

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 IPR2025-01046
Patent 8,166,892

**DECLARATION OF MEHDI AHMADIAN
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,166,892**

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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. 8,166,892 (“the ’892 patent”)
1002	File History of the ’892 patent
1004	Excerpts from <i>1946 Car Builders’ Cyclopedia</i> , 17th ed. (“1946 Cyclopedia”)
1005	U.S. Patent No. 1,321,928 (“Lindström”)
1006	U.S. Patent No. 4,941,411 (“Wong”)
1007	Excerpts from <i>Lancashire & Yorkshire, Vol. 2</i> , Noel Coates, copyright 2006 (“Coates”)
1023	U.S. Patent No. 2,030,748 (“Gilpin”)

4. I have also relied on my education, training, and experience, and my knowledge of pertinent literature in the field of the ’892 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. 8,166,892 (“the ’892 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 '892 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 '892

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 ’892 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 26 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 '892 PATENT

A. Overview of the '892 Patent

25. Each claim of the '892 patent requires sidewall stiffeners with “web continuity.” The '892 patent uses the term “web continuity” to refer to alignment in a vertical plane. EX1001 at Fig. 2c & 15:44-46 (“Portions 104 and 106 are co-planar, or substantially co-planar, such that stiffener 102 has web continuity through member 94.”). I discuss web continuity in greater detail below.

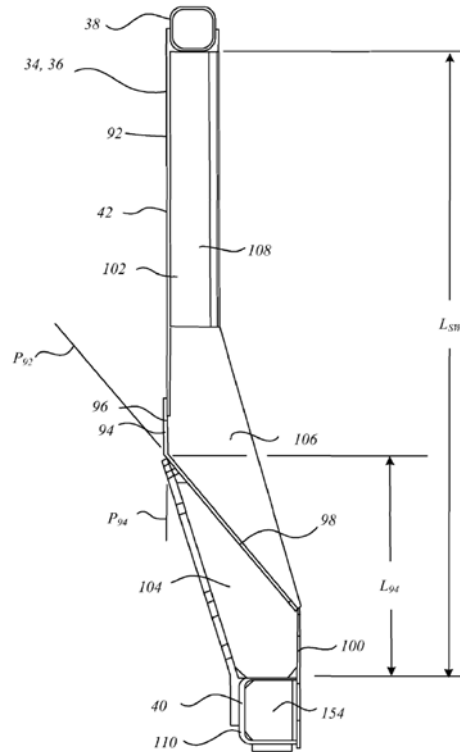


Figure 2c

EX1001 at Fig. 2c.

B. Priority Date of the '892 Patent

26. The '892 patent was filed as U.S. Application No. 12/559,065 on September 14, 2009 and claims priority to Canadian Patent Application No. 2,678,605, also filed on September 14, 2009, as well as to Canadian Patent Application No. 2,678,447, filed on September 11, 2009. EX1001 at cover; EX1002 at 120. I understand that the earliest claimed priority date of the '892 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 '892 patent.

C. Prosecution History of the '892 Patent

27. Based on my review of the file history for the '892 patent, I understand that, on January 3, 2012, the Examiner allowed the pending claims and offered the following Reasons for Allowance:

The following is an examiner's statement of reasons for allowance: The sidewall stiffener having web continuity between the first and second portions along with the first portion of the sidewall stiffener being laterally outboard of the first region and the second portion of the sidewall stiffener being laterally inboard of the second region is seen as an unobvious improvement over the art of record.

EX1002 at 416. I understand that the Examiner never discussed any prior art reference during the prosecution of the '892 patent.

D. Level of Ordinary Skill in the Art of the '892 Patent

28. It is my understanding that, when interpreting the claims of the '892 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 26 for discussion of invention date.)

29. 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.

30. The claims of the '892 patent are directed to reinforcing and assuring the structural integrity of the side wall of a railway hopper car. A person of ordinary skill in the art to which the '892 patent pertains 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. However, my opinions do not turn on this specific definition of the level of ordinary skill. The claims would be obvious from the perspective of a skilled artisan under any reasonable definition.

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

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

E. Claim Construction

33. 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. I also understand that an interpretation of a claim term that prevents the claim from covering any embodiment in the patent is rarely, if ever, correct.

34. In general, unless 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.

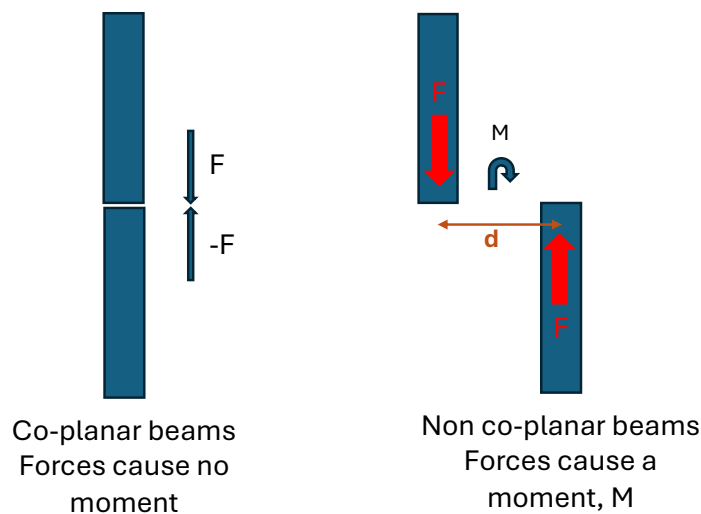
IV. CONCEPTS RELATED TO THE '892 PATENT

A. Transmitting Loads Through Co-Planar Reinforcing Elements

35. 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.

36. Aligning those load-transferring elements, i.e., 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.

37. 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

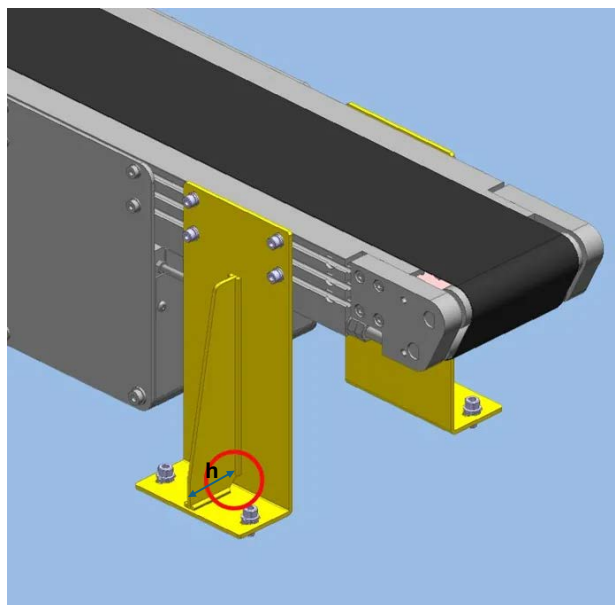
38. It was known to a POSITA long before 2009 that ribs are frequently used to improve the strength of sheet metal parts and reduce their deformation when subjected to heavy loading. It was known that a structure made of sections with sheet metals tends not to be strong and lacks stiffness and resistance 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 minerals. 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

39. 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.

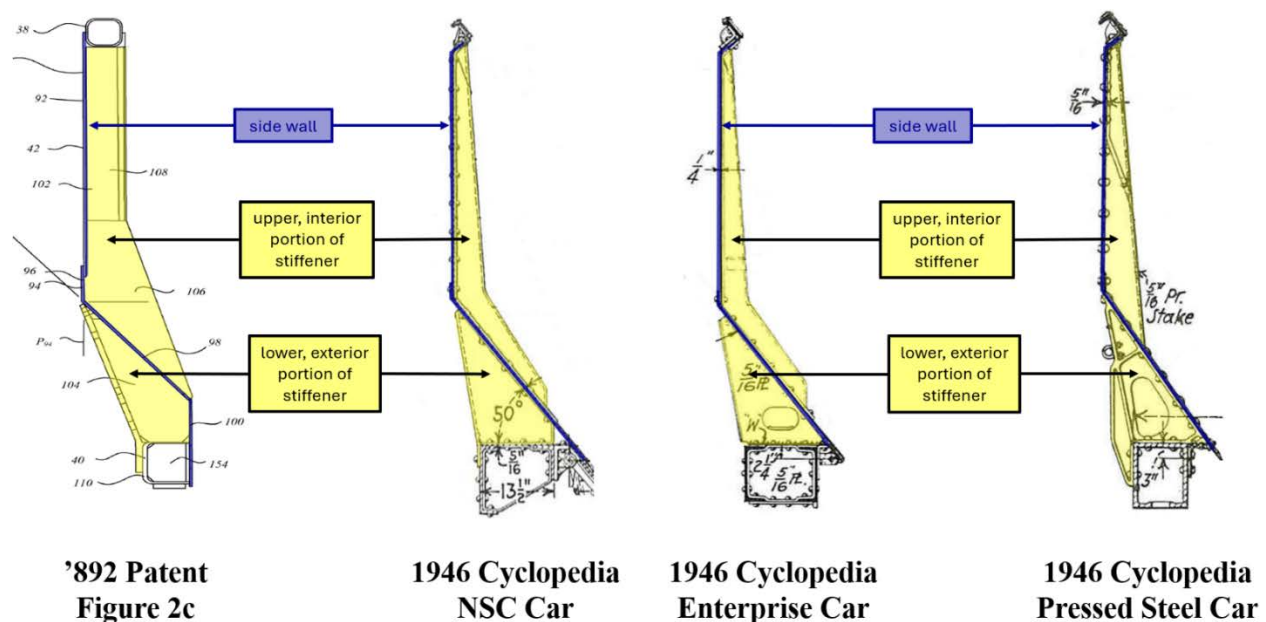
40. The stiffening effect of flat-bar ribs was known to persons of ordinary skill in the art long before the priority date. Equally known was the spacing of such flat bars. It was known to a POSITA that flat-bar ribs are uniformly spaced along the length of a structure, such as the sidewalls of a hopper 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

Side-wall stiffeners with two parts (e.g., 104 and 106 in '892 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 '892 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.*



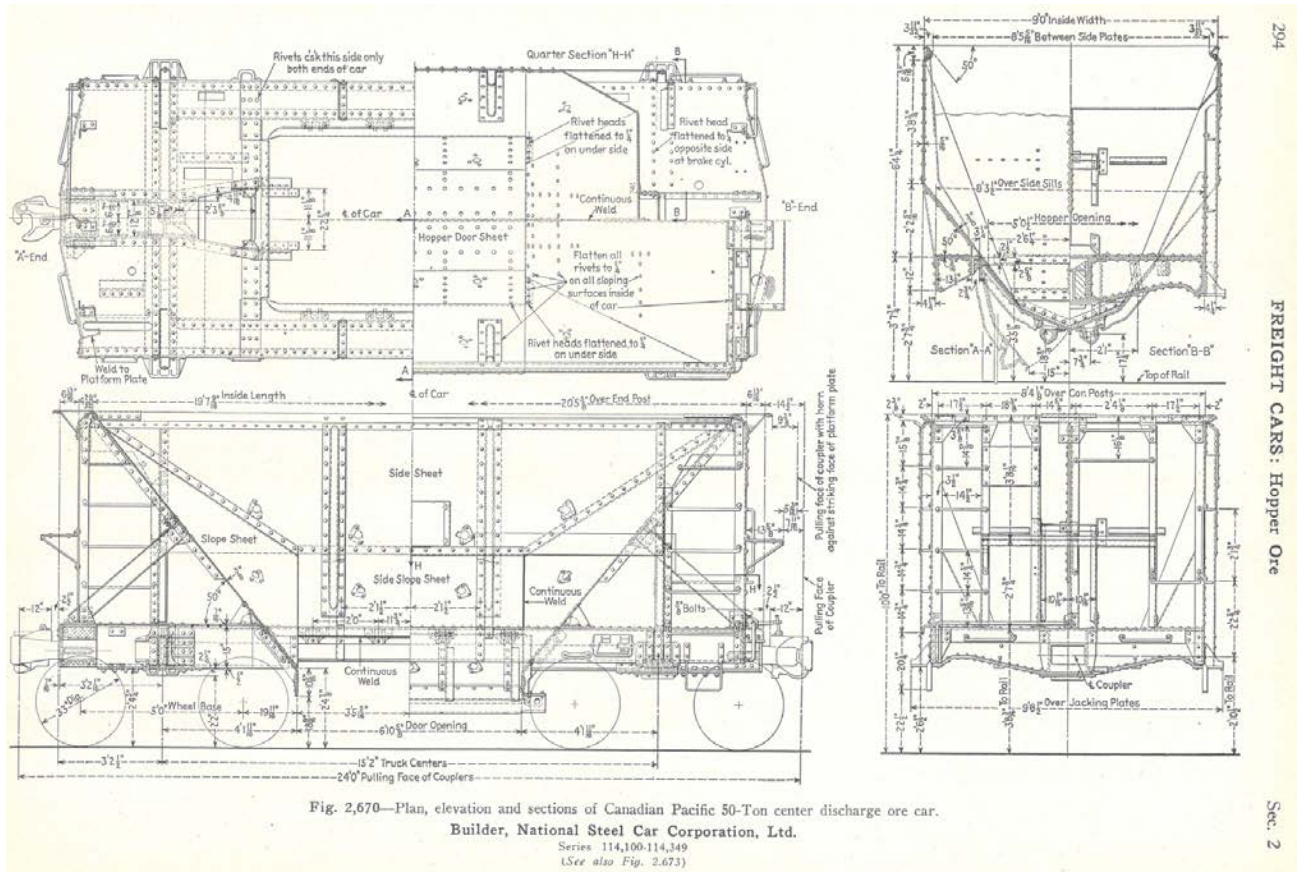
EX1001 at Fig. 2c; EX1004 at 294 (NSC Car); 292 (Enterprise Car); 290 (Pressed Steel Car).

E. Interpreting Technical Schematics from the 1940s

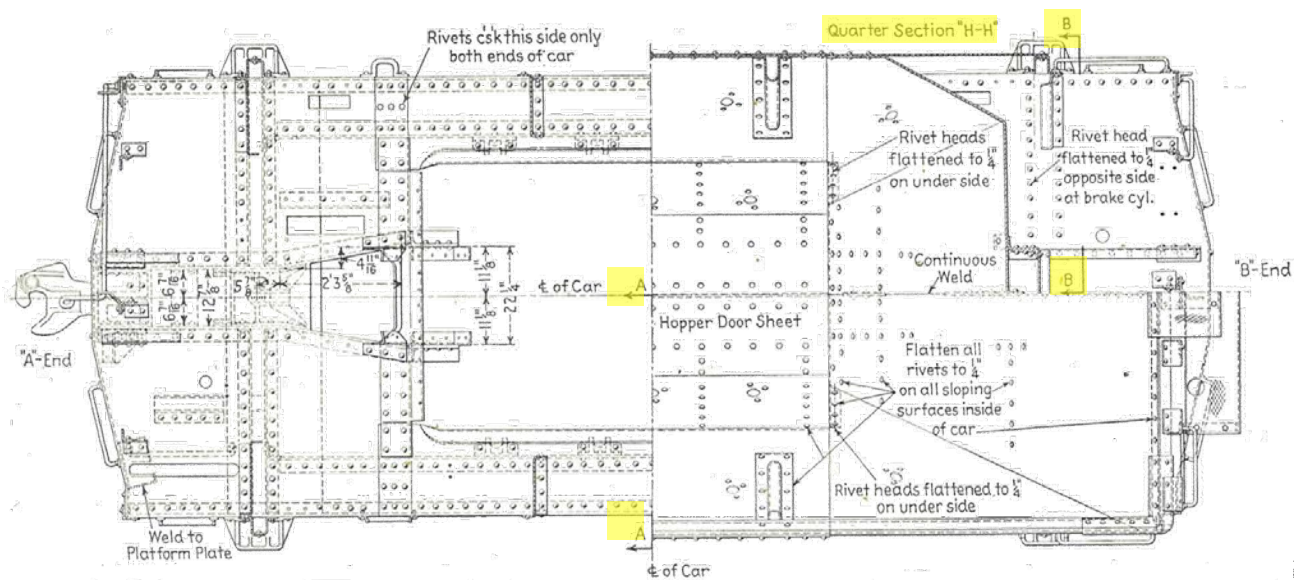
41. 1946 Cyclopedia contains four drawings of the NSC ore car, shown below. EX1004 at 294. These drawings are arranged in accordance with conventions that were common in the twentieth century, but that are less common today in the era of CAD-generated drawings. In three of those drawings, different

sections views are shown on left and right sides and/or the top and bottom portions.

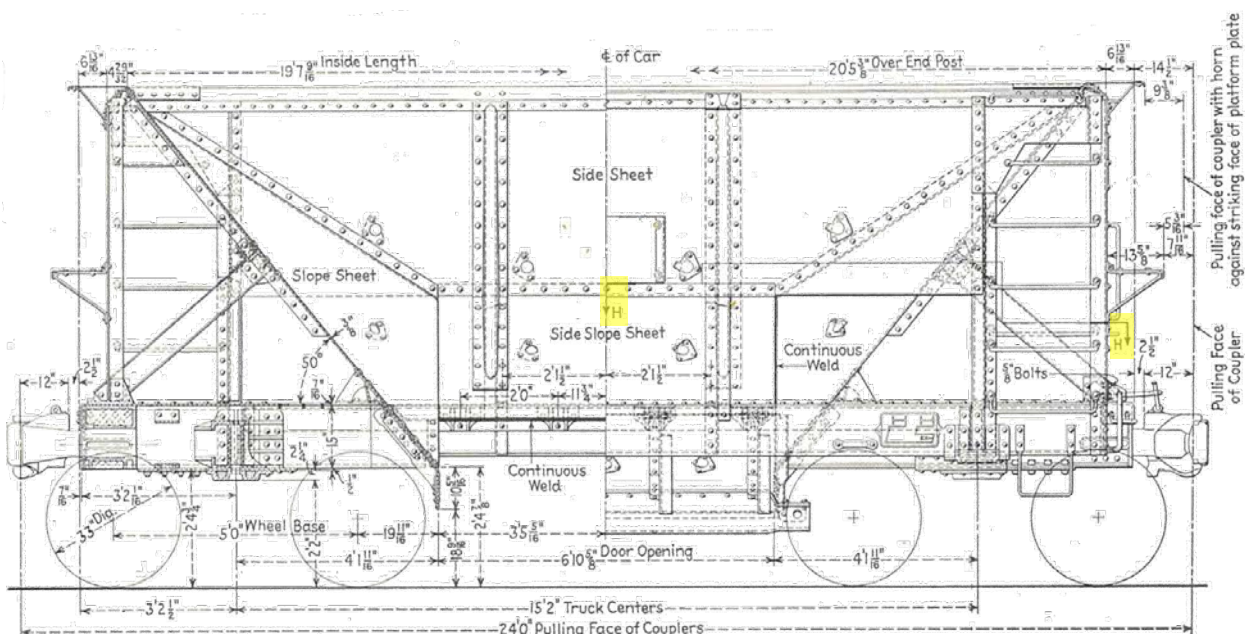
I will therefore briefly explain what is being shown in each of the four drawings.



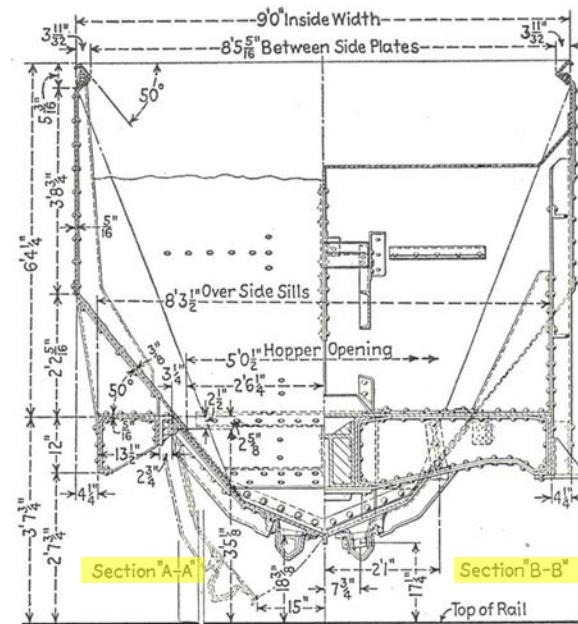
42. Top Left Drawing. In the top view (below), the left half is a sectional view that shows the structure of the lower frame or undercarriage; the upper-right quadrant shows a section along the line H-H, which the side view identifies as sectioning the ore car approximately midway between the undercarriage 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.



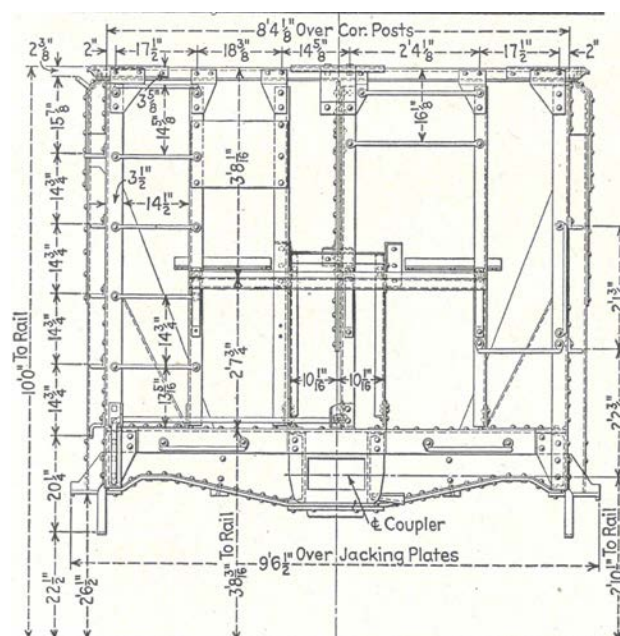
43. Bottom Left Drawing. In the side-view (below), the left half is a vertical-longitudinal sectional cut that shows the inside the hopper, and the right half shows a side view from outside the car. Thus, for example, the left half shows the interior surfaces of the sidewall positioned farther from the reader. The right half shows the exterior surfaces of the sidewall positioned closer to the reader.



44. 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.



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



46. The NSC ore car can be accurately depicted in these half or quarter views including because a POSITA would understand that the depicted rail car is symmetrical about its longitudinal and lateral axes. In these drawings, dashed lines indicate structure hidden behind other structure.

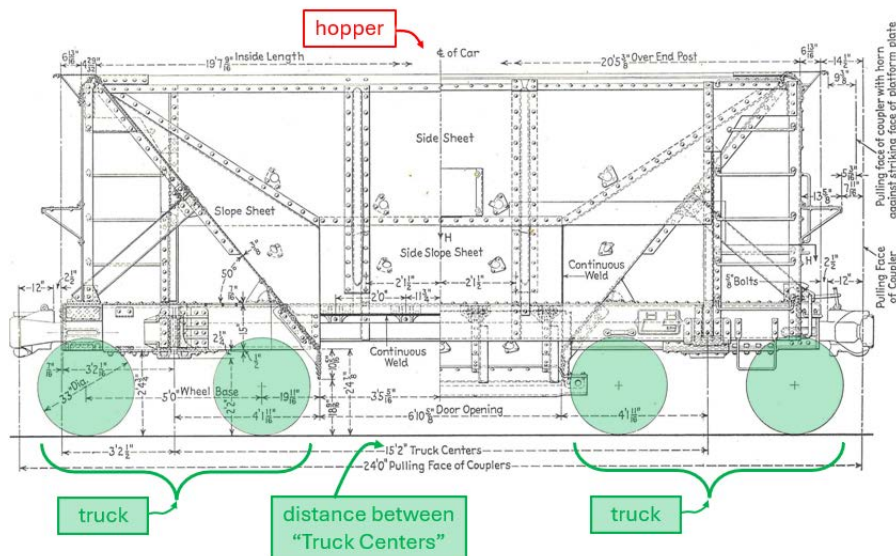
V. SPECIFIC PROPOSED GROUNDS FOR UNPATENTABILITY

A. Ground 1a: Claim 1 – anticipation by, or obviousness over, the 1946 Cyclopaedia.

1. Independent Claim 1

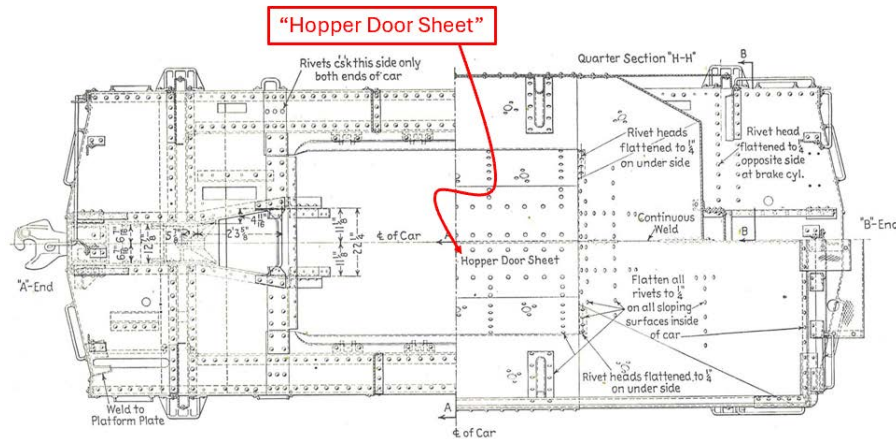
- a. [1a] “A rail road hopper car comprising: a hopper carried between a pair of trucks”

47. The 1946 Cyclopaedia’s disclosure of the NSC ore car discloses limitation [1a], as shown below. EX1004 at 294.



Regarding the hopper, the drawings are in a section of the Cyclopaedia called “Freight Cars: Hopper Ore.” EX1004 at 294.

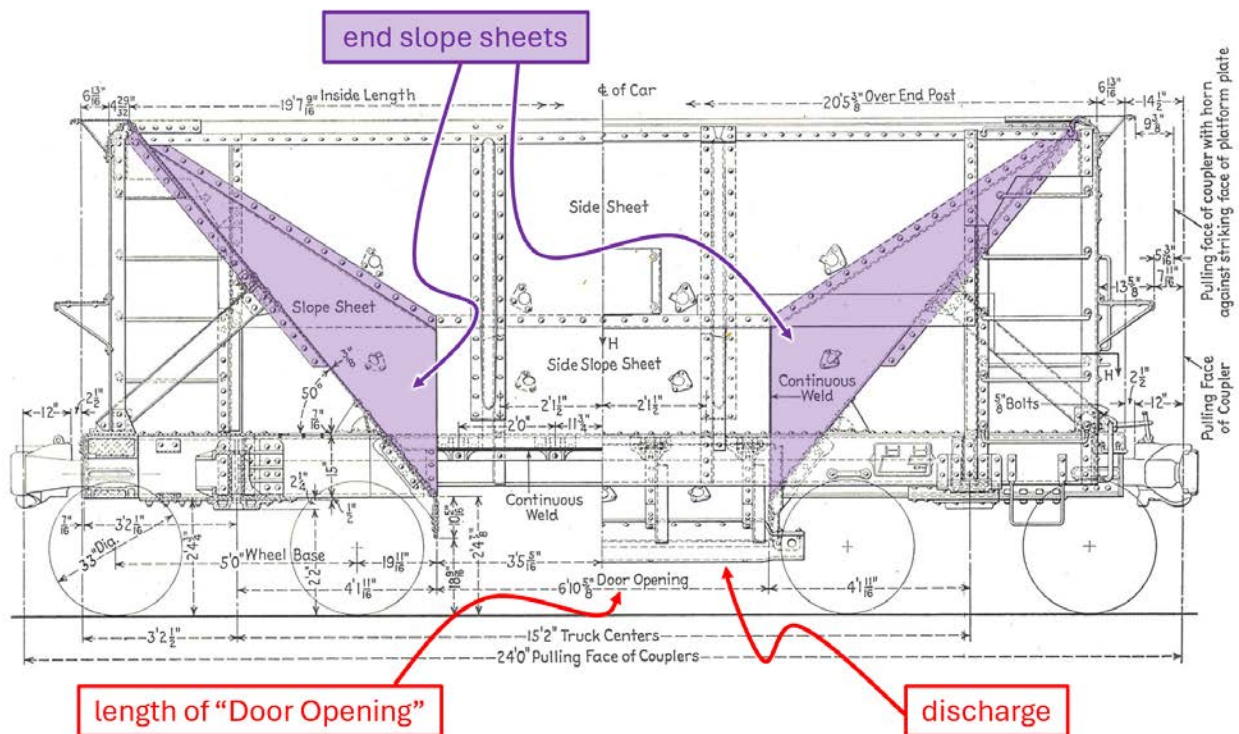
In addition, the drawing below expressly refers to the hopper door.



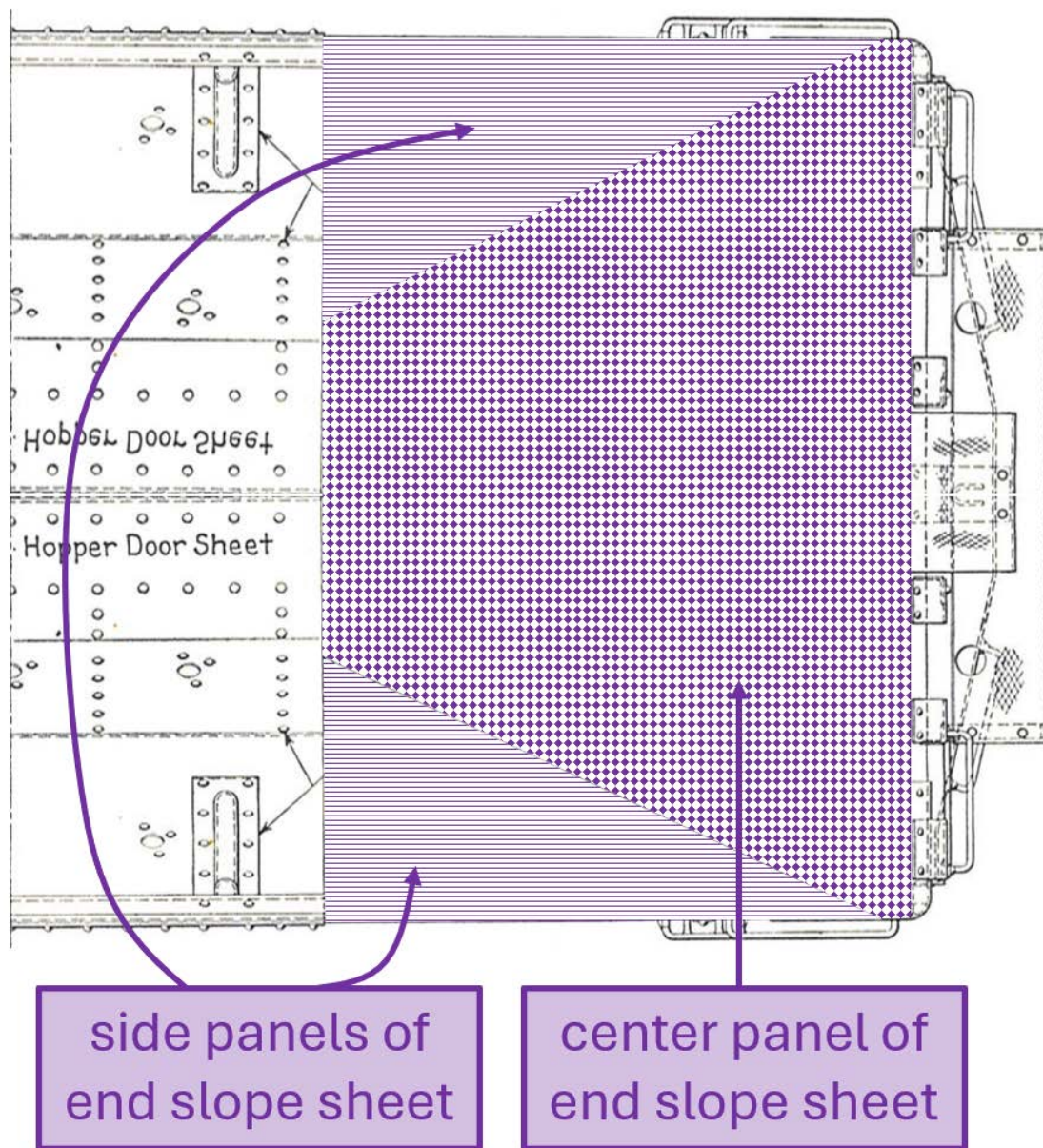
Id. Regarding the trucks, the 1946 Cyclopedia defines “truck” as “the assembly of parts comprising the structures which support a car body at each end ... and also provide for the attachment of wheels and axels.” *Id.* at 66. A POSITA would be familiar with the term “truck,” as trucks are standard features of rail cars. In the NSC drawing, each end of the car is supported by a truck with four wheels.

b. [1c] “said hopper having a lower discharge and convergent slope sheets giving onto said discharge;”

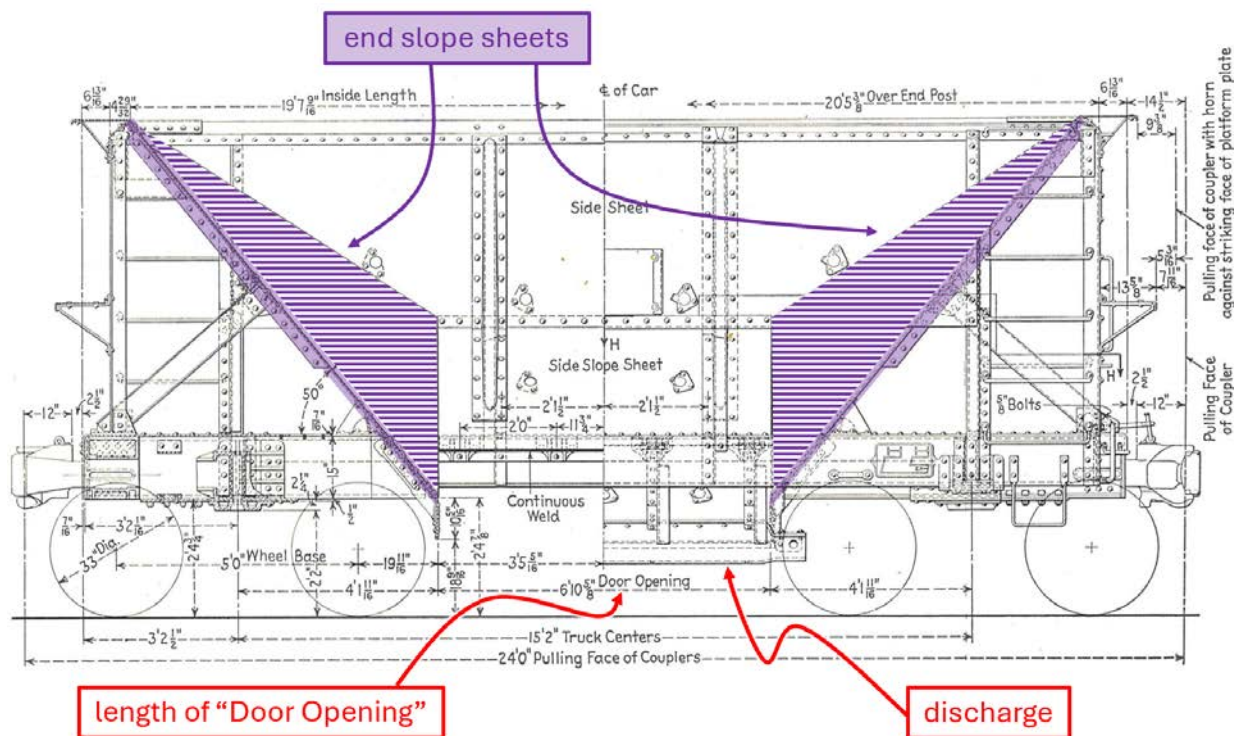
48. The NSC ore car has a lower discharge. This can be seen in the side-view drawing of the car, which calls out a measurement for the length of the “door opening” at the bottom of the rail car. The same side-view drawing shows end slope sheets that are angled to move lading toward the discharge at the center of the car, as shown below.



