

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FREIGHTCAR AMERICA, INC.,
Petitioner,

v.

NATIONAL STEEL CAR LIMITED,
Patent Owner.

Case IPR2025-01048
Patent 8,132,515

**DECLARATION OF MEHDI AHMADIAN
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,132,515**

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b.	[1c] “said first end section including a draft sill extending in the longitudinal direction, a main bolster extending crosswise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;”	34
c.	[1d] “said first end slope sheet of said hopper over hanging said shear plate of said first end section; and”	40
d.	[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;”	41
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g.	[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.”	55
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	hollow section beam extending across said hopper car between said first and second side walls;”	66
b.	[7g] “said hopper car being free of longitudinally oriented elephant ears extending between said draft sill and said end slope sheet;”	70
c.	[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 cross-wise across said hopper car between said first and second side walls.”	71
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I, Mehdi Ahmadian, Ph.D., declare as follows:

1. I am making this declaration at the request of FreightCar America, Inc. (“FCA”). I have been retained by FCA as a technical expert in this matter.

2. I am being compensated for my work on this matter and I am being reimbursed at cost for my expenses. My compensation in no way depends upon the outcome of this proceeding. I do not own any stock in FCA and, to my knowledge, I have no financial interest in FCA.

3. In preparation for this declaration, I have considered the following materials:

Exhibit No.	Description
1001	U.S. Patent No. 8,132,515 (“the ’515 Patent”)
1002	File History of the ’515 Patent
1004	Excerpts from <i>1946 Car Builders’ Cyclopedia</i> , 17 th ed. (“1946 Cyclopedia”)
1005	U.S. Patent No. 1,321,928 (“Lindström”)
1006	U.S. Patent No. 4,941,411 (“Wong”)
1007	<i>Excerpts from Lancashire & Yorkshire Wagons, Vol. II</i> , by Noel Coates, Copyright 2006 (“Coates”)
1008	U.S. Patent No. 992,192 (“Hart”)
1009	Excerpts from <i>The Car Builders’ Dictionary, 1906 Edition</i> (“1906 Cyclopedia”)
1010	Excerpts from <i>Car Builders’ Dictionary, 1912 (Seventh) Edition</i> (“1912 Cyclopedia”)

Exhibit No.	Description
1011	Excerpts from <i>Car Builders' Cyclopedia of American Practice, Tenth Edition—1922</i> (“1922 Cyclopedia”)
1012	U.S. Patent No. 1,537,051 (“Campbell ’051”)
1013	U.S. Patent No. 1,999,652 (“Campbell ’652”)
1014	U.S. Patent No. 3,710,729 (“Schuller”)
1015	U.S. Patent No. 4,348,962 (“Smith”)
1016	Excerpts from <i>COAL CARS: The First Three Hundred Years</i> , by Martin Robert Karig III, Copyright 2007 (“Karig”)
1017	Excerpts from <i>Modern Private Owner Wagons on British Rail</i> , by David Ratcliffe, Copyright 1989 (“Ratcliffe 1”)
1018	Excerpts from <i>Private-Owner Wagons in Colour, For the Modeller and Historian</i> , by David Ratcliffe, Copyright 2009 (“Ratcliffe 2”)
1019	Excerpts from <i>Wagons of the Final Years of the British Railways</i> , By David Larkin, Copyright 2008 (“Larkin 1”)
1020	Excerpts from <i>Working Wagons</i> , Vol. 3 1980–1984, by David Larkin, Copyright 2001 (“Larkin 2”)
1021	Excerpts from <i>Wagon Recognition</i> , Vol. 1 Carkinds – B to W, by Martin Buck and Mark Rawlinson (“Buck”)
1024	Excerpts from <i>Private Owner Wagons</i> , Vol. 1, by Andrew Marshall, Copyright 1989 (“Marshall”)

4. I have also relied on my education, training, and experience, and my knowledge of pertinent literature in the field of the ’515 patent.

I. EXPERIENCE AND QUALIFICATIONS

5. My experience and qualifications are summarized in my *curriculum vitae*, a copy of which is attached hereto as Appendix A.

6. I am currently employed as J. Bernard Jones Chair of Mechanical Engineering at Virginia Polytechnic Institute and State University ("Virginia Tech"). I am also the Director of the Center for Vehicle Systems and Safety (CVeSS) and the Railway Technologies Laboratory (RTL) at Virginia Tech. I am the founding director of CVeSS, RTL, Virginia Institute for Performance Engineering and Research (VIPER), and the Advanced Vehicle Dynamics Laboratory (AVDL).

7. I hold four degrees, three of which are in the field of Mechanical Engineering. I obtained my Doctor of Philosophy degree in Mechanical Engineering from the State University of New York at Buffalo in 1984. I obtained my Master of Business Administration (MBA) from Pennsylvania State University – Behrend College in 1994. I obtained my Master of Science (MS) in Mechanical Engineering from the State University of New York at Buffalo in 1982. I obtained my Bachelor of Science (BS) in Mechanical Engineering from the State University of New York at Buffalo in 1980. I worked at General Electric Transportation Systems from 1993-1995 before joining Virginia Tech as an assistant professor in 1995. Since joining Virginia Tech, a substantial portion of my research has been directed to the railroad

industry and railroad systems. This research is evident in the hundreds of publications, books, book chapters, and presentations listed in my CV.

8. I have over 25 years of experience as an independent consultant on matters related to product liability and patent litigation cases involving a broad spectrum of passenger cars, commercial vehicles, and railway systems. I have also assisted clients on issues related to vehicle dynamics and handling, electromechanical systems, braking, rollover stability, and active safety systems. I have broad technical experience in advanced vehicular systems for railway and heavy vehicles, including railway control and safety systems.

9. I have authored more than 500 publications and hold 12 U.S. and international patents. Additionally, I have edited eight technical volumes on various engineering topics. I have served as Editor of the International Journal of *Vehicle System Dynamics* (2008 to 2022) and Editor-in-chief of the *Journal of Vibration and Control* (2014 to 2023). I have also served as the Editor-in-Chief of *Shock and Vibration* (2011-2016), the Editor-in-Chief of *Advances in Automotive Engineering* (2012-2014), and Editor for *Smart Materials Research* (2010-2014), *Advances in Mechanical Engineering* (2008-2014), and *Mechanical Engineering* (2010-2014). I have also served as an Associate Editor for the *ASME Journal of Vibration and Acoustics* (1989-1996), the *AIAA Journal* (2000-2008), and *Shock and Vibration* (2003-2011). I have served on the editorial boards of *Advances in Theoretical and*

Applied Mechanics (2012 to present), *Nonlinear Analysis and Differential Equations* (2013 to present), and the *Journal of Theoretical and Applied Vibration and Acoustics* (2018 to present).

10. I am a Fellow of the Society of Automotive Engineers (SAE International) (2001 to present), a Fellow of the American Society of Mechanical Engineers (“ASME”) (1984 to present), a Fellow of the International Society for Condition Monitoring (“ISCM”) (2021 to present), a Fellow of the International Institute of Acoustics and Vibration (“IIAV”) (2021 to present), and an Associate Fellow of the American Institute for Aeronautics and Astronautics (“AIAA”) (1984 to present). I have also been a Member of the American Railway Engineering and Maintenance-of-Way Association (“AREMA”) (2011 to present), American Society of Education for Engineers (1984-2001), and Tau Beta Pi National Engineering Honorary Society (1979 to present)

11. I have received several professional awards throughout my career, including most recently being awarded the 2024 Society of Automotive Engineers (SAE) Medal of Honor (the highest recognition of lifetime achievement, bestowed on one SAE member per year) and the 2023 Virginia Tech Alumni Award for Research Excellence (regarded as the most prestigious Virginia Tech award for significant life-long research) for my research contributions.

12. I am an inventor on the following issued patents:

- Kinetic Energy-Harvesting Device for Powering and Charging Railway and Other Applications, U.S. Patent 12,088,180, September 10, 2024.
- Dual-action rotary dynamic load stabilization pneumatic valve system, U.S. Patent 9,975,392, May 22, 2018.
- A Compact Lightweight Double-piston Magnetorheological (MR) Damper with large adjustable dynamics force, Chinese Patent # ZL 201110420869.8, December 25, 2013.
- A Compact Lightweight Double-piston Magnetorheological (MR) Damper, Chinese Patent # ZL 201110418073.9, January 9, 2014.
- Doppler Sensor for the Derivation of Torsional Slip, Friction, and Related Parameters, U.S. Patent 8,294,883, October 23, 2012.
- Doppler Sensor for the Derivation of Torsional Slip, Friction and Related Parameters, U.S. Patent 7,705,972, April 27, 2010.
- No Jerk Semiactive Suspension System, U.S. Patent 6,115,658, September 5, 2000.
- No Jerk Semi-active Skyhook Control Methods and Apparatus, Canadian Patent Application, No. 09/225,147, December 17, 1999.
- Self-Steering Locomotive Truck, U.S. Patent 6,006,674, December 28, 1999.
- Self-Steering Locomotive Truck, U.S. Patent 5,746,135, May 5, 1998.
- Self-Steering Locomotive Truck, U.S. Patent 5,613,444, March 25, 1997.
- Electromagnetically Operated Pneumatic Valve Assembly for an Electrical Contactor Actuator, U.S. Patent 5,409,036, April 25, 1995.

II. APPLICABLE LEGAL STANDARDS

13. I have been asked to provide my opinions related to whether claims of U.S. Patent. No. 8,132,515 (“the ’515 patent”) are anticipated and/or would have

been obvious to a person of ordinary skill in the art at the time of the alleged invention, in view of the prior art.

14. I am an engineer by training and profession. The opinions I am expressing in this report involve the application of my training and technical knowledge and experience to the evaluation of certain prior art with respect to the '515 patent.

15. Although I have been involved as a technical expert in patent matters before, I am not an expert in patent law. Therefore, attorneys from Knobbe, Martens, Olson & Bear have provided me with guidance as to the applicable patent law in this matter. The paragraphs below express my understanding of how I must apply current principles related to patent validity in my analysis.

16. It is my understanding that a claim is “anticipated” if a person of ordinary skill in the art (POSITA), reading a prior art reference at the time of the invention, would have understood the reference to disclose each limitation of the claim.

17. It is my understanding that a claim is “obvious” if the claimed subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time of the alleged invention. I understand that the following factors must be evaluated to determine whether a claim would have been obvious: (i) the scope and content of the prior art; (ii) the differences, if any, between each claim of the '515

patent and the prior art; (iii) the level of ordinary skill in the art at the time of the claimed invention; and (iv) additional considerations, if any, that indicate that the invention was obvious. I understand that these “additional considerations” are often referred to as “secondary considerations” or “objective indicia” of non-obviousness.

18. I also understand that the frame of reference when evaluating obviousness is what a hypothetical person of ordinary skill in the pertinent art would have known at the time of the claimed invention. I understand that the hypothetical person of ordinary skill is presumed to have knowledge of all pertinent prior art references.

19. I understand that a prior art reference may be a pertinent prior art reference (or “analogous art”) if (i) it is in the same field of endeavor as the patent, or (ii) if it is pertinent to the problem that the inventors were trying to solve. I understand that a reference is reasonably pertinent if it logically would have commended itself to an inventor’s attention in considering the problem at hand. If a reference relates to the same problem as the claimed invention, I understand that supports use of the reference as prior art in an obviousness analysis.

20. It is my understanding that the law recognizes several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include:

- combining prior art elements according to known methods to yield predictable results;
- simple substitution of one known element for another to obtain predictable results;
- a predictable use of prior art elements according to their established functions;
- using known techniques to improve similar devices (methods, or products) in the same way;
- using a feature that was commonly used on similar devices and well-known in the field;
- applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success (in which case a claim would have been obvious to try);
- known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; and

- some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

21. I understand that a prior art reference may also suggest a combination with another prior art reference or a modification in view of another reference. In that case, even if the prior art reference does not explicitly or inherently disclose the limitation, the motivation to modify the prior art reference to include the limitation may exist within the prior art reference itself. Thus, the limitation would have been obvious over that prior art reference alone.

22. I understand that “secondary considerations” must be considered as part of the obviousness analysis when present. I further understand that the secondary considerations may include: (1) a long-felt but unmet need in the prior art that was satisfied by the claimed invention; (2) the failure of others; (3) skepticism by experts; (4) commercial success of a product covered by the patent; (5) unexpected results achieved by the claimed invention; (6) industry praise of the claimed invention; (7) deliberate copying of the invention; and (8) teaching away by others. I am not aware of any evidence of secondary considerations that would suggest that the claims of the ’515 patent would have been nonobvious at the time of the claimed invention.

23. I understand that when assessing obviousness, using hindsight is impermissible; that is, what is known today or what was learned from reading the asserted patent should not be considered. The asserted patent should not be used as a road map for selecting and combining items of prior art. Rather, obviousness must be considered from the perspective of a person of ordinary skill at the time the alleged invention was made. (See paragraph 30 for discussion of invention date.)

24. I also understand that an obviousness analysis must consider the invention as a whole, as opposed to just a part or element of the invention. I understand this “as a whole” assessment to require showing that one of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would have selected the elements from the prior art and combined them in the claimed manner.

III. THE '515 PATENT

A. Overview of the '515 Patent

25. The '515 patent describes a bottom-discharge hopper car, a railway freight car loaded through the hopper's open top and discharged through doors at the bottom of the hopper. The hopper's forward and rear walls—called “slope sheets”—incline toward the bottom center of the car to channel the payload to the hopper doors. The '515 patent describes reinforcing the slope sheets with transverse support beams under the slope sheet. By supporting the slope sheets with transverse beams,

the space below the slope sheet—called the “machinery space”—is not encumbered by support structures and can house machinery such as equipment for opening the hopper doors.

26. During prosecution, the applicant overcame the Examiner’s rejection of original Claim 1 by arguing that the prior art had support structures—large triangular plates known as “elephant ears”—that obstructed the machinery space. The Examiner thereafter allowed 44 claims. Each claim required either open machinery space below the slope sheets, crosswise reinforcement beams on the slope sheets, or both.

27. But although applicant persuaded the Examiner that slope-sheet support beams and open machinery spaces were novel, they were a century old when the applicant filed its patent application in 2009. For example, a hopper car manufactured for the Lancashire & Yorkshire Railroad in 1904 had unobstructed machinery space. EX1007. Many other hopper cars from the first half of the twentieth century also used support beams to keep their machinery spaces open.

28. The claims of the ’515 patent are unusually lengthy because they recite a host of hopper-car components widely used many decades before applicant’s filing date. Because these features are used in the claimed hopper car just as they have always been used in the prior art, their inclusion in the challenged claims would have been obvious to a person of ordinary skill in the art (or “POSITA”).

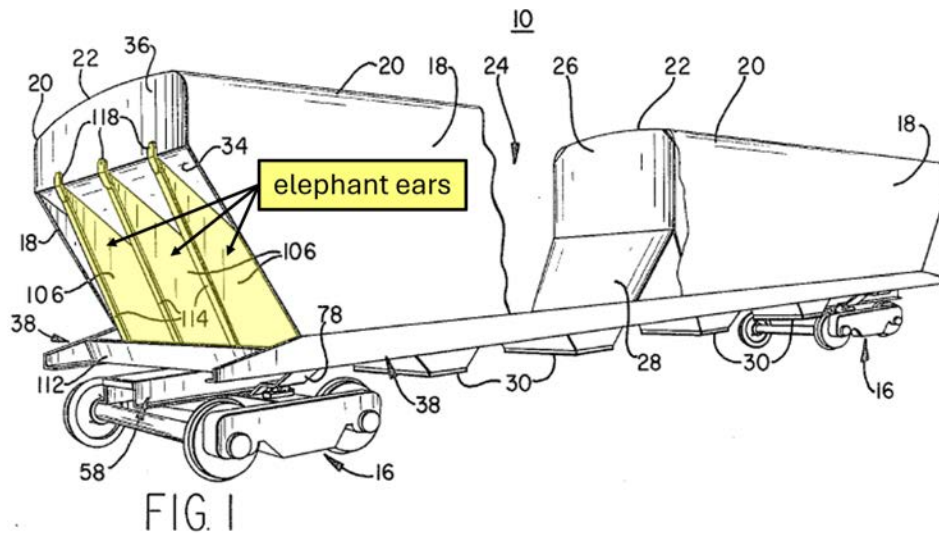
29. In my view, the '515 patent would not have been granted if the Examiner had been aware that slope-sheet support beams and open machinery spaces were old in 2009.

B. Priority Date of the '515 Patent

30. The '515 patent was filed as U.S. Application No. 12/816,660 on June 16, 2010. EX1001 at cover. The earliest application to which the '660 application claims priority is Canadian Patent Application No. 2,678,447, filed on September 11, 2009. EX1001 at 1:4–15. I understand that the earliest claimed priority date of the '515 patent is September 11, 2009, and I have been instructed to assume for the purposes of my opinions that this is the invention date for the '515 patent.

C. Prosecution History of the '515 Patent

31. Based on my review of the file history for the '515 patent, I understand that the application for the '515 patent was filed with original claims 1–42. EX1002 at 32-41. On November 30, 2010, the Examiner rejected Claims 1, 2, 23, and 24 as anticipated by Smith (U.S. Patent No. 4,348,962) and rejected or objected to the remaining claims. *Id.* at 80-88. The Smith patent cited by the Examiner is shown here:



EX1015, Fig. 1.

32. In its February 28, 2011 response, the applicant relied on (1) the '515 patent's statement that "Car 20 avoids the use of these 'elephant ears' and so provides a large unobstructed space shown in Figure 1b," and (2) Claim 1's requirement that the hopper can be "*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.*" (emphasis added). EX1002 at 112–13. The applicant argued that the gussets labeled 106 in Smith were elephant ears that "obstruct the machinery space." *Id.* The Examiner accepted this argument and allowed claims 1–10 on May 13, 2011, but rejected or objected to the remaining claims. *Id.* at 120–28.

33. On October 13, 2011, the applicant requested continued examination and submitted an information disclosure statement listing additional prior art. *Id.* at 145–159. The applicant cancelled claims 1–4, added the limitations of Claim 1 to

Claim 6, rewrote several claims in independent form, and made other amendments. *Id.* at 288. The new independent claims were 6, 16, 25, 27, 33, and 43. *Id.* Each independent claim required an open machinery space or excluded elephant ears such as those in Smith. *See, e.g., id.* at 273–81.

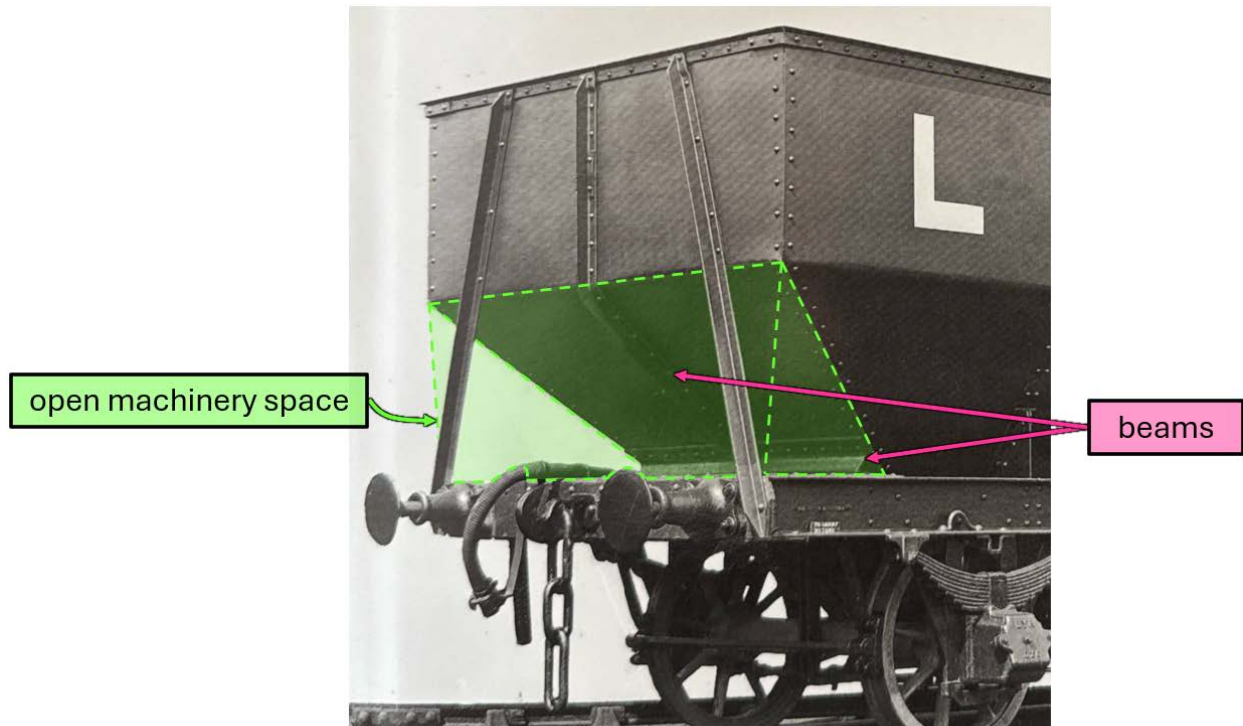
34. On November 1, 2011, the Examiner allowed all pending claims without applying or discussing any prior art submitted with the RCE. *Id.* at 305–39.

35. However, the Patent Office did not have the most relevant evidence. The prior art contained numerous hopper cars with open or unobstructed machinery spaces. To keep their machinery spaces unobstructed, these hopper cars used reinforcement beams that extended along the underside of the slope sheet, either crosswise or longitudinally.

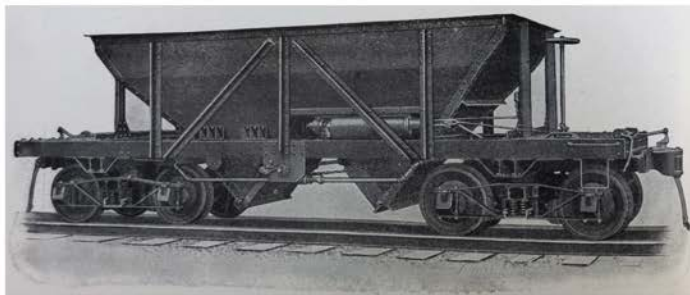
36. For example, historian Noel Coates reproduced photographs from England’s National Railway Museum of a hopper car manufactured for the Lancashire & Yorkshire Railroad in 1904. EX1007 at cover, 265 (“L&Y hopper car”) (shown below).



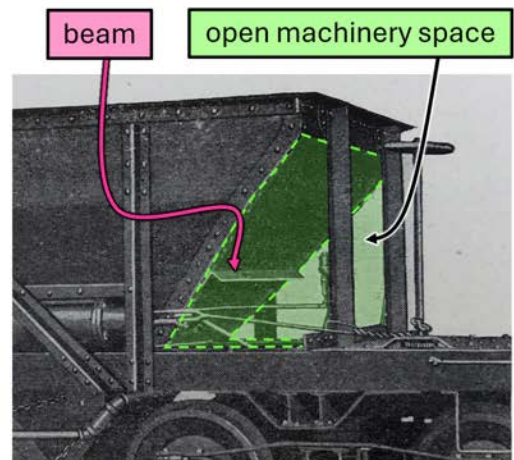
37. The L&Y car supported its slope sheet with one crosswise beam and one longitudinal beam, creating the unobstructed machinery space shown below. *Id.* The car has two end posts but, like the end post and corners posts of the '515 patent's sole embodiment, these posts are at the car's perimeter, not within its machinery space.

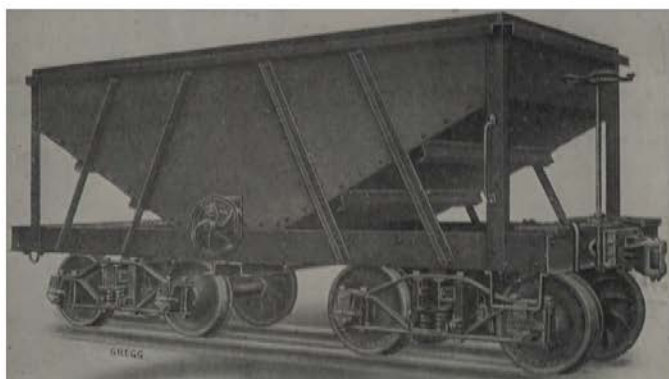


38. Later hopper cars also employed reinforcement beams to achieve an open machinery space. A few examples are shown below.

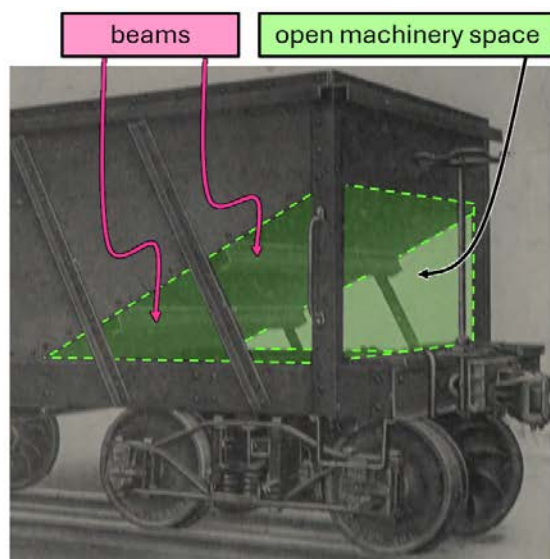


Kilbourne & Jacobs Hopper Car (1912)

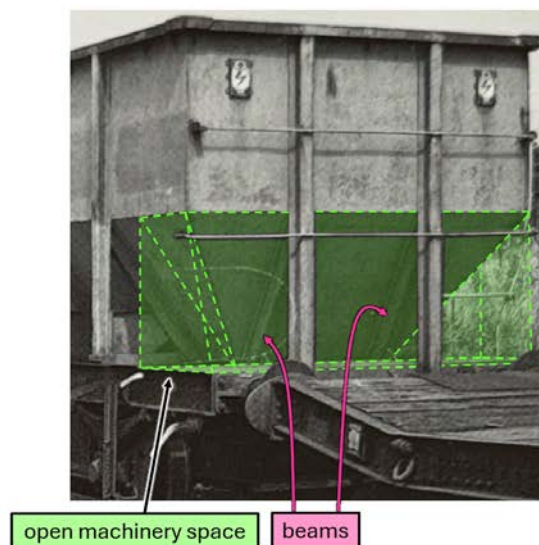




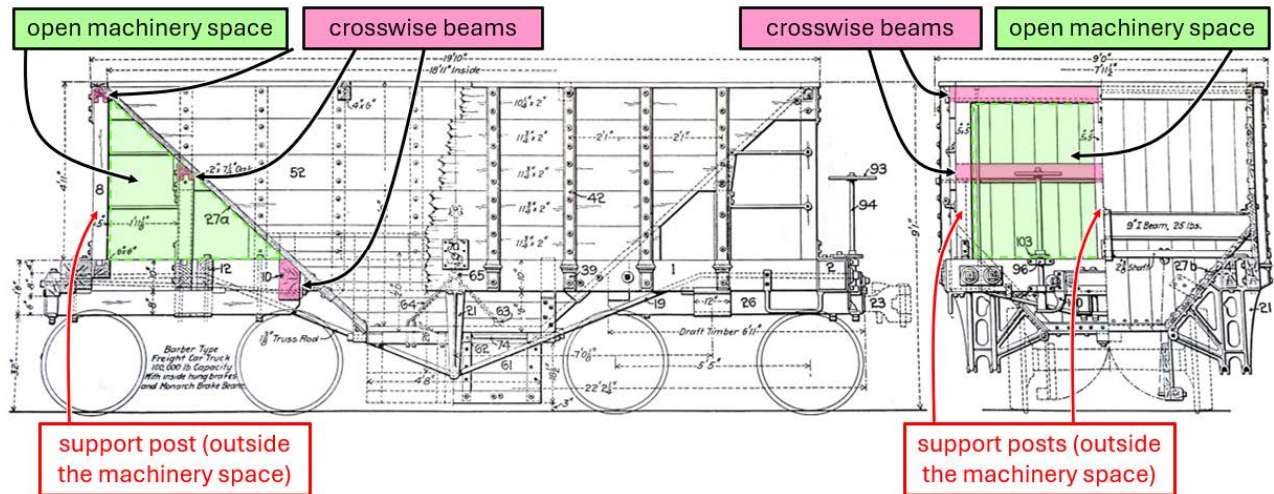
Gregg Co. Hopper Car (1922)



BR Shildon Hopper Car (1963)

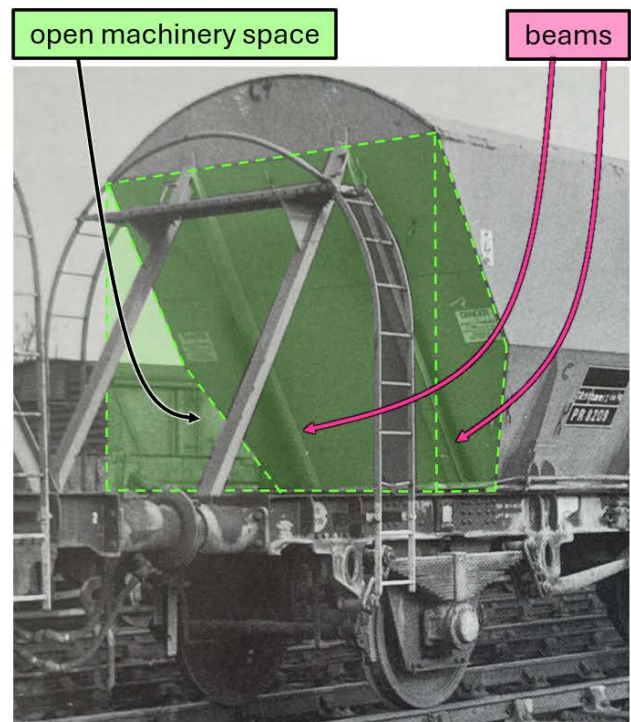


EX1010 at 208, Fig. 24 (Kilbourne & Jacobs); EX1011 at 1113, Fig. 2904 (Gregg);
EX1019 at 39 (BR Shildon).



