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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FREIGHTCAR AMERICA, INC.,
Petitioner,

v.

NATIONAL STEEL CAR LIMITED,
Patent Owner.

Case IPR2025-01048
Patent 8,132,515

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,132,515

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1002	File History of the '515 Patent
1003	Declaration of Mehdi Ahmadian, Ph.D.
1004	Excerpts from *1946 Car Builders' Cyclopedia*, 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 Lancashire & Yorkshire Wagons, Vol. II*, by Noel Coates, Copyright 2006 ("Coates")
1008	U.S. Patent No. 992,192 ("Hart")
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1010	Excerpts from *Car Builders' Dictionary, 1912 (Seventh) Edition* ("1912 Cyclopedia")
1011	Excerpts from *Car Builders' Cyclopedia of American Practice, Tenth Edition—1922* ("1922 Cyclopedia")
1012	U.S. Patent No. 1,537,051 ("Campbell '051")
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1016	Excerpts from *COAL CARS: The First Three Hundred Years*, by Martin Robert Karig III, Copyright 2007 ("Karig")

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1017	Excerpts from *Modern Private Owner Wagons on British Rail*, by David Ratcliffe, Copyright 1989 ("Ratcliffe 1")
1018	Excerpts from *Private-Owner Wagons in Colour, For the Modeller and Historian*, by David Ratcliffe, Copyright 2009 ("Ratcliffe 2")
1019	Excerpts from *Wagons of the Final Years of the British Railways*, By David Larkin, Copyright 2008 ("Larkin 1")
1020	Excerpts from *Working Wagons*, Vol. 3 1980–1984, by David Larkin, Copyright 2001 ("Larkin 2")
1021	Excerpts from *Wagon Recognition*, Vol. 1 Carkinds – B to W, by Martin Buck and Mark Rawlinson ("Buck")
1022	Declaration of Sylvia Hall-Ellis
1024	Excerpts from *Private Owner Wagons*, Vol. 1, by Andrew Marshall, Copyright 1989 ("Marshall")

CLAIM LISTING

Limitation	Claim Language
1a	A railroad hopper car for carrying particulate material, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,
1b	said hopper having a discharge section through which to release lading, and first and second end slope sheets oriented toward said first and second end sections, said end slope sheets being inclined in the longitudinal direction to feed said discharge section;
1c	said first end section including a draft sill extending in the longitudinal direction, a main bolster extending crosswise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;
1d	said first end slope sheet of said hopper over hanging said shear plate of said first end section; and
1e	said hopper car being free of primary structure directly above said shear plate of said first end section under said overhang of said first end slope sheet of said hopper;

Limitation	Claim Language
1f	one of: (a) said first end slope sheet has an upper margin and said hopper car includes an end post extending upwardly from said draft sill to said upper margin of said first end slope sheet; and (b) said first end slope sheet has an upper margin terminating at an end wall, and said hopper car includes an end post extending upwardly from draft stub sill to said end wall;
1g	said shear plate has a longitudinally outboard margin and said draft sill has a striker located outboard of said longitudinally outboard margin of said shear plate, and said end post is one of: (a) rooted to said draft sill adjacent to said striker; (b) rooted to said shear plate adjacent to said longitudinally outboard margin of said shear plate;
1h	said bolster has first and second laterally outboard distal ends, and said hopper car has corner posts extending upwardly from said distal ends of said bolster to said first end slope sheet; and
1i	said hopper car has a machinery space bounded by (a) said first end slope sheet; (b) said shear plate of said first end section; (c) said end post; and (d) said corner posts, and said machinery space is free of any other primary structure.
2	The railroad hopper car of claim 1 wherein said bolster has first and second laterally outboard distal ends, and said hopper car has corner posts extending upwardly from said distal ends of said hopper to said first end slope sheet.
3a	The railroad hopper car of claim 1 wherein: said hopper car has at least one longitudinally hinged discharge door, said discharge door being movable cross-wise between open and closed positions; and
3b	a longitudinally acting pneumatic actuator is at least partially lodged in said machinery space directly above said draft sill.

Limitation	Claim Language
4	The railroad hopper car of claim 3 wherein a brake reservoir is also at least partially lodged in said machinery space.
5a	The railroad hopper car of claim 1 wherein: said shear plate is mounted above, and to, said main bolster and defines an upper flange thereof;
5b	said main bolster has a lower flange downwardly spaced from said upper flange, said lower flange terminating at respective distal end portions at either side of said car;
5c	said car includes a side sill running along said car between said first and second end sections;
5d	said side sill has an upper flange, said upper flange of said side sill being substantially co-planar with, and connected to, said shear plate; and
5e	said side sill has a lower flange, said lower flange of said side sill being substantially co-planar with a respective one of said distal end portions of said lower flange of said main bolster.
6	The railroad hopper car of claim 5 wherein said shear plate defines an upper flange of said draft sill whereby said draft sill upper flange, said shear plate and said side sill upper flange are all substantially co-planar.
7a	A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,
7b	said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;

Limitation	Claim Language
7c	said first end section including a draft sill extending in the longitudinal direction, a main bolster extending cross-wise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;
7d	said first end slope sheet of said hopper over-hanging said shear plate of said first end section;
7e	first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;
7f	a first laterally extending reinforcement mounted cross-wise to said first end slope sheet adjacent to said shear plate; said shear plate of said first end section being connected to said first laterally extending reinforcement; said first end slope sheet of said first end section being connected to said first laterally extending reinforcement; said first laterally extending reinforcement defining part of a first hollow section beam extending across said hopper car between said first and second side walls;
7g	said hopper car being free of longitudinally oriented elephant ears extending between said draft sill and said end slope sheet;

Limitation	Claim Language
7h	said hopper car has a first end wall member running cross-wise between said first and second side walls; said first end slope sheet has an upper margin that meets said first end wall member at a first junction; said first end wall member extends upwardly from said first junction; said first end wall member has a lower portion extending downward of said first junction; said lower portion of said first end wall member and said upper margin of said first end slope sheet co-operate to define portions of the cross-section of a second hollow section beam extending cross-wise across said hopper car between said first and second side walls.
8	The railroad hopper car of claim 7 wherein said laterally extending reinforcement member includes a first edge mounted cross-wise along said first end slope sheet; a second edge mounted cross-wise along said first end slope sheet and spaced from said first edge, and a third portion mounted across said shear plate of said first end section.
9	The railroad hopper car of claim 7 wherein said laterally extending member has a pair of first and second spaced apart toes, and said laterally extending member is mounted toes-in against said first end slope sheet, whereby said first hollow section beam is defined by said laterally extending reinforcement and said first end slope sheet.
10	The railroad hopper car of claim 7 wherein said laterally extending reinforcement has, when seen in section, a first toe, a second toe, and a back; said laterally extending reinforcement is mounted toes-in against said first end slope sheet; and said back is mounted to said shear plate of said first end section.
11	The railroad hopper car of claim 10 wherein said laterally extending reinforcement is an angle iron mounted toes-in to said first end slope sheet.

Limitation	Claim Language
12	The railroad hopper car of claim 7 wherein said lower portion of said first end wall member has a lower margin that is bent to meet said upper margin of said first end slope sheet at a location lower than said first junction.
13	The railroad hopper car of claim 7 wherein said first end wall member has an upper margin that terminates at a top chord, said top chord extending from side to side of said hopper car.
14	The railroad hopper car of claim 7 wherein said car includes an upstanding end post, said end post being mounted over said draft sill longitudinally outboard of said main bolster and extending upwardly therefrom to meet said first end wall member.
15	The railroad hopper car of claim 7 wherein an intermediate beam extends across said first end slope sheet between said first and second side walls at a position intermediate said first hollow section beam and said second hollow section beam.
16	The railroad hopper car of claim 15 wherein said intermediate beam includes a cross-wise extending structural member mounted toes-in against said first end slope sheet to define a closed hollow section.
17	The railroad hopper car of claim 7 wherein said first and second side walls of said hopper car define sidewalls of said hopper, and said first and second side walls include end portions that are stepped laterally inboard, and said second hollow section beam extends between said end portions of said first and second side walls that are stepped laterally inboard.
18a	A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,

Limitation	Claim Language
18b	said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;
18c	said first end section including a draft sill extending in the longitudinal direction, a main bolster extending cross-wise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;
18d	said first end slope sheet of said hopper over-hanging said shear plate of said first end section;
18e	first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;
18f	a first laterally extending reinforcement mounted cross-wise to said first end slope sheet adjacent to said shear plate; said shear plate of said first end section being connected to said first laterally extending reinforcement; said first end slope sheet of said first end section being connected to said first laterally extending reinforcement; said first laterally extending reinforcement defining part of a first hollow section beam extending across said hopper car between said first and second side walls;
18g	said hopper car being free of longitudinally oriented shear webs ears extending between said draft sill and said end slope sheet;

Limitation	Claim Language
18h	said hopper car has second, and third hollow section beams as well as said first hollow section beam, said first, second and third hollow section beams extending thereacross between said first and second side walls thereof; said first end slope sheet has an uppermost margin, and said second hollow section beam runs along said uppermost margin of said first end slope sheet; said third hollow section beam is located intermediate said first and second hollow section beams;
18i	said hopper car has an end post mounted over said draft sill, said end post being located longitudinally outboard of said main bolster of said first end section; said end post extends upwardly to meet said second hollow section beam;
18j	said hopper car has first and second side sills running longitudinally along either side thereof, said first and second side walls extending upwardly of said first and second side sills respectively; said first and second side sills mate with first and second ends of said main bolster of said first end section; and
18k	said first and second side sills have upper flanges that mate with said shear plate of said first and section.
19	The railroad hopper car of claim 18 wherein: there is an end wall that extends from sidewall to sidewall; said end wall has an upper portion that has an upper margin terminating at a top chord of said end wall; said first end slope sheet has an uppermost margin, said uppermost margin of said first end slope sheet meeting said end wall along a first juncture; said end wall has a lower portion extending below said first juncture, said lower portion being bent to define a portion of said second hollow section beam; and said end post extends past said second hollow section beam along said end wall to mate with said top chord of said end wall.

Limitation	Claim Language
20a	A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,
20b	said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;
20c	said first end section including a draft sill extending in the longitudinal direction, a main bolster extending cross-wise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;
20d	said first end slope sheet of said hopper over-hanging said shear plate of said first end section;
20e	first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;
20f	a first laterally extending reinforcement mounted cross-wise to said first end slope sheet adjacent to said shear plate; said shear plate of said first end section being connected to said first laterally extending reinforcement; said first end slope sheet of said first end section being connected to said first laterally extending reinforcement; said first laterally extending reinforcement defining part of a first hollow section beam extending across said hopper car between said first and second side walls;
20g	said hopper car being free of longitudinally oriented elephant ears extending between said draft sill and said end slope sheet;

Limitation	Claim Language
20h	said main bolster of said first end section of said railroad hopper car has first and second ends at laterally outboard extremities thereof; said hopper car has first and second corner posts mounted at said first and second ends of said main bolster of said first end section, said corner posts extending upwardly from said main bolster to said first end slope sheet;
20i	said draft sill has a longitudinally outboard end; an end post stands upwardly of said longitudinally outboard end of said draft sill;
20j	a machinery space is defined above said shear plate, below said first end slope sheet, longitudinally inboard of said end post, and between said corner posts; and said machinery space is free of any other primary structure.
21	The railroad hopper car of claim 20 wherein: said hopper has a movable door by which egress of lading is governed; said hopper car has an actuator and a drive train, said drive train being connected between said actuator and said door, said actuator being operable to move said door; and said actuator is mounted in said machinery space.
22	The railroad hopper car of claim 21 wherein said first side wall has an aperture formed therein at a location higher than said shear plate, lower than said first end slope sheet, and longitudinally inboard of said first corner post.
23	The railroad hopper car of claim 20 wherein said first and second side walls of said car have openings defined therein longitudinally inboard of said respective corner posts, above said shear plate, and below said first end slope sheet.

Limitation	Claim Language
24a	A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,
24b	said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;
24c	said first end section including a draft sill extending in the longitudinal direction, a main bolster extending cross-wise to said draft sill, and a shear plate overlying said draft sill and said main bolster, said shear plate extending along said draft sill and cross-wise from side to side of said hopper car;
24d	said first end slope sheet over-hanging said shear plate of said first end section;
24e	first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;

Limitation	Claim Language
24f	there being a first end wall extending between said first and second side walls; said first end slope sheet having an uppermost margin, said uppermost margin meeting said first end wall at a first junction; said hopper car having a first beam extending cross-wise between said first and second side walls at said first junction of said uppermost margin of said first end slope sheet and said first end wall, said first beam being a beam of hollow section; said first end wall has an upper portion and a lower portion; said upper portion of said first end wall extends upwardly of said first junction of said uppermost margin of said first end slope sheet and said first end wall; said lower portion of said end wall extends downwardly of said first junction of said uppermost margin of said first end slope sheet and said first end wall; and said lower portion of said first end wall forms part of said first beam;
24g	said draft sill having longitudinally extending draft sill webs;
24h	said first end section being free of longitudinally oriented elephant ears extending upwardly of said draft sill webs to meet said end slope sheet;
24i	said lower portion of said first end wall has a margin, and said margin is bent to mate with said first end slope sheet as a second junction distant from the first junction, said lower portion of said first end wall and said uppermost margin of said first end slope sheet co-operating to define said first beam.
25	The railroad hopper car of claim 24 wherein an end post is mounted over said draft sill outboard of said main bolster, said end post extending upwardly to meet said first beam.

Limitation	Claim Language
26	The railroad hopper car of claim 25 wherein: said upper portion of said first end wall extends upwardly of said first junction to end at a top chord; said top chord extends across said hopper car between said first and second side walls; and said end post extends past said first beam to terminate at said top chord.
27	The railroad hopper car of claim 25 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom.
28	The railroad hopper car of claim 27 wherein: a machinery space is defined above said shear plate, in the lee of said first end slope sheet, longitudinally inboard of said end post and between said first and second corner posts; and said machinery space is free of any other primary structure.
29a	The railroad hopper car of claim 28 wherein: said first side wall has an aperture formed therein in a location that is longitudinally inboard of said first corner post, above said shear plate, and leeward of said first end slope sheet;
29b	said hopper has a movable gate operable to govern egress of lading from said hopper; there is an actuator mounted in said machinery space, and a drive train connecting said actuator to said gate.
30	The railroad hopper car of claim 24 wherein a second beam is mounted across said first end slope sheet adjacent said shear plate.
31	The railroad hopper car of claim 30 wherein a third beam is mounted across said first end slope sheet intermediate said first and second beams, and said third beam is formed of a structural member mounted toes-in against said first end slope sheet to define an hollow section.

Limitation	Claim Language
32a	A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,
32b	said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;
32c	said first end section including a draft sill extending in the longitudinal direction, said draft sill having first and second spaced apart longitudinally running draft sill webs and a draft pocket defined therebetween;
32d	said first end section including a main bolster extending cross-wise to said draft sill; said first end section having a truck center where said main bolster meets said draft sill; said draft sill having a striker end longitudinally outboard of said truck center; said first end section including a shear plate; said shear plate overlying said draft sill webs and said main bolster, said shear plate extending longitudinally along said draft sill and cross-wise from side to side of said hopper car; said shear plate having an outboard margin running across said car distant from said truck center and proximate said striker end;
32e	said first end slope sheet over-hanging said shear plate of said first end section;
32f	first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;

Limitation	Claim Language
32g	there being a first end wall extending between said first and second side walls; said first end slope sheet having an uppermost margin, said uppermost margin meeting said first end wall at a first junction; said hopper car having a first beam extending cross-wise between said first and second side walls at said first junction of said uppermost margin of said first end slope sheet and said first end wall, said first beam being a beam of hollow section;
32h	said first end wall is surmounted by a cross-wise running top chord; said first end wall includes a panel extending downwardly from said cross-wise running top chord;
32i	said first end section includes an end post extending upwardly of said draft sill, said end post being mounted above said draft sill distant from said truck center and proximate said striker end; said end post extending upwardly to meet said first beam and said top chord;
32j	said first end section being free of longitudinally oriented elephant ears extending upwardly of said draft sill webs of said draft sill to meet said first end slope sheet; and
32k	said hopper car having a second beam extending cross-wise between said first and second side walls, said second beam being a beam of hollow section; and said second beam being connected to said shear plate.
33	The railroad hopper car of claim 32 wherein a third beam is mounted across said first end slope sheet intermediate said first and second beams.
34	The railroad hopper car of claim 33 wherein said third beam is formed of a structural member mounted toes-in against said first end slope sheet to define an hollow section.

Limitation	Claim Language
35	The railroad hopper car of claim 32 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom to meet said first end slope sheet.
36	The railroad hopper car of claim 35 wherein: a machinery space is defined above said shear plate and under said first end slope sheet; and a door actuator is mounted above said shear plate and under said first end slope sheet.
37a	The railroad hopper car of claim 35 wherein: a machinery space is defined above said shear plate and under said first end slope sheet; said hopper has a movable gate operable to govern egress of lading from said hopper; there is an actuator mounted in said machinery space, and a drive train connecting said actuator to said gate.
37b	said first side wall has an aperture formed therein in a location that is longitudinally inboard of said first corner post, above said shear plate, and leeward of said first end slope sheet;
37c	said hopper has a movable gate operable to govern egress of lading from said hopper; there is an actuator mounted in said machinery space, and a drive train connecting said actuator to said gate.
38a	The railroad hopper car of claim 32 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom;
38b	said first side wall has an opening formed therein, said opening being located longitudinally inboard of said first corner post, upward of said shear plate, leeward of said first end slope sheet.

Limitation	Claim Language
39	The railroad hopper car of claim 32 wherein said draft sill has a longitudinally outboard end, and a striker plate mounted at said longitudinally outboard end; and said draft sill has a length between said truck center and said striker plate that is less than 50 inches.
40a	The railroad hopper car of claim 32 wherein said railroad hopper car has first and second end section, and said hopper is carried thereby;
40b	said first and second side walls each have a respective side sill and a top chord; said first side wall extends from said side sill to said top chord;
40c	said first side wall has a predominantly upwardly running side wall stiffener mounted thereto, said side wall stiffener being located at a longitudinal station intermediate the trucks;
40d	said first side wall having a first region, said first region being a lower region thereof; said first side wall having a second region, said second region being an upper region thereof;
40e	said side wall 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 side wall; said side wall stiffener having a second portion, said second portion being an upper portion thereof, said second portion being mounted to said second region of said side wall;
40f	said first portion of said first side wall stiffener being laterally outboard of said first region of said first side wall; said second portion of said side wall stiffener being laterally inboard of said second region of said first side wall;
40g	said side wall having a continuous section between said first and second regions thereof; and

Limitation	Claim Language
40h	said side wall stiffener having web continuity between said first and second portions thereof.
41	The railroad hopper car of claim 40 wherein said first and second portions of said side wall stiffener are substantially co-planar, and are substantially vertically aligned when seen in a sectional view looking along the car.
42	The railroad hopper car of claim 41 wherein said first side wall has a third region intermediate said first and second regions, said third region including a side sheet transition portion passing across said side wall stiffener from an inboard margin thereof to an outboard margin thereof, and said stiffener having vertical web continuity through said transition portion.
43a	The railroad hopper car of claim 40 wherein: said first side wall has a third region intermediate said first and second regions, said third region including a side sheet transition portion passing across said side wall stiffener from an inboard margin thereof to an outboard margin thereof;
43b	said hopper includes first and second sloped side sheets; and said first sloped side sheet meets said first side wall at said transition portion.
44	The railroad hopper car of claim 43 wherein said first side wall has an overall height from said side sill to said top chord, L, and said transition portion is located a distance above said side sill that is in the range of ¼ to ⅔ L.

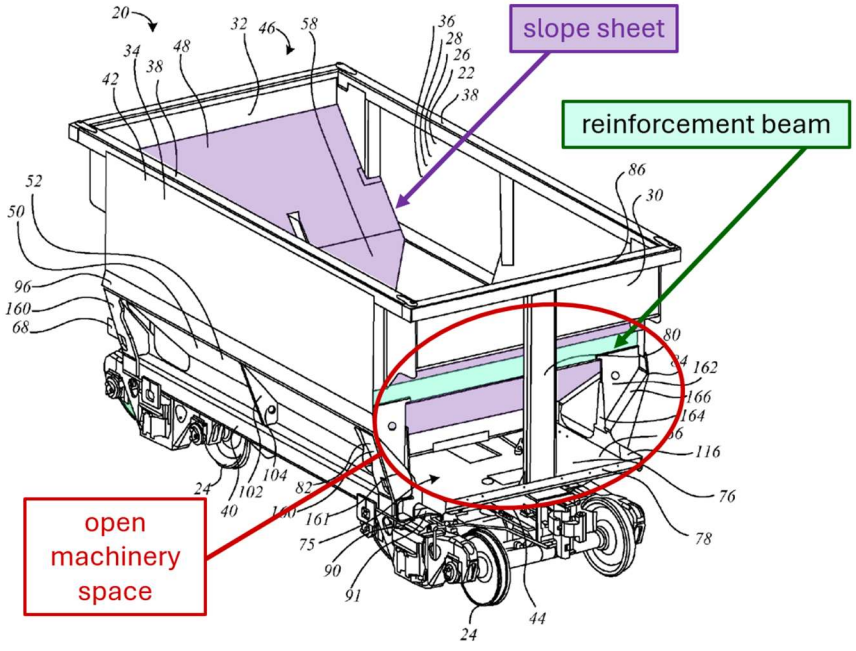
Grounds Listing

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

FreightCar America, Inc. ("FCA") requests *inter partes* review of claims 1-44 of U.S. Patent No. 8,132,515 (EX1001), a patent owned by National Steel Car Ltd. ("NSC").

I. INTRODUCTION

The ’515 patent describes a bottom-discharge hopper car, a railway freight car loaded through the hopper’s open top and discharged through doors at the bottom of the hopper. The hopper’s forward and rear walls—called “slope sheets”—incline toward the bottom center of the car to channel the payload to the hopper doors. The ’515 patent describes reinforcing the slope sheets with transverse support beams under the slope sheet. By supporting the slope sheets with transverse beams, the space below the slope sheet—called the “machinery space”—is not encumbered by support structures and can house machinery such as equipment for opening the hopper doors.



During prosecution, the applicant overcame the Examiner’s rejection of original Claim 1 by arguing that the prior art had support structures—large triangular

plates known as "elephant ears"—that obstructed the machinery space. The Examiner thereafter allowed 44 claims. Each claim required either open machinery space below the slope sheets, crosswise reinforcement beams on the slope sheets, or both.

But although the applicant persuaded the Examiner that slope-sheet support beams and open machinery spaces were novel, they were a century old when the applicant filed its patent application in 2009. One hopper car discussed in this petition – a freight car operated in Northern England by the Lancashire & Yorkshire Railroad – supported its slope sheets by placing beams along the underside of its slope sheet. That hopper car was first manufactured in 1904. Many other hopper cars from the first half of the twentieth century also used support beams, rather than elephant ears, to keep their machinery spaces open.

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

The '515 patent was granted only because the Examiner was unaware that slope-sheet support beams and open machinery spaces were already incredibly old in 2009. The claims of the '515 patent should be cancelled.

II. PRELIMINARY MATTERS

A. Priority Date

The '515 patent was filed as U.S. Application No. 12/816,660 on June 16, 2010. EX1001 at cover. The earliest application to which the '660 application claims priority is Canadian Patent Application No. 2,678,447, filed on September 11, 2009. EX1001 at 1:4–15. For this petition, FCA assumes this date is the '515 patent's priority date.

B. Prosecution History

The application for the '515 patent was filed with original claims 1–42. EX1002 at 32–41. On November 30, 2010, the Examiner rejected Claims 1, 2, 23, and 24 as anticipated by Smith (U.S. Patent No. 4,348,962) and rejected or objected to the remaining claims. *Id.* at 80–88.

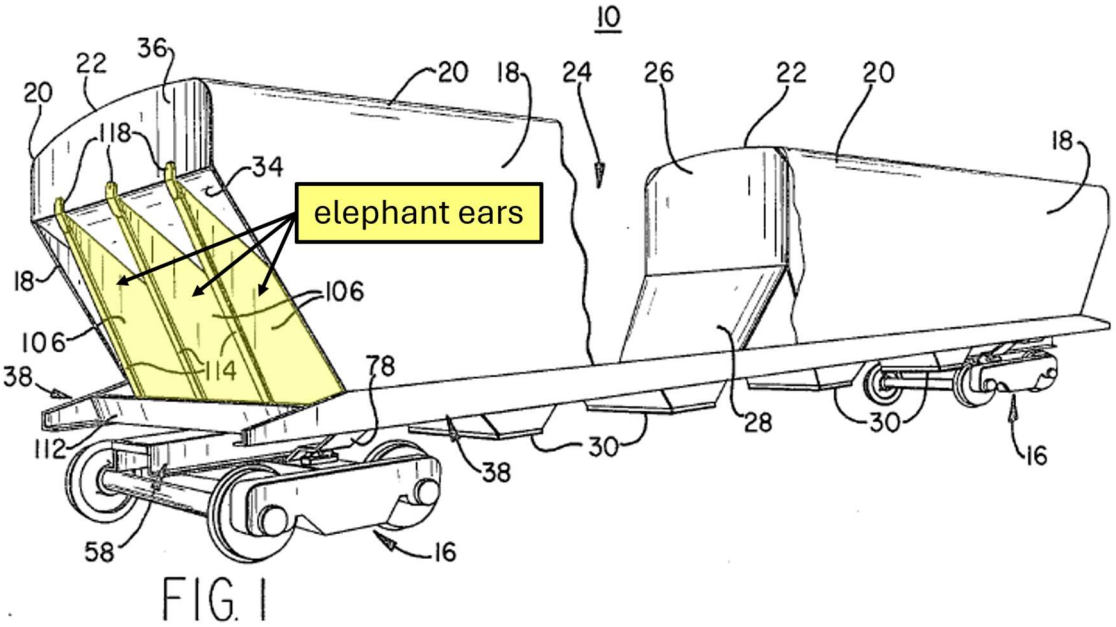


FIG. 1

Smith Patent – Cited by Examiner

EX1015, Fig. 1.

In its February 28, 2011 response, the applicant relied on (1) the '515 patent's statement that "Car 20 avoids the use of these 'elephant ears' and so provides a large unobstructed space shown in Figure lb," and (2) Claim 1's requirement that the hopper car be "***free of primary structure directly above said shear plate*** of said first end section ***under said overhang of said first end slope sheet*** of said hopper." (emphasis added). EX1002 at 112–13. The applicant argued that the gussets labeled 106 in Smith were elephant ears that "obstruct the machinery space." *Id.* The Examiner accepted this argument and allowed claims 1–10 on May 13, 2011, but rejected or objected to the remaining claims. *Id.* at 120-28.

On October 13, 2011, the applicant requested continued examination and submitted an information disclosure statement listing additional prior art. *Id.* at 145–59. The applicant cancelled claims 1–4, added the limitations of Claim 1 to Claim 6, rewrote several claims in independent form, and made other amendments. *Id.* at 288. The new independent claims were 6, 16, 25, 27, 33, and 43. *Id.* Each independent claim required an open machinery space or excluded elephant ears such as those in Smith. *See, e.g.*, *id*. at 273-81.

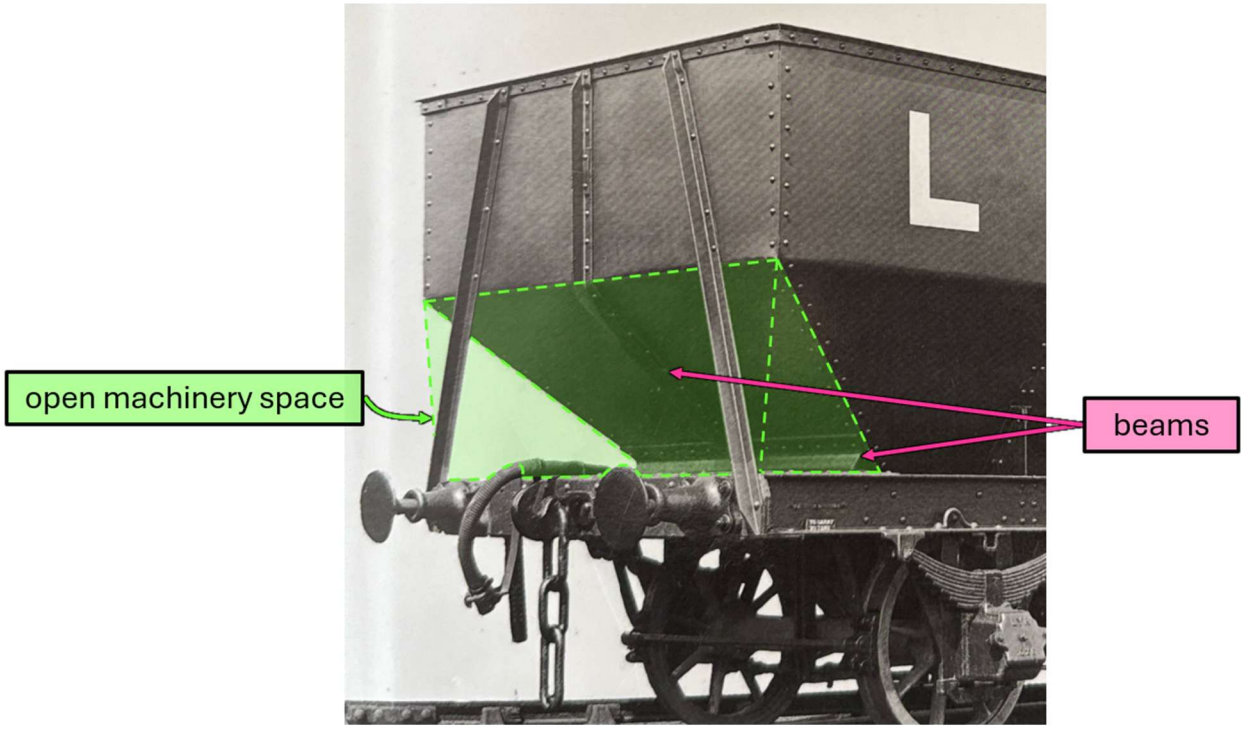
On November 1, 2011, the Examiner allowed all pending claims without applying or discussing any prior art submitted with the RCE. *Id.* at 305–39.

C. Prior Art

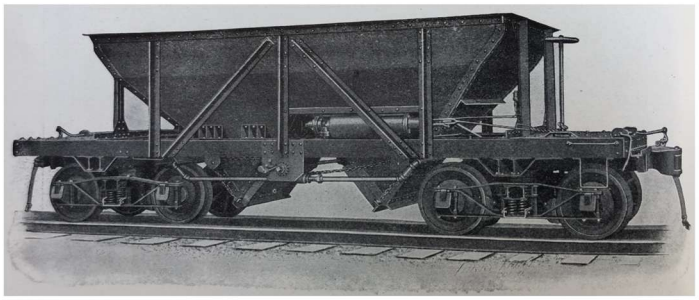
However, the Patent Office did not have the most relevant evidence. The prior art contained numerous hopper cars with open or unobstructed machinery spaces. To keep their machinery spaces unobstructed, these hopper cars used reinforcement beams that extended along the underside of the slope sheet, either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

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

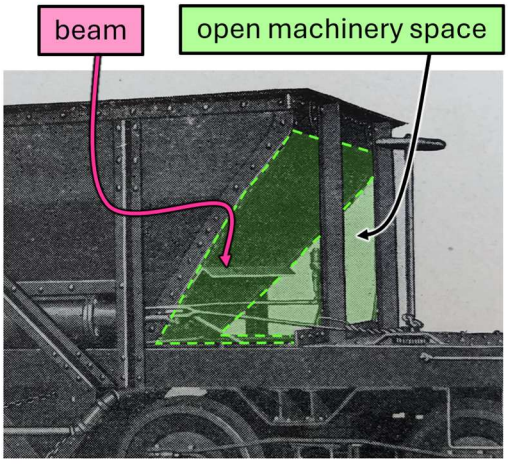
The L&Y car supported its slope sheet with one crosswise beam and one longitudinal beam, creating the unobstructed machinery space shown below. *Id*. The car had two end posts but, like the end post and corners posts of the '515 patent's sole embodiment, these posts were at the car's perimeter, not within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

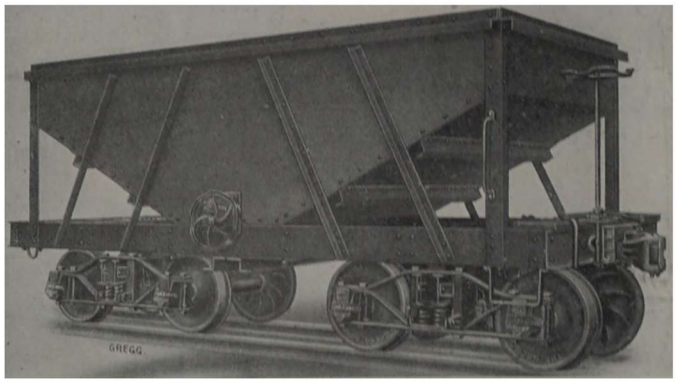


Later hopper cars also employed reinforcement beams to achieve an open machinery space. A few examples are shown below.

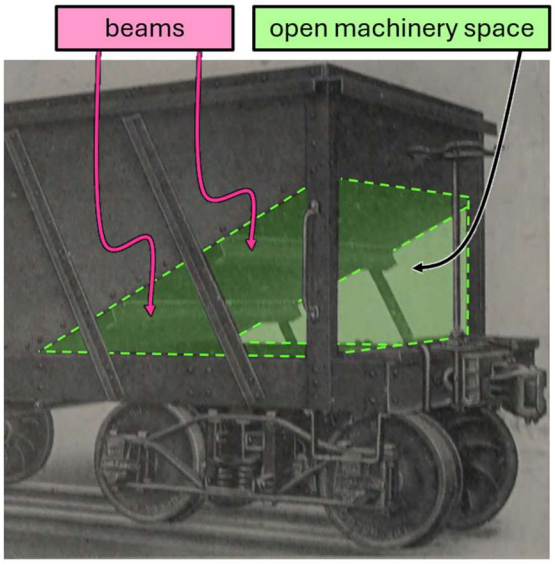


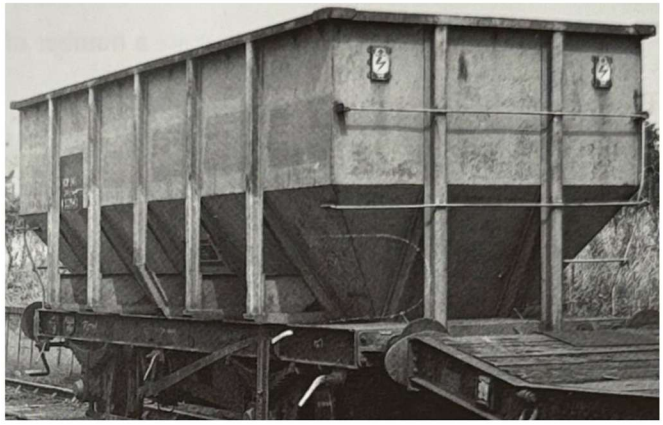
Kilbourne & Jacobs Hopper Car (1912)



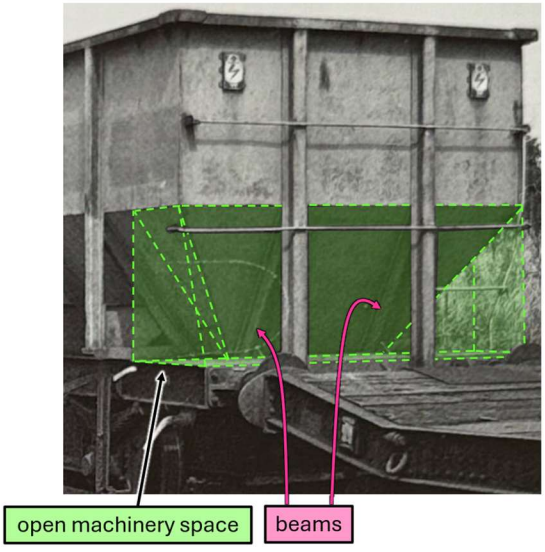


Gregg Co. Hopper Car (1922)



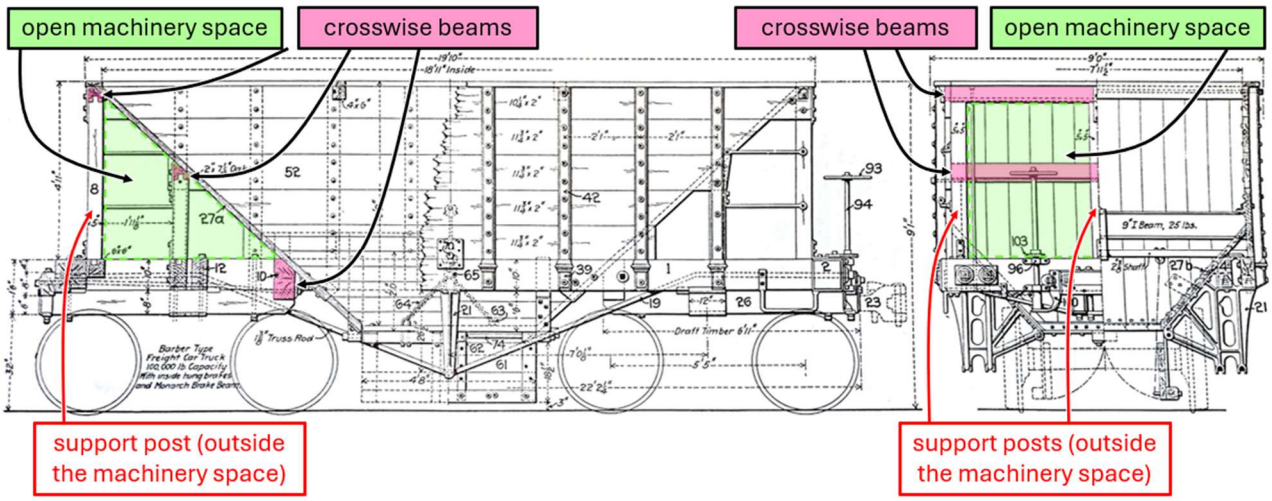


BR Shildon Hopper Car (1963)



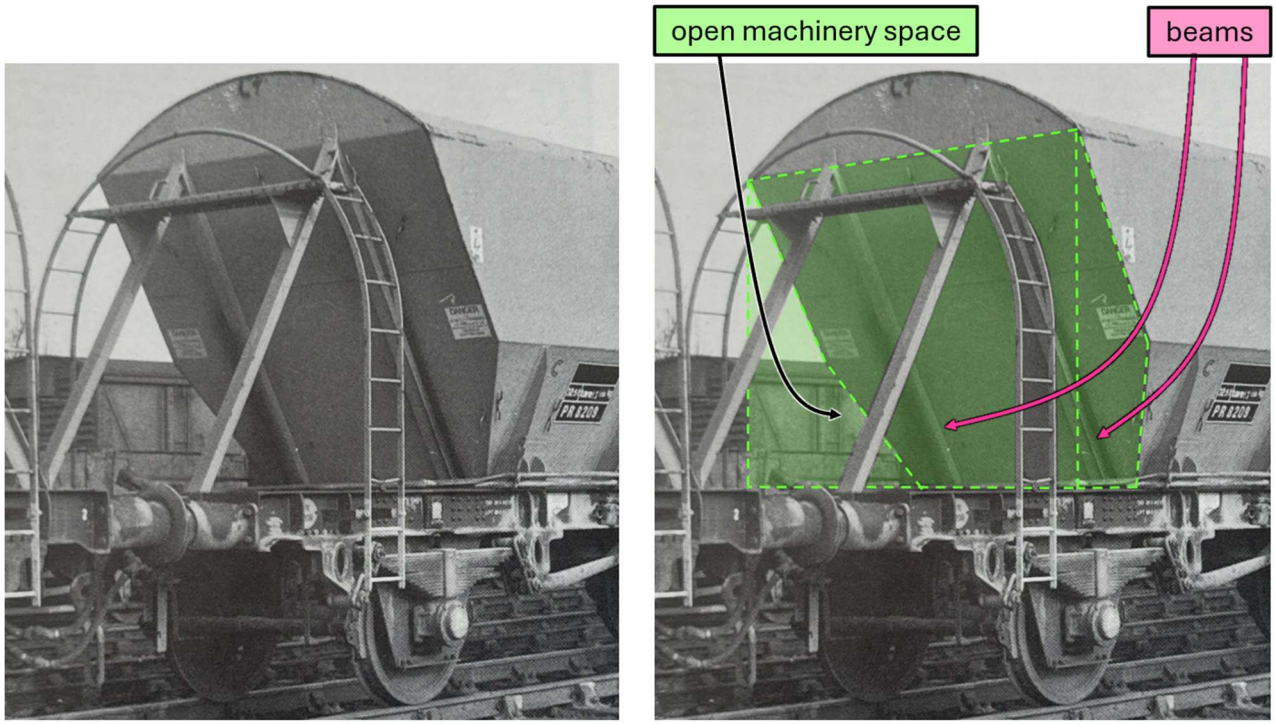
EX1010 at 208, Fig. 24 (Kilbourne & Jacobs); EX1011 at 1113, Fig. 2904 (Gregg);

EX1019 at 39 (BR Shildon).



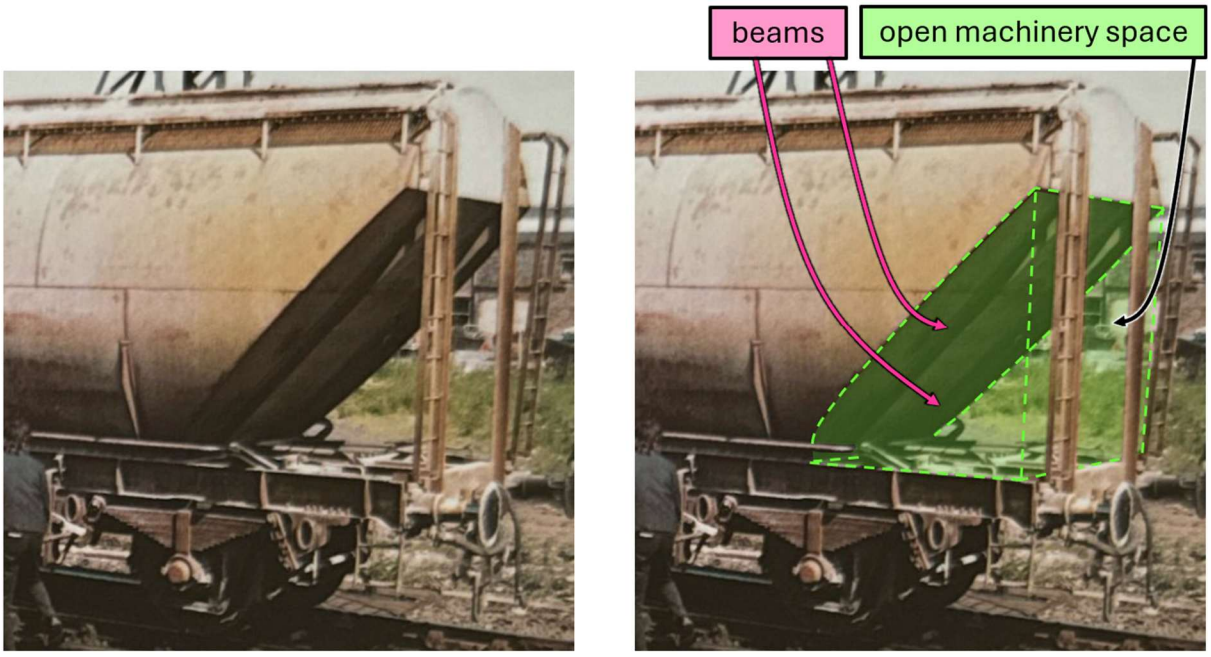
M&SP Ore Car – 1906 Cyclopedia

EX1009 at 118.



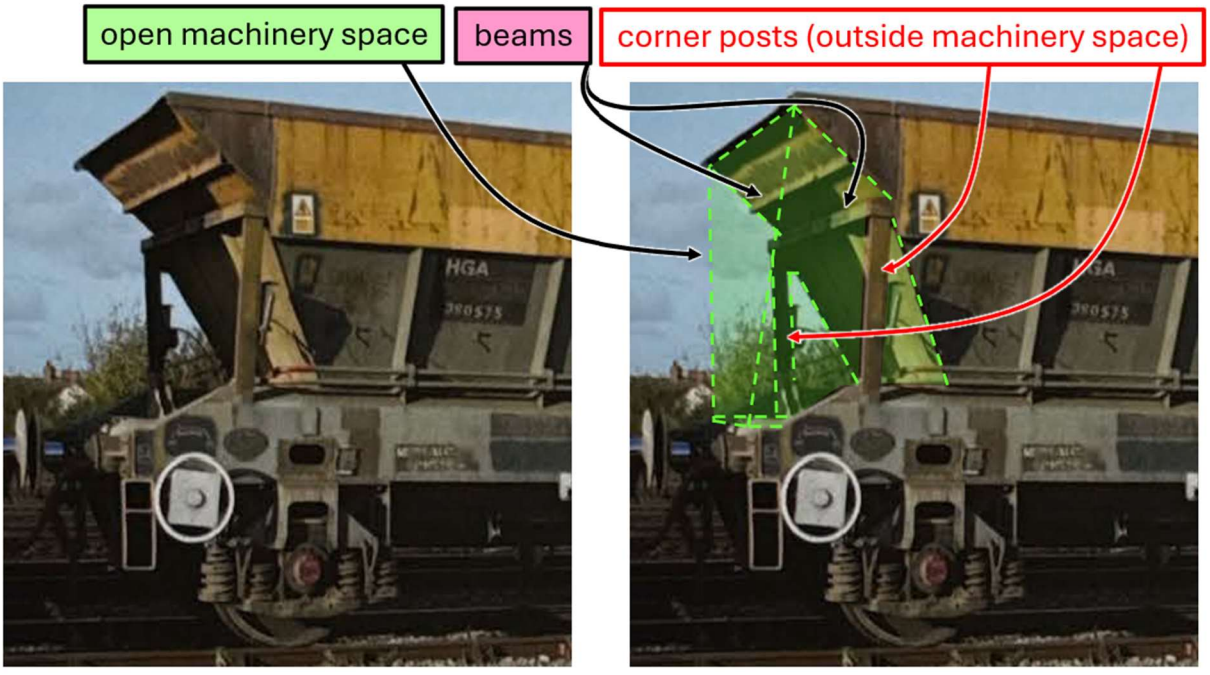
BP Chemicals Hopper Car (1971)

EX1020 at 62.



