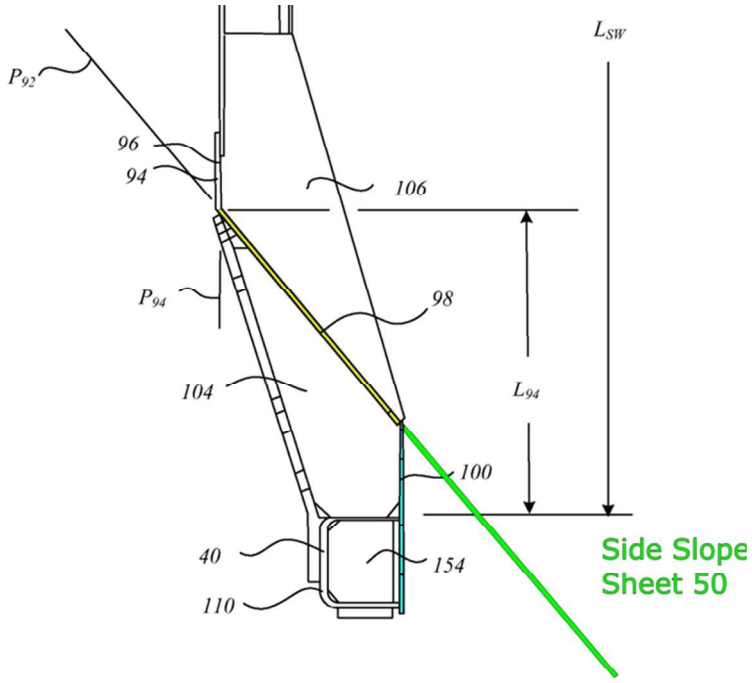


Figure 2c

'515 Patent at Fig. 2c (portion of figure showing side slope sheet annotated in green, bottom flange 100 annotated in blue, and sloped portion 98 annotated in yellow).

219. However, under Petitioner's and Dr. Ahmadian's interpretations, the claimed "sloped side sheet" is the same as the claimed "transition portion." The "sloped side sheet" cannot be the same physical structure as the "transition portion" because the "first sloped side sheet" cannot "meet" the "first sidewall at said transition portion" – they are one and the same.

220. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

10. Claim 44 ("The railroad hopper car of claim 43 wherein said first side wall has an overall height from said side sill to said top chord, L, and said transition portion is located a distance above said side sill that is in the range of ¼ to ⅔ L.")

221. I understand that patent drawings are not to be relied on as being to scale unless otherwise indicated in the specification. There is no such indication in Lindström. Petitioner and Dr. Ahmadian err in adopting dimensions from Lindström as if it was to scale.

222. Dr. Ahmadian states:

> [I]t would have been obvious to select dimensions consistent with the Lindström's drawings and with the NSC ore car for the additional reason that the precise dimensions are a matter of design choice. A POSITA would know to modify the angle of the transversely angled portion of the side sheet—thereby modifying the location of the transition portion—based on design constraints that are standard and well-understood, including maximizing hopper capacity, supporting the loads within the hopper including those seen at the slope sheet and hopper doors, and maximizing the car's efficiency in loading and discharging its intended lading. Selecting elements that are efficiently carry the loads from the longitudinal beam at the top of the hopper car to the still, aligning them co-planarly, spacing

> them properly, connecting various elements to reduce stress concentration, supporting the weights on bolsters, … are examples of engineering practices for maximizing capacity and efficiency. A POSITA is aware of and commonly employs such practices.

Ex. 1003 at ¶ 154. I disagree with this statement.

223. A POSITA would not make wholesale modifications to a rail car to obtain the claimed dimensions without first performing detailed engineering analyses to understand and confirm that such changes would be possible. Dr. Ahmadian fails to explain how having the claimed dimensions maximizes the design constraints he discusses, or that Lindström's sloped sheets are at different angles than the 1946 NSC Ore Car's.

224. In my opinion, the Petitioner and Dr. Ahmadian have not shown that the asserted art, whether taken alone or in the proposed combination, teaches, suggests, or renders obvious this claim limitation.

Executed in Chicago, IL on September 18, 2025



Mark J. Viz, Ph.D., P.E.

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FreightCar America Inc. v. National Steel Car Limited
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APPENDIX A: CURRICULUM VITAE OF MARK J. VIZ, PH.D., P.E.

IPR2025-01047 - National Steel Car Limited Exhibit 2035
FreightCar America Inc. v. National Steel Car Limited



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Professional Profile

Dr. Viz specializes in performance evaluation and mechanical analysis of railcar and aircraft structures. He also specializes in risk, reliability, and mechanical integrity assessments of a variety of process plant equipment such as pressure vessels and tanks, and certain types of transportation vessels including railcar tanks, intermodal vehicles, and over-the-road tank trailers.