EX1004 at 294. Each end slope sheet comprises a central portion perpendicular to the plane of the page, designated by two angled purple lines in the image above, as well as two corner portions that are angled with respect to the central portion. I have created the image below to show what all three portions would look like in a top view. I designated the center portion with a purple diamond pattern and the corner portions of the end slope sheet with a purple striped pattern.



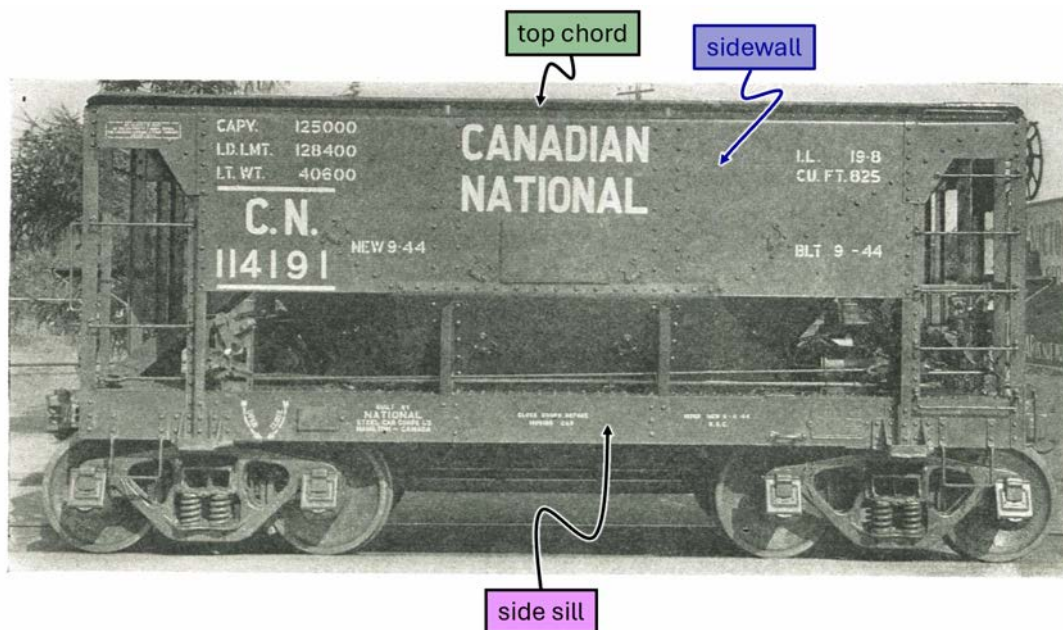
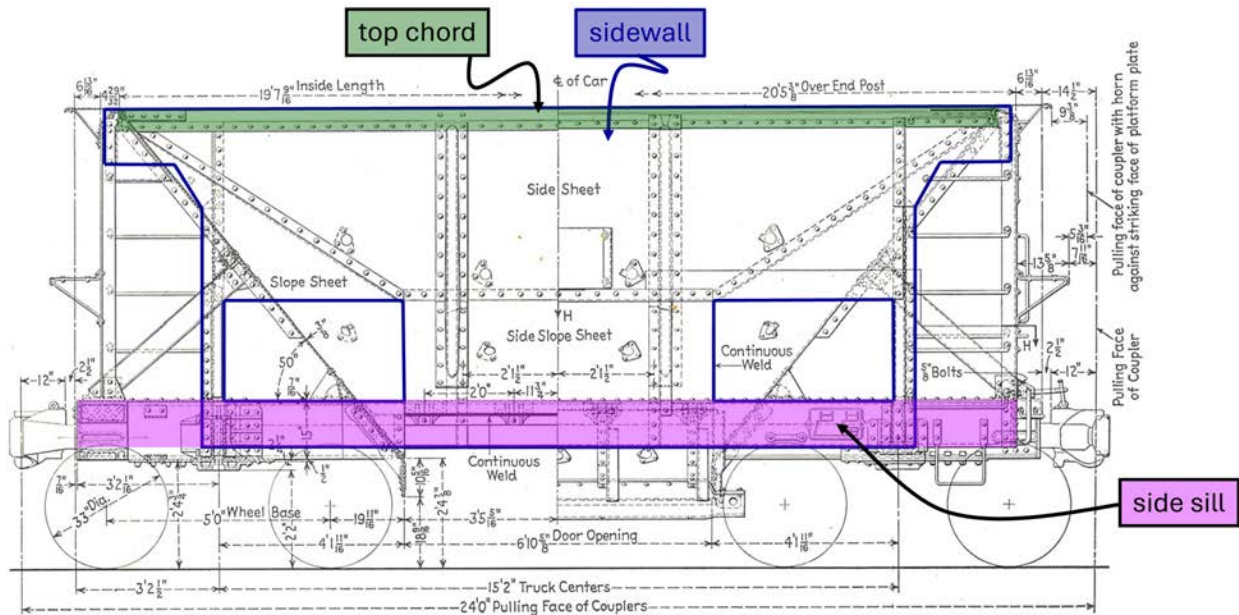
Id. (modified). Finally, the image below shows all portions of the end slope sheets that are visible in the side-view drawing of the NSC ore car.

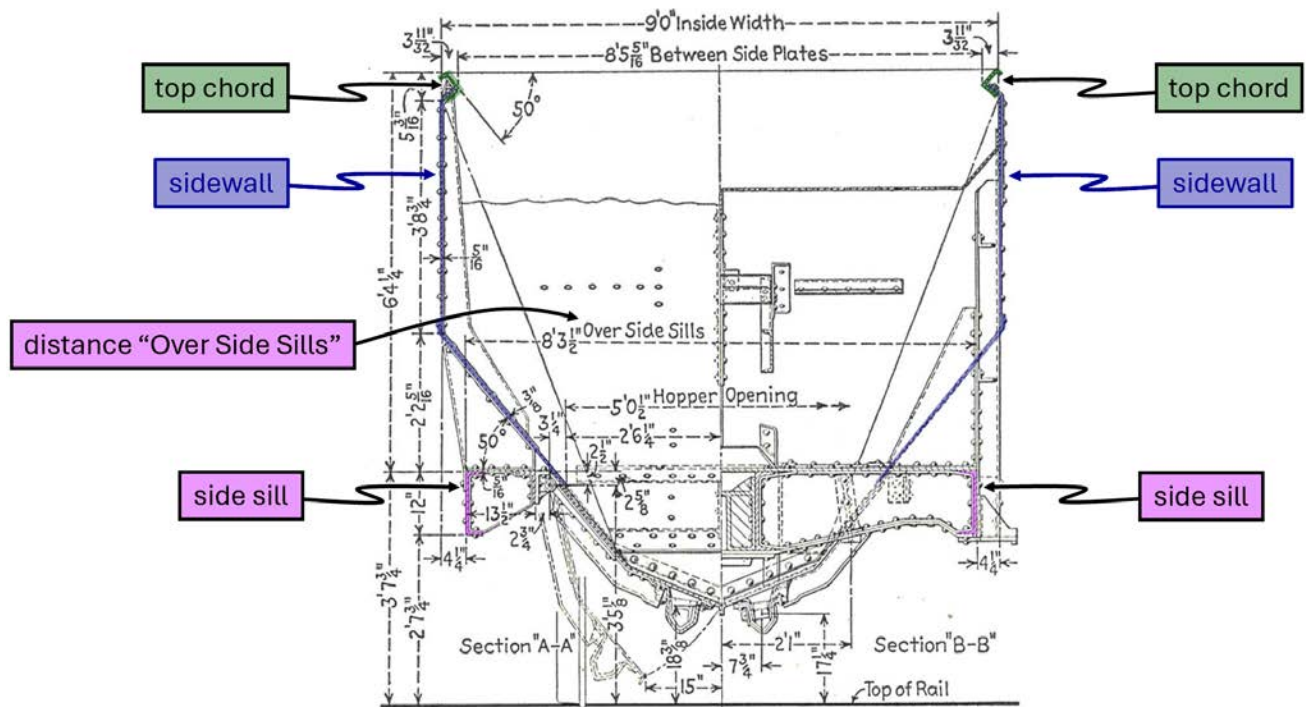


- c. [1d] “said rail road car having a side sill and a top chord; said first upstanding sidewall extending from said side sill to said top chord;”

49. The 1946 Cyclopaedia’s NSC ore car discloses limitation [1d], as shown below. EX1004 at 294-95. The top chord (shown in green) is a flange that runs along the top of the side walls (shown in blue). *Id.* The ’892 patent effectively defines the top chord as a flange when it refers to “a top flange or chord member, namely top chord 38.” EX1001 at 15:5-6. The side sills (shown in pink) run fore-and-aft along lower portions of the side sheets. Side sills are standard features on rail cars. The side wall is everything shown in Fig. 2b of the ’892 patent. EX1001 at 10:49 (“FIG. 2b shows a side view of the sidewall of FIG. 2a”). The side wall

therefore includes the top chord, the upper and lower side sheets, the corner posts, and at least the portion of the side sill that lies between the corner posts.





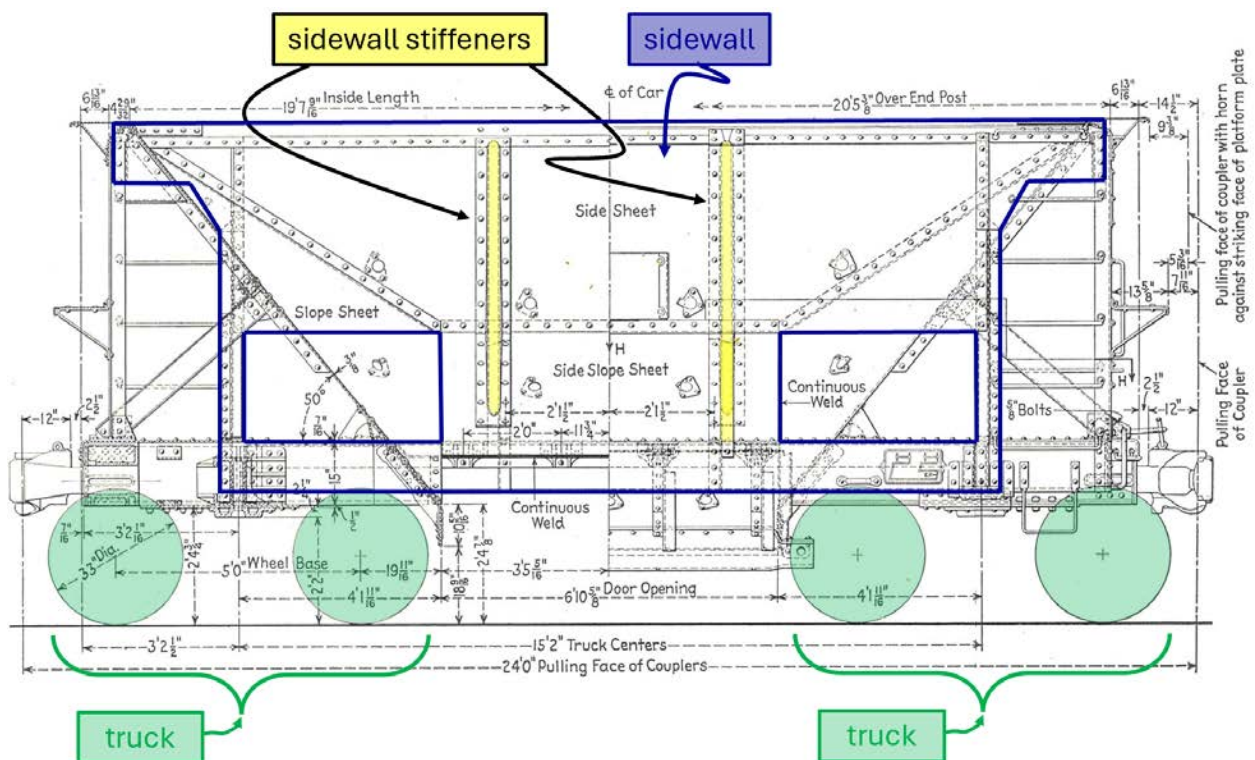
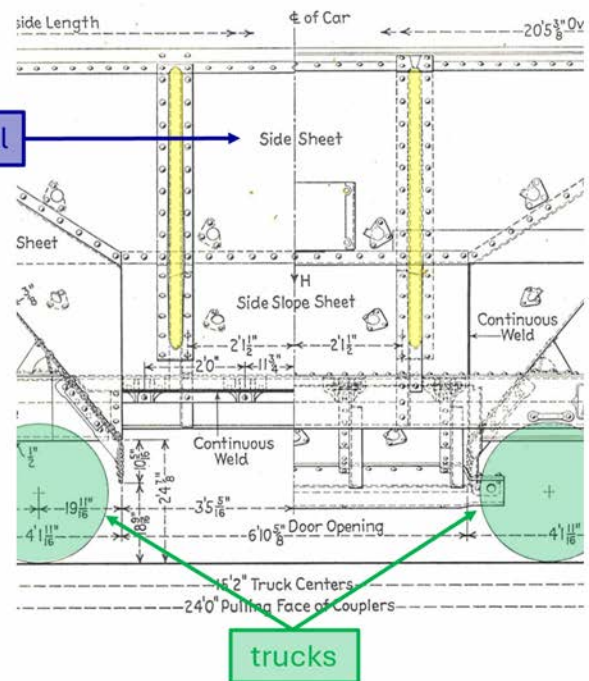
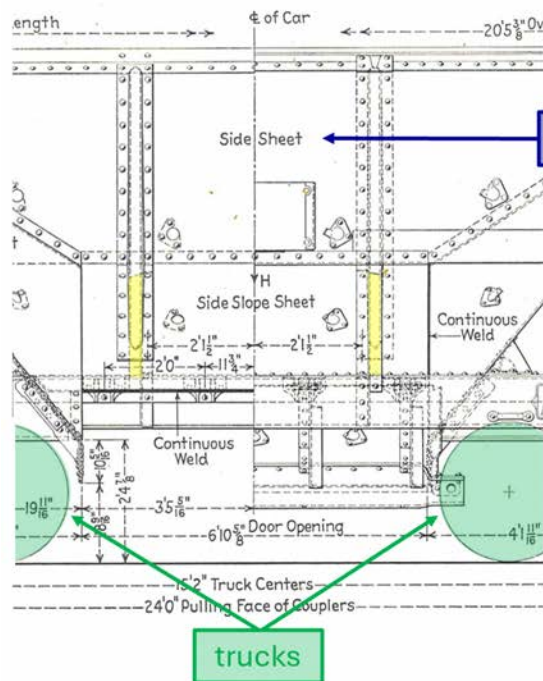
EX1004 at 294-95.

- d. [1e] “said first upstanding sidewall having a predominantly upwardly running sidewall stiffener mounted thereto, said sidewall stiffener being located at a longitudinal station intermediate the trucks;”

50. The 1946 Cyclopedia’s NSC ore car discloses limitation [1e], as shown below. EX1004 at 294-95. The sidewall has predominantly upwardly running sidewall stiffeners (shown in yellow). *Id.* A POSITA would recognize these as conventional stiffeners providing support to prevent bending in the lateral dimension. Those stiffeners are mounted to the sidewall (shown in blue), as claimed, with rivets and flanges shown in the drawings and photograph. *Id.* The sidewall stiffener is located at a longitudinal station intermediate the trucks, as claimed, as shown in the side view and photograph. *Id.*

lower, exterior (first) portions
of sidewall stiffeners

upper, interior (second)
portions of sidewall stiffeners

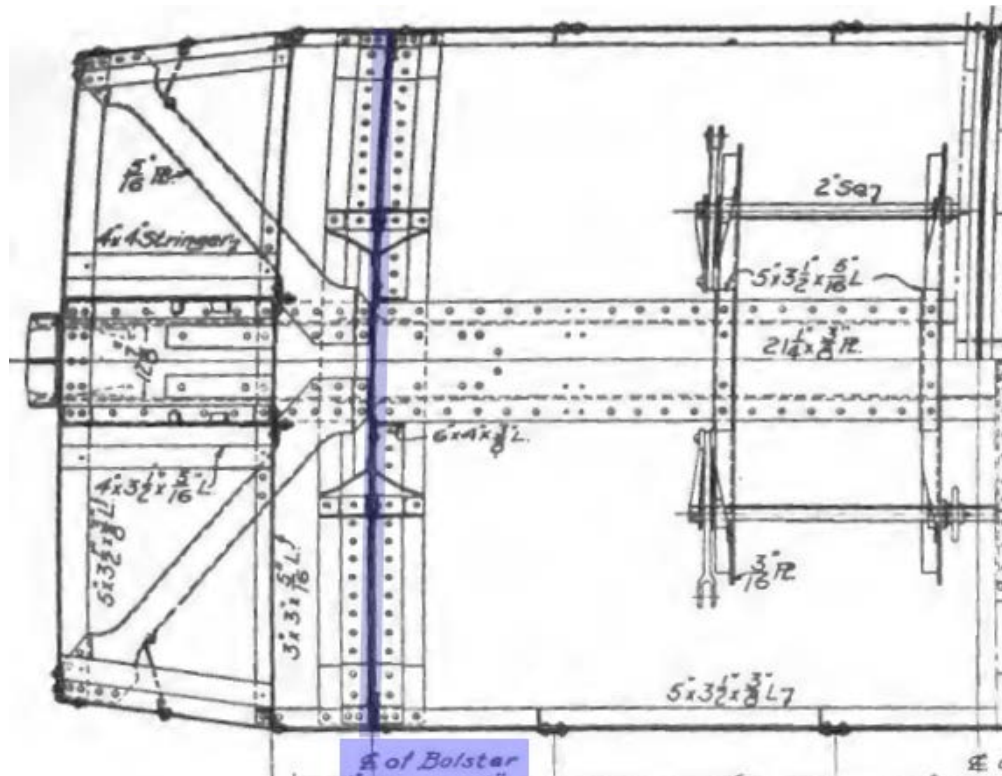


B. Ground 1b: Claims 2–8 and 10–14 – obviousness over the 1946 Cyclopedia in view of Lindström, and optionally in view of Wong.

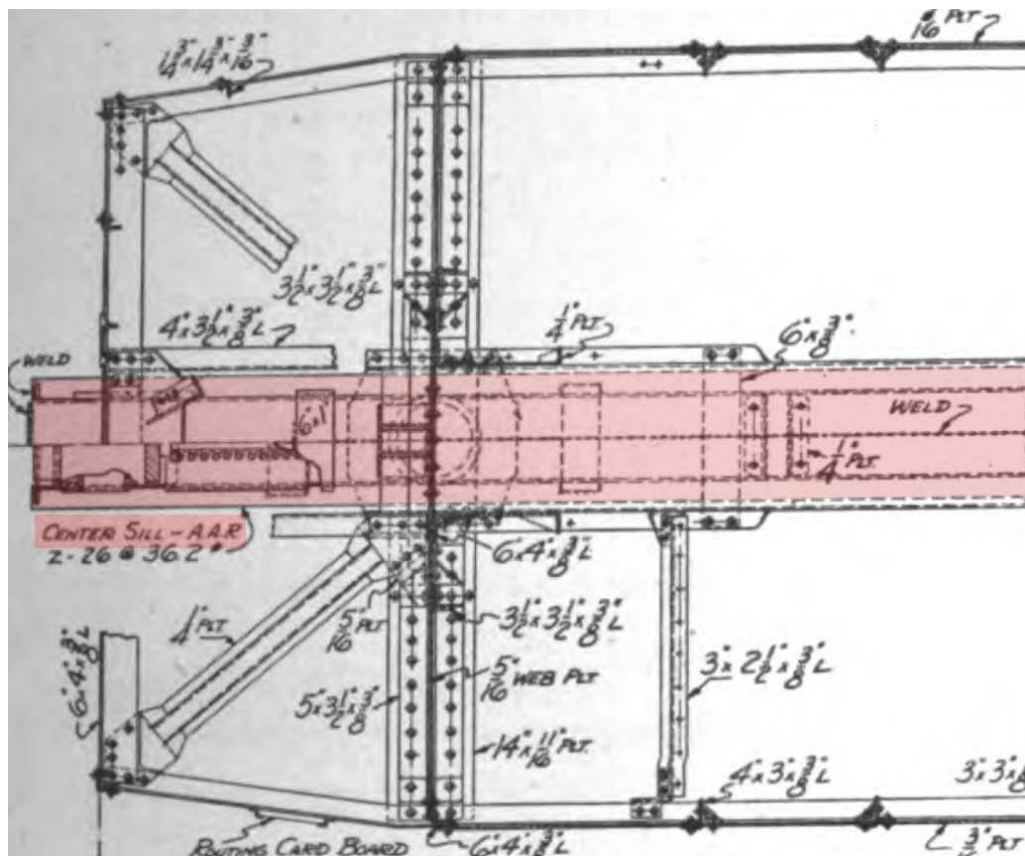
1. Independent Claim 2

- a. [2f] “said first end section having a first draft sill and a main bolster extending cross-wise to said first draft sill, said first draft sill and said main bolster intersecting at a first truck center, said first truck being located centrally under said first truck center;**

51. A POSITA would understand what is meant by the claim terms “bolster” and “draft sills.” These are standard features on rail cars, and have been since long before the priority date in 2009. For example, the 1946 Cyclopedia defines “bolster” as “a cross member on the underside of a car body and in the center of a truck, through which the weight is transmitted.” EX1004 at 16. It also discloses examples of bolsters, including by calling out the centerline of a bolster (“ Φ of Bolster”) in the following diagram:



Id. at 293 (color added). Regarding the claimed “draft sill,” the ’892 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 14:31-34. 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). As shown below, the 1946 Cyclopedia's NSC ore car discloses the first draft sill and the main bolster recited in limitation [2f], including the intersection of the two components at truck center.

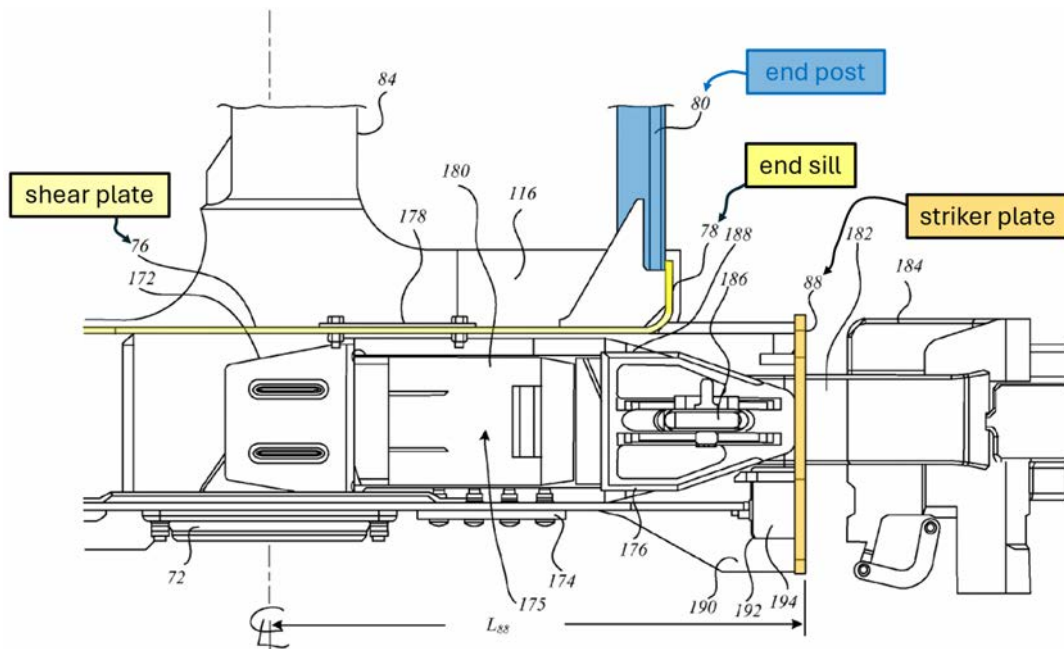
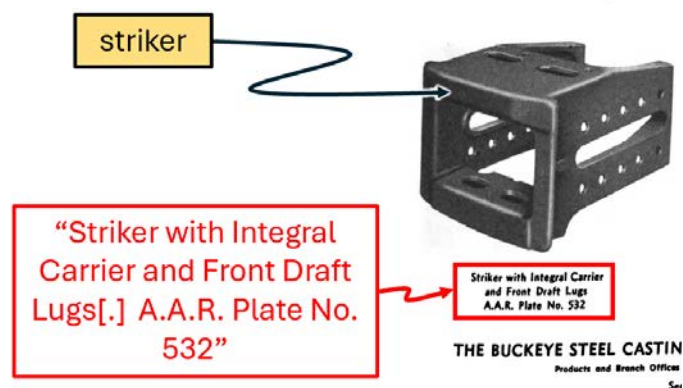


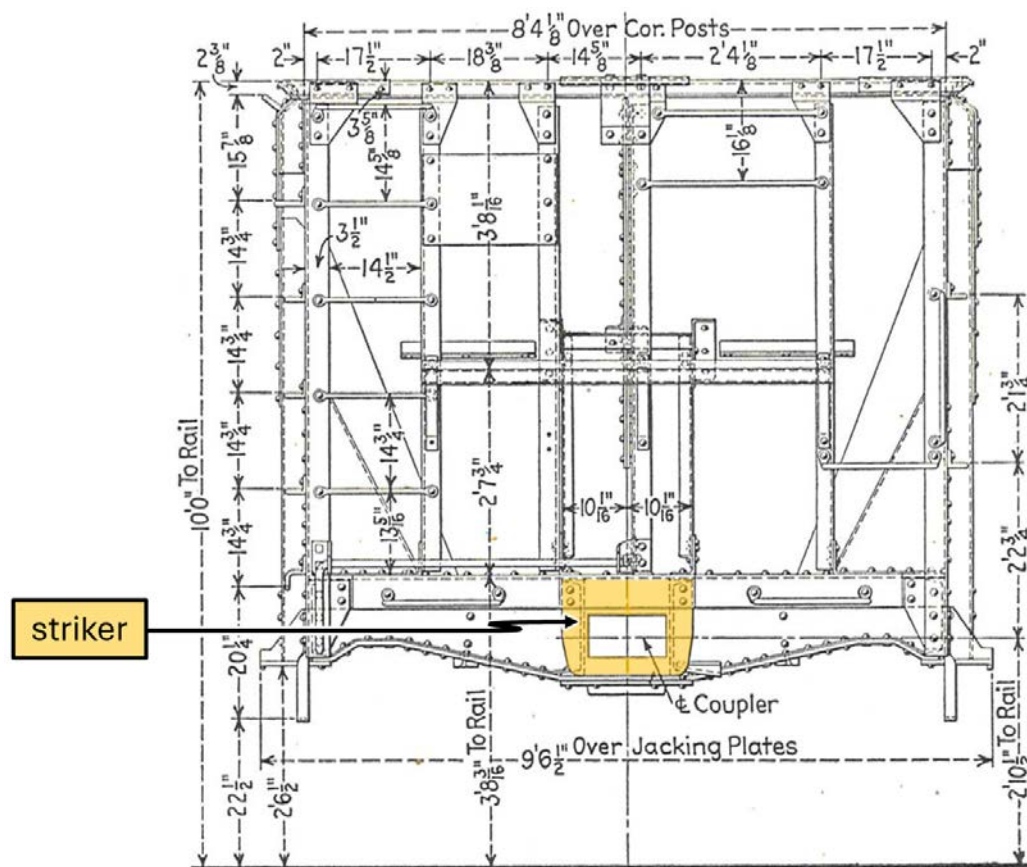
Figure 3c

EX1001 at Fig. 3a, 3c.