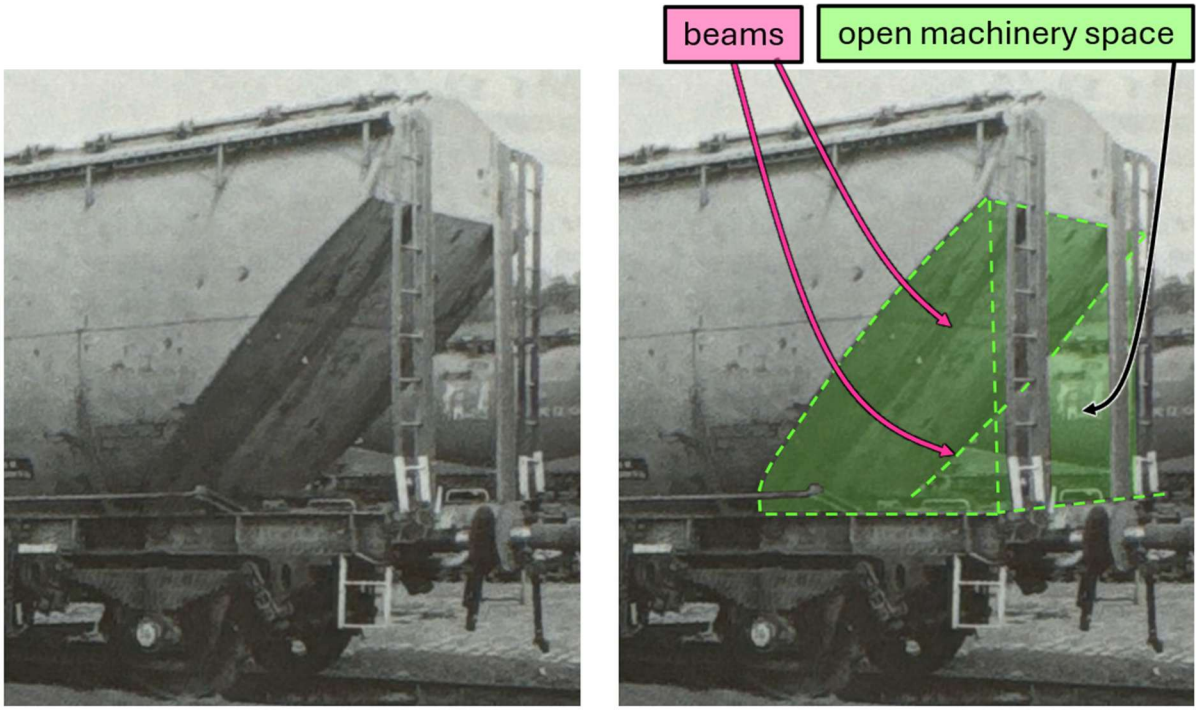
British Steel Hopper Car (1971)

EX1018 at 27.



Marcroft Hopper Car (1994 Conversion)

EX1021 at 55.



Steetley Hopper Car (1971)

EX1024 at 27. Finally, Hart also discloses a hopper car with crosswise beams and an open machinery space. EX1008. Hart is discussed in detail in the petition in IPR2025-01047.

D. Claim Construction

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

E. Reliance on Expert Analysis and Testimony

Expert testimony may help address the issues raised by this petition. Certain claim terms commonly used in the rail-car field require a brief explanation. In addition, because certain prior-art schematics are very old, expert testimony may help in interpreting them. Accordingly, this petition relies on expert analysis and testimony from Dr. Mehdi Ahmadian. EX1003.

F. Level of Ordinary Skill

The claims of the ’515 patent are directed to reinforcing and assuring the structural integrity of a railway hopper car. Accordingly, a person of ordinary skill in the art to which the ’515 patent pertains (POSITA) would have had at least a bachelor’s degree in a discipline related to mechanical engineering, physics, structural design, or an equivalent discipline, and at least two years of experience designing or analyzing rail cars or similar vehicles. EX1003 ¶¶ 43–47.

III. STATEMENT OF PRECISE RELIEF REQUESTED

A. Statutory Grounds for Cancellation

Petitioner requests that the Board cancel claims 1–44 of the ’515 Patent under 35 U.S.C. §§ 102 and 103 because they would have been obvious to a POSITA before their effective filing date.

B. Status of References as Prior Art

The following references are prior art under Pre-AIA 35 U.S.C. §102(a)/(b):

Exhibit No.	Description	Publication/Issue Date
EX1004	1946 Cyclopedia	Published in 1946
EX1005	Lindström	Issued January 12, 1915
EX1006	Wong	Issued July 17, 1990
EX1007	Coates	Published in 2006
EX1008	Hart	Issued May 16, 1911
EX1009	1906 Cyclopedia	Published in 1906
EX1010	1912 Cyclopedia	Published in 1913
EX1011	1922 Cyclopedia	Published in 1922
EX1012	Campbell ’051	Issued May 5, 1925
EX1013	Campbell ’652	Issued April 30, 1935
EX1014	Schuller	Issued January 16, 1973
EX1015	Smith	Issued September 14, 1982
EX1016	Karig	Published in 2007
EX1017	Ratcliffe 1	Published in 1989
EX1018	Ratcliffe 2	Published in 2009
EX1019	Larkin 1	Published in 2008
EX1020	Larkin 2	Published in 2001
EX1021	Buck	Published in 2008
EX1024	Marshall	Published in 1989

EX1018 and EX1019 were publicly available in December 2008 and therefore constitute prior art under pre-AIA 35 U.S.C. § 102(a). EX1022. The remaining exhibits listed above are prior art under pre-AIA 35 U.S.C. § 102(b) because their issue or publication date is more than a year before **September 11, 2009**, the earliest possible effective filing date of the '515 patent. *Id.* These references constitute analogous art because they are from the same field of endeavor as the '515 patent: rail car design. *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1000 (Fed. Cir. 2016). They are also reasonably pertinent to a particular problem with which the inventor was involved: improving and strengthening railway hopper cars. *Id.* Accordingly, a POSITA is presumed to have been aware of these references. *In re Nilssen*, 851 F.2d 1401, 1403 (Fed. Cir. 1988).

The examiner did not consider any prior-art reference listed above. *See* EX1002; EX1001 at 1–2.

IV. SPECIFIC PROPOSED GROUNDS FOR UNPATENTABILITY

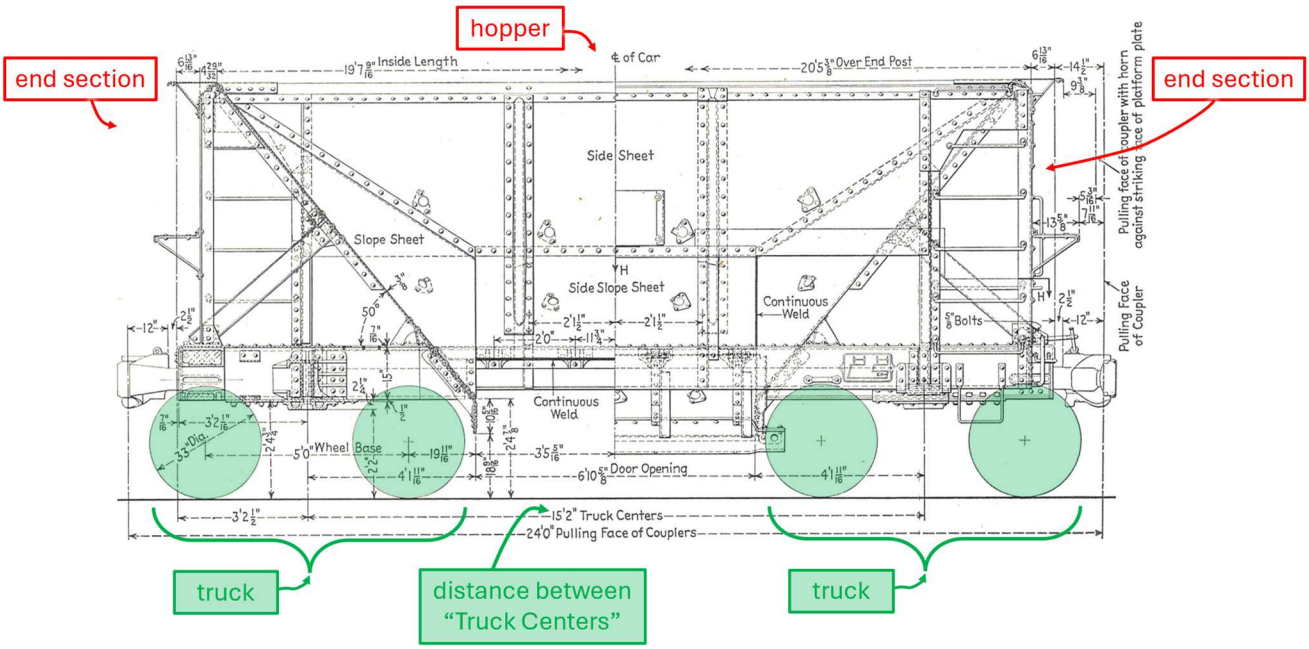
Claims 1–44 of the '515 patent would have been obvious in view of the prior art. The references discussed below disclose every limitation of these claims, though not always using identical terminology. *See In re Bond,* 910 F.2d 831, 832 (Fed. Cir. 1990) (disclosure need not be *ipsissimis verbis*).

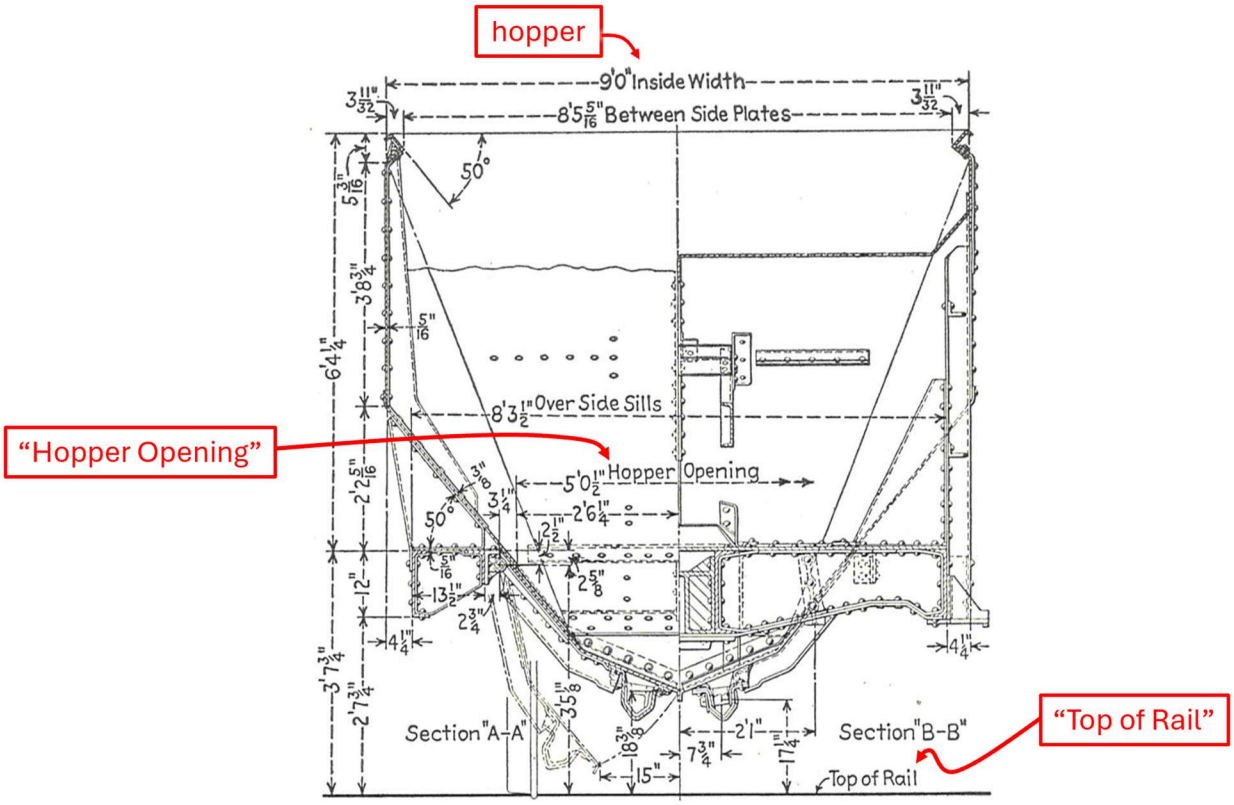
A. Ground 1: Claims 1-2, 5-6, 20, and 23 are obvious over the 1946 Cyclopedia and either Coates or the 1922 Cyclopedia.

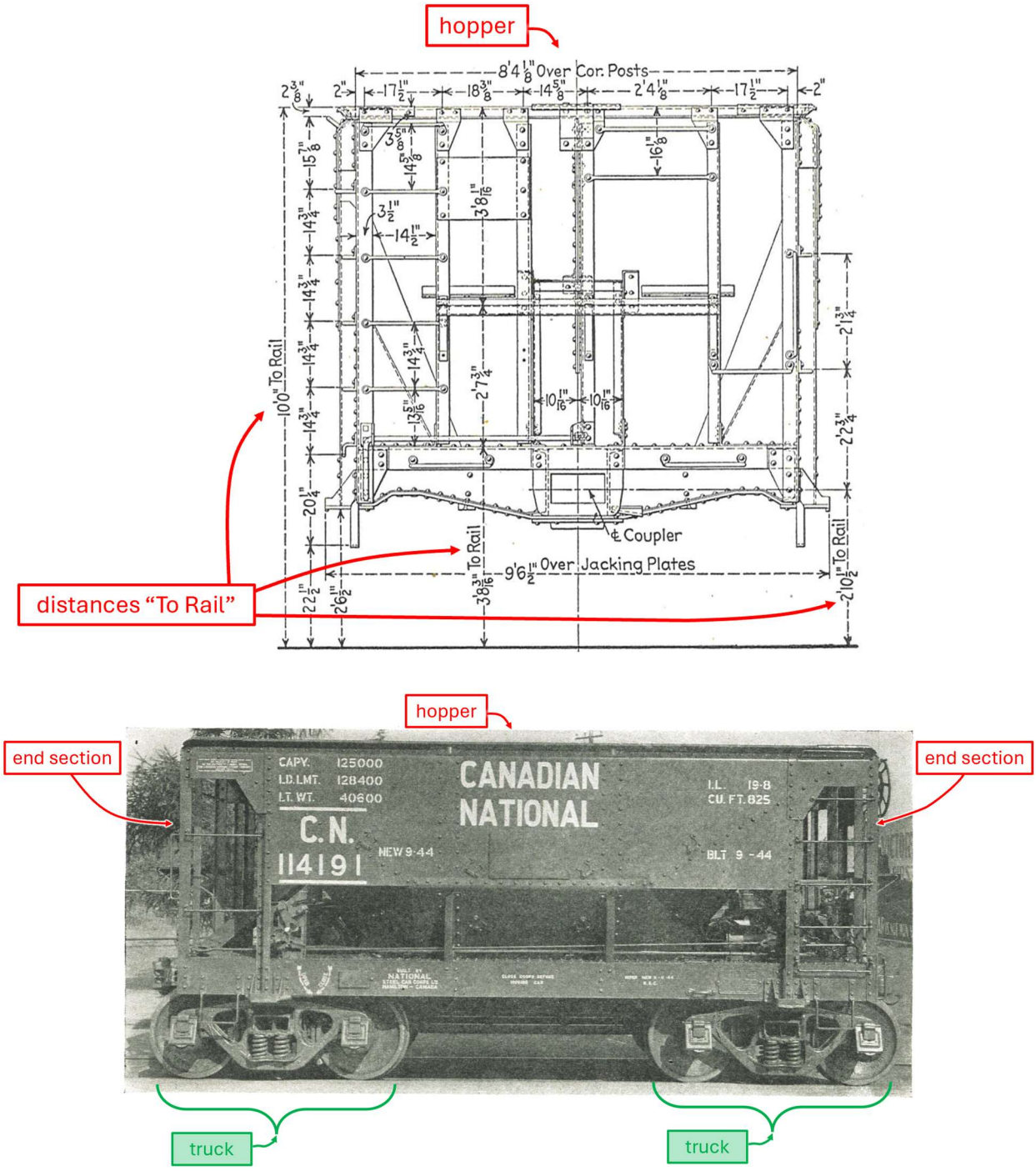
1. Independent Claim 1

a. [1a] "A railroad hopper car for carrying particulate material, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,"

The 1946 Cyclopedia's NSC ore car discloses this limitation. Regarding the "railroad hopper car for carrying particulate material," the 1946 Cyclopedia includes the NSC ore car in a section called "Freight Cars: Hopper Ore" and describes the car as an "ore car" for "mining operations." EX1004 at 294–95. As shown below, the NSC ore car has a hopper suspended between two end sections carried by two trucks. *Id.* The trucks are "for rolling motion along railroad tracks in a longitudinal direction," evidenced by its presence in a reference book on railroad cars, in the section on "hopper ore" cars; that book's description of the car as a "center discharge ore car"; and references in the drawings to the rails. *Id.*


hopper
end section
end section
Side Sheet
Slope Sheet
Side Slope Sheet
Continuous Weld
Continuous Weld
Pulling face of coupler with horn against striking face of platform plate
Pulling Face of Coupler
5" Bolts
5'0" Wheel Base
6'10⅝" Door Opening
15'2" Truck Centers
24'0" Pulling Face of Couplers
truck
distance between "Truck Centers"
truck


hopper
9'0" Inside Width
8'5 5/16" Between Side Plates
8'3 1/2" Over Side Sills
"Hopper Opening"
5'0 1/2" Hopper Opening
Section "A-A"
Section "B-B"
Top of Rail
"Top of Rail"

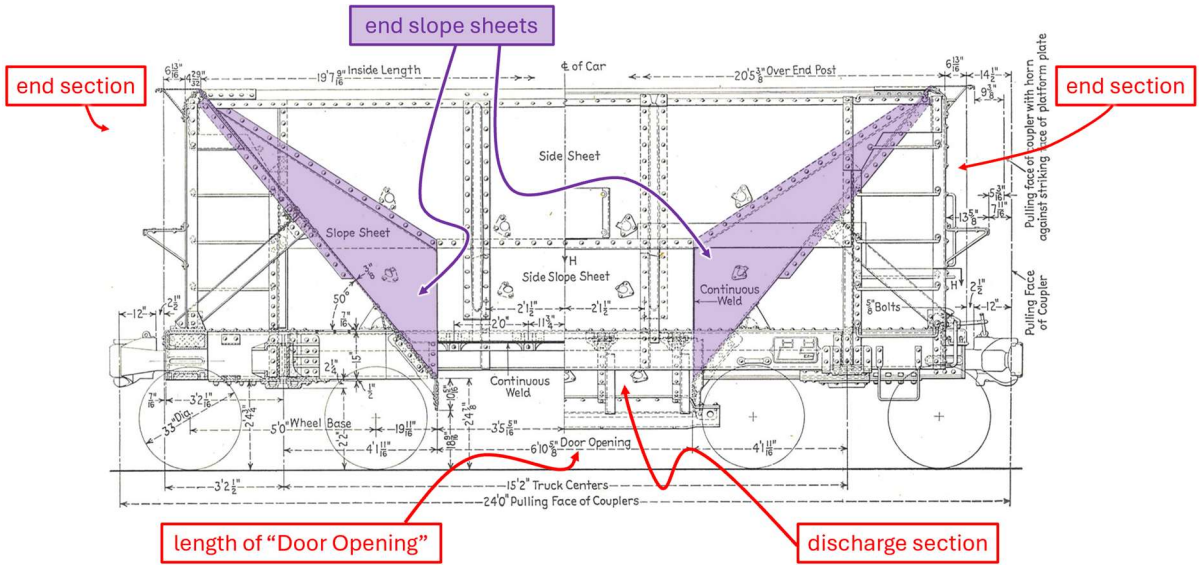

hopper
8'4 1/8" Over Cor. Posts
10'0" To Rail
distances "To Rail"
℄ Coupler
9'6 1/2" Over Jacking Plates
3'3 3/16" To Rail
2'10 1/2" To Rail
hopper
end section
end section
CAPY. 125000
L.D.LMT. 128400
L.T. WT. 40600
CANADIAN
NATIONAL
I.L. 19-8
CU. FT. 825
C.N.
114191
NEW 9-44
BLT 9 -44
truck
truck

Id.

b. [1b] "said hopper having a discharge section through which to release lading, and first and second end slope sheets oriented toward said first and second end sections, said end slope sheets being inclined in the longitudinal direction to feed said discharge section;"

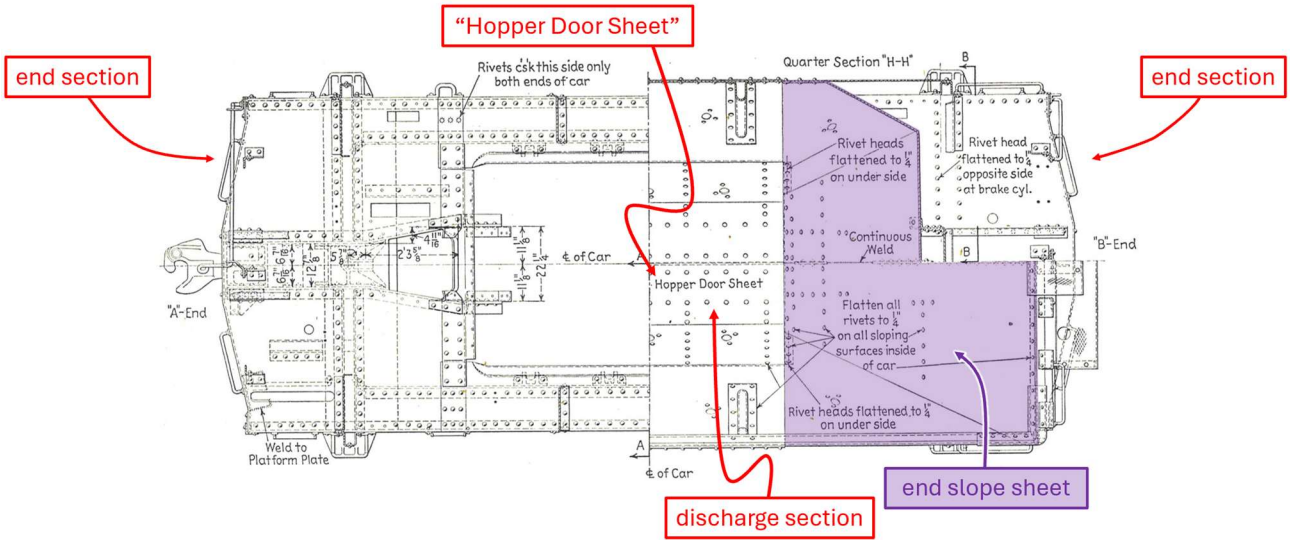
The 1946 Cyclopedia's NSC ore car discloses this limitation. The reference describes the NSC car as a "center discharge" ore car, calls out the length of a "Door Opening" at the bottom of the hopper, and shows a hopper door in open and closed positions. EX1004 at 294. The 1946 Cyclopedia also calls out an end slope sheet ("Slope Sheet"). *Id.* Regarding the discharge section "through which to release lading," the 1946 Cyclopedia describes the NSC ore car as a "center discharge" ore car for "mining operations." *Id.* at 294–95.

The left half of the side-view drawing below is a sectional view. EX1003, ¶61. Consequently, the portion of the end slope sheet shown there is the portion farther from the reader. *Id.* The right half of the drawing below is a side view and shows the discharge section and the portion of the end slope sheet that is closer to the reader. *Id.* The NSC ore car is symmetrical about its longitudinal and lateral axes, allowing it to be accurately depicted by a drawing showing a half or even a quarter of the car. *Id.*



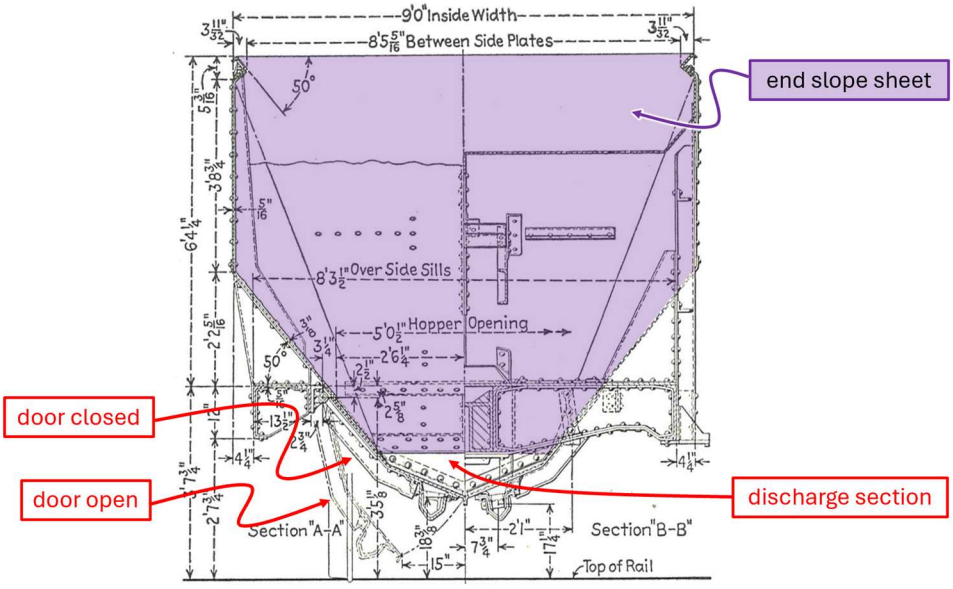
EX1004 at 294.

The left half of the top-view drawing below is a sectional view (from above) showing the structure of the ore car's lower frame or undercarriage. EX1003, ¶62. The right half of the drawing is divided into two parts. *Id.* The upper right quarter of the drawing is a sectional view (from above) in which the ore car is sectioned approximately midway between the undercarriage and the top of the car, along line H-H. *Id.* The lower right quarter is a top view of the rail car. *Id.* That top view shows half of one of the two end slope sheets. *Id.* It also includes a top view of the discharge section, and calls out the "Hopper Door Sheet."



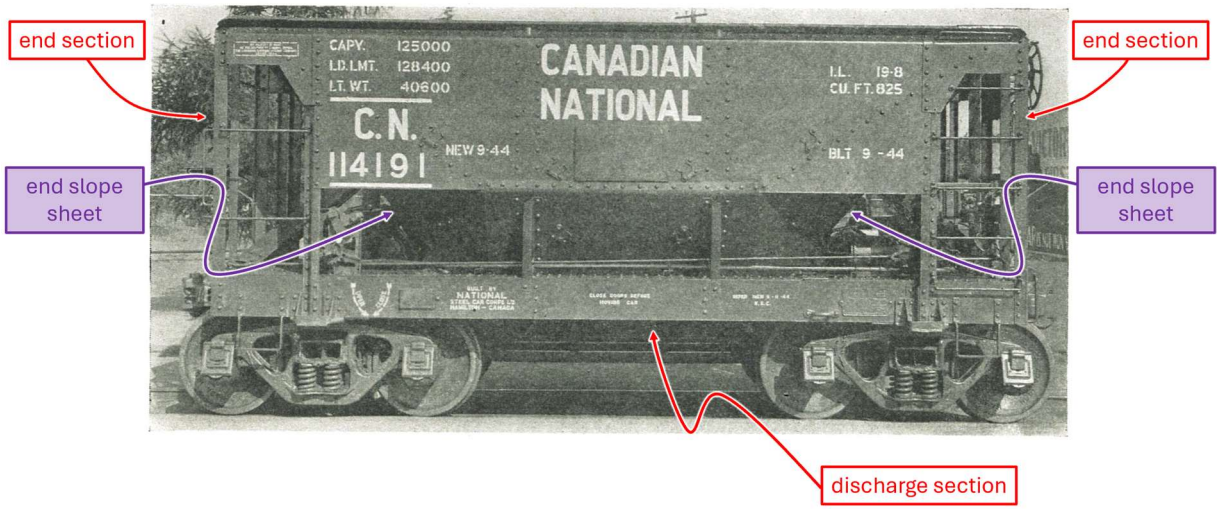
EX1004 at 294.

The left and right halves of the end-view drawing below are sectional views along lines A-A and B-B, respectively. EX1003, ¶ 63. An end slope sheet is shown in each of these views. The left half of the drawing shows an inside-the-hopper view of a portion of the end slope sheet that is farther from the reader. *Id.* In the right half of the drawing, the top part shows an inside-the-hopper view of a portion of the end slope sheet that is farther from the reader, and the part below that shows an outside-the-hopper view of a portion of the end slope sheet that is closer to the reader. *Id.*



EX1004 at 294; EX1003, ¶ 63.

The 1946 Cyclopedia also contains a photograph of the NSC ore car, shown below, which shows the car's end slope sheets and discharge section.

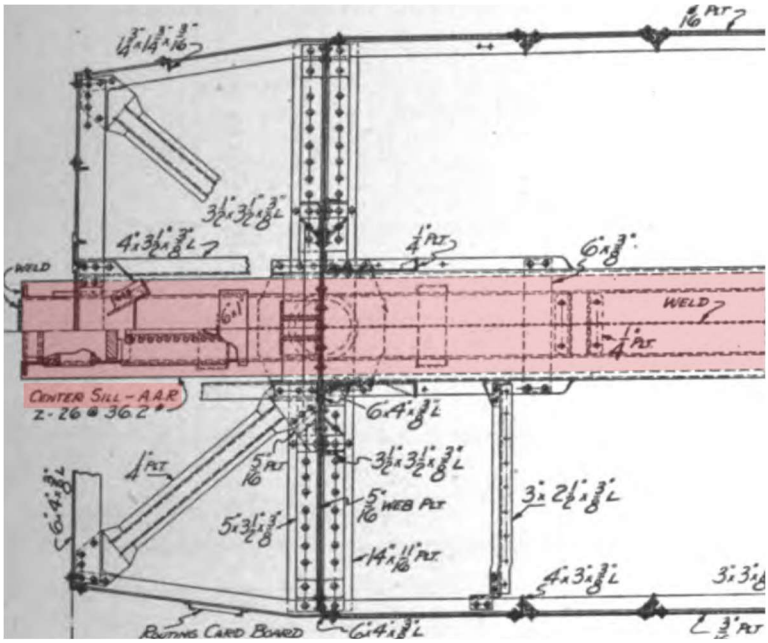


EX1004 at 295.

c. [1c] "said first end section including a draft sill extending in the longitudinal direction, a main bolster extending crosswise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;"

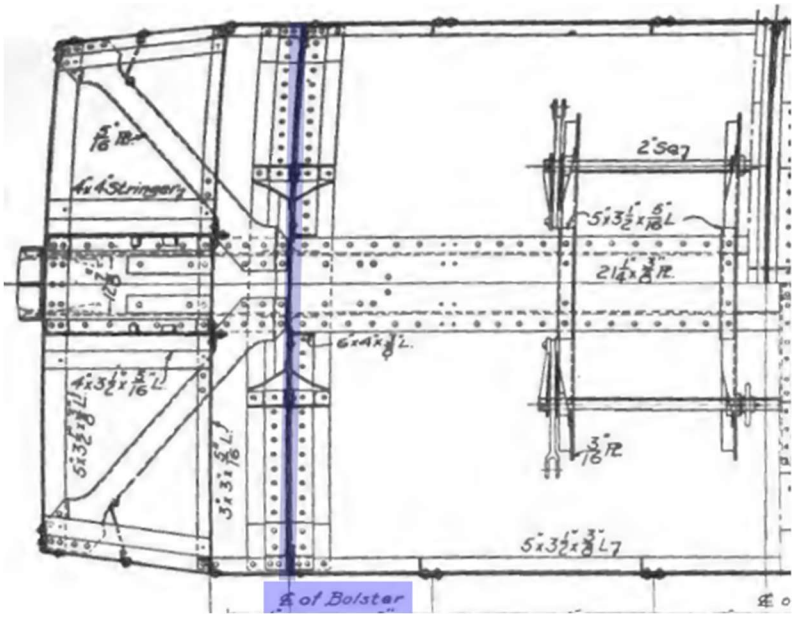
The 1946 Cyclopedia's NSC ore car discloses this limitation. A POSITA would understand what is meant by the claim terms "bolster," "draft sills," and "shear plate," as these are standard features on rail cars. EX1003, ¶ 64.

The '515 patent expressly defines "draft sill": "In the terminology of the industry, the portion of the center sill 44 (be it a stub center sill or a straight through center sill) that lies longitudinally outboard of the truck center … may also be referred to as the draft sill." EX1001 at 14:36–39. "Center sill" and "bolster" are not defined in the '515 patent, but 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 reference identifies the center sills in certain drawings, including the following:



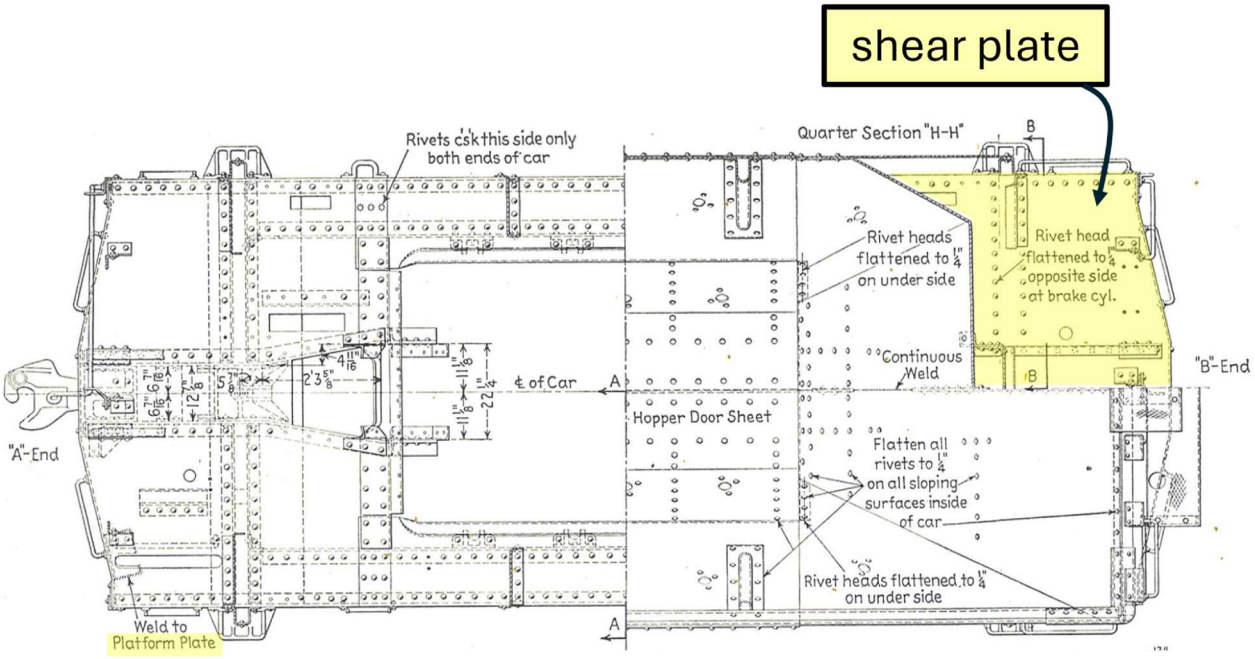
Id. at 404 (color added).

The 1946 Cyclopedia defines "bolster" as "[a] cross member on the under side of a car body and in the center of a truck, through which the weight is transmitted." *Id.* at 16. It also discloses examples of bolsters, including by calling out the centerline of a bolster ("℄ of Bolster") in the following diagram:

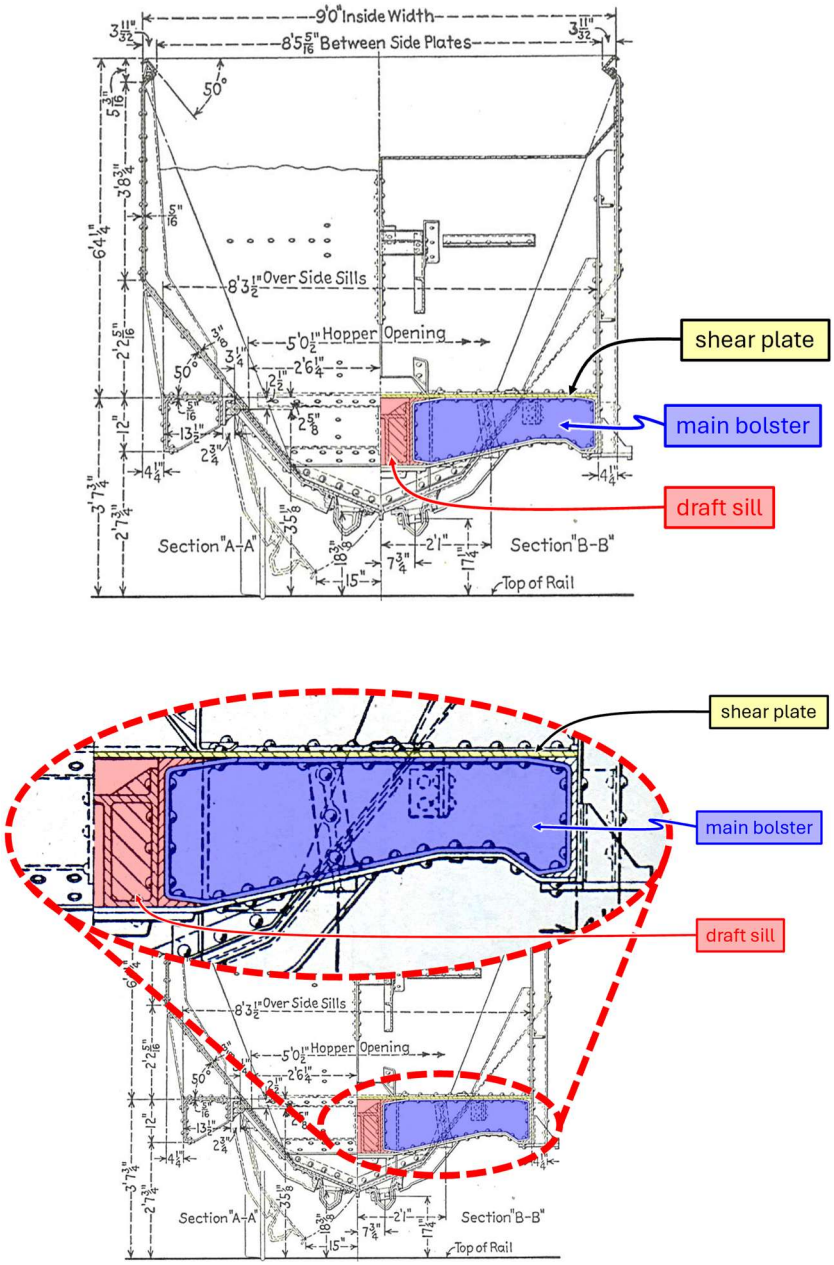


Id. at 293 (color added).

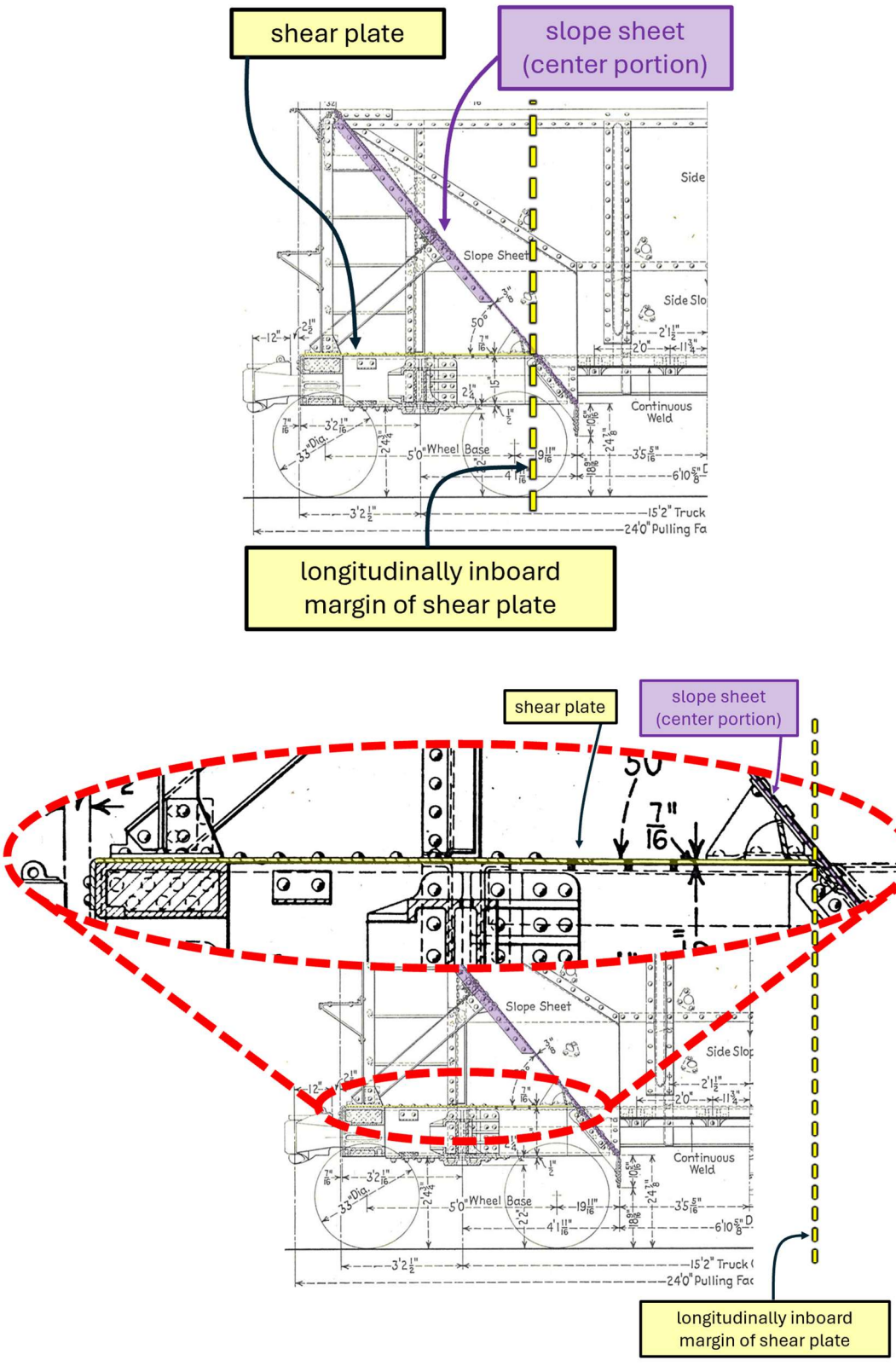
The 1946 Cyclopedia's NSC ore car discloses the claimed shear plate. The shear plate on one end of the car is partially shown in top sectional view H-H. *Id.* at 294; EX1003, ¶ 65. The view presented in the left half of the drawing refers to the shear plate as the "Platform Plate."



View H-H above—which shows only one side of the "B end" of the car—shows that the shear plate extends laterally from one side of the car to the other side. This is confirmed by end sectional view B-B below. There the shear plate is shown as a layer directly on top of the main bolster and the draft sill, riveted to the bolster, and extending from one side of the car to the other. EX1003, ¶ 65.

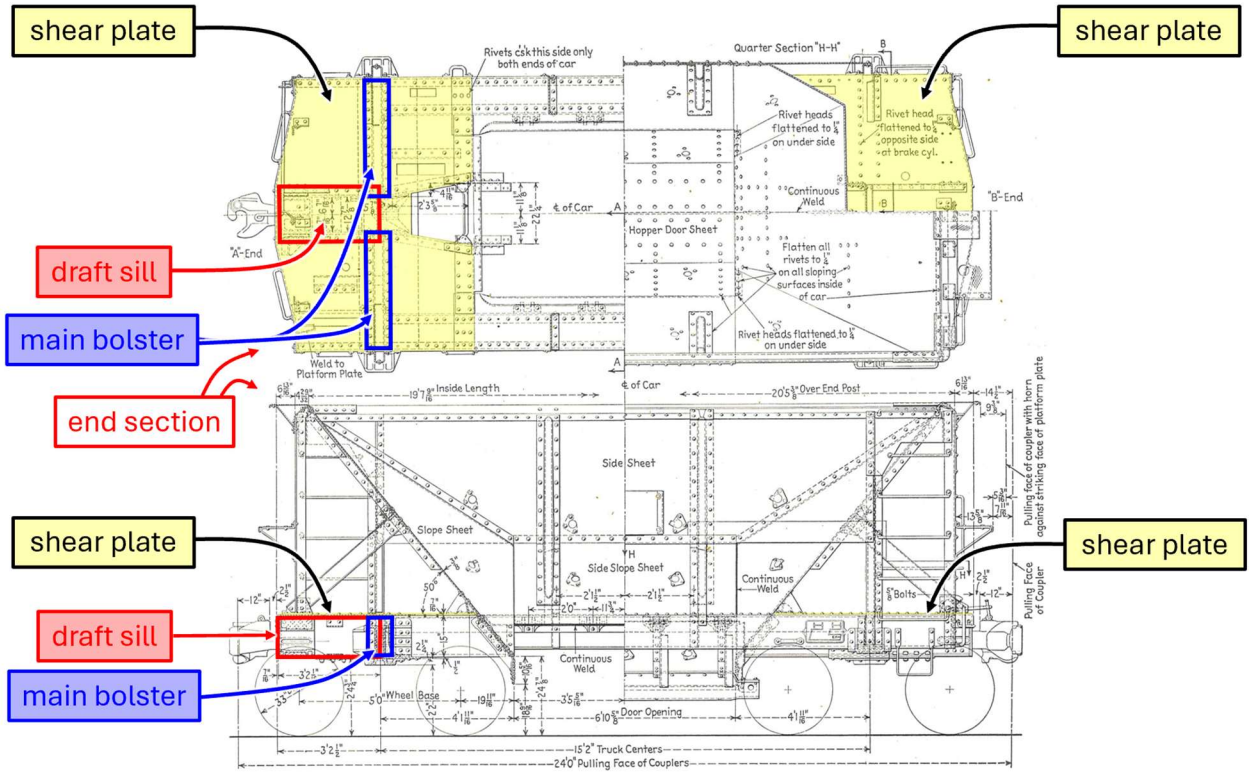


EX1004 at 294. The longitudinal extent of the shear plate may be seen in the sectional side view presented in the left half of the drawing below. The shear plate extends inward from the end of the draft sill (at the left of the image) to the point where it meets the downwardly extending slope sheet. EX1003, ¶ 65.