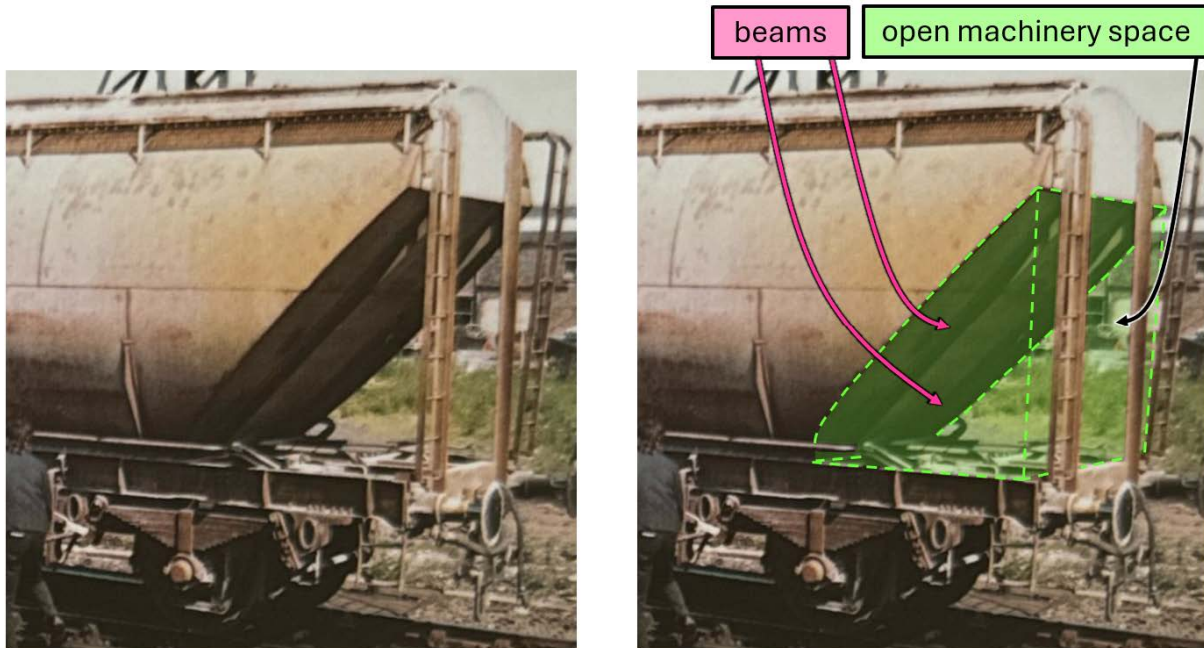
M&SP Ore Car – 1906 Cyclopedia

EX1009 at Figs. 430-34.



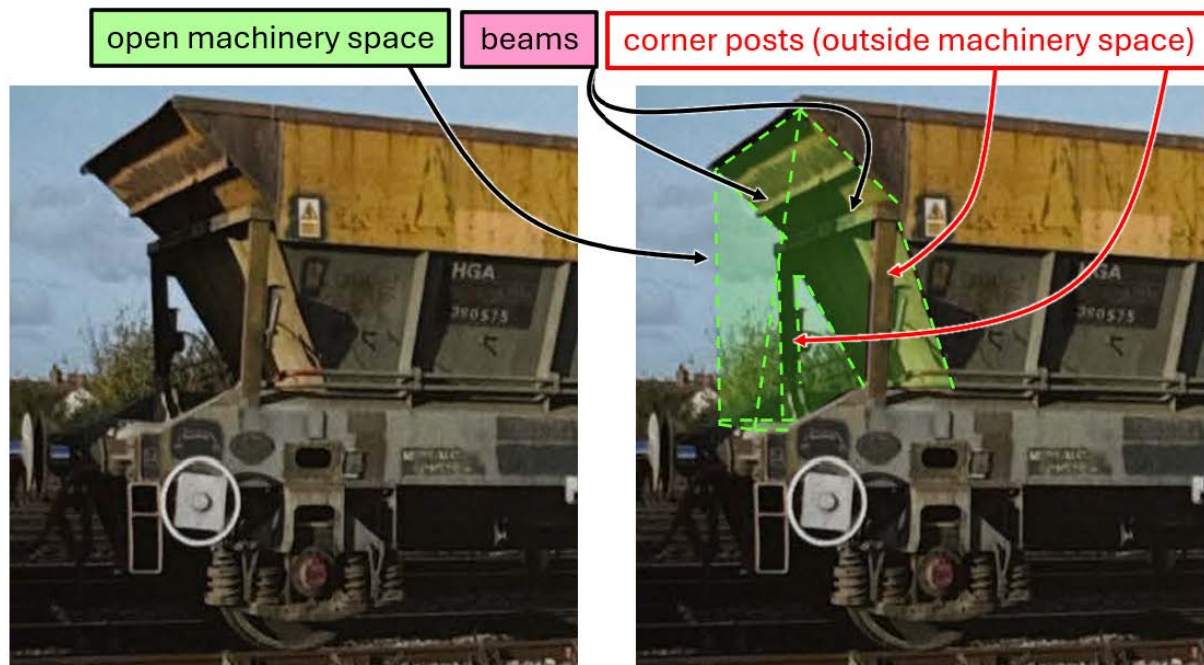
BP Chemicals Hopper Car (1971)

EX1020 at 62.



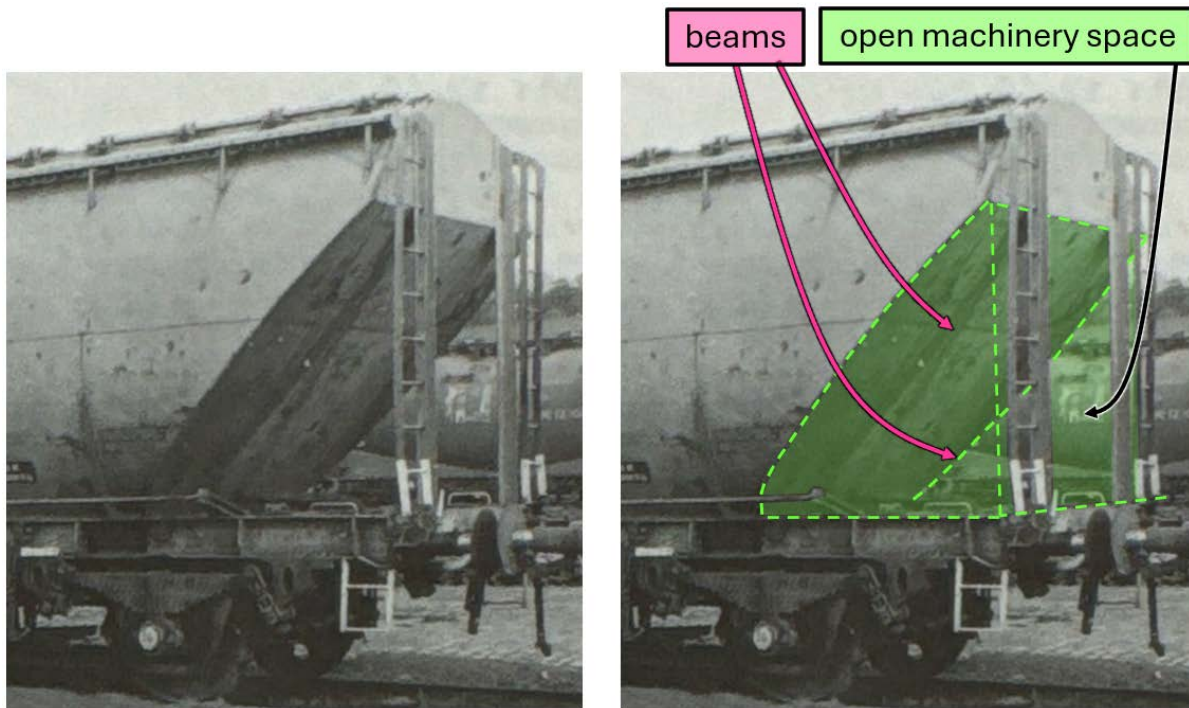
British Steel Hopper Car (1971)

EX1018 at 27.



Marcroft Hopper Car (1994 Conversion)

EX1021 at 55.



Steetley Hopper Car (1971)

EX1024 at 27.

39. Finally, Hart also discloses a hopper car with crosswise beams and an open machinery space. EX1008.

D. Claim Construction

40. It is my understanding that in determining whether a patent claim is anticipated by or obvious in view of the prior art, the Patent and Trademark Office construes the claim by giving the claim terms their plain and ordinary meaning, as they would have been understood by a POSITA at the time of the invention in view of the intrinsic record (patent claims, patent specification, and file history). I understand that a patent and its prosecution history are considered “intrinsic

evidence” and are the most important sources for determining how a POSITA would understand claim language.

41. Therefore, except where the intrinsic evidence indicates that the inventors adopted a special definition of a claim term, I have interpreted each claim term in accordance with its plain and ordinary meaning as it would have been understood by a person of ordinary skill in the art at the time of the invention.

42. Most claim terms in the ’515 patent are conventional names for standard rail-car features. Other claim terms are expressly defined in the specification of the ’515 patent. No remaining claim terms require construction to resolve the issues raised in this petition. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). The challenged claims are unpatentable under any reasonable construction.

E. Level of Ordinary Skill in the Art of the ’515 Patent

43. It is my understanding that, when interpreting the claims of the ’515 patent and evaluating whether a claim would have been obvious, I must do so based on the perspective of a person of ordinary skill in the art at the time of invention (POSITA). (See paragraph 30 for discussion of invention date.)

44. I understand that, in determining the level of ordinary skill in the art, several factors are considered. Those factors may include: (i) the type of problems encountered in the art; (ii) prior art solutions to those problems; (iii) the rapidity with

which innovations are made; (iv) the sophistication of the technology; and (v) the educational level of active workers in the field. A person of ordinary skill in the art must have the capability of understanding the scientific and engineering principles applicable to the pertinent art.

45. The claims of the '515 patent are directed to reinforcing and assuring the structural integrity of a railway hopper car. Accordingly, a person of ordinary skill in the art to which the '515 patent pertains (POSITA) 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.

46. My opinions herein would remain the same even if the invention date, field of endeavor, or level of ordinary skill were slightly different.

47. I qualify as a POSTIA based on my education and experience described herein and in my CV. *Supra* § I. ; App'x A.

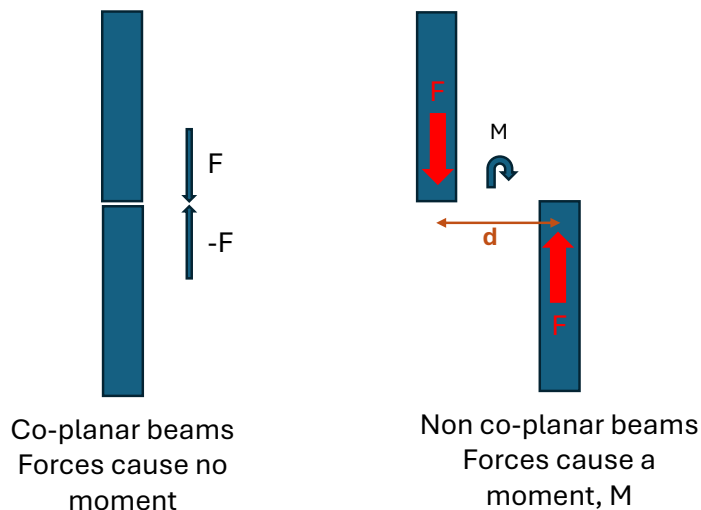
IV. CONCEPTS RELATED TO THE '515 PATENT

A. Transmitting Loads Through Co-Planar Reinforcing Elements

48. The use of elements that allow transferring loads and forces from one part of a structure to another part is not novel. It has been practiced in various embodiments for decades in various structures, including railcars, dating back to before the priority dates of the subject patents.

49. Aligning those load-transferring elements, e.g., making them co-planar in a plane through the axis of load transfer, offers benefits related to simplicity and efficiency in design and analysis, particularly in situations where the structure is two-dimensional or can be reasonably approximated as such. It also allows for a more efficient transfer of forces without causing an out-of-plane bending.

50. As shown below, the action and reaction forces are aligned in a co-planar structure, and no bending moment is generated. When they are not co-planar, a bending moment (M) is generated, directly proportional to the magnitude of the forces and their misalignment, known as the moment arm, d . The simplicity and efficiency of co-planar structures such as the beams shown below and in many hopper car structures are known to a POSITA.



B. Stiffening a Flat Structure by Adding Ribs Was Not Novel

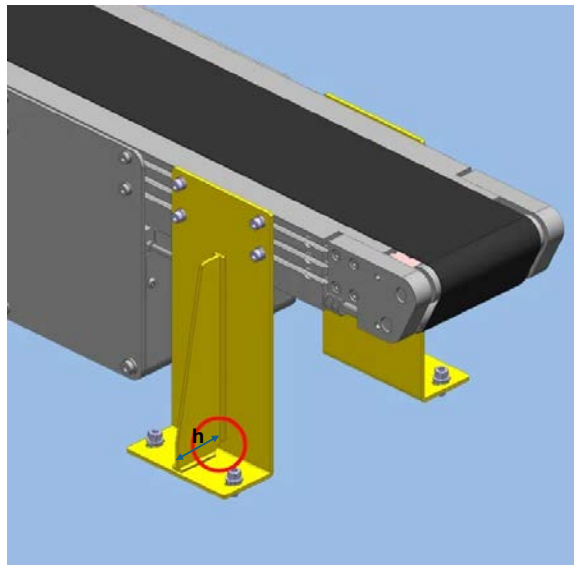
51. It was known to a POSITA long before the priority date that ribs are frequently used to improve the strength of sheet metal parts and reduce their

deformation when subjected to heavy loading. It was known that a structure made of sections with sheet metals tends not to be strong and lacks stiffness and resistance to bending. When subjected to large forces, such sheet metals can bow or bend in response to forces they are subjected to, such as those occurring in sidewall elements of a hopper car filled with heavy cargo like iron ore. Adding stiffening elements such as ribs, flanges, hems, flat elements, C-channels, L-brackets, or tubing to sheet metal parts increases their resistance to deformation when subjected to pressures caused by heavy loads. They do so by increasing the effective thickness of the sheet metal in the direction for which bending is to be prevented.

C. Making Reinforcing Elements from Flat Bar Was Not Novel

52. It was known to a POSITA long before the priority date that elements used for stiffening a sheet metal are often applied in the form of a rib made from flat bar. Flat bars have superior weight efficiency and cost-effectiveness to resist bending in the plane of the flat bar. A flat-bar rib, such as the one shown below, resists bending deformation in direct proportion to its height, h . Flat bars used in this fashion can be connected to supported material by separate L-brackets, incorporated flanges, welding (as shown below), or through other means. The plane (or “web”) of such flat bars can also take any of a multitude of cross-sectional shapes; for example, as shown below, a flat bar can be in a trapezoid form.

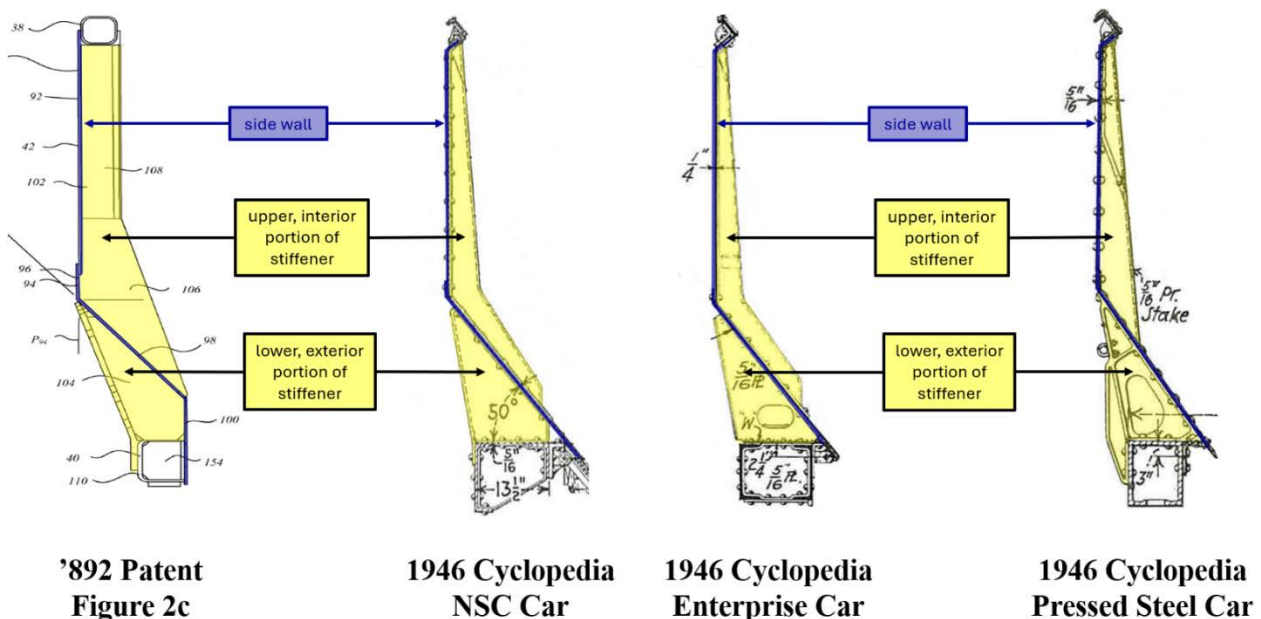
53. The stiffening effect of flat-bar ribs was known to POSITAs long before the priority date. Equally known was the spacing of such flat bars. It was known to a POSITA that flat-bar ribs are uniformly spaced along the length of a structure, such as the sidewalls of a hopper railcar, to reduce warping and offer deformation resistance when the hopper is loaded. This spacing can be seen in the railcars discussed in the following section.



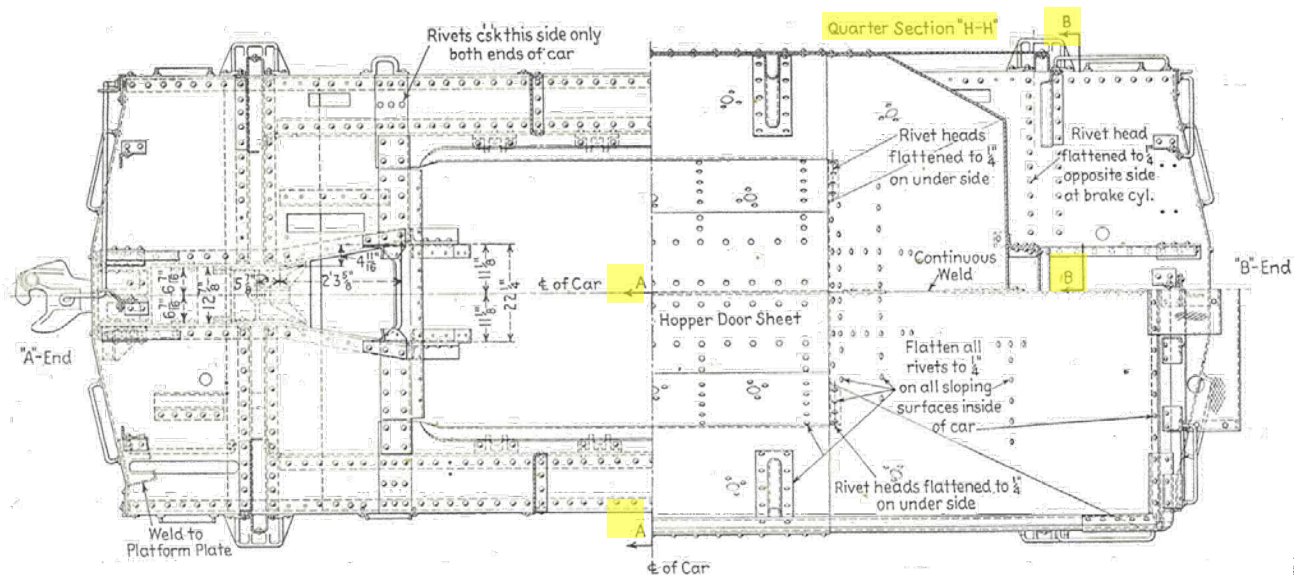
D. Web Continuity Was Not Novel in 2009

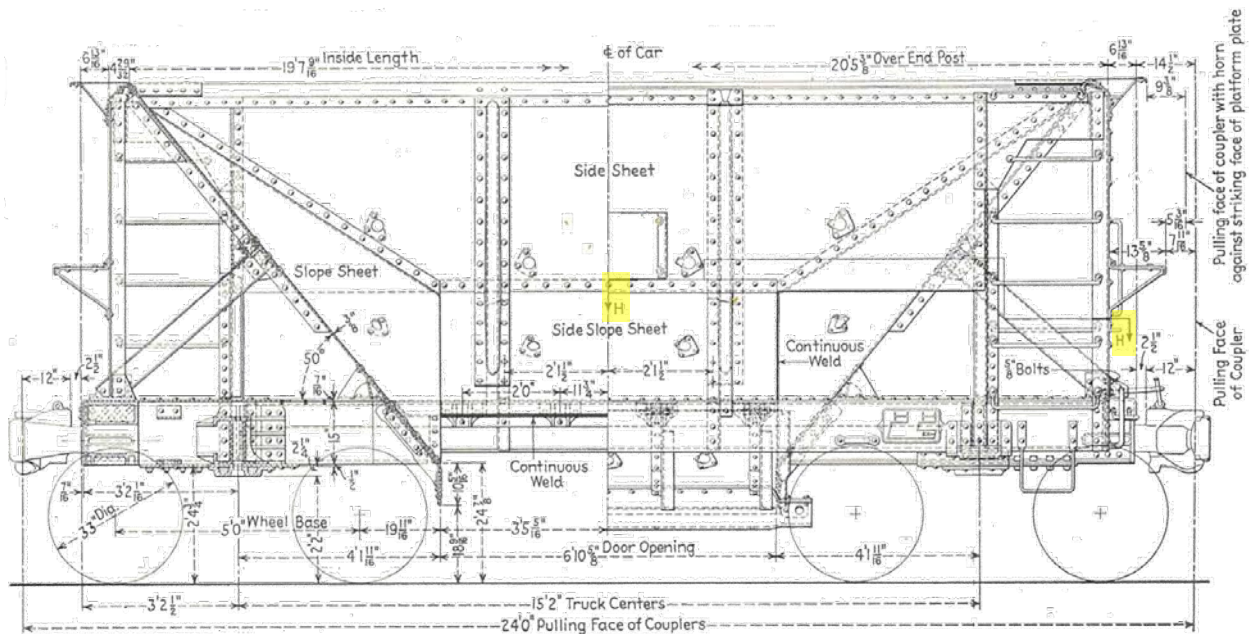
54. Side-wall stiffeners with two parts (e.g., 104 and 106 in '515 patent Fig. 2c above) having web continuity were common in hopper cars used to transport minerals such as coal and iron ore long before the priority date. For example, the 1946 Cyclopedia has a section regarding hopper ore cars. EX1004 at 290-95. In that ore-car section of the 1946 Cyclopedia, three of the four schematics in the

section disclose two-part side-wall stiffeners with web continuity. *Id.* at 290, 292, 294. Those three schematics have rear section views that show both the interior and exterior portions of the stiffener in relation to the side wall. *Id.* The arrangement of those stiffeners with respect to the sidewall is very similar—almost identical—to the arrangement thereof shown in Figure 2c of the '515 patent, as shown below. *Id.* For example, in each, the side wall has an upper vertical, outside aspect, below which the side wall angles laterally inward and downward between the two portions of the stiffener; the upper portion of the stiffener is attached to the interior side of the vertical and angled aspects of the side wall; the lower portion of the stiffener is attached to the exterior side of the angled aspect of the side wall; this setup is over, and transfers load to, the side sill. *Id.*

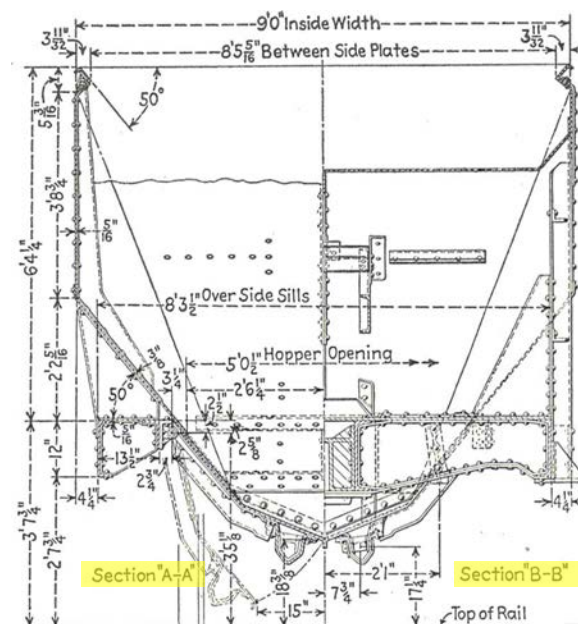


56. Top Left Drawing. In the top view (below), the left half is a sectional view that shows the structure of the lower frame or undercarriage; the upper-right quadrant shows a section along the line H-H, which the side view identifies as sectioning the ore car approximately midway between the undercarriage and the top of the car; and the lower-right quadrant shows a top view from outside the car. Thus, for example, the lower-right quadrant shows half of one of the two end slope sheets.

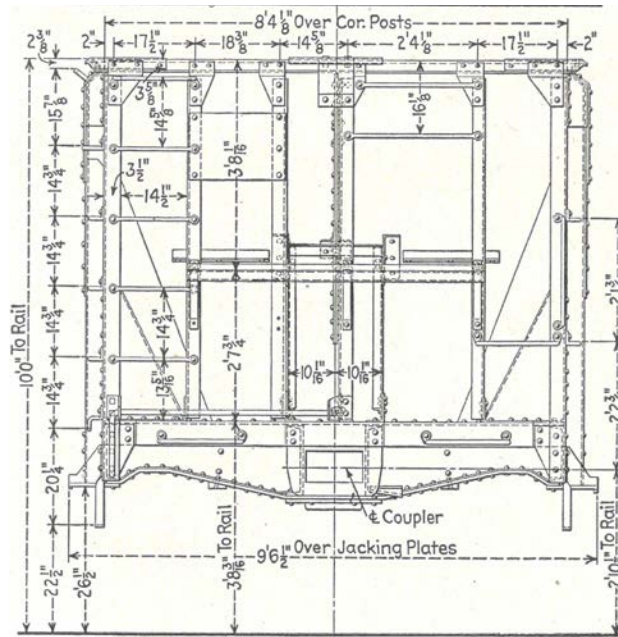




58. Top Right Drawing. The bottom right drawing In the end section views (below), the left half shows a section along the line A-A and the right half shows a section along the line B-B, both of which are identified in the top view.



59. Bottom Right Drawing. The final drawing is a simple rear view, though with certain hidden features shown in dashed lines.