Dr. Viz also has experience in component life reliability assessments, “repair or replace” risk decisions, and statistical analysis of in-service component performance. Other areas of Dr. Viz’s specific academic expertise include nonlinear finite element analysis, metal and composite material testing, fatigue and fracture mechanics, and statistical data reduction methods. He has investigated and/or consulted in matters involving railcar derailments, tank car ruptures, releases of hazardous materials in transportation, coal mining haulage accidents, rotor failures, bus rollovers, pressure vessel explosions, and other industrial accidents.

Given his expertise in engineering mechanics, Dr. Viz also performs engineering evaluations and analyses involving the mechanical performance of a variety of machines and products. Some of these devices include elements of cranes and lifting devices (e.g., wire rope failures, hydraulic and valve failures), elements of elevators, a variety of industrial machines (e.g., printing equipment, CNC machine tools, pumps, compressors), certain aspects of machine guarding and lock-out/tag-out procedures, and specialized evaluations of consumer products. Dr. Viz’s involvement in these types of cases typically involves the synthesis and execution of a variety of engineering mechanics calculations and analyses.

Prior to joining Exponent, Dr. Viz was a Product Development Engineer at the GATX Rail Corporation. His responsibilities included new rail car design and development, budget and schedule management, and sales and marketing support. Dr. Viz was also heavily involved in the regulatory environment concerning the transportation of hazardous materials in rail tank cars. Dr. Viz also served as a Specialist Engineer in the Structural Damage Technology group at the Boeing Company. He was responsible for the durability and damage tolerance analysis and testing of a wide variety of aircraft structures from wing and fuselage sections to individual fasteners. He has also taught probability, statistics, and mechanics of materials at the college level.

Academic Credentials & Professional Honors

Ph.D., Theoretical and Applied Mechanics, Cornell University, 1996

B.S., Aeronautics and Astronautics, Massachusetts Institute of Technology (MIT), 1990

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Licenses and Certifications

Professional Engineer, Illinois, #62062247

Mining Safety and Health Administration (MSHA) Part 46 and Part 48 trained

Respirator and SCBA fit-tested and trained

Prior Experience

Director of Applied Mechanics, Packer Engineering, 2001-2003

Product Development Engineer, GATX Rail, 1999-2001

Specialist Engineer - Structural Damage Tolerance, Boeing, 1997-1999

Professional Affiliations

American Society of Mechanical Engineers—ASME (member)

American Institute of Aeronautics and Astronautics—AIAA (member)

Society for Risk Analysis—SRA (member)

Publications

Viz MJ. Failure analysis in the design cycle. Presented as a guest lecture for CIV-ENG 395-0 Engineering Forensics course, Evanston, IL, April 16, 2008.

Viz MJ, Momsen RH. Reliability and risk management of railcar truck castings in high mileage, high gross rail load service: A case study. Presented at the Annual Meeting of the Society for Risk Analysis, Baltimore, MD, December 5, 2006.

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Ogle RA, Morrison III DR, Viz MJ. Emergency response to a non-collision HAZMAT release from a railcar. Presented at the 19th Annual CCPS International Conference, Emergency Planning: Preparedness, Prevention and Response, American Institute of Chemical Engineers, Orlando, FL, June 2004.

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Viz MJ, Zehnder AT. Fatigue crack growth in 2024-T3 aluminum under tensile and transverse shear stresses. Proceedings, FAA/NASA International Symposium on Advanced Structural Integrity Methods for Airframe Durability and Damage Tolerance. NASA CP-3271, pp. 891-910, 1992

Viz MJ, Zehnder AT, Ingraffea AR. Fatigue fracture in thin plates subjected to tensile and shearing loads: Crack tip fields, j integral and preliminary experimental results. Proceedings, 7th International Congress on Experimental Mechanics, Society of Experimental Mechanics; 1992: 44-50.

Project Experience

Directed, managed, and performed numerous rail tank car failure cause and origin investigations, most involving the release of hazardous materials. Projects typically involve extensive field investigations, including confined space entry of tank cars, mechanical and metallurgical analysis, mechanical integrity assessments, non-destructive examination, and sample collection.

Managed and performed numerous rail tank car loading and unloading incident investigations, often involving worker injuries or fatalities.

Investigated the unintentional uncoupling of mining service cars in a Virginia underground coal mine. The uncoupling resulted in a runaway car situation that lead to the fatalities of two miners. Project work included incident modeling and reconstruction, performance calculations, and inspections.

Actively directing a lengthy study involving the investigation of railroad track ballast fouling and coal dust mitigation evaluations for coal transport out of the Powder River Basin in Wyoming. Project work includes measurement of fugitive dust emissions, static and dynamic (over-the-road) monitoring of dust loss from railcars, cost analysis for proposed mitigation techniques, and analysis of health and safety issues.