EX1004 at 294.

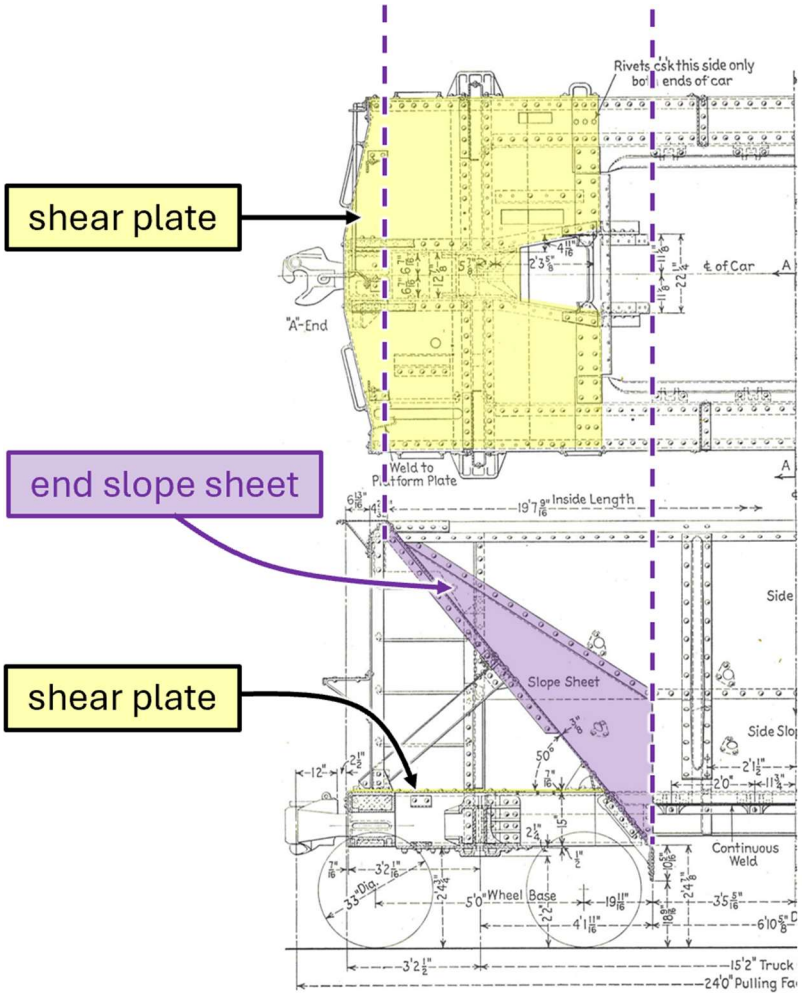
Identifying the lateral and longitudinal margins of the shear plate demonstrates that the 1946 Cyclopedia's NSC ore car discloses limitation [1c], as shown below.



Id.

d. [1d] "said first end slope sheet of said hopper over hanging said shear plate of said first end section; and"

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

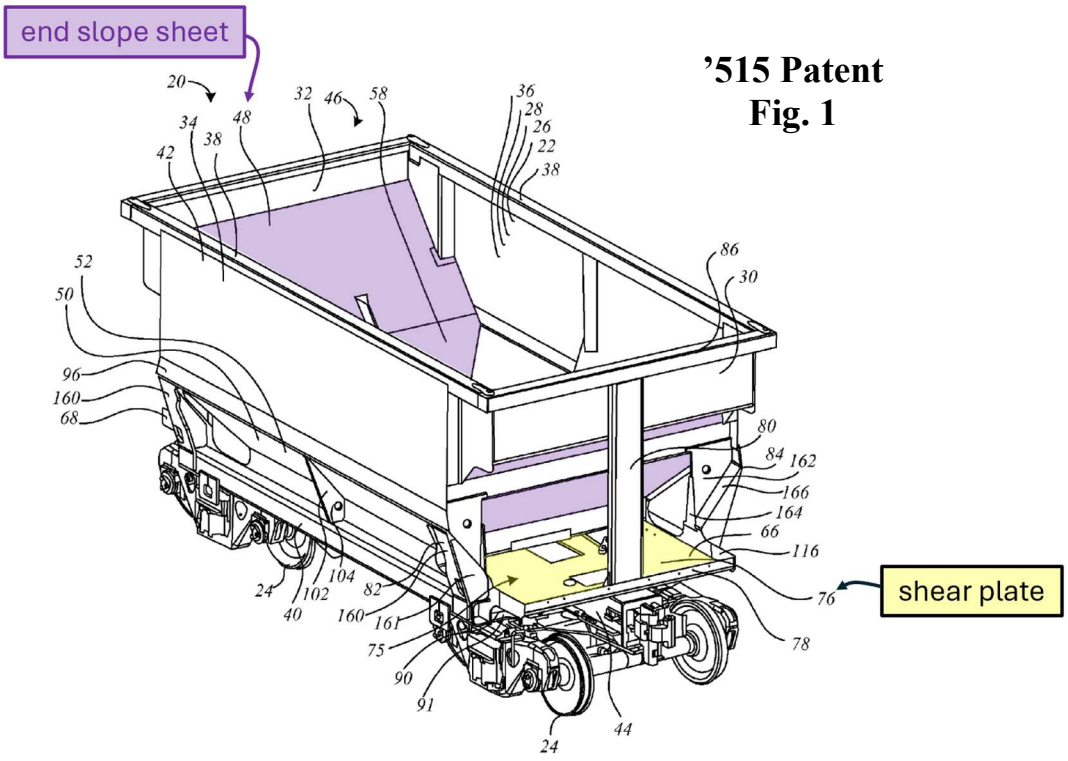


Id.; EX1003, ¶ 66.

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

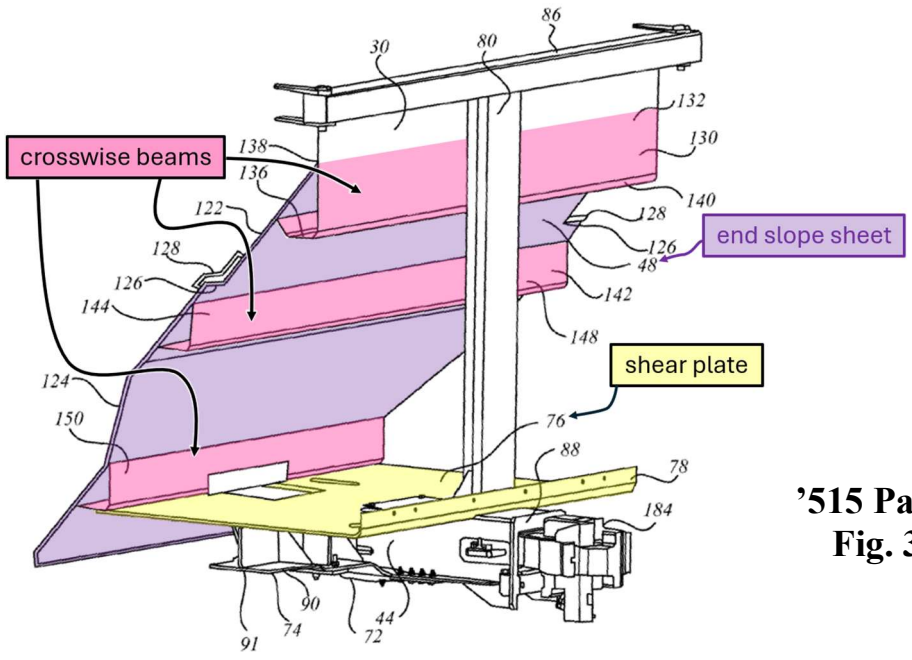
The 1946 Cyclopedia's NSC ore car, as modified in view of either Coates or the 1922 Cyclopedia's Gregg ore car, discloses this limitation.

The '515 patent discloses only one embodiment, shown in Fig. 1 below. EX1001 at 10:48–11:24 (stating that all figures show the Fig. 1 car).



'515 Patent
Fig. 1

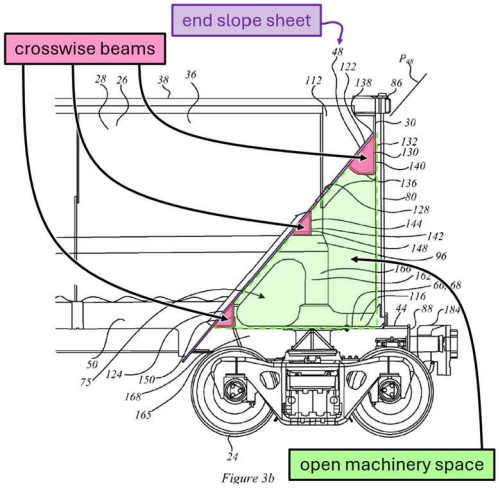
EX1001, Fig. 1. As shown below, the sole embodiment of the '515 patent has three support beams that extend crosswise along the underside of the slope sheet.



'515 Patent
Fig. 3a

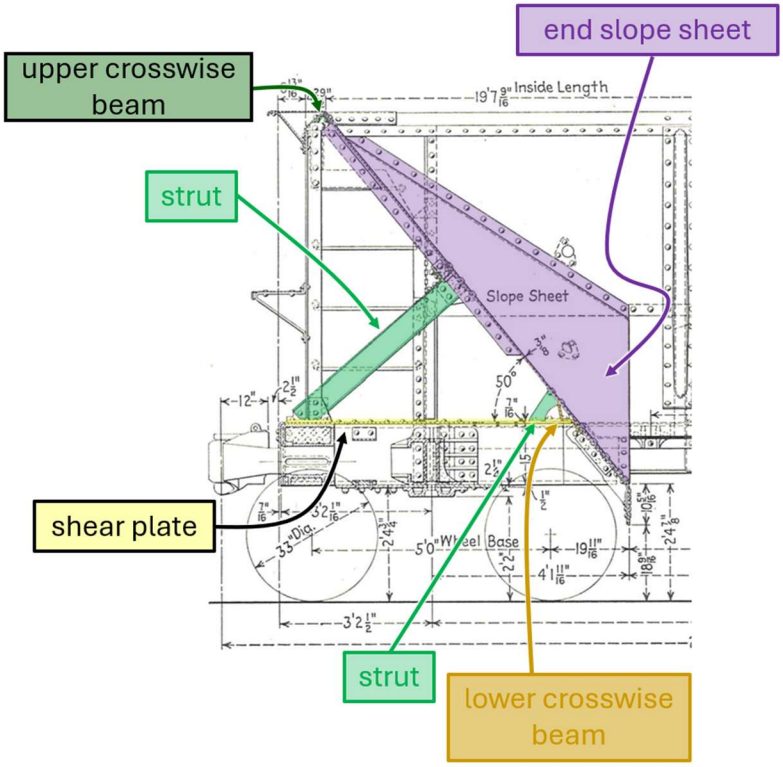
EX1001 Fig. 3a.

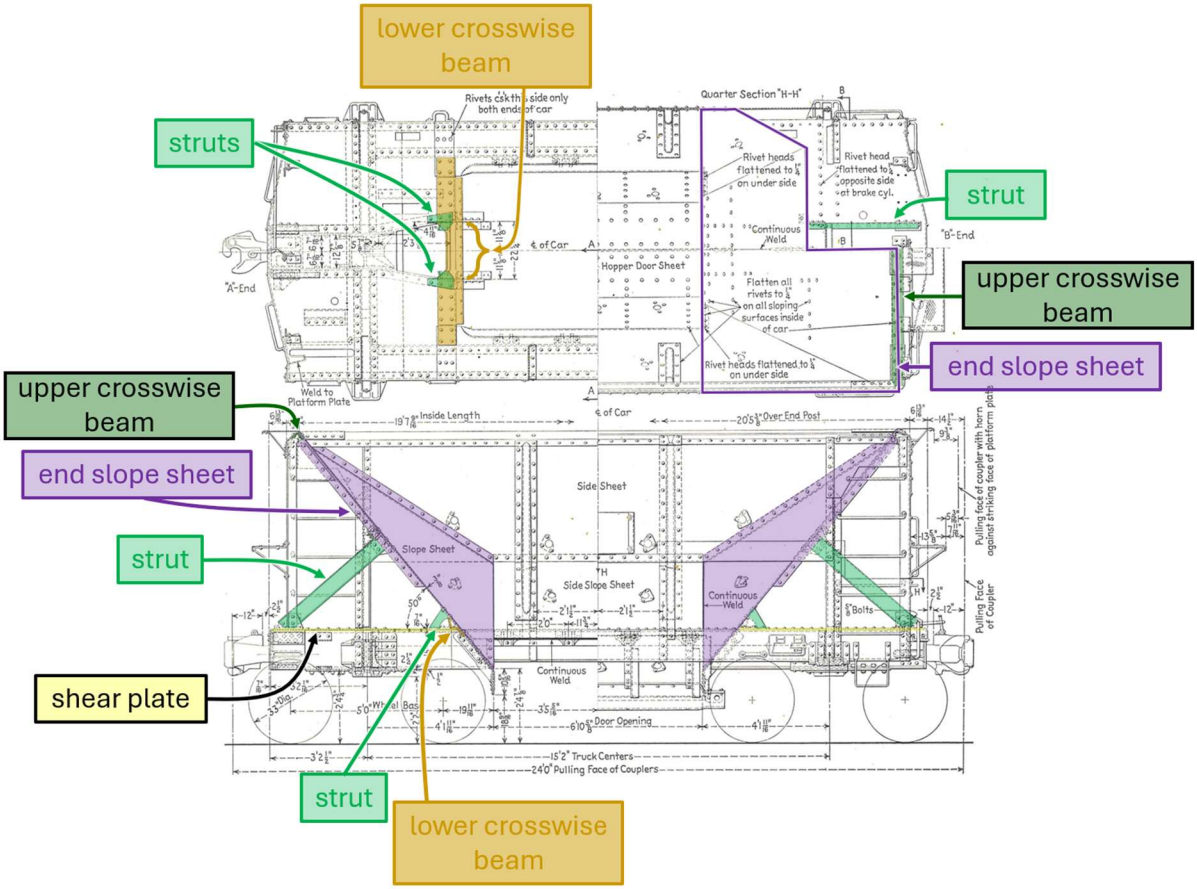
Limitation 1e requires a hopper car "free of primary structure" directly over the shear plate and under the slope sheet. *Id.*, Claim 1. The three support beams in the '515 patent embodiment are in that space, as shown below in Fig. 3b.

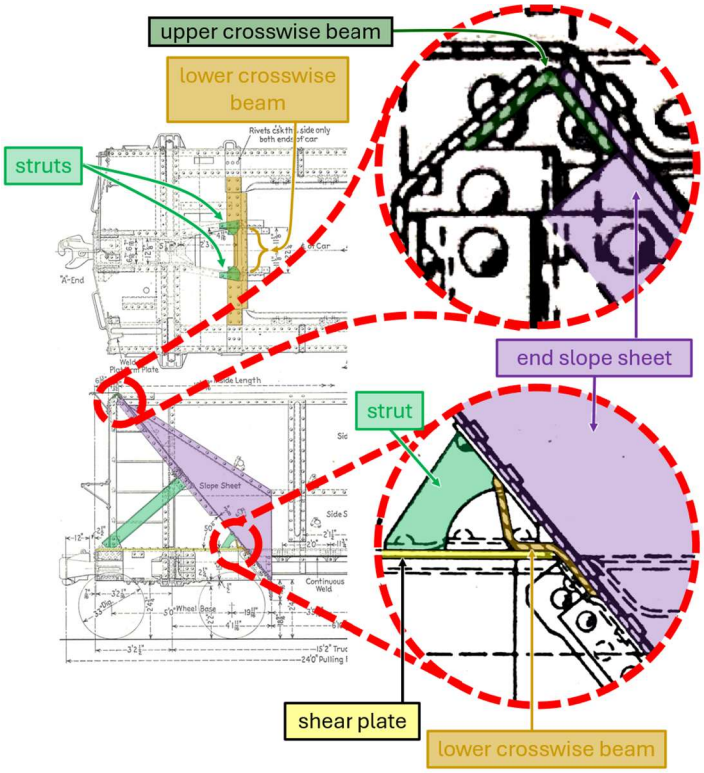


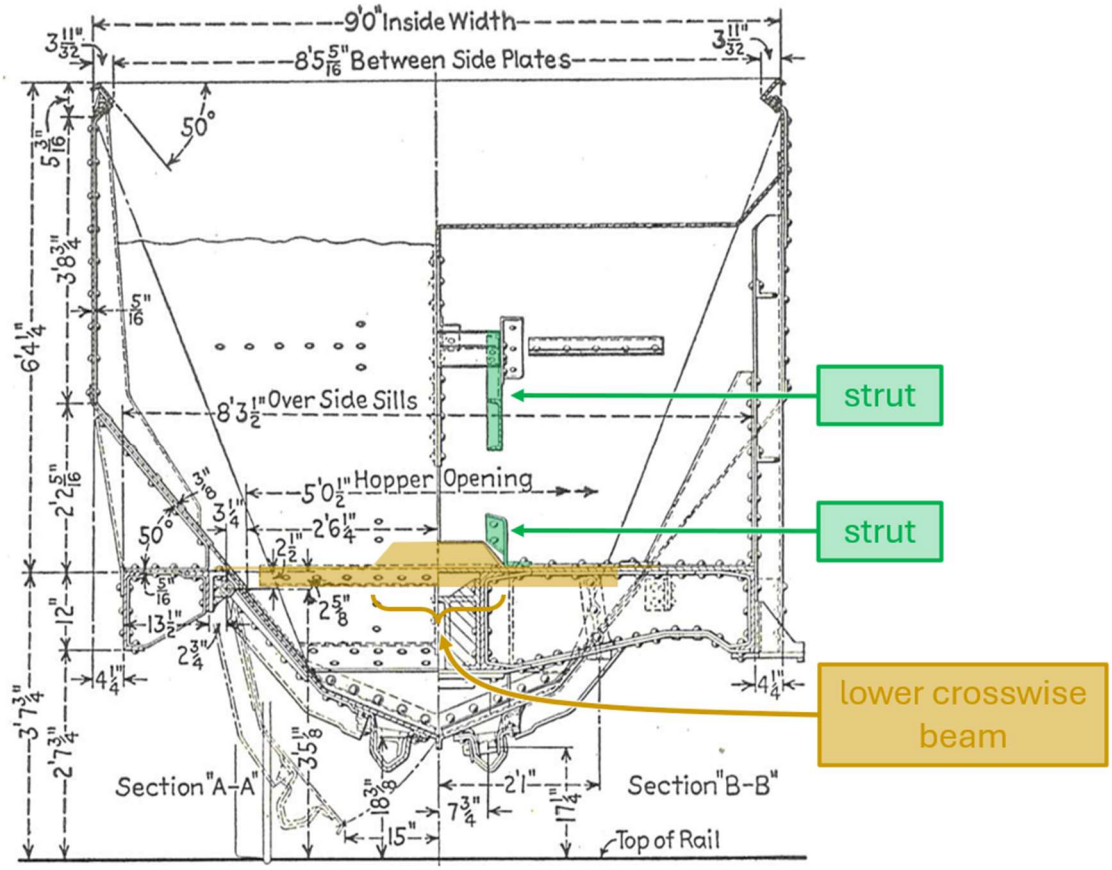
Id., Fig. 3b. Because Claim 1 must cover the only embodiment disclosed in the '515 patent's specification, either (i) the three crosswise beams under the slope sheet are not primary structure, or (ii) their presence on the underside of the slope sheet does not prevent the defined space from being "free of primary structure." Either way, Claim 1 must cover hopper cars with beams that extend along the underside of the slope sheet. EX1003, ¶ 67.

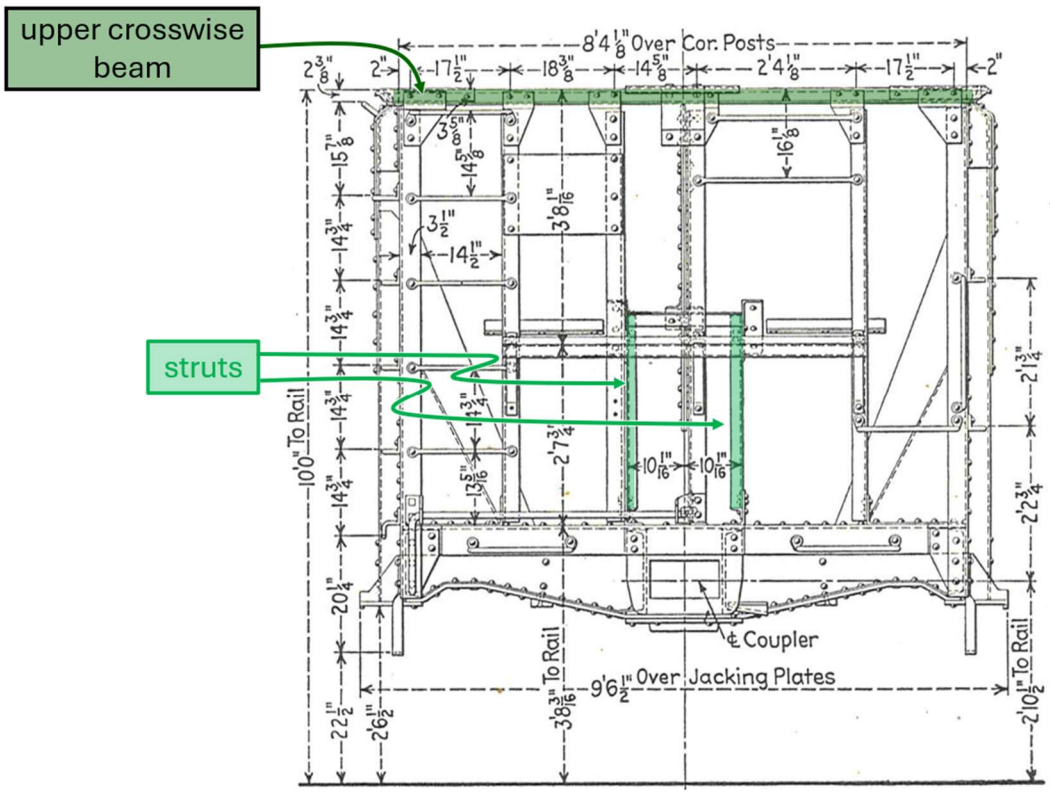
In the NSC ore car disclosed in the 1946 Cyclopedia, the slope sheet is supported by a crosswise beam at the upper end of the slope sheet, a crosswise beam at the lower end of the slope sheet, two large struts positioned at a right angle to the slope sheet, and two small struts positioned near the bottom of the slope sheet. EX1004 at 294.


end slope sheet
upper crosswise beam
strut
Slope Sheet
shear plate
strut
lower crosswise beam


lower crosswise beam
struts
strut
upper crosswise beam
end slope sheet
upper crosswise beam
end slope sheet
strut
Side Sheet
Slope Sheet
Side Slope Sheet
shear plate
strut
lower crosswise beam


upper crosswise beam
lower crosswise beam
struts
end slope sheet
strut
shear plate
lower crosswise beam

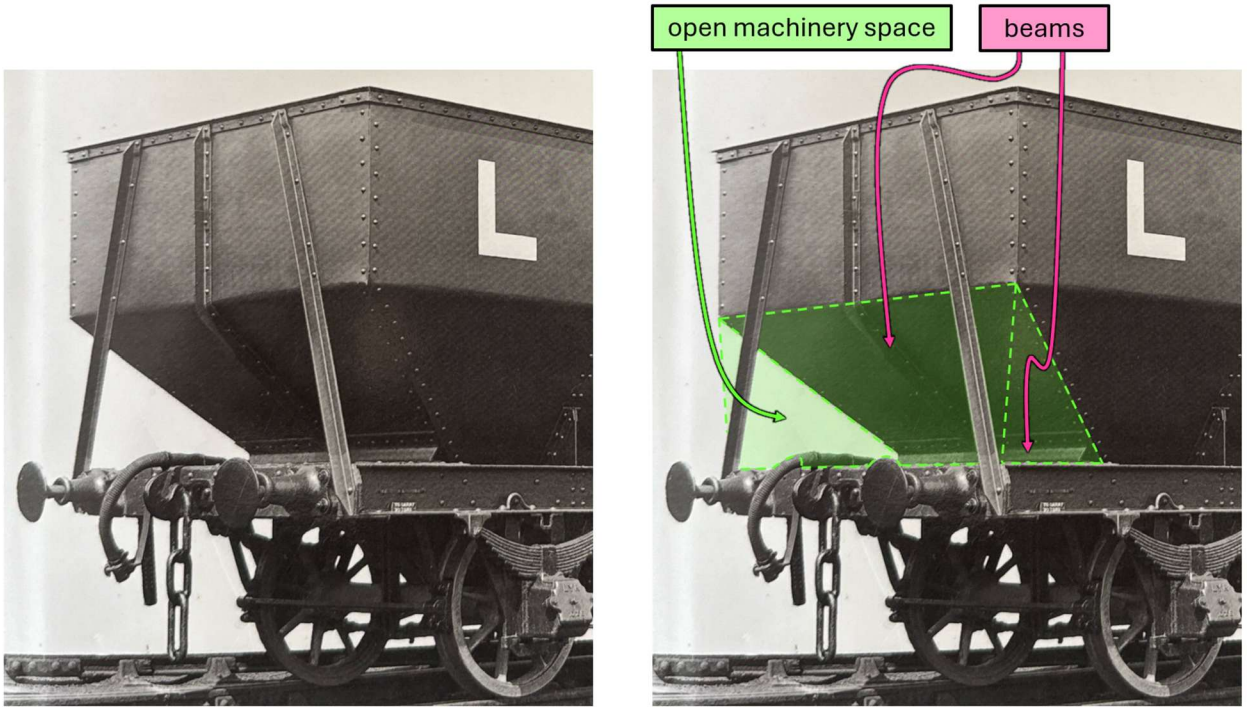

9'0" Inside Width
8'5 5/16" Between Side Plates
50°
8'3 1/2" Over Side Sills
5'0 1/2" Hopper Opening
2'6 1/4"
strut
strut
lower crosswise beam
Section "A-A"
Section "B-B"
Top of Rail



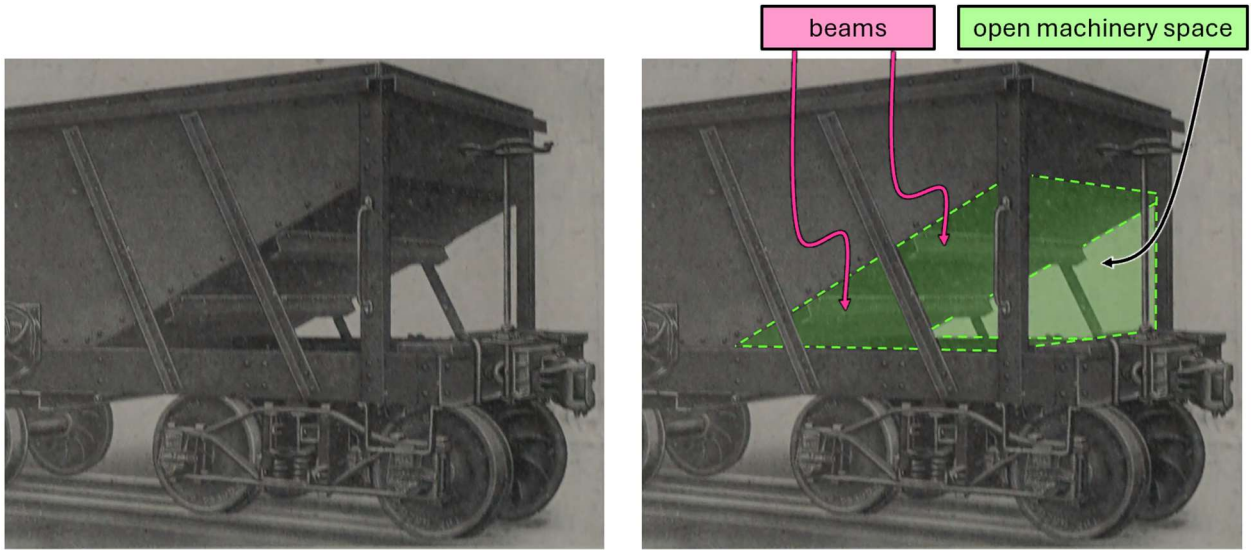
EX1004 at 294; EX1003, ¶ 68.

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

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



EX1007 at cover, 265.



EX1011 at 1113, Fig. 2904.

It would have been obvious to a POSITA to support the NSC ore car's slope sheet only with beams, as in the Gregg ore car or the L&Y hopper car, by replacing

the struts with one or more additional crosswise beams. EX1003, ¶ 70. A POSITA would have thought to substitute crosswise beams for the struts in the NSC ore car because, firstly, only a finite number of structural components can reinforce a hopper car slope sheet. *Id.* Specifically, slope sheets are supported by (1) struts; (2) longitudinally oriented plates, such as "elephant ears"; (3) crosswise plates, *e.g.*, EX1004 at 266; (4) longitudinally oriented beams; and/or (5) crosswise beams. EX1003, ¶ 70. In 2009, using any of these alternatives for supporting the slope sheet would have been obvious. *Id.*

In addition, Coates suggests using beams to support the slope sheets in the NSC ore car. *Id.* Coates teaches that space is at a premium in hopper cars, and consequently that brake equipment should be mounted on the platform created by one of the shear plates: "Such was the premium on space that the vacuum cylinder and reservoir had to be mounted on the end of one platform…." EX1007 at 261; EX1003, ¶ 70. This suggests using beams to support the slope sheet, as in the L&Y hopper car, as doing so would maximize space for machinery such as the brake reservoir or equipment for operating the hopper doors. EX1003, ¶ 70.

Finally, the choice between crosswise and longitudinal beams would have been a matter of design choice for a POSITA. *Id.* To a skilled artisan, either option would have been obvious to try, but the simplest (and therefore most obvious) option

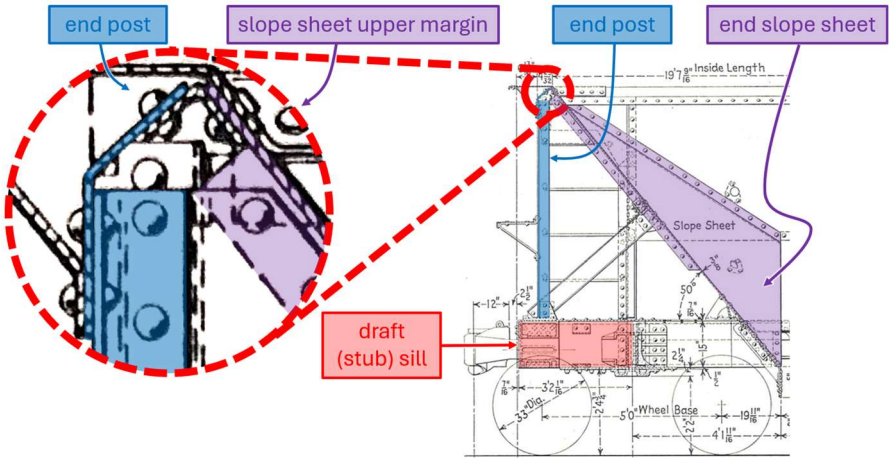
would have been to place a third crosswise beam intermediate the upper and lower crosswise beams. *Id.*

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

The 1946 Cyclopedia's NSC ore car, modified to replace the struts with one or more additional crosswise support beams, would satisfy limitation [1e].

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

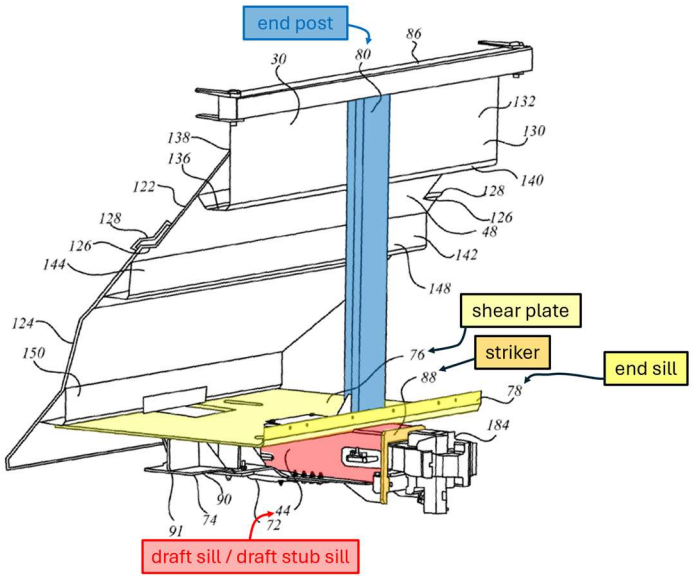
The 1946 Cyclopedia's NSC ore car discloses option (a) of this limitation, as shown below. That is, its end post extends upwardly from the draft sill to the upper margin of the end slope sheet. EX1004 at 294; EX1003, ¶ 72.



EX1004 at 294.

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

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



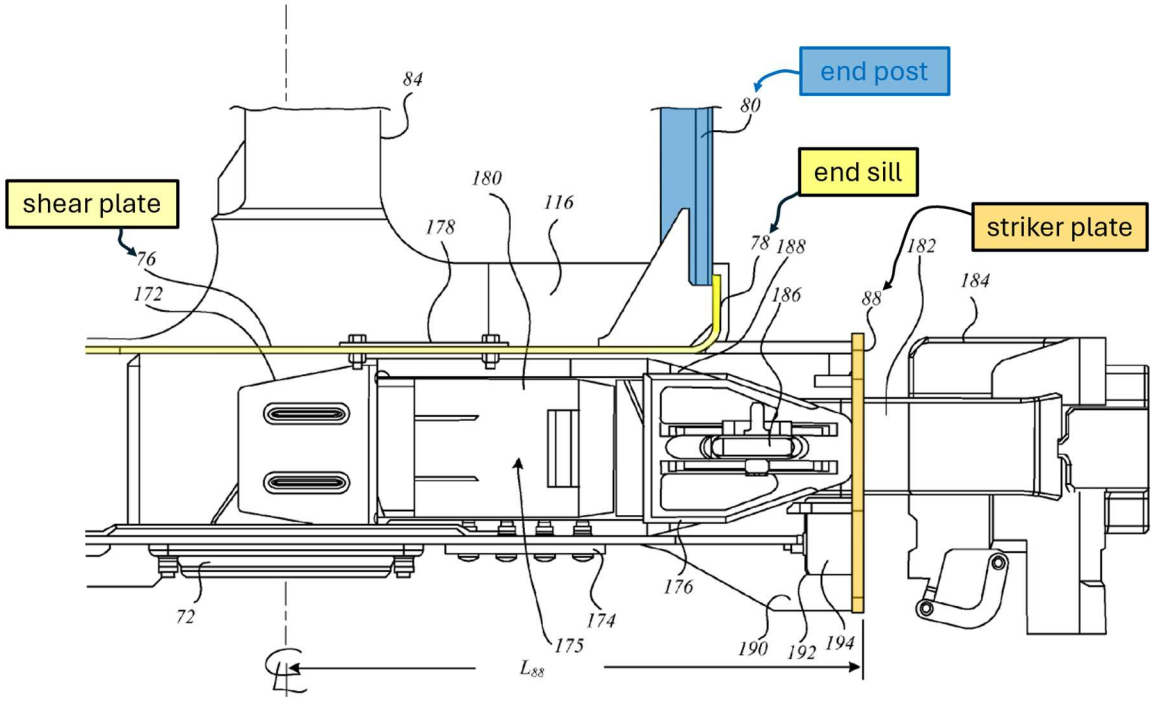
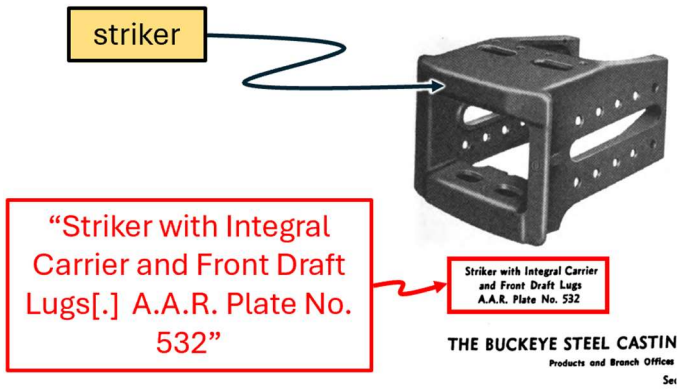
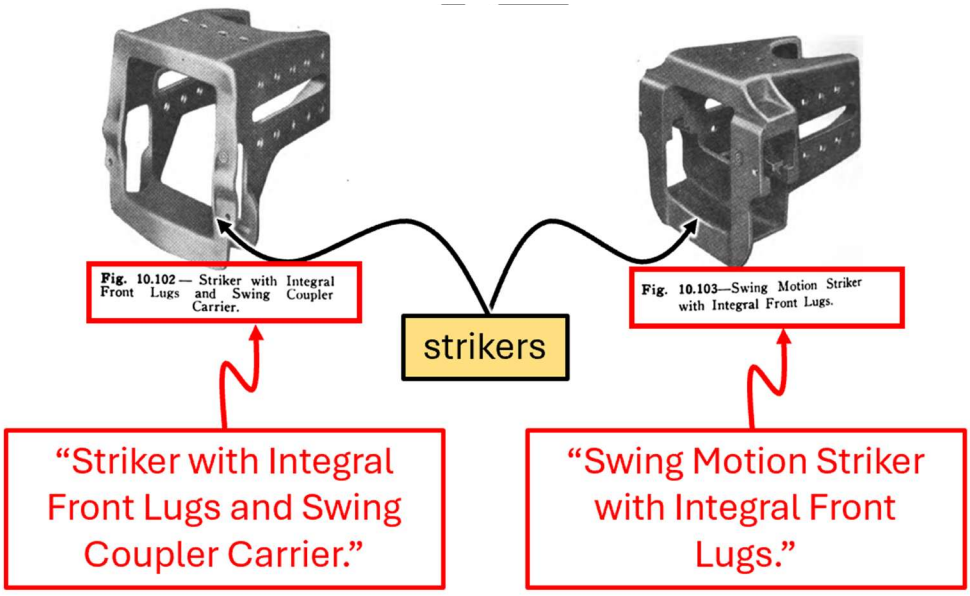


Figure 3c

EX1001 at Figs. 3a, 3c.

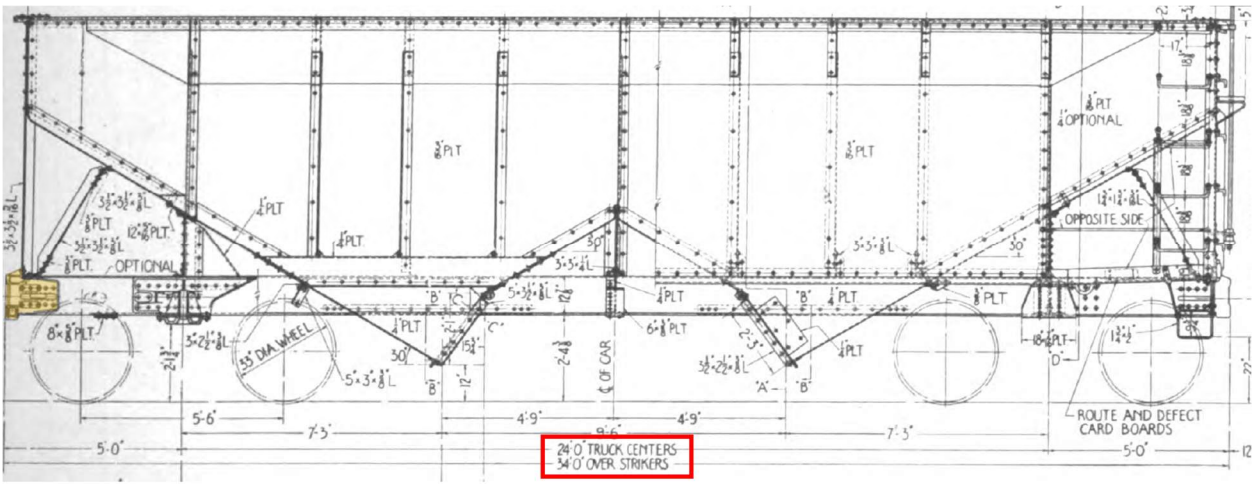
The 1946 Cyclopedia defines "striker" and "striking plate" to mean: "A member placed on the ends of the center sills of freight cars against which the horn of the coupler strikes, preventing damage to the draft gear and center sills." EX1004 at 62. The reference shows many examples of strikers, including the following:





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

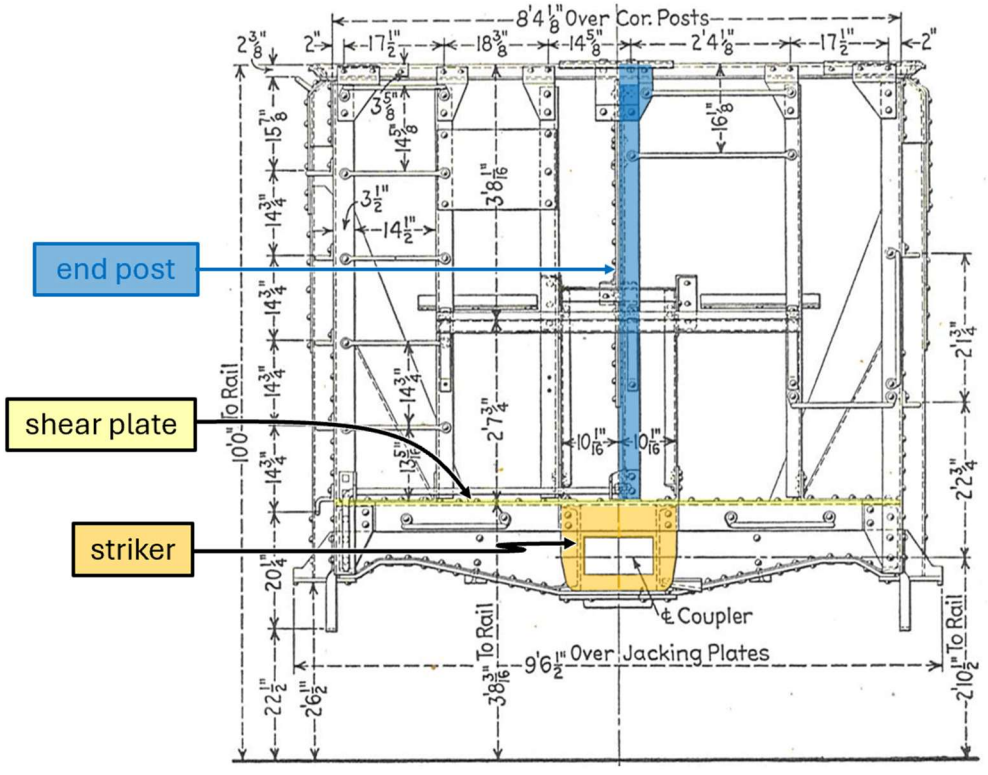
As shown below, the 1946 Cyclopedia frequently identifies strikers when calling out the longitudinal length of a car "over strikers" or "over striking plates."

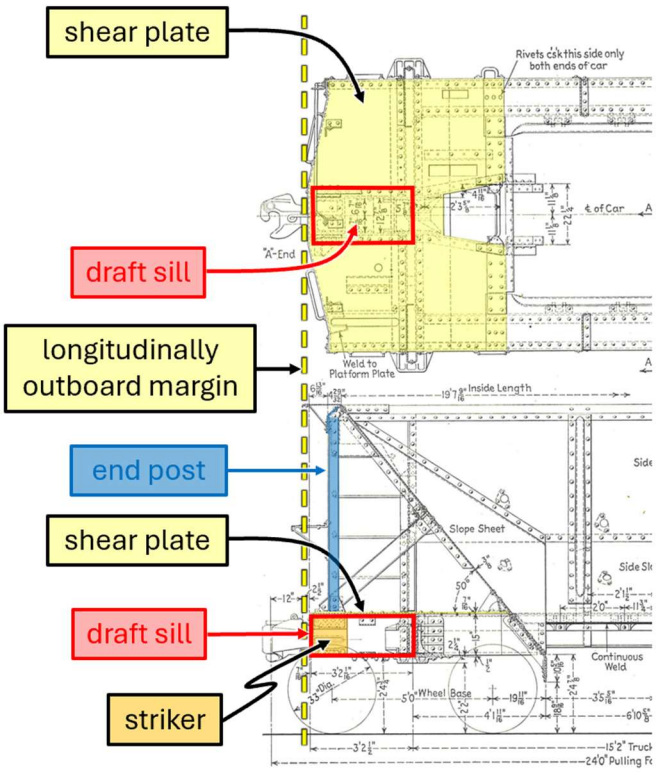


Id. at 254; *see also id.* at 262, 276, 280. Because strikers protect the rail car from impact with the couplers that connect adjacent rail cars, they are typically placed at

the end of the draft sill and therefore longitudinally outboard of truck center. EX1003, ¶ 75. Strikers are standard components on rail cars, and the distance between the strikers is a common measure of a rail car's length. *Id.*

Similarly, as shown below, the 1946 Cyclopedia's NSC ore car discloses a striker on the outboard margin of each draft sill. This striker is outboard of the longitudinally outboard margin of the shear plate. *See supra*, at § IV.A.1.c (identifying lateral and longitudinal margins of the shear plate for limitation [1c]). Additionally, as shown below, the NSC ore car's end post is rooted to both (a) the draft sill adjacent to the striker and (b) the shear plate adjacent to the longitudinally outboard margin of the shear plate, as claimed.