54. 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:



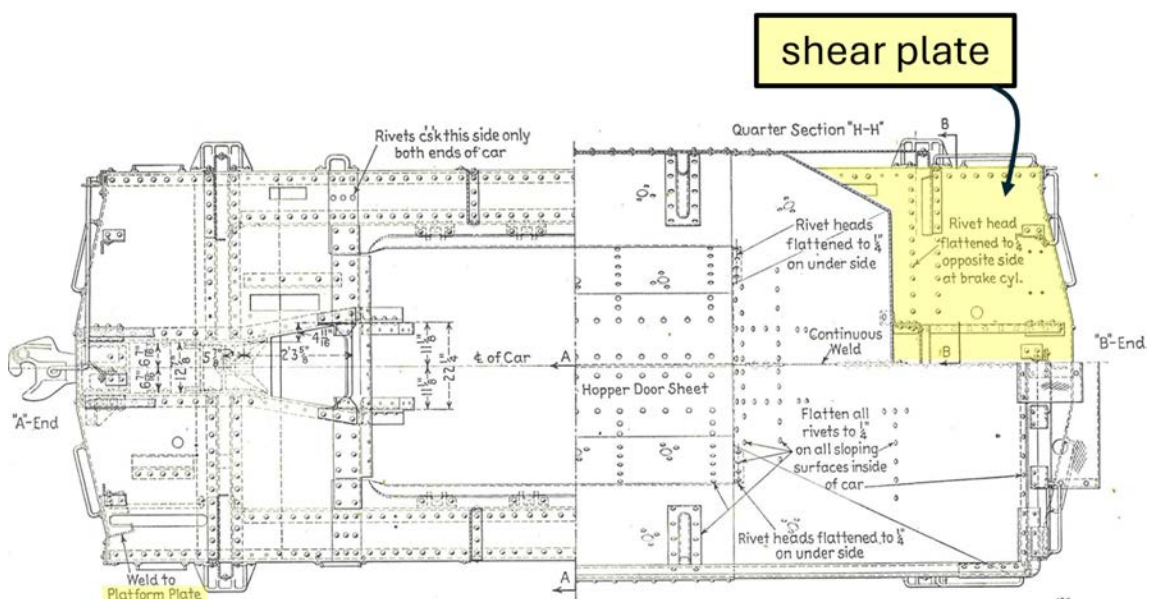
Id. at 972-73. As the definition of “striker” suggests, strikers protect the rail car from impact with the couplers that connect adjacent rail cars. For this reason, strikers are typically placed at the end of the center sill (in this case, the draft sill), which is longitudinally outboard of truck center. A POSITA would have wanted to use a striker in its customary position outboard of truck center with the 1946 Cyclopedia’s NSC ore car design to protect the draft sills from damage. Further, as shown below, the 1946 Cyclopedia’s NSC ore car explicitly discloses a striker on the end of each draft sill, and therefore outboard of truck center.



- c. [2h] “said first end section having a shear plate mounted overtop of said first draft sill and said main bolster; said shear plate having a longitudinally inboard margin adjacent to said longitudinally inboard end of said first end slope sheet; said shear plate having a longitudinally outboard cross-wise running margin traversing said draft sill longitudinally outboard of said truck center;”

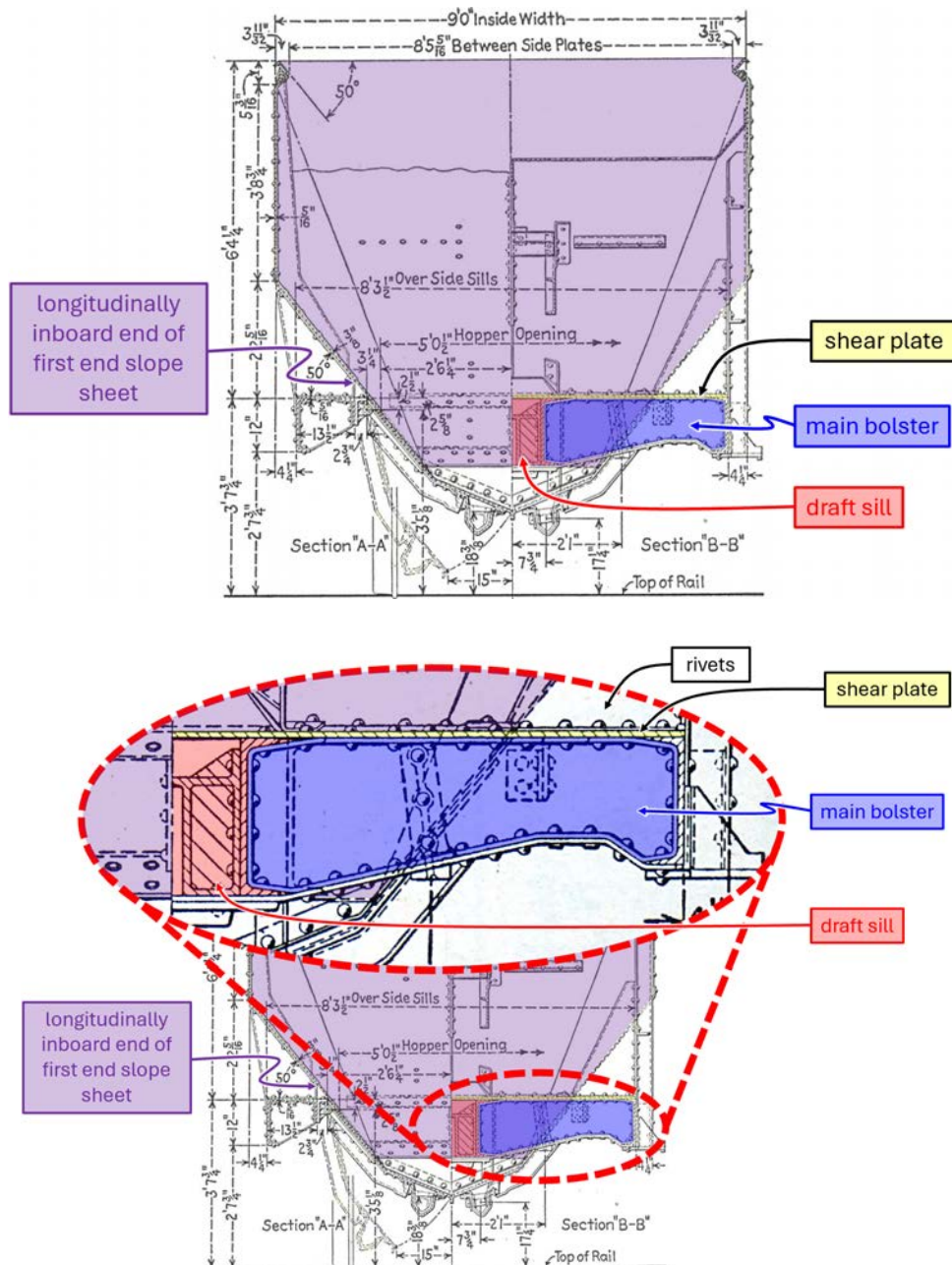
55. The 1946 Cyclopedia’s NSC ore car discloses the claimed shear plate.

The upper-right quadrant of the top view (below) shows the shear plate in the H-H, quarter section.

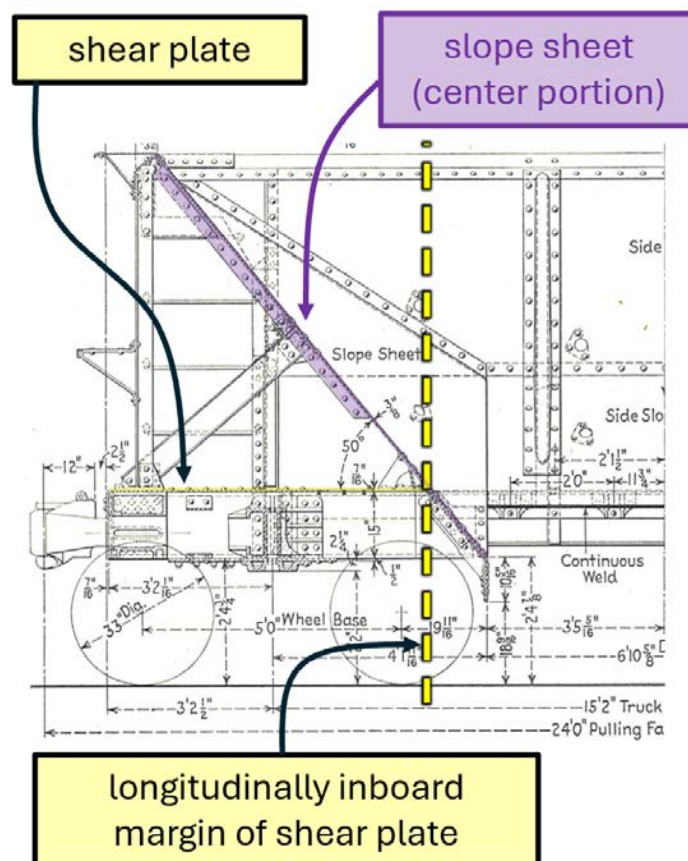


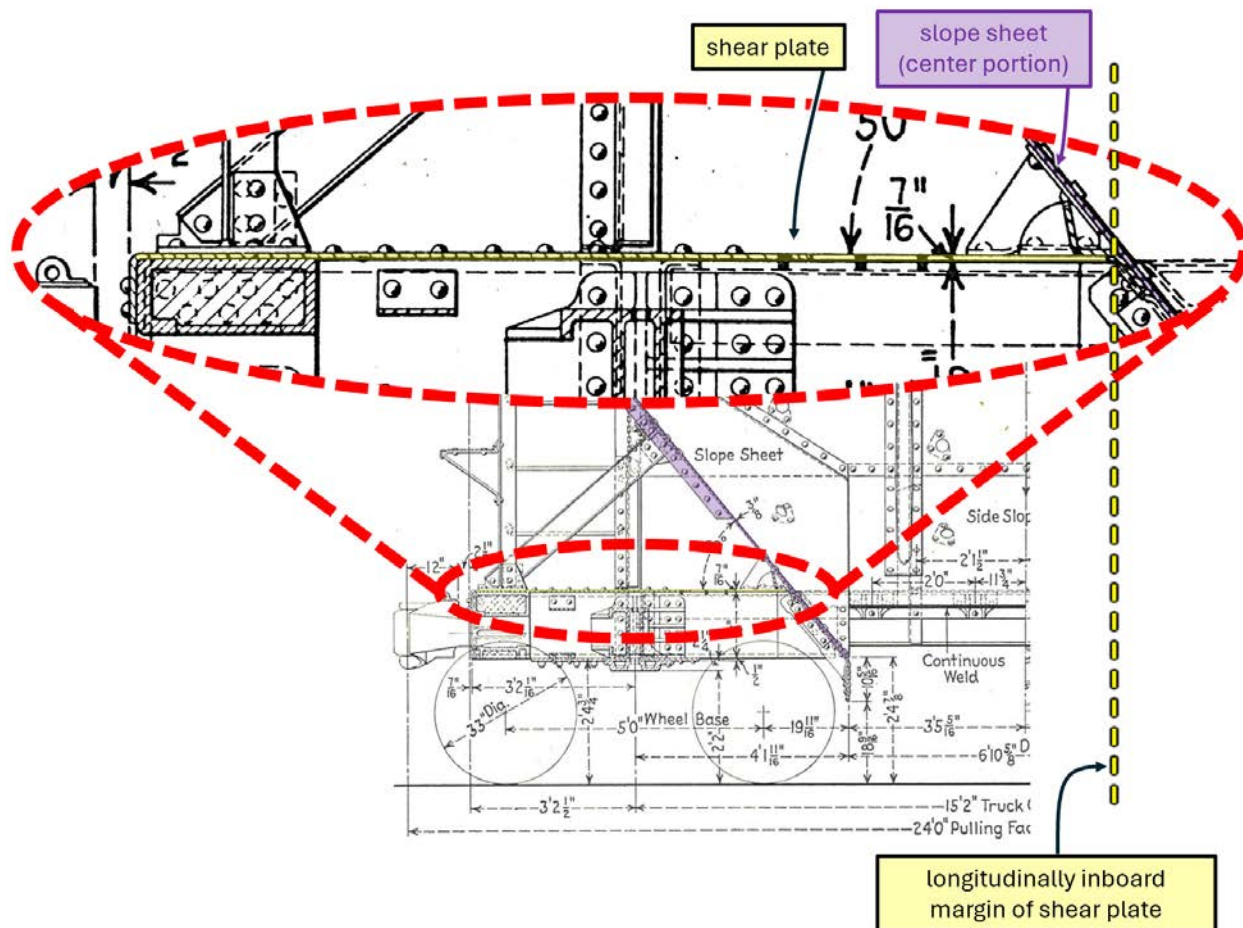
EX1004 at 294. This quarter section top view along the line H-H shows only one half of the “B end” of the car, symmetrically. *Id.* As discussed above, the NSC ore car can be accurately depicted in this quarter view because a POSITA would understand that the depicted structure is symmetrical about its longitudinal and lateral axes. Thus, the H-H quarter section shows that the shear plate extends laterally from one side of the car to the other side. *Id.* This is confirmed by sectional

end view along the line B-B, which appears below. *Id.* The B-B view confirms that the shear plate is a distinct layer directly on top of the main bolster and the draft sill, that the shear plate is riveted to the bolster, and that the shear plate extends from one side of the car to the other. *Id.*

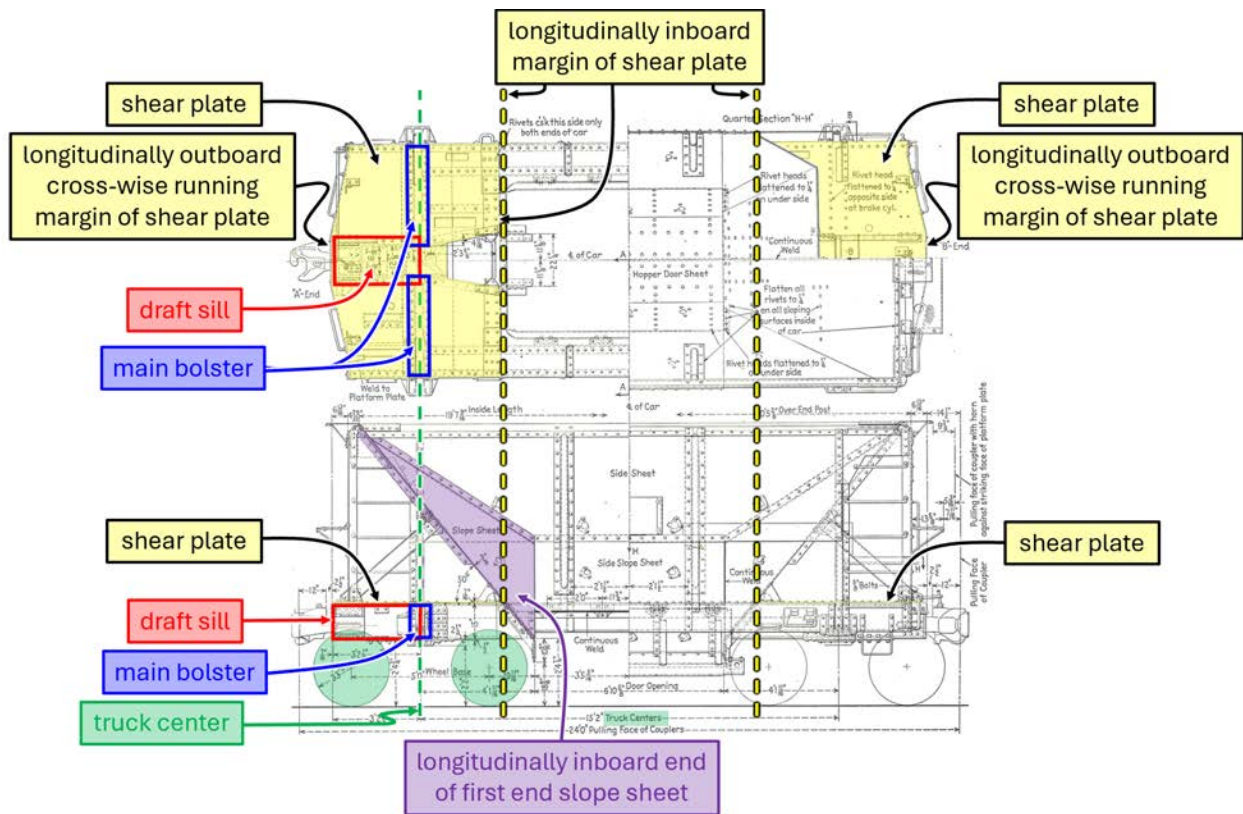


EX1004 at 294. The left half of the side view (below), which is a vertical-longitudinal sectional cut that shows inside the hopper, shows the longitudinal extent of the shear plate. *Id.* It shows that the shear plate extends inward from the end of the draft sill (at the left of the image) to the point where it meets the downwardly extending slope sheet. *Id.* The hatched portion indicates areas where the section cuts through the shear plate, whereas non-hatched portions indicate areas where the shear plate appears farther back into the page. *Id.* This hatching of the side section view enables a POSITA to understand the horizontal coverage of the shear plate shown in the left half of the top view (further below). *Id.*





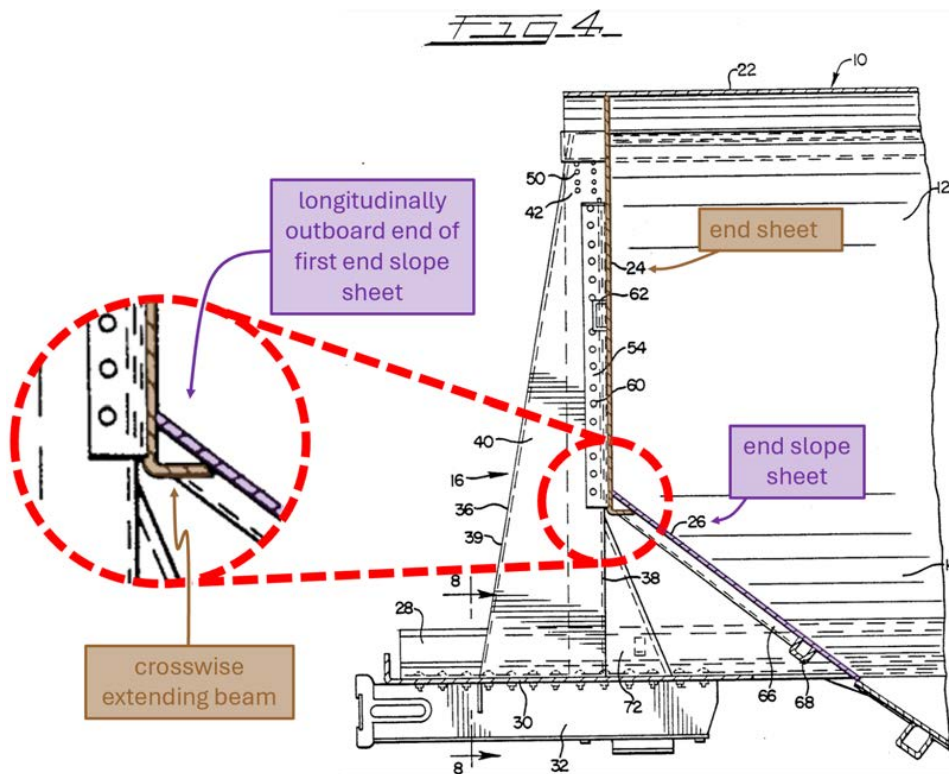
EX1004 at 294. Once the lateral and longitudinal margins of the shear plate are determined, it is apparent that the 1946 Cyclopedia's NSC ore car discloses limitation [2h], as shown below.



Id.

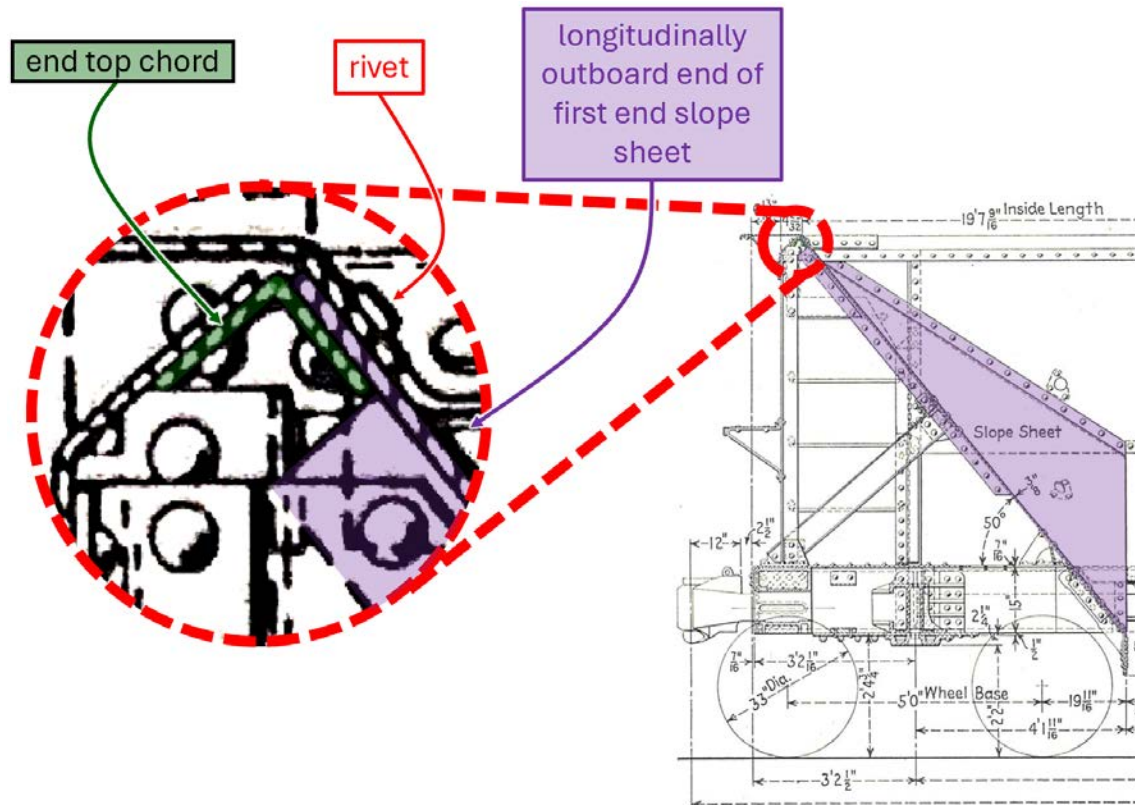
- d. [2i] “said upper, longitudinally outboard end of said first end slope sheet being reinforced by a first cross-wise extending beam;”

56. The 1946 Cyclopedia’s NSC ore car, as modified in view of Wong, would satisfy limitation [2i]. As shown below, Wong discloses a first end slope sheet (“end slope sheet” 26). The upper, outboard end of the sheet is reinforced by a cross-wise, L-shaped beam positioned under the slope sheet.

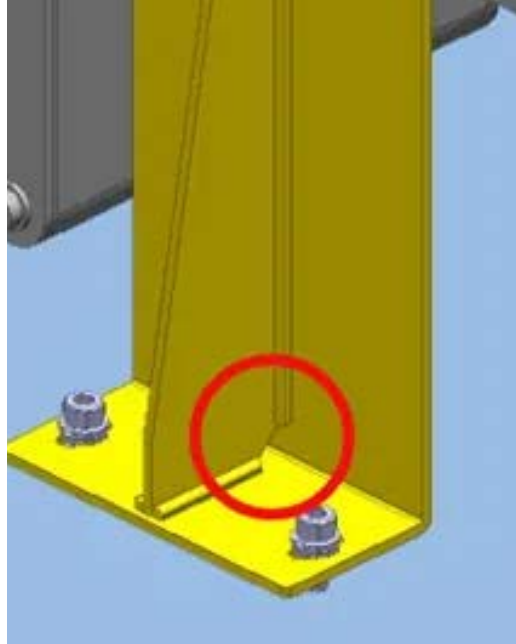


EX1006, Fig. 4. It would have been obvious to modify the 1946 Cyclopedia's NSC ore car to further support the upper, outboard end of the slope sheet with a crosswise, L-shaped beam as in Wong. A POSITA would have been motivated to make the modification. For example, Wong and the 1946 Cyclopedia are in the same field of hopper railcars. EX1004 at 294-95 ("ore car" with a hopper); EX1006, Abstract ("hopper railcar"). That is the same field to which every claim of the '892 patent is directed. EX1001, Cl. 1-2 preambles (each independent claim is directed to a "rail road hopper car"). As another example, a POSITA would have understood the benefits of further reinforcing the slope sheet at its upper end. A POSITA would have understood that, at that upper end, a load in the hopper creates a stress concentration at the intersection of the end slope sheet and the end top chord, which

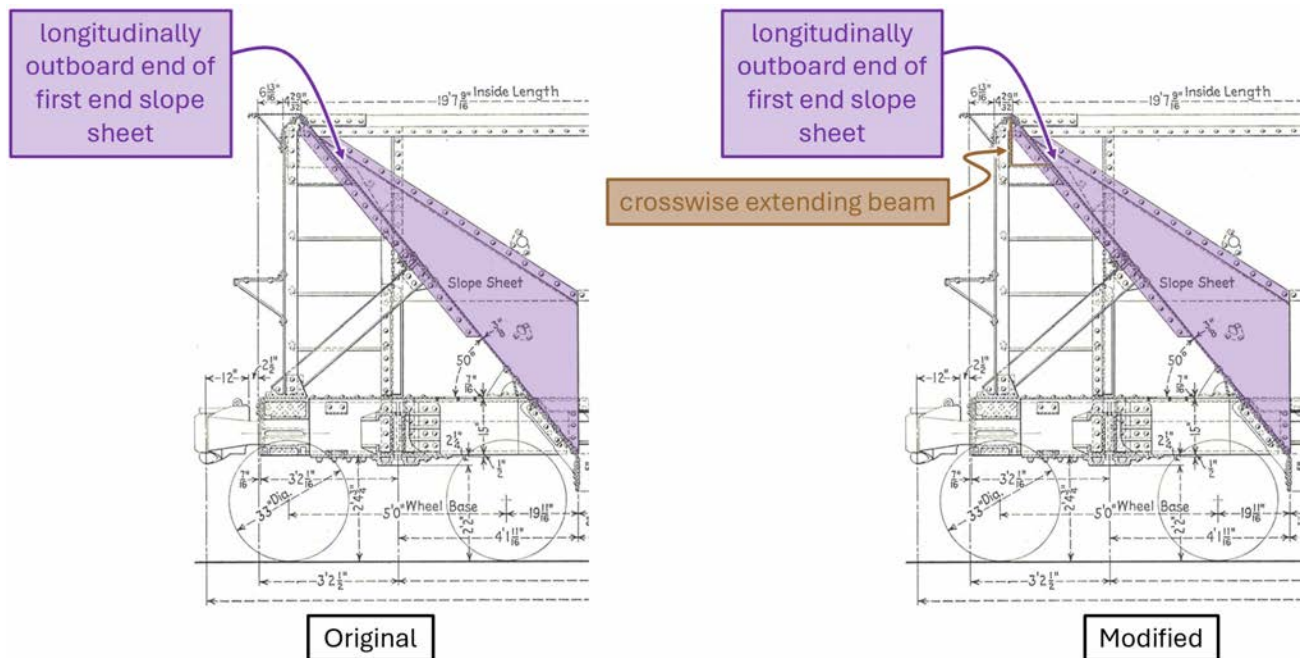
is shown below. A POSITA would have understood that the stress concentration could be ameliorated by spreading the load over a larger area. A common way to accomplish that was (and is) to support the upper, outboard end of the slope sheet with a cross-wise beam as in Wong.

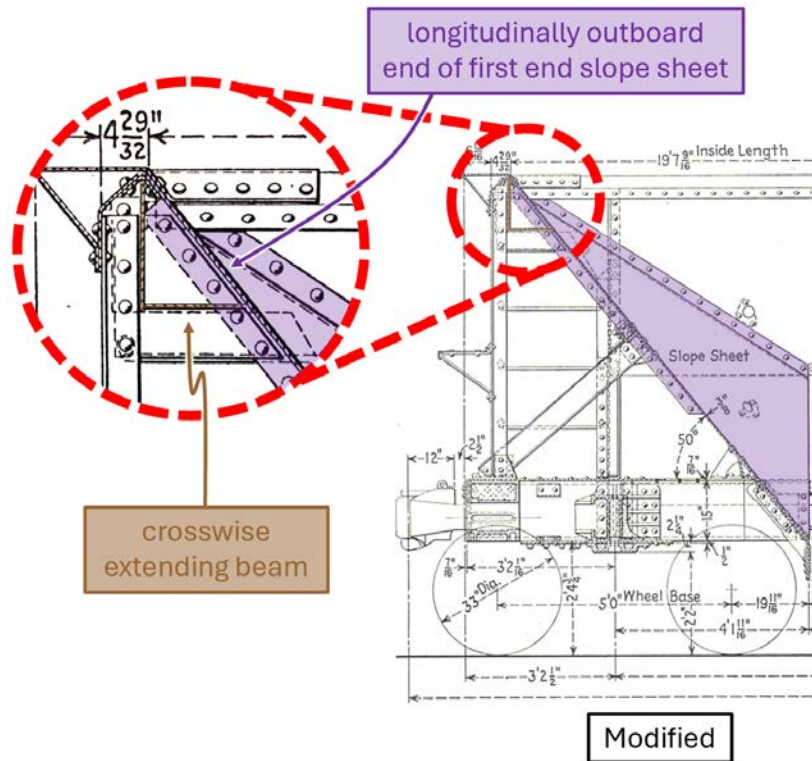


EX1004 at 294. Another such stress concentration relief is shown in the figure below, where the bracket's corner is rounded with a “relief hole”. Both Wang’s teaching (above) and what is shown below are common engineering methods for relieving stress concentrations.



A POSITA would have had a reasonable expectation of success in making this modification because it would be a straightforward addition of a simple structure, as shown below.





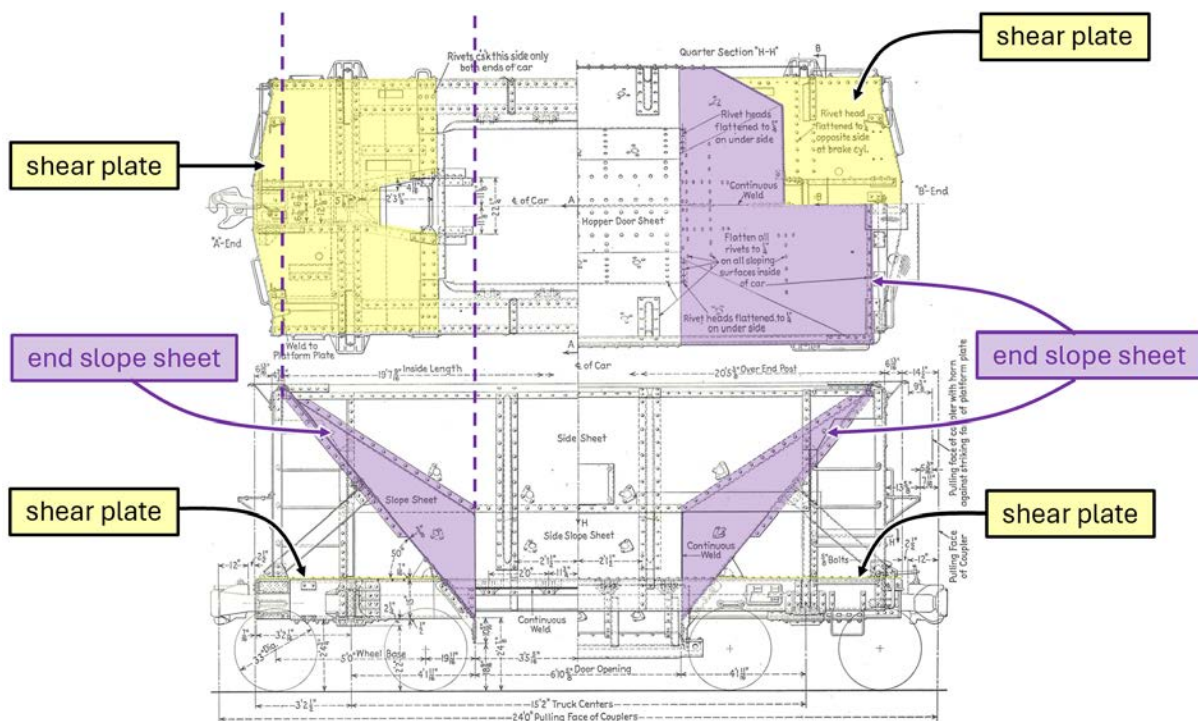
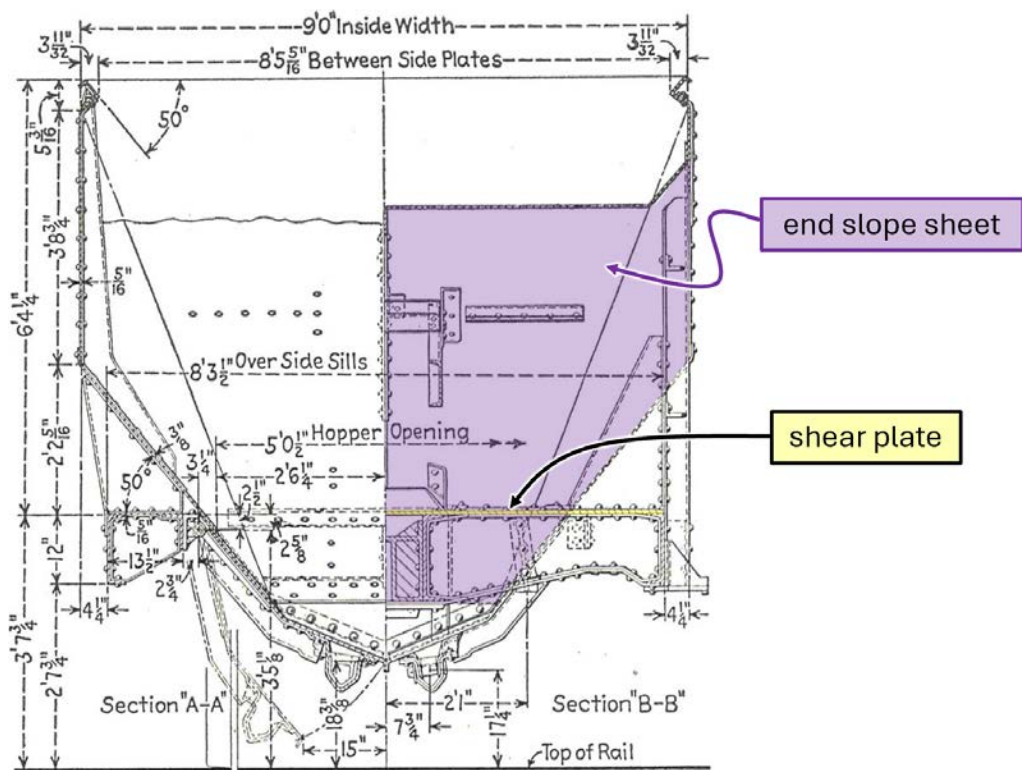
Id. (modified).