V. SPECIFIC PROPOSED GROUNDS FOR UNPATENTABILITY

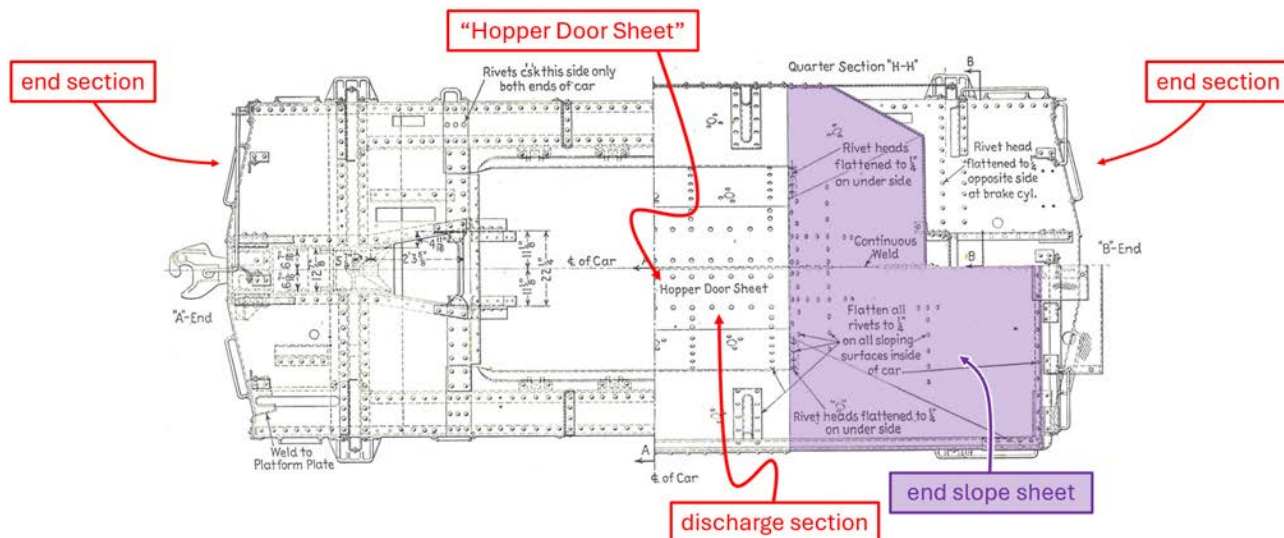
1. Independent Claim 1

61. The left half of the side-view drawing below is a side view along a longitudinal-vertical section that shows inside the hopper. Consequently, the portion

Technical drawing of a flat car showing various dimensions and components. The drawing includes labels for 'end section', 'end slope sheets', 'Side Sheet', 'Side Slope Sheet', 'Continuous Weld', 'Door Opening', 'length of "Door Opening"', 'discharge section', and 'end section'. Dimensions are provided in feet and inches, including 'Inside Length', 'ft. of Car', '205" Over End Post', 'Wheel Base', '15' 2" Truck Centers', and '24' 0" Pulling Face of Couplers'.

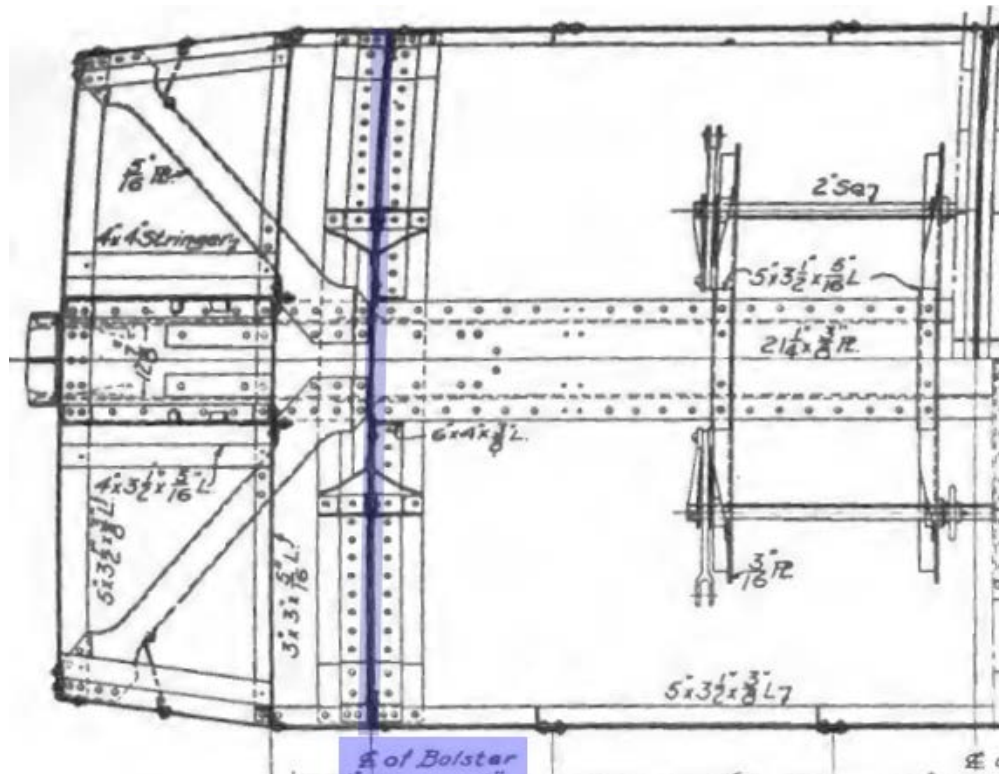
62. The left half of the top-view drawing below is a sectional view (from above) showing the structure of the ore car's lower frame or undercarriage. The right half of the drawing is divided into two parts. The upper right quarter of the drawing is a sectional view (from above) in which the ore car is sectioned approximately midway between the undercarriage and the top of the car, along line H-H. The lower right quarter is a top view of the rail car. That top view shows half

of one of the two end slope sheets. The lower right quarter also includes a top view of the discharge section, including calling out the “Hopper Door Sheet.”

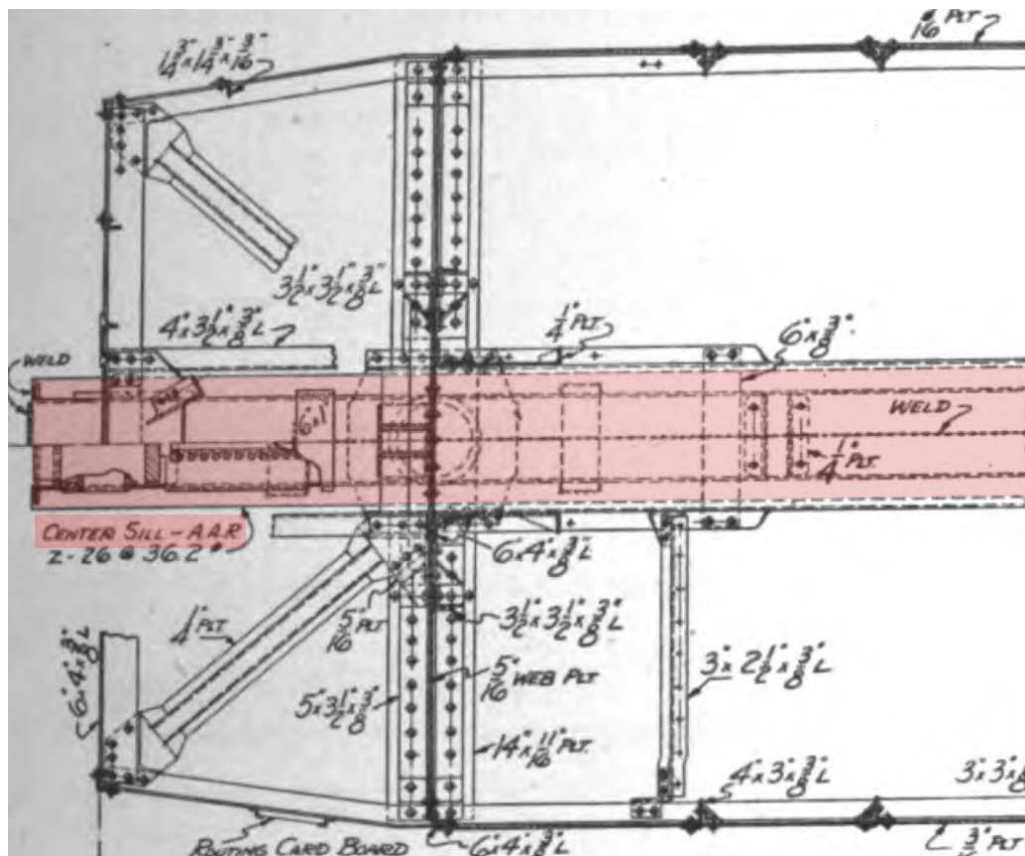


EX1004 at 294.

63. The left and right halves of the end-view drawing below are sectional views along lines A-A and B-B, respectively. An end slope sheet is shown in each of these views. The left half of the drawing shows an inside-the-hopper view of a portion of the end slope sheet that is farther from the reader. In the right half of the drawing, the top part shows an inside-the-hopper view of a portion of the end slope sheet that is farther from the reader, and the part below that shows an outside-the-hopper view of a portion of the end slope sheet that is closer to the reader.

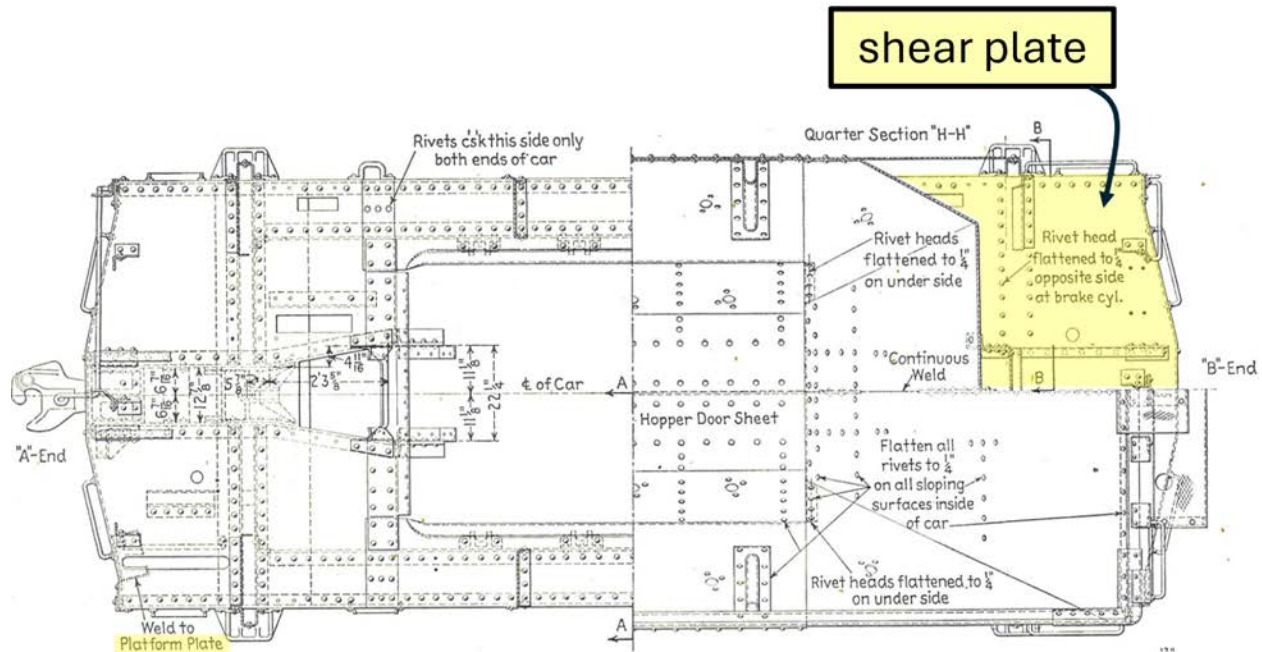


Id. at 293 (color added). Regarding the claimed “draft sill,” the ’515 patent states: “In the terminology of the industry, the portion of the center sill 44 (be it a stub center sill or a straight through center sill) that lies longitudinally outboard of the truck center ... may also be referred to as the draft sill.” EX1001 at 14:36-39. The 1946 Cyclopedia defines “center sill” as: “The central longitudinal member of the underframe of a car, which forms, as it were, the backbone of the underframe and transmits most of the buffing shocks, from one end of the car to the other.” EX1004 at 22. The 1946 Cyclopedia identifies the center sills in certain drawings, including the following:

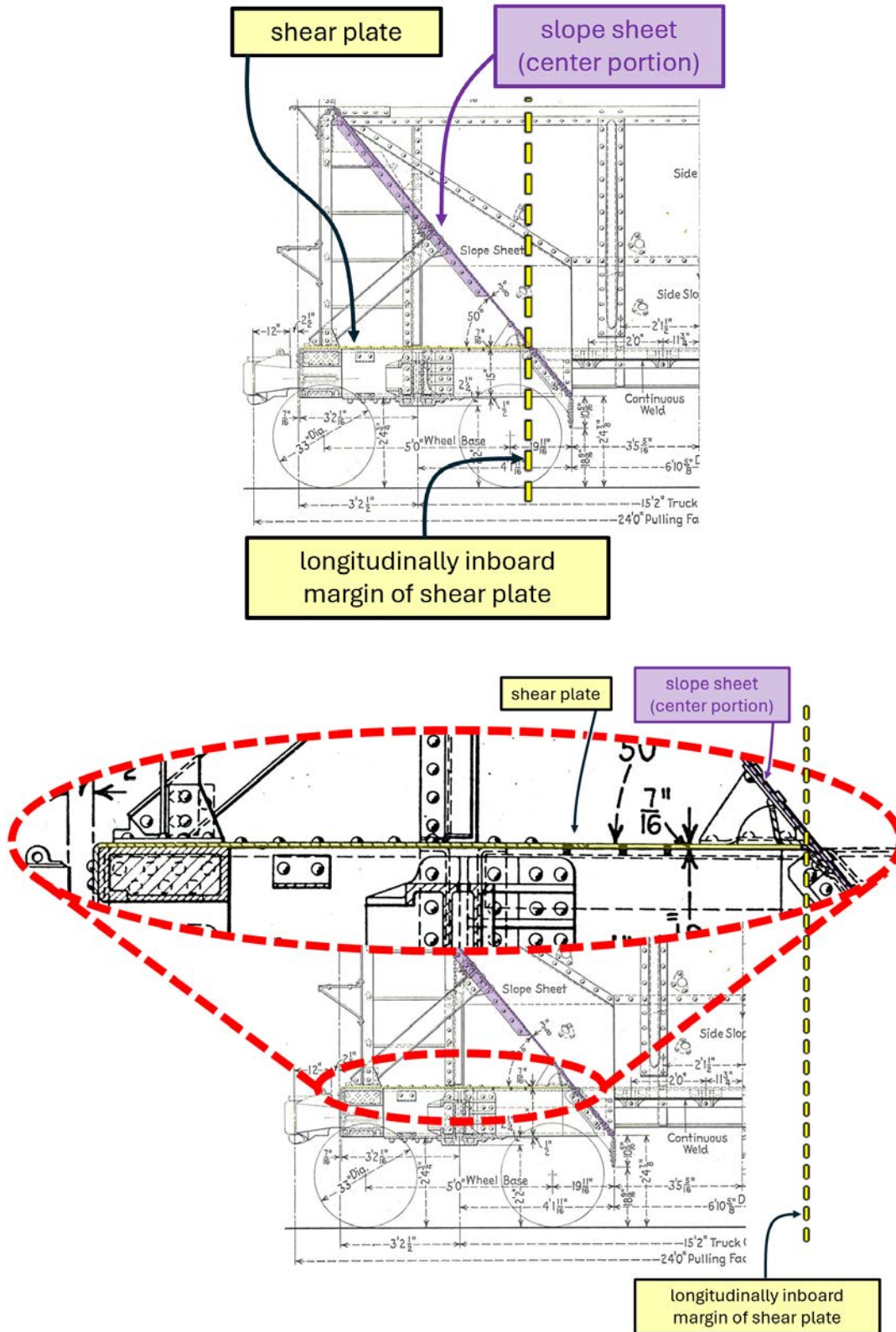


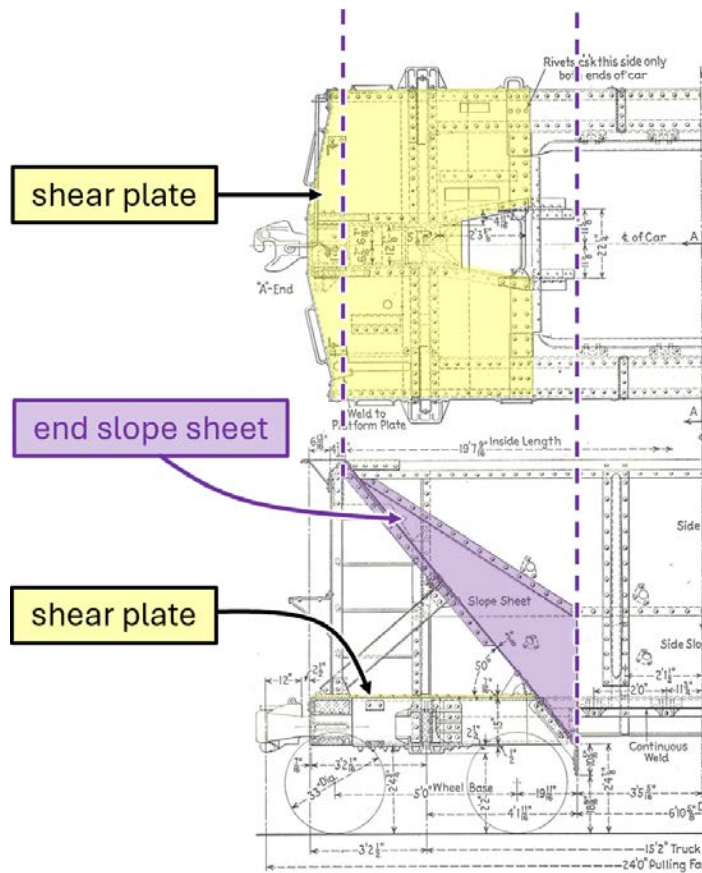
Id. at 404 (color added).

65. In the 1946 Cyclopedia's NSC ore car, the shear plate on one end of the car is partially shown in top sectional view H-H. The view presented in the left half of the drawing refers to the shear plate as the "Platform Plate."



Id. at 294. Based on symmetry, view H-H above – which shows only one side of the “B end” of the car – shows that the shear plate extends laterally from one side of the car to the other side. This is confirmed by the end view along section B-B below. There the shear plate is shown as a layer directly on top of the main bolster and the draft sill, riveted to the bolster, and extending from one side of the car to the other.



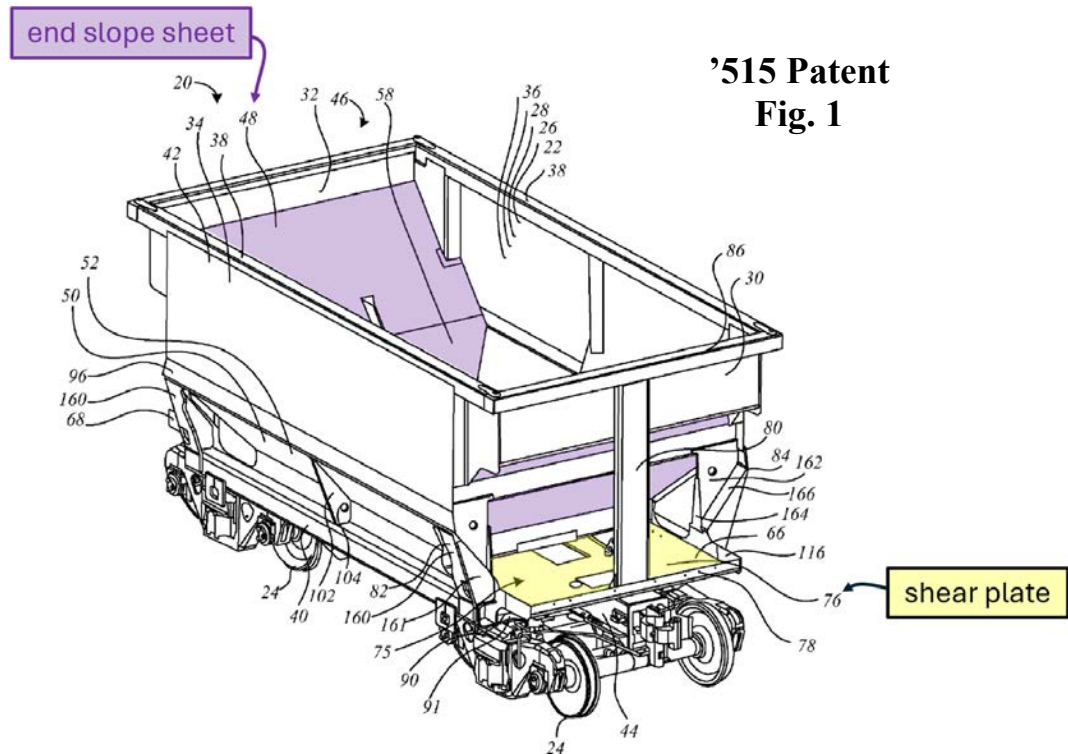


Id.

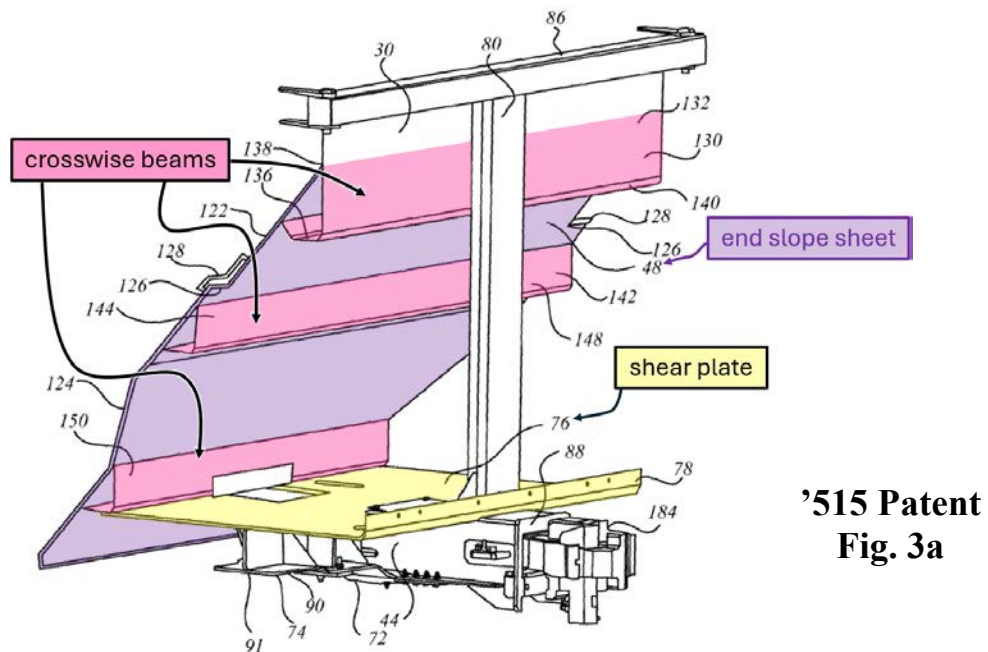
- d. [1e] “said hopper car being free of primary structure directly above said shear plate of said first end section under said overhang of said first end slope sheet of said hopper;”

67. The '515 patent discloses only one embodiment, shown in Fig. 1 below.

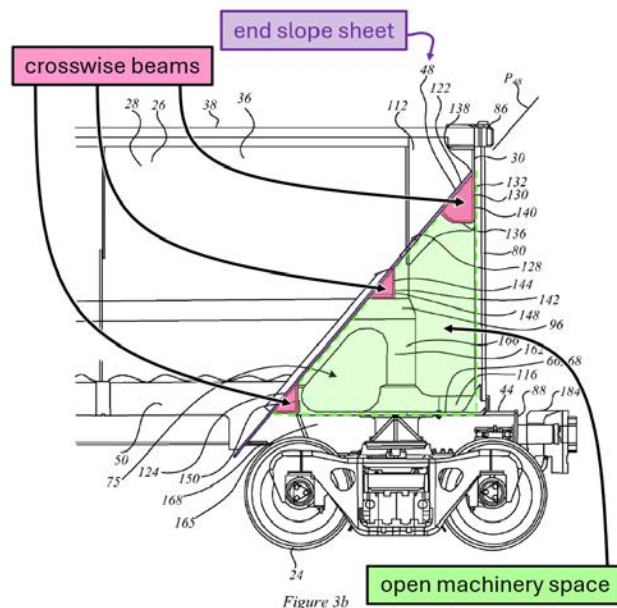
EX1001 at 10:48-11:24 (stating that all figures show the Fig. 1 car).



EX1001, Fig. 1. As shown below, the sole embodiment of the '515 patent has three support beams that extend crosswise along the underside of the slope sheet.



EX1001 Figs. 1, 3a. Limitation 1e requires a hopper car “free of primary structure” directly over the shear plate and under the slope sheet. *Id.*, Claim 1. The three support beams in the ’515 patent embodiment are in that space, as shown below in Fig. 3b.

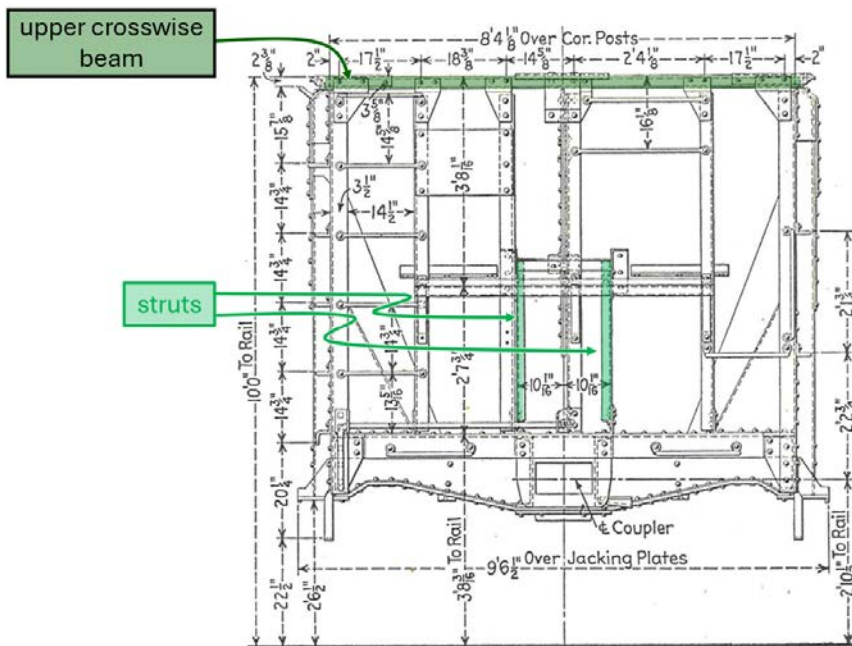
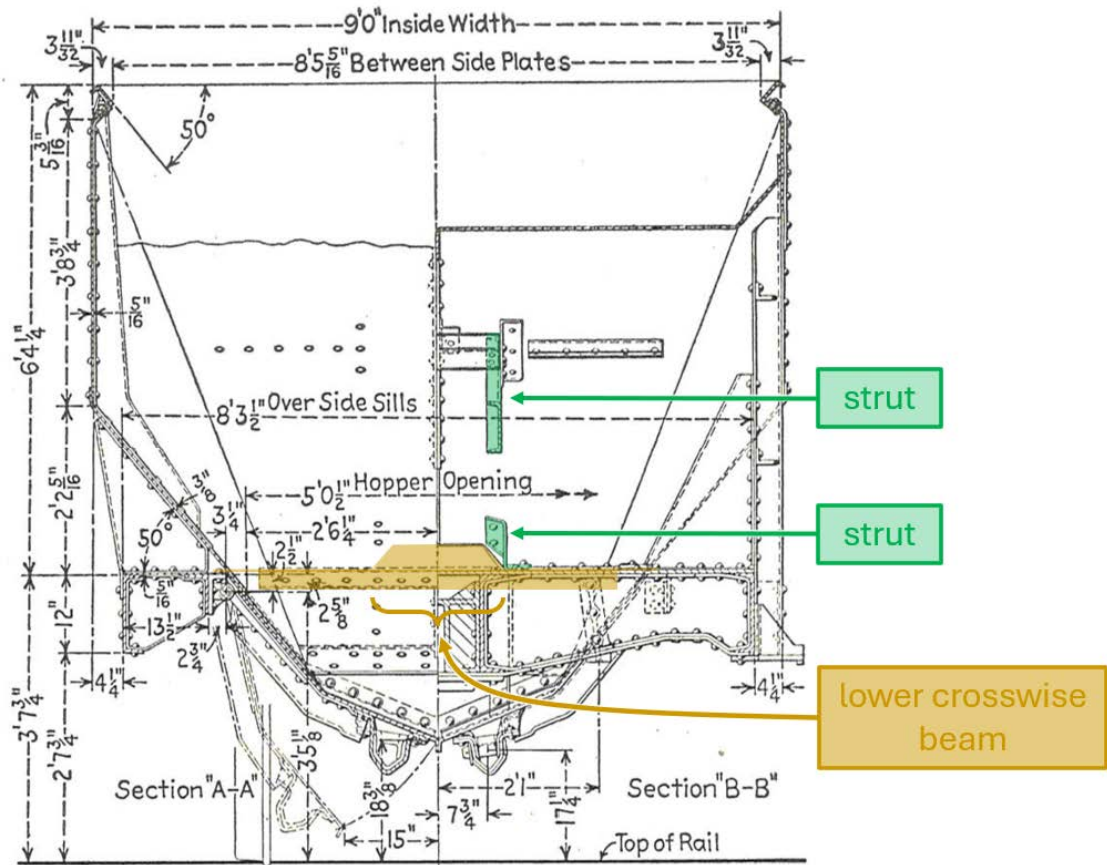


Id., Fig. 3b. I understand Claim 1 covers the only embodiment disclosed in the ’515 patent’s specification. Thus, either (i) the three crosswise beams under the slope sheet are not primary structure, or (ii) their presence on the underside of the slope sheet does not prevent the defined space from being “free of primary structure.” Either way, Claim 1 would cover hopper cars with beams that extend along the underside of the slope sheet.