EX1004 at 294. Even if the 1946 Cyclopedia's NSC ore car did not expressly disclose the claimed striker, it would have been obvious to use the claimed striker with that rail car design, in view of the portions of the same reference cited above, because strikers have long been standard features on rail cars and because a POSITA would have wanted to protect the car's draft sills from damage. EX1003, ¶ 77.

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

The 1946 Cyclopedia's NSC ore car discloses this limitation. The '515 patent discloses "corner posts" 82 and 84. EX1001 at 14:26–28; *see also id.* at 16:63–17:7. These posts are not at the true corners of the railcar, but rather extend upward from

"the junction of the laterally outboard ends of left and right hand main bolster arms 74 and side sills 40." *Id.* at 14:26–28. Each post's upper edge "runs horizontally along lateral reinforcement beam 148." *Id.* at 17:11–12.

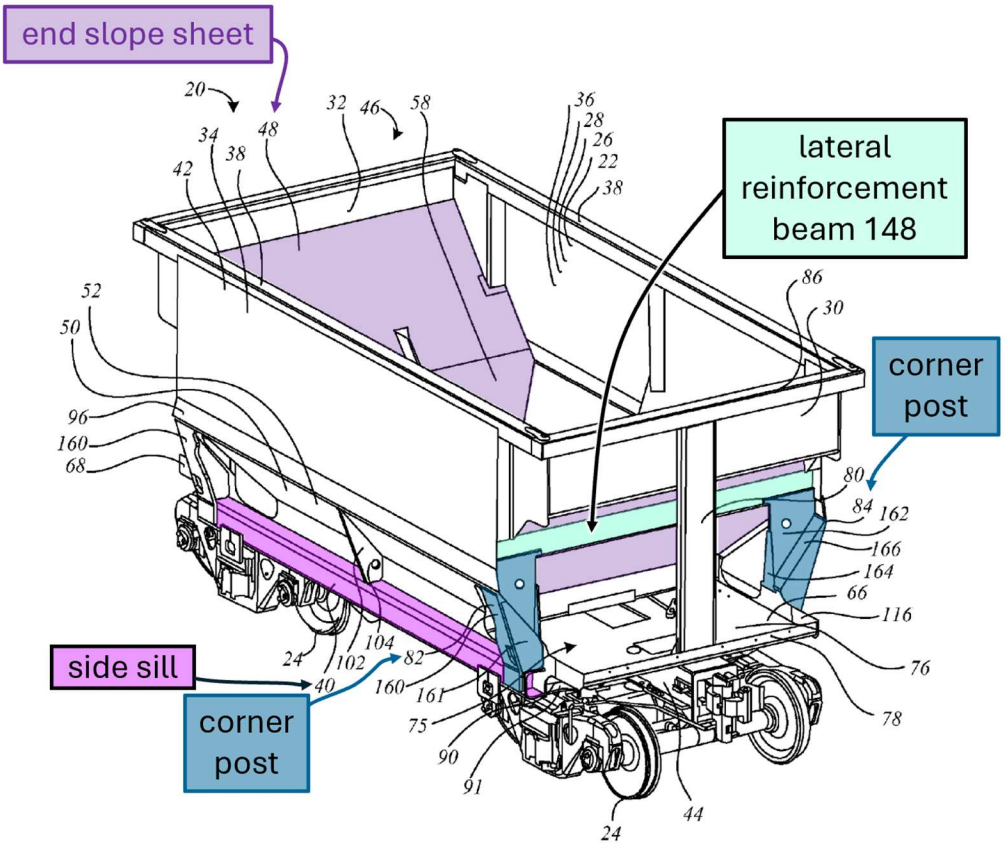
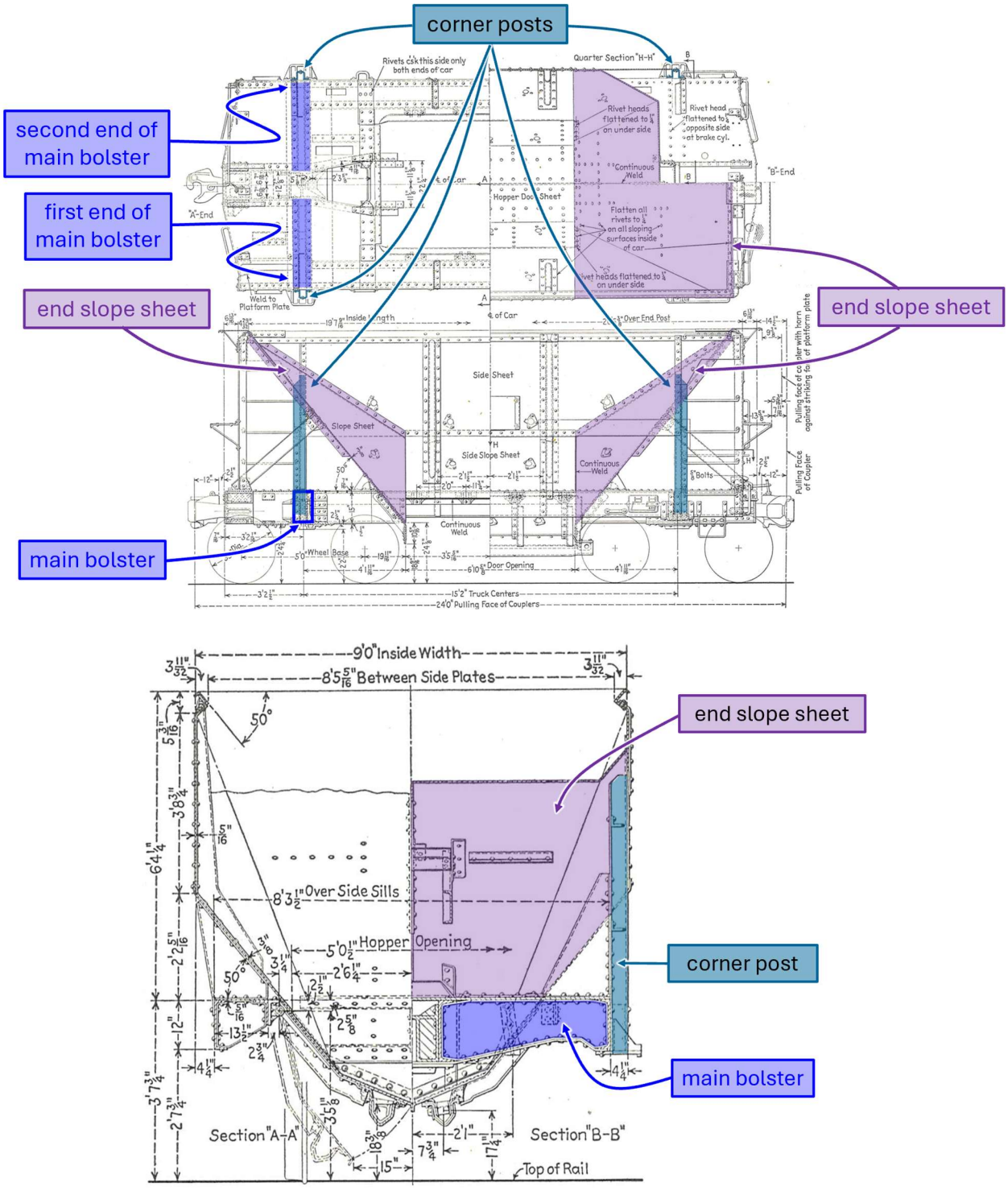


Figure 1

Id. Fig. 1.

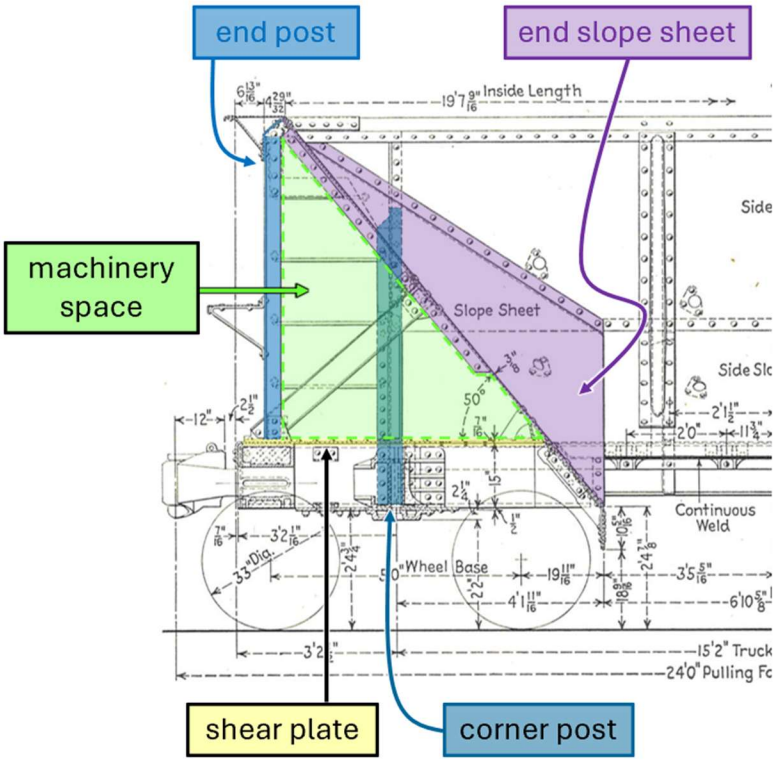
The 1946 Cyclopedia's NSC ore car discloses the configuration claimed in [1h], as shown below.



EX1004 at 294.

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

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



EX1004 at 294.

As discussed above with limitation [1e], it would have been obvious to remove the NSC ore car's struts and support the slope sheet only with beams, as in

Coates or the 1922 Cyclopedia's Gregg ore car. So modified, the NSC ore car would have a machinery space free of primary structure, as claimed. EX1004 at 294; EX1007 at cover, 261–65; EX1011 at 1113, Fig. 2904; EX1003, ¶ 79.

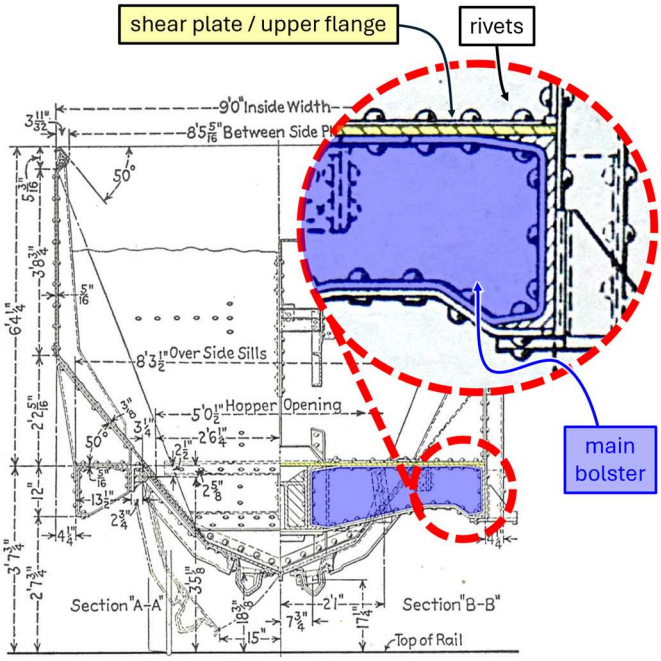
2. <u>Claim 2:</u> "The railroad hopper car of claim 1 wherein said bolster has first and second laterally outboard distal ends, and said hopper car has corner posts extending upwardly from said distal ends of said hopper to said first end slope sheet;

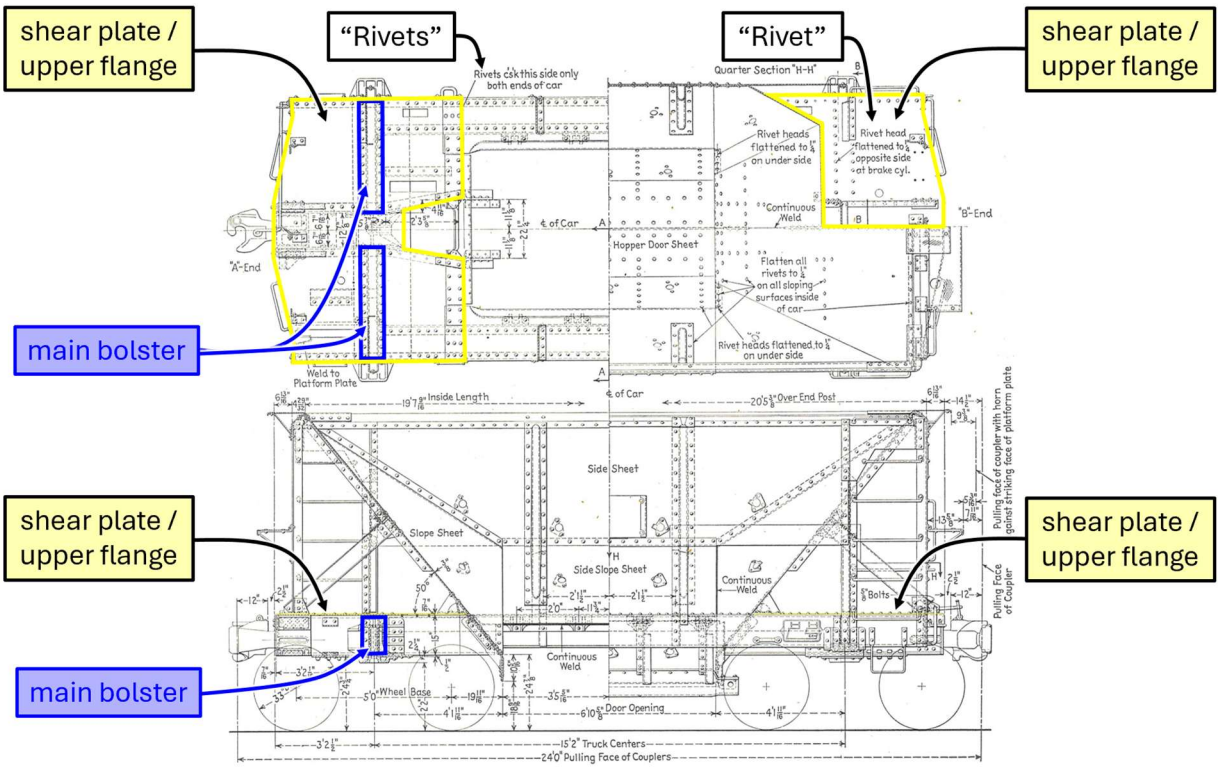
The 1946 Cyclopedia's NSC ore car discloses the limitation of this claim for the same reason it discloses limitation [1h].

3. <u>Claim 5</u>

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

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

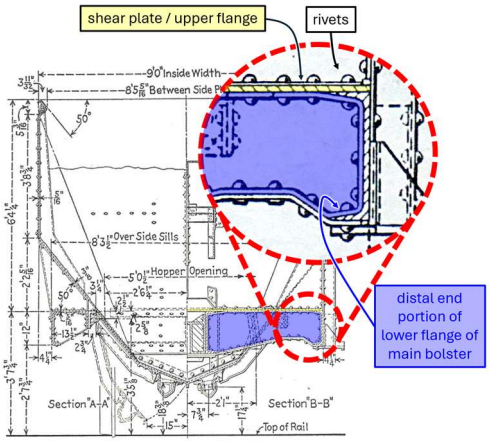


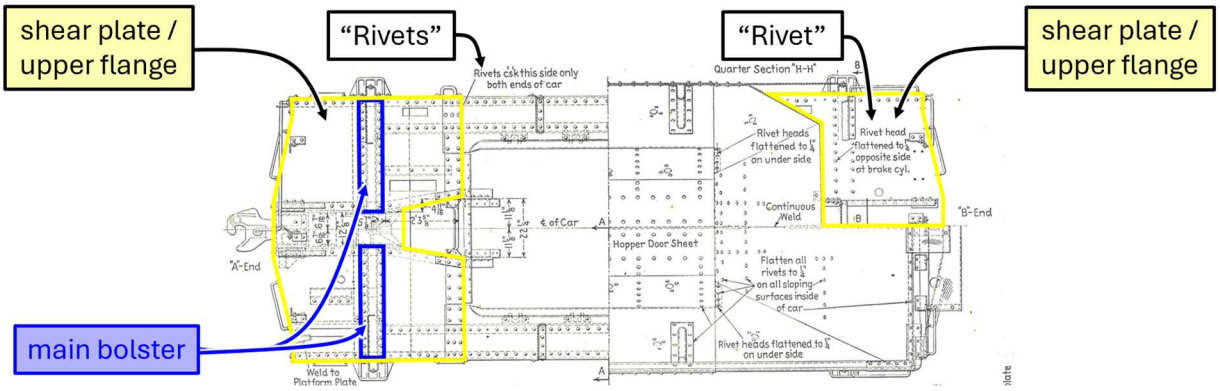


EX1004 at 294; EX1003, ¶ 80.

b. [5b] "said main bolster has a lower flange downwardly spaced from said upper flange, said lower flange terminating at respective distal end portions at either side of said car;"

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

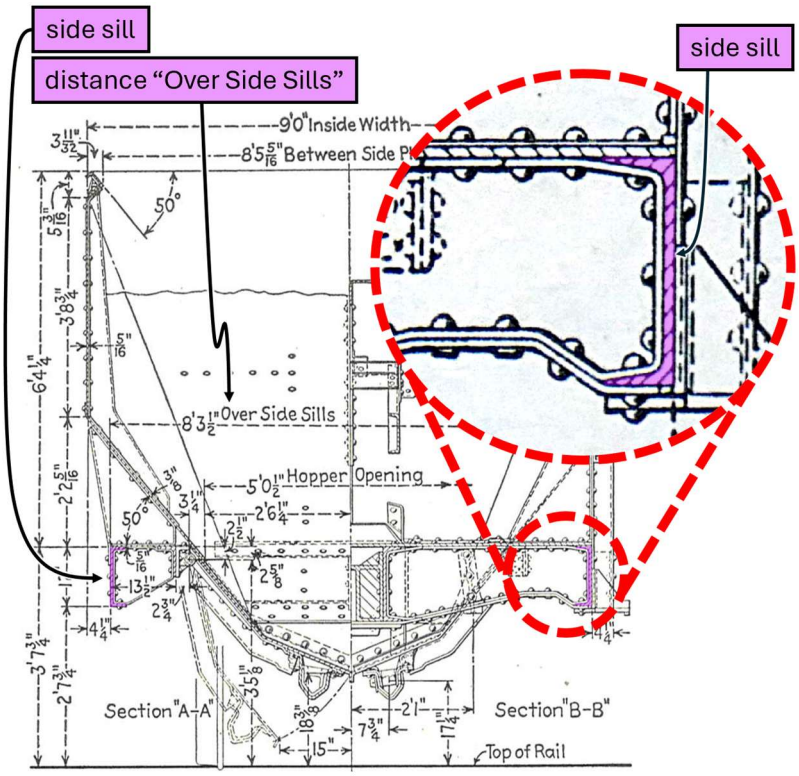


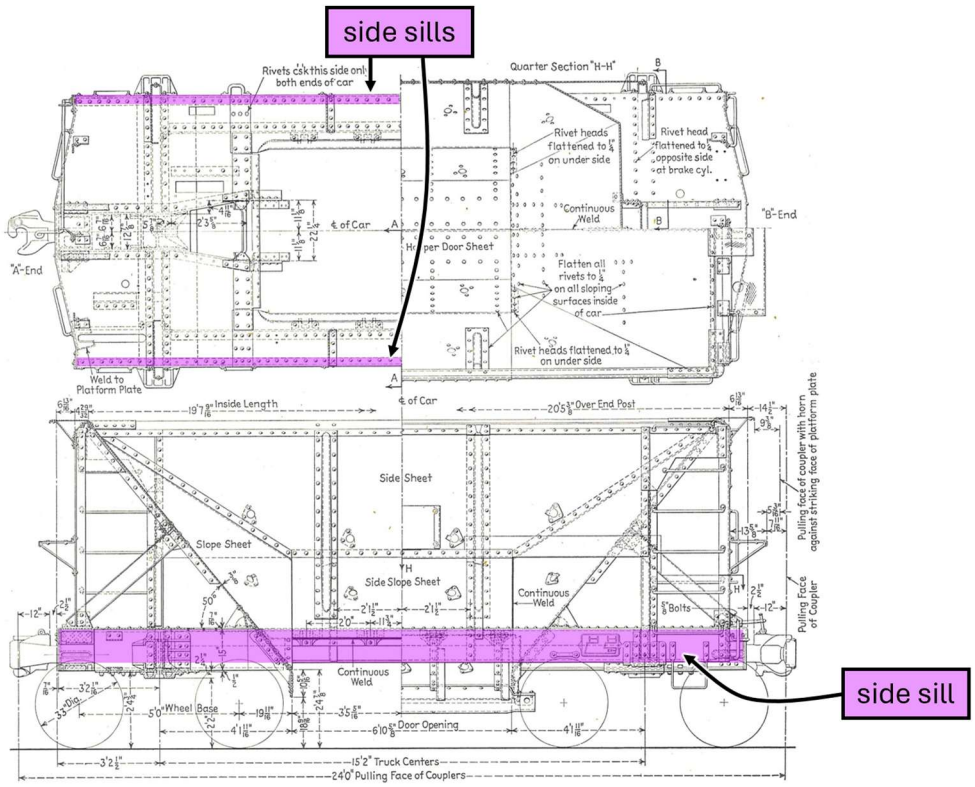


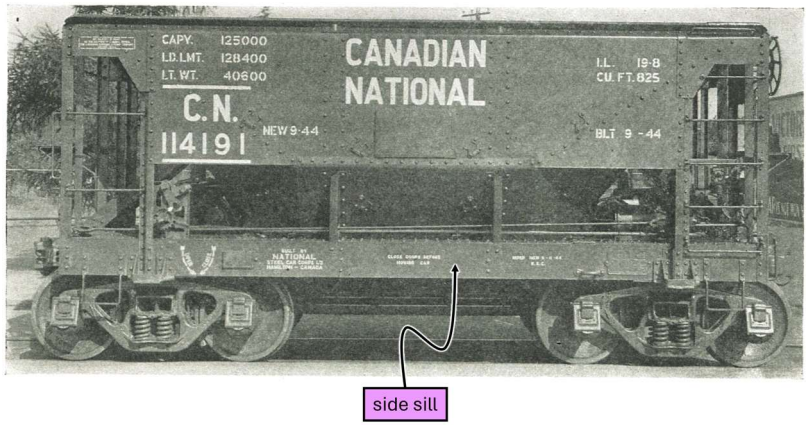
EX1004 at 294; EX1003, ¶ 81.

c. [5c] "said car includes a side sill running along said car between said first and second end sections;"

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



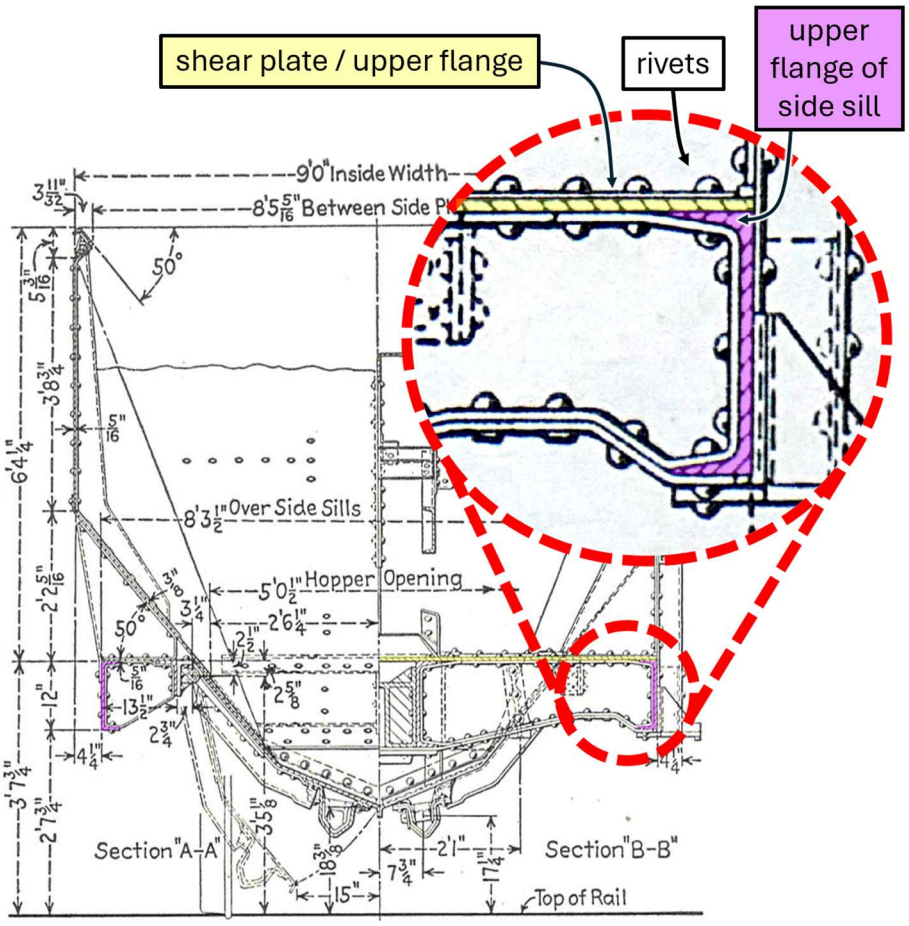




EX1004 at 294–95.

d. [5d] "said side sill has an upper flange, said upper flange of said side sill being substantially co-planar with, and connected to, said shear plate; and"

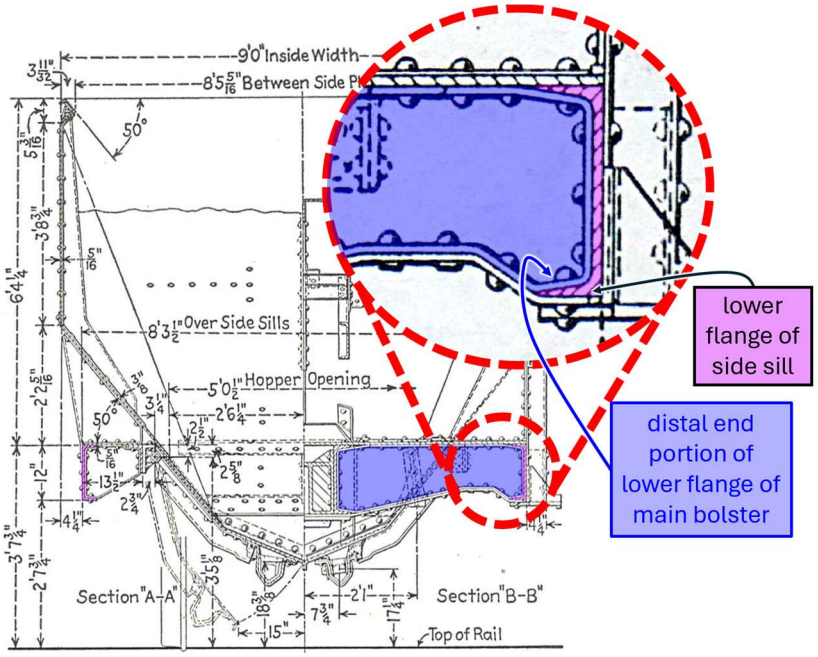
The 1946 Cyclopedia's NSC ore car discloses this limitation:



EX1004 at 294; EX1003, ¶ 82.

e. [5e] "said side sill has a lower flange, said lower flange of said side sill being substantially co-planar with a respective one of said distal end portions of said lower flange of said main bolster."

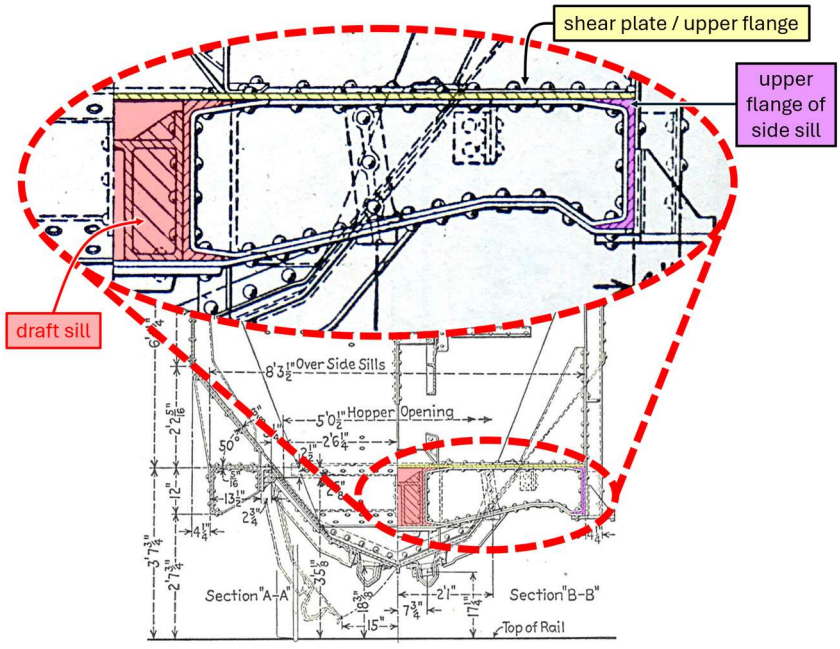
The 1946 Cyclopedia's NSC ore car discloses this limitation:

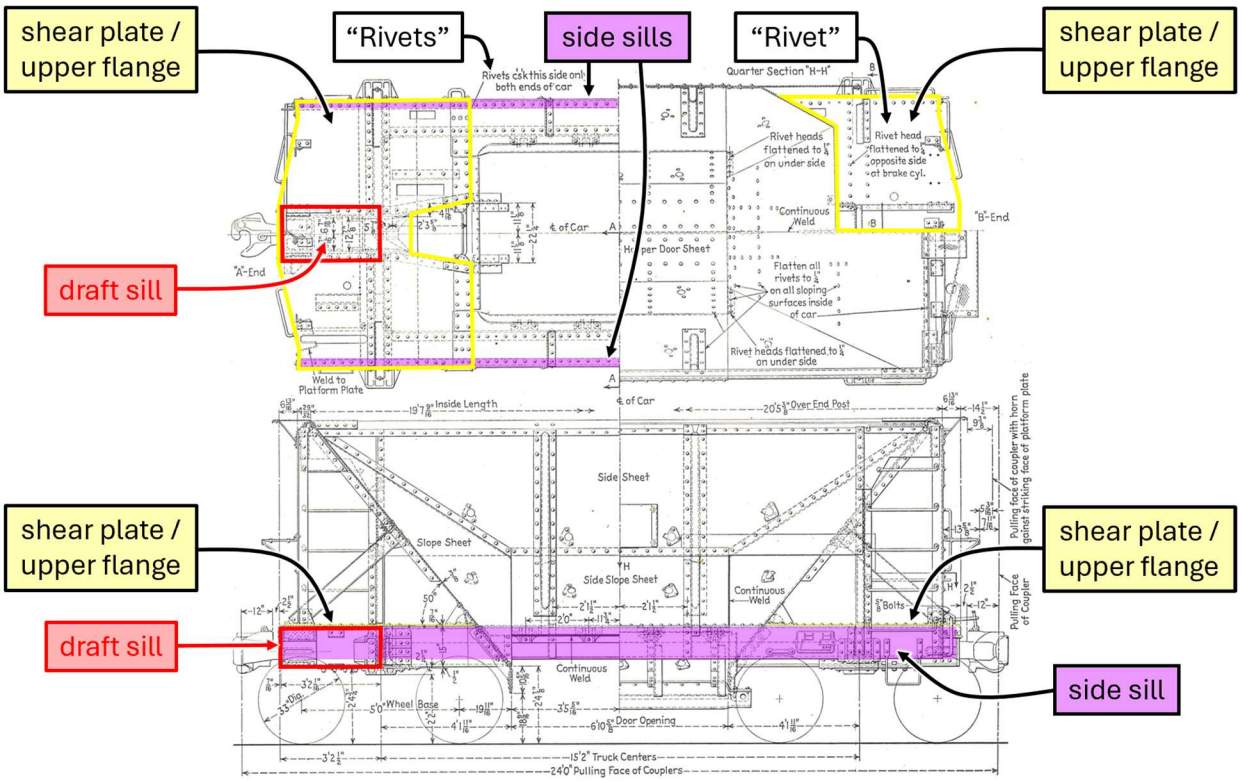


EX1004 at 294; EX1003, ¶ 83.

4. **<u>Claim 6:</u> "The railroad hopper car of claim 5 wherein said shear plate defines an upper flange of said draft sill whereby said draft sill upper flange, said shear plate and said side sill upper flange are all substantially co-planar."**

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





EX1004 at 294; EX1003, ¶ 84.

5. Independent Claim 20

a. [20a] "A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1a].

b. [20b] "said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being

inclined in the longitudinal direction to feed said discharge section;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1b].

c. [20c] "said first end section including a draft sill extending in the longitudinal direction, a main bolster extending cross-wise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;"

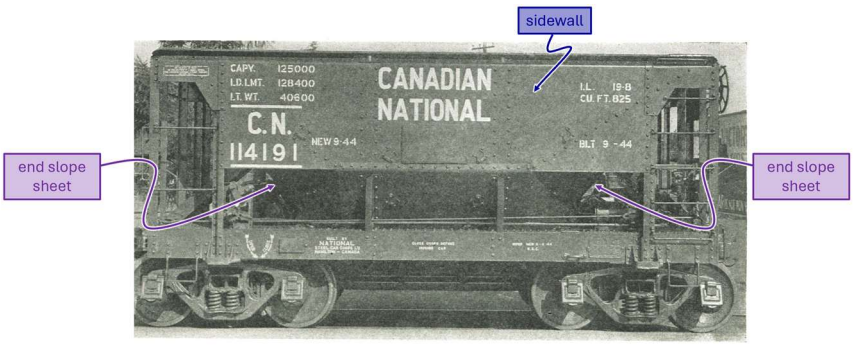
The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1c].

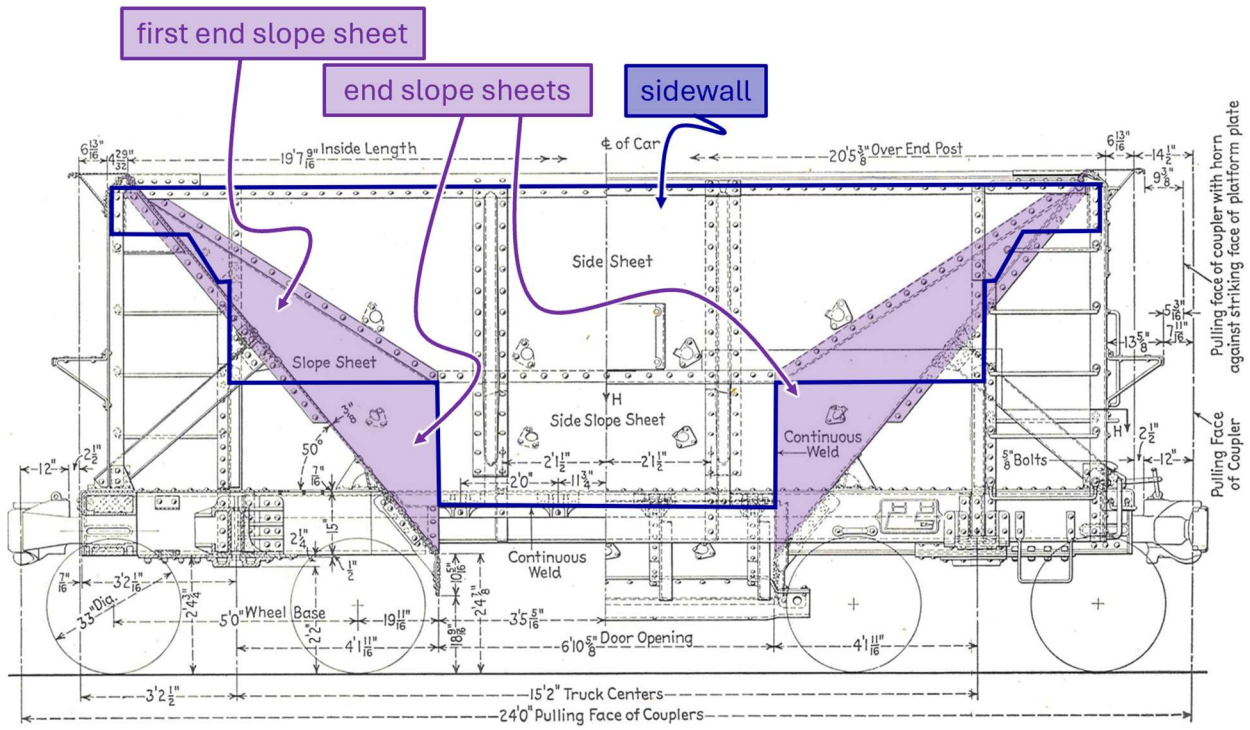
d. [20d] "said first end slope sheet of said hopper over-hanging said shear plate of said first end section;"

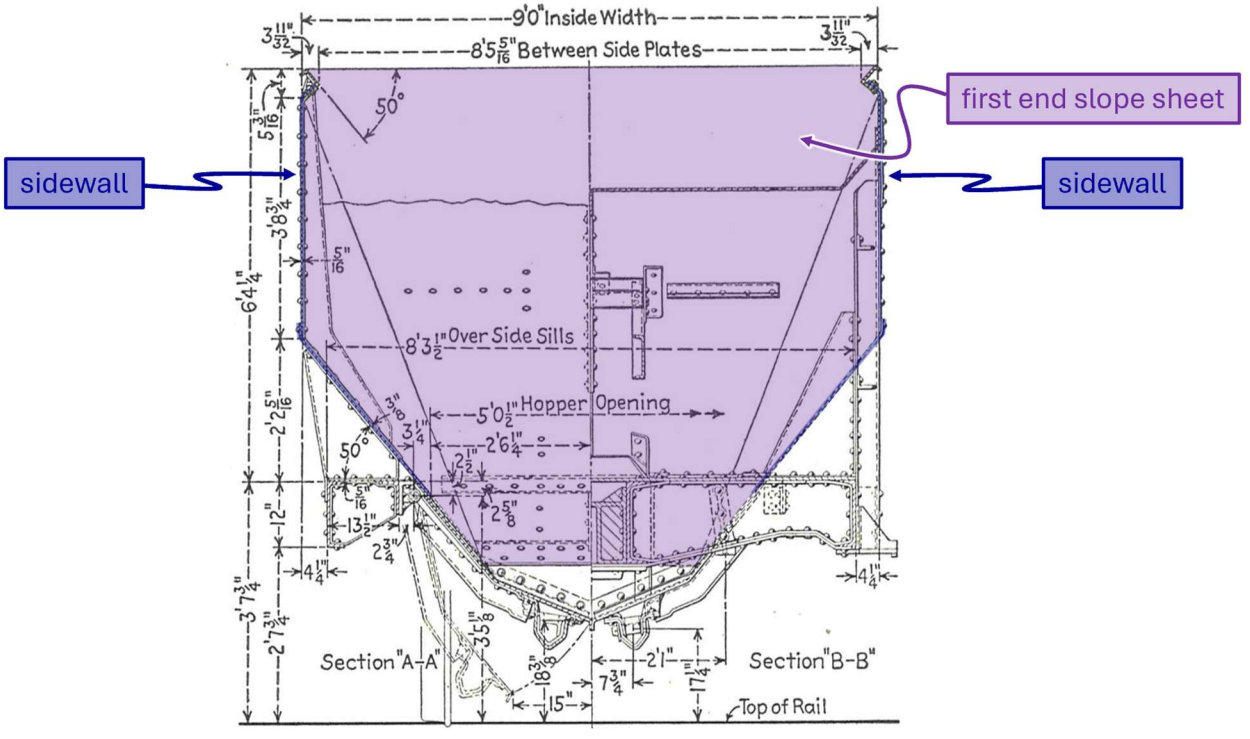
The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1d].

e. [20e] "first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;"

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



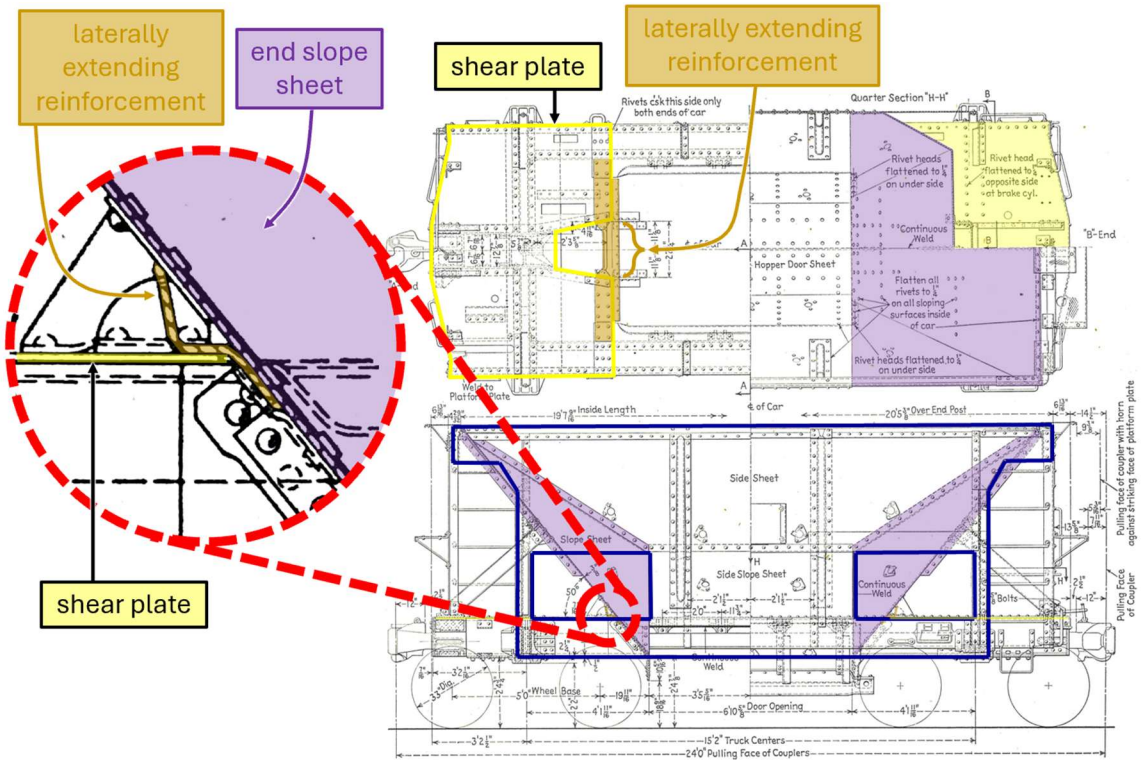


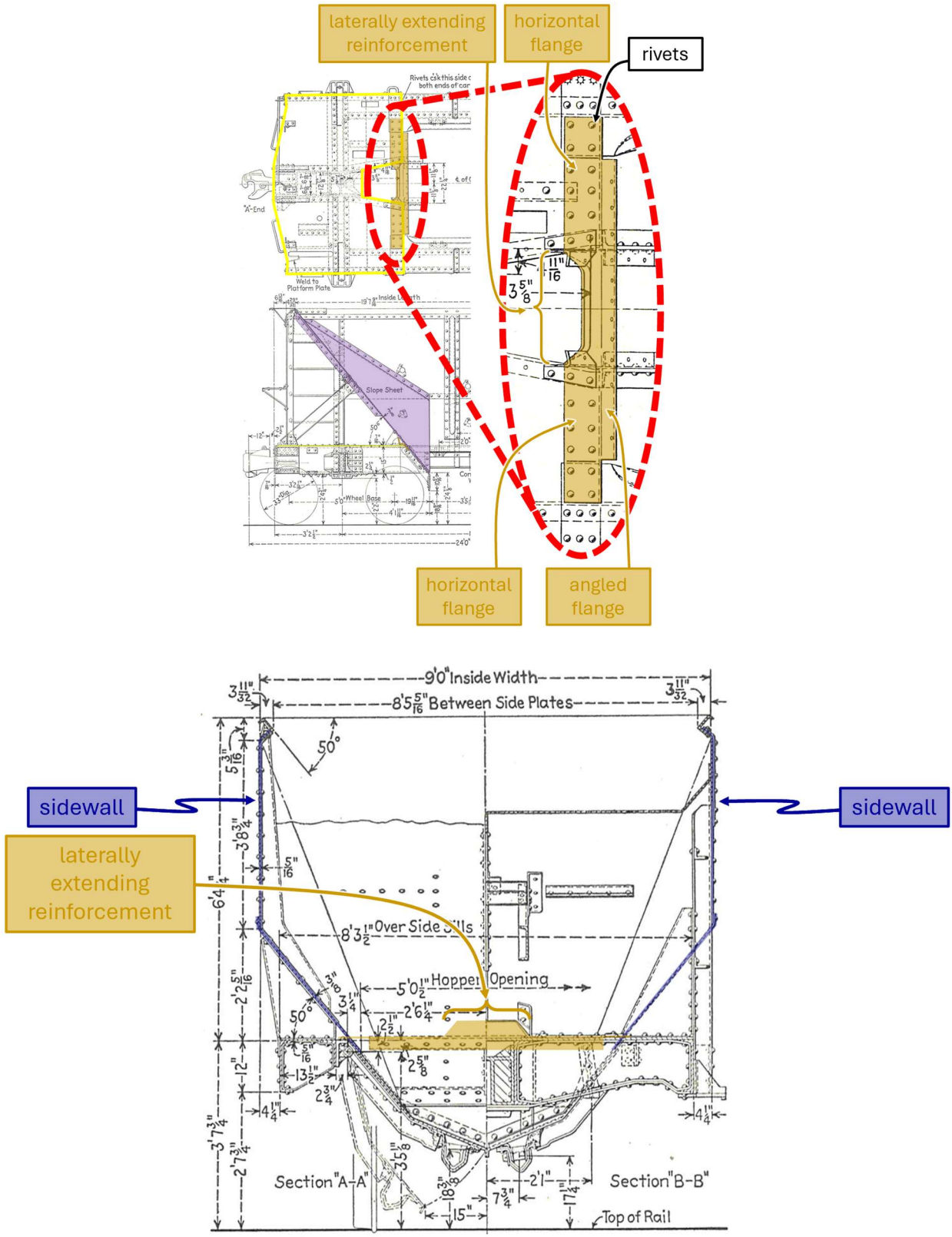


EX1004 at 294–95.