- e. [2j] “said lower, longitudinally inboard end of said first end slope sheet being reinforced by a second cross-wise extending beam;”

57. The 1946 Cyclopedia’s NSC ore car discloses this limitation. As shown below, a support plate for the slope sheet (orange) is on top of the shear plate. EX1004 at 294. The support plate has horizontal flanges riveted to the shear plate. *Id.* Those rivets are seen most clearly on the left side of the top view (enlarged below). *Id.* The support plate also has an angled flange connected to the slope sheet below the plane of the shear plate. *Id.*

f. [2k] “said first end slope sheet overhanging said shear plate;”

58. The 1946 Cyclopedia’s NSC ore car discloses limitation [2k], as shown below. EX1004 at 294. The end view’s right portion, which is along section B-B, shows the end slope sheet overhangs the shear plate in a transverse-vertical plane. *Id.* The side view shows the end slope sheet overhangs the shear plate in a longitudinal-vertical plane. *Id.* Comparing the top view’s upper-right and lower-right quadrants shows the end slope sheet overhangs the shear plate—the upper-right quadrant’s horizontal-section view along the cross-section H-H approximately midway between the undercarriage and the top of the car reveals portions of the shear plate the end slope sheet obscures in the lower-right quadrant’s un-sectioned top view. *Id.*

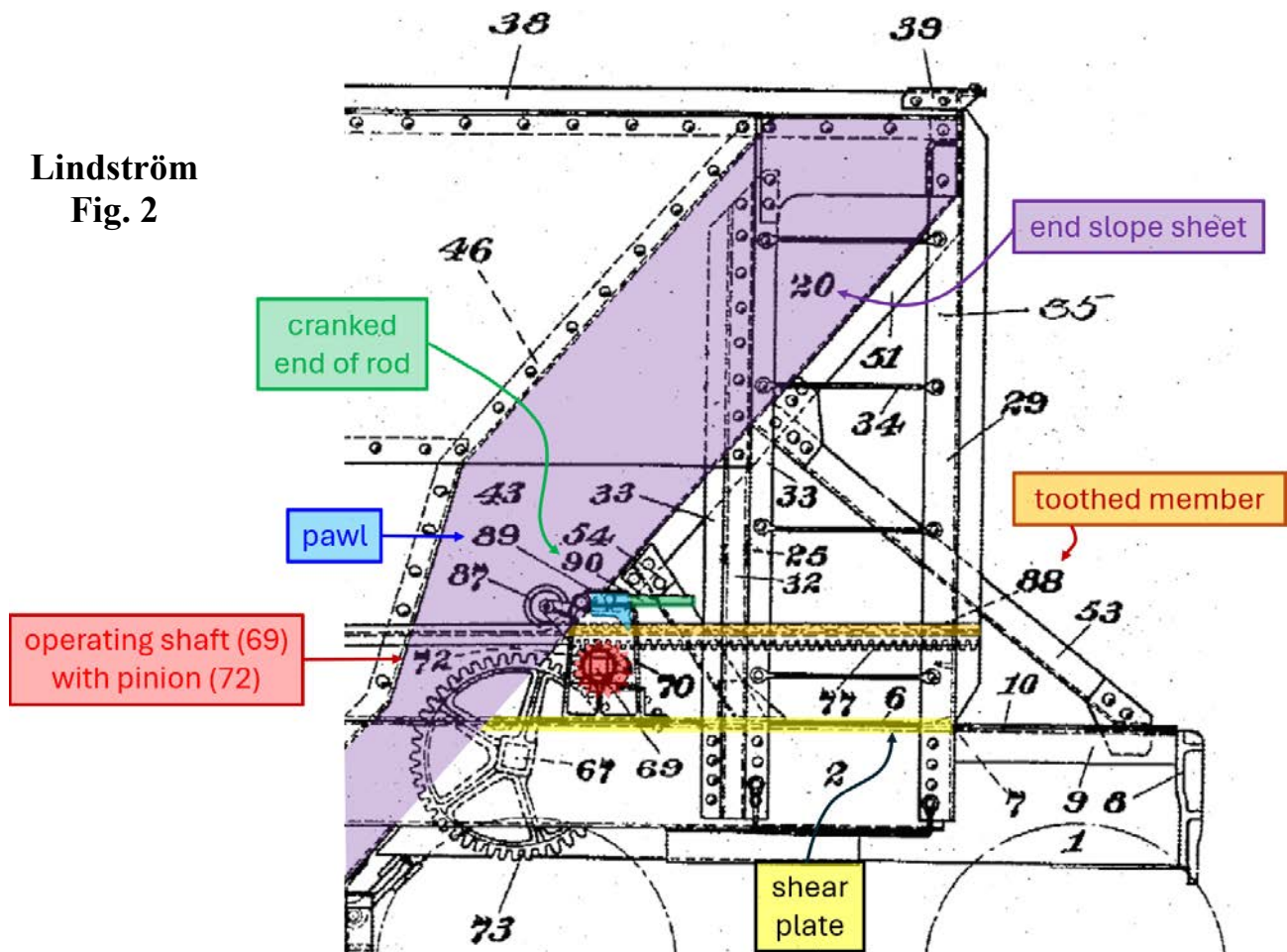


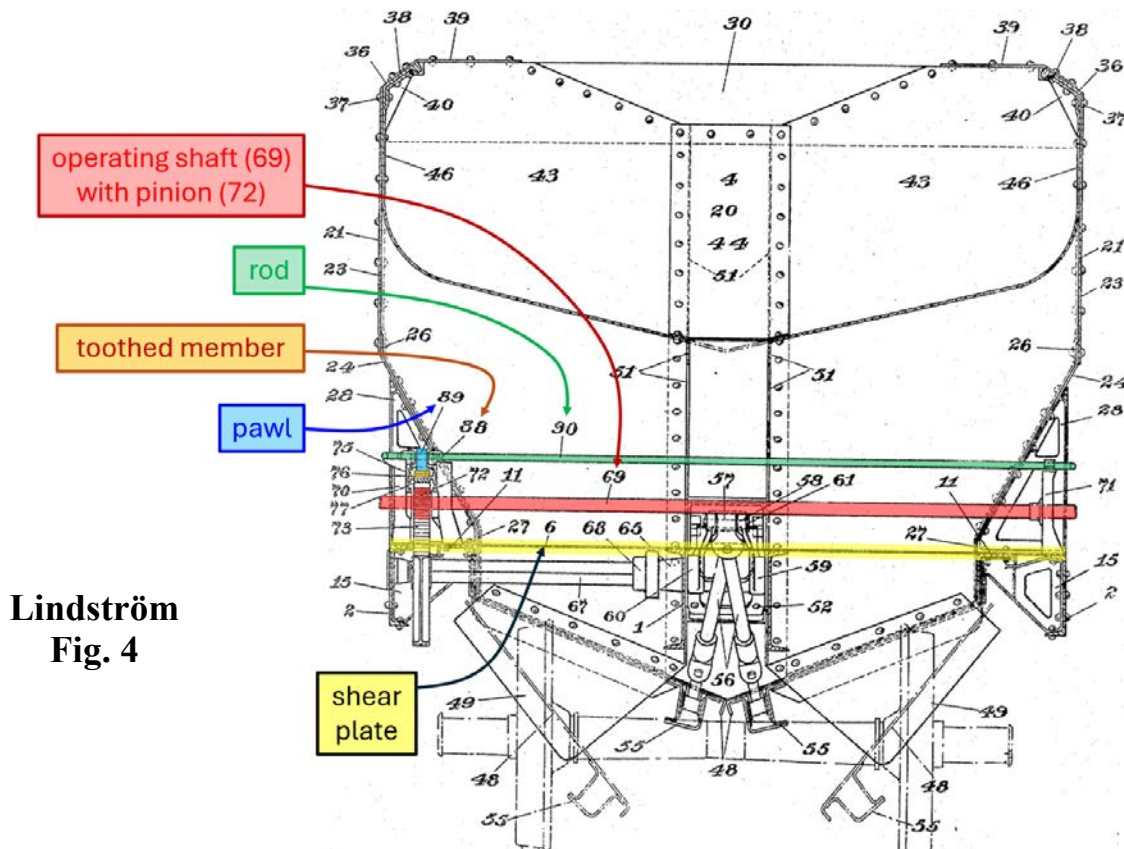
Id.

- g. [21] “a door actuator mounted above said shear plate, said door actuator being at least partially overhung by said first end slope sheet; said door actuator being connected to said door by a mechanical transmission;”

59. The 1946 Cyclopedia’s NSC ore car, as modified by Lindström, satisfies this claim limitation. As shown below, Lindström discloses a hopper car with a shear plate comprising plate 6 and an end slope sheet (“sloping end floor” 20). For opening hopper doors 48, Lindström discloses a door actuator comprising an operating shaft 69, a pinion 72, a toothed member 88, a pawl 89 and a rod 90.

Lindström
Fig. 2



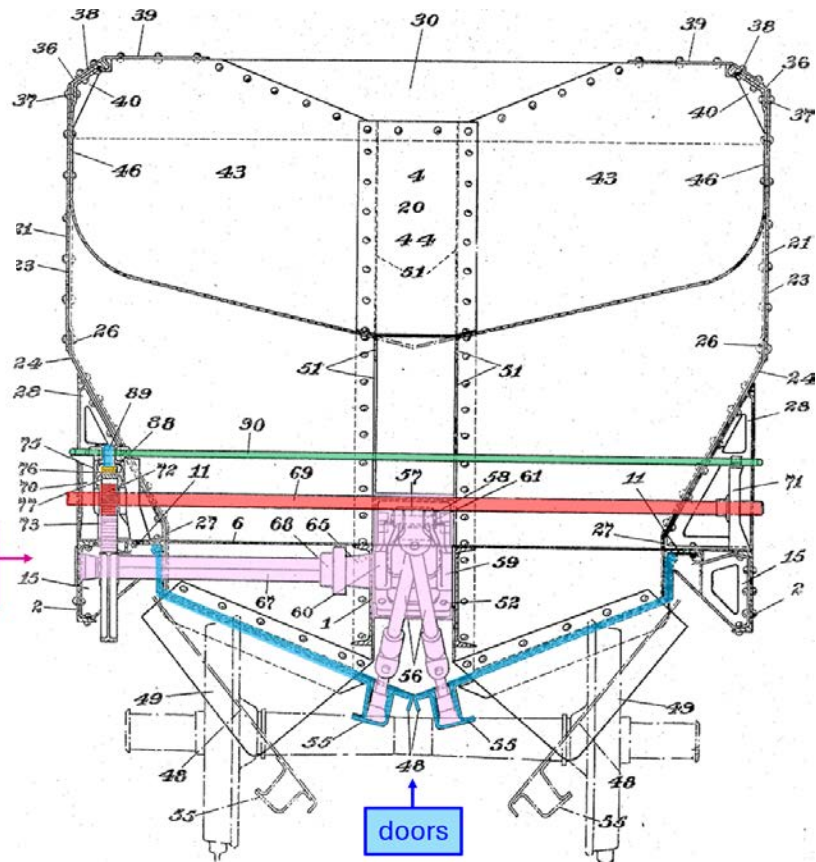


**Lindström
Fig. 4**

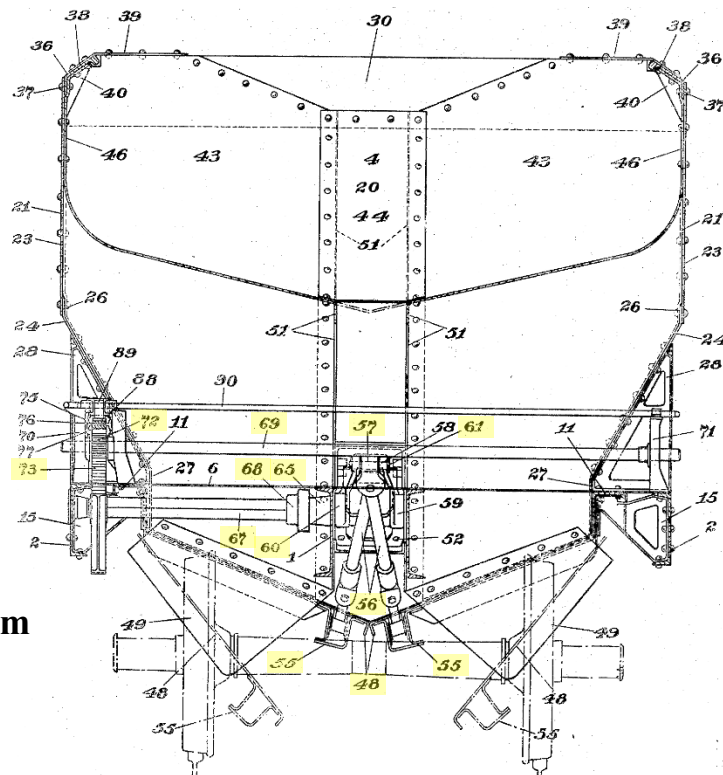
EX1005, Figs. 2, 4. To open the hopper doors, “the operator grasps the rod 90 by one of its cranked ends and through its operation throws the pawl 89 out of engagement with the toothed member 88. A crank or wrench is then applied to the end of the shaft 69, which is then operated in the direction of the arrow, as shown in Fig. 2.” *Id.* at 5:115-122. Shaft 69 is connected to the hopper doors by a mechanical transmission that transfers force between gears and linkages as follows.

Lindström
Fig. 4

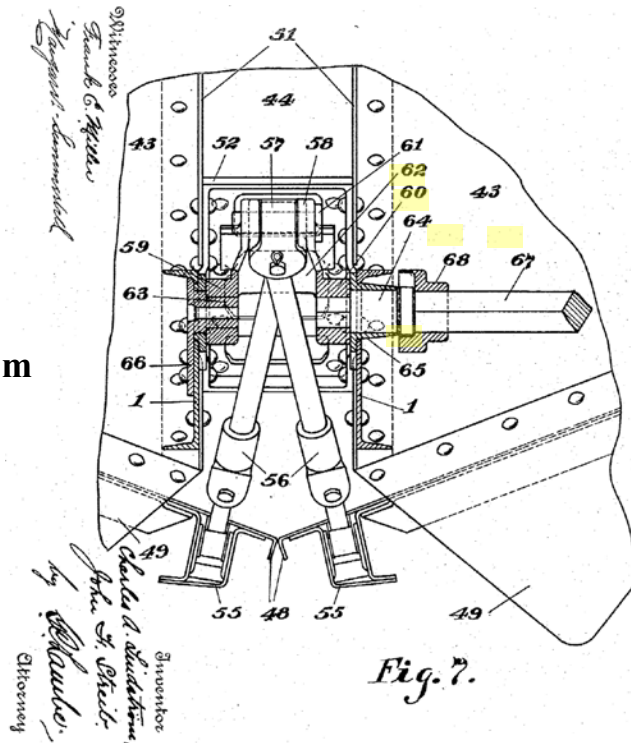
mechanical
transmission



Lindström
Fig. 4



**Lindström
Fig. 7**



Id. at Figs. 4, 7.

1. Shaft 69 to pinion 72 to segment gear 73 to shaft 67. *Id.* at 5:40-44 (“The shaft 69 is connected to one of the shafts 67 through the medium of a pinion 72 secured on the shaft 69, meshing with a segment gear 73 on the shaft 67 . . .”).
2. Shaft 67 to clutch member 68 to trunnion 64 (Fig. 7), which is journaled in bearing member 65 and is part of arm 60. *Id.* at 4:118-21 (“shafts 67 are provided which are secured in the outer portions of the clutches hereinafter described”), 5:5-7 (“the lug in the clutch member 68 when rotating will strike the lug on the trunnion 64 and transmit motion to such trunnion 64”), 4:105-08 (“arms 60 are provided with trunnions 64 having

cylindrical outer bearing portions which are suitably journaled in bearing members 65”).

3. Arm 60 to crank pin 61 to yoke 57 to link 56 to beam 55 to door 48. *Id.* at 4:83-86 (“At the free ends of the crank arm there is carried the crank pins 61 upon which the yokes 57 are directly mounted.”), 4:74-80 (“there is a pair of links 56 at each end of the discharge doors, one end of each of said links being connected to the end of its respective beam 55, the other end of each pair of links being brought together and pivotally mounted in the yoke 57”), 4:64-65 (“Each of the discharge doors 48 is provided with a beam 55”).

This mechanical transmission between shaft 69 and the hopper doors 48 is described in detail in the following passage in Lindström:

For the purpose of operating the doors 48, 48 we have provided a mechanism which is similar to the mechanism shown in U. S. Letters Patent No. 1,002,856 and 1,012,260, granted to Charles A. Lindstrom, with the following improvements: Instead of locating the crank operating mechanism on both sides of the car in such a manner that the mechanism on one side operates one end of each of the doors and the mechanism on the other side operates the other end of each of the doors, in which location they are difficult to inspect without going from side to side of the car, the mechanism has been mounted on one side of the car. This improvement also reduces the number of pinion wheels from two to one, and permits the whole mechanism to be constructed more accessible and compact, and also cheaper.

The present mechanism including parts previously used and the modifications are as follows: ***Each of the discharge doors 48 is provided with a beam 55***, composed of Z or other suitable section or

sections extending along and under its free edge and projecting slightly on each end of the door. The ends of beams 55, 55 are connected through the medium of universally jointed links 56 to yokes 57, 57 pivotally mounted in crank frames 58, 58, which are preferably located between the sills 1, 1, and at each end of the doors. That is to say, ***there is a pair of links 56 at each end of the discharge doors, one end of each of said links being connected to the end of its respective beam 55, the other end of each pair of links being brought together and pivotally mounted in the yoke 57.*** Each of the crank frames which are oppositely disposed consists of a pair of crank arms 59, 60 connected together through the medium of a web 62. ***At the free ends of the crank arm there is carried the crank pins 61 upon which the yokes 57 are directly mounted.*** Each of the crank frames 58 is journaled, as later described, in the draft sills 1, 1 in such a position that when the discharge doors 48, 48 are closed, the links 56 and yoke 57 are on the dead center of the crank frame 58, or slightly beyond the same toward the sloping floor, so that the load on the doors tends to force the crank frame in the closing direction and thus the doors are automatically locked against opening from jars or shocks during transit. It will be noted from the drawings that the crank frames 58 are oppositely disposed so that through the medium of the yokes 57 and the links 56 they oppose each other, which arrangement is a further safeguard against accidental opening of the doors during transit.

The arms 59 of the crank frames 58 are journaled on trunnions 63, while the ***arms 60 are provided with trunnions 64 having cylindrical outer bearing portions which are suitably journaled in bearing members 65*** preferably integral with the members 52 secured between the sills 1, 1. Each of these trunnions is provided with a squared inner end which fits in a square perforation in the crank arm 60 and may form a member of the safety clutch hereinafter referred to. Trunnions 63 are each provided with a flange 66 which is preferably secured to the outer face of the sill 1.

For operating the crank frames 58, ***shafts 67 are provided which are secured in the outer portions of the clutches hereinafter described*** by any suitable means. The shafts 67 extend transversely from the clutches to the side of the car, and are supported at their outer ends by suitable bearings. Near the outer ends of the shafts 67, segments of gears are

secured thereto, connected with rack operating mechanism hereinafter described.

Safety clutches are introduced for the purpose of permitting the dropping of the doors quickly without danger to the operator. The clutch members 68 and the trunnions 64 are provided with projecting lugs, such lugs being in the same rotary plane so that ***the lug in the clutch member 68 when rotating will strike the lug on the trunnion 64 and transmit motion to such trunnion 64*** and, conversely, either the clutch member or the trunnion is capable of limited non-transmitting movement relative to the other. These clutches are of the same general character as described in United States Letters Patent Nos. 865,714, 865,920 and 865,921 granted to Charles A. Lindstrom. It will be noted that the crank frames 58, in dropping the doors will make about one half revolution, and this being the case, because of the interposition of the clutches, such movement will not be transmitted to the shafts 67, and hence will be independent of shafts 67 and the balance of the mechanism.

It is necessary that the two crank frames 58 operate simultaneously to prevent undue strain on either side of a door due to one crank frame operating before the other, also that the two crank frames move away from the end sloping floors when the doors are being opened and toward the floors when the doors are being closed, which enables the placing of the crank frames closer to the floors and also allows the use of straight connections to the beams 55; further, as the load on the doors is naturally great, on account of the size of the doors as well as the nature of the lading, a power increasing mechanism is necessary. For this purpose the two shafts 67 are operatively connected to a common operating shaft 69, preferably extending transversely of the car and journaled in bearings 70 and 71. ***The shaft 69 is connected to one of the shafts 67 through the medium of a pinion 72 secured on the shaft 69, meshing with a segment gear 73 on the shaft 67,*** such segment gear projecting upwardly between the side sill 2 and the member 11, and shaft 69 being preferably located above the horizontal plane of the upper surfaces of the side and draft sills. The operating shaft 69 is connected with the other shaft 67 by means of a segment gear 74 on the shaft 67, the pinion 72 on the shaft 69 and toothed racks 75 meshing with and operatively connecting said segment gear 74 and pinion 72.

The rack 75 comprises a member 76 which is preferably of I form having toothed members 77 and 78 attached to its horizontally disposed web in such position as to mesh with the pinion 72 and the segment gear 74 respectively. The toothed member 78 is attached to the web of the member 76 through the medium of bolts 79 which pass through perforations in the member 78 and through slotted perforations 80 in the member 76, such bolts being held in position by nuts or other suitable means. To the member 76, intermediate the members 77 and 78, a bracket 81 is secured. Held within this bracket and extending outwardly therefrom is a threaded member 82 which is adapted to pass through a perforation in the lug 83 of the member 78. This member 82 is provided with nuts 84 and 85 which are adapted to engage the opposite faces of the lug 83 and hold the member 78 in any desired position. When for any reason it is desired to lengthen or shorten the distance between the members 77 and 78 the nuts 84 and 85 are turned to affect such adjustment.

The rack 75 is supported in operative position by means of brackets 86 and 70, projections being provided on the inner sides of the vertical portion of the sides of the brackets, on which slide the side extensions or flanges of the rack. The rack is retained in such a position, that the teeth shall be in mesh with the teeth of the pinion 72 and segment gear 74, by means of rollers 87 which contact with the upper portions of the rack, and which are held in such position by means of pins which are passed through the upward extensions of the brackets 86 and 70. Intermediate the brackets 86 and 70 the rack is retained in position by a roller journaled between the lugs 28a which are preferably integral with one of the members 28.

Id. at 4:43-5:96. As shown in the figures above, Lindström's door actuator is mounted above the shear plate and is at least partially overhung by the end slope sheet.

60. It would have been obvious to modify the 1946 Cyclopedia's NSC ore car to add a door opening mechanism like Lindström's, including the door actuator. A POSITA would have been motivated to make that modification. For example,

Lindström and the 1946 Cyclopedia are in the same field of hopper railcars. EX1004 at 294-95 (“ore car” with a hopper); EX1005 at 1:11-13 & Figs 1-2 (“dumping car” with a hopper). That is the same field to which every claim of the ’892 patent is directed. EX1001, Cl. 1-2 preambles (each independent claim is directed to a “rail road hopper car”). As another example, the NSC ore car has a configuration similar to that of Lindström’s car—for instance, both cars have similar views that disclose similar arrangements of claimed features such as hoppers, trucks, lower discharge, slope sheets, side sills, top chords, sidewalls, sidewall stiffeners with lower portions outside the sidewall and upper portions inside the sidewall in web continuity. *Compare, e.g.,* EX1004 at 294 *with* EX1005 Figs. 1, 2, 5. Further, the NSC ore car would have required a door-opening mechanism; indeed, such mechanisms were ubiquitous on bottom-discharge ore cars. Thus, a POSITA would have known that some door opening mechanism is necessary for NSC’s ore car to function properly and that the absence of a door-opening mechanism in the NSC car drawings indicates that the particular mechanism is not critical and that any suitable mechanism would work. Given that the two cars are similar in overall configuration, a POSITA would have had a reasonable expectation of success in incorporating a door-opening mechanism like Lindström’s in the NSC ore-car design.

- h. [2m] “said first end section being free of longitudinally oriented elephant ears extending between said draft sill and said first end slope sheet;”

61. The NSC ore car disclosed in the 1946 Cyclopedia does not have elephant ears. The '892 patent states:

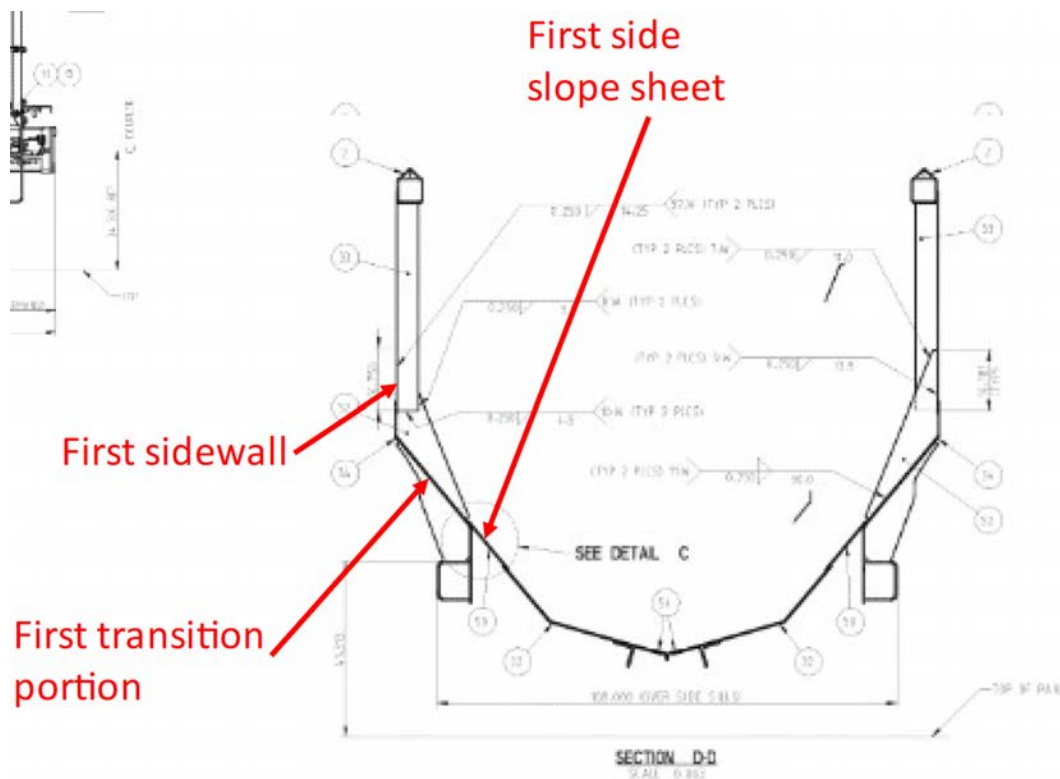
Car 20 has an end of car machinery space, indicated generally as 75, that is bounded by shear plate 76 on the bottom, the sloped end wall assembly 30 or 32 of the car on the top, main vertical central end post 80, and main side posts 82, 84 at the ends of main bolster 90. . . .

In existing cars, this space, 75, is often occupied or otherwise obstructed by other primary structure, such as so-called “elephant ears”. In this context, **“elephant ears” are large, substantially triangular planar plates**, sometimes provided with central lightening holes, ***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. The third edge is typically a free edge.

EX1001 at 14:38-63 (emphasis added). As shown in the figures below, the NSC ore car does not have large triangular plates. Instead, the slope sheet is supported by two crosswise beams (one near the shear plate and another at the top of the slope sheet), a large strut positioned at a right angle to the slope sheet, and two small struts positioned near the bottom of the slope sheet. EX1004 at 294. The large strut and one of the two small struts may be seen in the drawing below. *Id.* Besides not being elephant ears, the small struts do not extend from the draft sill. *Id.* The '892 patent defines the draft sill as the portion of the center sill outboard of truck center. *Id.*; see also EX1001 at 14:31-34.

- b. [6b] “said hopper includes first and second sloped side sheets; and said first sloped side sheet meets said first sidewall at said transition portion.”

63. I have reviewed the infringement claim chart for Claim 6 that NSC served in the litigation *National Steel Car Limited v. FreightCar America, Inc. et al.*, No. 1:24-cv-00594 (D. Del.). That claim chart, shown below, explains NSC’s position on what portions of the accused products satisfy the elements of Claim 6. I note that NSC’s chart for Claim 6 substitutes the term “side slope sheet” for the claim term “sloped side sheet.” Thus, I understand NSC has construed “sloped side sheet” to refer to the “side slope sheet” 50 in the ’892 patent. This is confirmed by the arrows in NSC’s chart, point to a portion of the hopper that is not part of the side sheet.