68. In the NSC ore car disclosed in the 1946 Cyclopedica, the slope sheet is supported by a crosswise beam at the upper end of the slope sheet, a crosswise beam at the lower end of the slope sheet, a large strut positioned at a right angle to the

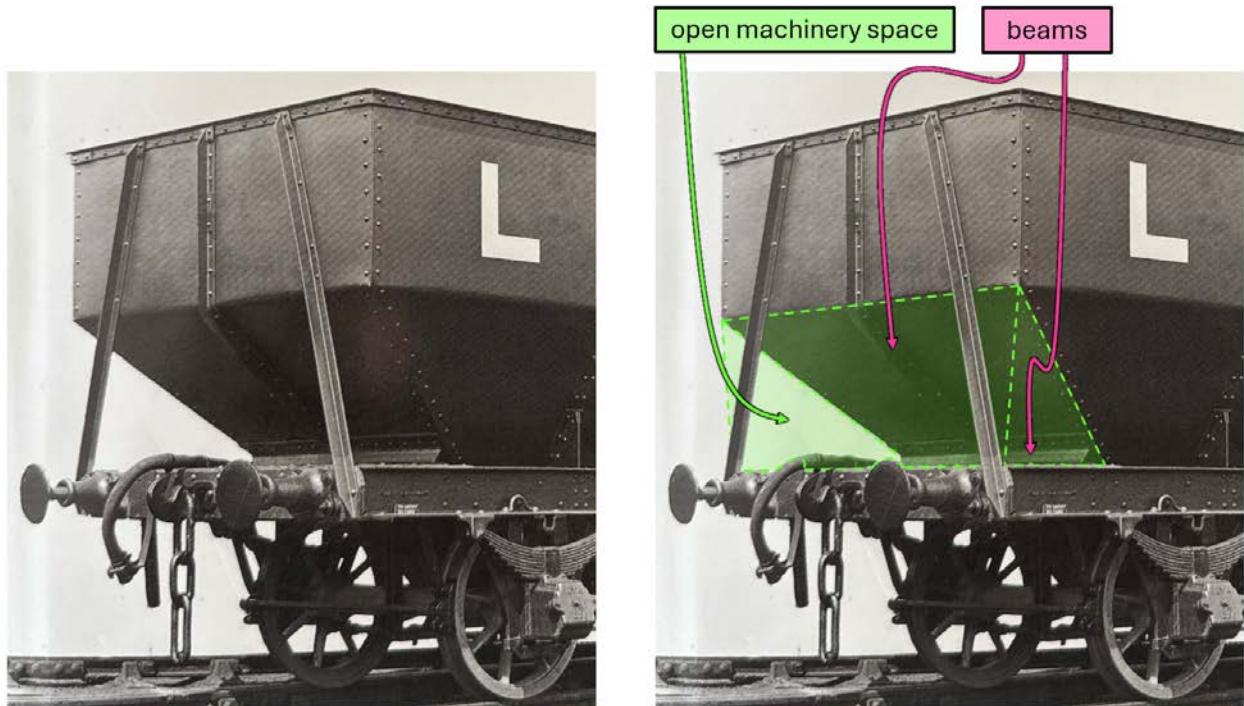
EX1004 at 294.



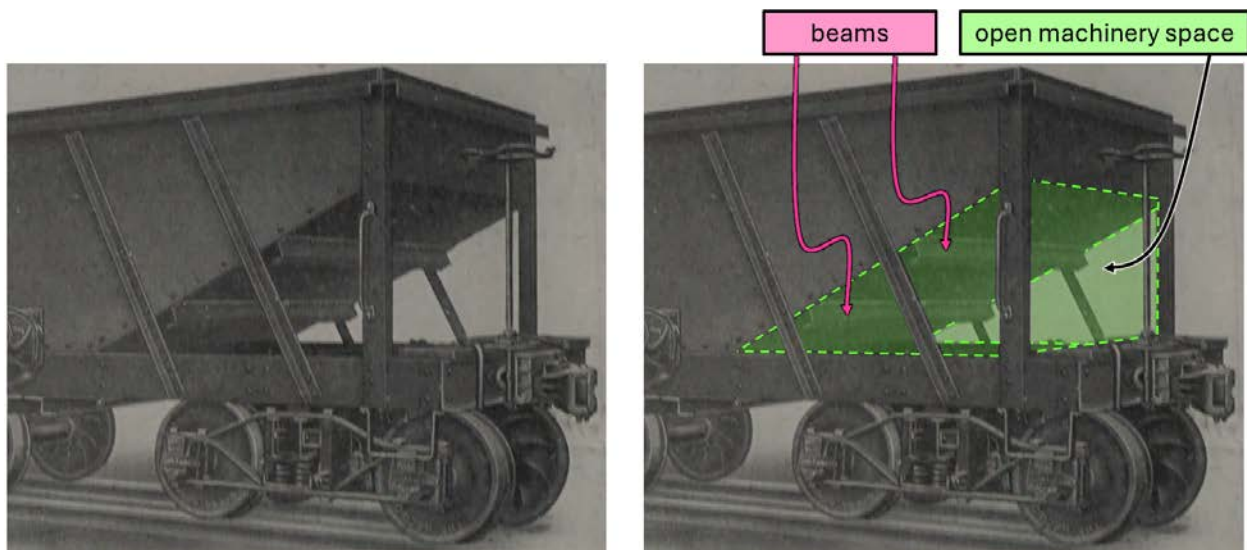


Id. at 294. As discussed above, I understand Claim 1 reads on hopper cars with support beams under the slope sheet. The NSC ore car has two such beams. However, the three struts in the NSC ore car are arguably primary structure located directly above the shear plate and under the slope sheet.

69. Coates's L&Y hopper car and the 1922 Cyclopedia's Gregg ore car each disclose supporting the end slope sheet only with beams, so that the machinery space is unencumbered by primary structure.



EX1007 at cover, 265.



EX1011 at 1113, Fig. 2904.

70. It would have been obvious to a POSITA to support the NSC ore car's slope sheet with only beams, as in the Greg ore car or the L&Y hopper car, by replacing the struts with one or more additional crosswise beams. **First**, a POSITA would have thought to substitute crosswise beams for the struts in the NSC ore car because, only a finite number of structural components can reinforce a hopper car slope sheet. Specifically, slope sheets are supported by (1) struts; (2) longitudinally oriented plates, such as "elephant ears"; (3) crosswise plates, *e.g.*, EX1004 at 266; (4) longitudinally oriented beams; and/or (5) crosswise beams. Thus, a POSITA in 2009 would have found the use of any of these alternatives for supporting the 1946 Cyclopedia ore car's slope sheet to have been obvious. **Second**, Coates suggests using beams to support the slope sheets in the NSC ore car. *E.g.*, EX1007 at front cover. Coates teaches that space is at a premium in hopper cars, and consequently

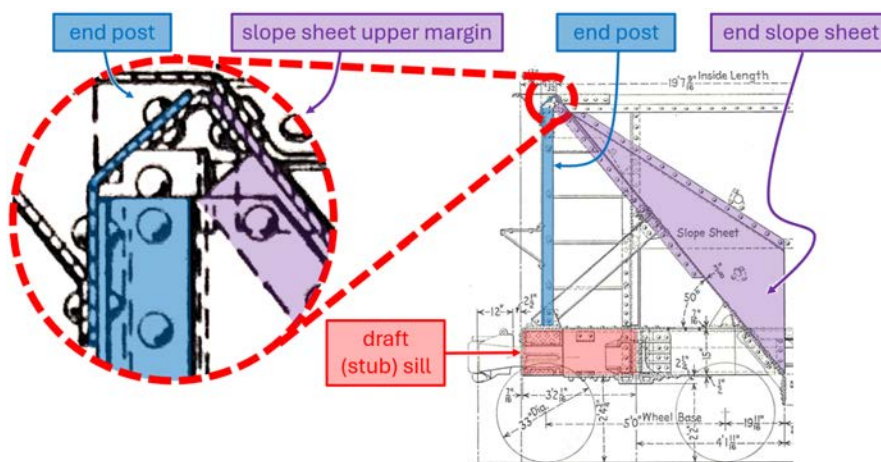
that brake equipment should be mounted on the platform created by one of the shear plates: “Such was the premium on space that the vacuum cylinder and reservoir had to be mounted on the end of one platform....” EX1007 at 261. This suggests using beams to support the slope sheet, as in the L&Y hopper car, as doing so would maximize space for machinery such as brake equipment or equipment for operating the hopper doors. *Third*, the choice between crosswise and longitudinal beams would have been a matter of design choice for a POSITA. To a skilled artisan, either option would have been obvious to try, but the simplest (and therefore most obvious) option would have been to place a third crosswise beam intermediate the upper and lower crosswise beams.

71. In 2009, a POSITA would have had a reasonable expectation of success in using crosswise beams to support the slope sheet, for several reasons. First, slope-sheet-support beams had been used for over a century, and it would have been simple to rivet or weld a beam to the underside of the slope sheet, or to form the beams from the same sheet(s) of metal used to form the slope sheet itself. Further, determining an appropriate size, configuration, number and arrangement of beams to support the expected loads would have been a straightforward application of principles of statics and mechanics.

- e. **[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;”

72. The 1946 Cyclopedia’s NSC ore car discloses option (a) of this limitation, as shown below. That is, its end post extends upwardly from the draft sill to the upper margin of the end slope sheet. EX1004 at 294.



EX1004 at 294.

- f. [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;”

73. The 1946 Cyclopedia’s NSC ore car discloses both options (a) and (b) of this limitation. The ’515 patent discloses a draft sill (stub center sill / stub sill / center sill 44) with a striker 88 at its outboard end, as shown below.

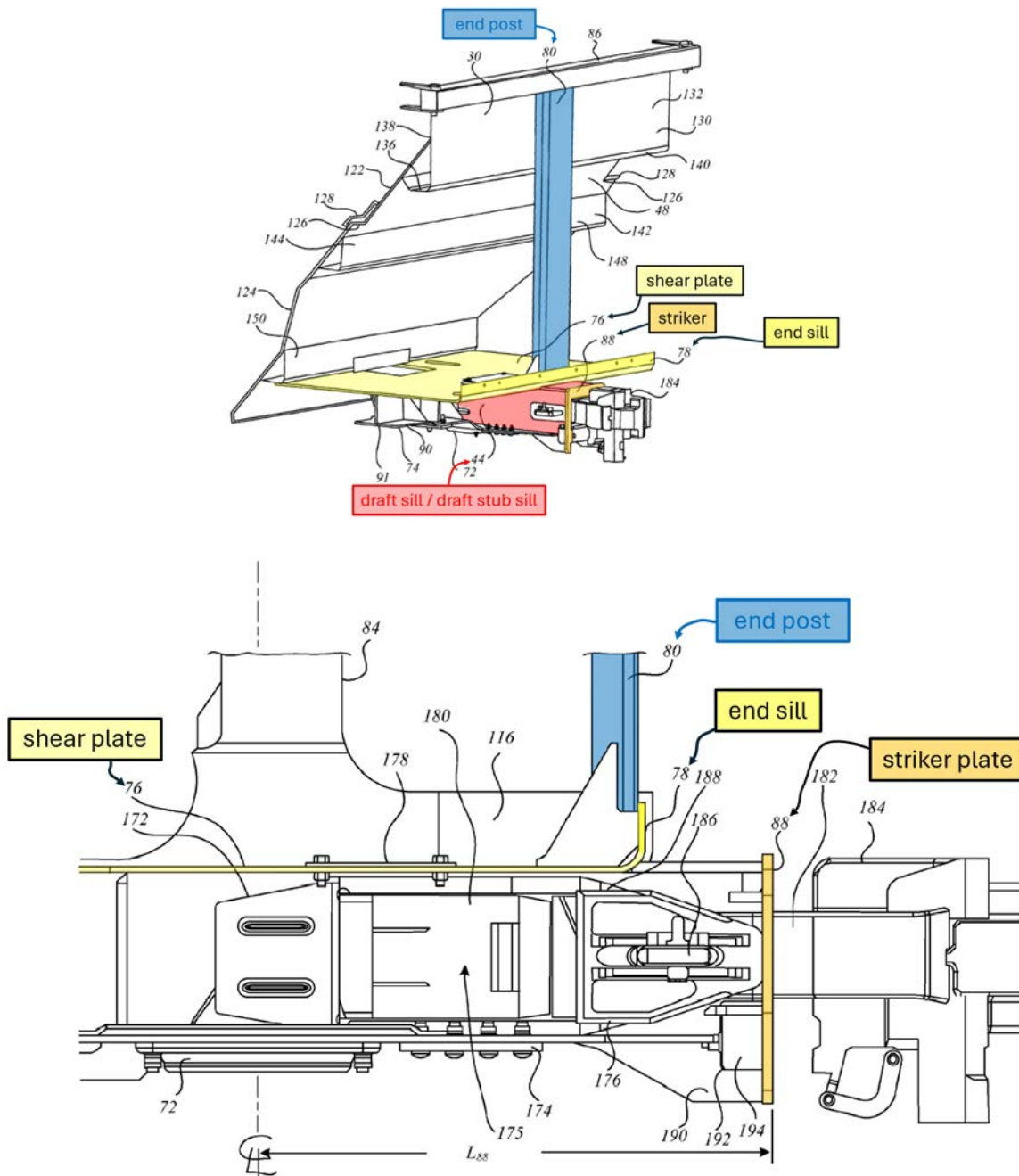
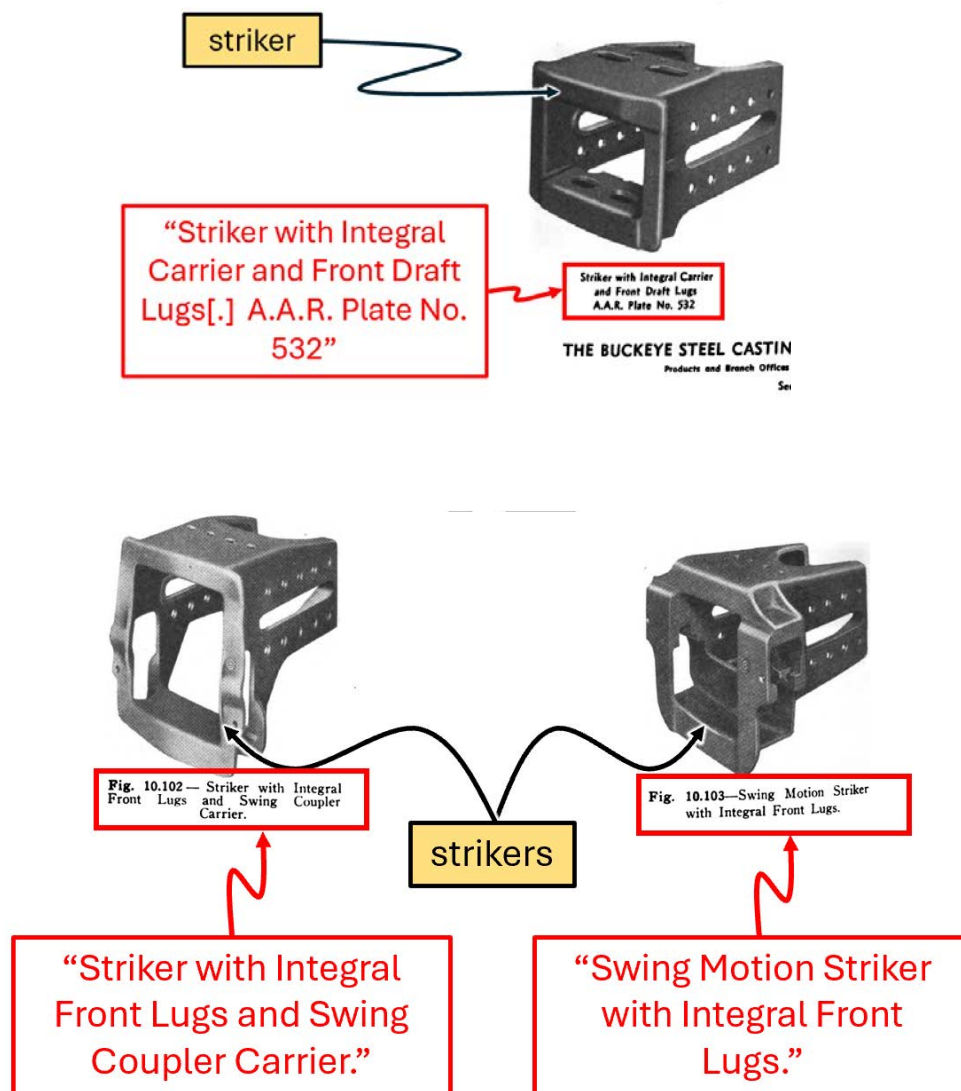


Figure 3c

EX1001 at Figs. 3a, 3c.

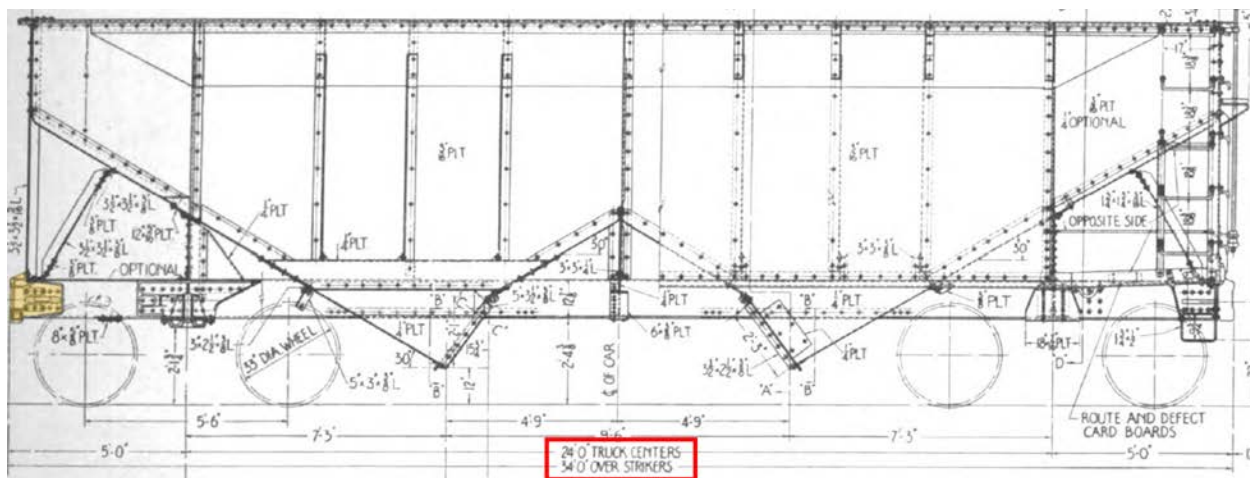
74. The 1946 Cyclopedia defines “striker” and “striking plate” to mean: “A member placed on the ends of the center sills of freight cars against which the horn

of the coupler strikes, preventing damage to the draft gear and center sills.” EX1004 at 62. The reference shows many examples of strikers, including the following:



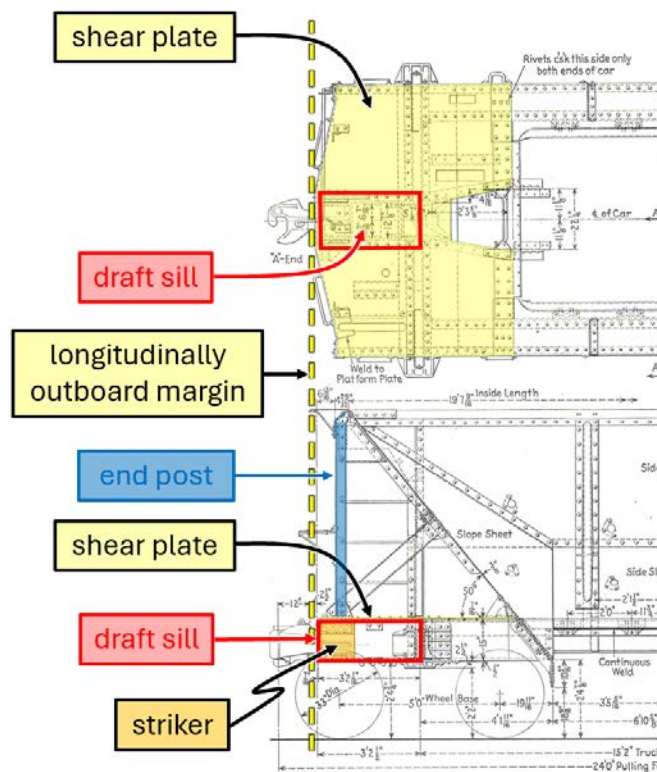
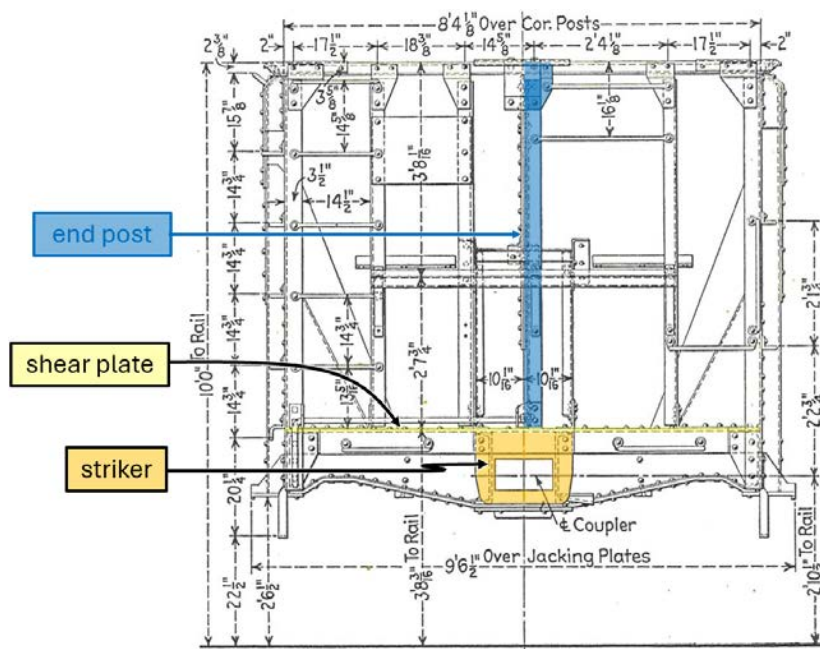
Id. at 972-73; *see also id.* at 1136.

75. As shown below, the 1946 Cyclopedia frequently identifies strikers when calling out the longitudinal length of a car “over strikers” or “over striking plates.”



Id. at 254; *see also id.* at 262, 276, 280. Because strikers protect the rail car from impact with the couplers that connect adjacent rail cars, they are typically placed at the end of the draft sill and therefore longitudinally outboard of truck center. Strikers are standard components on rail cars, and the distance between the strikers is a common measure of a rail car's length.

76. Similarly, as shown below, the 1946 Cyclopedia's NSC ore car discloses a striker on the outboard margin of each draft sill. This striker is outboard of the longitudinally outboard margin of the shear plate. Additionally, as shown below, the NSC ore car discloses its end post rooted to both (a) the draft sill adjacent to the striker and (b) the shear plate adjacent to the longitudinally outboard margin of the shear plate.



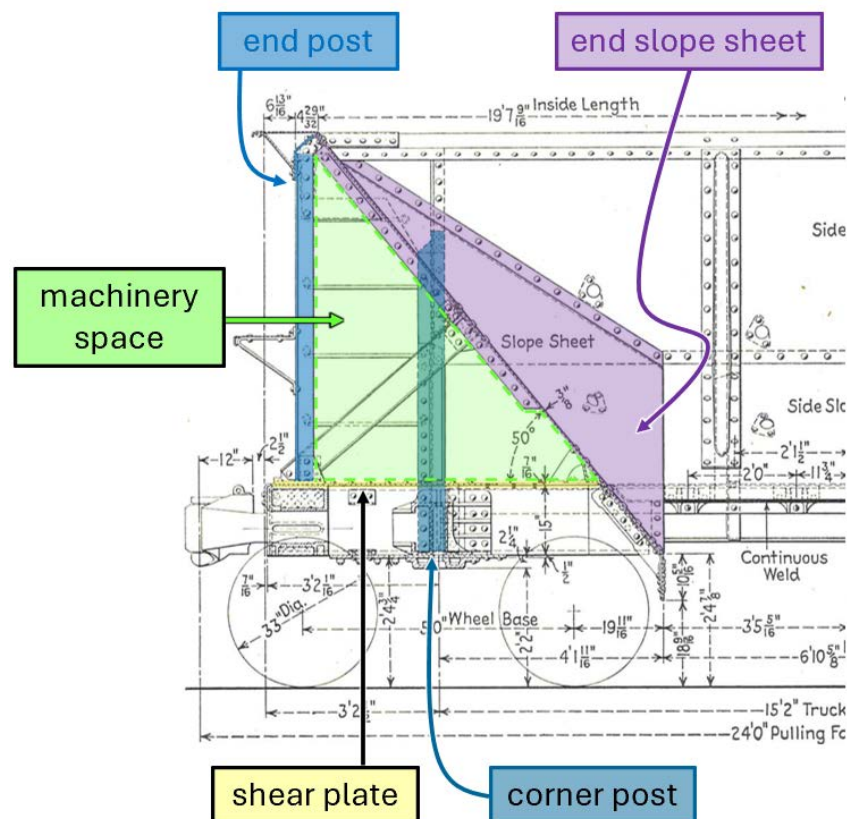
EX1004 at 294.

77. Moreover, strikers have long been standard features on rail cars and a POSITA would have wanted to protect the car's draft sills from damage. Thus, even

if the 1946 Cyclopedia's NSC ore car did not expressly disclose the claimed striker, it would have been obvious to use the claimed striker with that rail car design, in view of the portions of the same reference cited above.

- g. [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.”**

78. The 1946 Cyclopedia's NSC ore car, as modified in view of either Coates or the 1922 Cyclopedia's Gregg ore car, discloses this limitation. The 1946 Cyclopedia's NSC ore car discloses the claimed machinery space bounded by (a) the first end slope sheet, (b) the shear plate, (c) the end post, and (d) the corner posts.



EX1004 at 294.

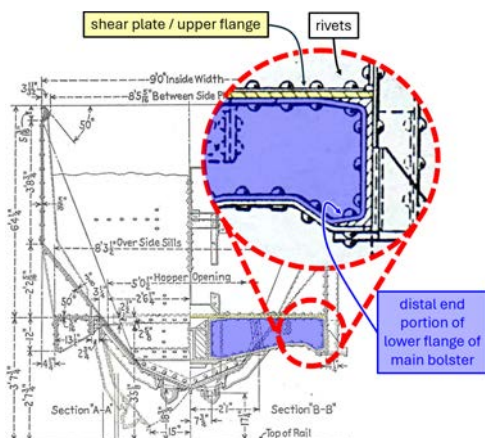
79. As discussed above with limitation [1e], it would have been obvious to remove the NSC ore car's struts and support the slope sheet only with beams, as in Coates or the 1922 Cyclopedia's Gregg ore car. EX1004 at 294; EX1007 at cover, 261–65; EX1011 at 1113, Fig. 2904. So modified, the NSC ore car would have a machinery space free of primary structure, as claimed.