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

The 1946 Cyclopedia's NSC ore car discloses this limitation. As shown below, a laterally extending reinforcement for the slope sheet (orange) is riveted to the top of the shear plate. EX1003, ¶ 91. The center portion of the longitudinally outboard edge of that reinforcement is bent upwards to contact the bottom surface of the slope sheet, forming a hollow section beam extending across the hopper car between the sidewalls. *Id.*



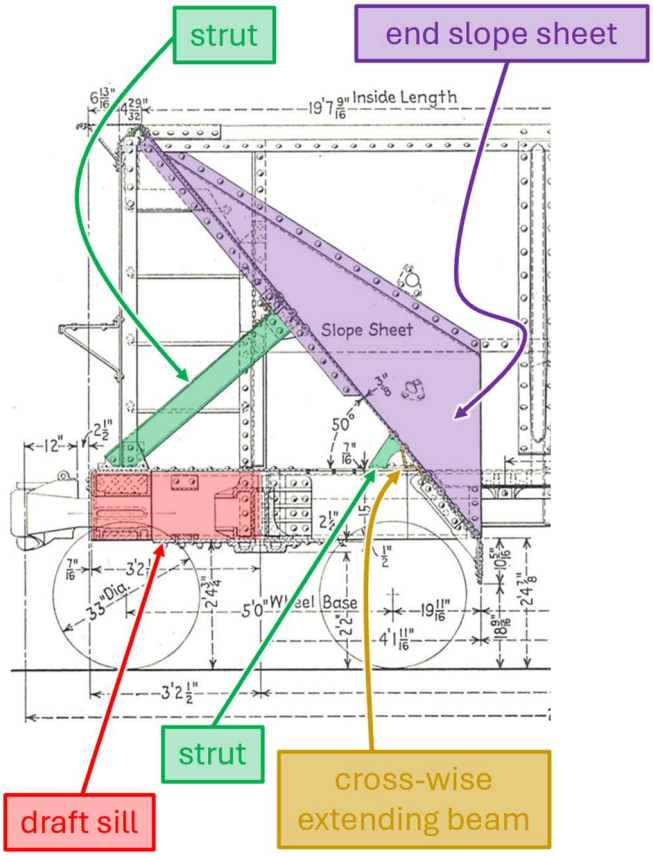


EX1004 at 294.

As shown above, the laterally extending reinforcement is between the car's side walls, as limitation [20f] requires.

g. [20g] "said hopper car being free of longitudinally oriented elephant ears extending between said draft sill and said end slope sheet;"

The 1946 Cyclopedia's NSC ore car discloses this limitation. The '515 patent defines "elephant ears" as "large, substantially triangular planar plates … that have one edge fixed along the junction of the center sill webs and the center sill cover plate, and another edge welded to the end slope sheet." EX1001 at 14:63–67. The NSC ore car disclosed in the 1946 Cyclopedia lacks elephant ears. EX1003, ¶93. Instead, the slope sheet is supported by the two crosswise beams discussed above, a large strut positioned at a right angle to the slope sheet, and two small struts positioned near the bottom of the slope sheet. *Id.* The large strut and one of the two small struts may be seen in the drawing below. EX1004 at 294. Besides not being elephant ears, the small struts do not extend from the draft sill, which the '515 patent defines as the portion of the center sill outboard of truck center. *Id.*; *see also* EX1001 at 14:36–39.



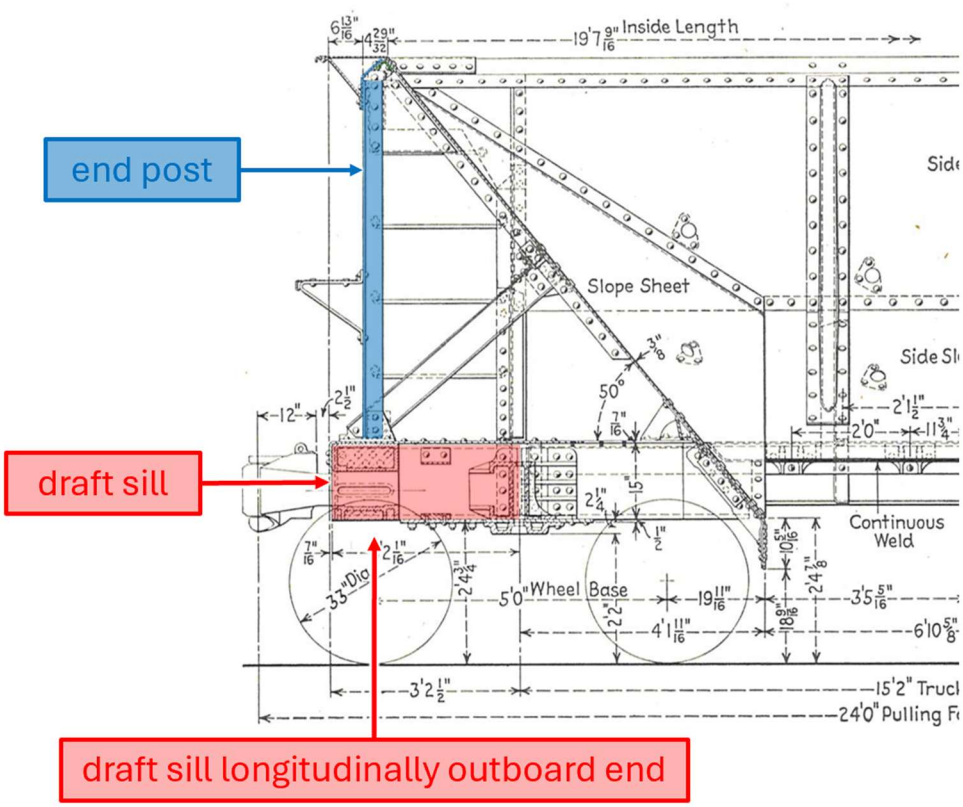
EX1004 at 294.

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

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1h].

i. [20i] "said draft sill has a longitudinally outboard end; an end post stands upwardly of said longitudinally outboard end of said draft sill;"

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



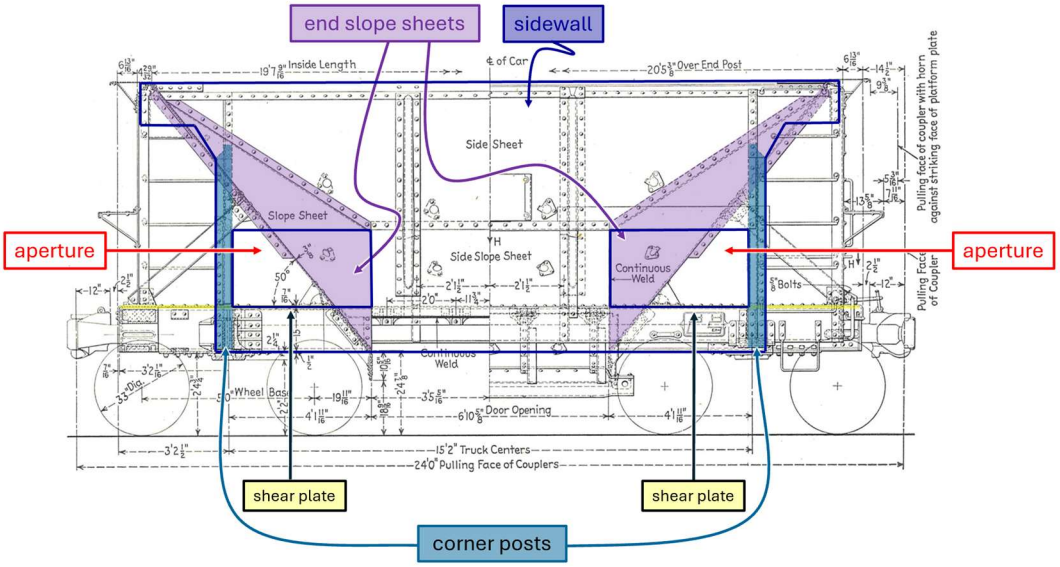
EX1004 at 294; EX1003, ¶ 85.

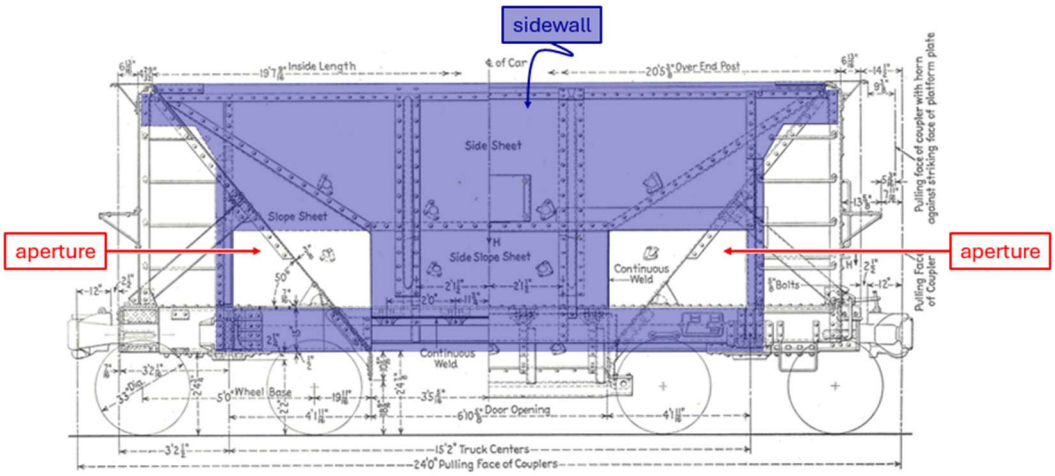
j. [20j] "a machinery space is defined above said shear plate, below said first end slope sheet, longitudinally inboard of said end post, and between said corner posts; and said machinery space is free of any other primary structure."

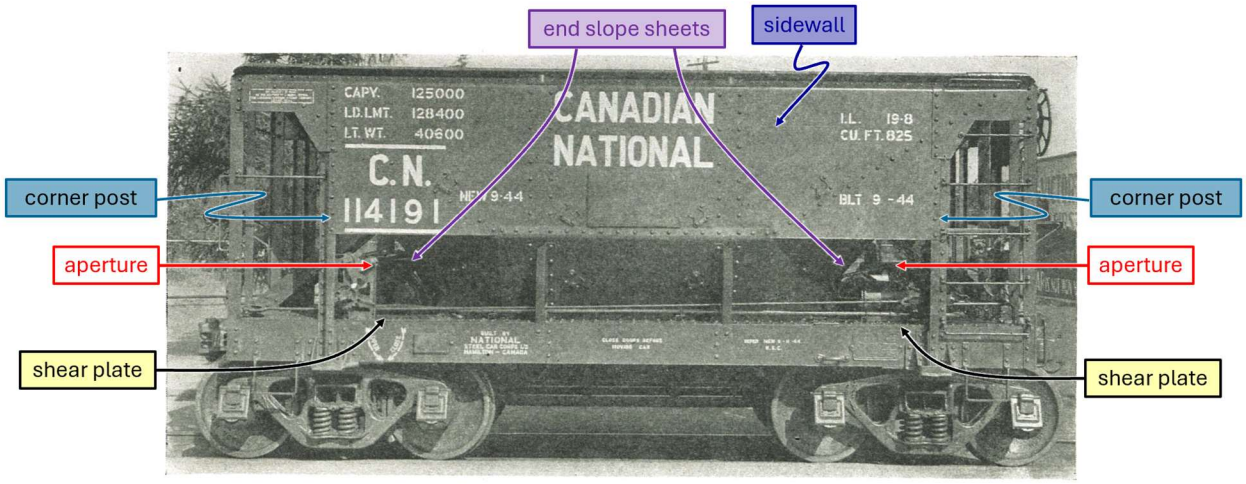
The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1i].

6. <u>Claim 23:</u> "The railroad hopper car of claim 20 wherein said first and second side walls of said car have openings defined therein longitudinally inboard of said respective corner posts, above said shear plate, and below said first end slope sheet."

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







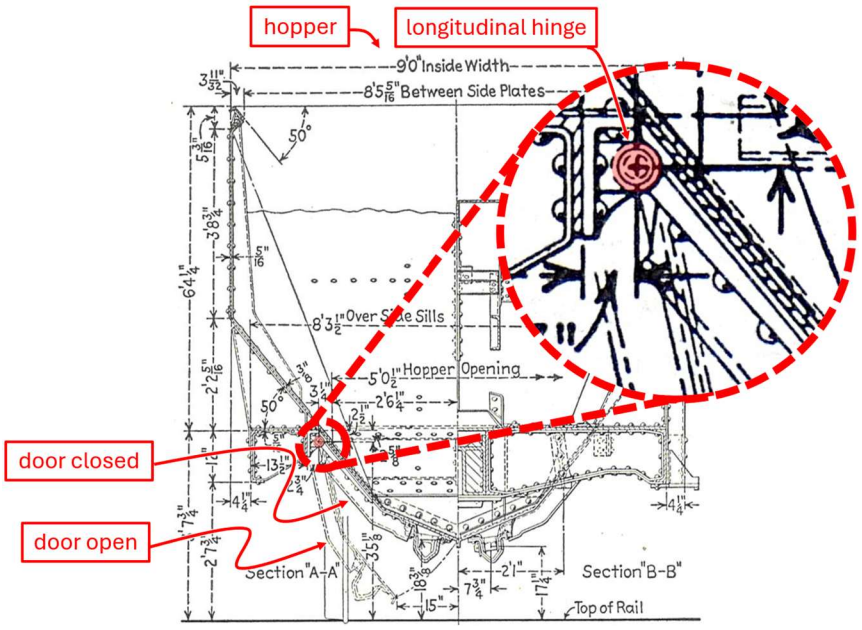
EX1004 at 294–95; EX1003 ¶ 88.

B. Ground 2: Claims 3 and 21-22 are obvious over the 1946 Cyclopedia, Coates or the 1922 Cyclopedia, and Schuller.

1. Claim 3

a. [3a] "The railroad hopper car of claim 1 wherein: said hopper car has at least one longitudinally hinged discharge door, said discharge door being movable cross-wise between open and closed positions; and"

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

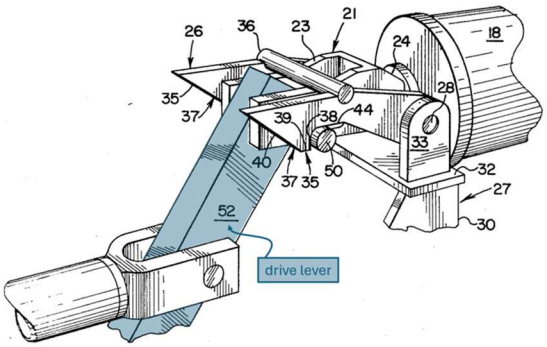


EX1004 at 294.

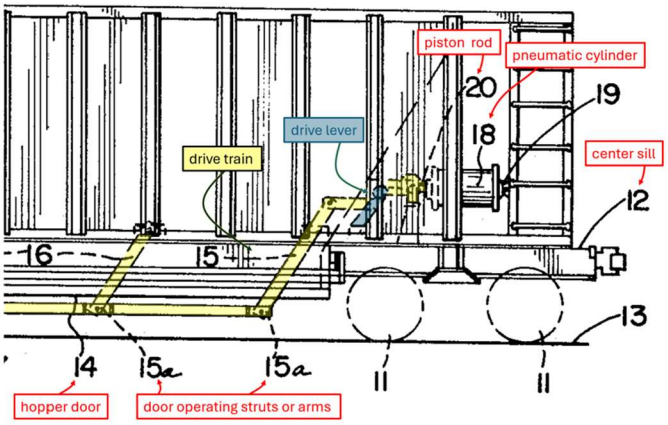
b. [3b] "a longitudinally acting pneumatic actuator is at least partially lodged in said machinery space directly above said draft sill."

The 1946 Cyclopedia's NSC ore car, as modified in view of Schuller, discloses this limitation. Schuller also discloses longitudinally hinged discharge doors: "Hopper doors 14 are pivoted on a longitudinal axis and open downward to

discharge lading." EX1014 at 1:53–54. Schuller teaches using a "pneumatic cylinder means operative upon a door opening lever mechanism for opening and closing of pivoted discharge doors." *Id*., claim 1. Schuller's pneumatic cylinder acts longitudinally by moving lever 52 longitudinally, which in turn moves other components of the drive train longitudinally to open or close the hopper doors. EX1003, ¶ 86.



Schuller Fig. 5



Schuller Fig. 1

EX1014, Figs. 1, 5. As Fig. 1 shows, Schuller's pneumatic cylinder 18 is mounted in the machinery space. Fig. 5 shows that it is directly above supporting means 27, which in turn is "fixedly attached to the top 29 of the center sill 12." *Id*. at 2:7–-9.

The 1946 Cyclopedia's NSC ore car does not show a complete mechanism for operating the hopper doors. A POSITA would have known that some door-opening mechanism is necessary in the NSC design and would have been motivated to use a pneumatic door-operating system like Schuller's to automate the door-opening

process, thereby reducing the manual labor required and the risk of injury. EX1003, ¶ 87. So modified, the 1946 Cyclopedia's NSC ore car would embody Claim 3.

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

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Schuller, discussed in connection with limitation [3b], discloses this limitation.

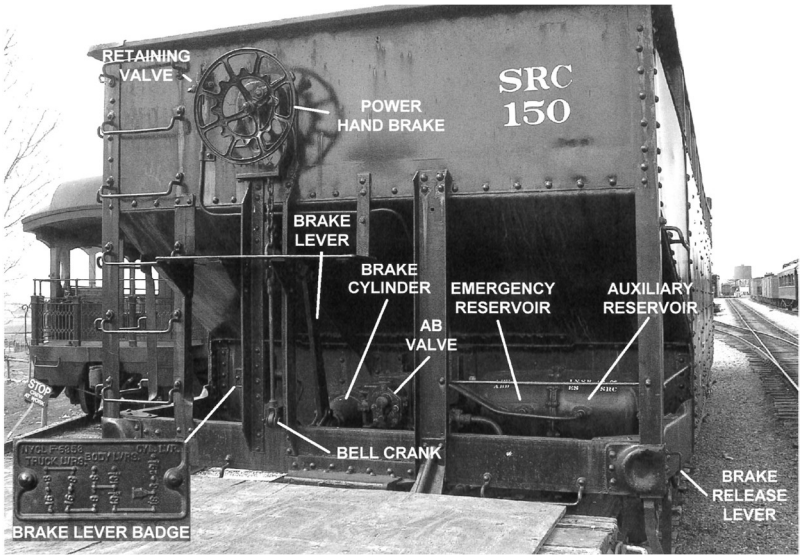
3. <u>Claim 22:</u> "The railroad hopper car of claim 21 wherein said first side wall has an aperture formed therein at a location higher than said shear plate, lower than said first end slope sheet, and longitudinally inboard of said first corner post."

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses the limitation of Claim 23.

C. Ground 3: Claim 4 is obvious over the 1946 Cyclopedia, Coates or the 1922 Cyclopedia, Schuller, and Karig.

1. <u>Claim 4:</u> "The railroad hopper car of claim 3 wherein a brake reservoir is also at least partially lodged in said machinery space."

Lodging the brake reservoir in the machinery space has been conventional for decades. EX1003, ¶ 89. For example, Karig discloses multiple hopper cars with this configuration. *See, e.g.*, EX1016 at 127, 129. One such example is shown below.



Id. at 129 (annotations in the original).

By 2009, it would have been obvious to use a conventional air brake system in the NSC ore-car design, and to lodge the brake reservoir in the conventional place, *i.e.*, in the machinery space at one end of the rail car. EX1003, ¶ 90. So modified, 1946 Cyclopedia's NSC ore car would embody the limitation of claim 4.

D. Ground 4: Claims 7–16, 18–19, 24–27, 30–35, and 38–42 are obvious over the 1946 Cyclopedia and Wong.

1. Independent Claim 7

a. [7a] "A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1a].

b. [7b] "said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1b].

c. [7c] "said first end section including a draft sill extending in the longitudinal direction, a main bolster extending crosswise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1c].

d. [7d] "said first end slope sheet of said hopper over hanging said shear plate of said first end section;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1d].

e. [7e] "first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [20e].

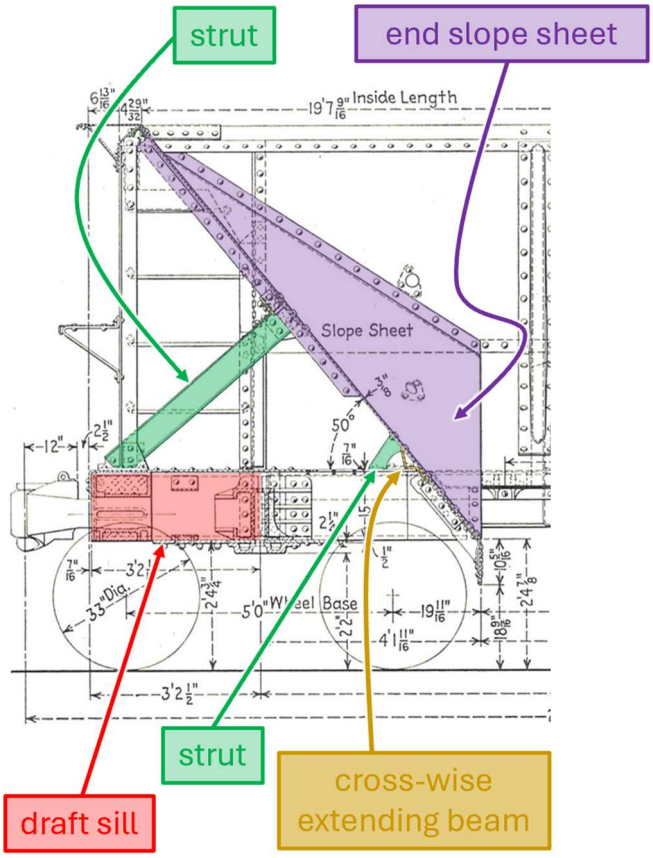
f. [7f] "a first laterally extending reinforcement mounted cross-wise to said first end slope sheet adjacent to said shear plate; said shear plate of said first end section being connected to said first laterally extending reinforcement; said first end slope sheet of said first end section being connected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

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [20f].

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

The 1946 Cyclopedia's NSC ore car discloses this limitation. The '515 patent defines "elephant ears" as "large, substantially triangular planar plates … that have one edge fixed along the junction of the center sill webs and the center sill cover plate, and another edge welded to the end slope sheet." EX1001 at 14:63–67. The NSC ore car disclosed in the 1946 Cyclopedia lacks elephant ears. EX1003, ¶93. Instead, the slope sheet is supported by the two crosswise beams discussed above, two large struts positioned at a right angle to the slope sheet, and two small struts positioned near the bottom of the slope sheet. *Id.* The large strut and one of the two small struts may be seen in the drawing below. EX1004 at 294. Besides not being elephant ears, the small struts do not extend from the draft sill, which the '515 patent

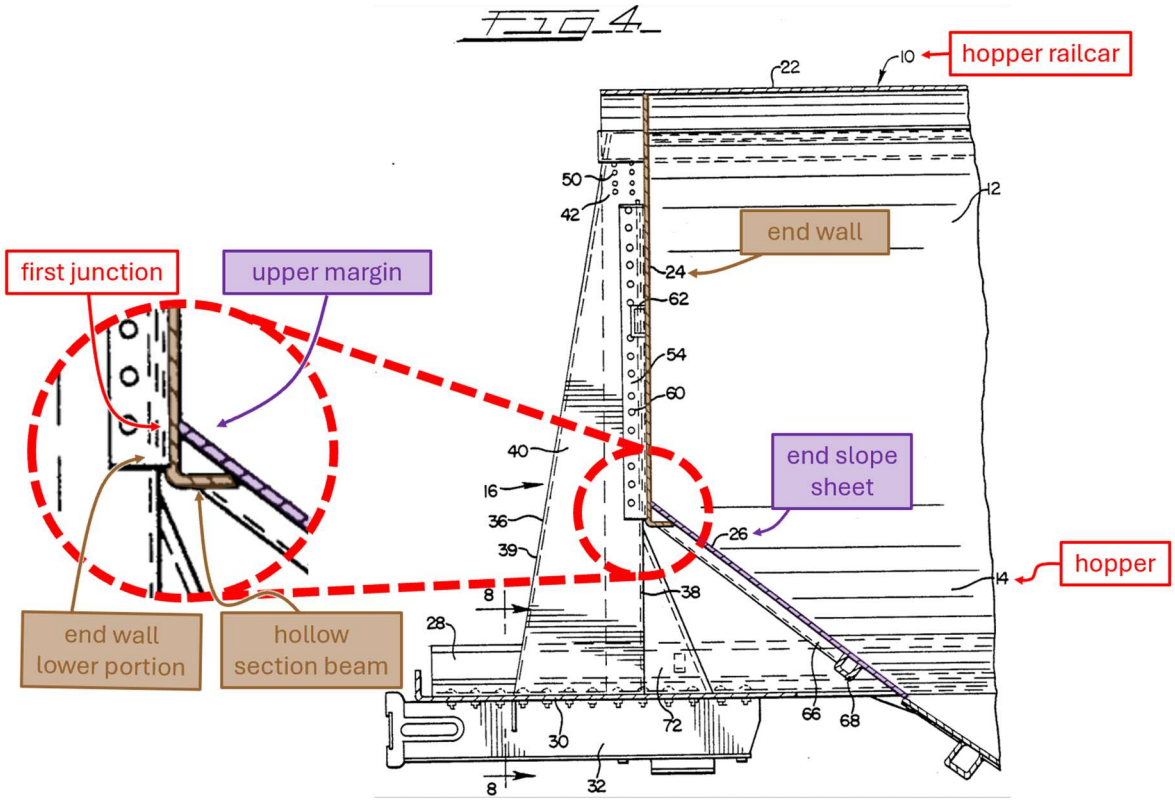
defines as the portion of the center sill outboard of truck center. *Id.*; *see also* EX1001 at 14:36–39.



EX1004 at 294.

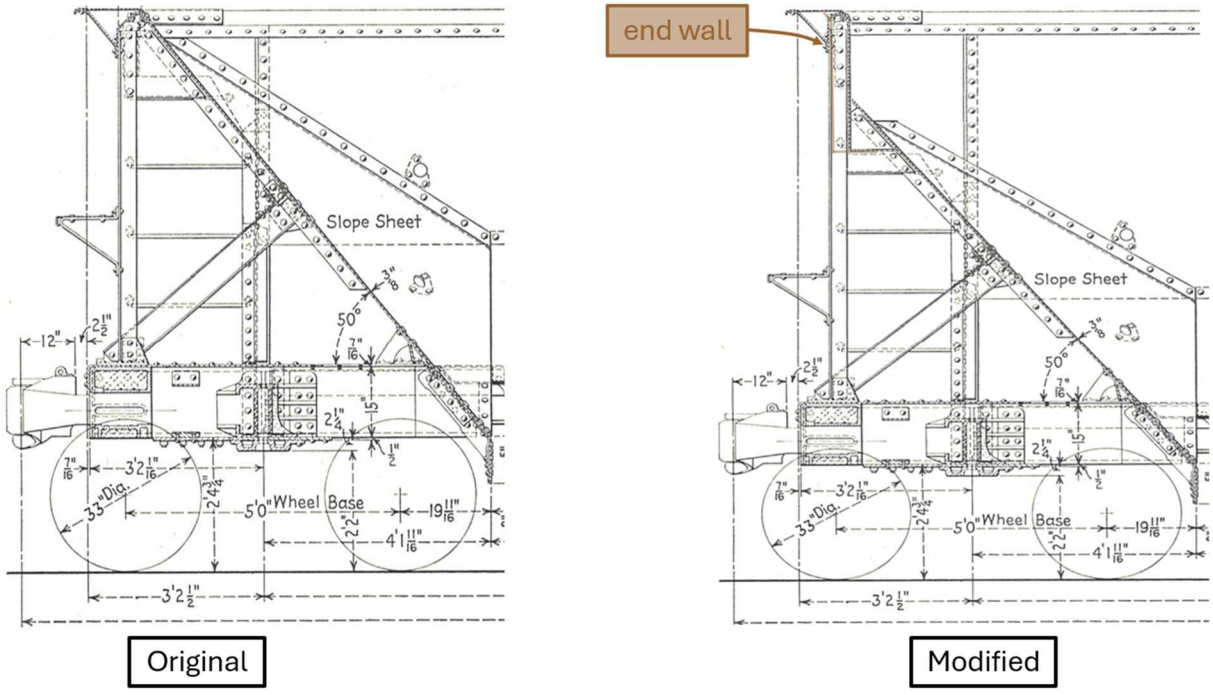
h. [7h] "said hopper car has a first end wall member running cross-wise between said first and second side walls; said first end slope sheet has an upper margin that meets said first end wall member at a first junction; said first end wall member extends upwardly from said first junction; said first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

The 1946 Cyclopedia's NSC ore car, as modified in view of Wong, discloses this limitation. As shown below, Wong discloses a railroad 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. Wong's end wall meets an upper margin of the end slope sheet at a first junction, and is bent inwards at its lower end to contact the underside of the slope sheet. *Id.* As shown below, this creates a hollow support beam that runs crosswise underneath the upper end of the slope sheet. *Id.*



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. The modification could be made either (i) by leaving the end slope sheets in place and increasing the overall height of the hopper; or (ii) by reducing the inclination of the slope sheets so that their outboard ends terminate at a lower height (*i.e.*, lower along the end wall). EX1003, ¶95. The exemplary illustration below shows such a modification using the latter method:



EX1004 at 294 (modified).

A POSITA would have had reason to modify the NSC design to incorporate an end wall, as in Wong. EX1003, ¶96. First, doing so would increase the hopper's volume without increasing the rail car's length or width (or even its height, if the end wall is added by altering the incline of the slope sheets). *Id.*

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

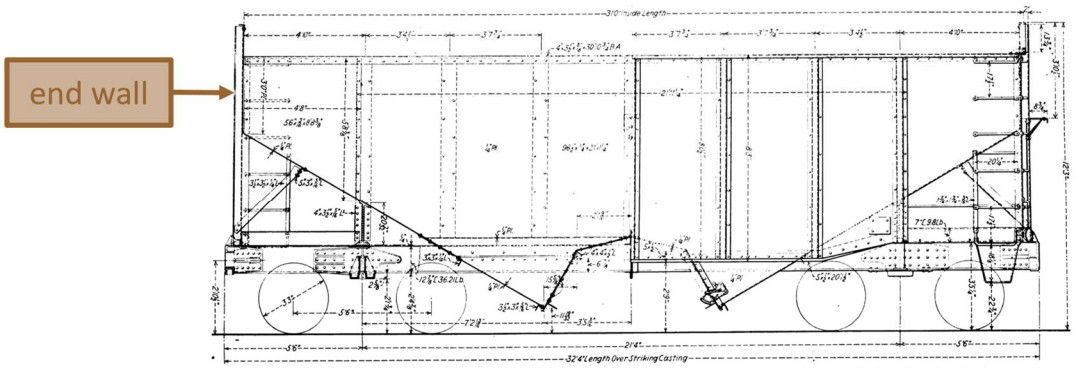


Fig. 2.604—Norfolk & Western 55-ton hopper car (2 hoppers), Road Class, HL, A. A. R. Class HM. Design characterized by the small number of parts.
(Note: Some changes, including ⅜ in. end and slope sheets have been made in last cars built)
(*See also Page 259*)

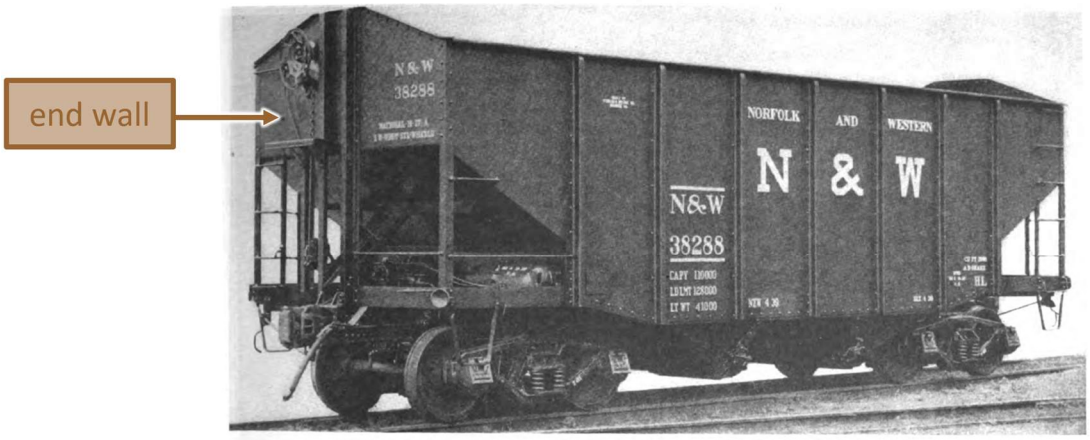


Fig. 2.605—Norfolk & Western 55-ton hopper car, Road Class HL, A. A. R. Class HM. Road Numbers 22,000-25,999; 38,000-39,999; 56,500-59,999; 67,000-69,999
(*See also Figs. 2.604-2.607*)

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

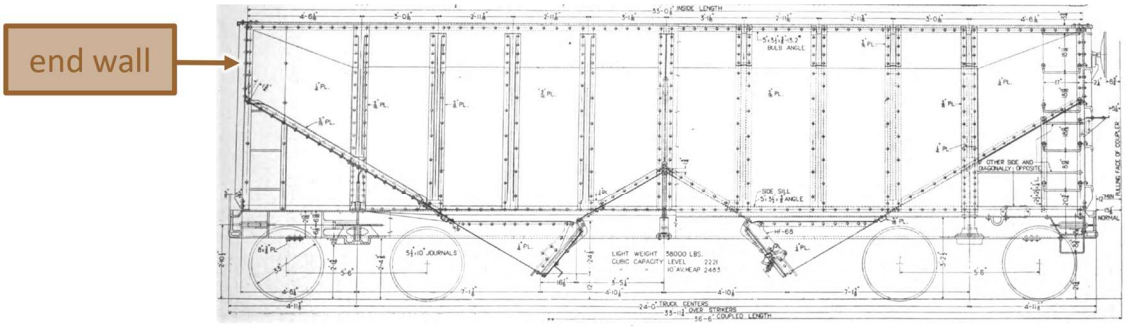


Fig. 2.608—Plan and elevation of Unitcast design, high-capacity, 60-ton twin hopper car with cast steel center sill, body bolsters, crossbearer, crossbearer arms and hopper frames
Unitcast Corporation.
(*See also Pages* 261, 262, 263)

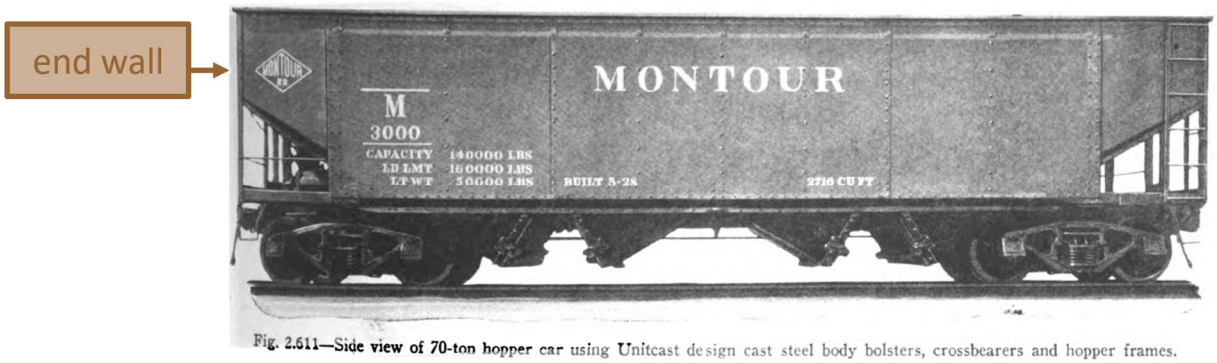
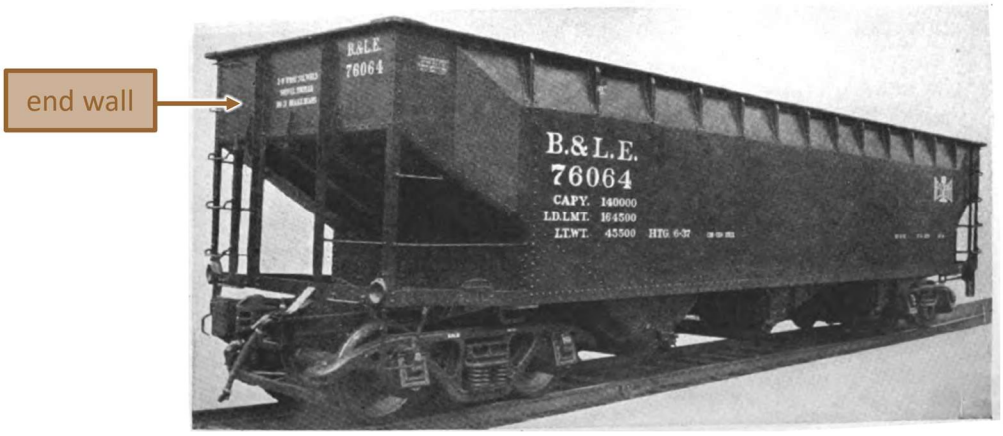


Fig. 2.611—Side view of 70-ton hopper car using Unitcast design cast steel body bolsters, crossbearers and hopper frames.

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



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

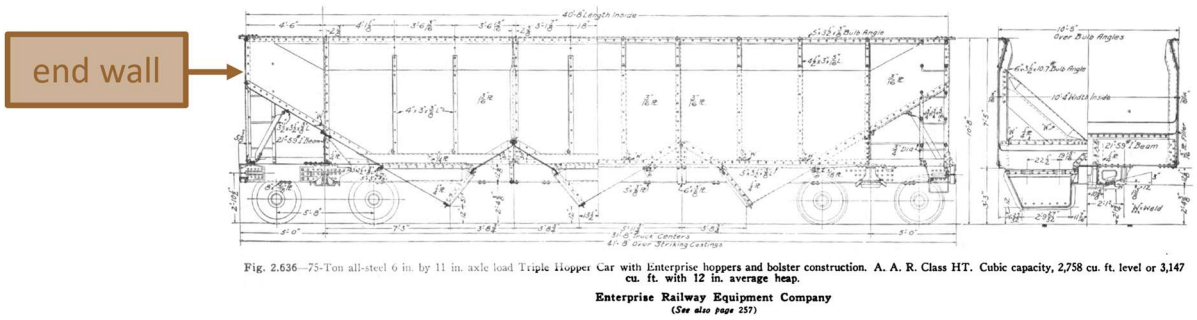


Fig. 2.636—75-Ton all-steel 6 in. by 11 in. axle load Triple Hopper Car with Enterprise hoppers and bolster construction. A. A. R. Class HT. Cubic capacity, 2,758 cu. ft. level or 3,147 cu. ft. with 12 in. average heap.

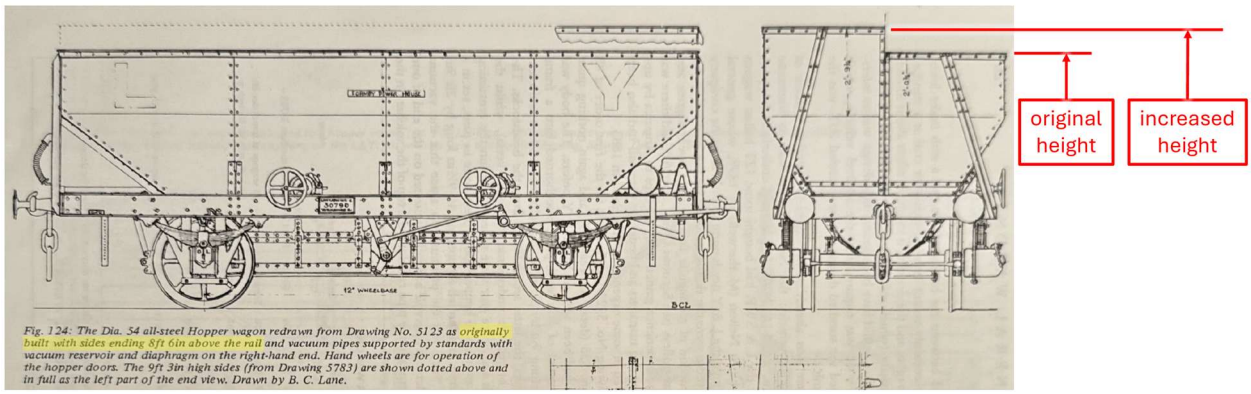
Enterprise Railway Equipment Company

(*See also page 257*)

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, namely: (i) incorporating an end wall or (ii) extending the slope sheet to the top cord. EX1003, ¶98. The routine design choice between these two options is governed by balancing well-understood considerations, *e.g.*, maintaining the desired maximum exterior dimensions of the railcar, maximizing the capacity of the hopper, supporting the loads carried by the slope sheet and hopper doors, and maximizing the car's efficiency in discharging its intended lading. *Id*.

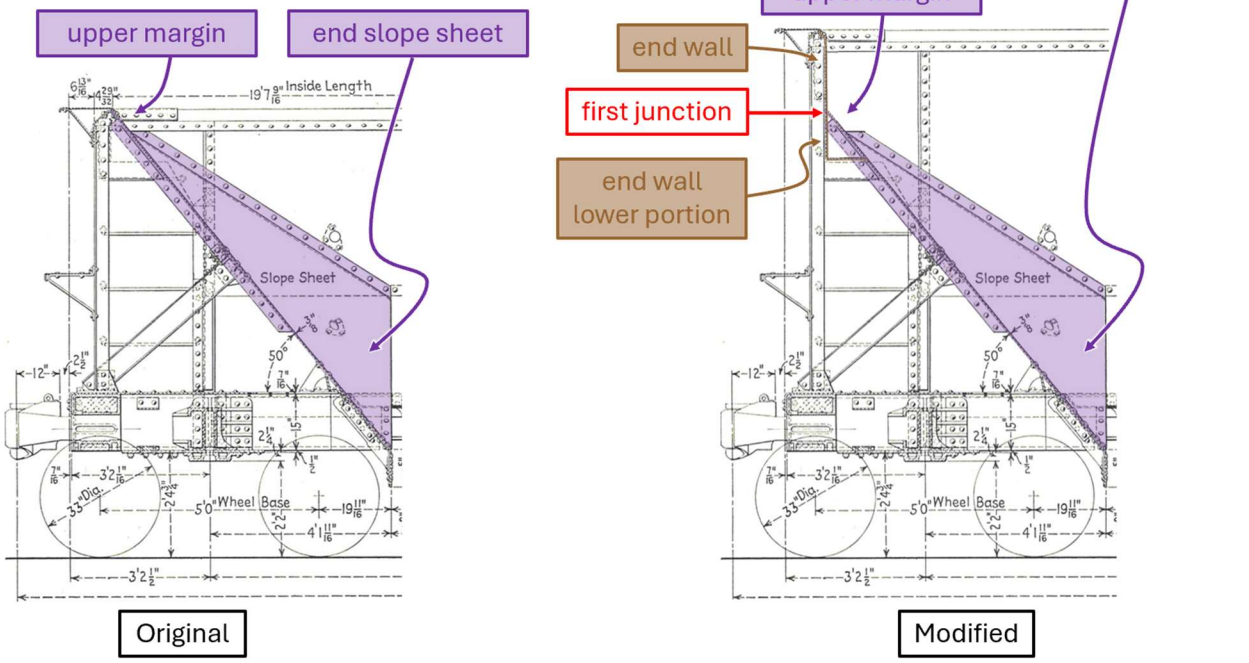
Finally, as shown below, Coates describes how the height of the hopper walls on the L&Y Hopper Car was increased by nine inches in approximately 1904-1906 to increase the hopper's capacity. EX1007 at 263. This suggests increasing the height of the hopper walls of the NSC design, thereby creating end walls. EX1003, ¶99.