64. The '892 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 15:46-50.

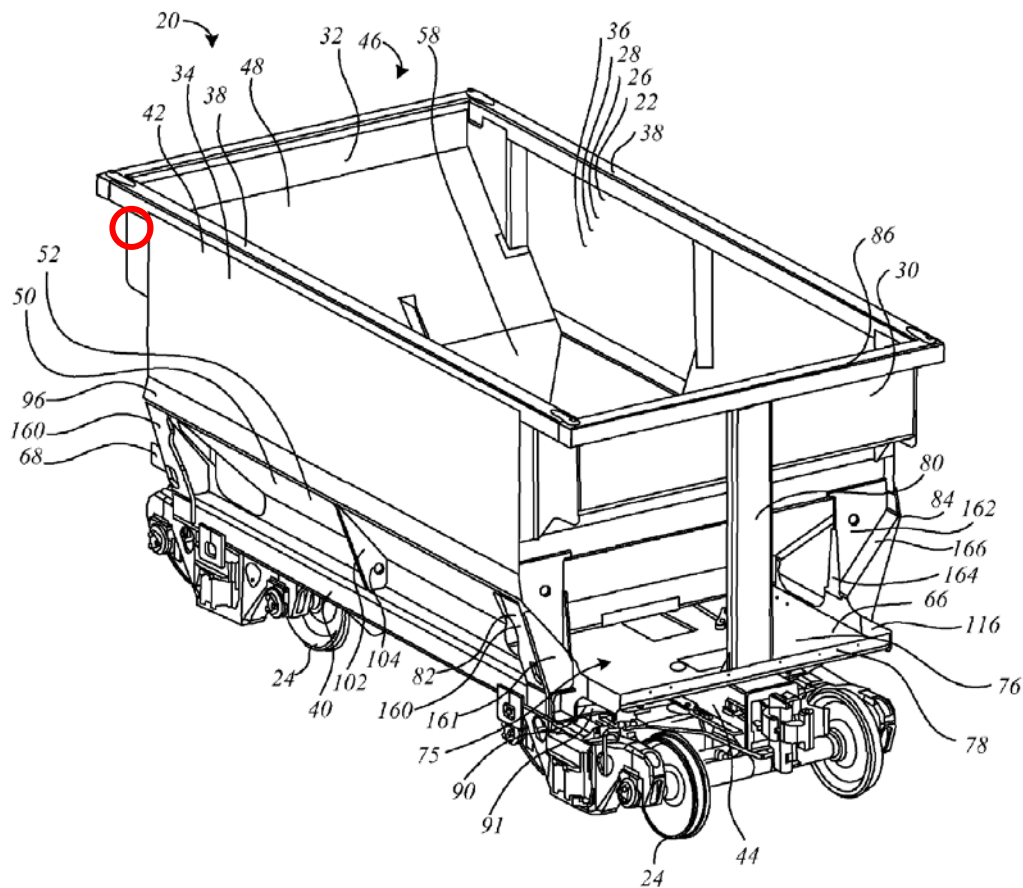


Figure 1

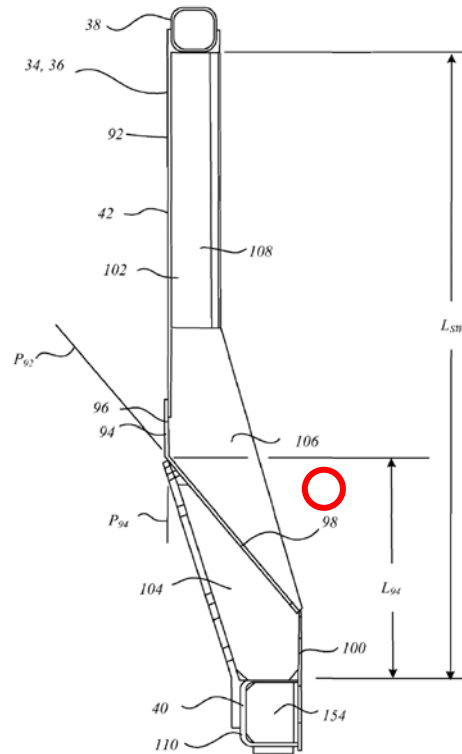


Figure 2c

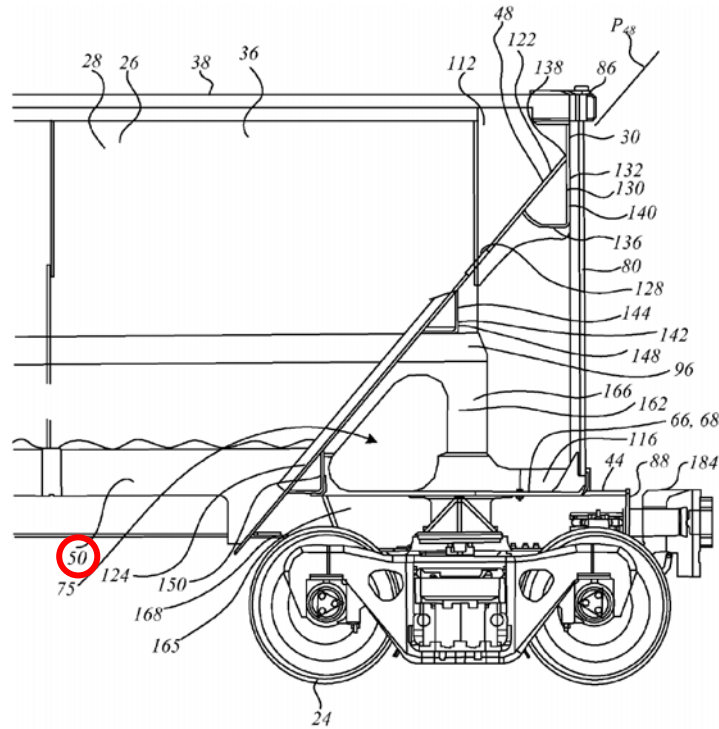
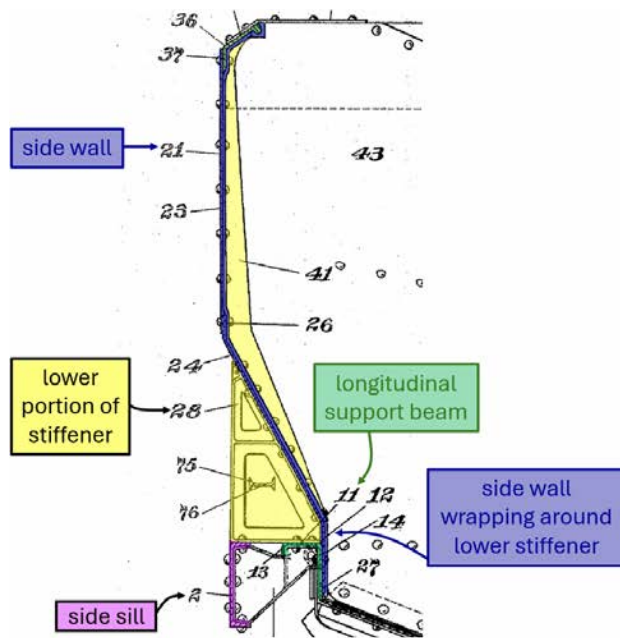


Figure 3b

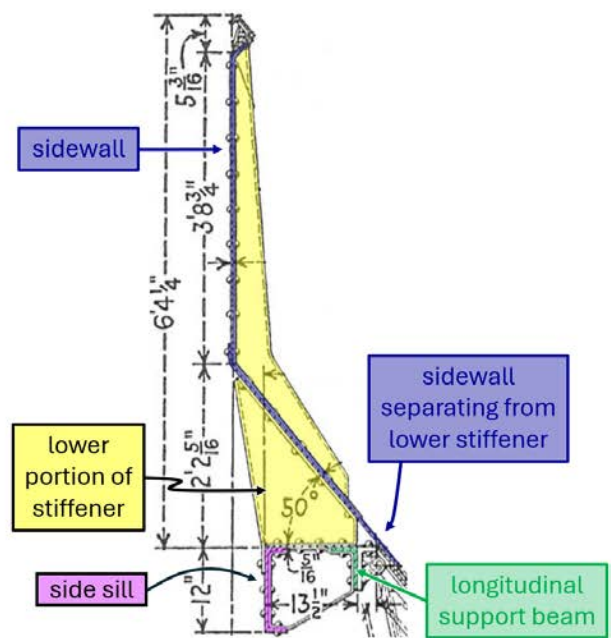
Id. at Figs. 1, 2c, 3b.

65. Under NSC's construction, which interprets "sloped side sheet" to refer to the "side slope sheet" 50, limitation [6b] is satisfied by an obvious modification of the 1946 Cyclopedia's NSC ore-car design in view of Lindström.

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)**

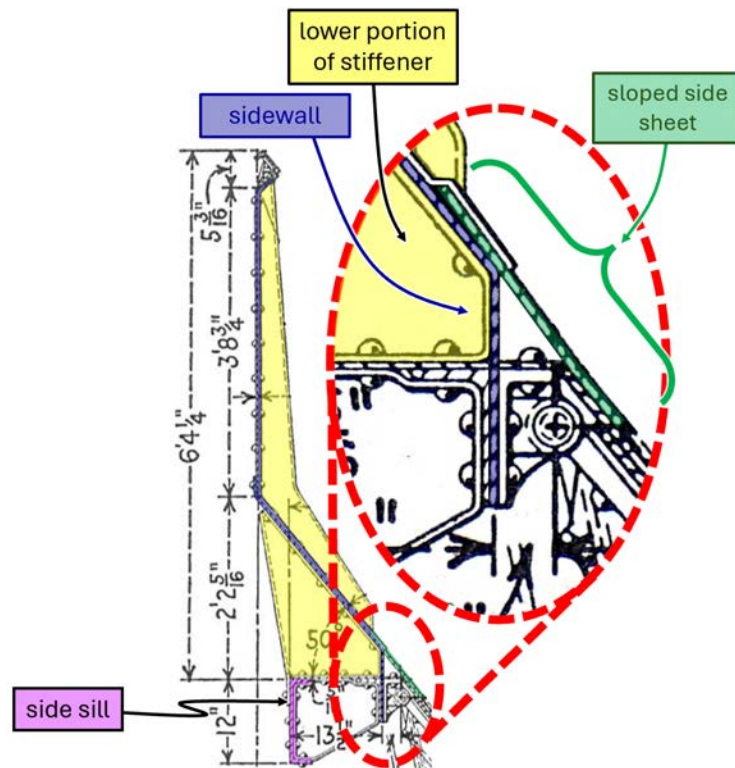
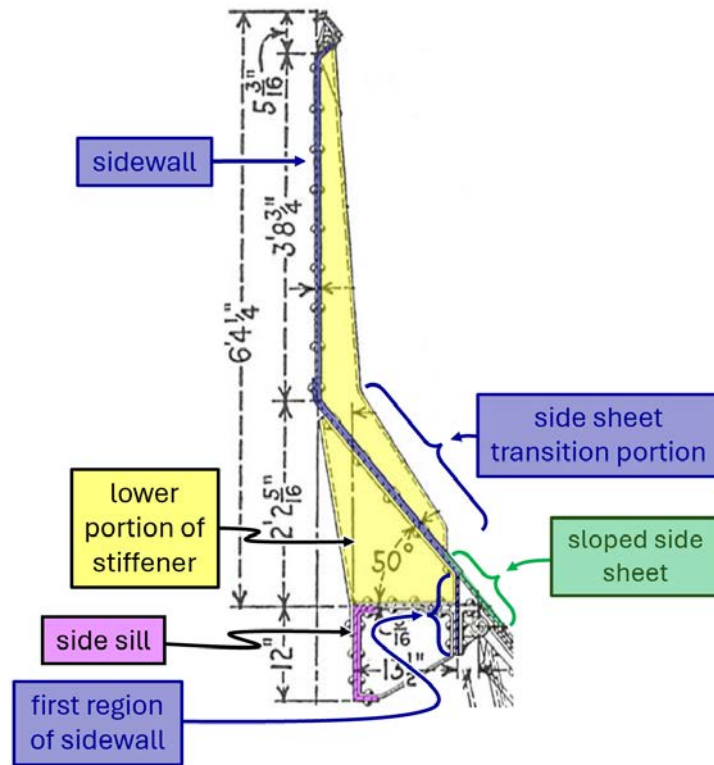
EX1005, Fig. 5; EX1004 at 294.

66. 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 as Lindström, 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).

67. 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.

68. Modified in this way, the "first sloped side sheet meets said first sidewall at said transition portion."



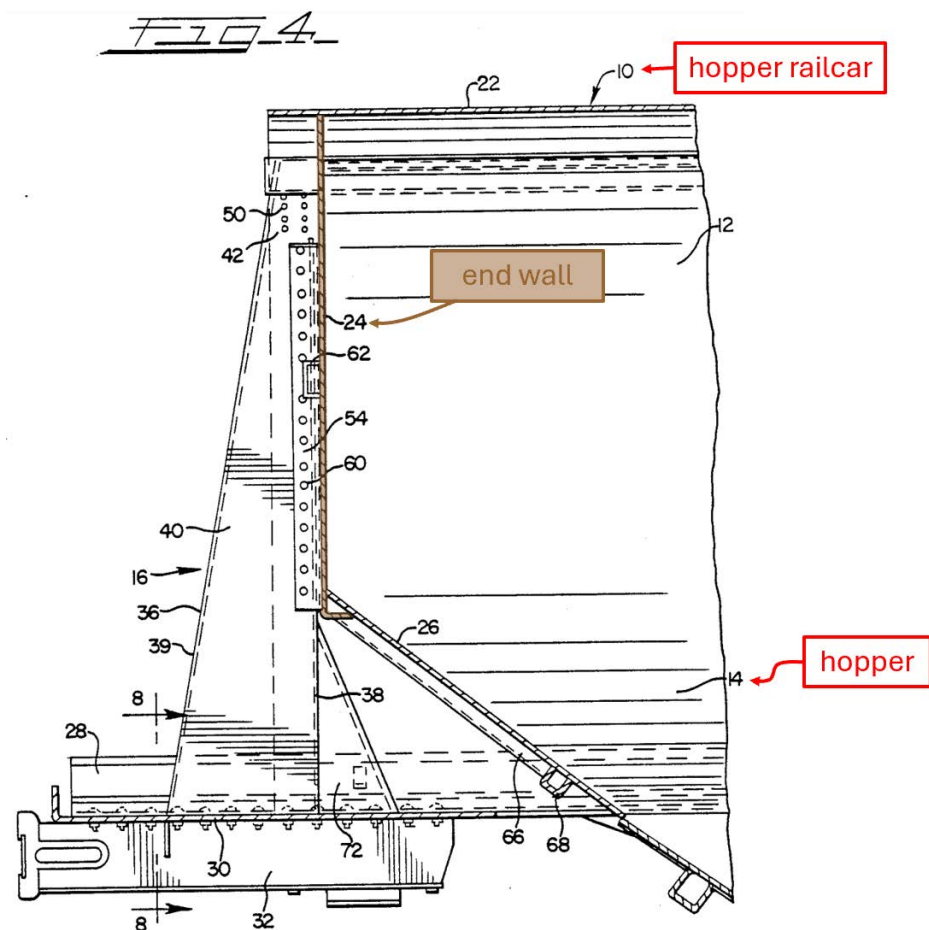
EX1004 at 294 (modified).

C. Ground 1c: Claim 9 – obviousness over the 1946 Cyclopedia in view of Lindström and Wong.

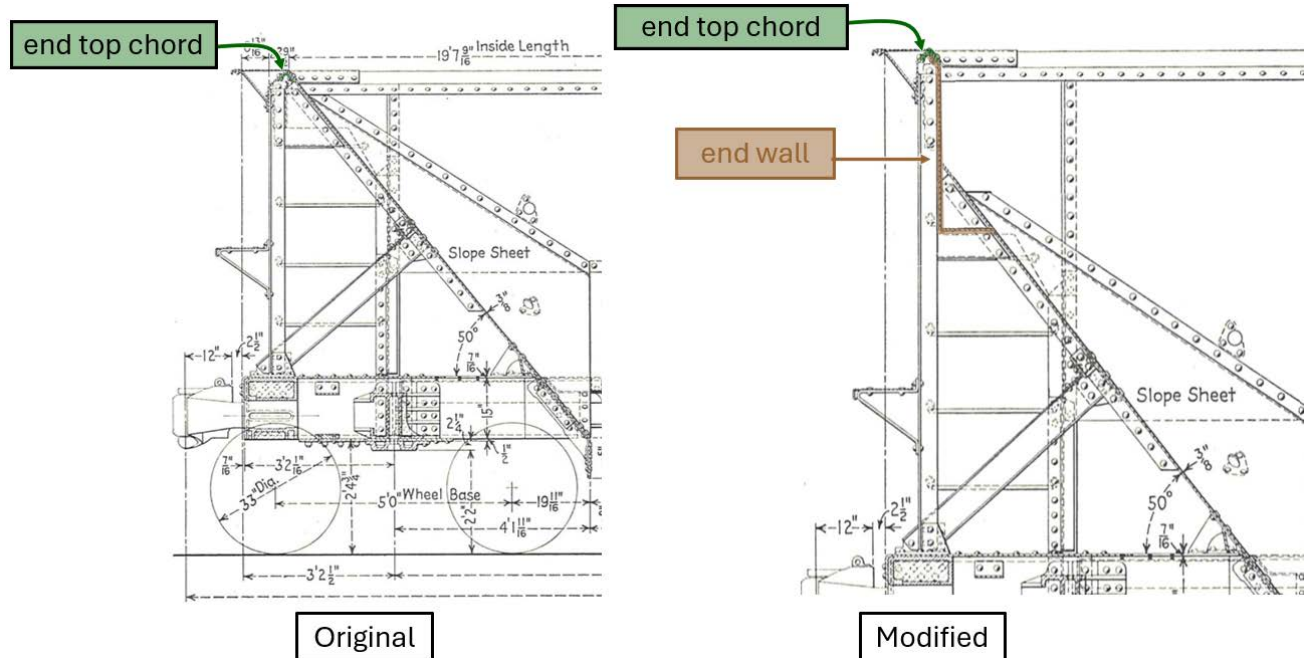
1. Dependent Claim 9:

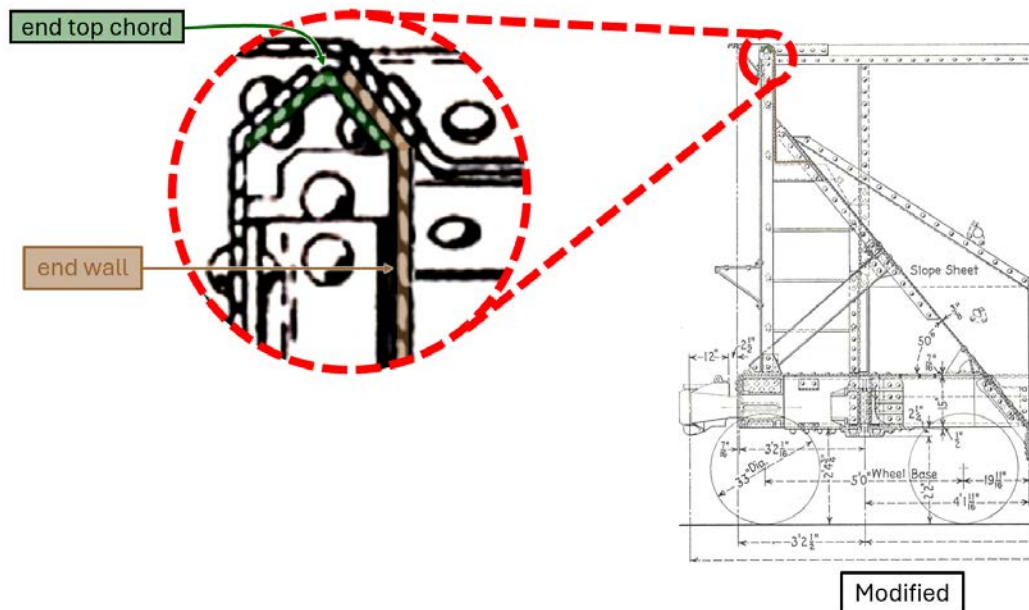
- a. [9a] “The rail road hopper car of claim 8 wherein said hopper has an end wall extending downward of said end top chord;

69. The 1946 Cyclopedia’s NSC ore car, as modified in view of Wong, discloses this limitation. As shown below, Wong discloses a rail road hopper car (“hopper railcar” 10) with a hopper (“hopper” 14) and an end wall (“end sheet” 24) extending downward from the top of the rail car.



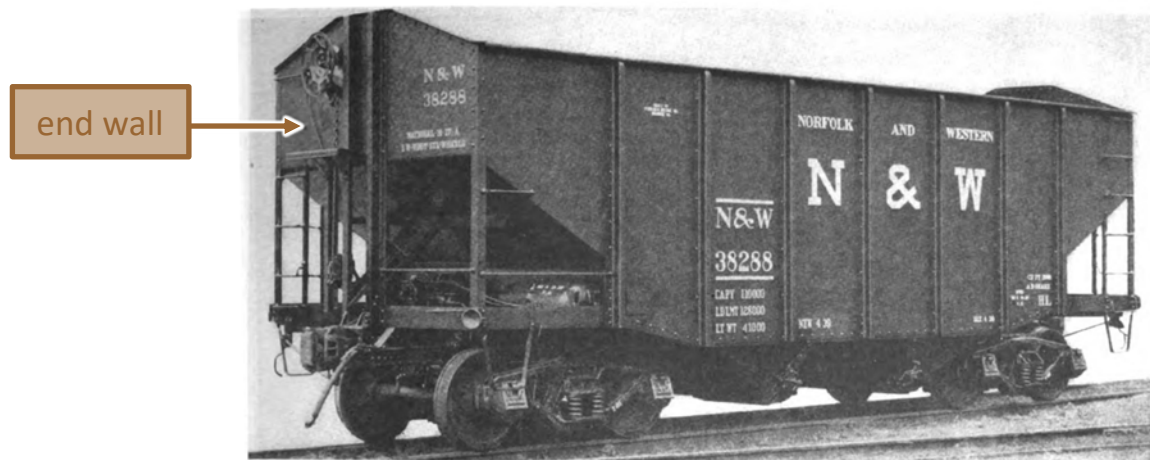
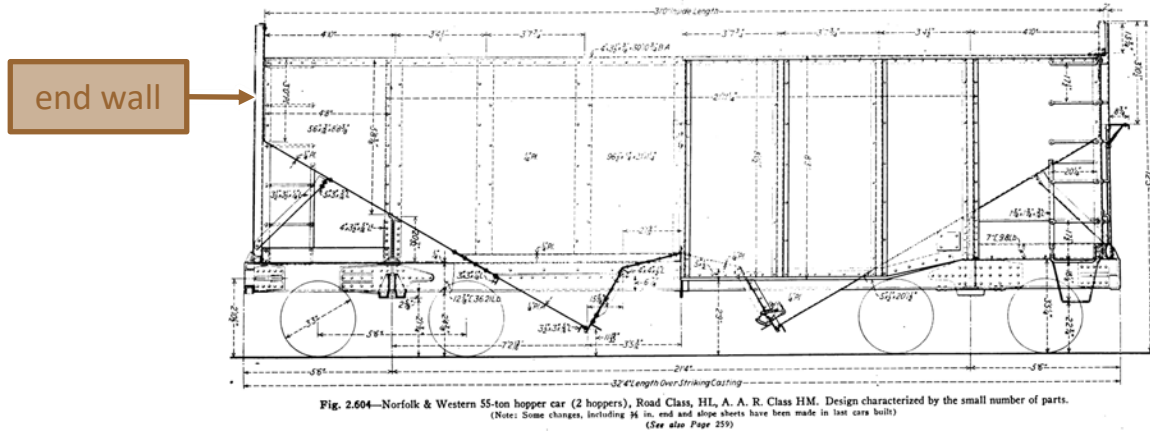
EX1006, Fig. 4. It would have been obvious to modify the 1946 Cyclopedia's NSC ore car to include an end wall similar to Wong's. As illustrated below, the modified car would disclose limitation [9a]. The modification could be made by either of two methods. First, by leaving the end slope sheets in place and increasing the overall height of the hopper. Second, 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 first method:



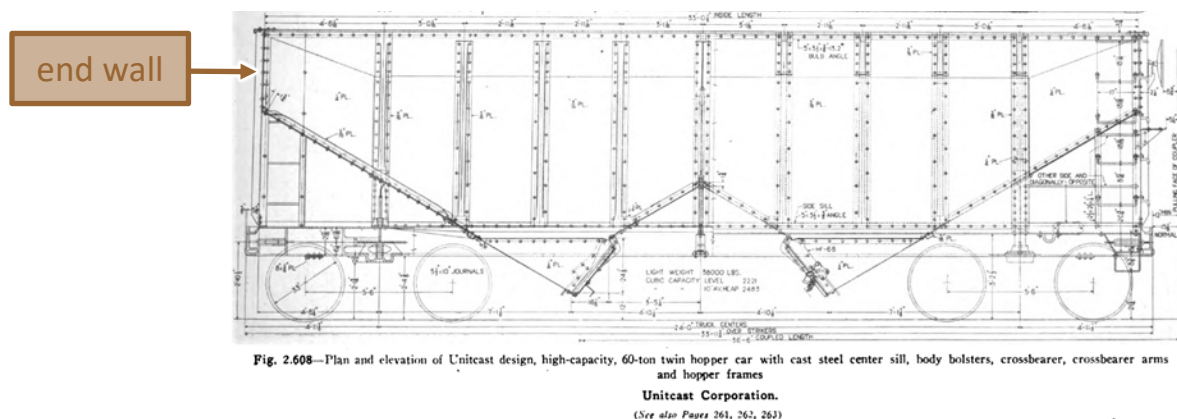


EX1004 at 294 (modified). In this simple modification, the height of the end post and side walls are increased, and the end top chord is shifted slightly longitudinally outboard such that the end post provides longitudinal support for the end wall. A POSITA would have had reason to modify the NSC design 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 inclination of the slope sheets). Increasing volume was desirable, as it would enable the end user to load and unload the same amount of ore in fewer cars, which saves time. Indeed, Coates described how the L&Y Hopper Car was modified in this way in the 1904-1906 time frame, increasing the height of the hopper walls on the car by nine inches to increase the hopper's capacity. EX1007 at 262-65. **Second**, by decades before the 2009 priority date, end walls were common

and well-known optional features of hopper cars. For example, the 1946 Cyclopedia shows multiple examples of hopper cars with end walls, such as the following:



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



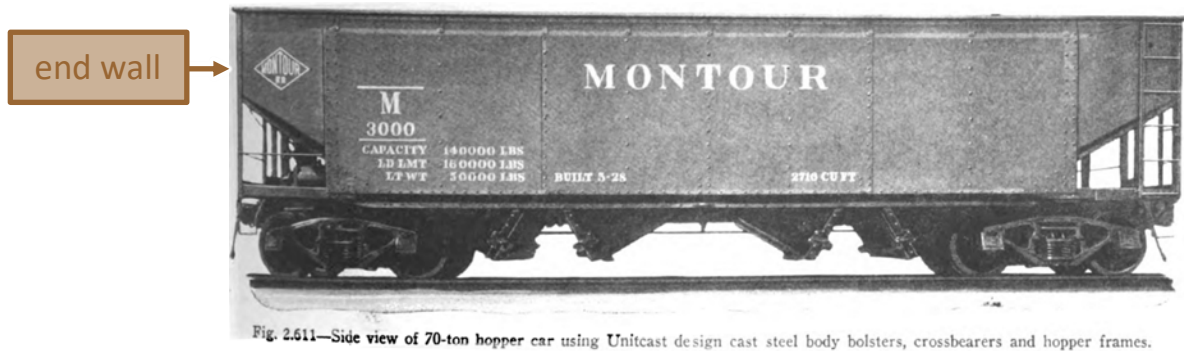
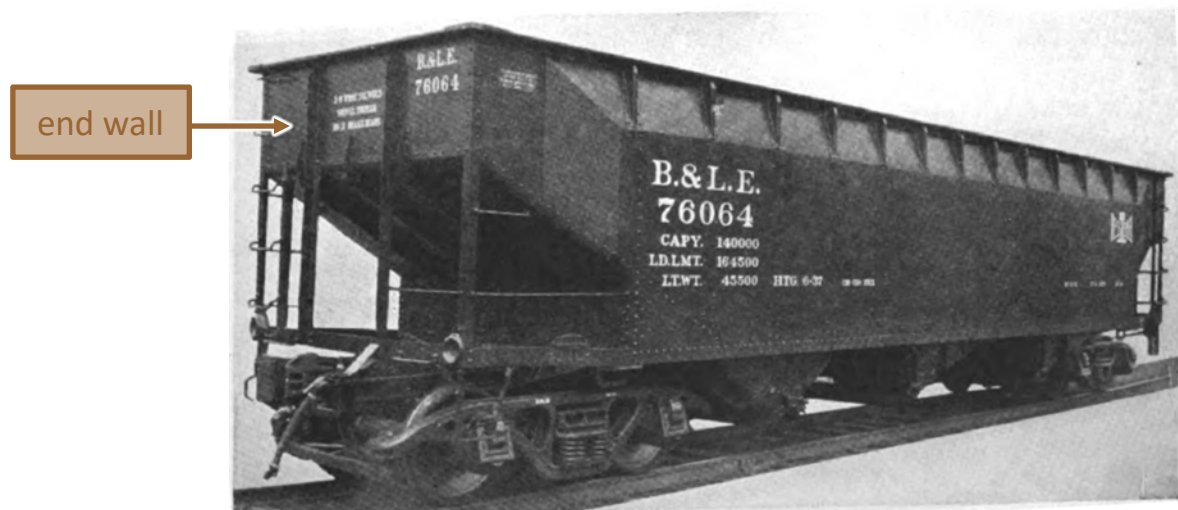
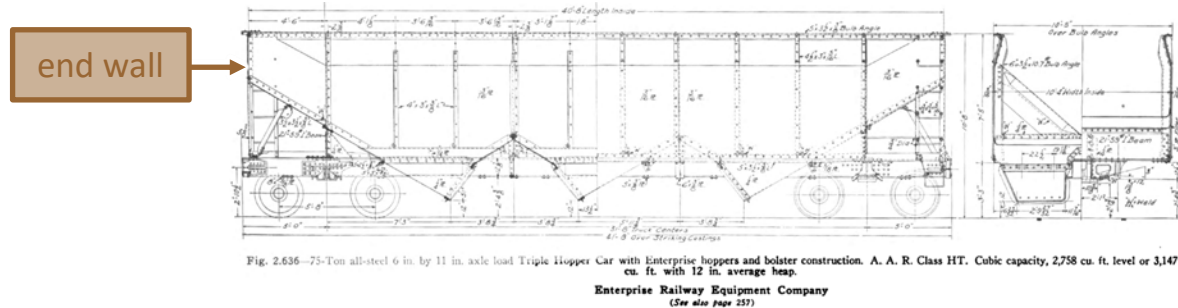


Fig. 2.611—Side view of 70-ton hopper car using Unitcast design cast steel body bolsters, crossbearers and hopper frames.

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

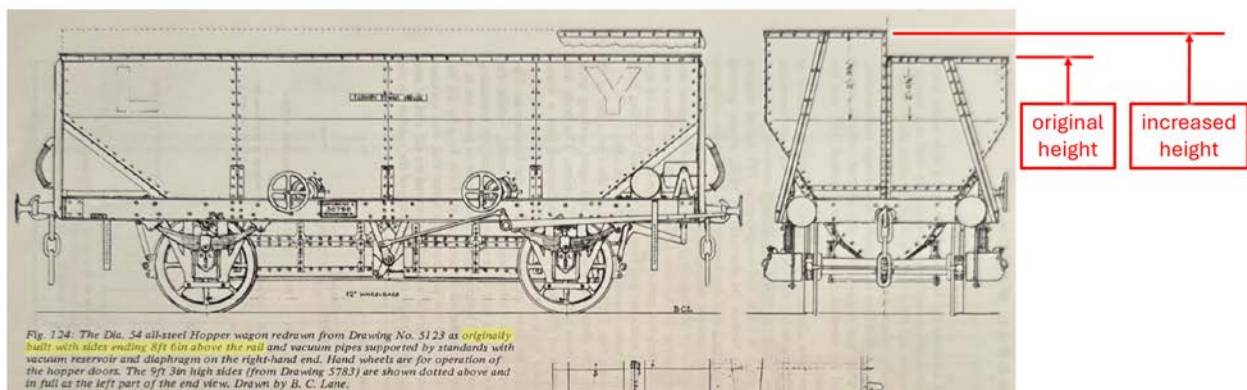


Id. at 277 (Bessemer & Lake Erie hopper car).



Id. at 275 (Enterprise hopper car). **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. Those

options are (i) incorporating an end wall or (ii) extending the slope sheet to the end top cord. A POSTIA would decide between these two options by considering design constraints that are standard and well-understood. These include conforming to maximum exterior dimensions of the railcar, 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. **Fourth**, Coates contains a suggestion to modify the NSC design to incorporate an end wall, as in Wong. As shown below, Coates describes how the height of the hopper walls on the L&Y Hopper Car was increased by nine inches—8'6" to 9'3" (see caption in the image below)—in the 1904-1906 time frame to increase the hopper's capacity. EX1007 at 263. This suggests increasing the height of the hopper walls of the NSC design, which would increase the height of the side walls and create end walls.



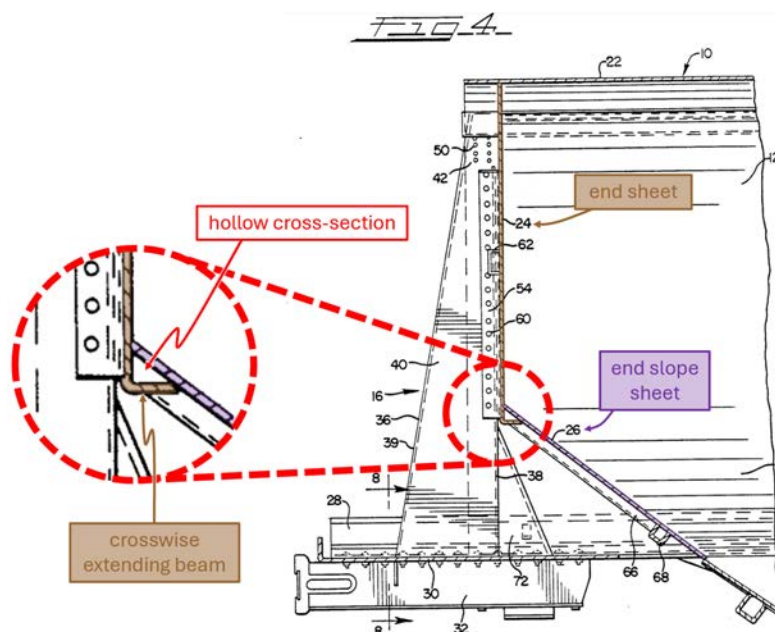
Id. at 262. Further, because end walls had been commonplace for decades before 2009, a POSITA would have had a reasonable expectation of success in incorporating an end wall in the NSC design disclosed in the 1946 Cyclopedia.