2. Dependent Claim 5

- a. [5a] “The railroad hopper car of claim 1 wherein: said shear plate is mounted above, and to, said main bolster and defines an upper flange thereof;”**

80. The 1946 Cyclopedia's NSC ore car discloses its shear plate being mounted above, and to, the main bolster. Both the end and the top views appearing below show a row of laterally placed rivets. The end view shows the upper and lower portions of those rivets are vertically aligned. The top view shows those rivets placed longitudinally where a POSITA would understand to be the traditional location for a main bolster. In this arrangement shown in the figures below, wherein the shear plate is above and extends longitudinally beyond the main bolster, the shear plate define an upper flange of the main bolster.

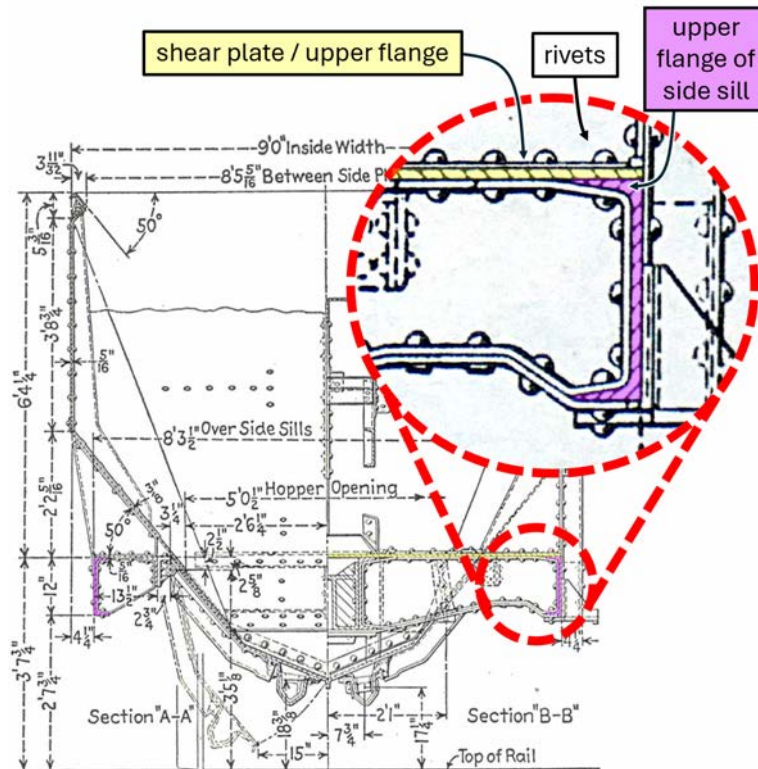
81. The 1946 Cyclopedia's NSC ore car discloses that the main bolster has a lower flange, which is the figure appearing below labels as a "distal end portion of lower flange of main bolster." As also shown below, that lower flange is downwardly spaced from the upper flange, which limitation [5a] defines as the shear plate. As further shown below, the lower flange of the main bolster is terminating at a distal end portion of the main bolster, which is at the far right of the main bolster in the figure below. That is at the side of the car, as shown, for example, in the op view shown for limitation [5a] above.



c. [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”

FreightCar America, Ex. 1003
IPR Petition - USP 8,132,515

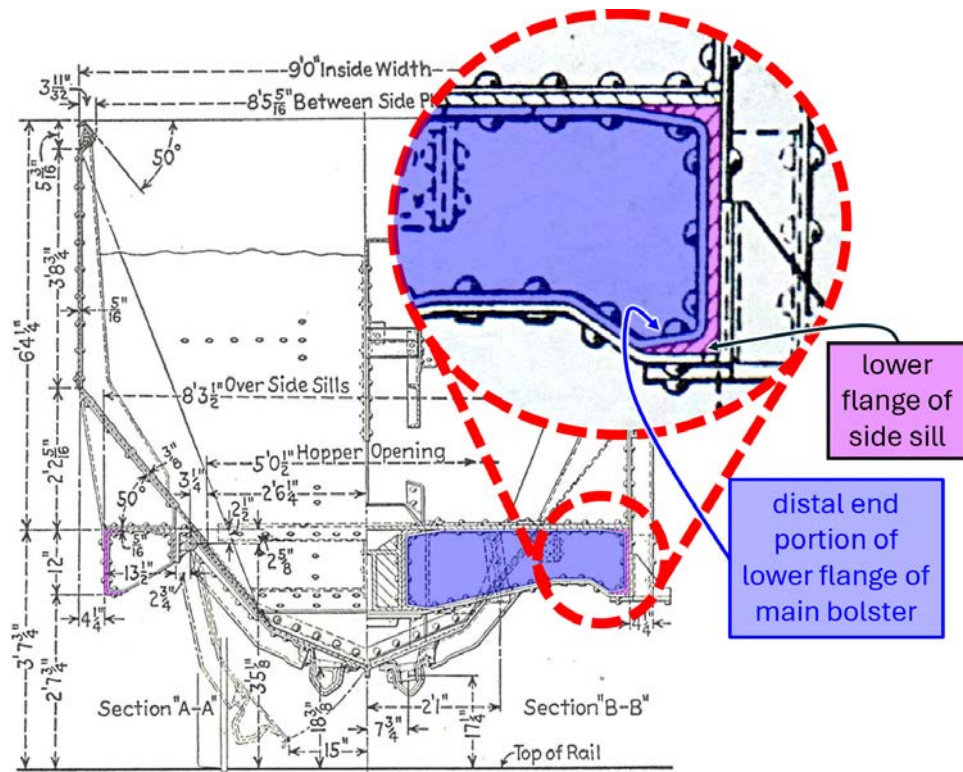
is connected to the shear plate and secured with a rivet. The reference further discloses that the upper flange is substantially co-planar with the shear plate—indeed, they share the plane of their connection.



EX1004 at 294.

- d. [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.”

83. The 1946 Cyclopedia’s NSC ore car discloses that its side sill has (i) a lower flange and (ii) a distal end portion of the lower flange of the main bolster, both labeled below. The reference further discloses these features as substantially co-planar—indeed, they share the plane of their connection.



EX1004 at 294.

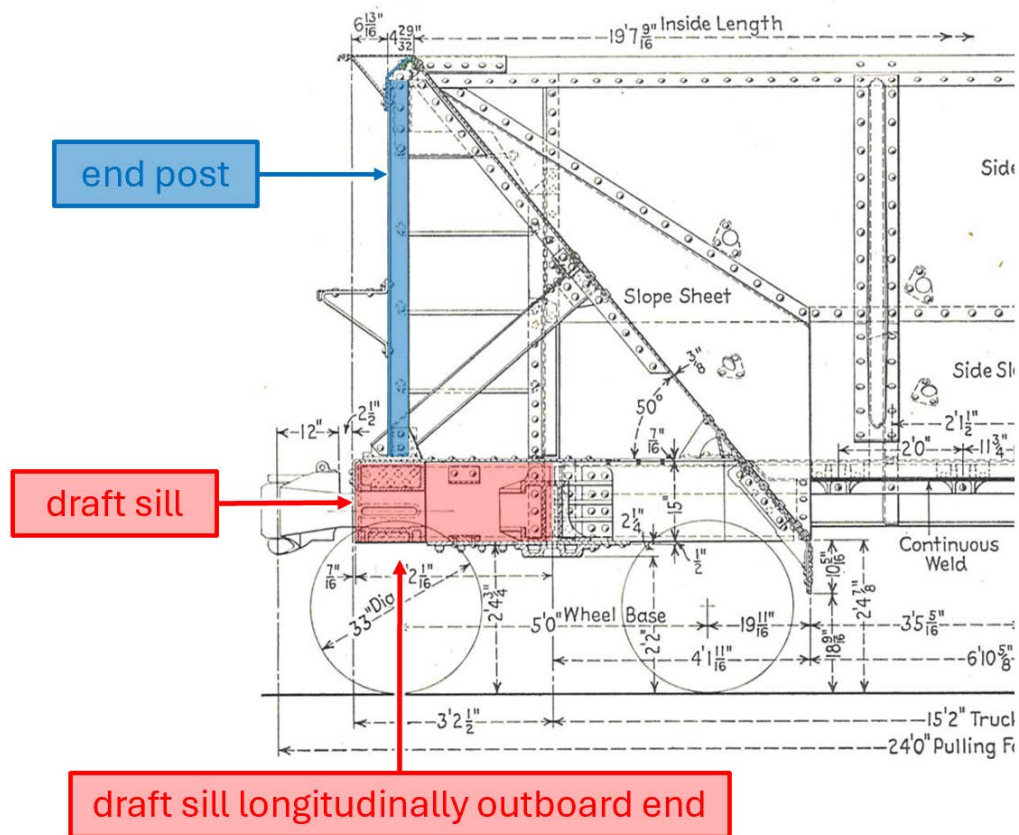
3. **Dependent Claim 6: “The railroad hopper car of claim 5 wherein said shear plate defines an upper flange of said draft sill whereby said draft sill upper flange, said shear plate and said side sill upper flange are all substantially co-planar.”**

84. In the arrangement the 1946 Cyclopedia’s NSC ore car discloses in the figures below, wherein the shear plate is above and extends longitudinally beyond the draft sill, the shear plate defines an upper flange of the draft sill. The reference further discloses that the same draft sill upper flange / shear plate is substantially co-planar with the side sill upper flange, as shown below—indeed, they share the plane of their connection.

4. Independent Claim 20

- a. [20i] “said draft sill has a longitudinally outboard end; an end post stands upwardly of said longitudinally outboard end of said draft sill;”**

85. The 1946 Cyclopedia's NSC ore car discloses an end post that stands upwardly of a longitudinally outboard end of a draft sill.



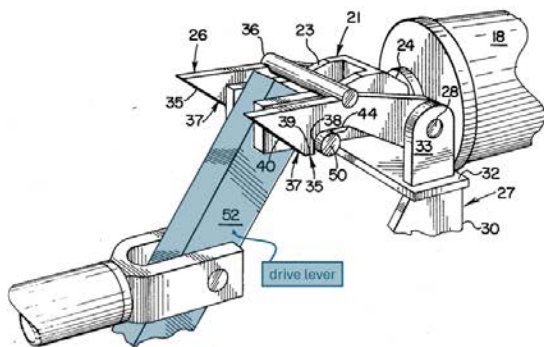
EX1004 at 294.

B. Ground 2: Claims 3 and 21-22 – obviousness over the 1946 Cyclopedia in view of either Coates or the 1922 Cyclopedia and further in view of Schuller.

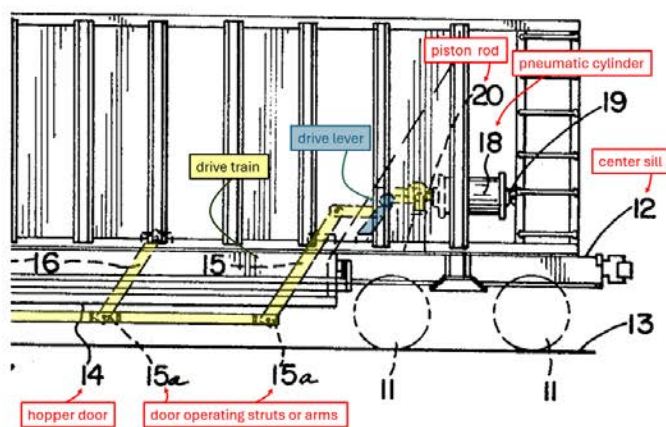
1. Dependent Claim 3

- a. [3b] “a longitudinally acting pneumatic actuator is at least partially lodged in said machinery space directly above said draft sill.”

86. Schuller also discloses longitudinally hinged discharge doors: “Hopper doors 14 are pivoted on a longitudinal axis and open downward to discharge lading.” EX1014 at 1:53–54. Schuller teaches using a “pneumatic cylinder means operative upon a door opening lever mechanism for opening and closing of pivoted discharge doors.” *Id.*, claim 1. Schuller’s pneumatic cylinder acts longitudinally by moving lever 52 longitudinally, which in turn moves other components of the drive train longitudinally to open or close the hopper doors.



Schuller Fig. 5



Schuller Fig. 1

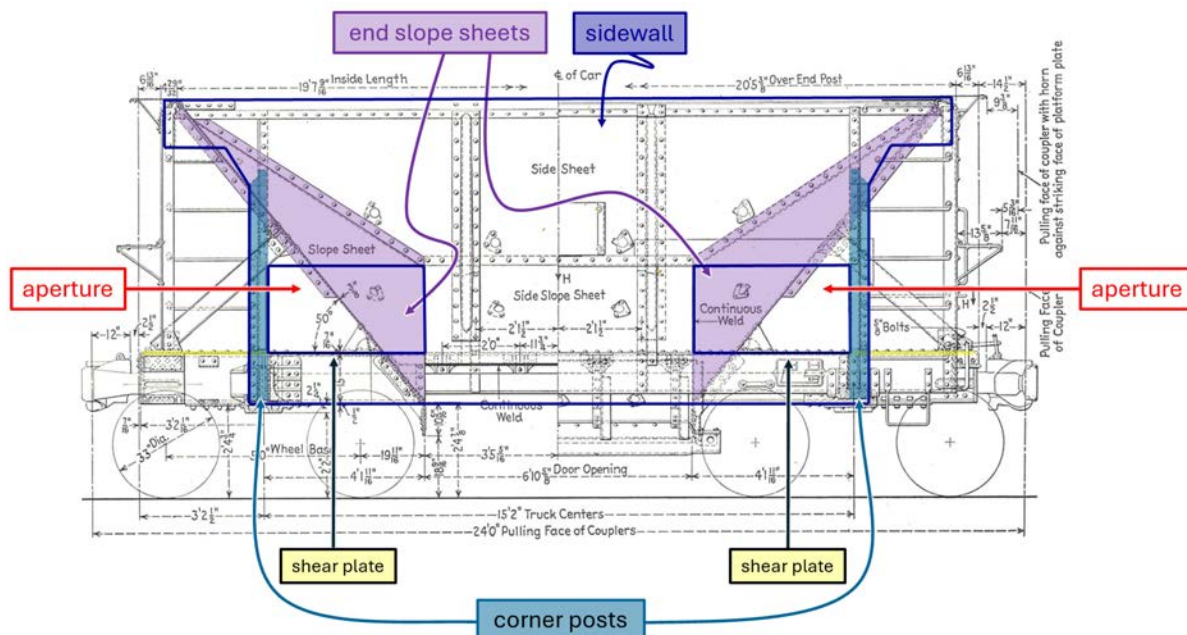
EX1014, Figs. 1, 5. As Fig. 1 shows, Schuller’s pneumatic cylinder 18 is mounted in the machinery space. Fig. 5 shows that it is directly above supporting means 27,

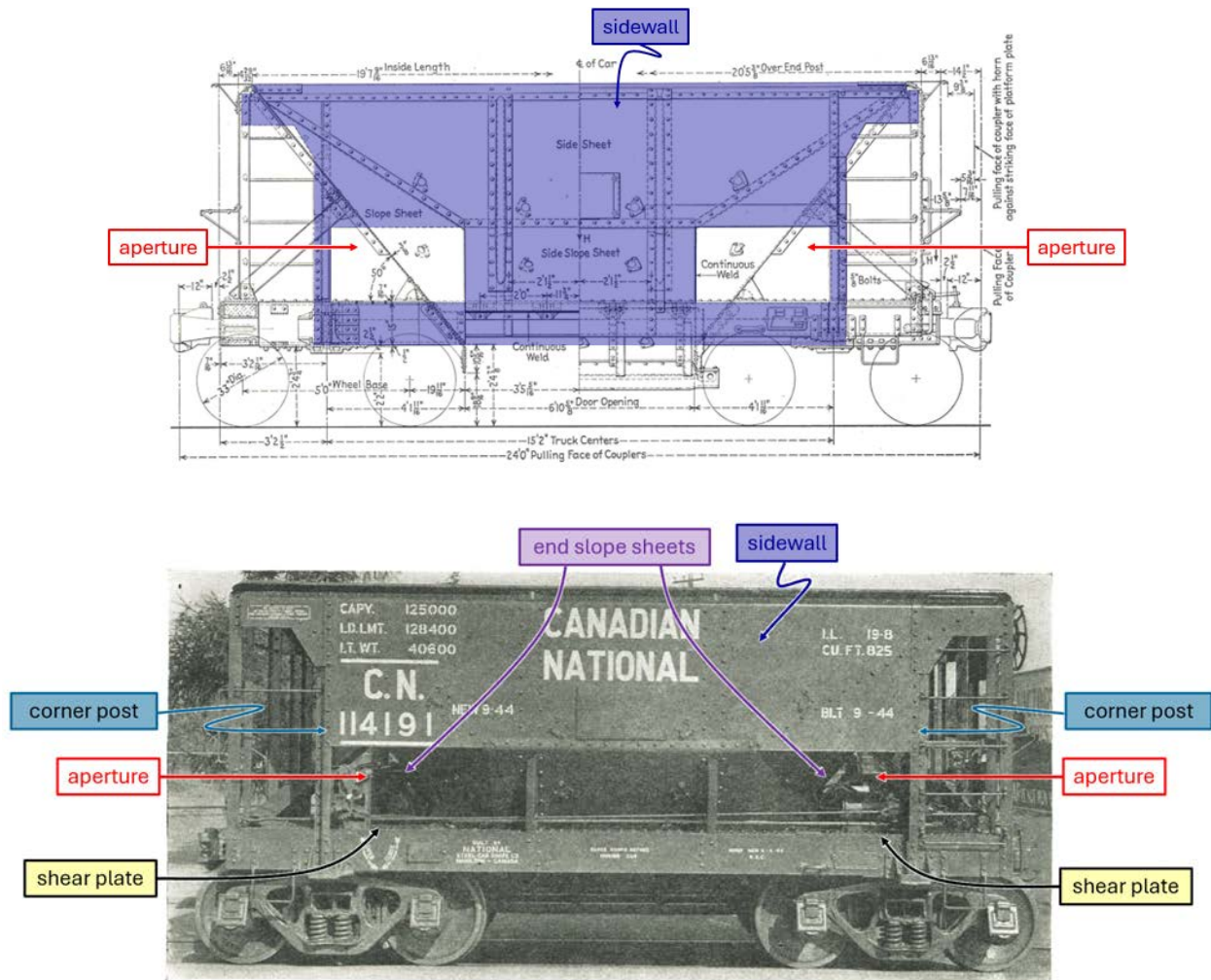
which in turn is “fixedly attached to the top 29 of the center sill 12.” *Id.* at 2:7-9.

87. The 1946 Cyclopedia’s NSC ore car does not show a complete mechanism for operating the hopper doors. A POSITA would have known that some door-opening mechanism is necessary in the NSC design and would have been motivated to use a pneumatic door-operating system like Schuller’s to automate the door-opening process, thereby reducing the manual labor required and the risk of injury. So modified, the 1946 Cyclopedia’s NSC ore car would embody Claim 3.

2. Dependent 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.”

88. The following applies to claim 22 and similar claims and limitations, including claim 23. The 1946 Cyclopedia’s NSC ore car discloses this limitation:





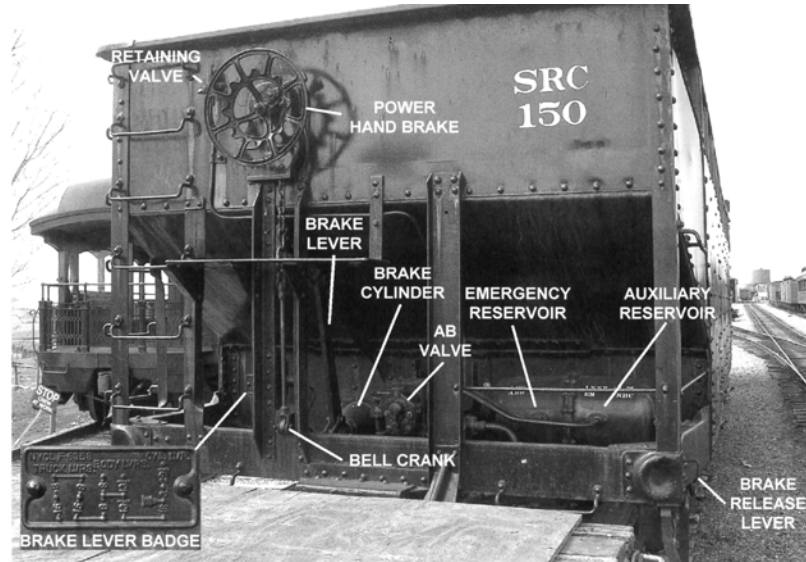
EX1004 at 294-95.

C. **Ground 3: Claim 4 – obviousness over the 1946 Cyclopedia in view of either Coates or the 1922 Cyclopedia and further in view of Schuller and Karig.**

1. **Dependent Claim 4: “The railroad hopper car of claim 3 wherein a brake reservoir is also at least partially lodged in said machinery space.”**

89. Lodging the brake reservoir in the machinery space has been conventional for decades. For example, Karig discloses multiple hopper cars with

this configuration. *See, e.g.,* EX1016 at 127, 129. One such example is shown below.



Id. at 129 (annotations in the original).

90. By 2009, it would have been obvious to use a conventional air brake system in Hart's design, and to lodge the brake reservoir in the conventional place, *i.e.*, in the machinery space at one end of the rail car. So modified, 1946 Cyclopedia's NSC ore car would embody the limitation of claim 4.

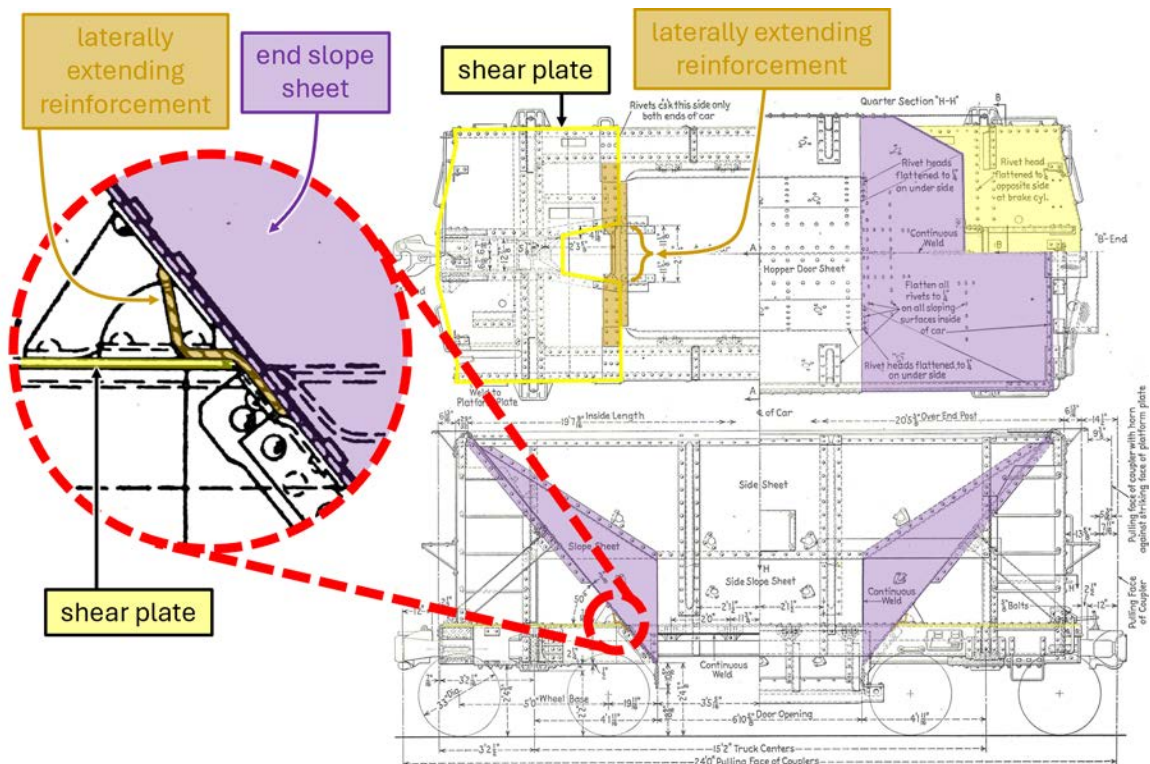
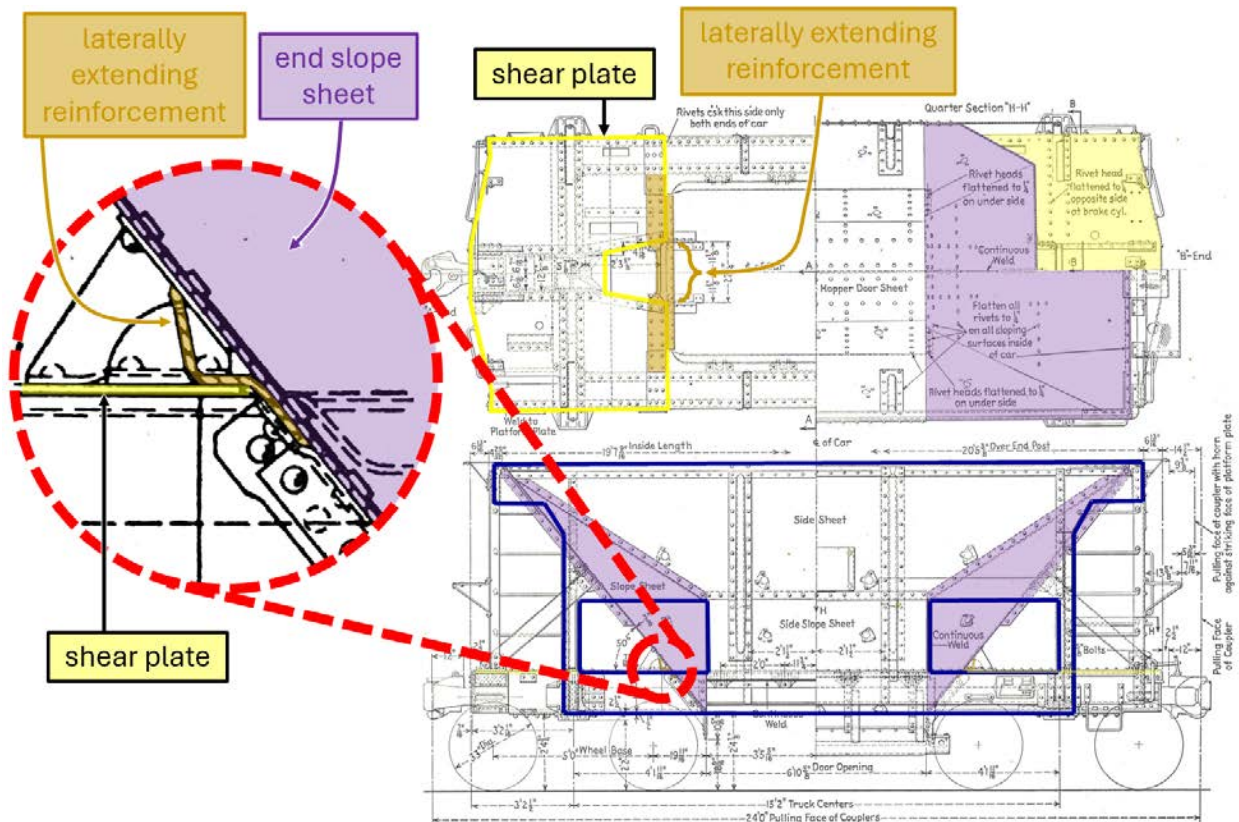
D. Ground 4: Claims 7-16, 18-19, 24-27, 30-35, and 38-42 – obviousness over the 1946 Cyclopedia in view of Wong.