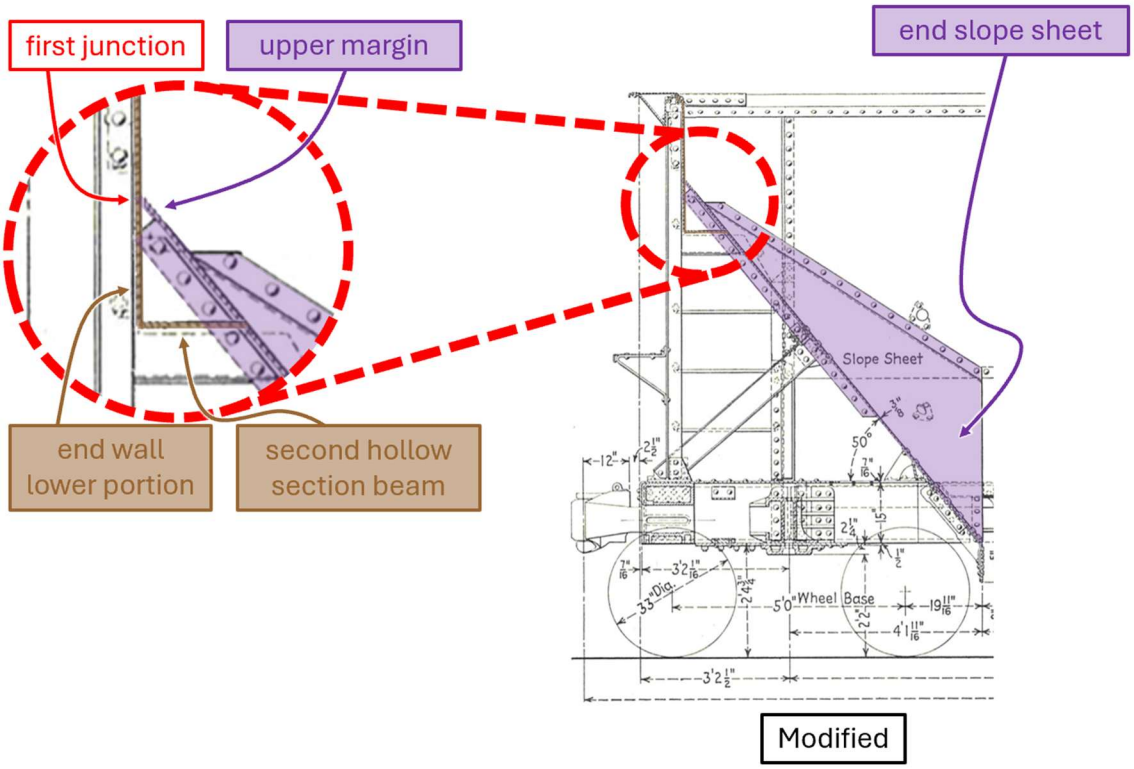


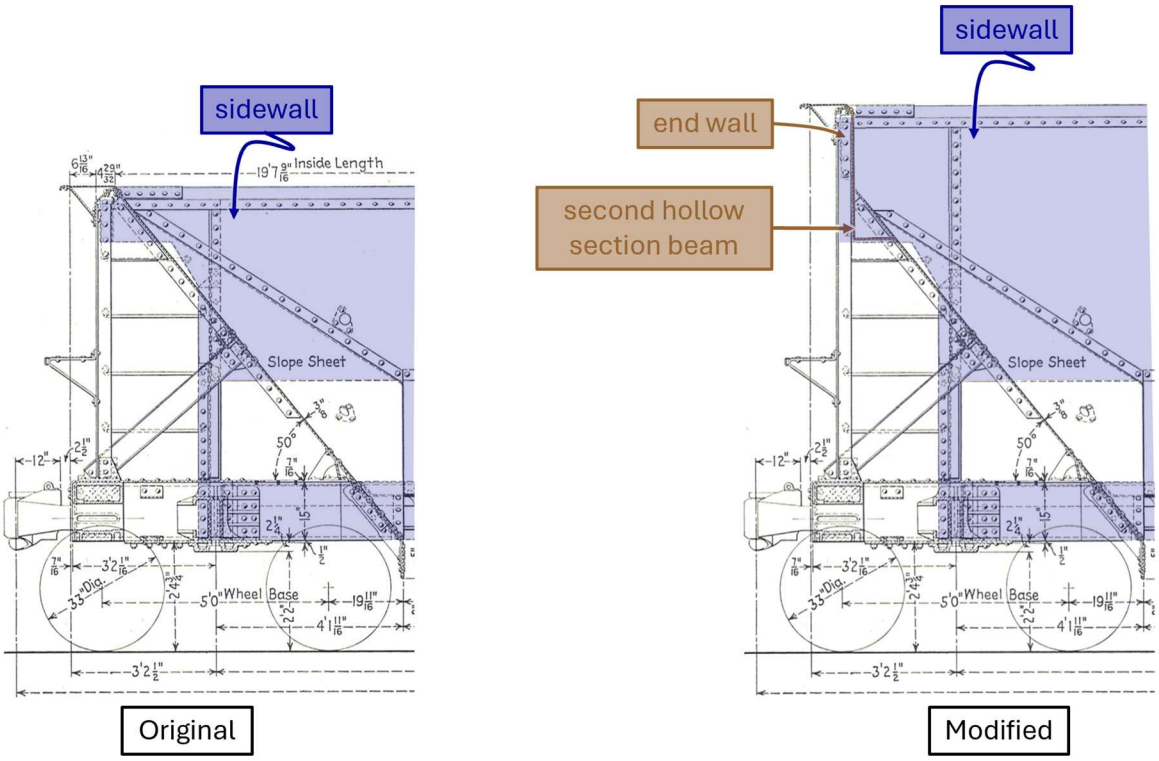
EX1007 at 262.

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. EX1003 at ¶100.

It also would have been obvious to use the specific end wall shown in Wong—with a bent lower end—to provide additional support for the slope sheet. *Id.* at ¶101. 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. *Id.* The modified design would satisfy limitation [7h], as illustrated below.


upper margin
end slope sheet
Slope Sheet
Original
upper margin
end slope sheet
end wall
first junction
end wall
lower portion
Slope Sheet
Modified

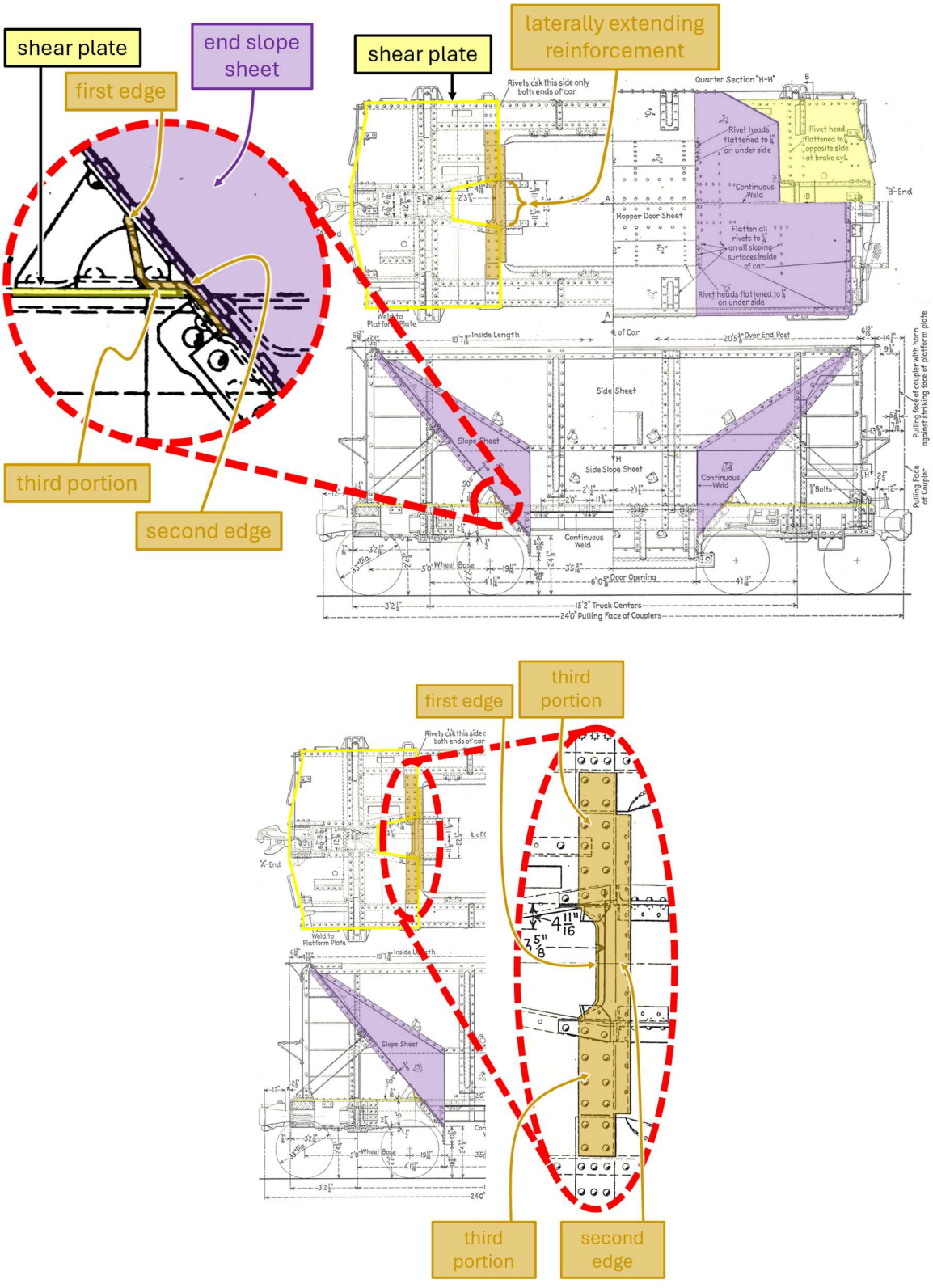

first junction
upper margin
end slope sheet
end wall
lower portion
second hollow
section beam
Slope Sheet
Modified



EX1004 at 294 (modified).

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

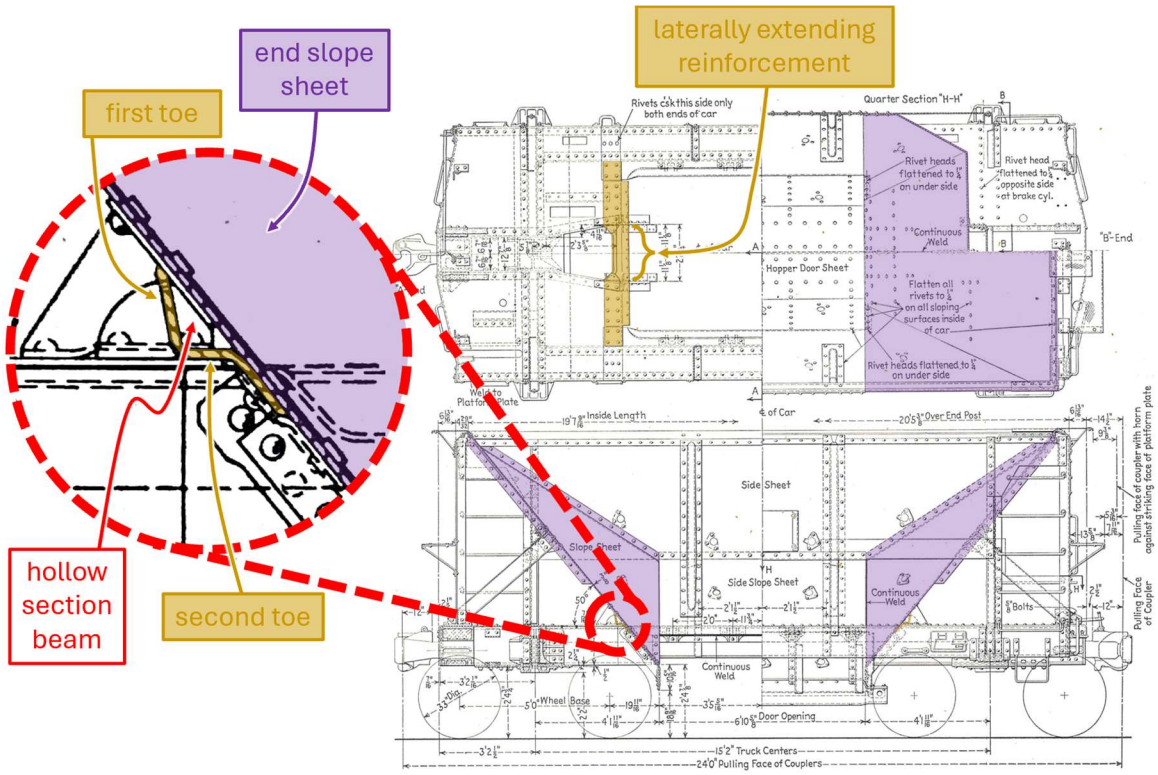
The 1946 Cyclopedia's NSC ore car discloses this limitation:



EX1004 at 294; EX1003, ¶102.

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

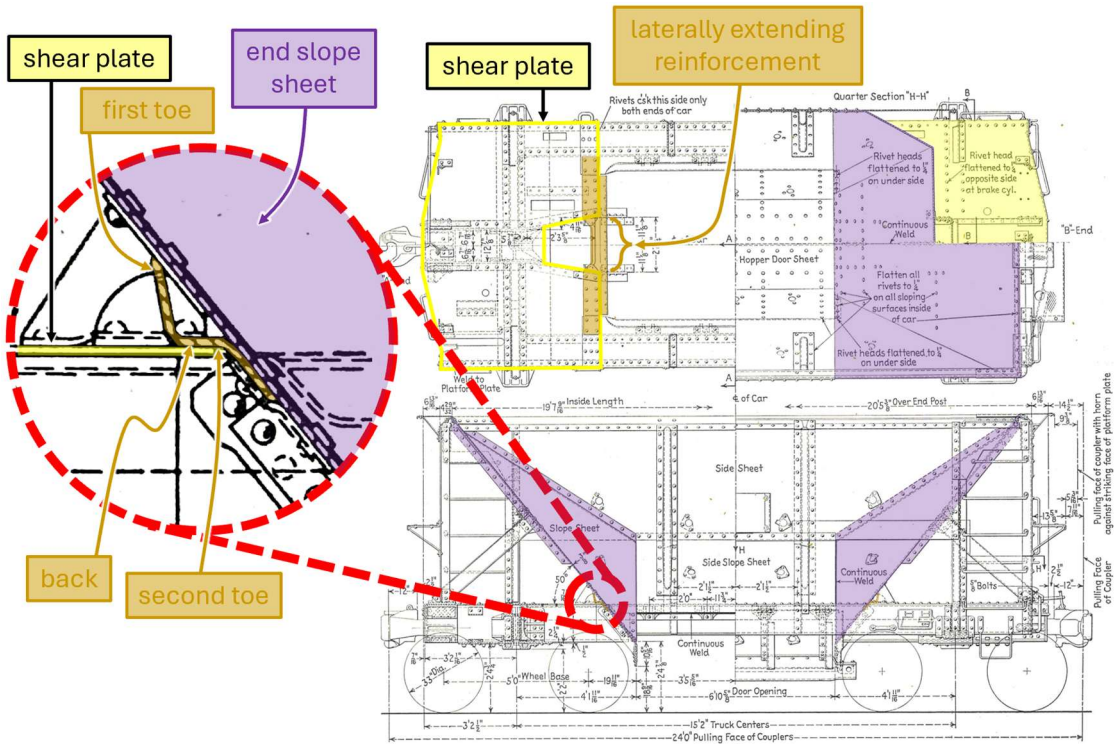
The 1946 Cyclopedia's NSC ore car discloses this limitation:



EX1004 at 294; EX1003, ¶103.

4. **<u>Claim 10:</u> "The railroad hopper car of claim 7 wherein said laterally extending reinforcement has, when seen in section, a first toe, a second toe, and a back; said laterally extending reinforcement is mounted toes-in against said first end slope sheet; and said back is mounted to said shear plate of said first end section."**

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



EX1004 at 294; EX1003, ¶104.

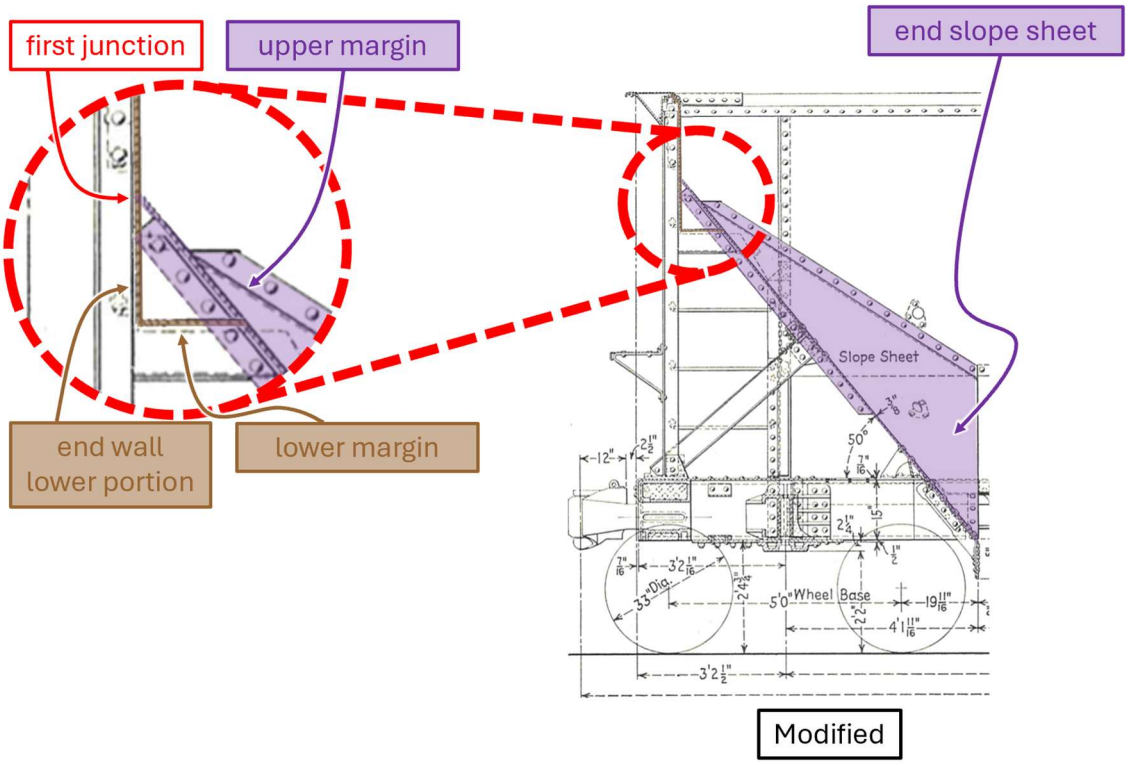
5. <u>Claim 11:</u> "The railroad hopper car of claim 10 wherein said laterally extending reinforcement is an angle iron mounted toes-in to said first end slope sheet."

The 1946 Cyclopedia's NSC ore car discloses this limitation. The '515 patent specification never uses the term "angle iron." *See* EX1001. However, a POSITA would understand the term to refer to "a piece of structural steel rolled with an L-shaped section." EX1003, ¶105 (quoting Merriam Webster).[1] Applying this definition, or any reasonable definition, the lower support beam of the 1946 Cyclopedia's NSC ore car satisfies the limitation of Claim 11. *See supra*, at § IV.D.5 (claim 10).

[1] The definition is available at www.merriam-webster.com/dictionary/angle%20iron.

6. **<u>Claim 12:</u> "The railroad hopper car of claim 7 wherein said lower portion of said first end wall member has a lower margin that is bent to meet said upper margin of said first end slope sheet at a location lower than said first junction."**

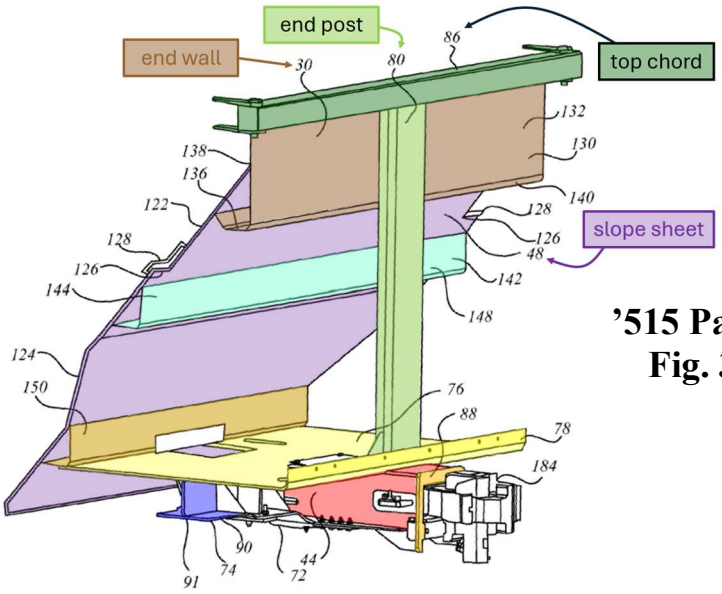
The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with limitation [7h], discloses this limitation.



EX1004 at 294 (modified).

7. **<u>Claim 13:</u> "The railroad hopper car of claim 7 wherein said first end wall member has an upper margin that terminates at a top chord, said top chord extending from side to side of said hopper car."**

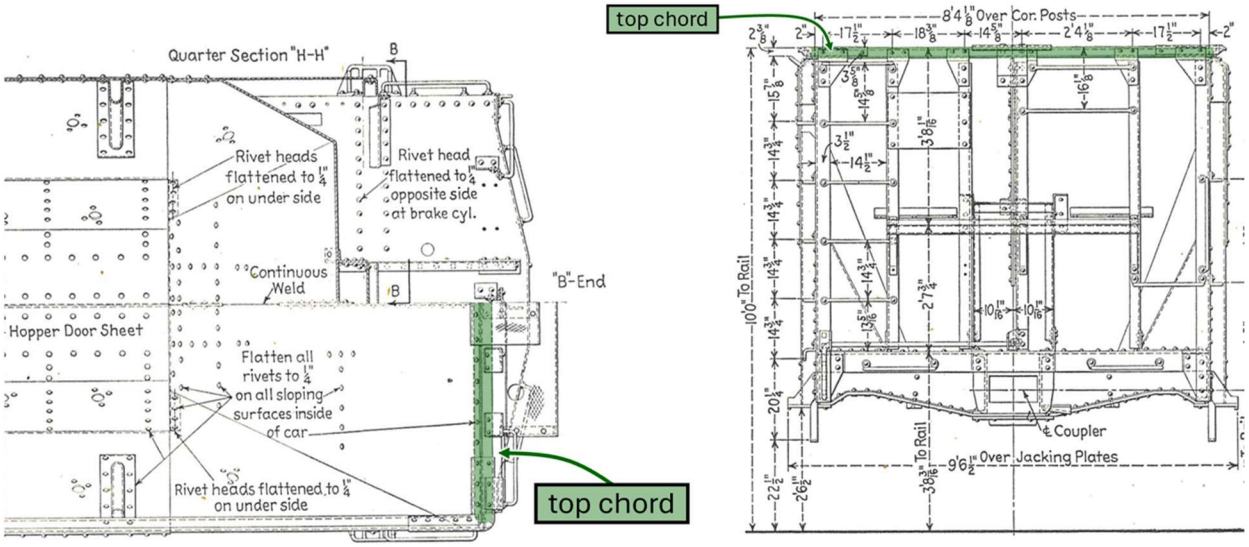
The 1946 Cyclopedia's NSC ore car discloses this limitation. The '515 patent defines the top chord as a flange when it refers to "a top flange or chord." EX1001 at 15:9-14. The '515 patent shows the elements of Claim 13 in the figure below.



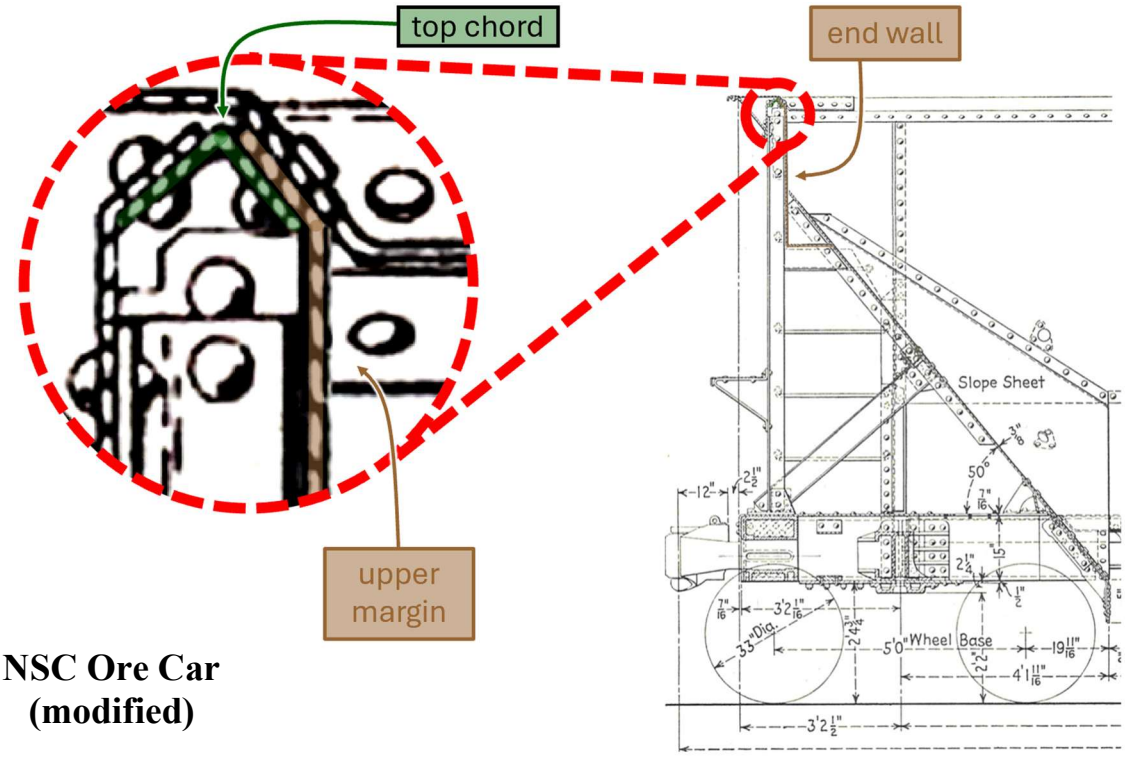
'515 Patent Fig. 3a

EX1001, Fig. 3a.

The 1946 Cyclopedia's NSC ore car also discloses a top chord or flange:



EX1004 at 294.

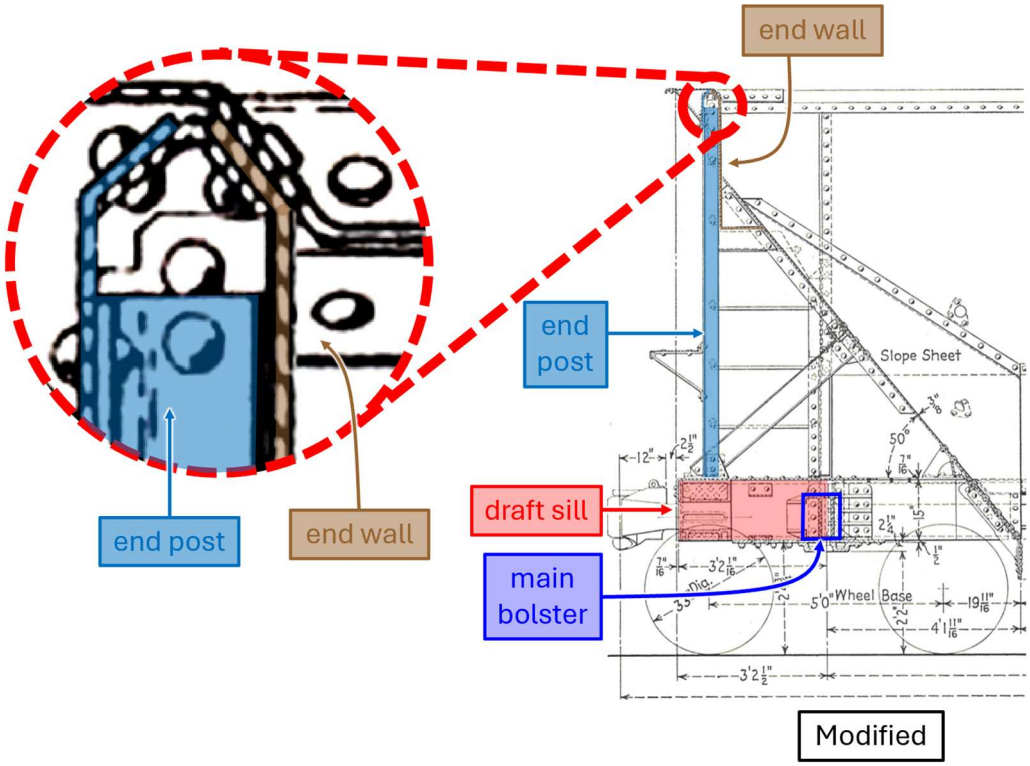


NSC Ore Car (modified)

EX1004 at 294 (modified).

8. **<u>Claim 14:</u> "The railroad hopper car of claim 7 wherein said car includes an upstanding end post, said end post being mounted over said draft sill longitudinally outboard of said main bolster and extending upwardly therefrom to meet said first end wall member."**

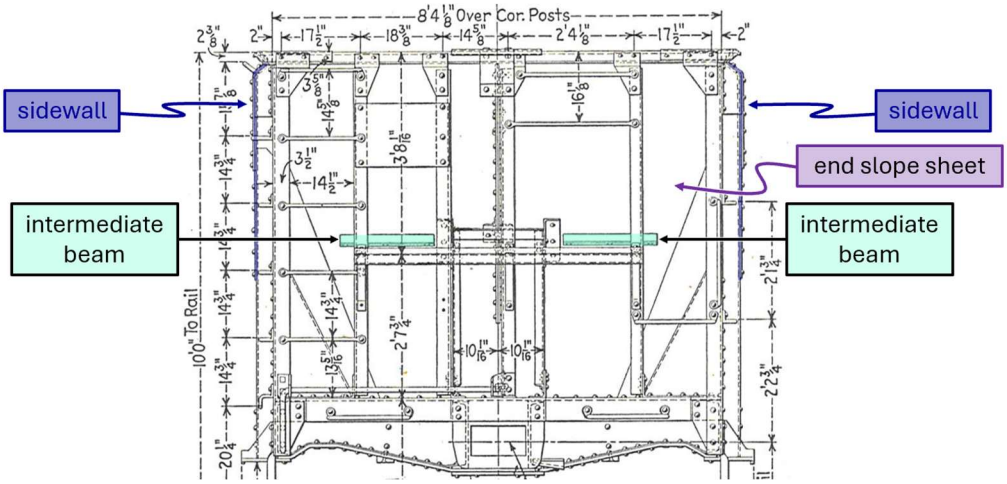
The 1946 Cyclopedia's NSC ore car discloses an end post mounted over the draft sill in the recited location, and therefore the obvious modification of the NSC design in view of Wong (discussed with limitation 7h) discloses the limitation of Claim 14:

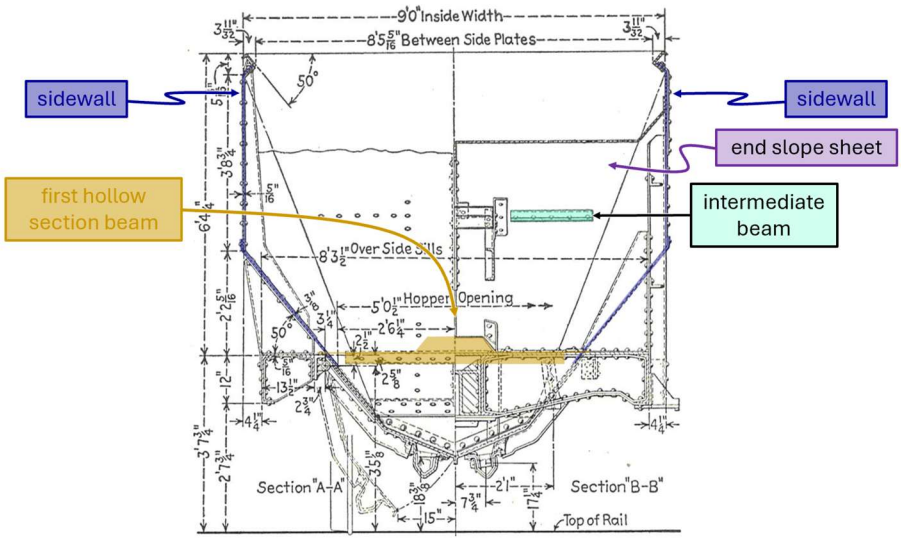


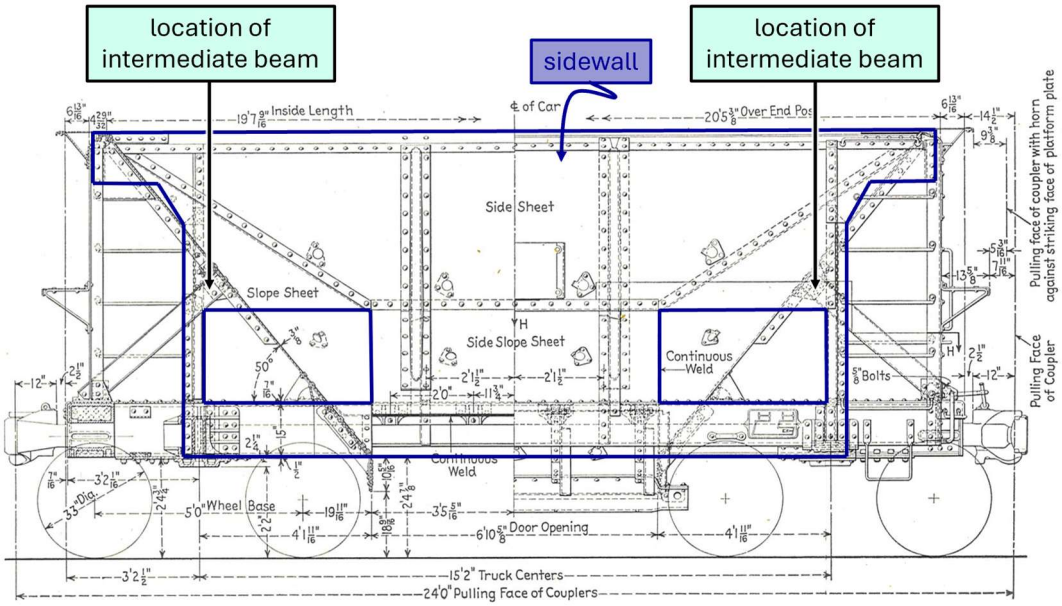
EX1004 at 294 (modified).

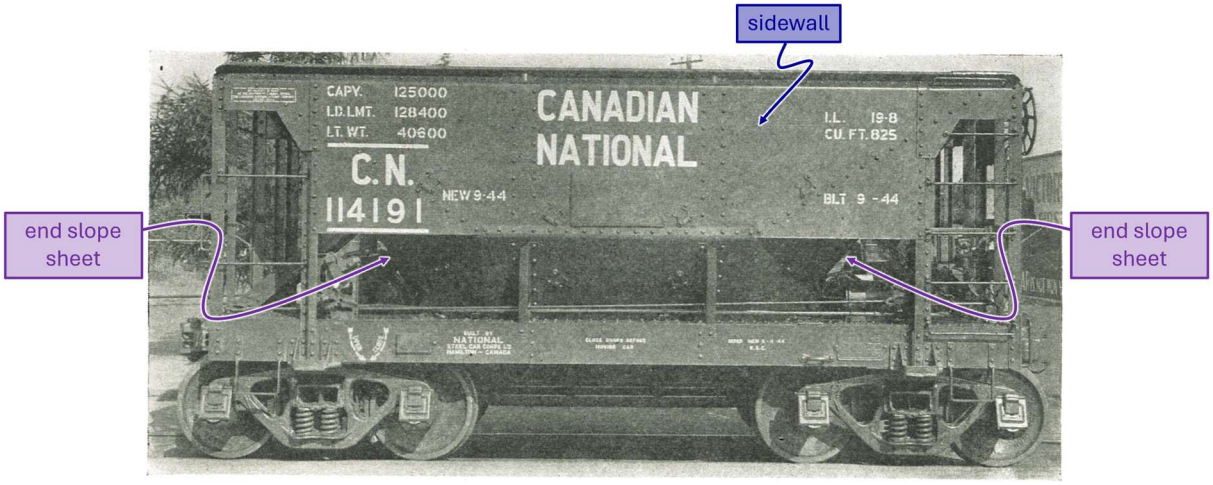
9. **<u>Claim 15:</u> "The railroad hopper car of claim 7 wherein an intermediate beam extends across said first end slope sheet between said first and second side walls at a position intermediate said first hollow section beam and said second hollow section beam."**

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




sidewall
sidewall
end slope sheet
first hollow section beam
intermediate beam
9'0" Inside Width
8'5 5/16" Between Side Plates
8'3 1/2" Over Side Sills
5'0 1/2" Hopper Opening
Section "A-A"
Section "B-B"
Top of Rail

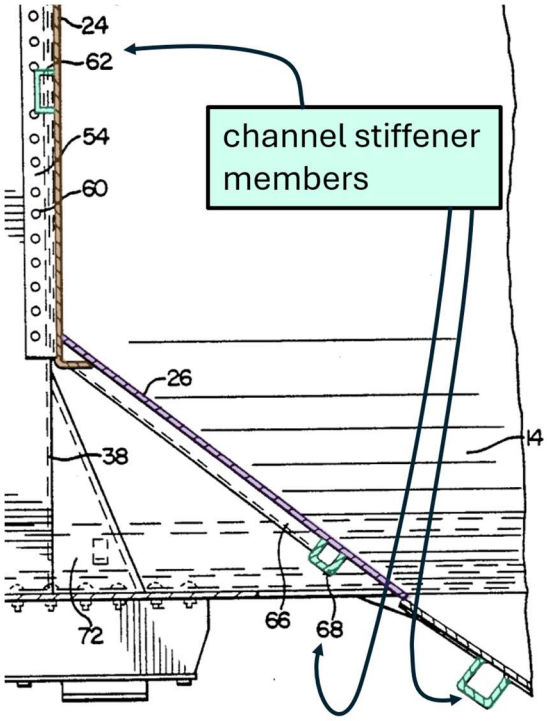

location of intermediate beam
sidewall
location of intermediate beam
19'7 9/16" Inside Length
℄ of Car
20'5 3/8" Over End Pos
Side Sheet
Slope Sheet
Side Slope Sheet
Continuous Weld
Continuous Weld
5/8" Bolts
Pulling face of coupler with horn against striking face of platform plate
Pulling Face of Coupler
5'0" Wheel Base
6'10 5/8" Door Opening
15'2" Truck Centers
24'0" Pulling Face of Couplers


sidewall
end slope sheet
end slope sheet
CAPY. 125000
LD. LMT. 128400
LT. WT. 40600
C.N.
114191
NEW 9-44
CANADIAN NATIONAL
I.L. 19-8
CU. FT. 825
BLT 9 -44

EX1004 at 294-95; EX1003, ¶106.

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

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



EX1006, Fig. 4. A POSITA would have been motivated to add an intermediate beam to the NSC ore car, similar to Wong's hollow channel stiffener 68, to support the part of the slope sheet farthest from the upper and lower stiffeners. EX1003, ¶108. So modified, the NSC ore car would embody Claim 15.

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

As discussed above with Claim 15, Wong's channel stiffeners are mounted "toes-in" to the underside of the slope sheet. The modification discussed in that section would therefore satisfy the limitation of Claim 16.

11. <u>Independent Claim 18</u>

a. [18a] "A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1a].

b. [18b] "said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1b].

c. [18c] "said first end section including a draft sill extending in the longitudinal direction, a main bolster extending cross-wise to said draft sill, and a shear plate mounted to said draft sill and to said main bolster, said shear plate

extending lengthwise along said draft sill and cross-wise from side to side of said hopper car;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1c].

d. [18d] "said first end slope sheet of said hopper over-hanging said shear plate of said first end section;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1d].

e. [18e] "first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [20e].

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

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [20f].

g. [18g] "said hopper car being free of longitudinally oriented shear webs ears extending between said draft sill and said end slope sheet;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reasons it discloses limitation [20g].

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

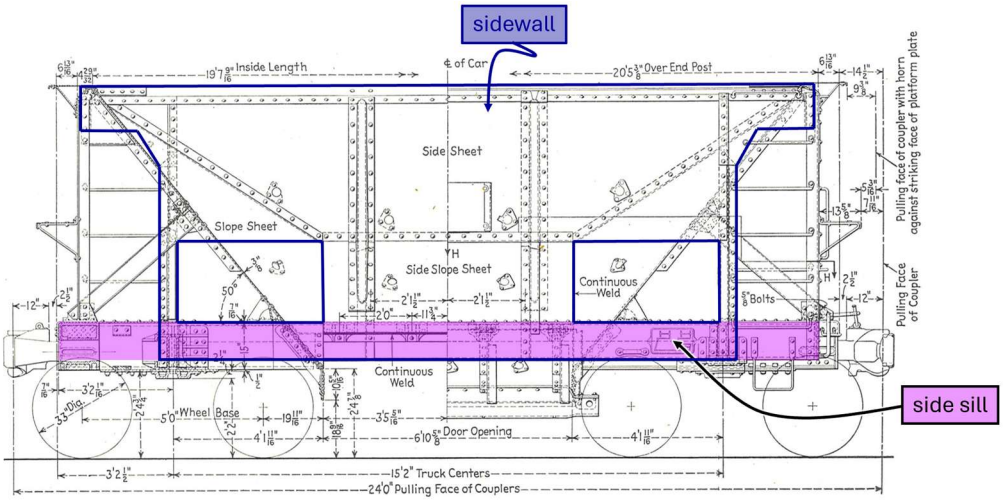
As discussed above in connection with limitation [20f], the 1946 Cyclopedia's NSC ore car discloses the claimed first hollow section beam. With the obvious modifications of the NSC ore car in view of Wong, discussed in connection with limitation 7h and Claim 15, the NSC ore car discloses the claimed second and third hollow section beams, respectively.

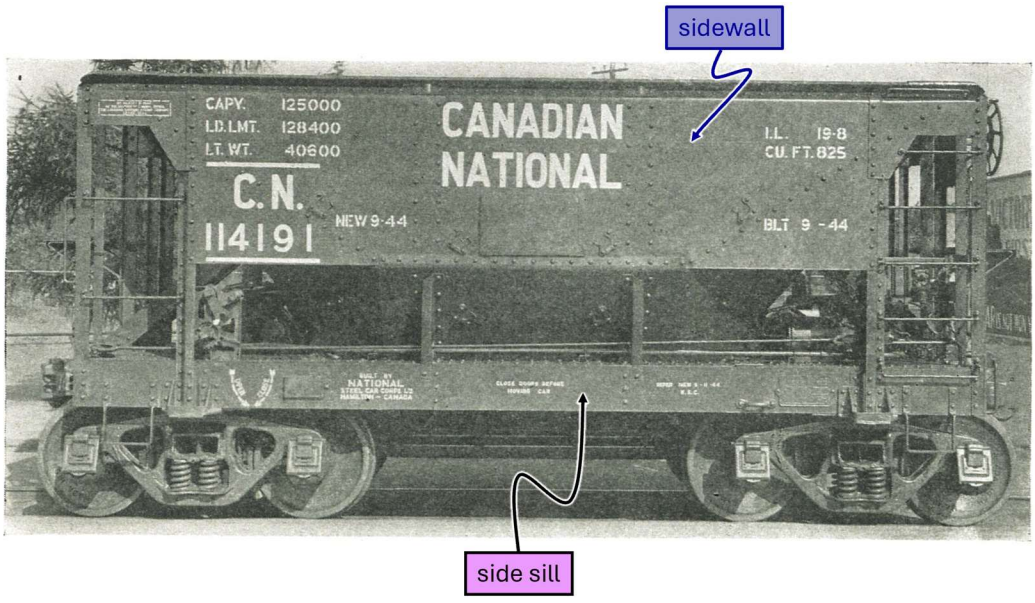
i. [18i] "said hopper car has an end post mounted over said draft sill, said end post being located longitudinally outboard of said main bolster of said first end section; said end post extends upwardly to meet said second hollow section beam;"

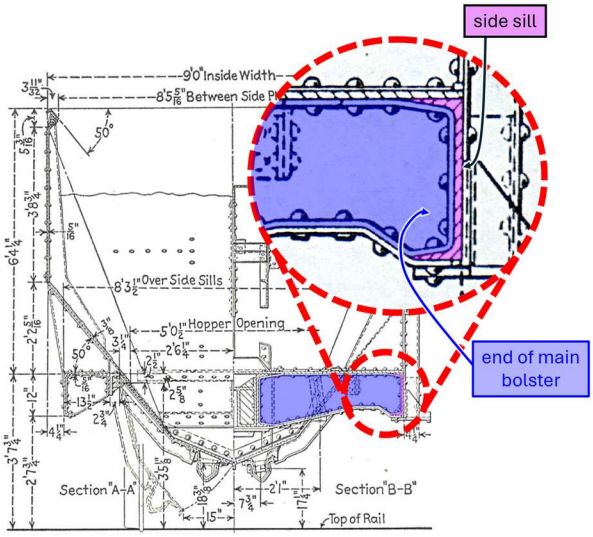
For the reasons stated in connection with Claim 14, the obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong (discussed in connection with limitation [7h]) discloses this limitation.

j. [18j] "said hopper car has first and second side sills running longitudinally along either side thereof, said first and second side walls extending upwardly of said first and second side sills respectively; said first and second side sills mate with first and second ends of said main bolster of said first end section; and"

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



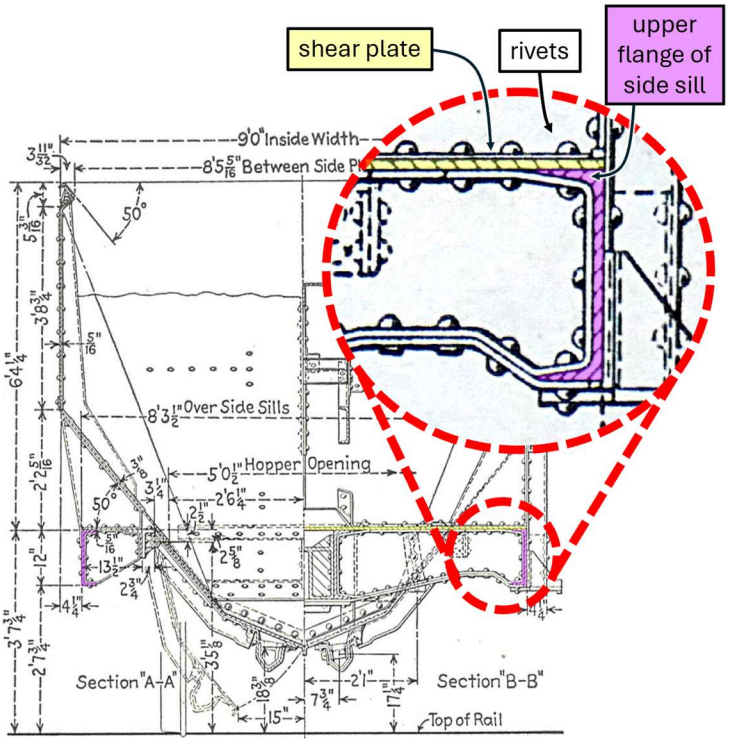




EX1004 at 294-95.

k. [18k] "said first and second side sills have upper flanges that mate with said shear plate of said first and section."