Managed and performed projects for multiple clients involving the mechanical integrity assessment and fitness-for-service evaluations of railcar truck castings (bolsters and side frames). These projects have typically involved the development and implementation of non-destructive examination procedures for both on-car and off-car examination, cyclic fatigue testing, mechanical and metallurgical testing, engineering evaluation of test results with respect to mechanical performance, and development of engineering plans to manage fleet components over the projected remaining useful service life. Have presented findings to the Association of American Railroads (AAR) for multiple clients.

Performed risk, reliability, and mechanical integrity assessments for a variety of process plant equipment including piping and tanks. Select assignments have involved flash train tanks at a bauxite to alumina processing plant, piping and vessels at a district cooling ammonia refrigeration plant, liquid carbon dioxide

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storage tanks, baghouse equipment at cement kilns, and a variety of other equipment subject to OSHA PSM (process safety management) and EPA RMP (risk management plan) regulations.

Directed, managed, and performed numerous incidents involving the release of hazardous materials from transportation vessels, including rail tank cars, intermodal containers, and over-the-road tank trailers. Projects typically have involved extensive field investigations, including confined space entry of tank cars, mechanical and metallurgical analysis, mechanical integrity assessments, non-destructive examination, and sample collection.

Performed design evaluation and risk assessment of a manufacturer's new product offering that provides GPS location and condition monitoring of railcars while in-transit. System includes remote sensing, GPS and satellite uplink equipment, all packaged in a field-hardened package. Project work included FMEA (failure modes and effects analysis), reliability modeling, and predictions for warranty structuring and material compatibility analyses.

Performed mechanical performance and stress analysis calculations for a fleet of coal railcars that exhibited top chord and side sheet buckling failures. The project involved performing detailed field inspections of the damaged railcars, finite element analysis (FEA) of the cars, and a determination of the in-service loads that were needed to produce the exhibited damage.

Managed and performed a collision damage assessment and engineering repair oversight for a major accident involving a monorail train in the Pacific northwest. Project work included responsibility for oversight of repair plans, mechanical contractor selection and qualification review, quality assurance oversight, schedule analysis, and general technical consulting. Project involved extensive field work and multiple presentations to technical staff and insurance adjusters.

Performed numerous mechanical performance analyses/evaluations for a variety of machines and products including:

- Manufacturing machinery (printing and binding equipment, forming and cutting machines, product conveying equipment, certain types of CNC machine tools
- Elements of machine guarding and lock-out/tag-out procedures (drum foamers, printing and binding equipment, packaging equipment)
- Elements of crane and lifting devices (e.g., scissor lifts), including wire rope failures, hydraulic cylinder failures, holding valve failures, and stability issues
- Elements of consumer product performance including structural performance and mechanical response.

Additional Education & Training

Completion of Highway-Rail Grade Crossing Safety course offered through the University of Wisconsin - Madison, 12-13 November 2019

Completion of Aircraft Accident Investigation Orientation for Aviation Professionals course offered by the NTSB, 27-28 October 2021

Completion of Accident Investigation Orientation for Rail Professionals course offered by the NTSB, 8-10 November 2021

Completion of Ethics for Engineers course offered by ASME, 5 January 2022

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APPENDIX B: TESTIMONY LIST OF MARK J. VIZ, PH.D., P.E.

IPR2025-01047 - National Steel Car Limited Exhibit 2035
FreightCar America Inc. v. National Steel Car Limited

Mark J. Viz, Ph.D., P.E. – Testimony List (eight years prior to 18 August 2025)

DEPOSITIONS

1. George Holloway and Georgia Holloway v. Harbor Freight Tools USA, Inc., United States District Court for the Western District of Missouri, Southwestern Division, No. 3:15-CV-05047-DPR, 28 March 2017.

2. Milton Banks, Jr. v. Hiab USA, Inc. and Deep South Equipment Co., United States District Court for the Middle District of Louisiana, No. 3:15-CV-00263, 6 April 2017.

3. George Holloway and Georgia Holloway v. Harbor Freight Tools USA, Inc., United States District Court for the Western District of Missouri, Southwestern Division, No. 3:15-CV-05047-DPR, 8 May 2017, (second deposition for this matter).

4. Colette Carpenter, individually and as Administrator of the Estate of Clayton O. Carpenter, deceased; Jon Ternstrom, an individual; Maria Ternstrom, an individual; Cameron Witzler, an individual; and Michelle Witzler, an individual v. Sikorsky Aircraft Corporation, a Delaware corporation; Sikorsky Support Services, Inc. dba Sikorsky Aerospace Maintenance, a Delaware Corporation, United States District Court, District of Connecticut, No. 3:15-CV-01582-JBA, 20 December 2017.