- b. [9b] “said upper, longitudinally outboard end of said first end slope sheet meets said downwardly extending end wall;

and said first cross-wise extending beam is located where said downwardly extending end wall meets said first end slope sheet; and

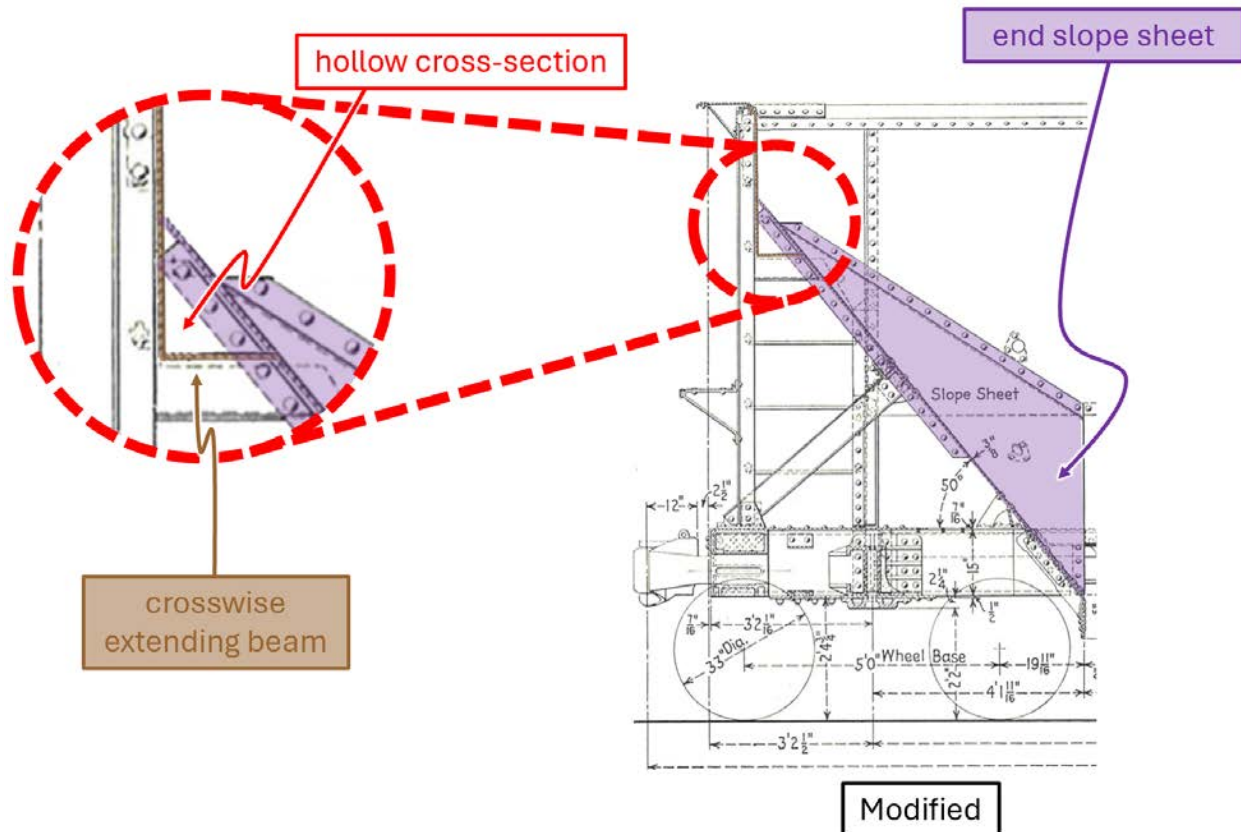
said first cross-wise extending beam is of hollow cross-section.”

70. The 1946 Cyclopedia’s NSC ore car, as further modified in view of Wong, discloses this limitation. Wong’s end wall, discussed above, is bent inwards at its lower end to contact the underside of the slope sheet. EX1006, Fig. 4. As shown below, this creates a hollow support beam that runs crosswise underneath the upper end of the slope sheet.



Id. As discussed above, it would have been obvious to modify the NSC ore car disclosed in the 1946 Cyclopedia to add an end wall, as in Wong. It also would have been obvious to use the specific end wall shown in Wong with a bent lower end, thereby forming the claimed crosswise extending beam. **First**, that modification employs well-known elements (end walls and end slope sheets) according to known methods (bending a flange of the end wall to create two lines of contact) to yield the predictable result of providing additional support for the slope sheet. **Second**, the modification uses the known technique of bending a flange of the end wall to support the end slope sheet that is taught in the “hopper railcar” of Wong (EX1006 at Abstract) to improve another hopper railcar (i.e., the NSC ore car in the 1946 Cyclopedia) in the same way. **Third**, the NSC ore car in the 1946 Cyclopedia was ready for the improvement of adding the end wall of Wong having a bent lower end. The NSC ore car possessed other structures to support that addition, including an end post for providing longitudinal support for the end wall, sidewalls that can be extended upwards, and an upper and longitudinally outboard flange of the sidewall that can provide lateral support for the end wall and bent lower end. EX1004 at 294-95. Applying the known technique of bending a flange of the end wall to support the end slope sheet to the NSC ore car in the 1946 Cyclopedia that was ready for that improvement would yield the predictable result of providing additional support for the end slope sheet. Moreover, 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 [9b], as illustrated below.



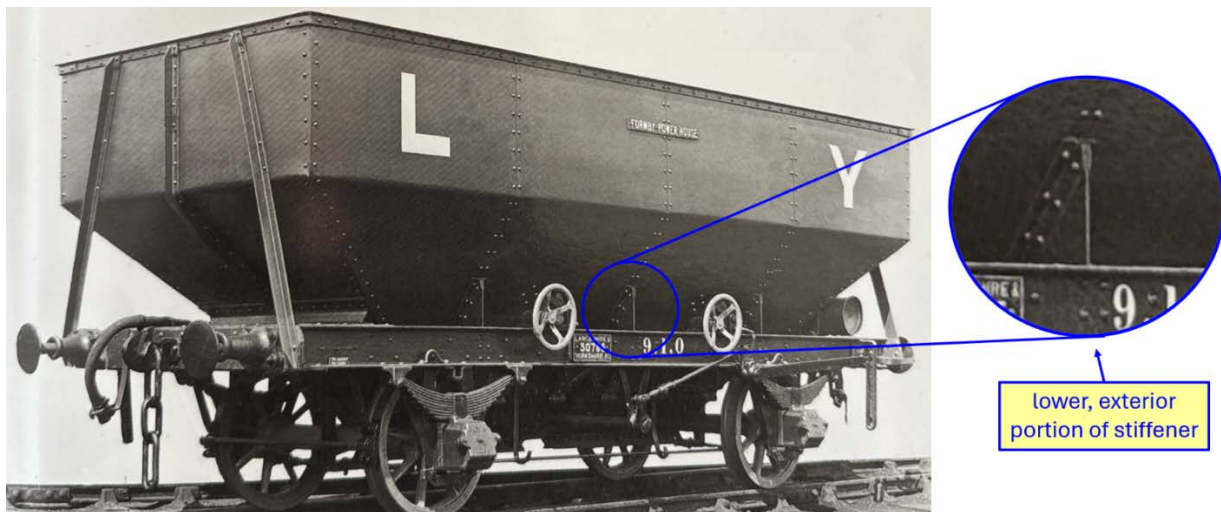
EX1004 at 294 (modified).

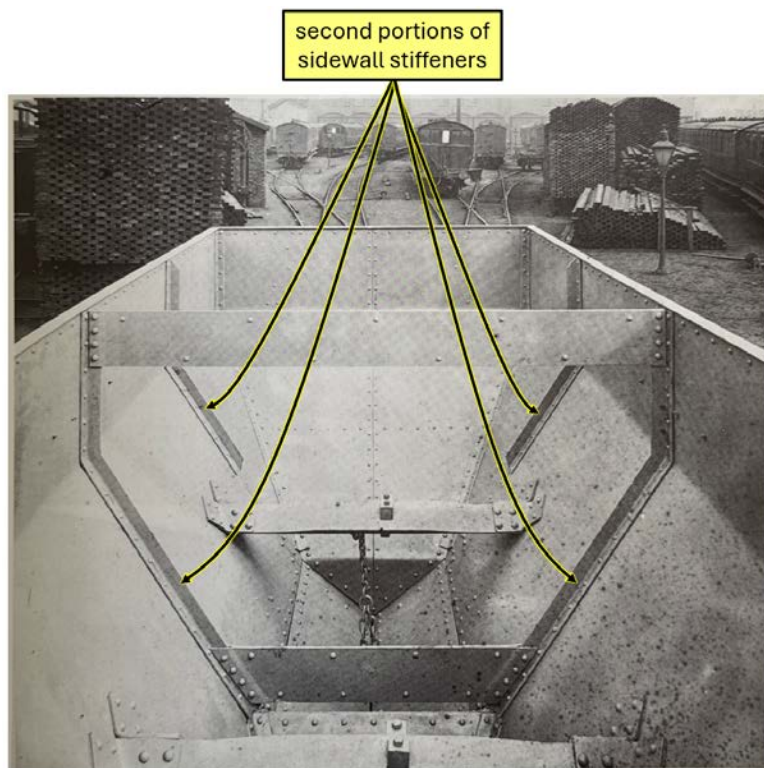
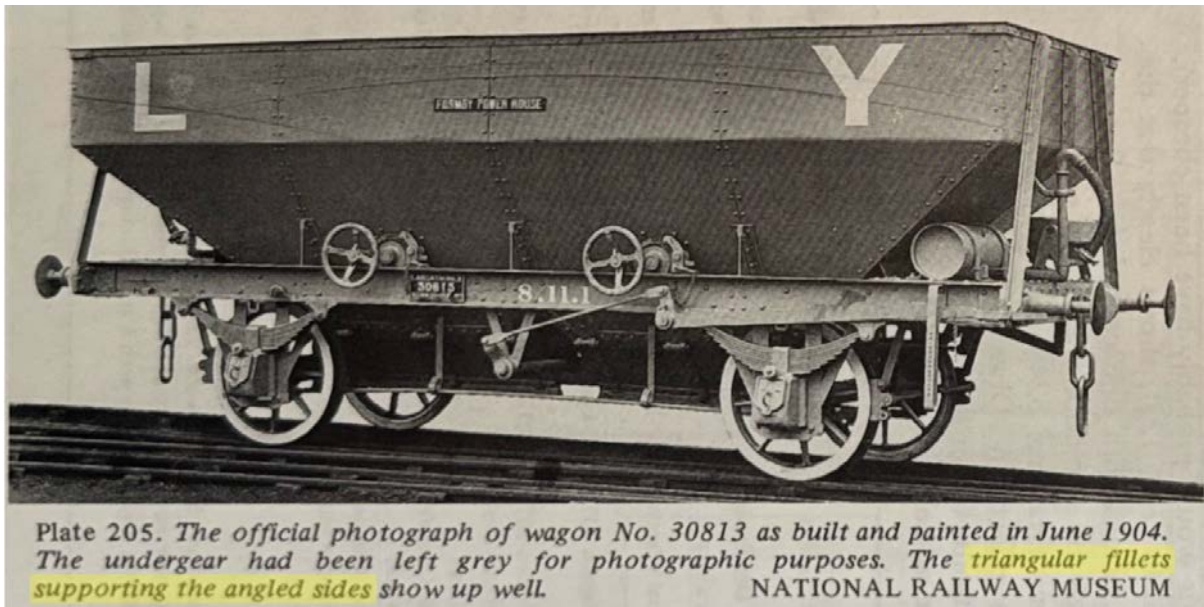
D. Ground 1d: Claim 15 – obviousness over the art in Ground 1b in view of Coates.

- 1. Dependent Claim 15: “The rail road hopper car of claim 2 wherein said first and second portions of said sidewall stiffener are made of flat bar, are positioned in vertical-transverse planes, are substantially co-planar, and are substantially vertically aligned when seen in a sectional view looking along the car.”**

71. As shown below, Coates contains photographs of the L&Y Hopper Car with a sidewall stiffener having a lower, exterior (first) portion and an upper, interior

(second) portion aligned in the same vertical plane. The lower, exterior portion of the stiffener is a triangular flat bar mounted to the side wall with a pair of L-brackets and rivets. This can be seen most clearly in the enlarged portion of the first image appearing below. The caption in the second image appearing below specifically identifies these flat bars as “triangular fillets” supporting the angled sides. In the L&Y Hopper Car, the stiffener’s upper, interior portion is disclosed as a generally rectangular flat bar that is attached to the side sheet with a flange and rivets; this is shown in the third image appearing below.





EX1007 at 262-64, front cover. A POSITA would have had reason to make the stiffener of flat bar, and would have had a reasonable expectation of success in doing so. Flat bar is a common, inexpensive material that was regularly used in rail cars

long before 2009—indeed, back to at least the 1904-1906 L&Y hopper car. EX1007 at 262-64. Flat bar is particularly appropriate for use as a stiffener because it efficiently provides support in the vertical-transverse plane in which the sidewalls are loaded. Indeed, adding material to support the sidewalls in another plane would be largely wasted, leaving flat bar as the most efficient choice for the sidewall stiffeners in the 1946 Cyclopedia’s NSC ore car. Choosing flat bar as the material for the NSC ore car amounts to the simple substitution of one known material (i.e., flat bar) for another to obtain the predictable result of supporting the side wall. Flat bar is also one of a small number of identified, predictable materials for a sidewall stiffener. Incorporating flat bar as the material for NSC ore car’s sidewall stiffener would have been a simple process of using known methods and materials in an ordinary way—e.g., cutting the flat bar to the desired shape and connecting it to the sidewall with flanges and rivets. Thus, a POSITA would have had a reasonable expectation of successfully incorporating that material.

E. Ground 2a: Claim 1 – anticipation by Lindström, or at least obviousness over Lindström in view of the 1946 Cyclopedia.

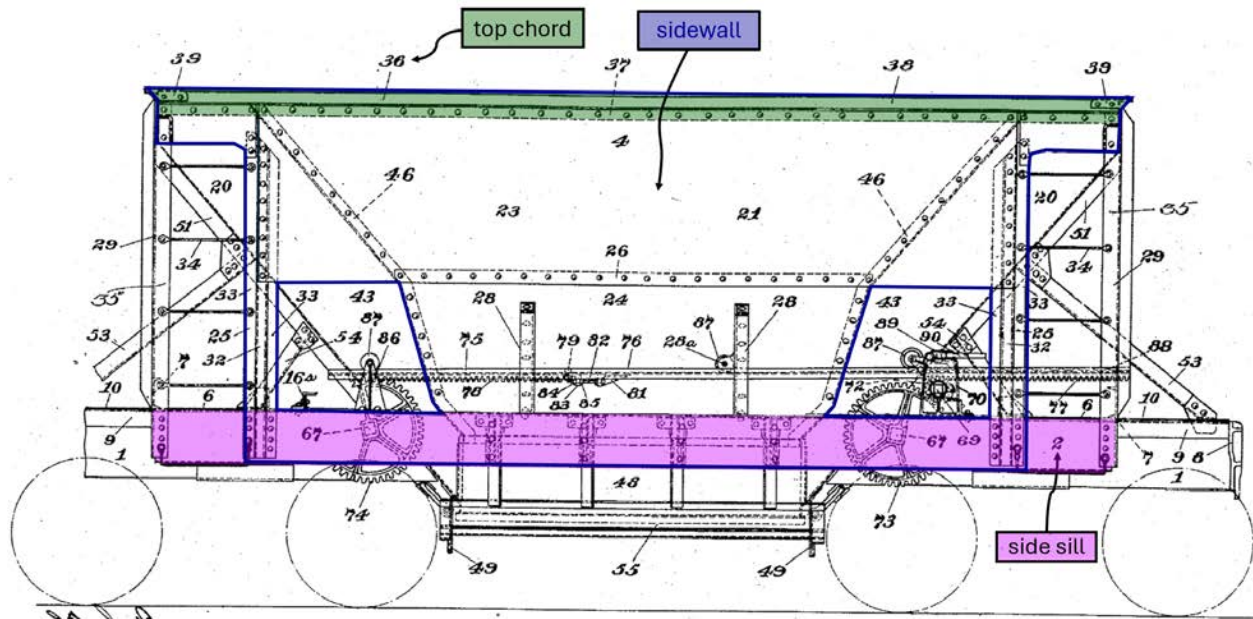
1. Independent Claim 1

- a. [1d] “said rail road car having a side sill and a top chord; said first upstanding sidewall extending from said side sill to said top chord;”**

72. Lindström discloses this limitation, as shown in Fig. 2 below.

Lindström discloses said rail road car having a side sill (“side sills” 2) and a top

chord (“top members” 36); said first upstanding sidewall (“combined side walls and sloping floors” 21 that “preferably comprise an upper side plate 23 and a lower or sloping floor plate 24,” EX1005 at 2:84-89) extending from said side sill to said top chord (shown in the figure below).

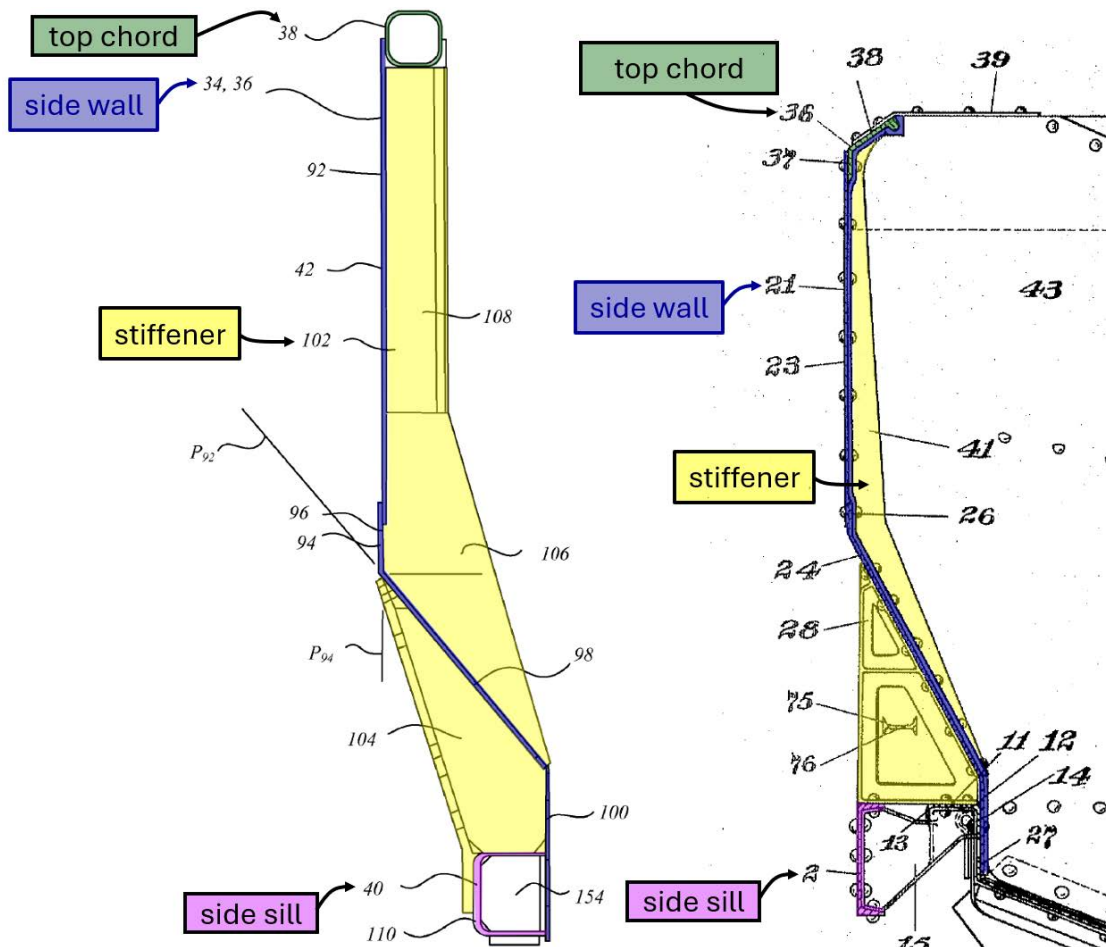


EX1005, Fig. 2.

- b. [1e] “said first upstanding sidewall having a predominantly upwardly running sidewall stiffener mounted thereto, said sidewall stiffener being located at a longitudinal station intermediate the trucks;”

73. Lindström discloses this limitation, as shown below. As in the '892 patent, Lindström's side-wall stiffener has two portions: an upper portion attached to the interior surface of the side wall (stiffening “stakes” 41), and a lower portion attached to the exterior of the sidewall (stiffening “members” 28). EX1005, Fig. 5. A POSITA would understand that both “stakes” 41 and “members” 28 are stiffeners

for the sidewall. Indeed, Lindström explicitly states: “*To assist in supporting and stiffening the combined side walls and sloping floor plate 21, 21, members 28 are provided* which are preferably of triangular form and secured to the longitudinally extending columns, viz., to the side sills 2, 2 and the members 11, 11 thereof, and to the sloping floor plates 24, 24.” EX1005 at 2:111-19. Lindström also states: “*To further stiffen and strengthen the combined side walls and sloping floors 21, 21 stakes 41 are provided* which are preferably of U-shape in cross section having lateral flanges, which are secured to the plates 23 and 24 by rivets or other suitable means.” *Id.* at 3:39-45. Moreover, Lindström’s “stakes” 41 and “members” 28 have the same shape and position as was common for sidewall stiffeners. *E.g.*, EX1004 at 294-95 (1946 Cyclopedia’s NSC ore car).



'892 patent
Fig. 2c

Lindström
Fig. 5

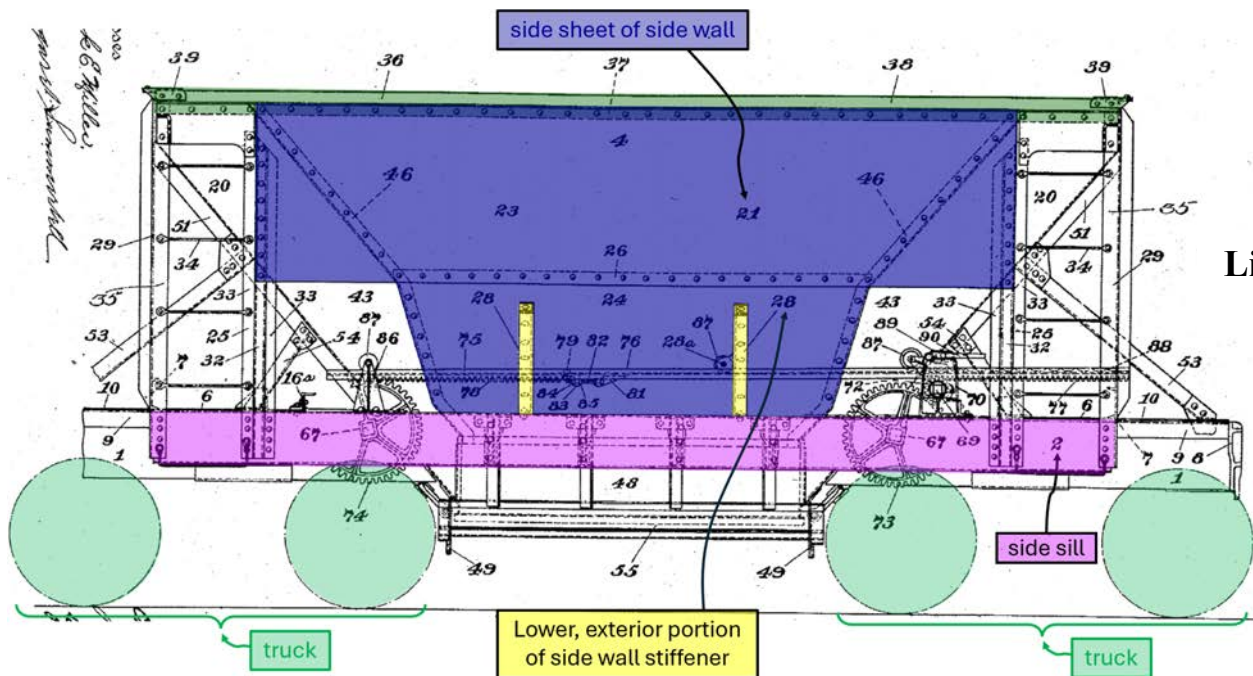
EX1001, Fig. 2c; EX1005, Fig. 5.

- c. [1g] “said sidewall stiffener having a first portion, said first portion being a lower portion thereof, said first portion being mounted to said first region of said first upstanding sidewall;

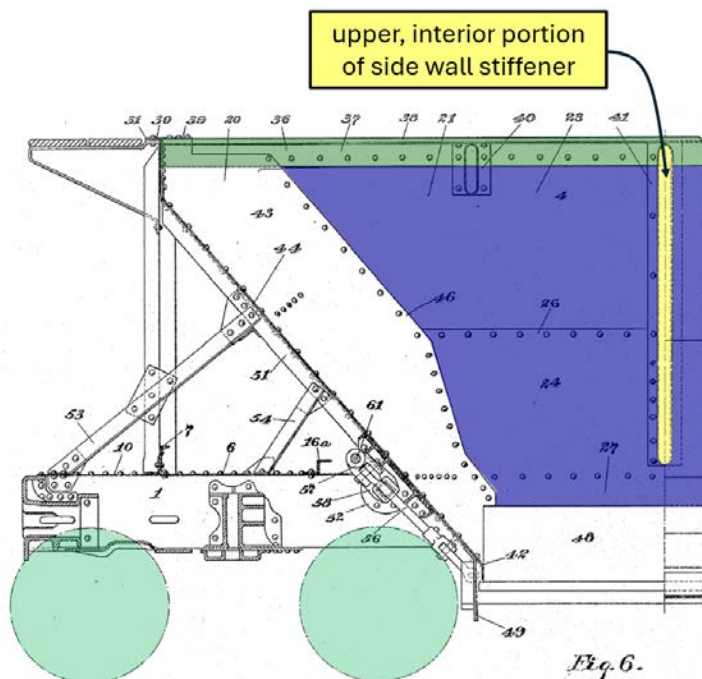
said sidewall stiffener having a second portion, said second portion being an upper portion thereof, said second portion

74. Lindström discloses this limitation, as shown below. Both portions of the side-wall stiffener may be seen in Lindström’s Fig. 5, which is an end view. *See supra* § V. E.1.b (discussing stiffening “stakes” 41 and stiffening “members” 28). The lower, exterior portion may also be seen in Lindström’s Fig. 2, which is a side view. The upper, interior portion may also be seen in Fig. 6, which is a cross-sectional side view.





Lindström
Fig. 2

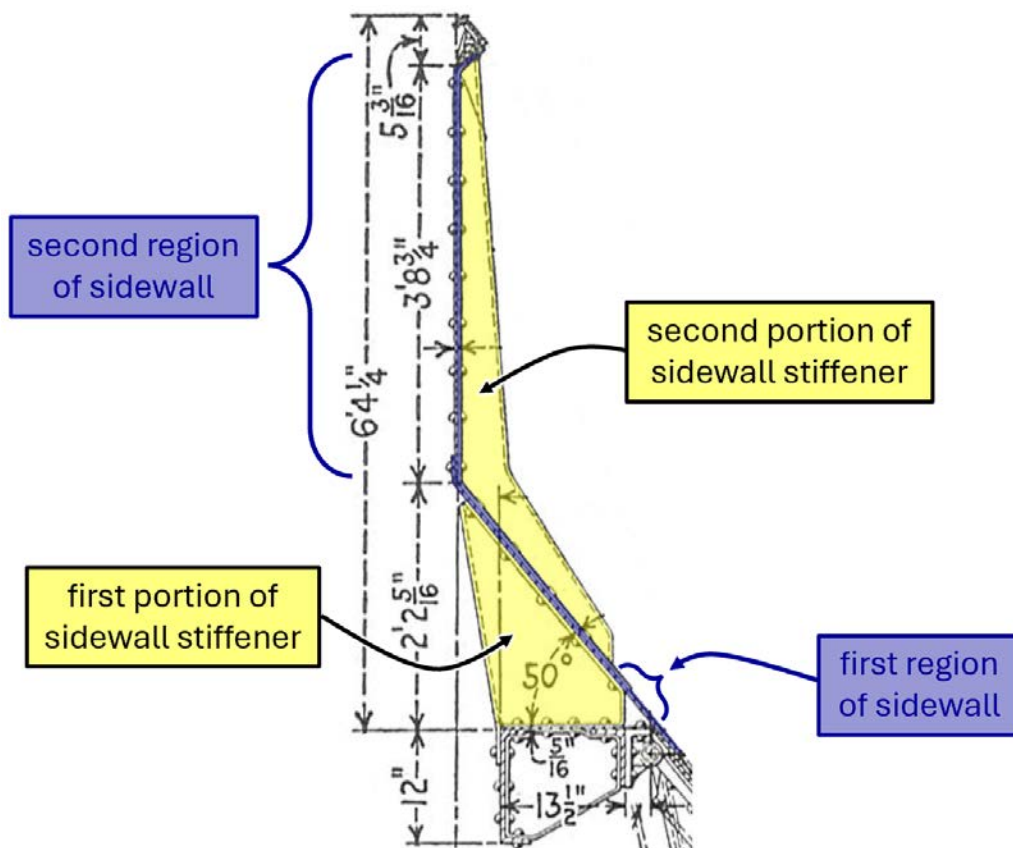


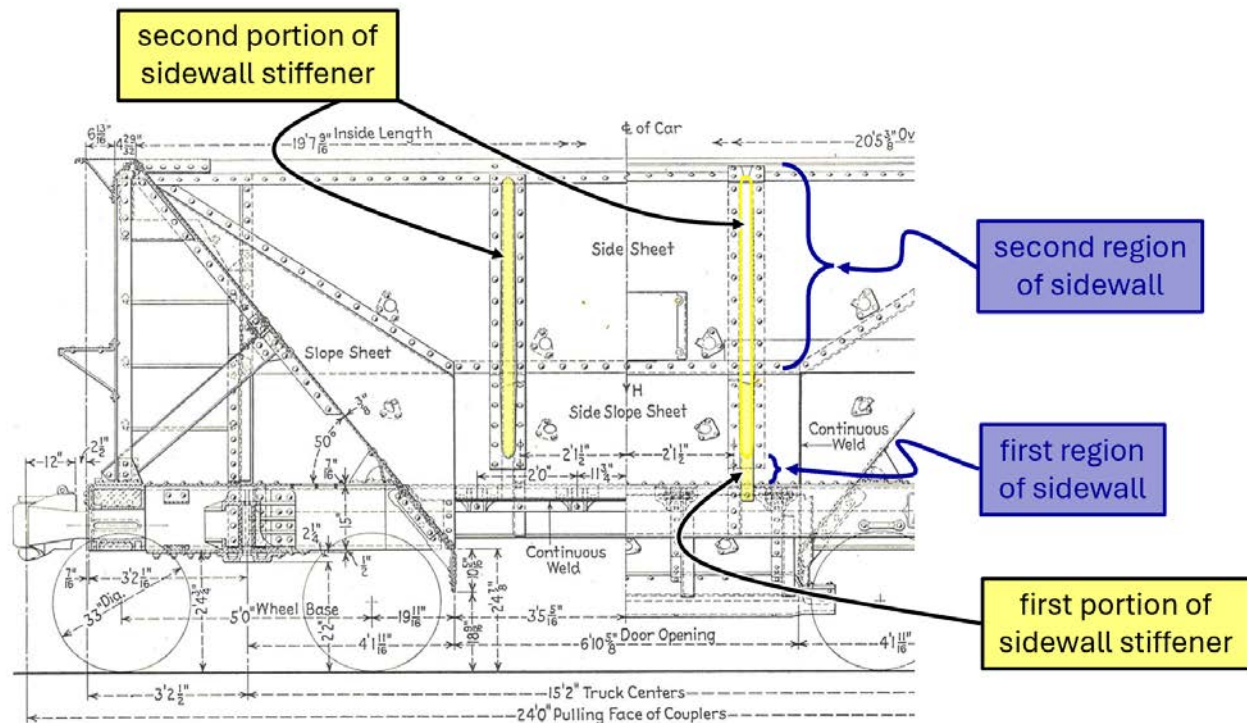
Lindström
Fig. 6

EX1001, Fig. 2c; EX1005, Figs. 2, 5-6.

d. [1j] “said sidewall stiffener having web continuity between said first and second portions thereof.”