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



EX1004 at 294.

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

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with limitation [7h], discloses this limitation.

13. **Independent Claim 24**

a. **[24a] "A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,"**

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1a].

b. **[24b] "said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;"**

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1b].

c. [24c] "said first end section including a draft sill extending in the longitudinal direction, a main bolster extending cross-wise to said draft sill, and a shear plate overlying said draft sill and said main bolster, said shear plate extending along said draft sill and cross-wise from side to side of said hopper car;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1c].

d. [24d] "said first end slope sheet over-hanging said shear plate of said first end section;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1d].

e. [24e] "first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [20e].

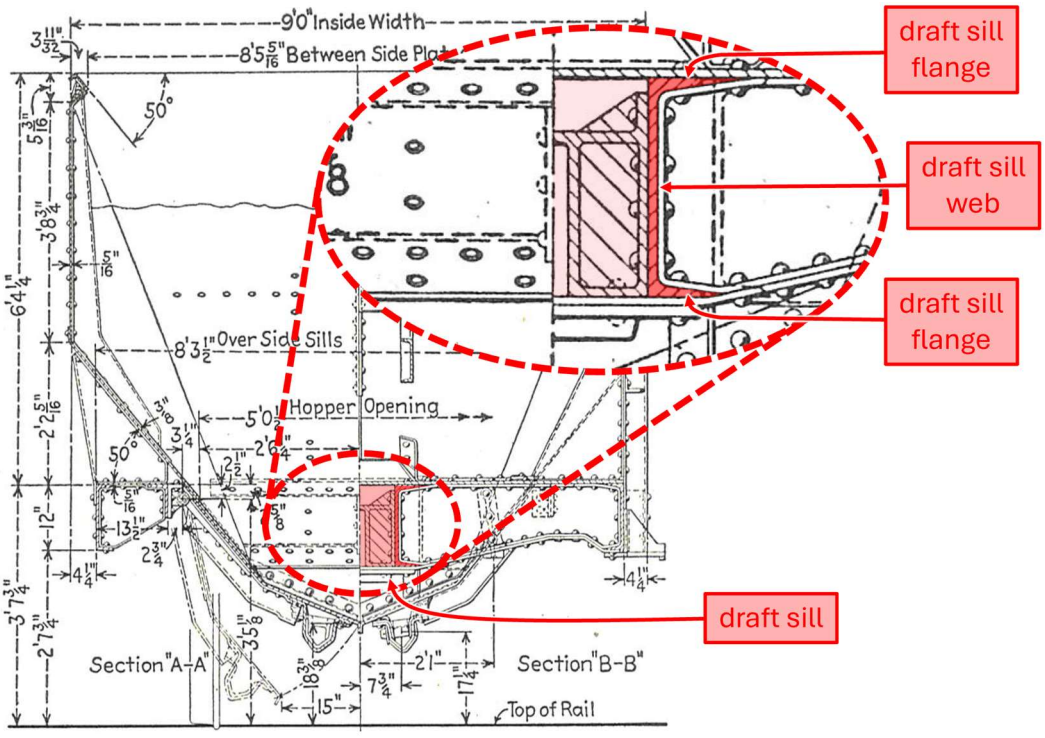
f. [24f] "there being a first end wall extending between said first and second side walls; said first end slope sheet having an uppermost margin, said uppermost margin meeting said first end wall at a first junction; said hopper car having a first beam extending cross-wise between said first and second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

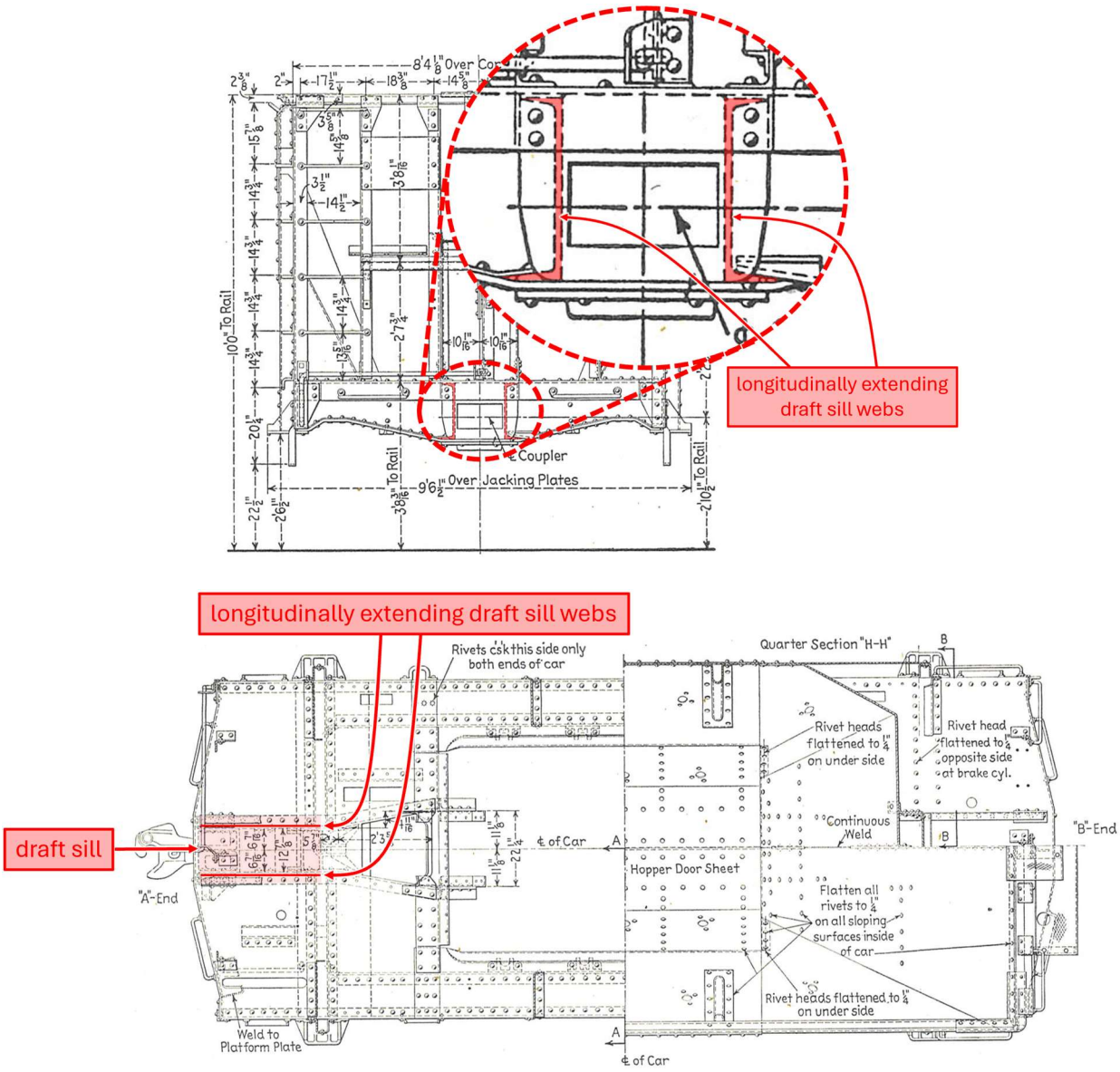
said uppermost margin of said first end slope sheet and said first end wall; and said lower portion of said first end wall forms part of said first beam;"

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with limitation [7h], discloses this limitation.

g. [24g] "said draft sill having longitudinally extending draft sill webs;"

The 1946 Cyclopedia defines "web" as "[a] term applied to the center portion of a beam, as an I-beam, which ties the flanges together." EX1004 at 69. The 1946 Cyclopedia's NSC ore car discloses this limitation, as shown below.





EX1004 at 294.

h. [24h] "said first end section being free of longitudinally oriented elephant ears extending upwardly of said draft sill webs to meet said end slope sheet;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [7g].

i. [24i] "said lower portion of said first end wall has a margin, and said margin is bent to mate with said first end slope sheet as a second junction distant from the first junction, said lower portion of said first end wall and said uppermost margin of said first end slope sheet co-operating to define said first beam."

For the reasons stated in connection with Claim 12, the obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong (discussed in connection with limitation [7h]) discloses this limitation.

14. <u>Claim 25:</u> "The railroad hopper car of claim 24 wherein an end post is mounted over said draft sill outboard of said main bolster, said end post extending upwardly to meet said first beam."

For the reasons stated in connection with Claim 14, the obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong (discussed in connection with limitation [7h]) discloses this limitation.

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

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with limitation [7h], discloses this limitation.

16. **<u>Claim 27:</u> "The railroad hopper car of claim 25 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom."**

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1h].

17. **<u>Claim 30:</u> "The railroad hopper car of claim 24 wherein a second beam is mounted across said first end slope sheet adjacent said shear plate."**

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [7f].

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

The modification of the 1946 Cyclopedia's NSC ore car discussed in connection with Claims 15 and 16 also discloses the limitation of Claim 31.

19. **<u>Independent Claim 32</u>**

    a. **[32a] "A railroad hopper car, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between said first and second end sections,"**

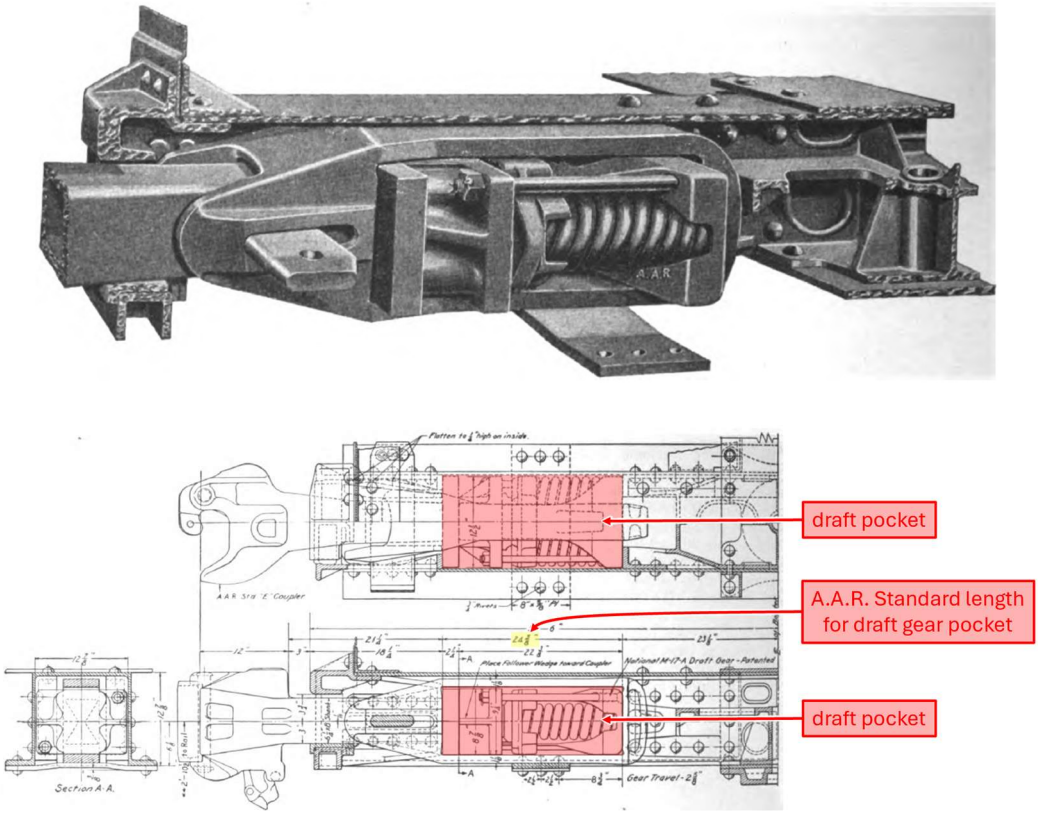
The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1a].

b. [32b] "said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;"

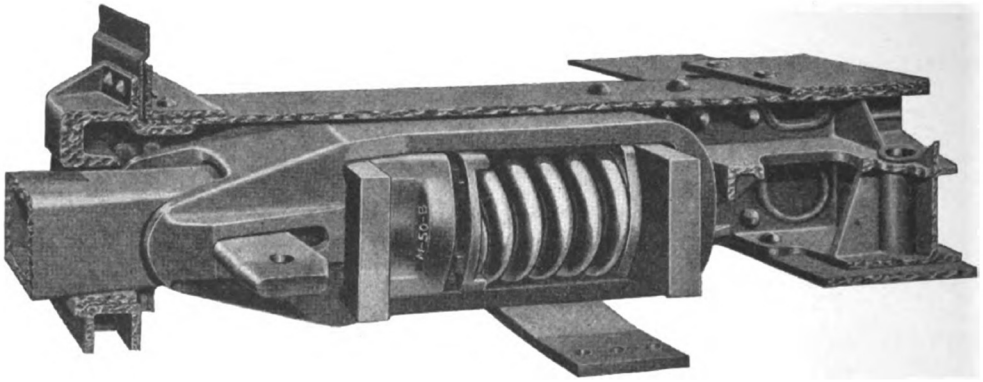
The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1b].

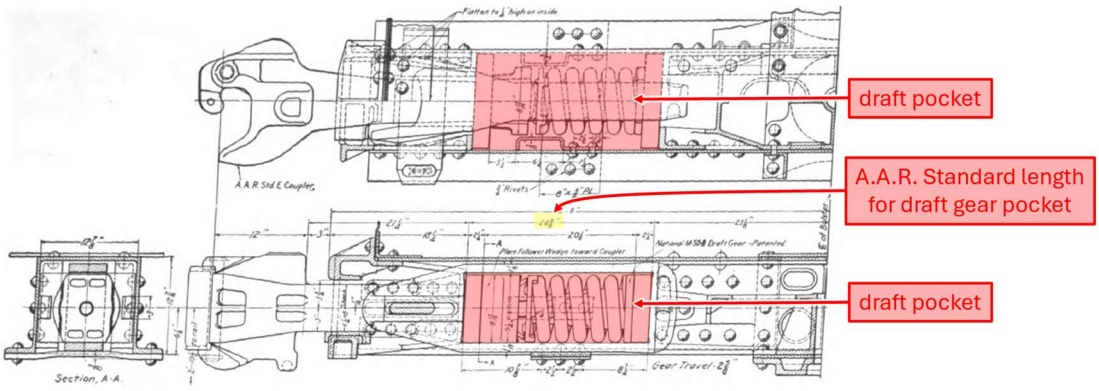
c. [32c] "said first end section including a draft sill extending in the longitudinal direction, said draft sill having first and second spaced apart longitudinally running draft sill webs and a draft pocket defined therebetween;"

The 1946 Cyclopedia's NSC ore car discloses this limitation. Regarding the claimed "draft pocket" defined between the draft sill webs, the '515 patent's specification uses the term "draft pocket" interchangeably with the term "draft gear pocket." EX1001 at 9:55-10:10. The 1946 Cyclopedia defines "Draft Gear Pocket" as "[t]he space occupied by the draft gear and followers in the center or draft sills. Manual M-901." EX1004 at 31. The Association of American Railroads (A.A.R.) Standards, as revised in 1938, set a standard length for a "draft gear pocket in the car sills" of 24 5/8 inches. EX1004 at 367 (citing A.A.R. Manual Page C-3, item 18). The 1946 Cyclopedia has a 28-page section regarding draft gears that includes the following examples of draft pockets and call out the A.A.R. Standard length therefor. EX1004 at 936-963 (1946 Cyclopedia section on draft gears).



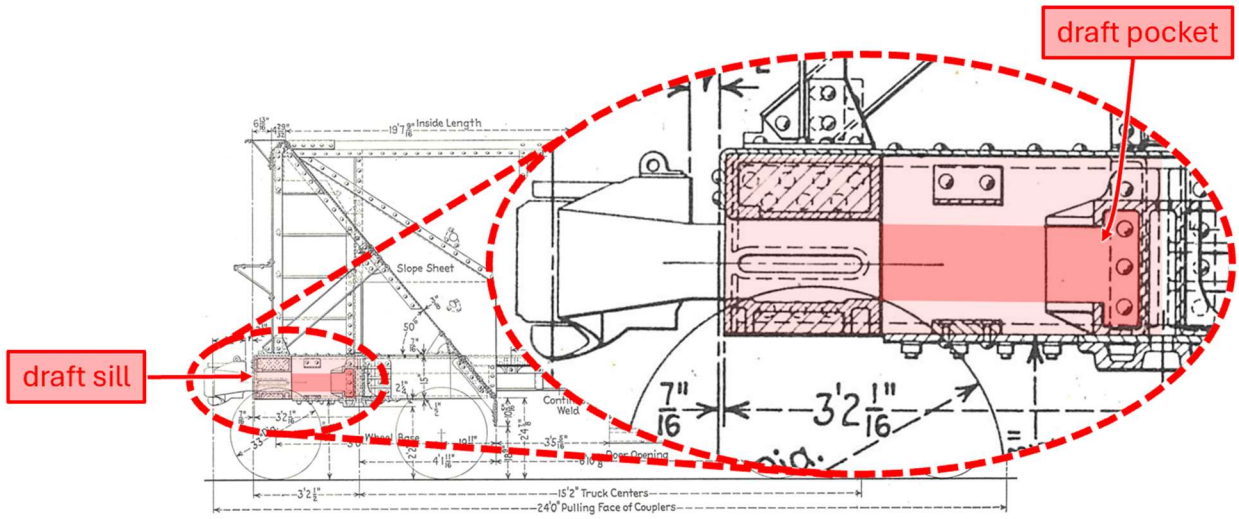
EX1004 at 952 Fig 10.67, 954 Fig. 10.69 ("National friction draft gear, Type M-17-A").

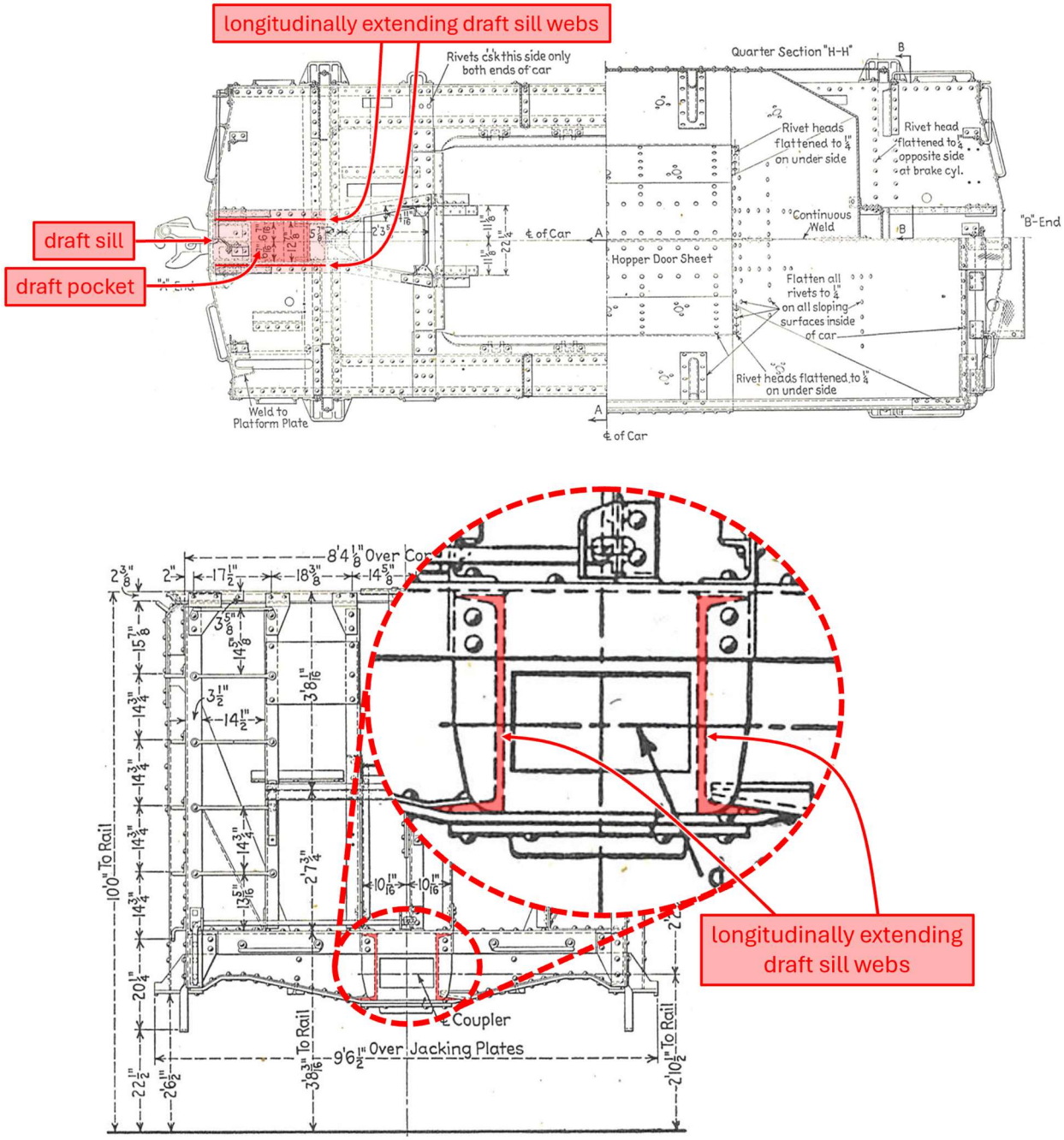


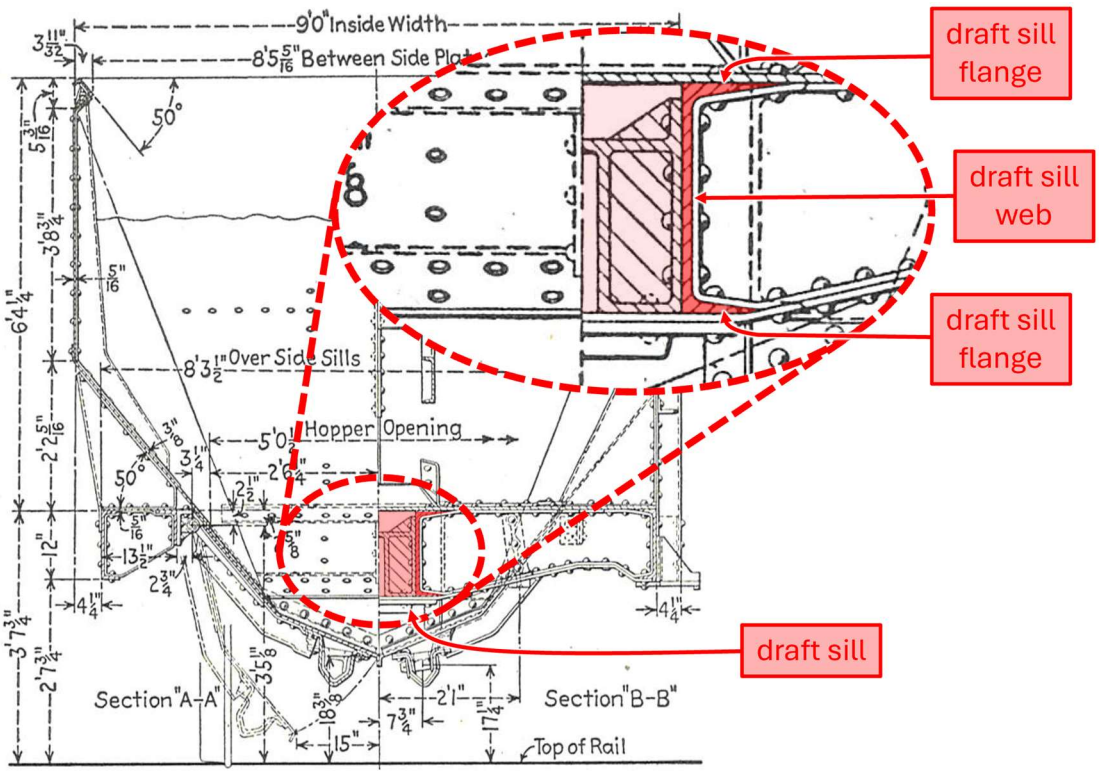


EX1004 at 956 Fig. 10.74, 957 Fig. Fig. 10.76 ("National friction draft gear, Type M-50-B").

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



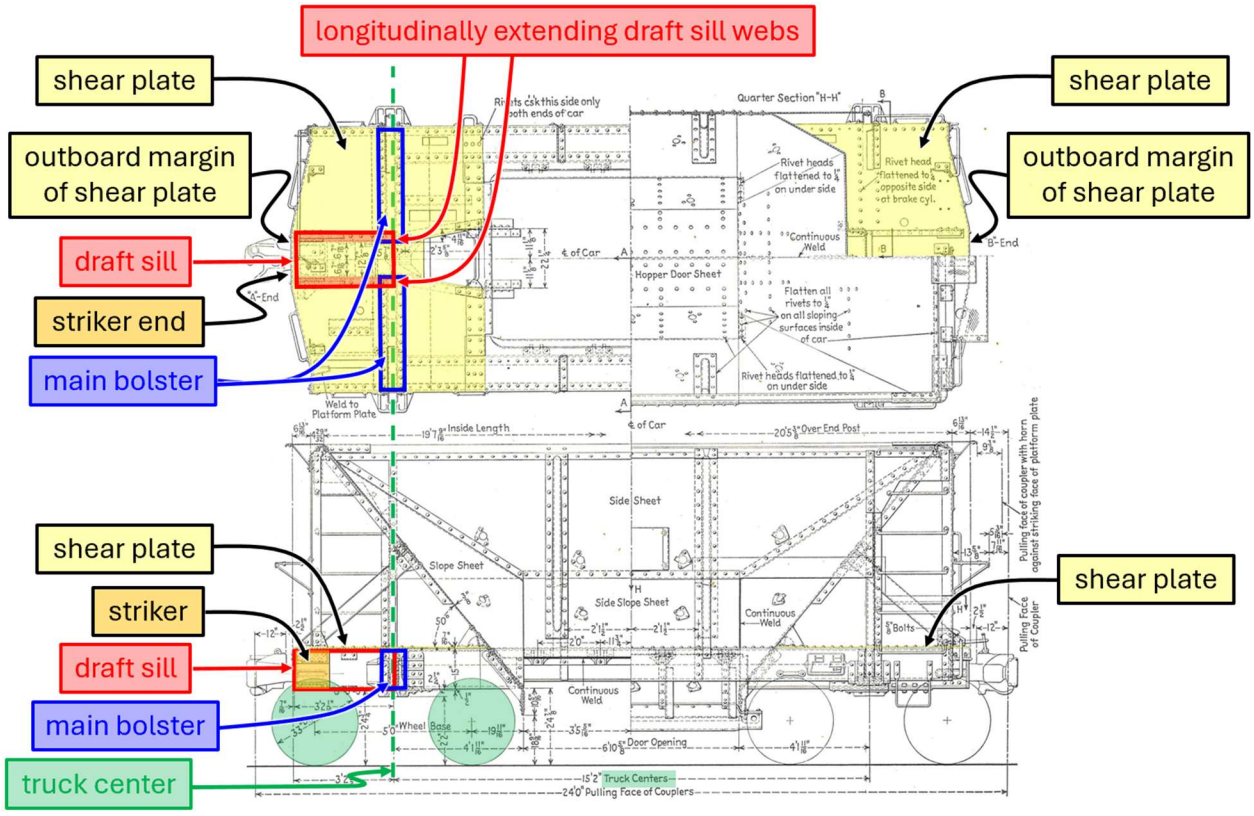

longitudinally extending draft sill webs
draft sill
draft pocket
Rivets c'sk this side only both ends of car
Quarter Section "H-H"
Rivet heads flattened to ¼" on under side
Rivet head flattened to ¼" opposite side at brake cyl.
Continuous Weld
"B" End
℄ of Car
Hopper Door Sheet
Flatten all rivets to ¼" on all sloping surfaces inside of car
Rivet heads flattened to ¼" on under side
Weld to Platform Plate
8'4 1/8" Over Coupler
10'0" To Rail
9'6 1/2" Over Jacking Plates
longitudinally extending draft sill webs

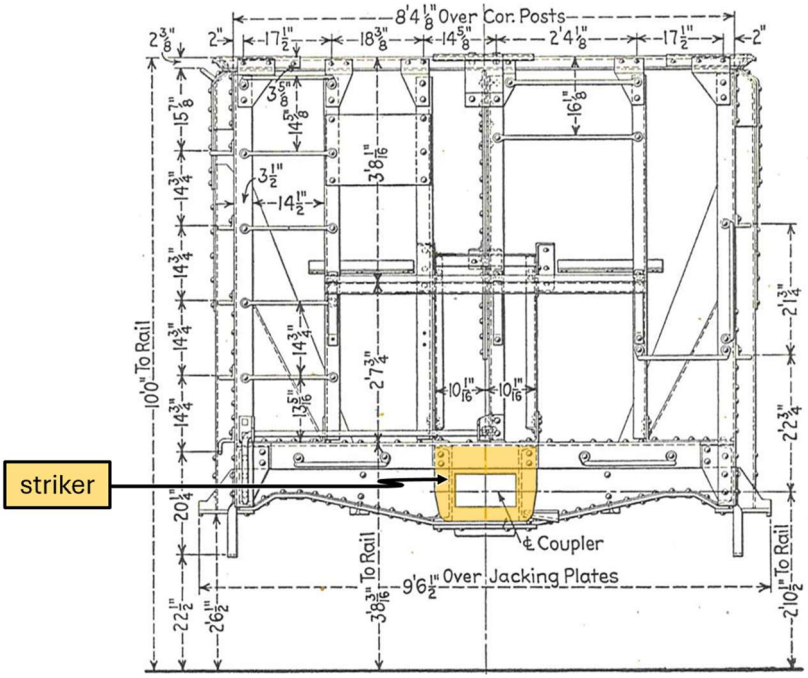


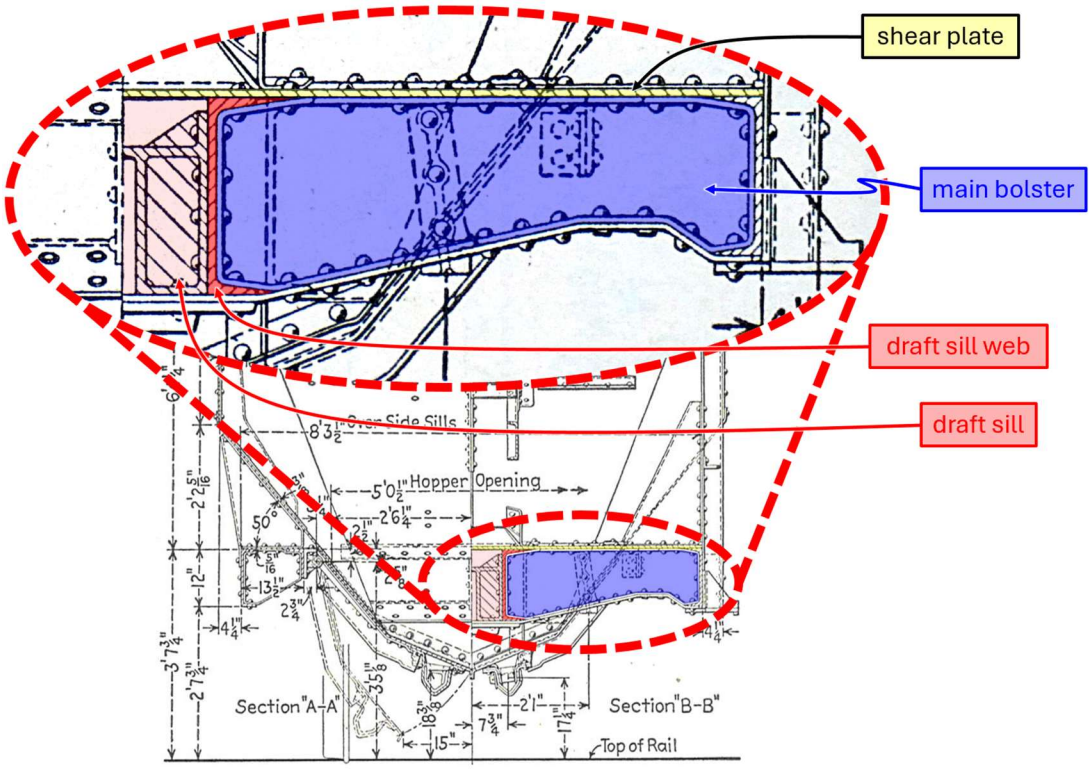
EX1004 at 294; EX1003, ¶110.

d. [32d] "said first end section including a main bolster extending cross-wise to said draft sill; said first end section having a truck center where said main bolster meets said draft sill; said draft sill having a striker end longitudinally outboard of said truck center; said first end section including a shear plate; said shear plate overlying said draft sill webs and said main bolster, said shear plate extending longitudinally along said draft sill and cross-wise from side to side of said hopper car; said shear plate having an outboard margin running across said car distant from said truck center and proximate said striker end;"

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


longitudinally extending draft sill webs
shear plate
outboard margin of shear plate
draft sill
striker end
main bolster
shear plate
outboard margin of shear plate
shear plate
striker
draft sill
main bolster
truck center
shear plate
Quarter Section "H-H"
Hopper Door Sheet
Side Sheet
Slope Sheet
Side Slope Sheet
Continuous Weld
Rivet heads flattened to ⅞" on under side
Flatten all rivets to ¾" on all sloping surfaces inside of car
Rivet heads flattened to ¾" on under side
Weld to Platform Plate
Inside Length
Over End Post
Pulling face of coupler with horn against striking face of platform plate
Pulling Face of Coupler
⅞" Bolts
Wheel Base
Door Opening
Truck Centers
Pulling Face of Couplers


striker
8'4⅛" Over Cor. Posts
100" To Rail
℄ Coupler
9'6½" Over Jacking Plates
38/16" To Rail
10½" To Rail



EX1004 at 294.

e. [32e] "said first end slope sheet over-hanging said shear plate of said first end section;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [7d].

f. [32f] "first and second side walls running lengthwise along first and second sides of said car, said first end slope sheet of said hopper extending cross-wise between said first and second side walls;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [20e].

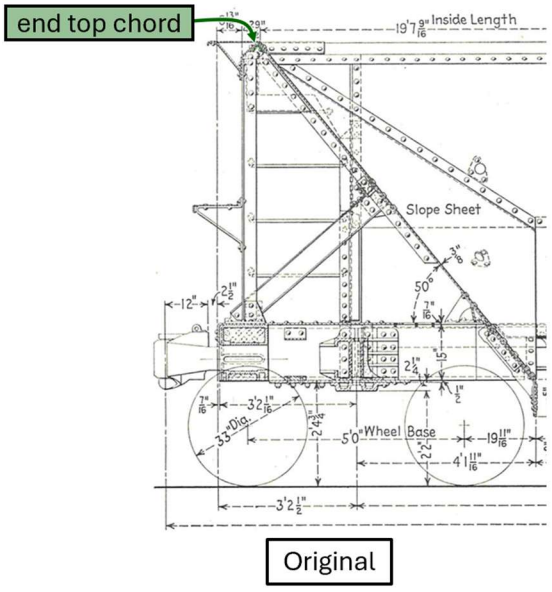
g. [32g] "there being a first end wall extending between said first and second side walls; said first end slope sheet having an uppermost margin, said uppermost margin meeting said

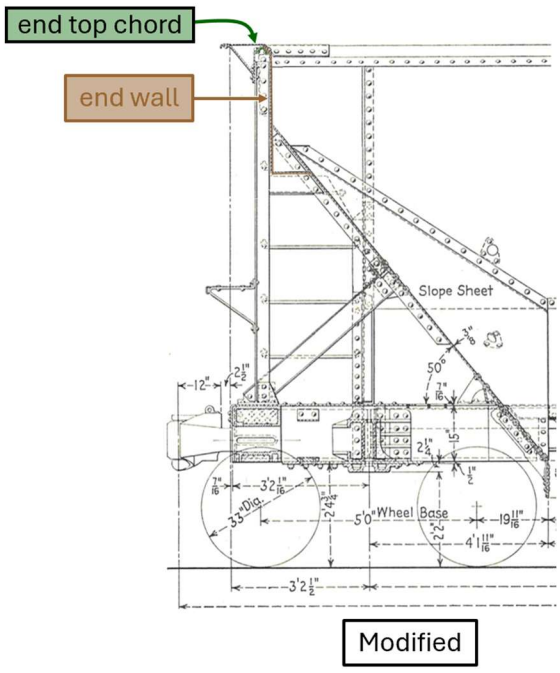
first end wall at a first junction; said hopper car having a first beam extending cross-wise between said first and second side walls at said first junction of said uppermost margin of said first end slope sheet and said first end wall, said first beam being a beam of hollow section;"

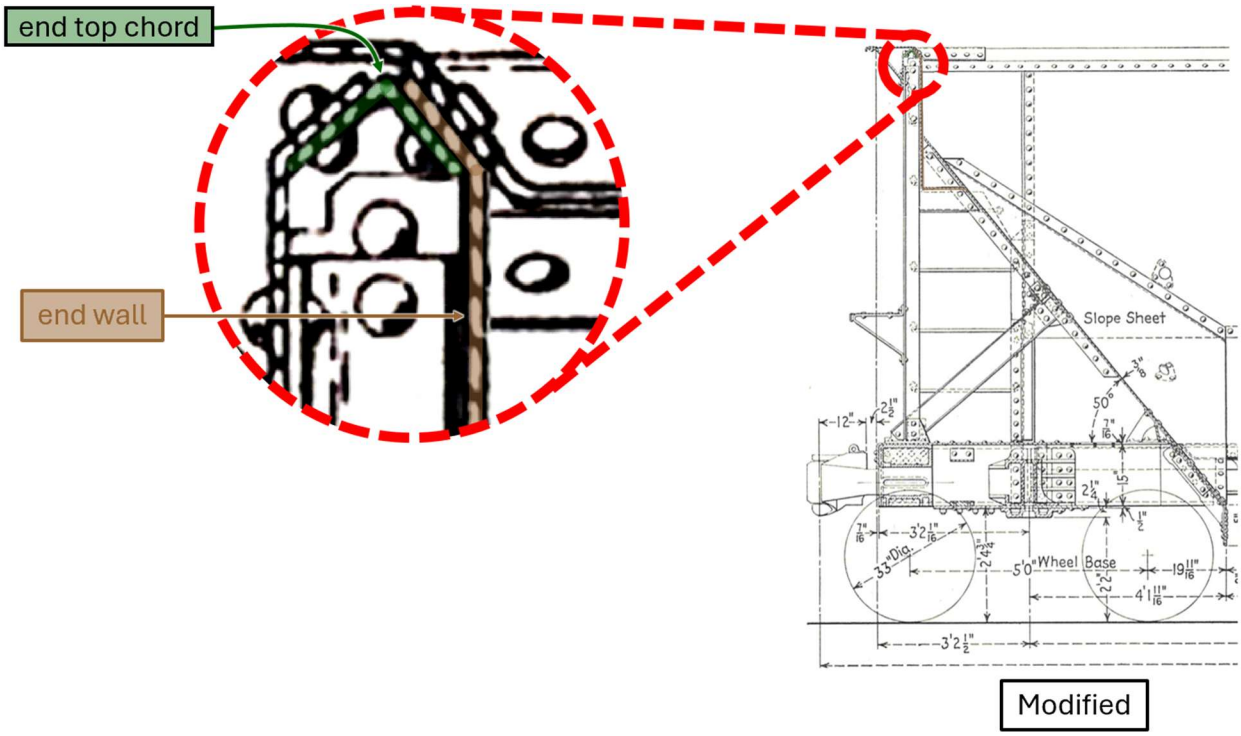
The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [7h].

h. [32h] "said first end wall is surmounted by a cross-wise running top chord; said first end wall includes a panel extending downwardly from said cross-wise running top chord;"

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with limitation [7h], discloses this limitation:



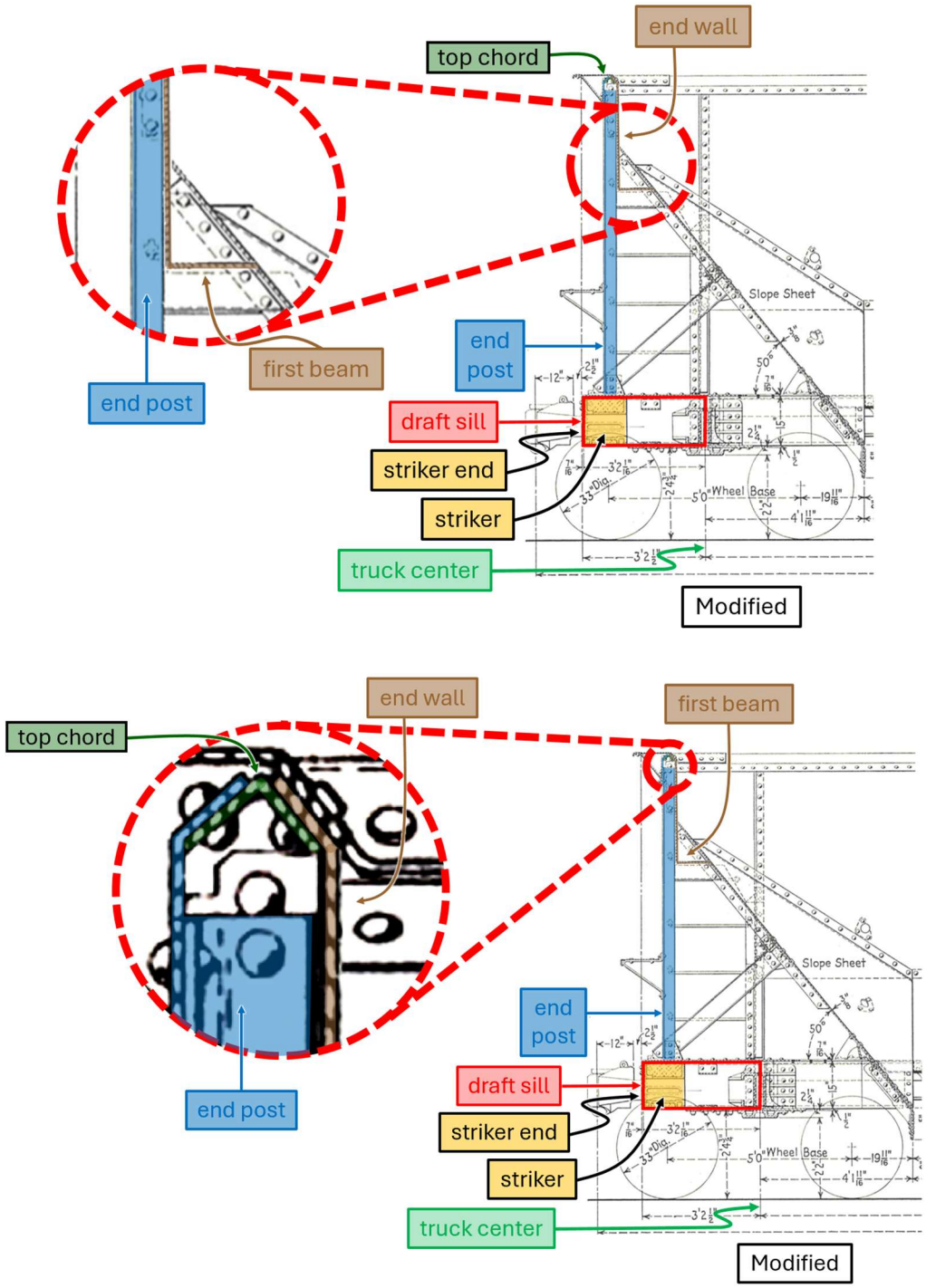




EX1004 at 294.

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

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with limitation 7h, discloses this limitation:



EX1004 at 294.

j. [32j] "said first end section being free of longitudinally oriented elephant ears extending upwardly of said draft sill webs of said draft sill to meet said first end slope sheet;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [7g].

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

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [20f], the 1946 Cyclopedia's NSC ore car discloses this limitation.

20. <u>Claim 33:</u> "The railroad hopper car of claim 32 wherein a third beam is mounted across said first end slope sheet intermediate said first and second beams."

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with Claim 15, discloses this limitation.

21. <u>Claim 34:</u> "The railroad hopper car of claim 33 wherein said third beam is formed of a structural member mounted toes-in against said first end slope sheet to define an hollow section."

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with Claims 15 and 16, discloses this limitation.

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

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1h].