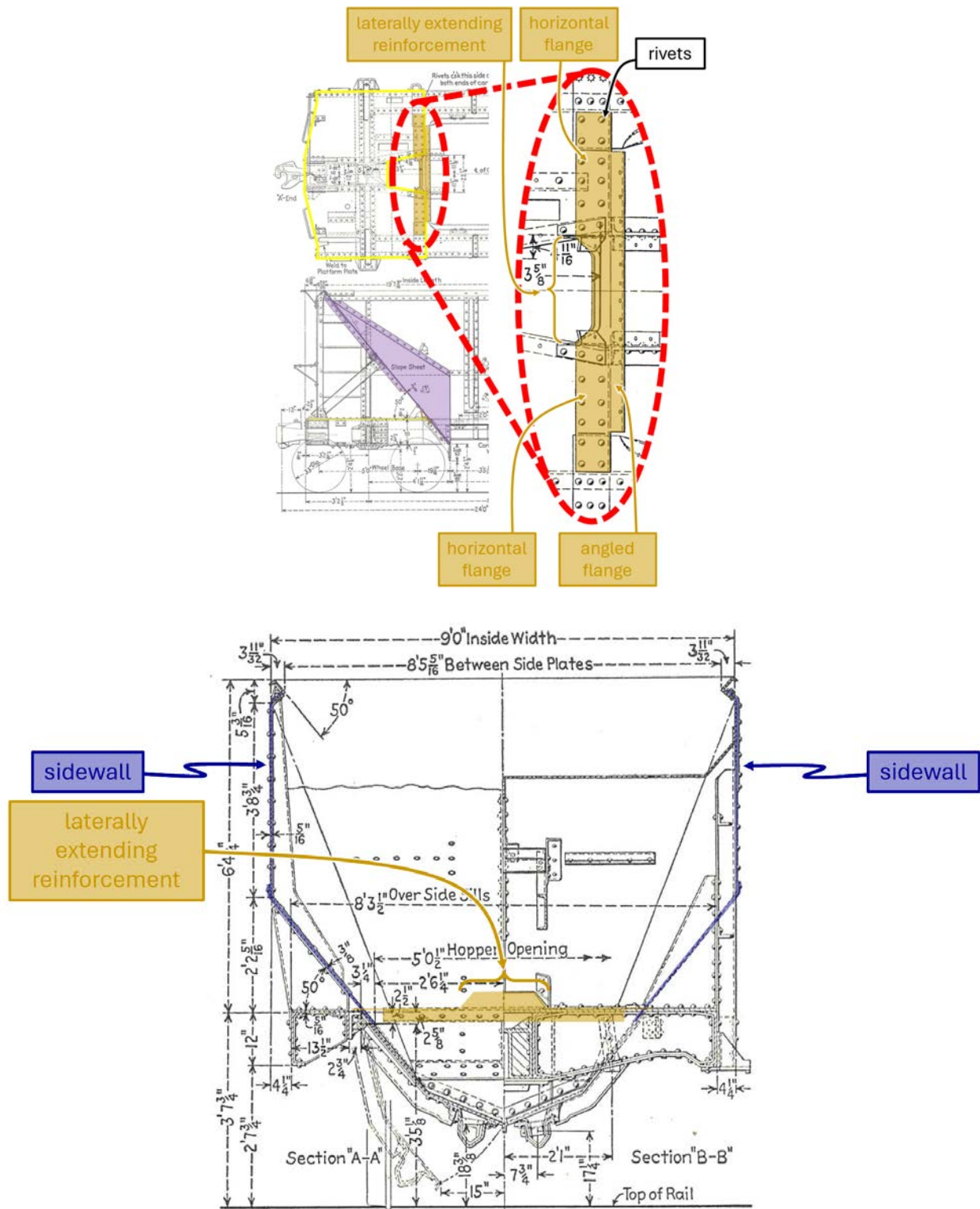
1. Independent Claim 7

- a. [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;"

91. The following applies to limitation [7f] and similar limitations, including limitation [20f]. As shown below, a laterally extending reinforcement for the slope sheet (orange) is riveted to the top of the shear plate. The center portion of the longitudinally outboard edge of that reinforcement is bent upwards to contact the bottom surface of the slope sheet, forming a hollow section beam extending across the hopper car between the sidewalls.





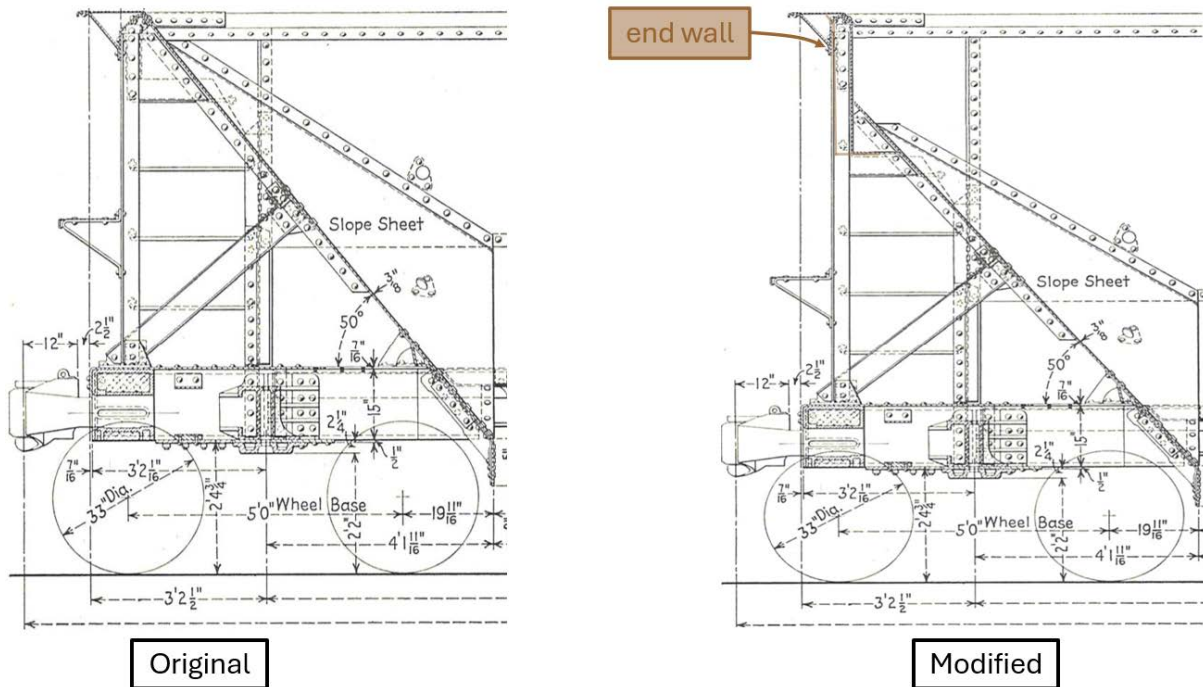
EX1004 at 294.

92. As shown above, the laterally extending reinforcement is between the car's side walls, as limitation [7f] requires.

- b. [7g] **“said hopper car being free of longitudinally oriented elephant ears extending between said draft sill and said end slope sheet;”**

93. The '515 patent defines “elephant ears” as “large, substantially triangular planar plates ... that have one edge fixed along the junction of the center sill webs and the center sill cover plate, and another edge welded to the end slope sheet.” EX1001 at 14:63-67. The NSC ore car disclosed in the 1946 Cyclopedia lacks elephant ears. Instead, the slope sheet is supported by the two crosswise beams discussed above, a large strut positioned at a right angle to the slope sheet, and two small struts positioned near the bottom of the slope sheet. The large strut and one of the two small struts may be seen in the drawing below. EX1004 at 294. Besides not being elephant ears, the small struts do not extend from the draft sill, which the '515 patent defines as the portion of the center sill outboard of truck center. *Id.*; *see also* EX1001 at 14:36-39.

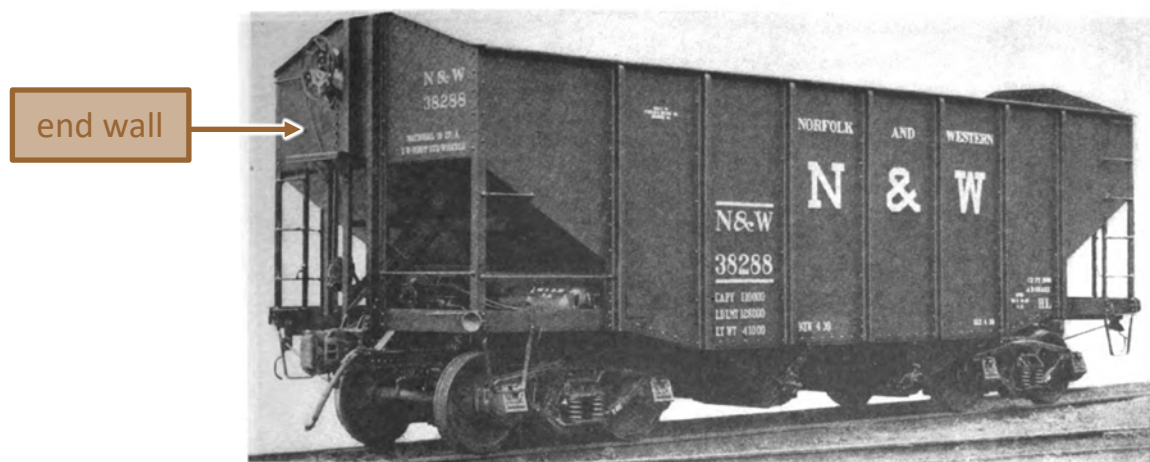
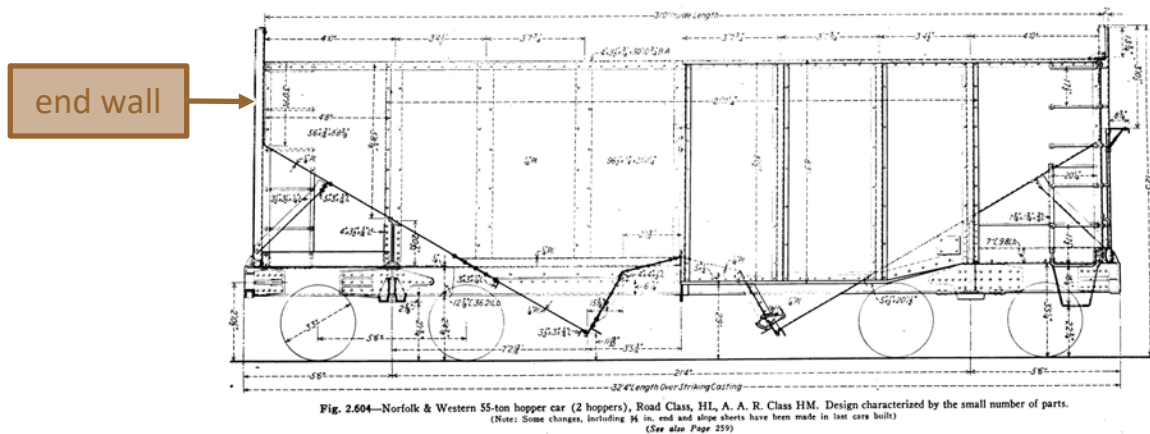
hopper; or (ii) by reducing the inclination of the slope sheets so that their outboard ends terminate at a lower height (*i.e.*, lower along the end wall). The exemplary illustration below shows such a modification using the latter method:



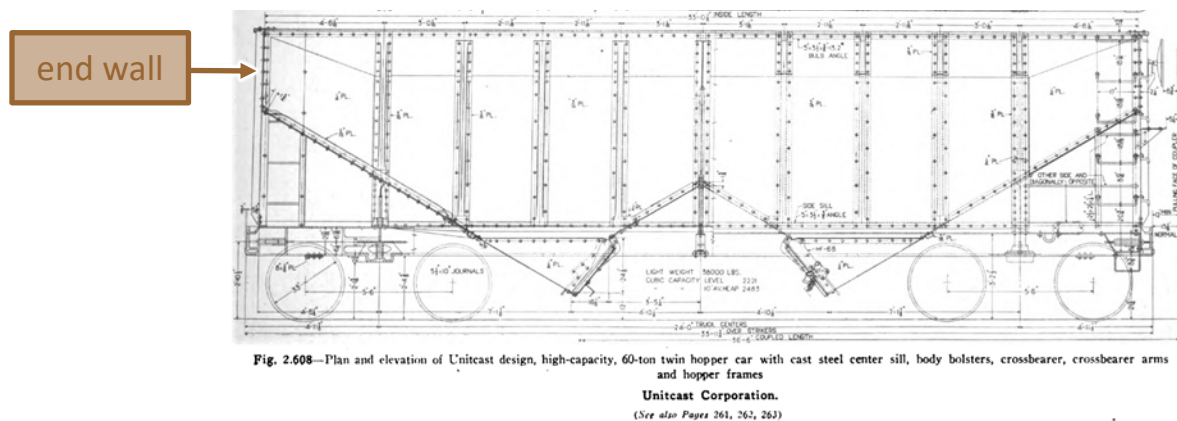
EX1004 at 294 (modified).

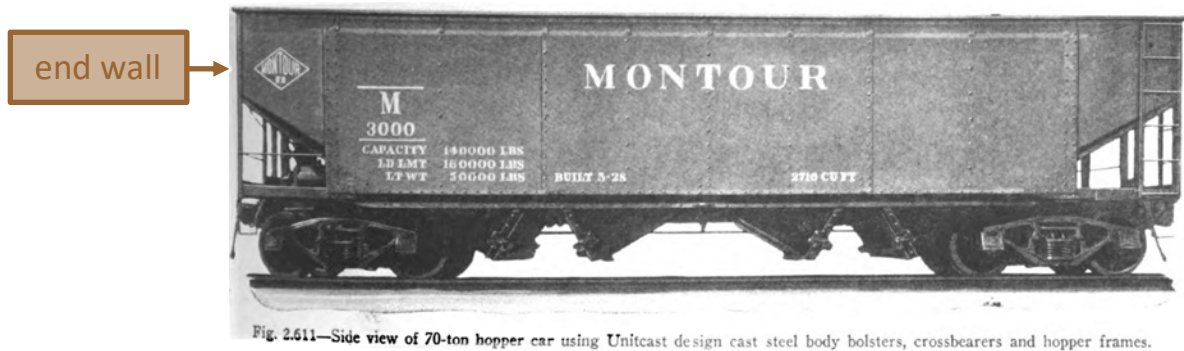
96. A POSITA would have had reason to modify the NSC design to incorporate an end wall, as in Wong. First, doing so would increase the hopper's volume without increasing the rail car's length or width (or even its height, if the end wall is added by altering the incline of the slope sheets).

97. Second, by 2009, end walls were common and well-known optional features of hopper cars. Indeed, end walls were common and well-known even by 1946, as demonstrated by the numerous examples of hopper cars with end walls shown in the 1946 Cyclopedia, such as the following:

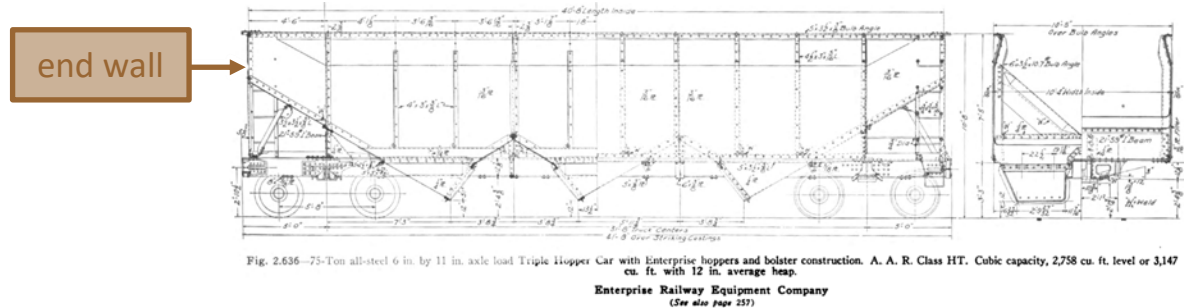
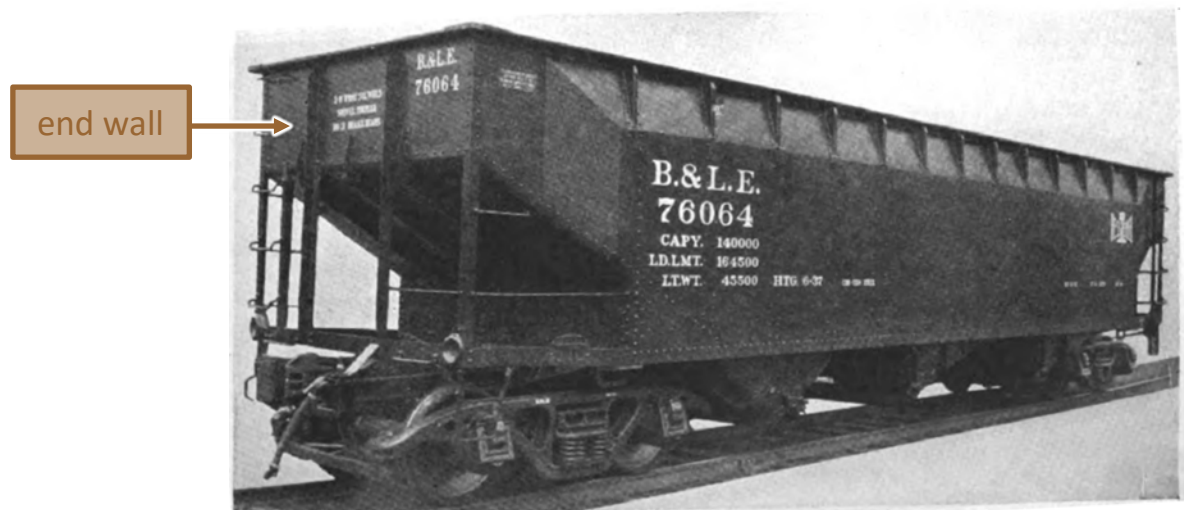


EX1004 at 258-59 (Norfolk & Western 55-ton hopper car).





Id. at 260, 263 (Unicast Corporation hopper cars).

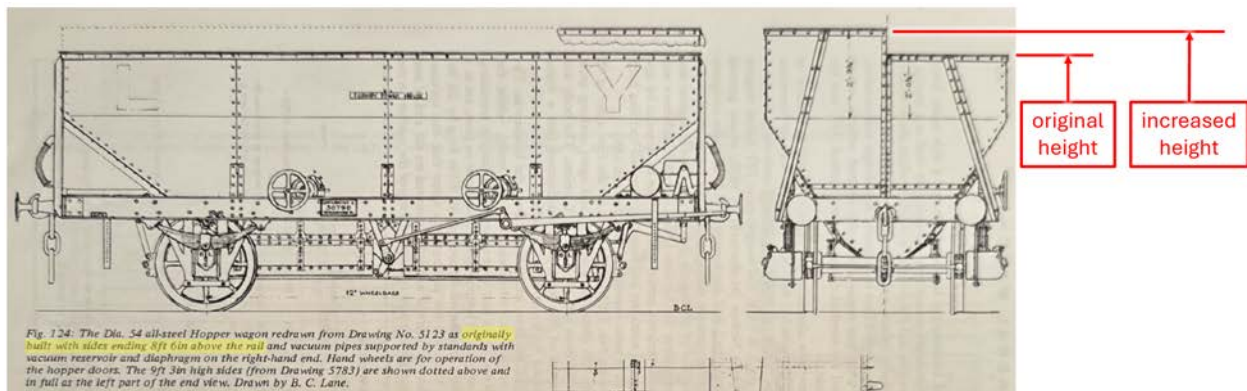


Id. at 275 (Enterprise hopper car).

98. Third, incorporating an end wall (such as Wong's) in the NSC design would have been obvious to a POSITA because it is one of a finite number of well-

understood options for the end of a hopper car, namely: (i) incorporating an end wall or (ii) extending the slope sheet to the top cord. The routine design choice between these two options is governed by balancing well-understood considerations, *e.g.*, maintaining the desired maximum exterior dimensions of the railcar, maximizing the capacity of the hopper, supporting the loads carried by the slope sheet and hopper doors, and maximizing the car's efficiency in discharging its intended lading.

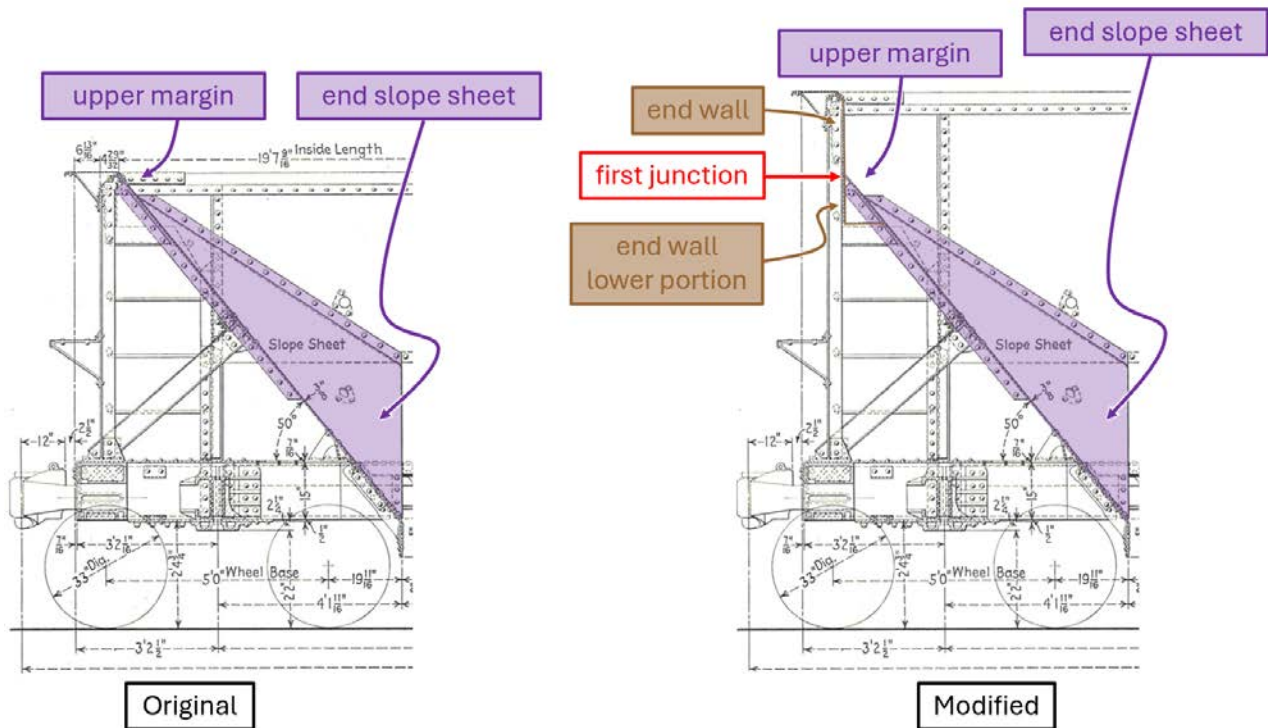
99. Finally, as shown below, Coates describes how the height of the hopper walls on the L&Y Hopper Car was increased by nine inches from 1904-1906 to increase the hopper's capacity. EX1007 at 263. This suggests increasing the height of the hopper walls of the NSC design, thereby creating end walls.



EX1007 at 262, 265.

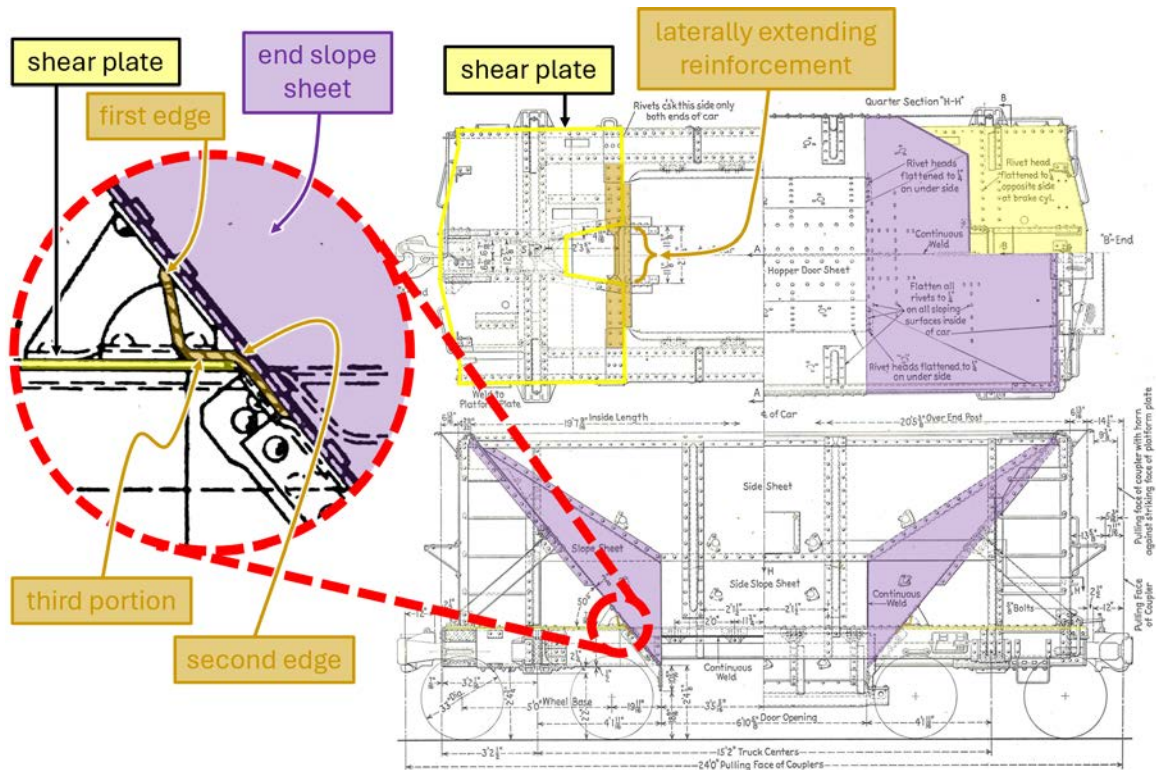
100. Because end walls had been commonplace for decades before 2009, a POSITA would have had a reasonable expectation of success in incorporating an end wall in the NSC design disclosed in the 1946 Cyclopedia.

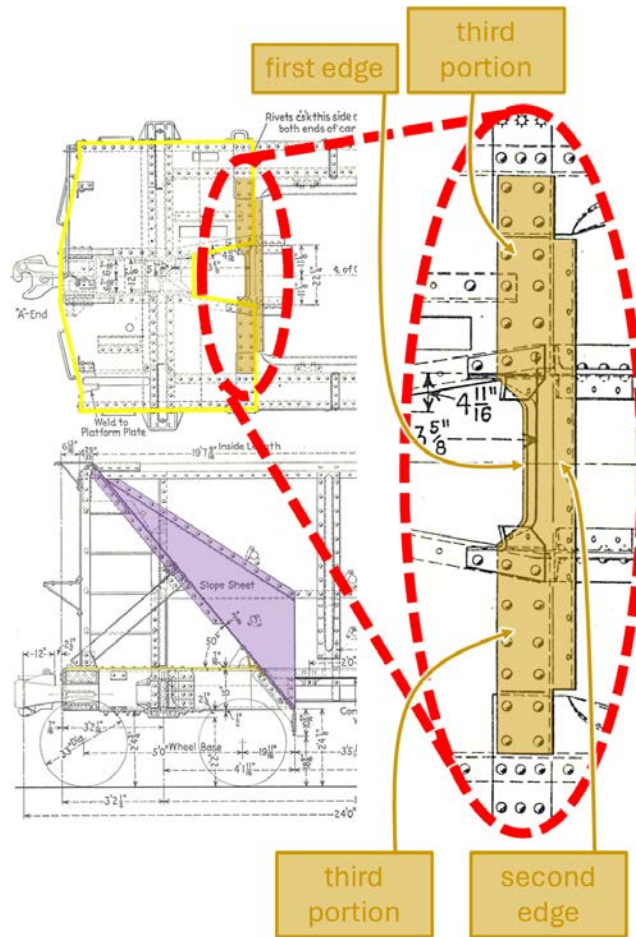
101. It also would have been obvious to use the specific end wall shown in Wong – with a bent lower end – to provide additional support for the slope sheet. A POSITA would have had a reasonable expectation of success because of the simplicity of the modification: bending the lower end of the end wall. The modified design would satisfy limitation [7h], as illustrated below.