75. A POSITA would understand that the two portions of Lindström’s side-wall stiffener are arranged in the same vertical plane, as in the ’892 patent. *See supra* § V. E.1.c (showing EX1001, Fig. 2c; EX1005, Figs. 2, 5-6). Any other arrangement would subject the side walls to bending moments that could damage them. *Supra* § IV. A; *see generally supra* § IV. The 1946 Cyclopedia’s NSC ore car drawings also disclose two-part side-wall stiffeners with web continuity.





EX1004 at 294. Even supposing, for the sake of argument, that the portions of Lindström's side-wall stiffener were not aligned in the same vertical plane, a POSITA would have been motivated to so align those portions, as in 1946 Cyclopedia's NSC ore car. For example, the POSITA would be motivated to avoid the bending moments discussed earlier. As another example, aligning side-wall stiffeners in a vertical-transverse plane had become commonplace at least by 1946—indeed, they date back to at least the 1904-1906 L&Y conversion. EX1007 at 262-64. In fact, in the ore-car section of the 1946 Cyclopedia, three of the four ore cars for which schematics are provided have two-part side wall stiffeners with web continuity. EX1004 at 289-300 (Pressed Steel car, p. 290; Enterprise car, p. 292; NSC car, p. 294).

Aligning the portions in this way would be no more than combining prior art elements (stiffeners with inside and outside portions) according to known methods (aligning inside and outside portions) to yield predictable results (e.g., supporting the side sheet, transferring load to the side sill, and avoiding moments). Such alignment would also be the application of a known technique (aligning inside and outside portions of the sidewall stiffener) from the L&Y hopper car and the 1946 Cyclopedia ore cars to improve a similar device (Lindström).

F. Ground 2b: Claims 2-14 – obviousness over Lindström in view of Wong, and optionally the 1946 Cyclopedia.

1. Independent Claim 2

- a. [2f] “said first end section having a first draft sill and a main bolster extending cross-wise to said first draft sill, said first draft sill and said main bolster intersecting at a first truck center, said first truck being located centrally under said first truck center;**

76. Lindström expressly discloses “draft sills 2” and “bolsters 3.” EX1005 at 1:81-83. Lindström’s figures show these structures in the claimed arrangement. Specifically, Figure 2 shows that truck center is located just outboard of post 25, and Figure 1 shows that the first draft sill and the first main bolster intersect at truck center. *Id.*, Figs. 1-2. Moreover, a POSITA would have known to position the main bolster at truck center. For example, doing so was common. *E.g.*, EX1004 at 294 (NSC ore car having main bolster at truck center). Further, a POSITA would be

supra § IV.



Fig. 2



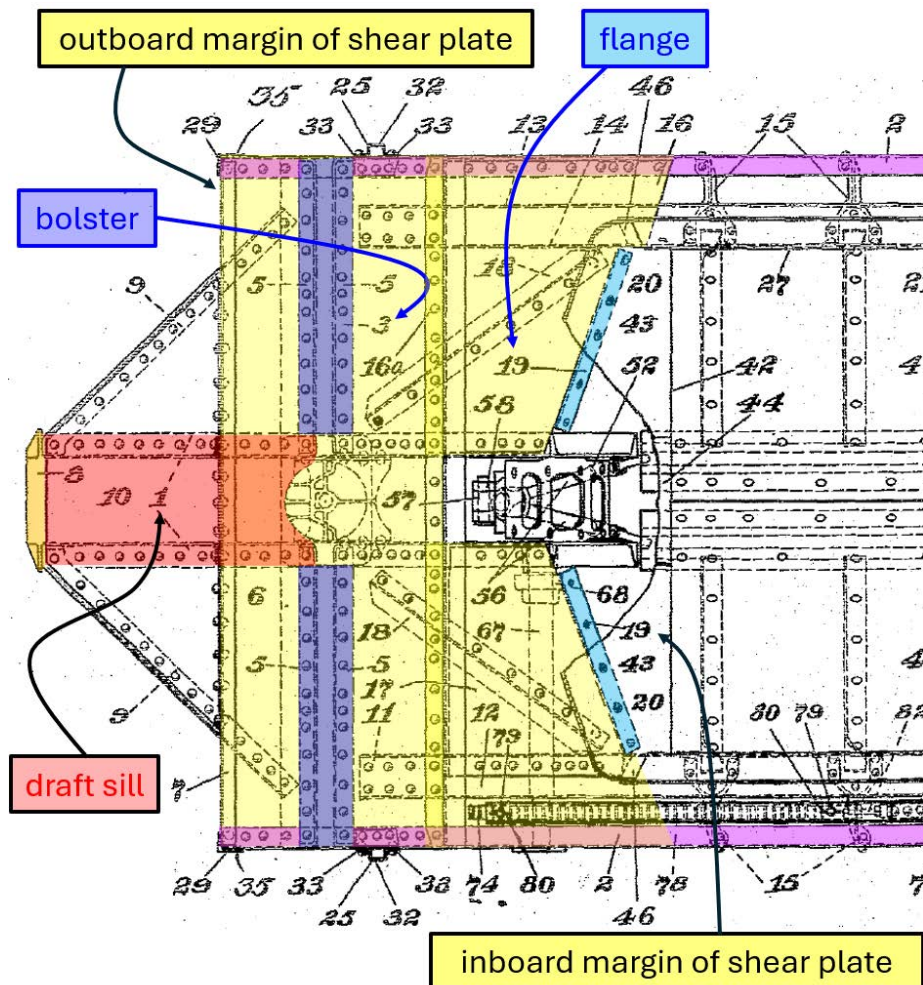
Fig. 1

EX1005, Figs. 1-2.

- b. **[2h] “said first end section having a shear plate mounted overtop of said first draft sill and said main bolster; said shear plate having a longitudinally inboard margin adjacent to said longitudinally inboard end of said first end slope sheet; said shear plate having a longitudinally outboard cross-wise running margin traversing said draft sill longitudinally outboard of said truck center;”**

77. Lindström discloses three plates that together comprise the shear plate at one end of the hopper car: “plates” 6, 16, and 17. EX1005, Fig. 1. “Plate” 6 has a rectangular horizontal face that extends from side to side, extends outboard to the outboard margin, and extends inboard to slightly overlap with “plates” 16 and 17. *Id.* “Plates” 16 and 17 include “flanges” 19 and are symmetrically placed on either side of the longitudinal centerline. *Id.*, Fig. 1, 4:29-33 (“the flanges 19 of the plates 16 and 17”). They extend longitudinally inboard of their overlap with “plate” 6 to the longitudinally inboard end of “flanges” 19, laterally outboard to the side, and laterally inboard to a set of longitudinally aligned rivets. At the inboard ends of “plates” 16 and 17 are downwardly angled flanges 19 that are riveted to the underside of the slope sheet, specifically, to the sloping end plates of the slope sheet. EX1005 at 2:36-39 (“At their inner edges each of these plates 16 and 17 are provided with flanges 19 which are secured to the sloping end floors, hereinafter more fully described.”), 4:29-33 (“The lower portions of the sloping end floor plates are secured to the flanges 19 of the plates 16 and 17 thus providing additional connections

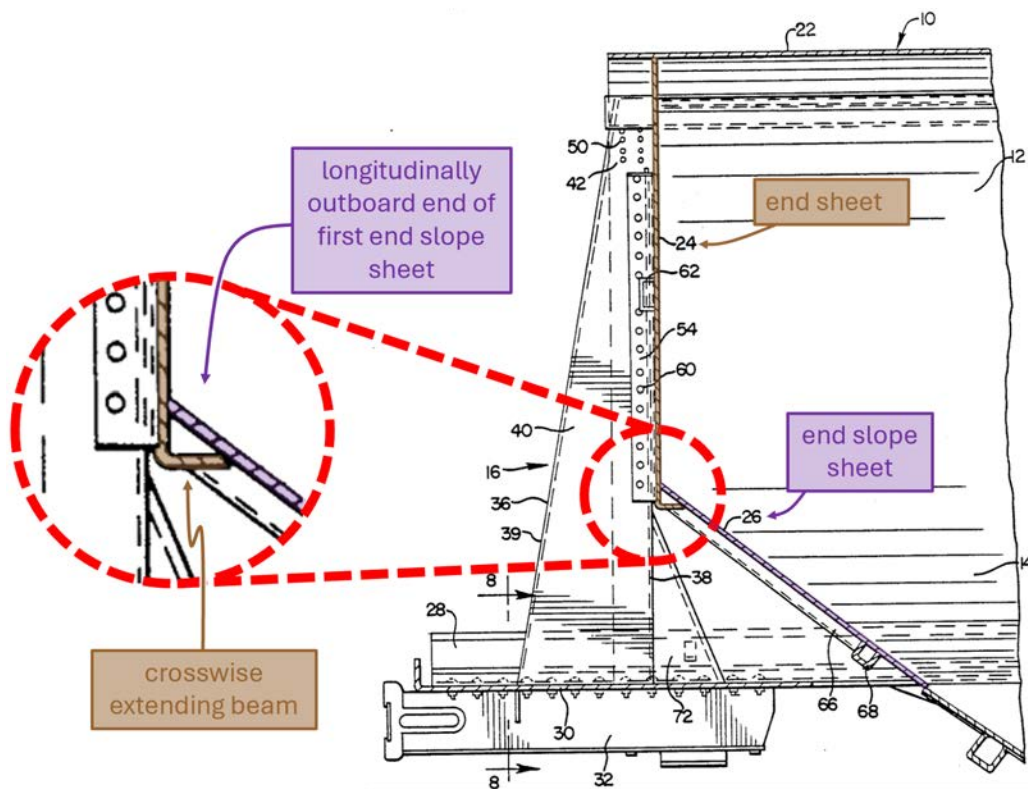
Lindström's shear plate satisfies limitation [2h], as shown below. The inboard margin of the shear plate is adjacent to the inboard end of slope sheet because the two structures are riveted together (via flanges 19) at the inboard end of the slope sheet. EX1005 Fig. 1, 2:36-39 ("plates 16 and 17 are provided with flanges 19 which are secured to the sloping end floors"), 4:29-33 ("The lower portions of the sloping end floor plates are secured to the flanges 19 of the plates 16 and 17").



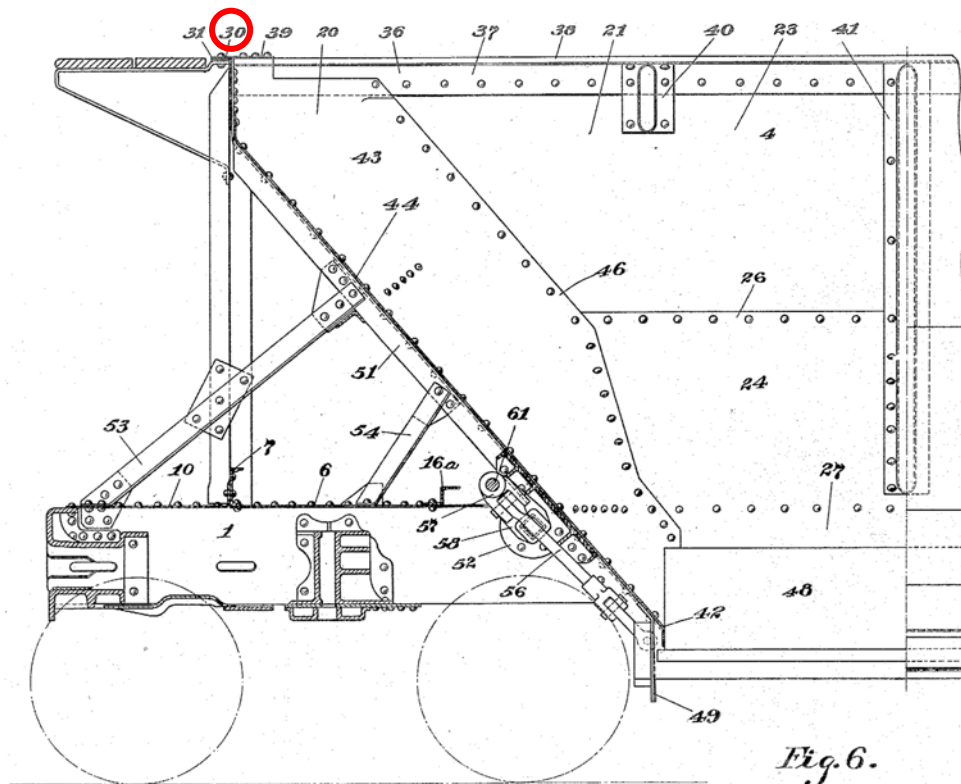
Id., Fig. 1.

- c. [2i] “said upper, longitudinally outboard end of said first end slope sheet being reinforced by a first cross-wise extending beam;”

78. As discussed above in connection with Ground 1b, and as shown below, Wong discloses a cross-wise extending beam for reinforcing the upper end of the slope sheet (“end slope sheet” 26). *See supra* § V. B.1.d.

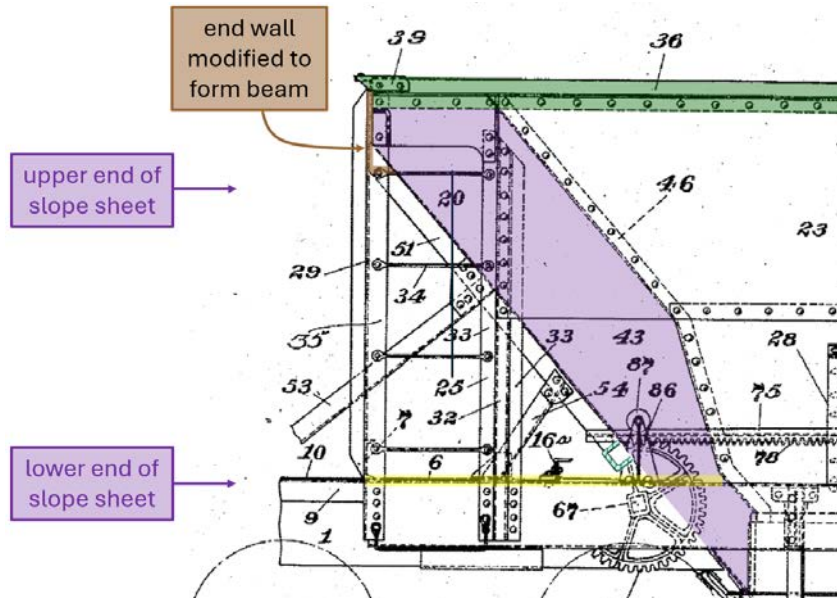


EX1006, Fig. 4. Lindström discloses an end wall (“plate” 30 that “forms an end wall of the car body.” EX1005 at 2:123-27.



EX1005, Figs. 1, 5-6. For the reasons set forth in Ground 1b, it would have been obvious to modify Lindström's end wall ("plate" 30) to support the upper, outboard end of the slope sheet with a crosswise, L-shaped beam as in Wong. *See supra* § V. B.1.d. A POSITA would have been motivated to make the modification. For example, Wong and the Lindström are in the same field of hopper railcars. EX1006, Abstract ("hopper railcar"); EX1005 at 1:11-13 & Figs 1-2 ("dumping car" with a hopper). That is the same field to which every claim of the '892 patent is directed. EX1001, Cl. 1-2 preambles (each independent claim is directed to a "rail road hopper car"). As another example, a POSITA would have understood the benefits of further reinforcing the slope sheet at its upper end. A POSITA would have understood that,

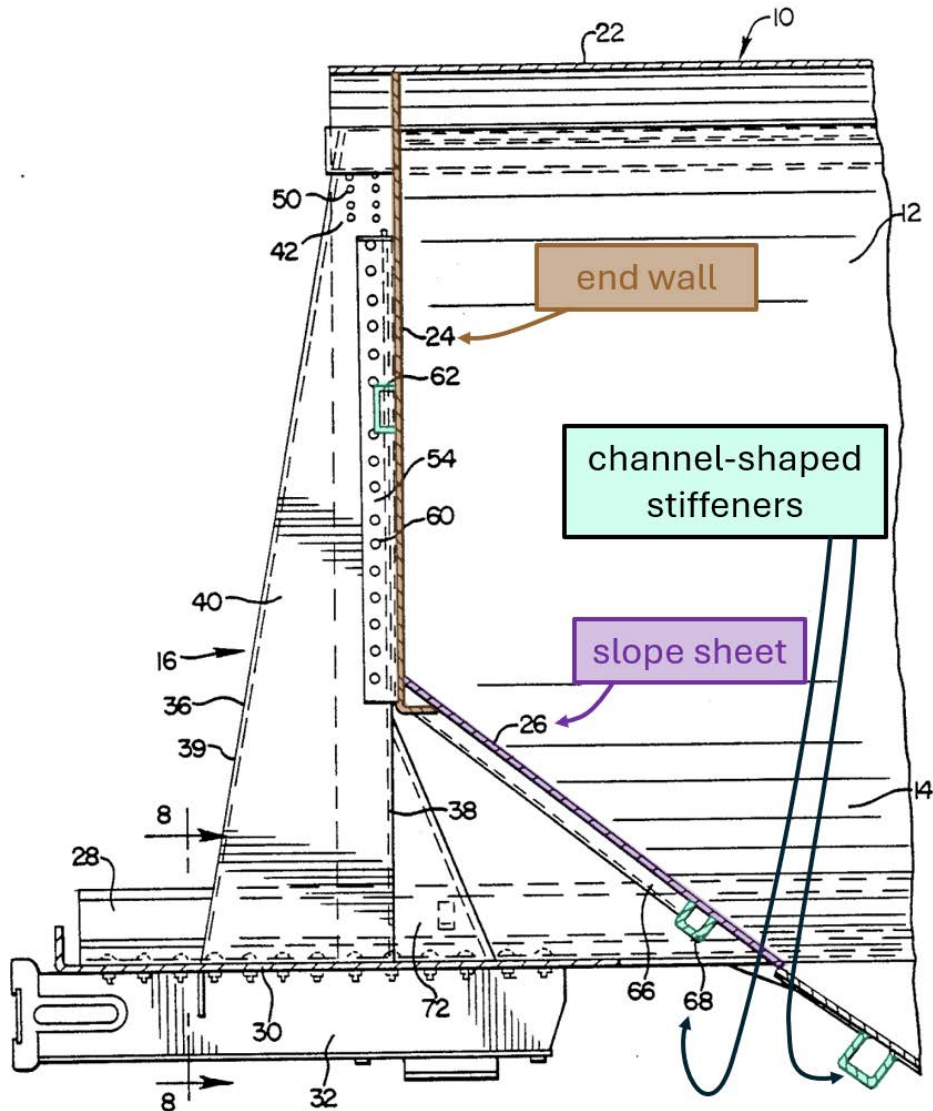
at that upper end, a load in the hopper creates a stress concentration at the intersection of the end slope sheet and the end top chord, which is shown below. A POSITA would have understood that the stress concentration could be ameliorated by spreading the load over a larger area, for example, through techniques discussed above. Another known way to accomplish that was (and is) to support the upper, outboard end of the slope sheet with a cross-wise, L-shaped beam as in Wong. A POSITA would have had a reasonable expectation of success in making this modification including because it is a straightforward modification of Lindström's existing end wall 30. EX1005 at 2:123-27 (plate 30 "forms an end wall of the car body"). Specifically, Lindström's end wall would be slightly lengthened and bent inward at its lower end, as shown below. This straightforward modification can be accomplished with the well-known technique of bending a plate ("plate" 30). Lindström is ready for improvement, including already having a plate to extend and bend.



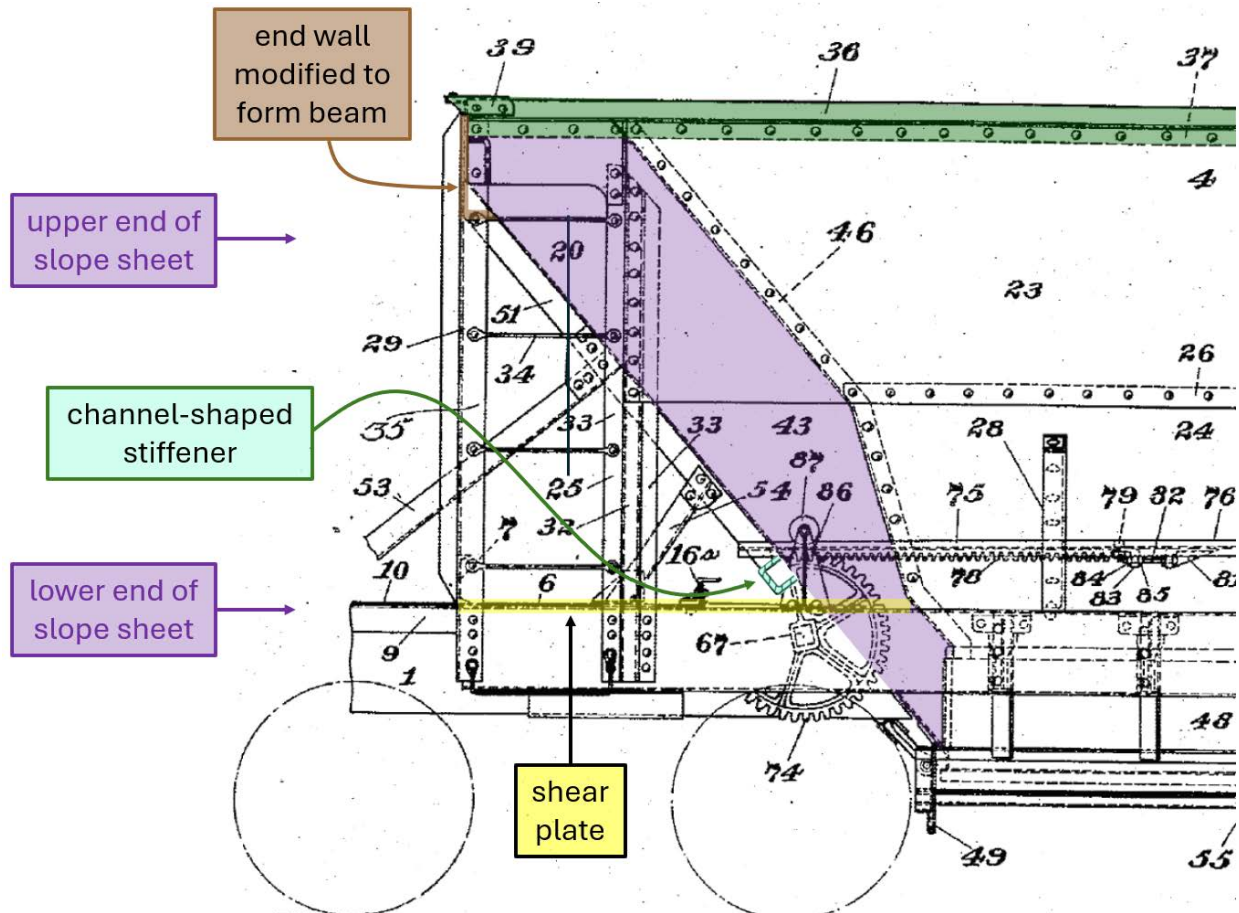
EX1005, Fig. 2 (modified).

- d. [2j] said lower, longitudinally inboard end of said first end slope sheet being reinforced by a second cross-wise extending beam;

79. As shown below, Wong discloses a hollow reinforcement beam at the inboard end of the slope sheet that the patent refers to as “channel stiffener member 68.” EX1006 at 4:50-56. For the reasons set forth in Ground 1b, it would have been obvious to modify Lindström’s design to support the lower, inboard end of the slope sheet with a U-shaped hollow beam, as in Wong. *See supra* § V. B.1.d (limitation [2i]).



EX1006, Fig. 4. A POSITA would have had a reasonable expectation of success in making this modification because it is a straightforward addition of a U-shaped beam to the underside of Lindström's slope sheet, as shown below. That modification uses a standard component (a U-shaped hollow beam). A POSITA would have known to use any means of joining that standard component to the slope sheet, such as welding or rivets.

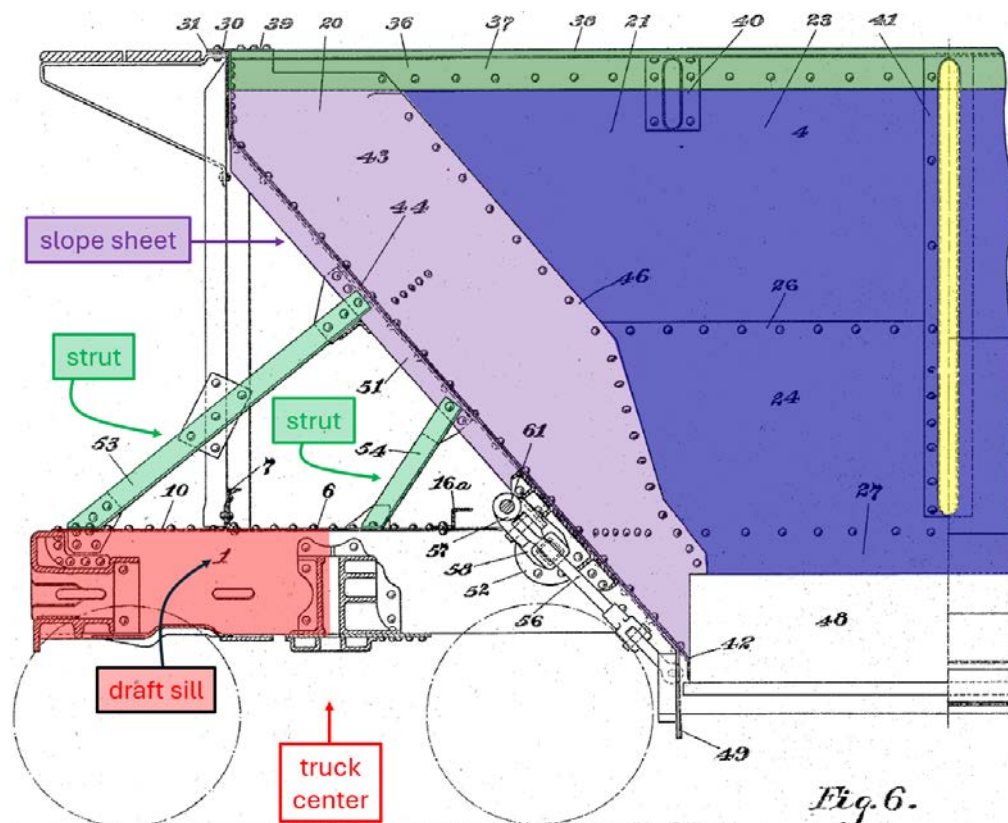


EX1005, Fig. 2 (modified).

- e. [2m] “said first end section being free of longitudinally oriented elephant ears extending between said draft sill and said first end slope sheet;”

80. As discussed above in connection with Ground 1b, the '892 patent defines elephant ears as “large, substantially triangular planar plates.” *See supra* § V. B.1.h. As shown below, Lindström’s slope sheets are not supported by elephant ears, but by larger struts 53 and a smaller struts 54 in a manner that resembles truss elements. Trusses are used in many structures for carrying loads from one element to another. EX1005 at 4:34-42 (“To assist in supporting and bracing the body 4,

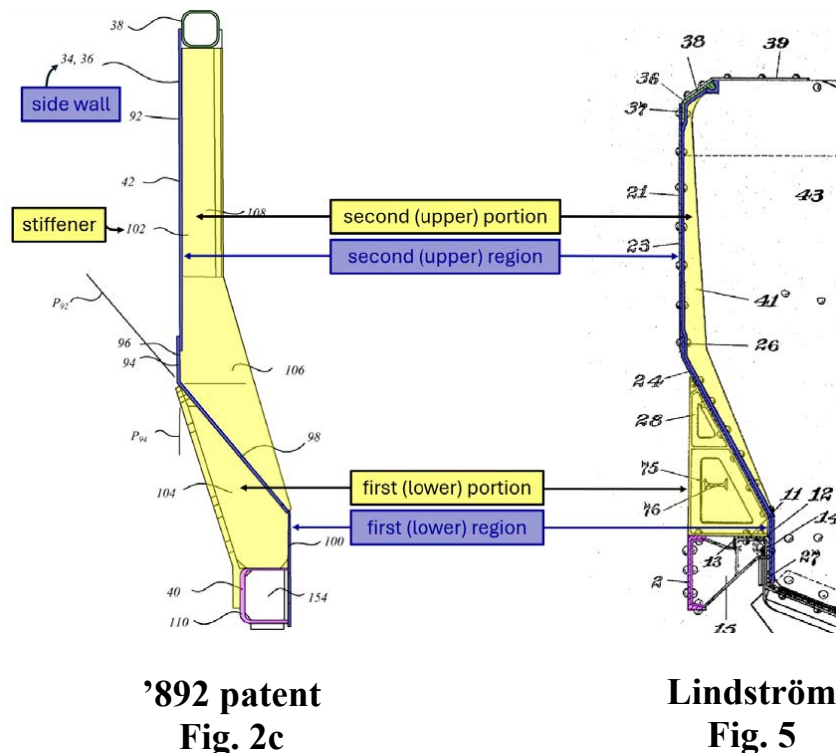
members 53 and 54 are provided, each of which is preferably of angular form. One end of each of these members is preferably secured to one of the sills 1, and each member extends upwardly and the upper end thereof may be connected with the flange 51 of one of the floor plates 43 by rivets or other suitable means.”).



EX1005, Fig. 6. In addition, the smaller strut does not extend between the draft sill and the slope sheet. *Id.* Thus, Lindström’s car has no elephant ears over the shear plate and under the slope sheet.

2. **Dependent Claim 3: “The rail road hopper car of claim 2 wherein said first and second portions of said sidewall stiffener are substantially co-planar, and are substantially vertically aligned when seen in a sectional view looking along the car.”**

81. The two portions of Lindström’s stiffener are substantially vertically aligned when seen in a sectional view looking along the car, as shown below.



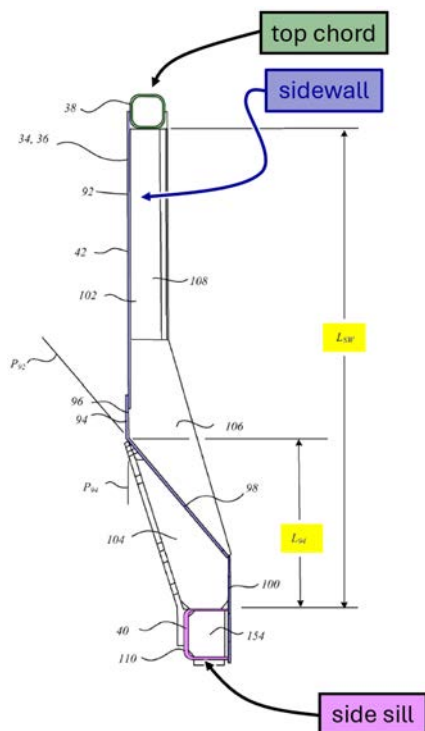
EX1001, Fig. 2c; EX1005, Fig. 5. A POSITA would understand that the two portions of Lindström’s side-wall stiffener are arranged in the same vertical plane, as in the ’892 patent, because any other arrangement would subject the side walls to bending moments that could damage them. *Supra* § IV. A; *see generally supra* § IV. Even assuming, for the sake of argument, that Lindström did not disclose this vertical alignment, a POSITA would have been motivated to so align those portions,

as in 1946 Cyclopedia's NSC ore car, for the same reasons noted for limitation [1j].