5. Matthew Mosley v. Johnny Scoggins; Purenergy Operating Services, LLC; StoneAge, Inc.; Jetstream of Houston, LLP; Federal Signal Corp., State Court of Fulton County, State of Georgia, No. 15EV003510, 25 January 2018.

6. Ruben Lopez and Carmen Lopez, Husband and Wife, v. DMP Corporation, Alphatronics Engineering, Alphatek of Texas, Inc., Illinois Crane, Inc., and All-Brite Anodizing Co., Circuit Court of Cook County, Illinois, County Department, Law Division, No. 14 L 7532, 8 February 2018.

7. Timothy Juve Jr., by and through his legal guardian, Timothy Juve, Sr., v. Premier Tech Technologies, Ltd., f/k/a Premier Tech Ltd., d/b/a Premier Tech, Premier Tech Chronos, Premier Tech, Inc., and Premier Tech Horticulture, v. Pine Products, Inc., United States District Court, District of Minnesota, Court File No. 0:17-CV-04545 (DWF/LIB), 12 July 2019.

8. Martin McCallion v. Michael Nemlich, Circuit Court of Cook County, Illinois, County Department, Law Division, No. 2017 L 001387, 16 July 2019.

9. Emma Schmidt and Hallie Meyer v. Conagra Foods, Inc., United States District Court, District of Connecticut, No. 3:14-CV-01816 (SRU), 26 July 2019.

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10. Southern California Regional Rail Authority v. Hyundai Rotem Company, Raul V. Bravo + Associates, Inc., and DOES 1 through 10, United States District Court, Central District of California, No. 16-cv-08042-JAK (JEMx), 28 August 2019.

11. Korean Air Lines Co., Ltd. (Claimant) v. Greenpoint Technologies, Inc. and Aviation Technical Services (Respondents), International Centre for Dispute Resolution, No. 01-19-0001-7823, 15 December 2020.

12. GATX Corporation v. Georgia Power Co., United States District Court, Northern District of Georgia, Atlanta Division, No. 1:19-CV-04790-AT, 24 June 2021.

13. Metrolink Train Accident Cases, Case No. 4889, Superior Court of the State of California, County of Los Angeles, Central District, 17 May 2022.

14. Jennifer Barr, as Personal Representative of the Estate of Matthew Barr, Deceased, v. Walter Matisiak, James Blase, Progress Rail Locomotive, Inc., Progress Rail Services Corporation, Progress Rail Welding Corporation, Progress Rail Equipment Leasing Corporation, and Caterpillar, Inc., Circuit Court of Cook County, Illinois, County Department, Law Division, No. 2021 L 007441, 14 March 2024.

15. Kyle Phillips v. Pioneer Pipe, Inc. and Constellium Rolled Products Ravenswood, LLC, Circuit Court of Jackson County, West Virginia, Case No. 23-C-39, 11 July 2024 (first).

16. Kyle Phillips v. Pioneer Pipe, Inc. and Constellium Rolled Products Ravenswood, LLC, Circuit Court of Jackson County, West Virginia, Case No. 23-C-39, 30 August 2024 (second).

17. Dalton Merritt v. BASF Corporation and GATX Corporation, United States District Court, Southern District of Ohio, Cincinnati Division, Case No. 1:21-cv-00067-DRC, 4 April 2025.

18. Rodney Romans and Regina Romans v. SWVA, Inc. d/b/a Steel of West Virginia, Inc., United States District Court, Southern District of West Virginia, Huntington Division, Case No. 3:24-cv-00301-RCC, 25 July 2025.

TRIAL/ARBITRATION

1. Martin McCallion v. Michael Nemlich, Circuit Court of Cook County, Illinois, County Department, Law Division, No. 2017 L 001387, *jury trial*, 29 July 2019.

2. Airbus SAS (France), Airbus Operations GmbH (Germany), Airbus Operations SL (Spain), Airbus Operations SAS (France), Airbus Operations Limited (United Kingdom), Airbus Defence and Space GmbH (Germany) (Claimants) v. Howmet Aerospace Inc. (USA), Howmet Europe SARL (Switzerland), Arconic Manufacturing (GB) Limited (United Kingdom) (Respondents) AND Airbus Defence and Space GmbH (Germany) (Claimant)

v. Howmet Aerospace Inc. (USA) and Arconic Manufacturing (GB) Limited (United Kingdom) (Respondents), International Court of Arbitration, International Chamber of Commerce, ICC Case Nos. 23279/FS and 23281/FS, respectively, *three-member panel*, London, 26 October – 13 November 2020.

3. Korean Air Lines Co., Ltd. (Claimant) v. Greenpoint Technologies, Inc. and Aviation Technical Services (Respondents), International Centre for Dispute Resolution, No. 01-19-0001-7823, *three-member panel*, virtual hearing, 21 January 2021.

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