2. **Dependent Claim 8: “The railroad hopper car of claim 7 wherein said laterally extending reinforcement member includes a first edge mounted cross-wise along said first end slope sheet; a second edge mounted cross-wise along said first end slope sheet and spaced from said first edge, and a third portion mounted across said shear plate of said first end section.”**

102. The 1946 Cyclopedia’s NSC ore car discloses this limitation:

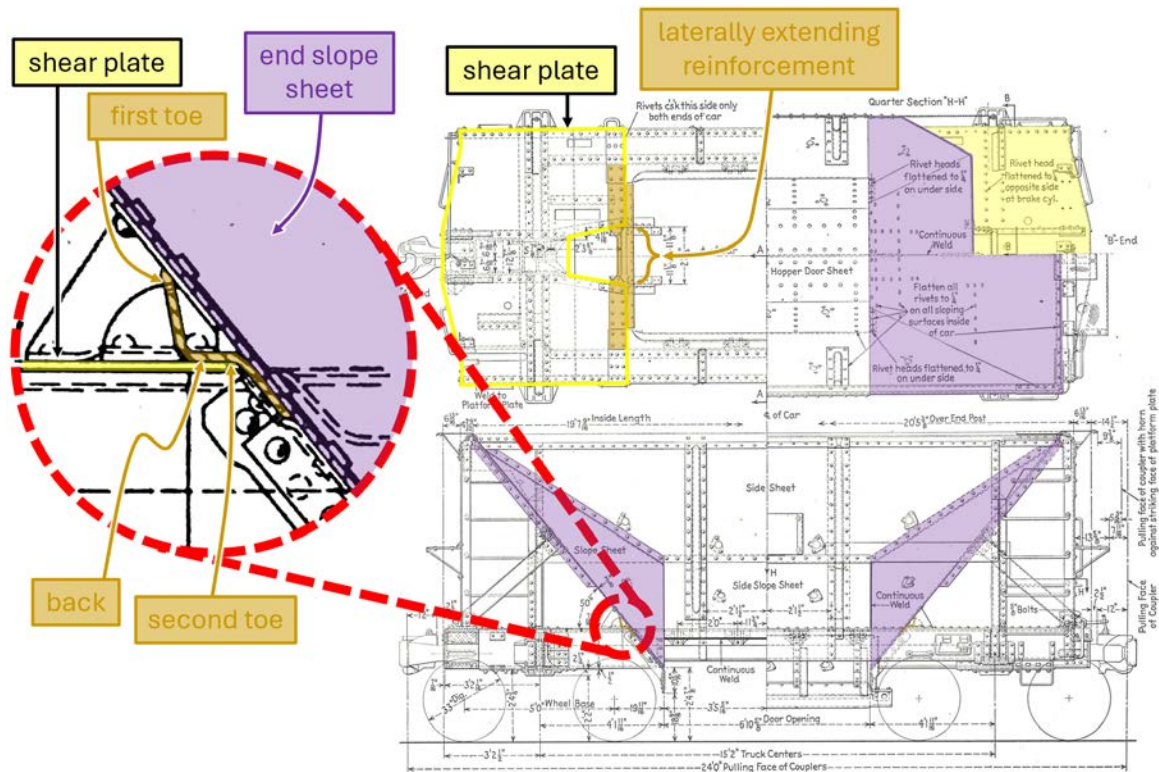




EX1004 at 294.

3. **Dependent 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.”**

103. The 1946 Cyclopedia’s NSC ore car discloses that the laterally extending member has a pair of first and second spaced apart toes; is mounted toes-in against the first end slope sheet; and, with the end slope sheet, defines the first hollow section beam.



EX1004 at 294.

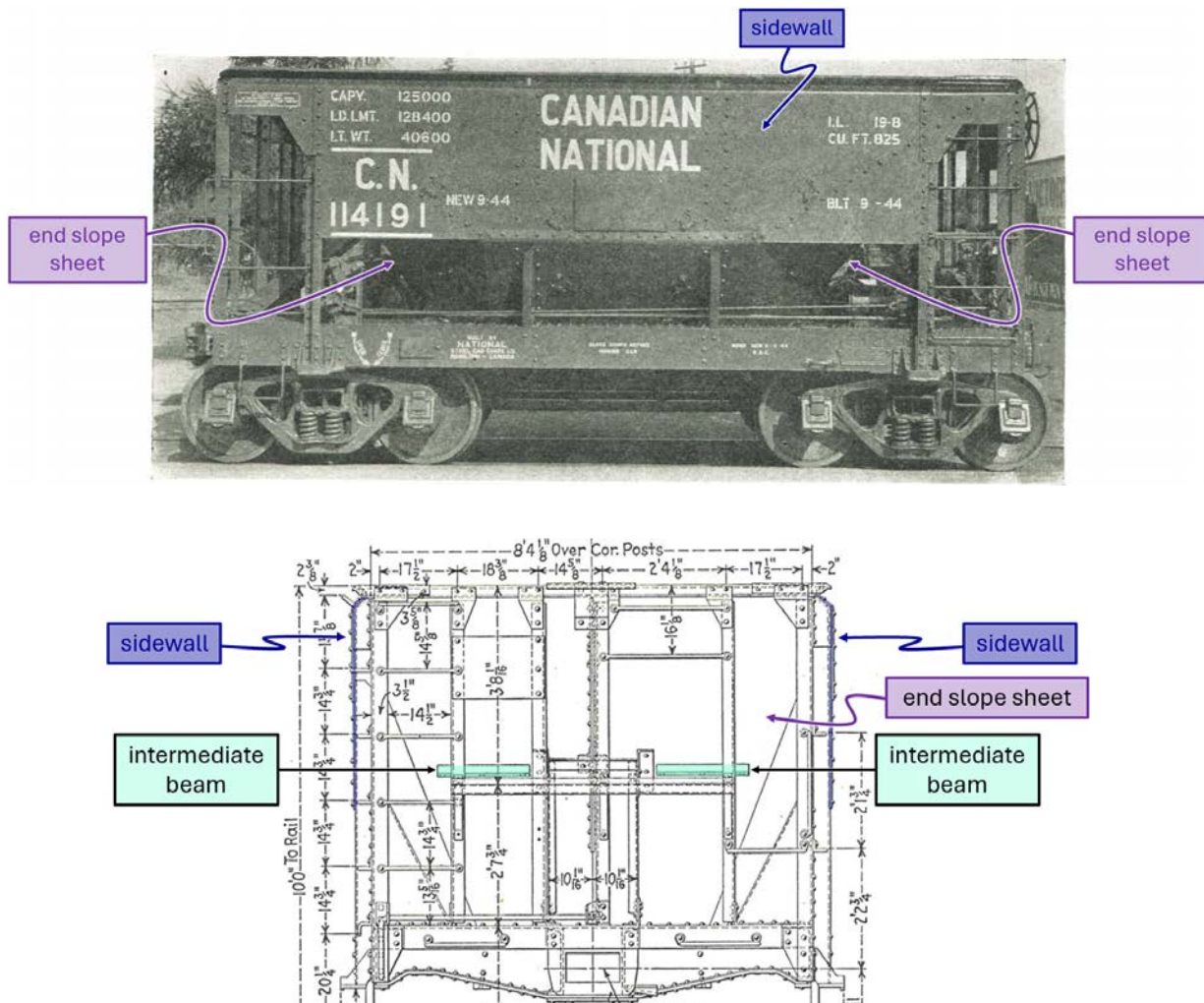
5. **Dependent Claim 11: “The railroad hopper car of claim 10 wherein said laterally extending reinforcement is an angle iron mounted toes-in to said first end slope sheet.”**

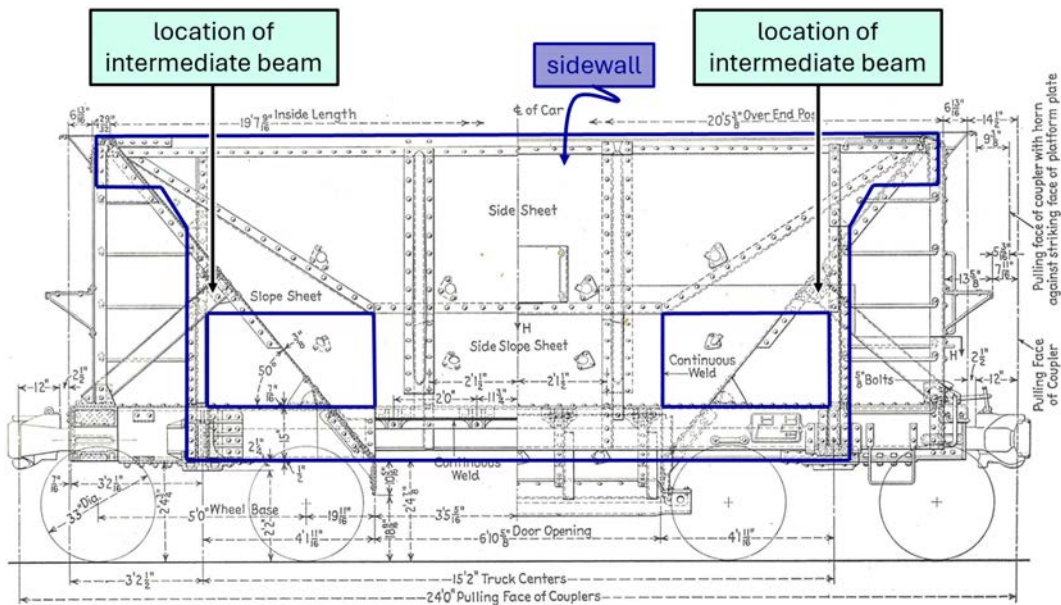
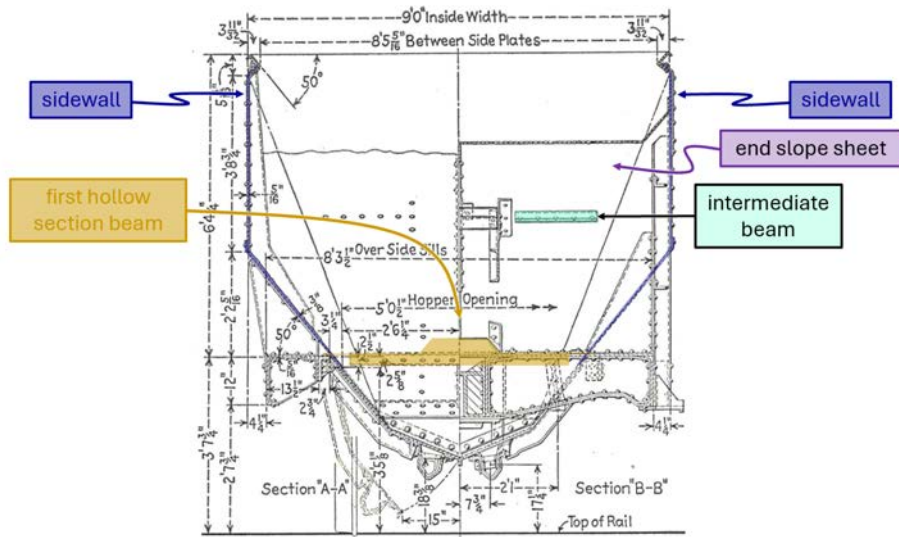
105. The '515 patent specification never uses the term “angle iron.”

EX1001. Merriam-Webster defines the term “angle iron” as “a piece of structural steel rolled with an L-shaped section.” Merriam-Webster Dictionary, available at <https://www.merriam-webster.com/dictionary/angle%20iron> (last accessed May 26, 2025). A POSITA would understand the term according to that definition. Applying this definition, or any reasonable definition, NSC’s lower support beam satisfies the limitation of Claim 11, as shown in the discussion herein for Claim 10. Claim 11 is obvious for the same reason as Claims 10.

6. **Dependent 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.”

106. The 1946 Cyclopedia's NSC ore car discloses this limitation:

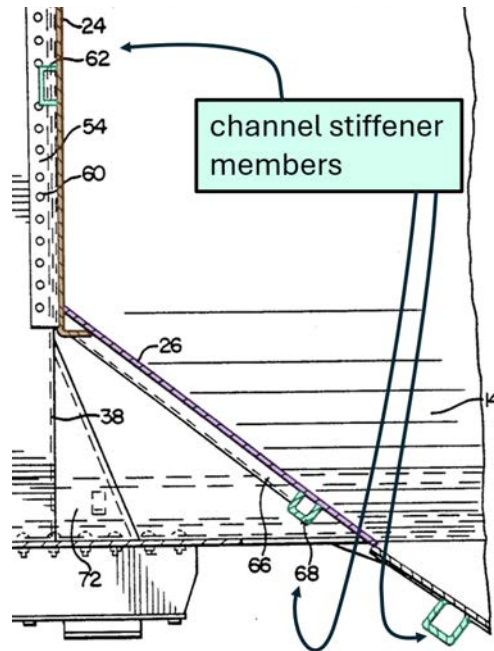




EX1004 at 294-95.

107. Even if the NSC ore car drawings did not expressly disclose an intermediate beam, it would have been obvious to modify the car to add an intermediate beam, as taught by Wong.

108. Wong discloses “channel stiffener members,” crosswise beams that are mounted “toes-in” to the slope sheet, as shown below.



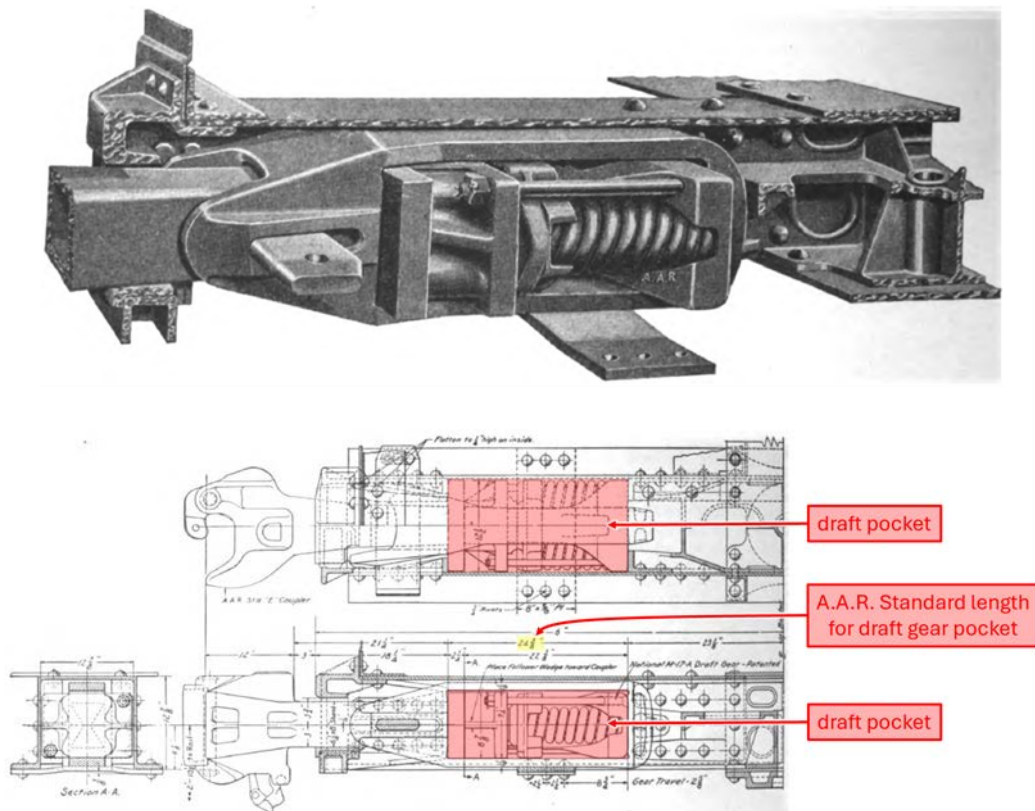
EX1006, Fig. 4. A POSITA would have been motivated to add an intermediate beam to the NSC ore car, similar to Wong’s hollow channel stiffener 68, to support the part of the slope sheet farthest from the upper and lower stiffeners. So modified, the NSC ore car would embody Claim 15.

7. Independent Claim 32

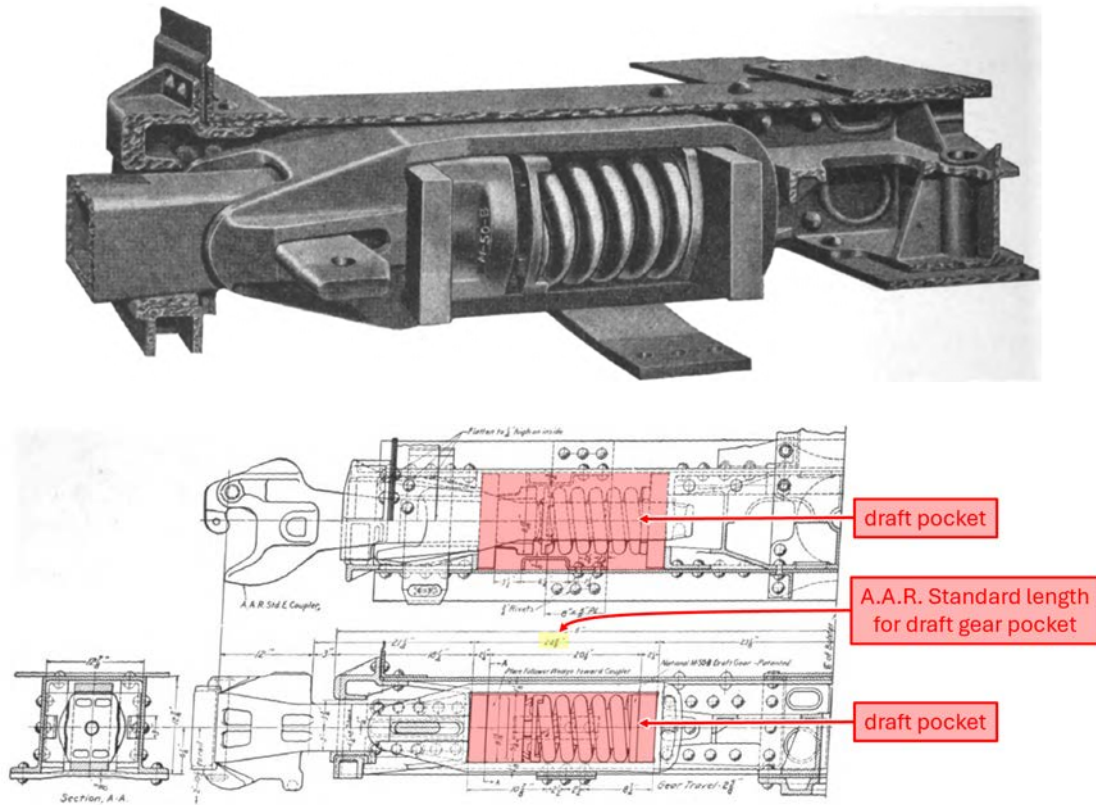
- a. [32c] “said first end section including a draft sill extending in the longitudinal direction, said draft sill having first and second spaced apart longitudinally running draft sill webs and a draft pocket defined therebetween;”

109. Regarding the claimed “draft pocket” defined between the draft sill webs, the ’515 patent’s specification uses the term “draft pocket” interchangeably with the term “draft gear pocket.” EX1001 at 9:55-10:10. The 1946 Cyclopedia defines “Draft Gear Pocket” as “[t]he space occupied by the draft gear and followers in the center or draft sills. Manual M-901.” EX1004 at 31. The Association of

American Railroads (A.A.R.) Standards, as revised in 1938, set a standard length for a “draft gear pocket in the car sills” of 24 5/8 inches. EX1004 at 367 (citing A.A.R. Manual Page C-3, item 18). The 1946 Cyclopedia has a 28-page section regarding draft gears that includes the following examples thereof that show draft pockets and call out the A.A.R. Standard length therefor. EX1004 at 936-963 (1946 Cyclopedia section regarding draft gears).

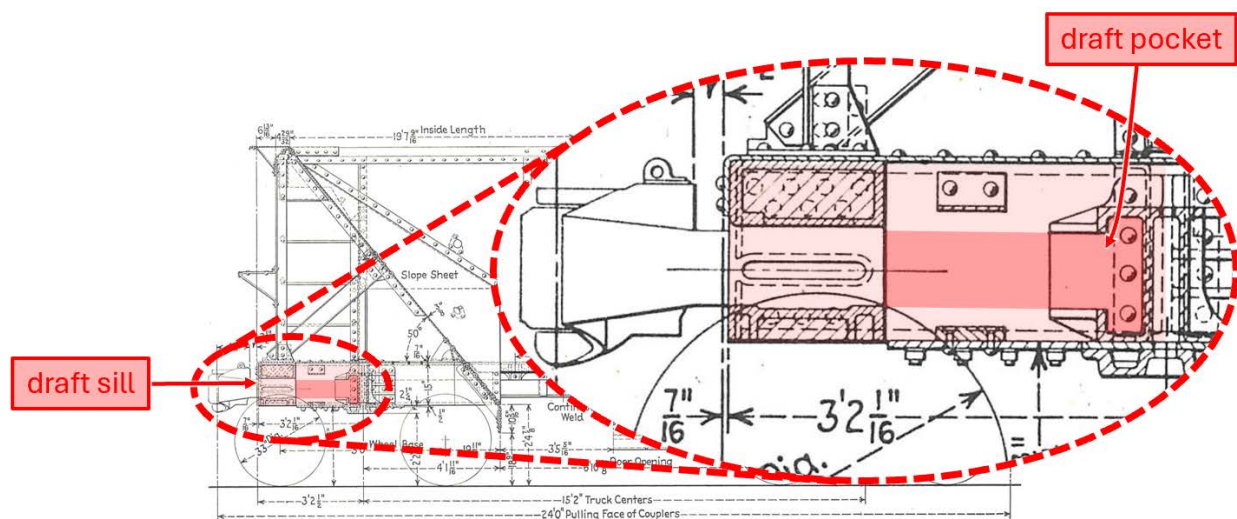


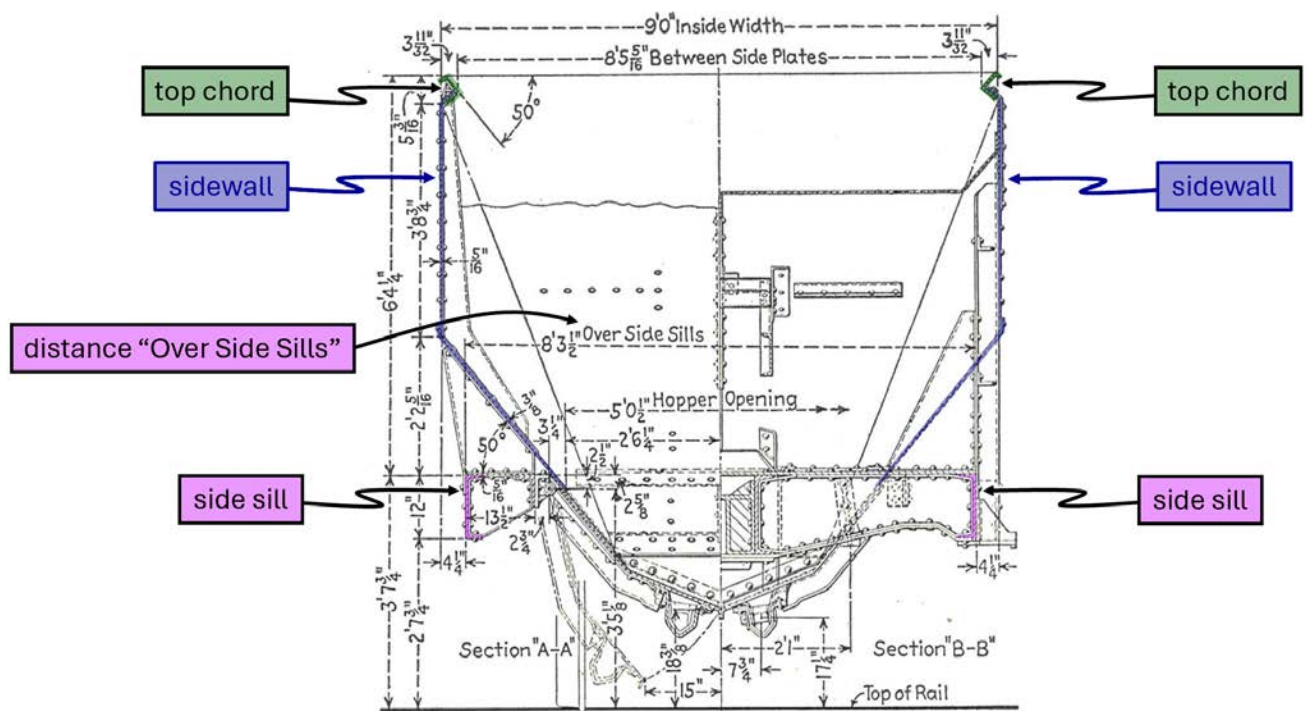
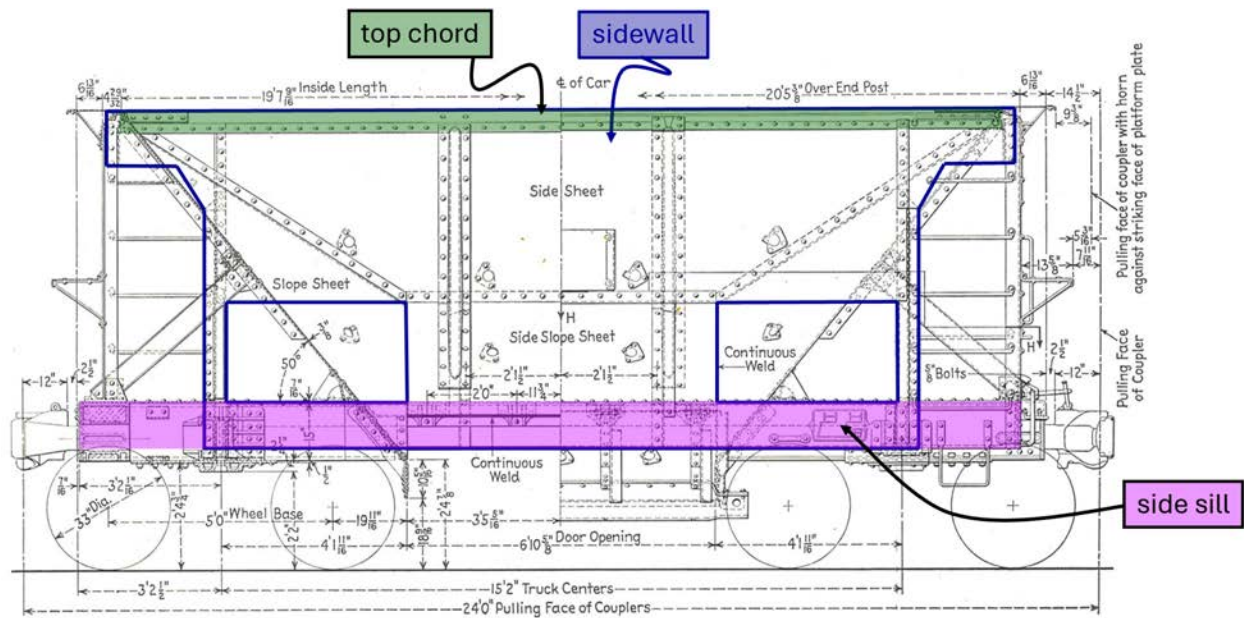
EX1004 at 952 Fig 10.67, 954 Fig. 10.69 (“National friction draft gear, Type M-17-A”).

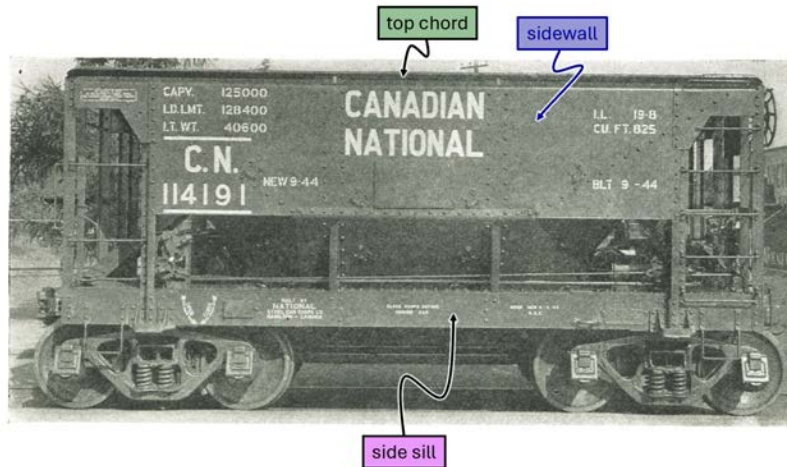


EX1004 at 956 Fig. 10.74, 957 Fig. Fig. 10.76 (“National friction draft gear, Type M-50-B”).

110. The 1946 Cyclopedia’s NSC ore car discloses this limitation [32c], as shown below.







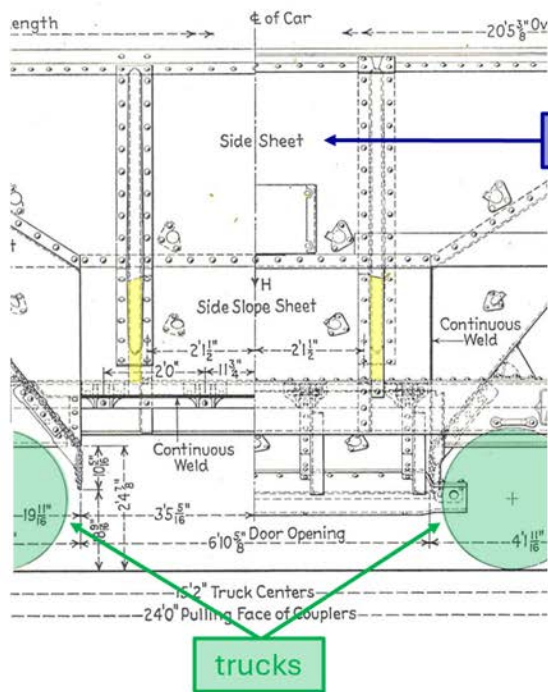
EX1004 at 294-95.