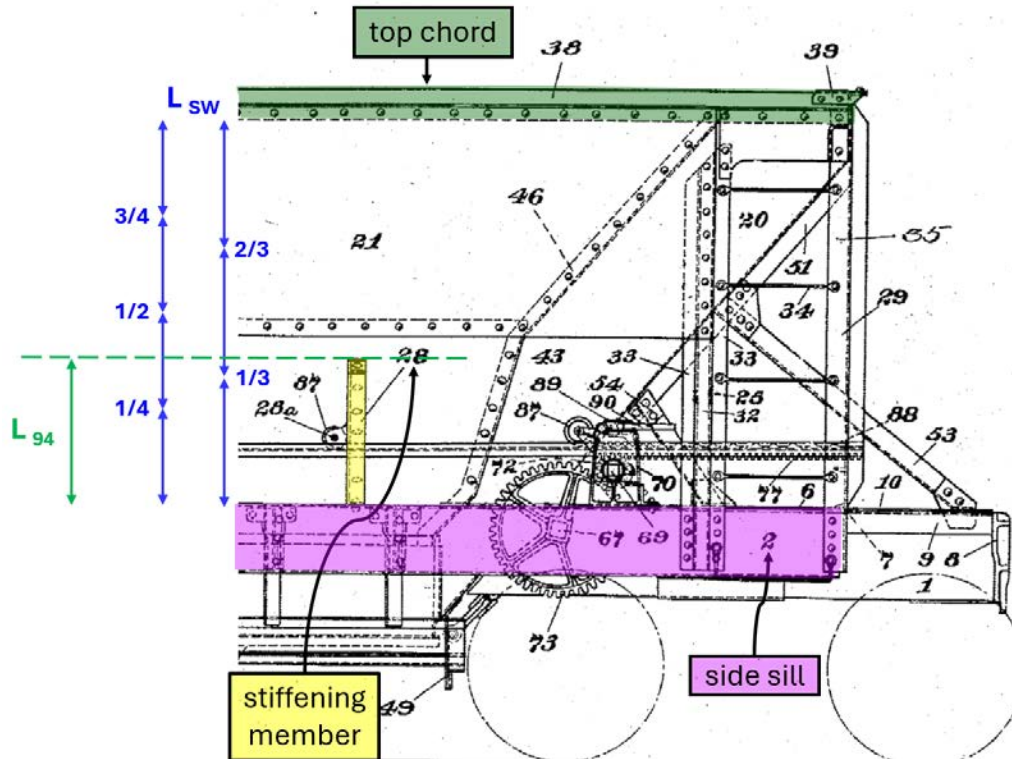
Supra § V. E.1.d.

3. **Dependent Claim 5: “The rail road hopper car of claim 4 wherein said first sidewall has an overall height from said first side sill to said first top chord, L , and said transition portion is located a distance above said first side sill that is in the range of $\frac{1}{4}$ to $\frac{2}{3} L$.”**

82. The '892 patent's only disclosure of this limitation is in Fig. 2c, shown below, and in the text in column 15, lines 58-63. As shown below and to the left, the '892 patent compares the height of the side wall, labeled L_{sw} , and the distance from the side sill to the juncture of the upper vertical (second) region of the side walls and the sloped (third) region of the sidewall, labeled L_{94} . EX1001, Fig. 2. The text states that distance L_{94} “may lie in the range of $\frac{1}{4}$ to $\frac{2}{3}$ of the distance L_{sw} .” *Id.* at 15:61-62.



Id., Fig.2c. As shown below, Lindström discloses that its distance L_{94} is between $1/4$ and $2/3$ of L_{sw} , as required by Claim 5.



EX1005, Fig. 2. It 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 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, etc. are all examples of engineering practices for maximizing capacity and efficiency. A POISTA would be aware of such practices.

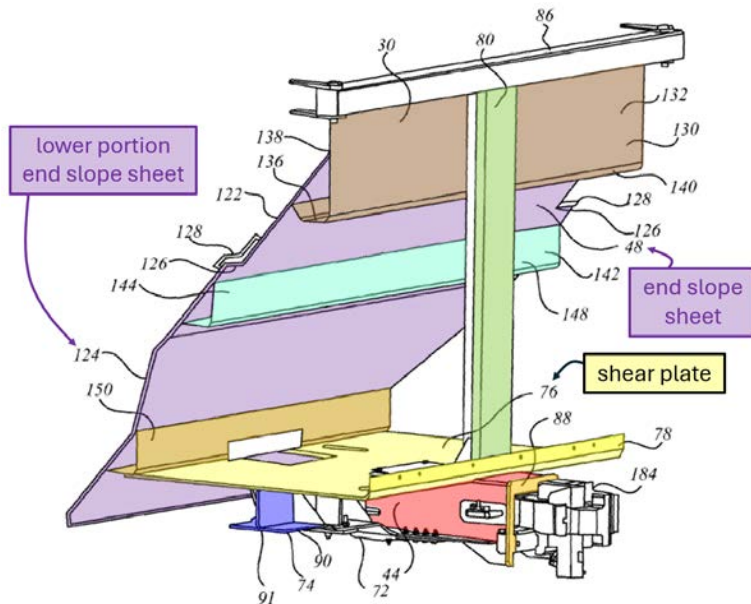
4. Dependent Claim 6:

- a. **[6a] “The rail road hopper car of claim 2 wherein said first upstanding sidewall has a third region intermediate said first and second regions, said third region including a side sheet transition portion passing across said sidewall stiffener from an inboard margin thereof to an outboard margin thereof;”**

83. This limitation is included here for reference.

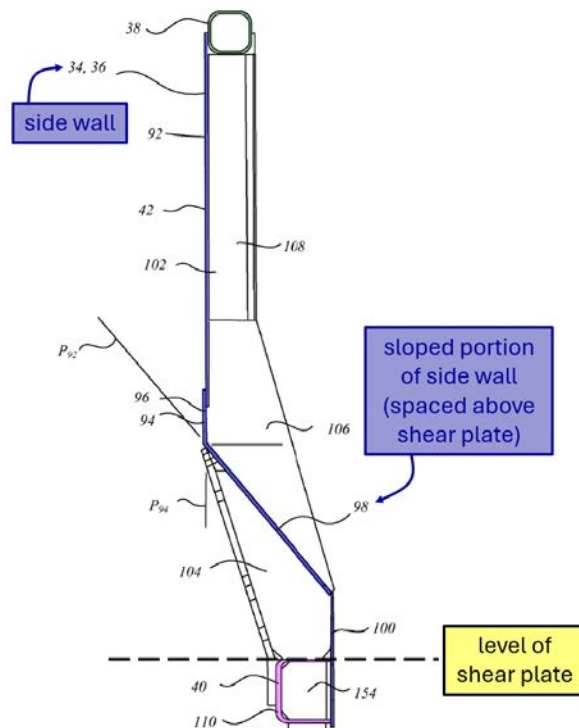
- b. **[6b] “said hopper includes first and second sloped side sheets; and said first sloped side sheet meets said first sidewall at said transition portion.”**

84. The written description of the '892 patent uses the term “sloped side sheet” only once, where it states: “Lower portion 124 tapers in width to match the narrowing width between the *sloped side sheets* with which it mates.” EX1001 at 16:34-36 (emphasis added). The lower portion 124 is a sloped portion of end wall 30. *Id.* at 16:29-30 (“End walls 30, 32 each include upper and lower sloped surface members 122 and 124”). End wall 30 with its lower portion 124 is shown in Fig. 3a below.



**'892 patent
Fig. 3a**

Id., Fig. 3a. As the figure shows, lower portion 124 is spaced above the (yellow) shear plate 76. Thus, for this ground, I understand the “sloped side sheets” that mate with the sides of lower portion 124 to be the sloped portions 98 of the side walls, as these are sloped portions of the side walls that are spaced above the shear plate:

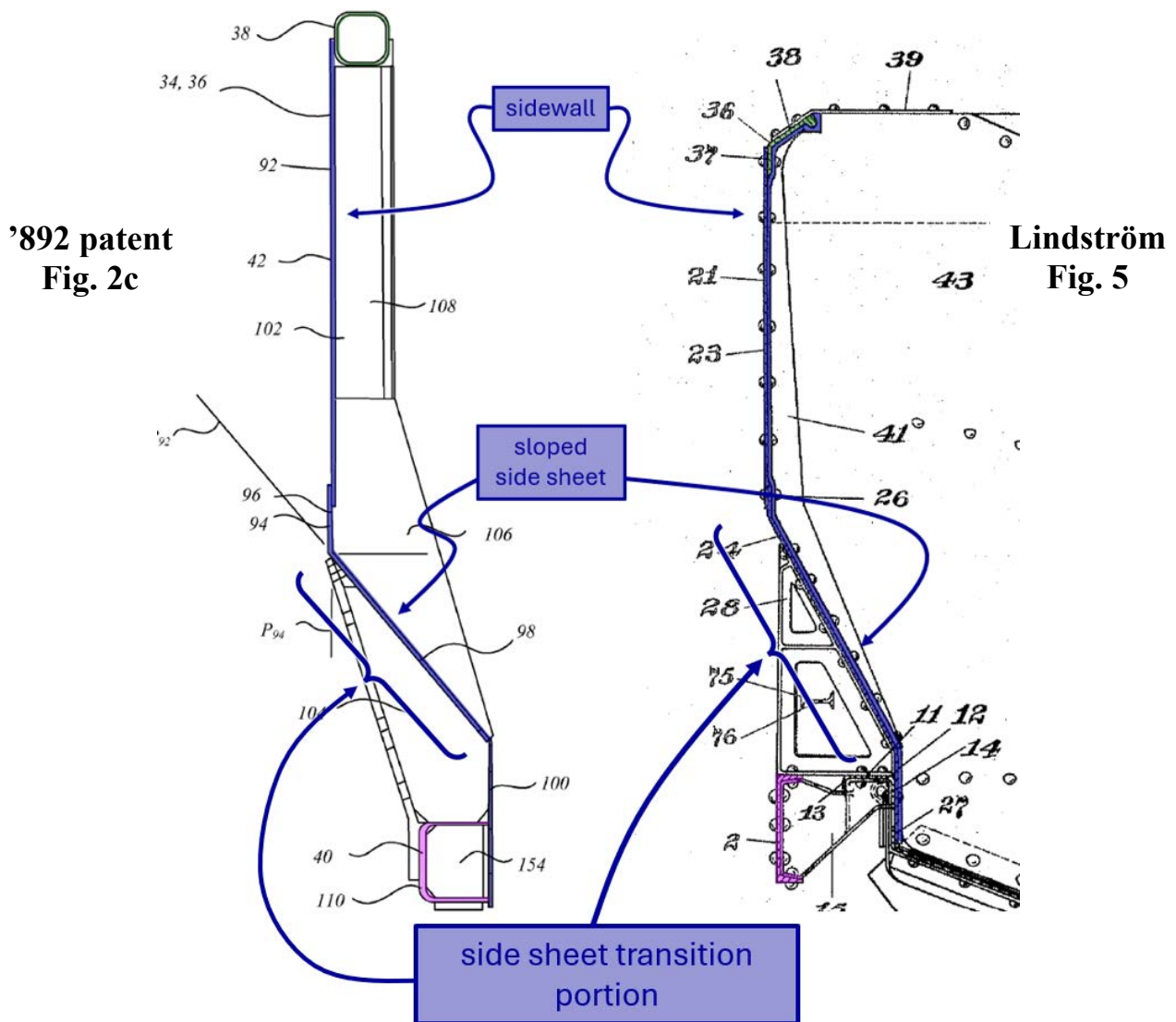


**'892 patent
Fig. 2c**

Id., Fig. 2c. Accordingly, a POSITA would conclude that the “sloped side sheets” recited in limitation [6b] are the sloped portions 98 of side walls 34, 36.

Limitation [6b] recites that the first sloped side sheet, which is part of the first side wall, “meets” the first side wall. Claim 6’s requirement that the sloped side sheet “meets” the side wall must therefore be satisfied by a sloped side sheet that forms part of the side wall.

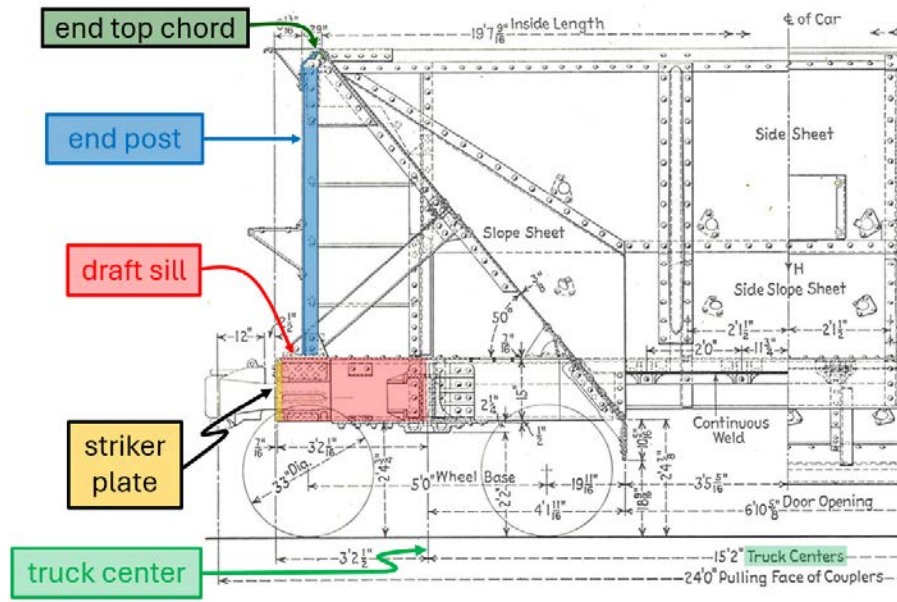
Lindström discloses the same structure. As shown below, Lindström has a sloped side sheet that forms part of the car’s side wall. And as in the ’892 patent, the sloped side sheet is located in the same part of the side wall as the transition portion. Lindström therefore discloses limitation [6b] under any reasonable interpretation of the claim language.



EX1001, Fig. 2c; EX1005, Fig. 5.

- c. [8b] “and an end post extends from said draft sill to said end top chord, said end post being mounted above said draft sill between said truck center and said striker.”

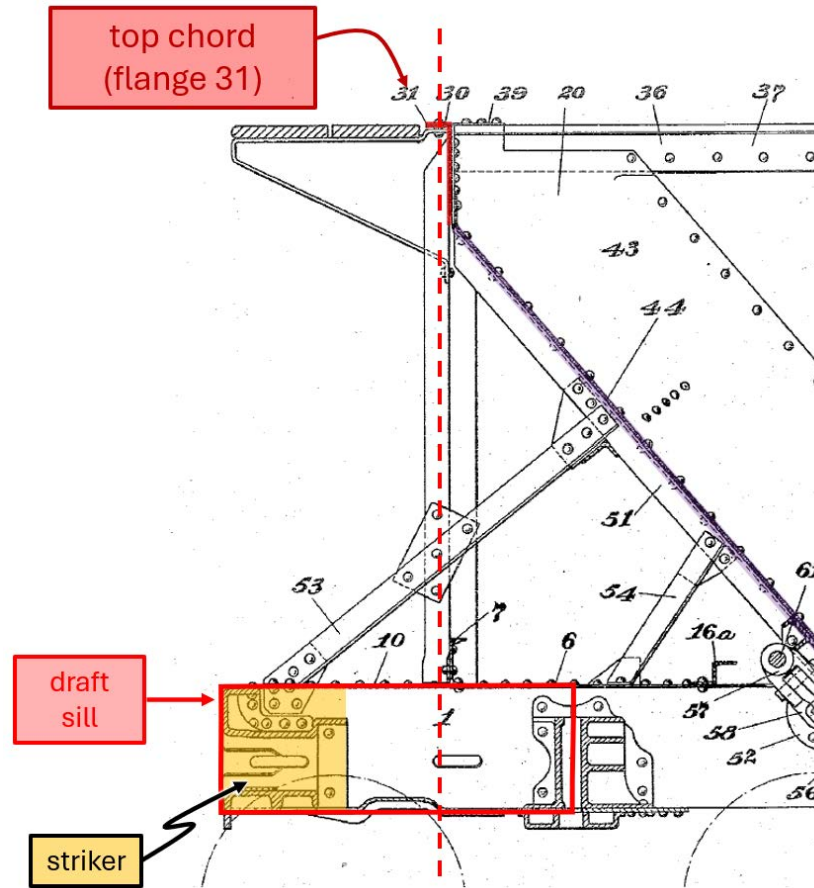
85. As discussed in connection with Ground 1b, and as shown below, the 1946 Cyclopedia’s NSC ore car drawings disclose an end post extending from the draft sill (between truck center and the striker) to the end top chord.



EX1004 at 294.

A POSITA would have been motivated to modify Lindström's design to incorporate an end post extending from the draft sill to the top chord, similar to the end post in the NSC car, to further strengthen the top chord and end wall, which are subject to significant stresses because the slope sheet is connected to the end wall. A POSITA would have a reasonable expectation of success in making the modification because it would be a straightforward addition of a simple structure that is very similar to Lindström's corner posts, but with the end post extending from the draft sill rather than a side sill. *Id.* A POSITA would have further been motivated to maintain, to the extent possible, a straight end post, as in the 1946 Cyclopedia's NSC ore car, to most efficiently transfer the loads between the top cord and draft sill. Finally, in the modified car, the end post would extend from a part of the draft sill between truck center and the striker, because (i) the entire draft sill lies between

truck center and the striker, and (ii) a vertical end post would extend down from the top chord to a point between truck center and the striker, as shown below. *Id.*

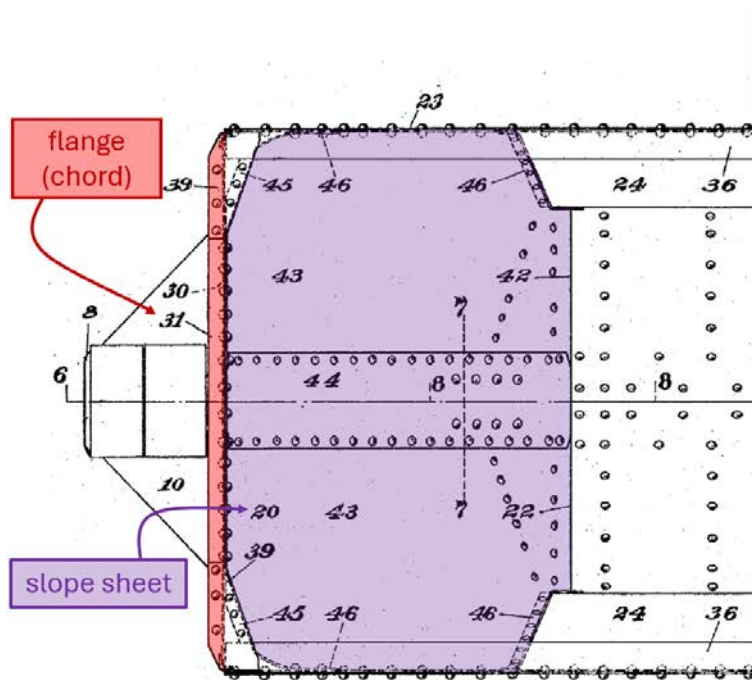


EX1005, Fig. 6.

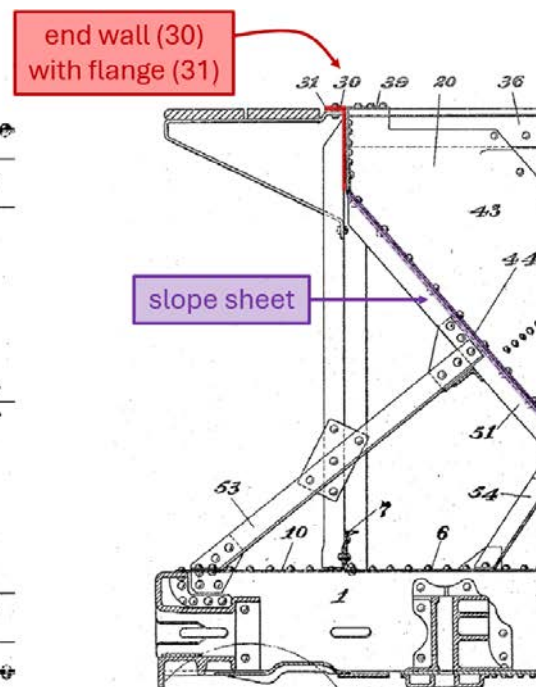
5. Dependent Claim 9:

- a. [9a] “The rail road hopper car of claim 8 wherein said hopper has an end wall extending downward of said end top chord;

86. Lindström discloses this limitation, as shown below.



**Lindström
Fig. 1**



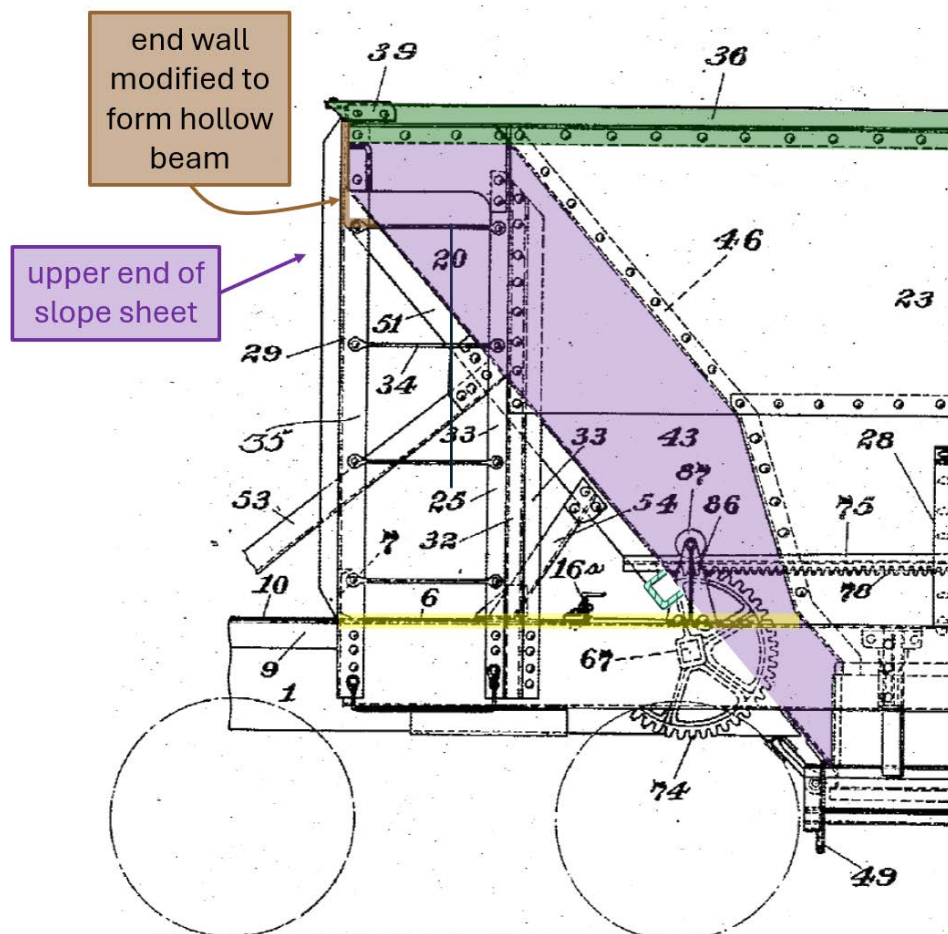
**Lindström
Fig. 6**

Id., Figs. 1, 6.

- b. [9b] “said upper, longitudinally outboard end of said first end slope sheet meets said downwardly extending end wall;
and said first cross-wise extending beam is located where said downwardly extending end wall meets said first end slope sheet; and
said first cross-wise extending beam is of hollow cross-section.”

87. As discussed above in connection with limitation [2i], it would have been obvious to modify Lindström’s car design to support the upper, outboard end of the slope sheet with a crosswise, L shaped beam as in Wong. *See supra* § V.

F.1.c. The resulting modified car design would satisfy limitation [9b], as shown below. That is, said upper, longitudinally outboard end of said first end slope sheet (“sloping end floors” 20) meets said downwardly extending end wall (modified “plate” 30 that “forms an end wall of the car body,” EX1005 at 2:123-27); and said first cross-wise extending beam (end wall modified to form beam) is located where said downwardly extending end wall meets said first end slope sheet (see figure below); and said first cross-wise extending beam is of hollow cross-section (see figure below).



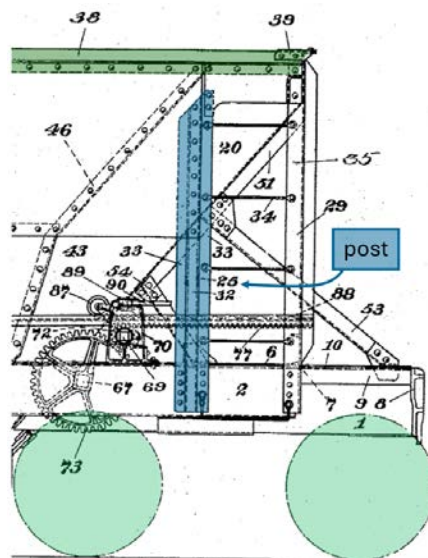
EX1005, Fig. 2 (modified).

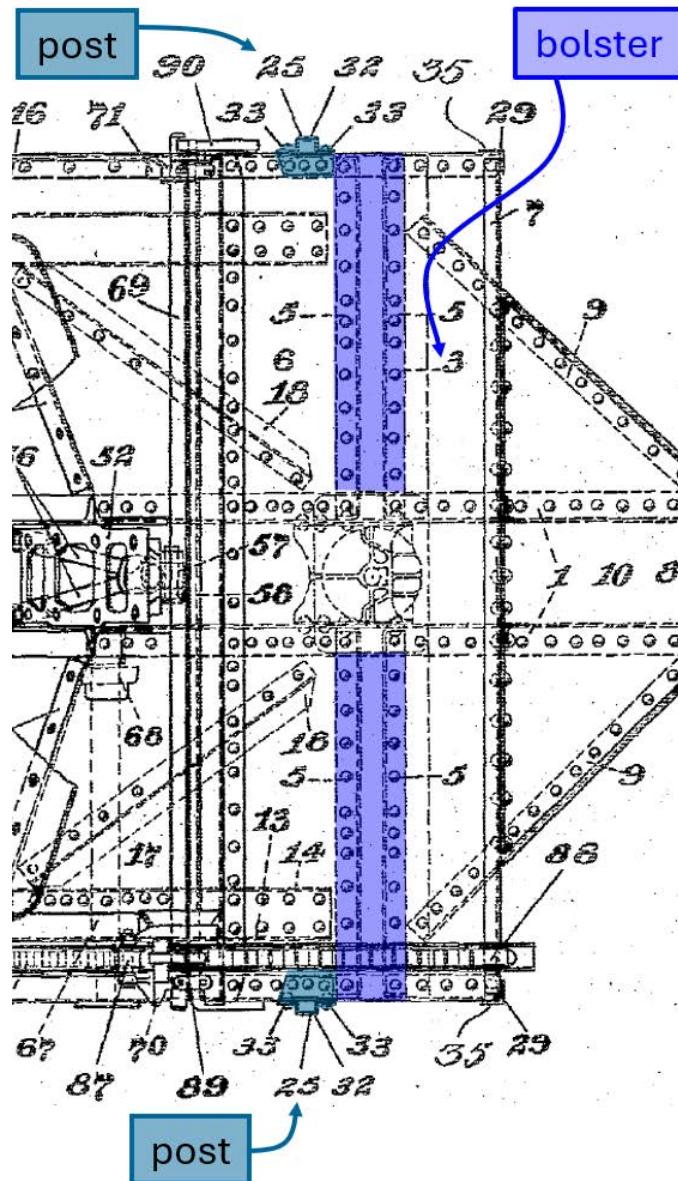
6. **Dependent Claim 11: “The rail road hopper car of claim 10 wherein said main bolster has first and second ends; and first and second corner posts extend upwardly from said first and second ends respectively to mate with said sidewalls.”**

88. The '892 patent discloses “corner posts” 82 and 84 that do not extend upward from the true corners of the railcar, but rather from “the junction of the laterally outboard ends of left and right hand main bolster and side sills.” EX1001 at 14:21-23. Lindström discloses corner posts (“posts” 25) whose corrugated portions mate with the side walls:

Each of the posts 25 is preferably provided with a channel shaped corrugation 32 and with flanges 33, 33 which flanges may be secured to the side sill 2. When these posts 25 are secured to the side sill 2, the corrugations 32 extend outwardly beyond the vertical plane of the side sill and at their upper portion are connected with the side wall sheets 23 by rivets or other suitable means.

Id. at 2:129-3:8. Posts 25 are positioned just laterally inboard of the bolster ends, as shown below.

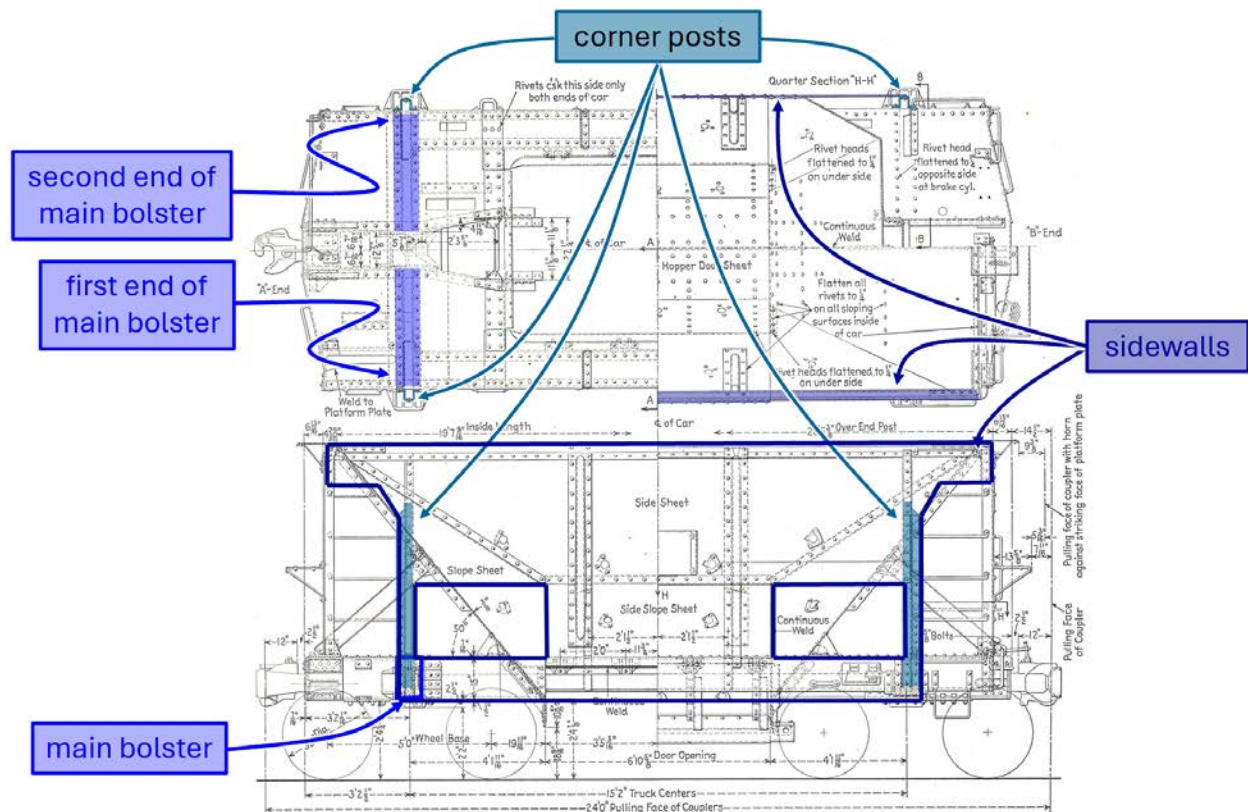




Id., Figs. 2-3. A POSITA would consider Lindström's posts 25 to extend upwardly from the ends of the bolster, as required by Claim 11.

Additionally, it would have been obvious to move Lindström's posts 25 slightly longitudinally outboard, so that they could be more directly supported by the bolster. A POSTIA would be motivated to do so to eliminate the bending moments imparted when a load is transferred from Lindström's posts 25 to its

bolsters 3. *Supra* § IV. A; *see generally supra* § IV. A suggestion to move Lindström's posts 25 more directly over the bolster appears in the the 1946 Cyclopedia's drawings and photograph of the NSC ore car. EX1004 at 294-95. As shown below, the NSC ore car discloses its first and second corner posts extending upwardly from the first and second ends of its main bolster to mate with its sidewalls.



VI. GROUNDS AND COMBINATIONS

89. 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.

GROUND 1a	Claim 1: 1946 Cyclopedia
GROUND 1b	Claims 2–8, 10–14: 1946 Cyclopedia, Lindström and optionally Wong
GROUND 1c	Claim 9: 1946 Cyclopedia, Lindström and Wong
GROUND 1d	Claim 15: The art in Ground 1b and Coates
GROUND 2a	Claim 1: Lindström and optionally the 1946 Cyclopedia
GROUND 2b	Claims 2–14: Lindström, 1946 Cyclopedia and Wong
GROUND 2c	Claim 15: The art in Ground 2b and Coates

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.