- b. [40c] “said first side wall has a predominantly upwardly running side wall stiffener mounted thereto, said side wall stiffener being located at a longitudinal station intermediate the trucks;”

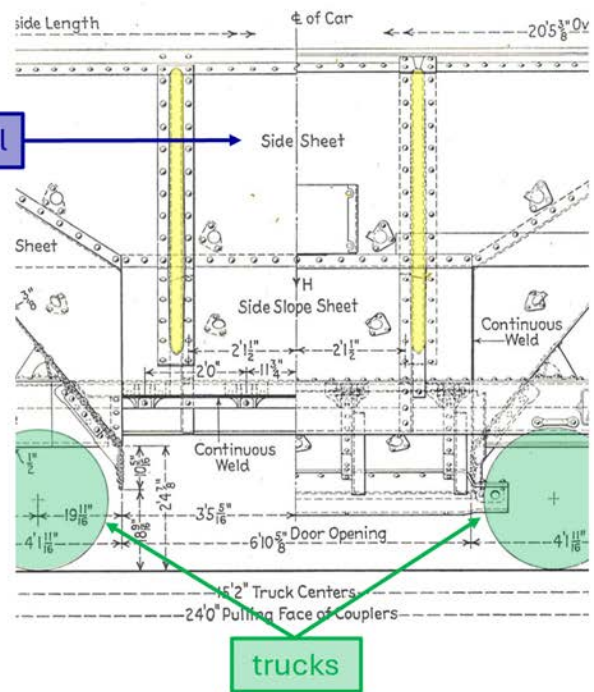
113. The 1946 Cyclopedia’s NSC ore car discloses this limitation, as shown below.

lower, exterior (first) portions
of sidewall stiffeners

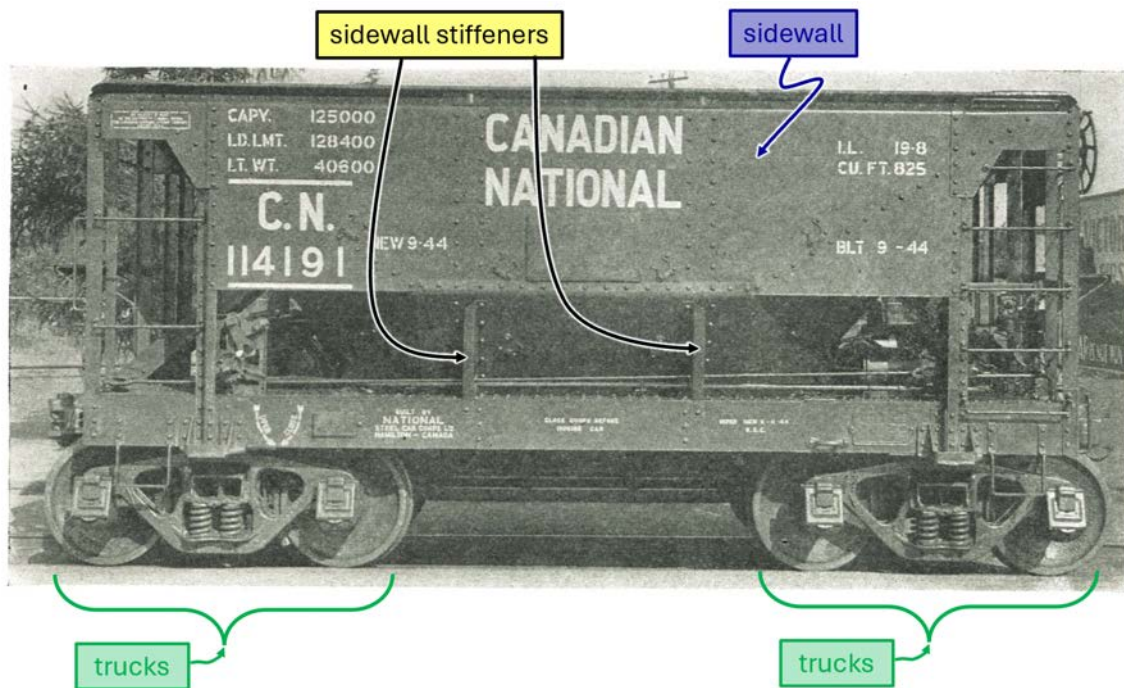
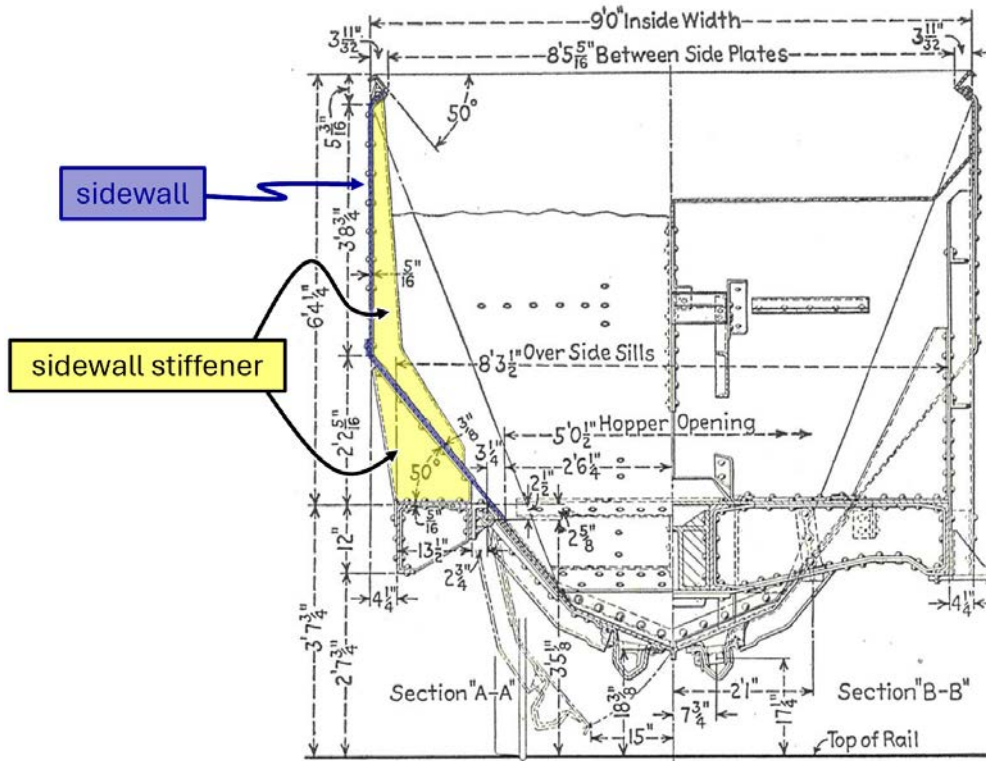
upper, interior (second)
portions of sidewall stiffeners



sidewall



EX1004 at 294. Both portions of the sidewall stiffener may be seen in the sectional end view below.

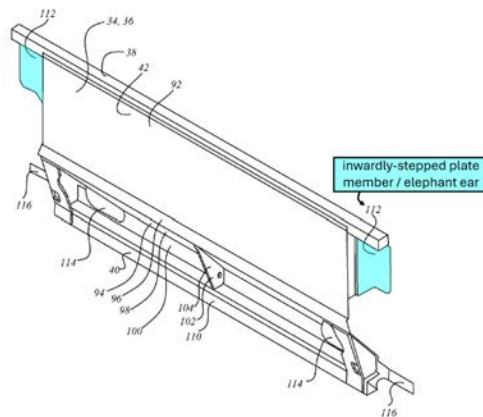


Id. at 294-95.

E. Ground 5: Claim 17 – obviousness over the 1946 Cyclopedia in view of Wong and Campbell '051.

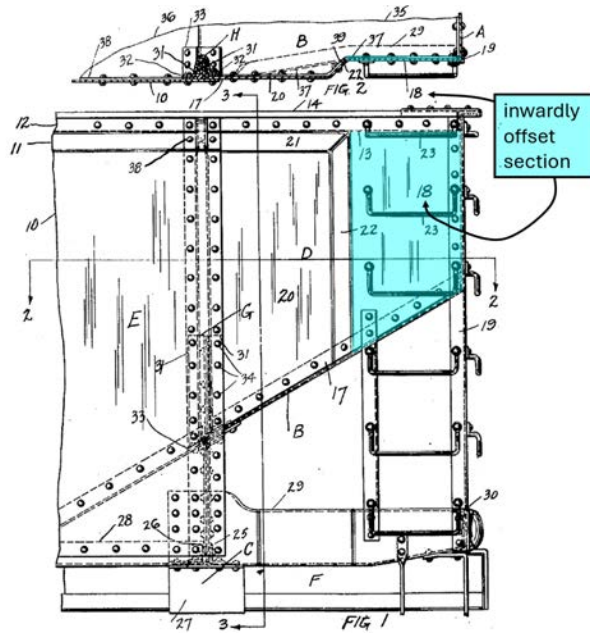
- 1. Dependent Claim 17: “The railroad hopper car of claim 7 wherein said first and second side walls of said hopper car define sidewalls of said hopper, and said first and second side walls include end portions that are stepped laterally inboard, and said second hollow section beam extends between said end portions of said first and second side walls that are stepped laterally inboard.”**

114. The '515 patent illustrates side walls with end portions that are stepped laterally inboard:



EX1001, Fig. 2a. However, stepped side walls were well known long before 2009.

As shown below, they were disclosed by Campbell '051 as early as 1925.



EX1012, Fig. 1.

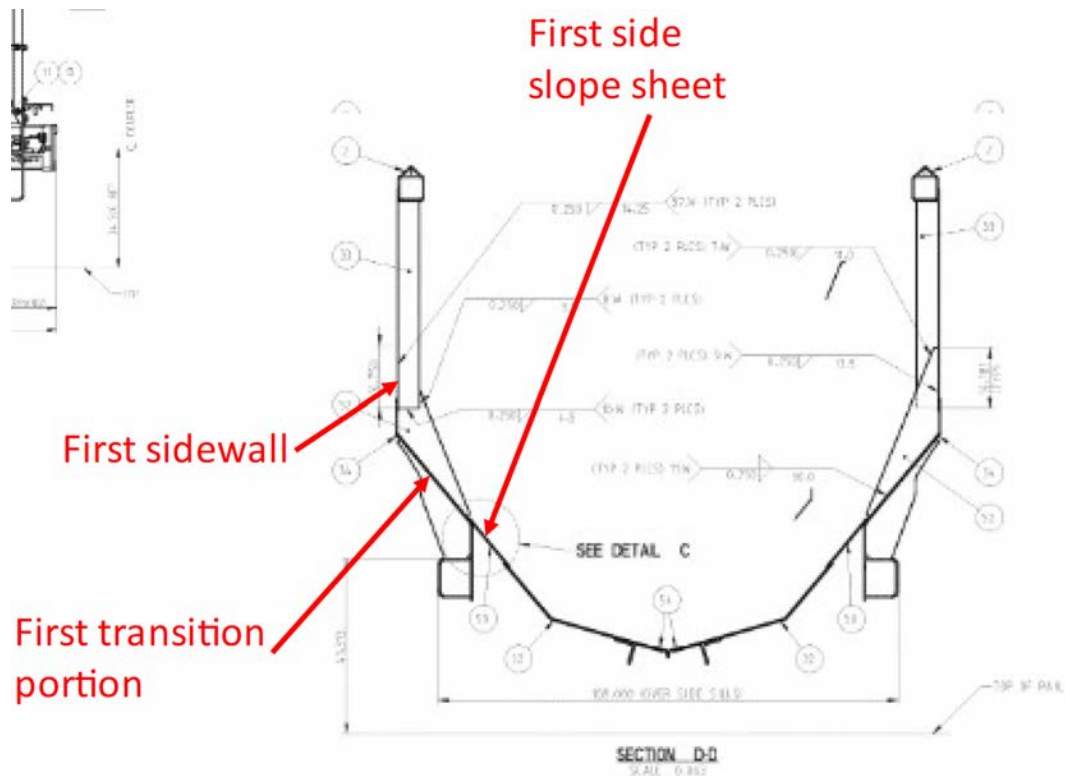
115. Campbell '051 explains that the purpose of the stepped design “is to provide a car . . . having the maximum over-all width possible,” *id.* at 1:14–23, while also having an “offset section 18 for the purpose of accommodating the usual ladder rungs 23 within the permissible overall width of the car,” *id.* at 1:90–94. A POSITA in 2009 would have been motivated to modify the NSC ore car to provide stepped end portions of the side walls to obtain these benefits and would have had a reasonable expectation of success in making that simple modification, including due to its simplicity and that the modification had been incorporated into many railcars. So modified, the 1946 Cyclopedia’s NSC ore car would embody Claim 17.

F. Ground 9: Claims 43-44 – obviousness over the 1946 Cyclopedia in view of Wong and Lindström.

1. Dependent Claim 43

- a. [43b] “said hopper includes first and second sloped side sheets; and said first sloped side sheet meets said first side wall at said transition portion.”**

116. I have reviewed the infringement claim charts for this limitation that NSC served in the litigation *National Steel Car Limited v. FreightCar America, Inc. et al.*, No. 1:24-cv-00594 (D. Del.). Those claim charts purport to relate each known accused product to the asserted claims each such product allegedly infringes. For the portion of those claim charts purporting to relate the accused product to the claim reciting a “sloped side sheet” (i.e., ’515 claim 43 and ’892 patent claim 6), those claim charts use the language “side slope sheet,” rather than the claim language “sloped side sheet.” Thus, I understand NSC has construed “sloped side sheet” to refer to the “side slope sheet” 50 in the ’515 patent. This is confirmed by the arrows in NSC’s claim chart, which identify the “sloped side sheet” by pointing to a portion of the hopper that is not part of the side sheet:



117. The '515 patent's specification states: "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." EX1001 at 15:51-55.

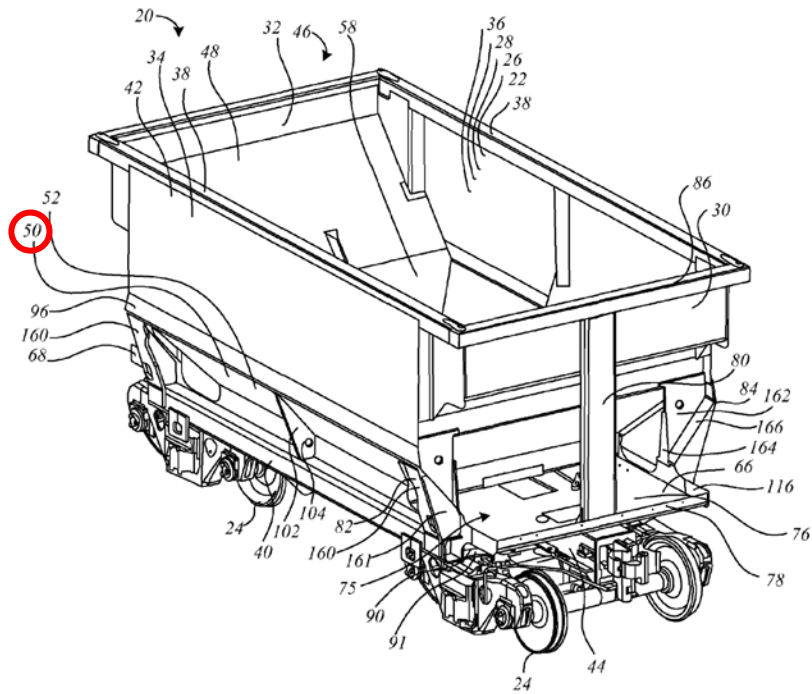


Figure 1

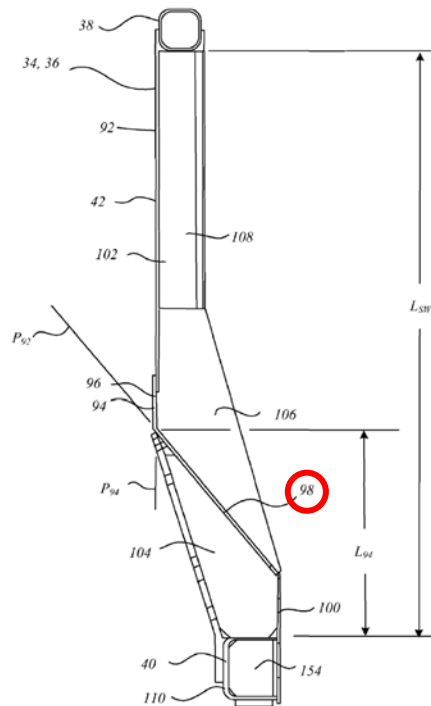


Figure 2c

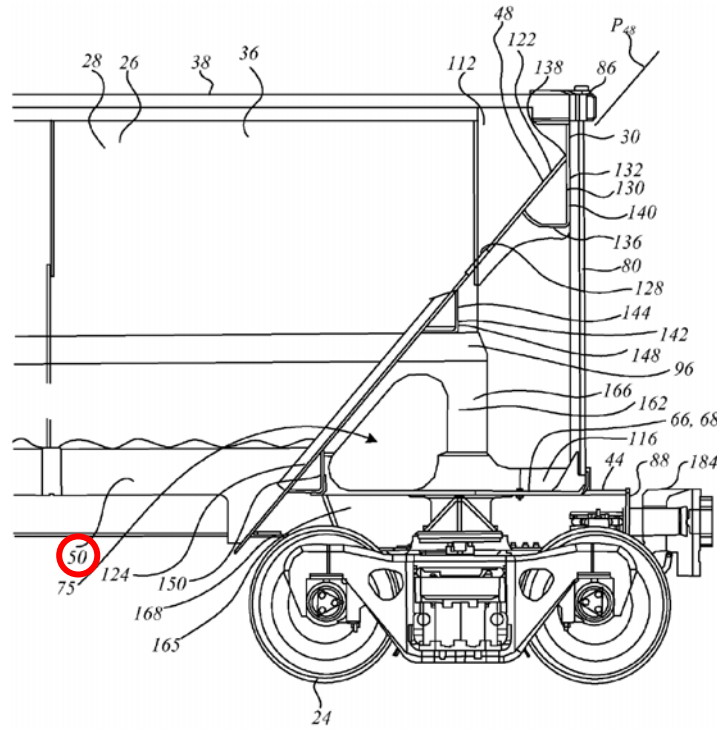


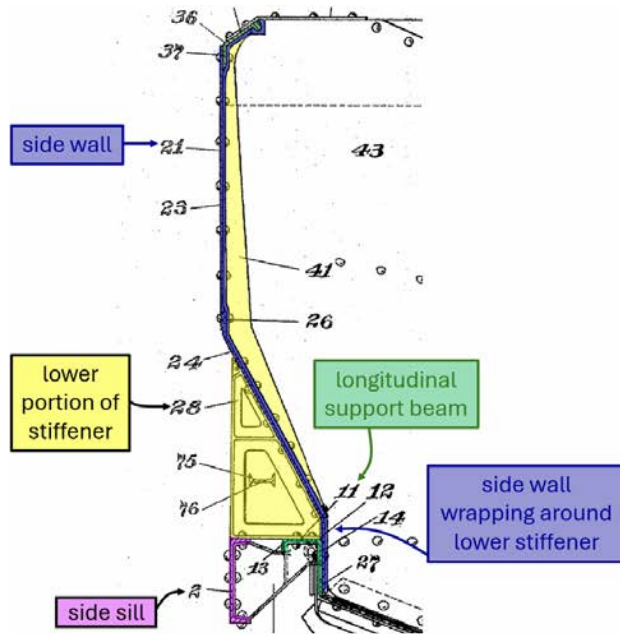
Figure 3b

Id. Figs. 1, 2c, 3b.

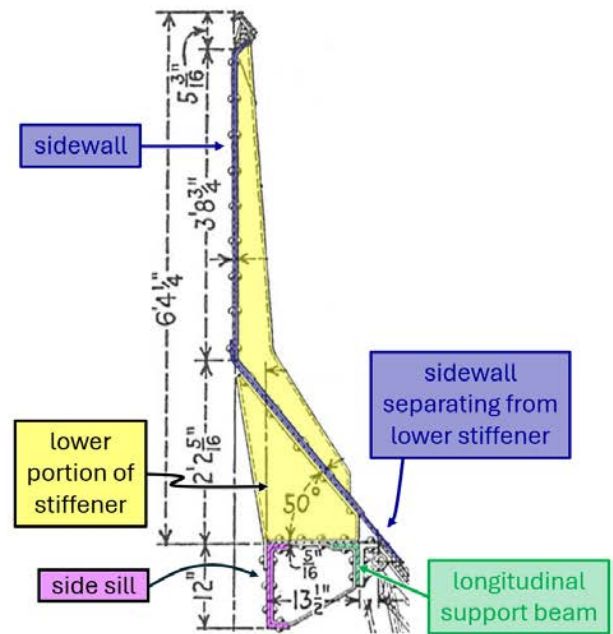
118. Under NSC's construction of "sloped side sheet" as the "side slope sheet" 50 in the '515 patent, limitation [43b] is satisfied by an obvious modification of the 1946 Cyclopedia's NSC ore-car design in view of Lindström.

119. As shown below, both the 1946 Cyclopedia's NSC ore car and Lindström disclose sidewalls that extend downwards from a top chord and then pass from outboard to inboard across a two-part sidewall stiffener. Both references also disclose the lower portion of the stiffener being supported by a side sill on the outboard end and a longitudinal support beam on the inboard end. A difference between the references is that, at the inboard margin of the lower portion of the stiffener, the 1946 Cyclopedia's NSC ore car discloses the sidewall separating from

the stiffener and continuing its downward-inboard slope; whereas Lindström discloses the sidewall remaining connected to the stiffener and sloping downward. The sidewall that Lindström discloses wraps around the inward side of the lower portion of the stiffener (28) and the longitudinally extending support member (11).



**Lindström
Fig. 5**



**NSC Ore Car
(Unmodified)**

EX1005, Fig. 5; EX1004 at 294.

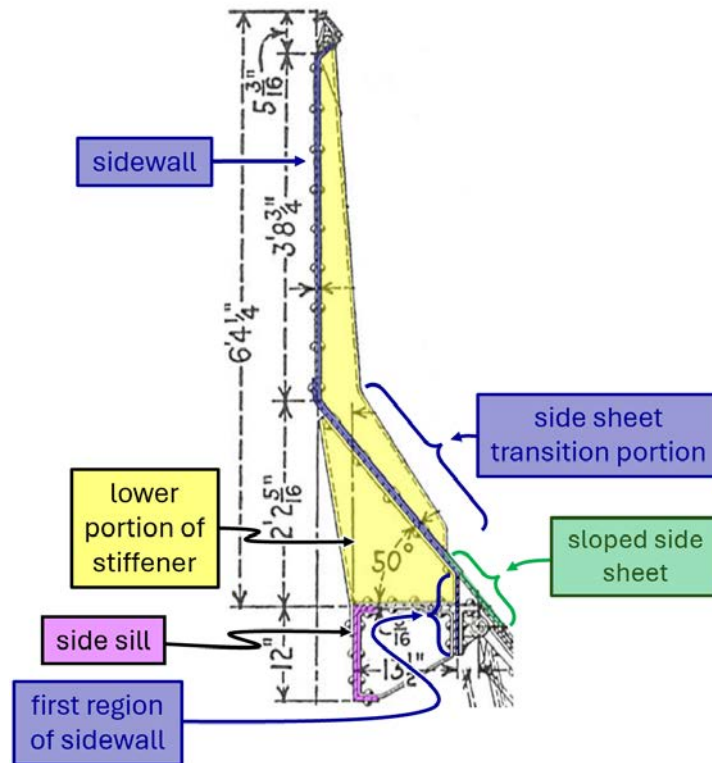
120. In view of Lindström, it would have been obvious to modify the side wall of the 1946 Cyclopedia's NSC ore car so that it too wraps around the inward side of the lower stiffener. The NSC ore car was ready for this improvement. As shown above, the NSC ore car has the same relevant structures that are arranged in the same way as in Lindström. For example, in both references, the inward side the

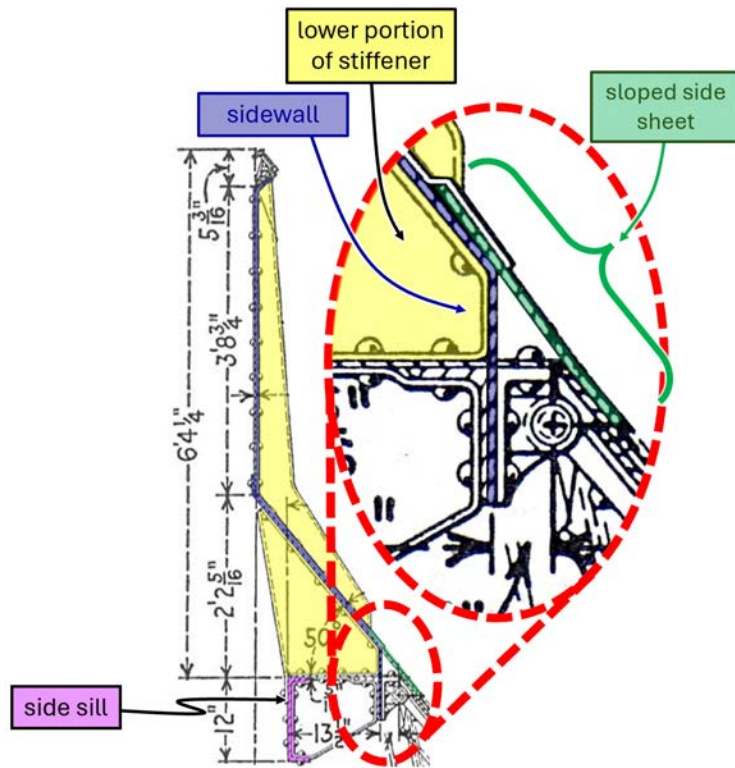
lower stiffener is above and aligned with the inward side of the longitudinal support beam, which allows the sidewall to be secured thereto. The modification would also yield predictable results, including providing additional lateral stability to the side wall. A POSITA would have been motivated to make the modification to provide such additional lateral stability to the side wall. A POSITA would understand that the lading in the hopper would tend to push the side wall and stiffener laterally outward, and that wrapping the bottom of the side wall around the stiffener and longitudinal support beam would help stabilize the side wall and stiffener against movement in the laterally outward direction. The modification amounts to mere application of a known technique (i.e., wrapping the side wall around the inward side of the stiffener) to a known device (i.e., the NSC ore car) that is ready for improvement to yield predictable results (e.g., providing additional lateral stability to the side wall).

121. After that modification, it would have been obvious to add a sloped side sheet, as shown below in green. A POSITA would be motivated to make this addition to ensure the side wall of the hopper has a continuous sloped surface without discontinuities that could impede the movement of the lading to the hopper doors. The unmodified NSC ore car, for example, teaches such a continuous sloped surface. The addition of a slope side sheet would simply replace the segment of the NSC ore

car's sidewall that had extended downward and inboard of the outer stiffener before modification.

122. So modified, the “ first sloped side sheet meets said first side wall at said transition portion,” as claimed.





EX1004 at 294 (modified).

VI. GROUNDS AND COMBINATIONS

123. I have reviewed all grounds and combinations of prior art references referenced in this declaration, and I agree that each ground would render obvious the relevant claims. In particular, the following combinations of prior art references would be successfully combined and modified as described. Although I have not illustrated each modification, I have considered them all as part of this analysis to reach my conclusions.

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GROUND	CLAIMS	OBVIOUSNESS REFERENCES
1	1, 2, 5, 6, 20, 23	The 1946 Cyclopedia and Coates or the 1922 Cyclopedia
2	3 and 21–22	The 1946 Cyclopedia, Coates or the 1922 Cyclopedia, and Schuller
3	4	The 1946 Cyclopedia, Coates or the 1922 Cyclopedia, Schuller, and Karig
4	7–16, 18–19, 24–27, 30–35, 38–42	The 1946 Cyclopedia and Wong
5	17	The 1946 Cyclopedia, Wong, and Campbell '051
6	28	The 1946 Cyclopedia, Wong, and Coates or the 1922 Cyclopedia
7	29	The 1946 Cyclopedia, Wong, Coates or the 1922 Cyclopedia, and Schuller
8	36–37	The 1946 Cyclopedia, Wong, and Schuller
9	43–44	The 1946 Cyclopedia, Wong, and Lindstrom

VII. CONCLUSION

I reserve the right to supplement my opinions in the future to respond to any arguments or positions that the patent owner may raise, taking account of new information as it becomes available to me.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

May 27, 2025



Mehdi Ahmadian, Ph.D.