23. <u>Claim 38</u>

a. [38a] "The railroad hopper car of claim 32 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom;"

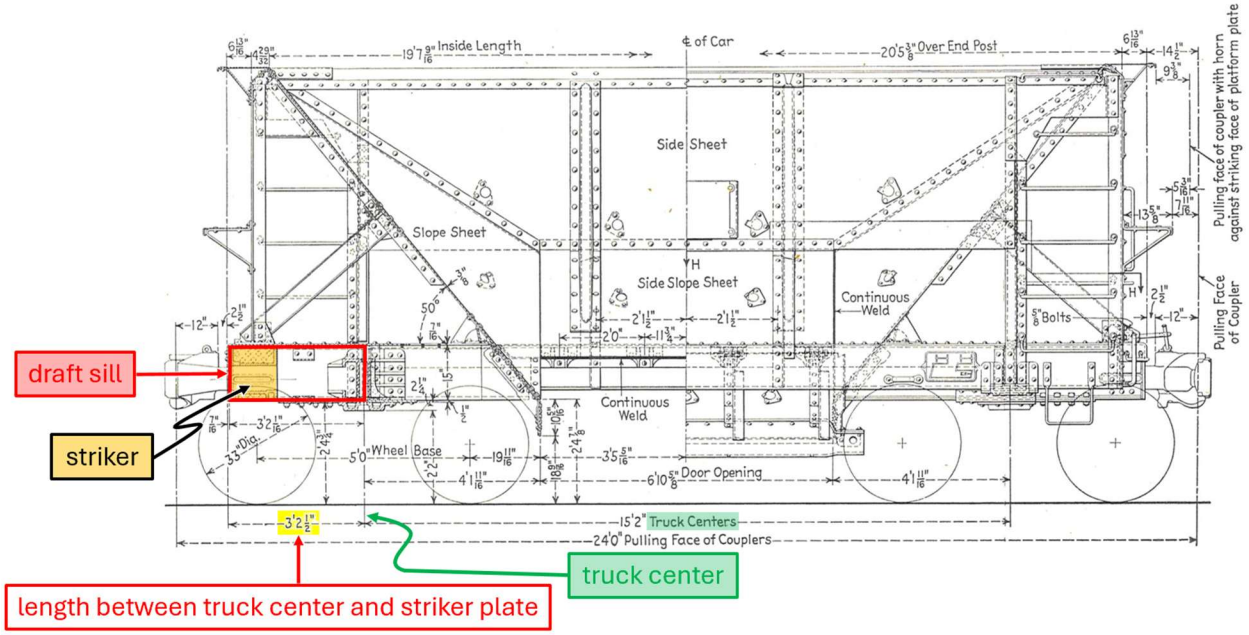
The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses limitation [1h].

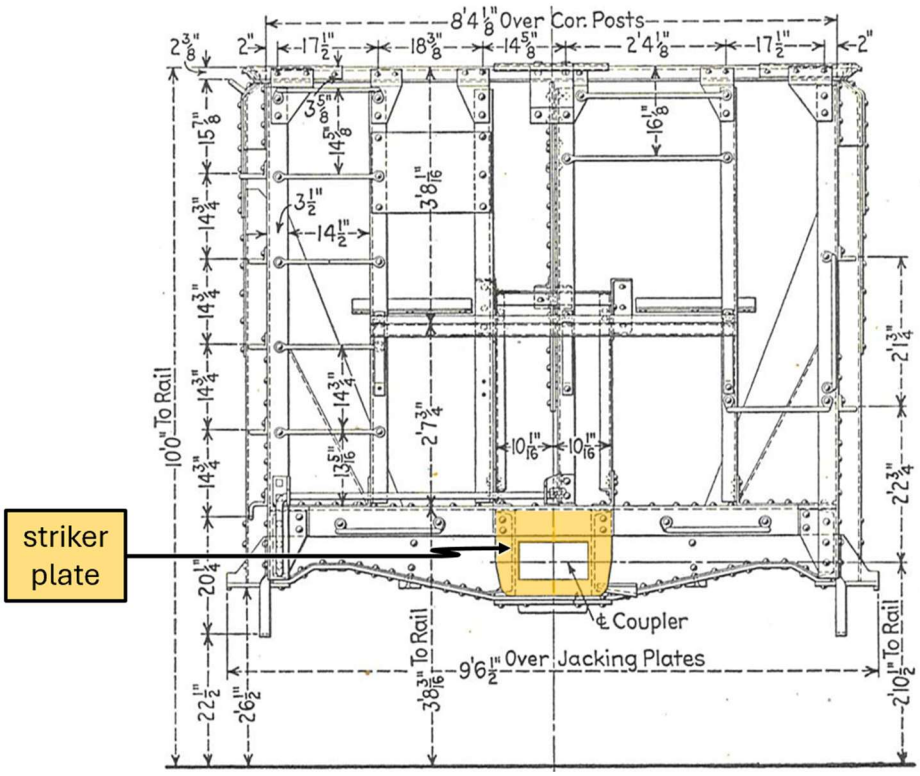
b. [38b] "said first side wall has an opening formed therein, said opening being located longitudinally inboard of said first corner post, upward of said shear plate, leeward of said first end slope sheet."

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses the limitation of Claim 23.

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

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



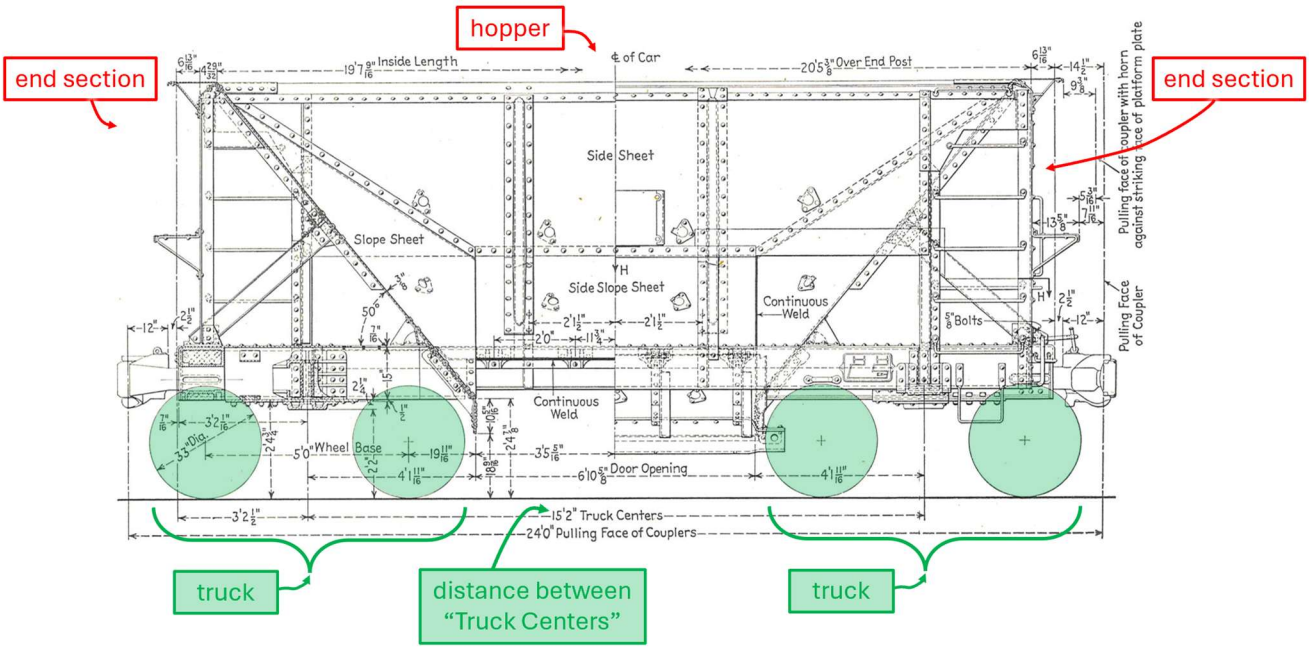


EX1004 at 294.

25. Claim 40

a. [40a] "The railroad hopper car of claim 32 wherein said railroad hopper car has first and second end section, and said hopper is carried thereby;"

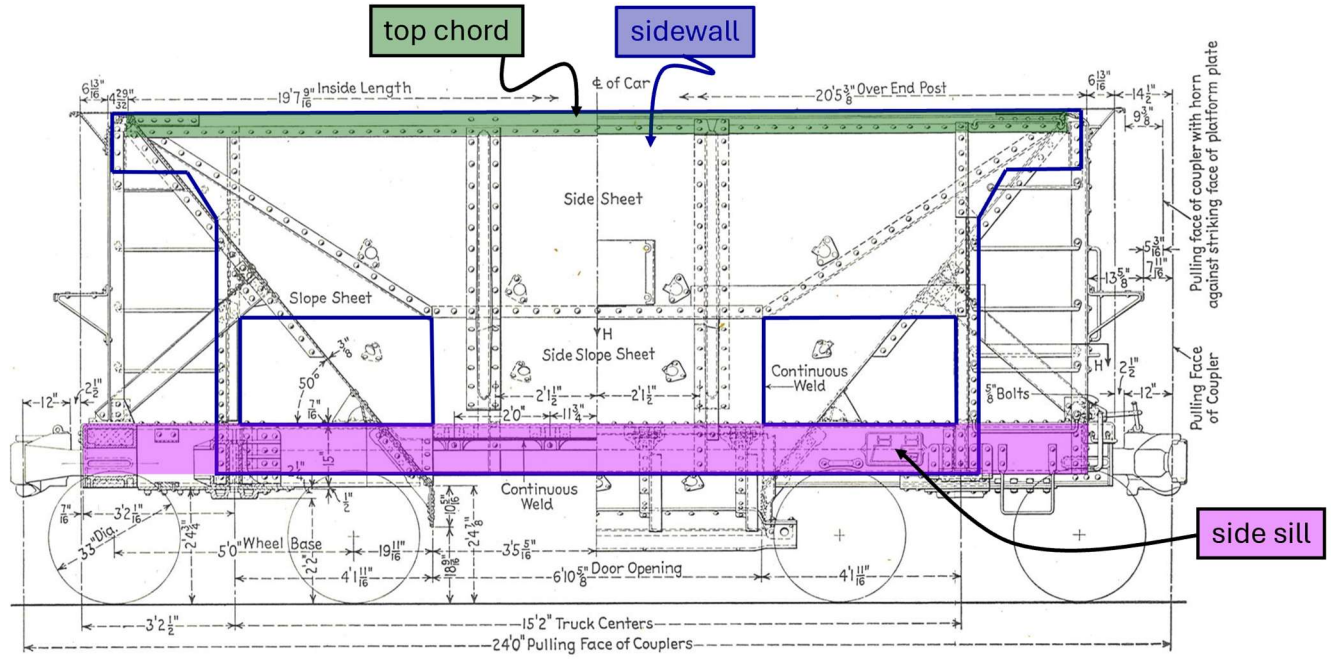
The 1946 Cyclopedia's NSC ore car discloses this limitation.

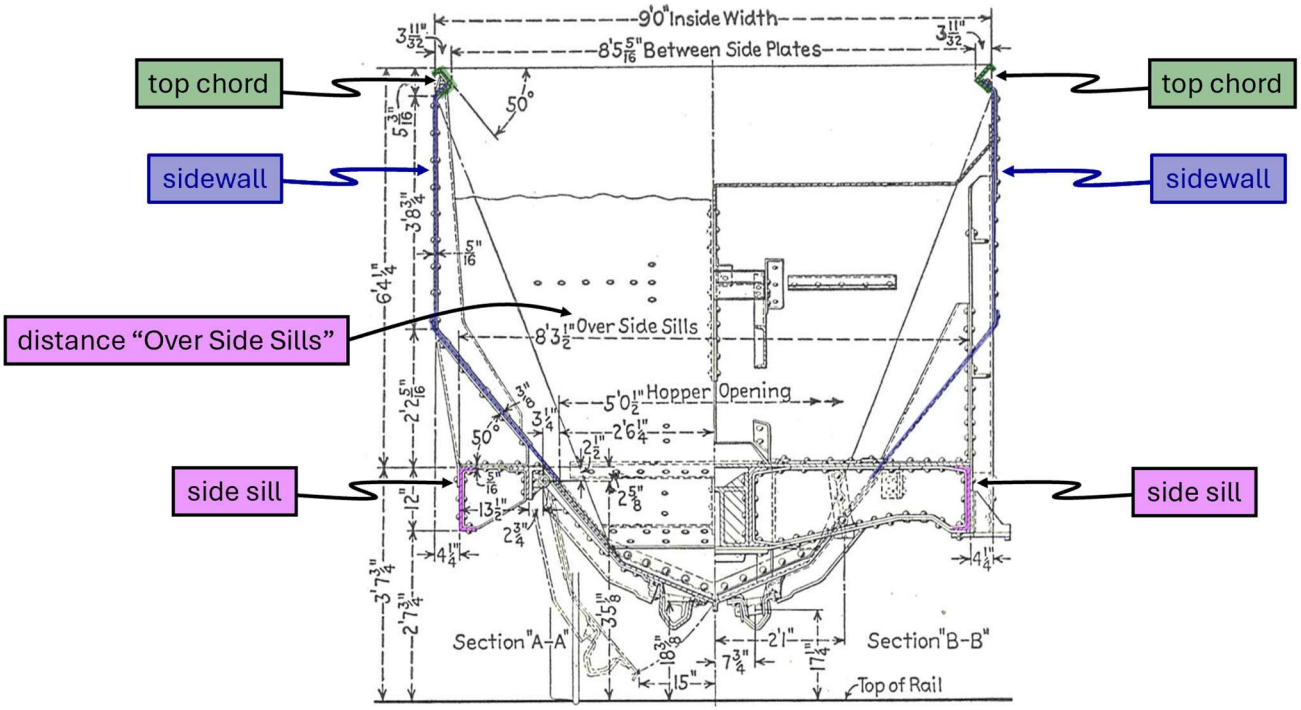


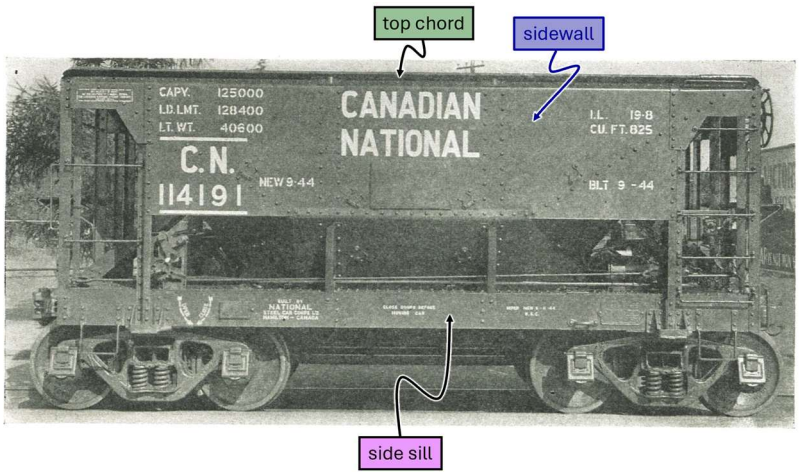
EX1004 at 294.

b. [40b] "said first and second side walls each have a respective side sill and a top chord; said first side wall extends from said side sill to said top chord;"

The 1946 Cyclopedia's NSC ore car discloses this limitation, as shown below. EX1003 ¶112. It shows a top flange or "chord" at the top of the side wall, and a lower side sill at the bottom of side wall. One drawing calls out a lateral distance "Over Side Sills."


top chord
sidewall
side sill
Side Sheet
Slope Sheet
Side Slope Sheet
Continuous Weld
Continuous Weld
Pulling face of coupler with horn against striking face of platform plate
Pulling Face of Coupler
5/8" Bolts
50°
33" Dia.
5'0" Wheel Base
6'10 5/8" Door Opening
15'2" Truck Centers
24'0" Pulling Face of Couplers

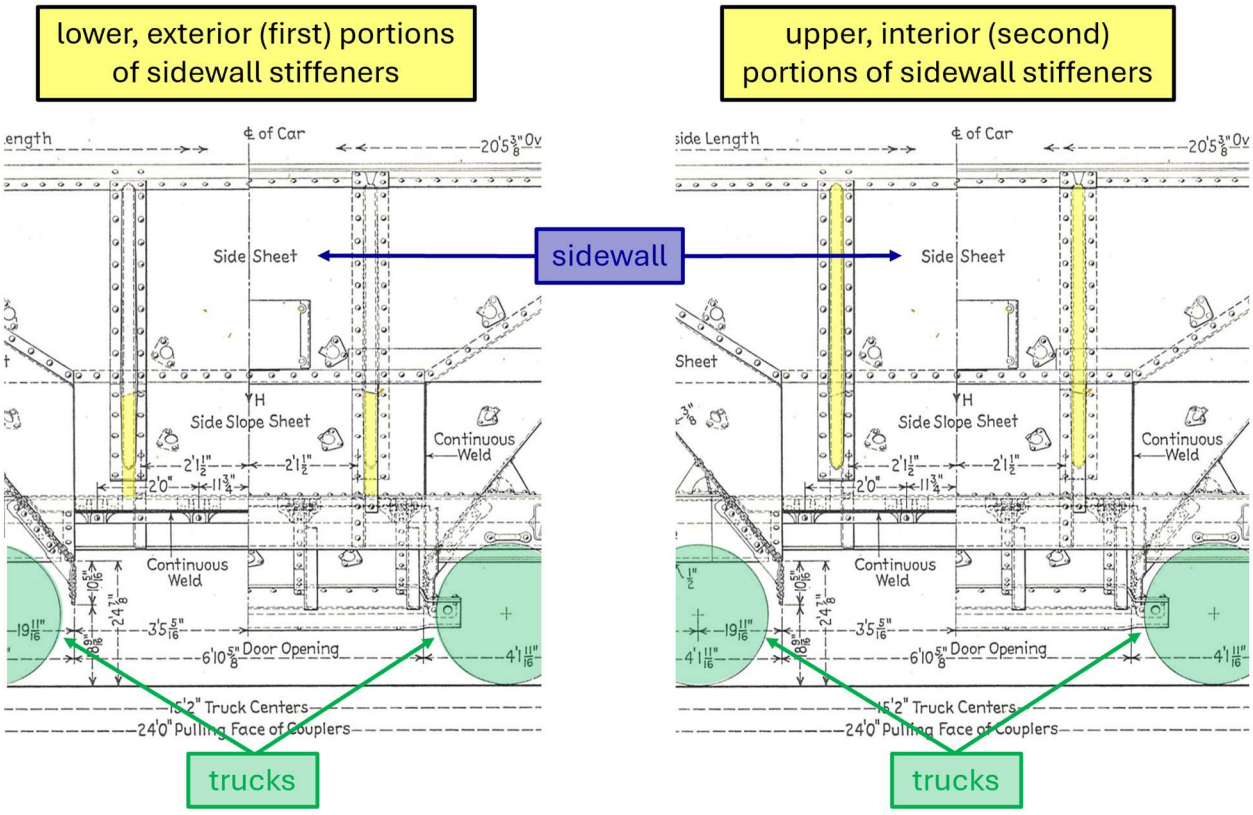

top chord
top chord
sidewall
sidewall
distance "Over Side Sills"
side sill
side sill
9'0" Inside Width
8'5 5/16" Between Side Plates
8'3 1/2" Over Side Sills
5'0 1/2" Hopper Opening
2'6 1/4"
50°
Section "A-A"
Section "B-B"
Top of Rail



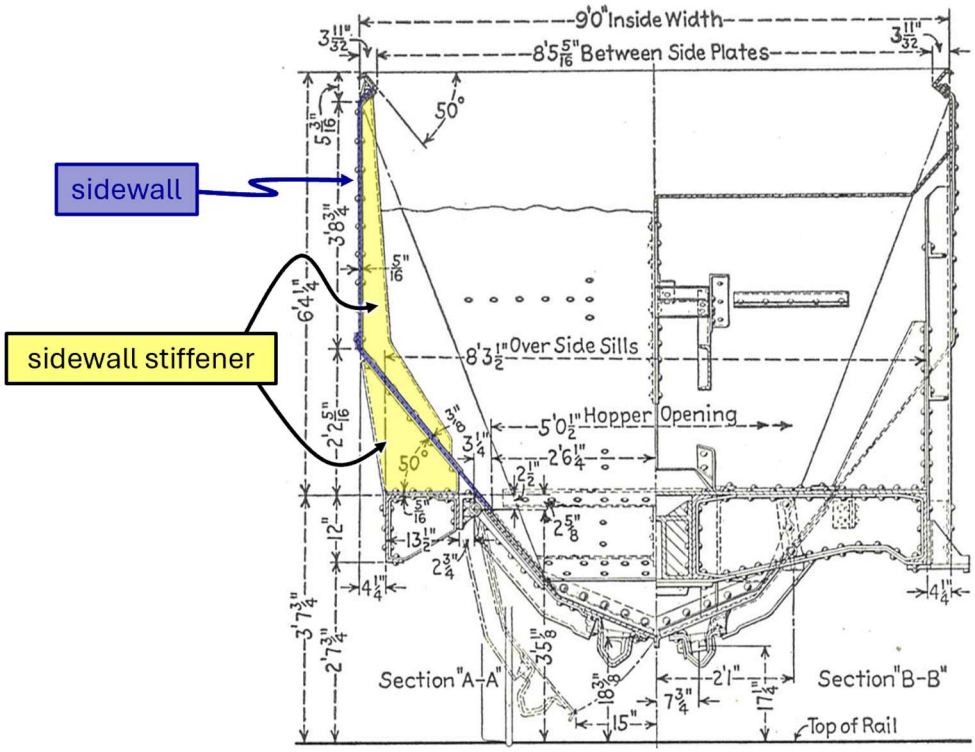
EX1004 at 294-95.

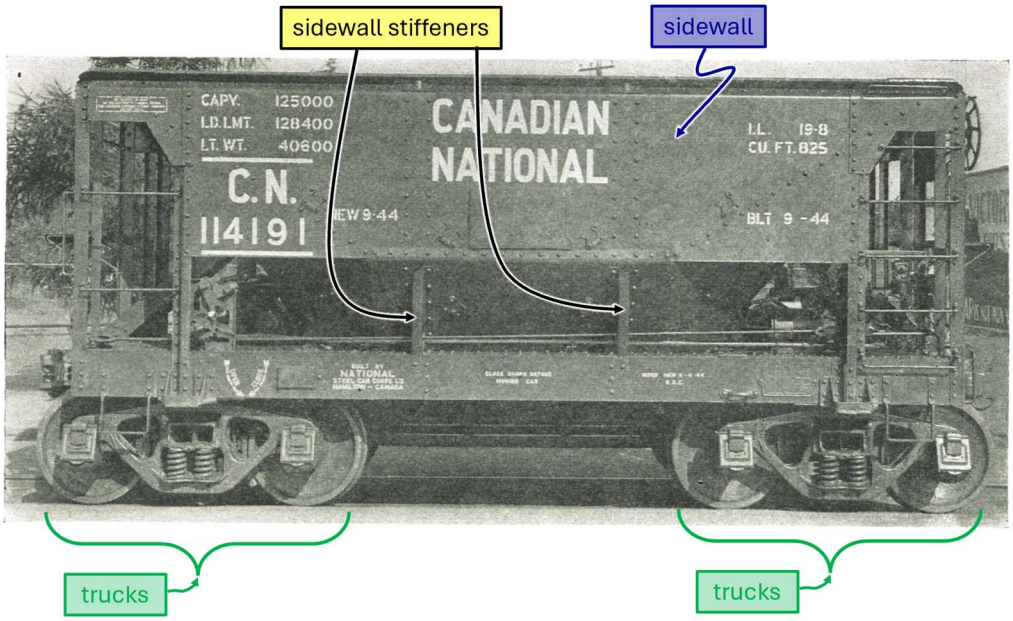
c. [40c] "said first side wall has a predominantly upwardly running side wall stiffener mounted thereto, said side wall stiffener being located at a longitudinal station intermediate the trucks;"

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



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

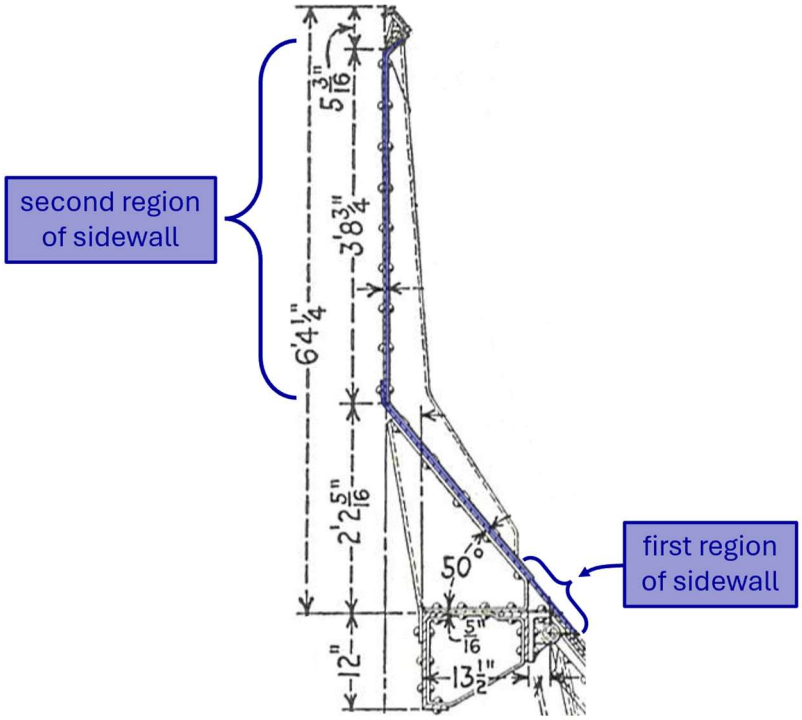


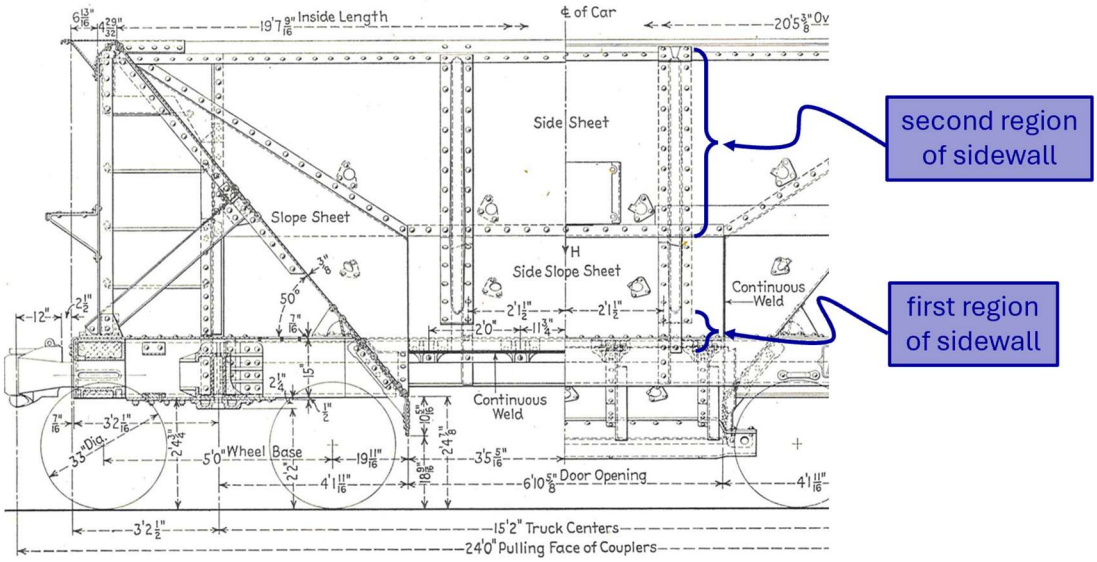


Id. at 294-95; EX1003, ¶113.

d. [40d] "said first side wall having a first region, said first region being a lower region thereof; said first side wall having a second region, said second region being an upper region thereof;"

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

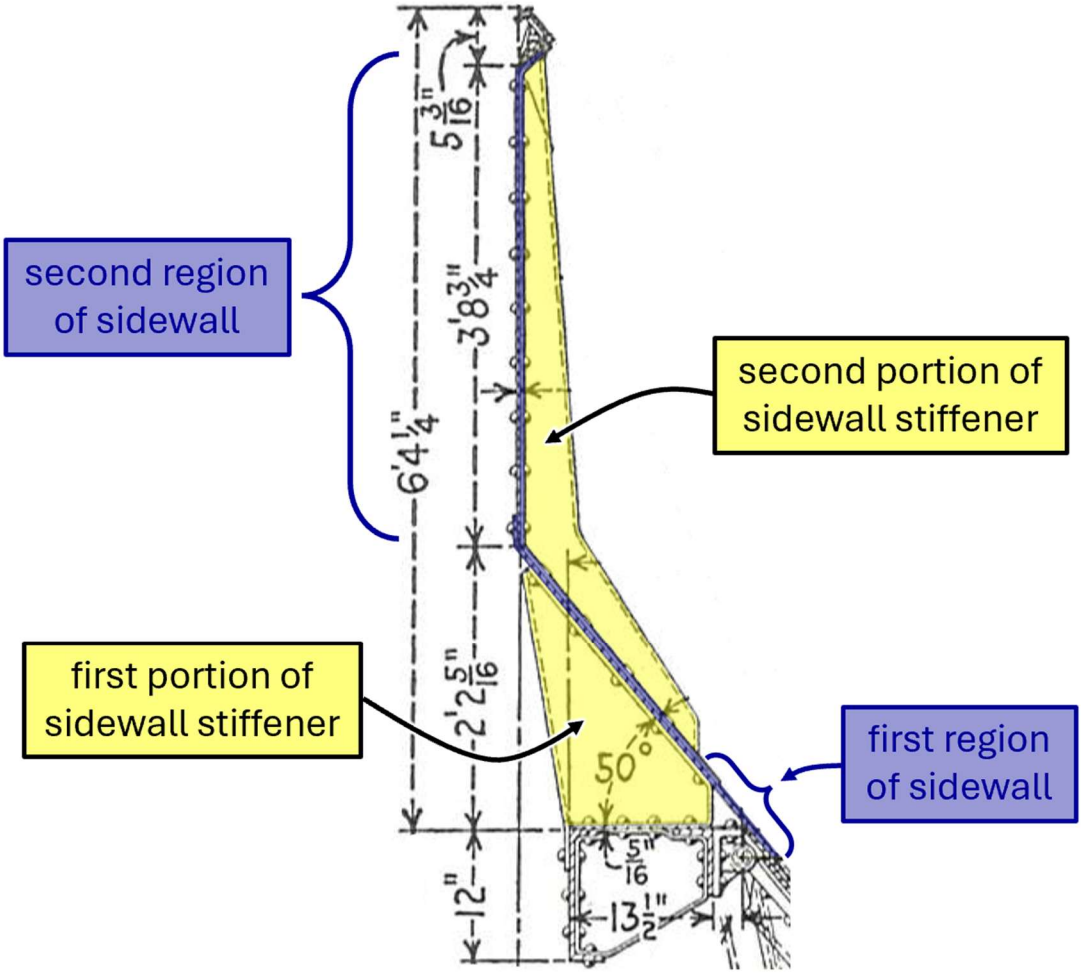


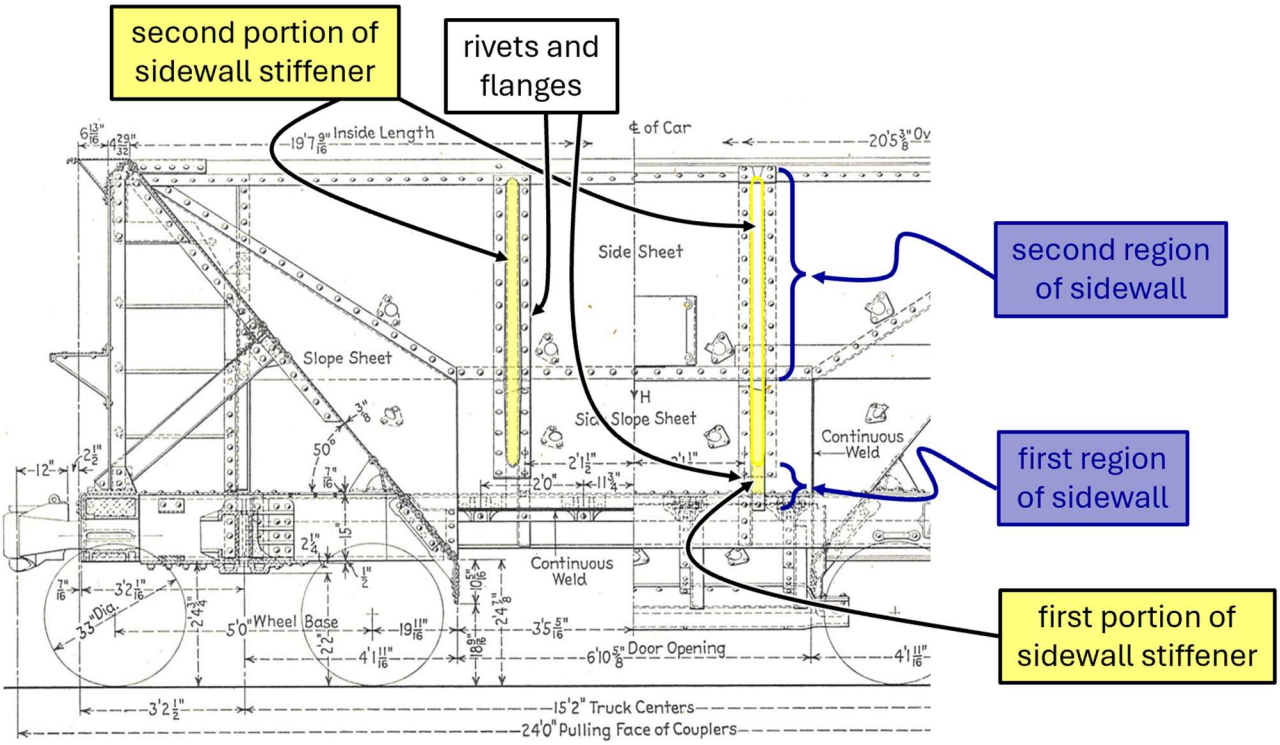


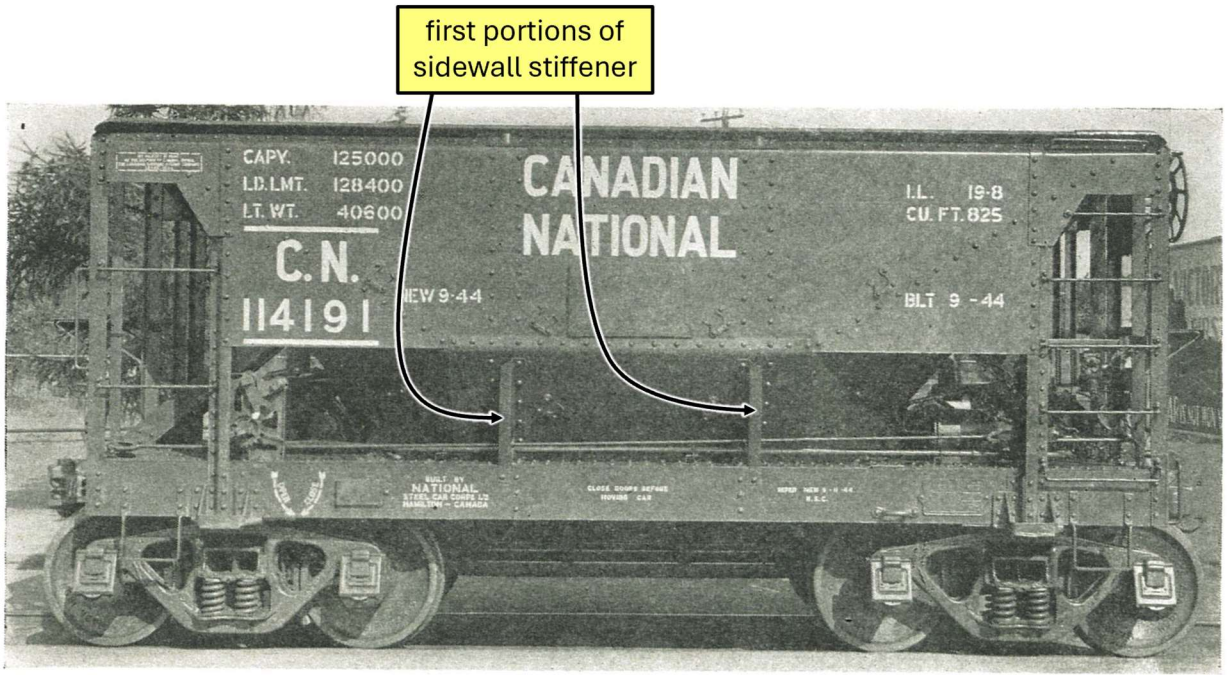
EX1004 at 294.

e. [40e] "said side wall 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 side wall; said side wall stiffener having a second portion, said second portion being an upper portion thereof, said second portion being mounted to said second region of said side wall;"

The 1946 Cyclopedia's NSC ore car discloses this limitation, as indicated below. The drawings show that the stiffener portions are mounted to the sidewall with rivets and flanges.



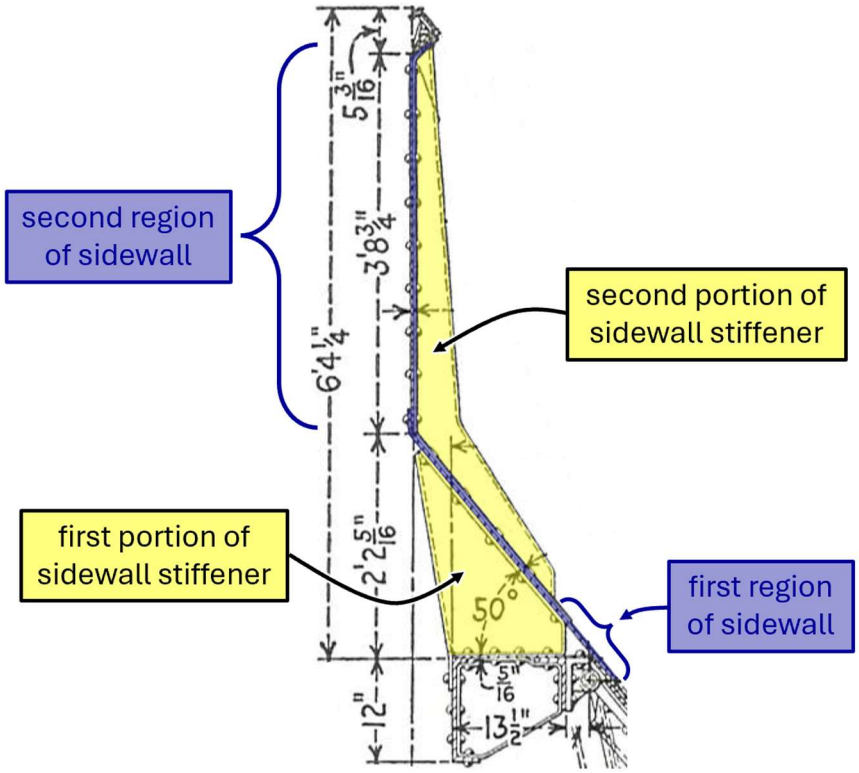

second portion of sidewall stiffener
rivets and flanges
second region of sidewall
first region of sidewall
first portion of sidewall stiffener
Inside Length
℄ of Car
Side Sheet
Slope Sheet
Continuous Weld
Wheel Base
Door Opening
Truck Centers
Pulling Face of Couplers


first portions of sidewall stiffener
CAPY. 125000
L.D. LMT. 128400
LT. WT. 40600
C.N.
114191
CANADIAN NATIONAL
I.L. 19-8
CU. FT. 825
BLT 9-44

Id. at 294-95.

f. [40f] "said first portion of said first side wall stiffener being laterally outboard of said first region of said first side wall; said second portion of said side wall stiffener being laterally inboard of said second region of said first side wall;"

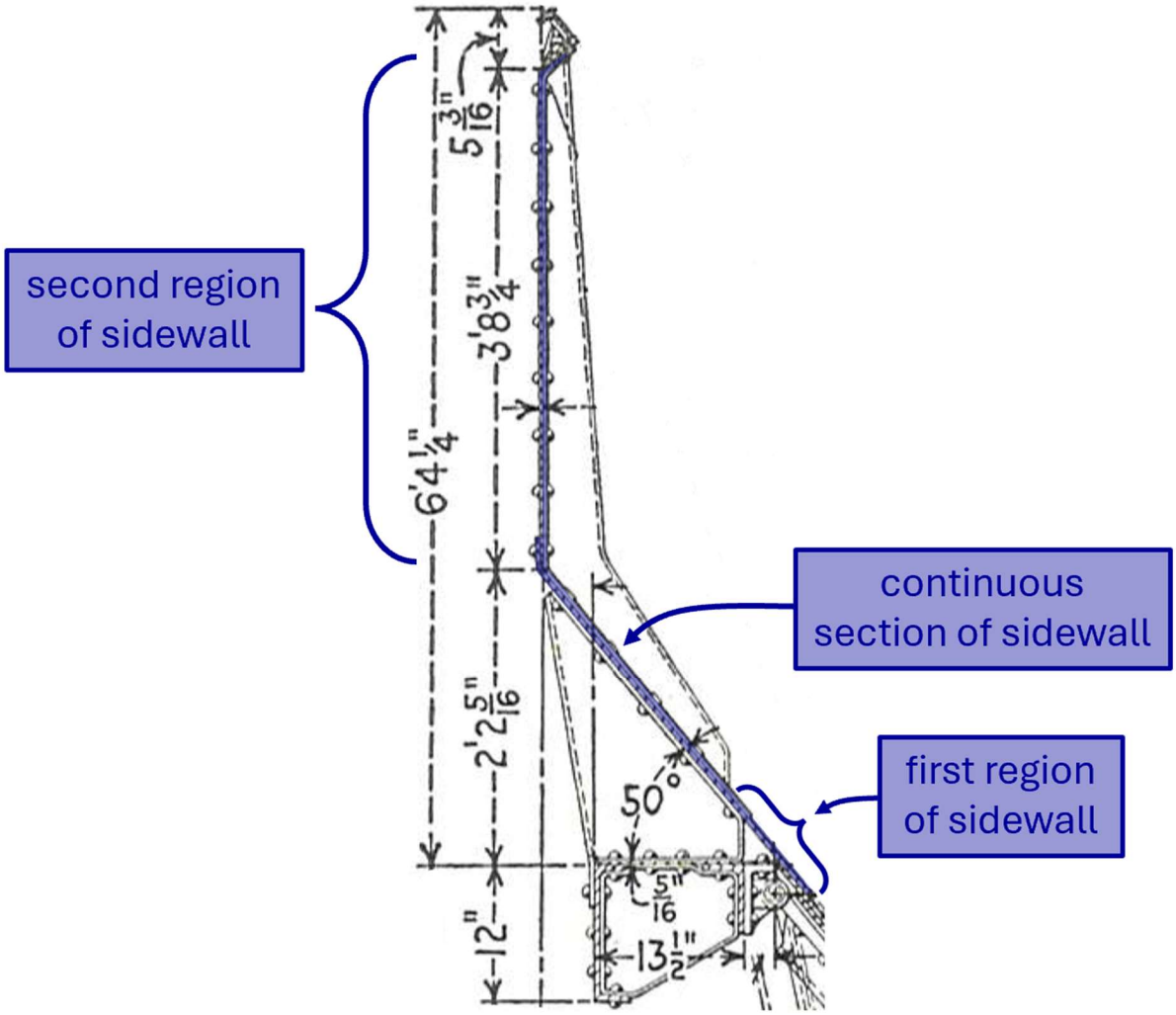
The 1946 Cyclopedia's NSC ore car discloses this limitation, as shown below. In the illustration below, "inboard" is to the right and "outboard" is to the left.



Id. at 294.

g. [40g] "said side wall having a continuous section between said first and second regions thereof; and"

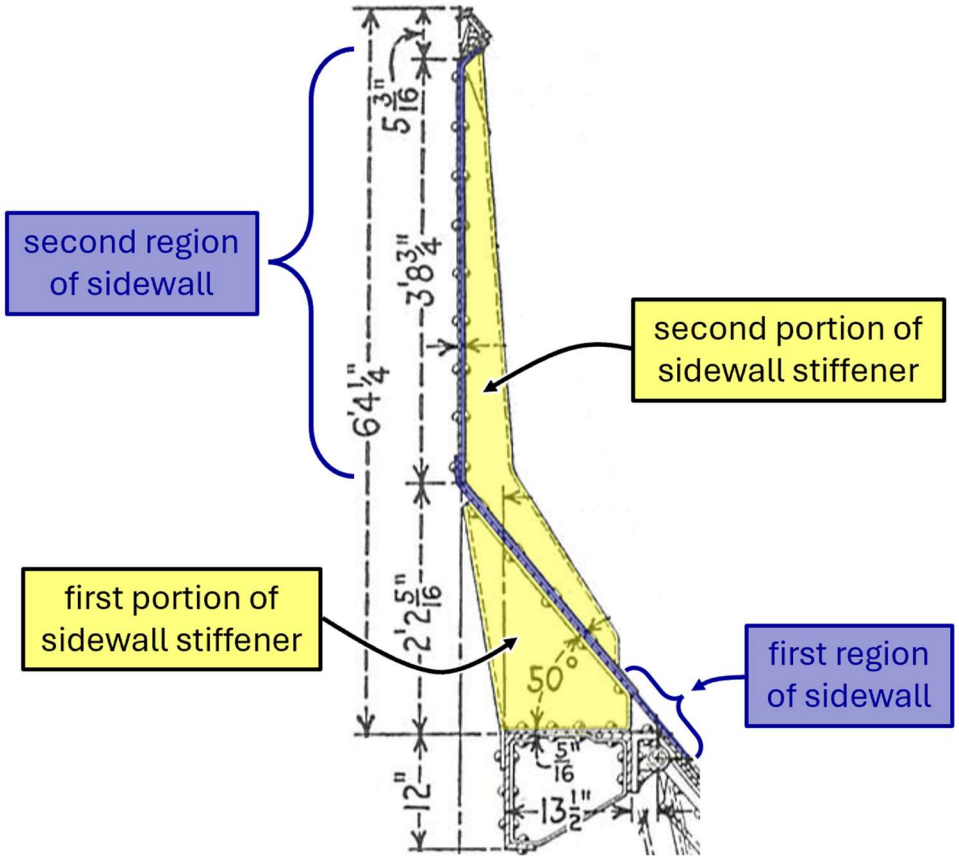
The 1946 Cyclopedia's NSC ore car discloses this limitation, as shown below. The blue side wall extends without interruption from its upper end to its lower end, including in the section between the first and second regions.

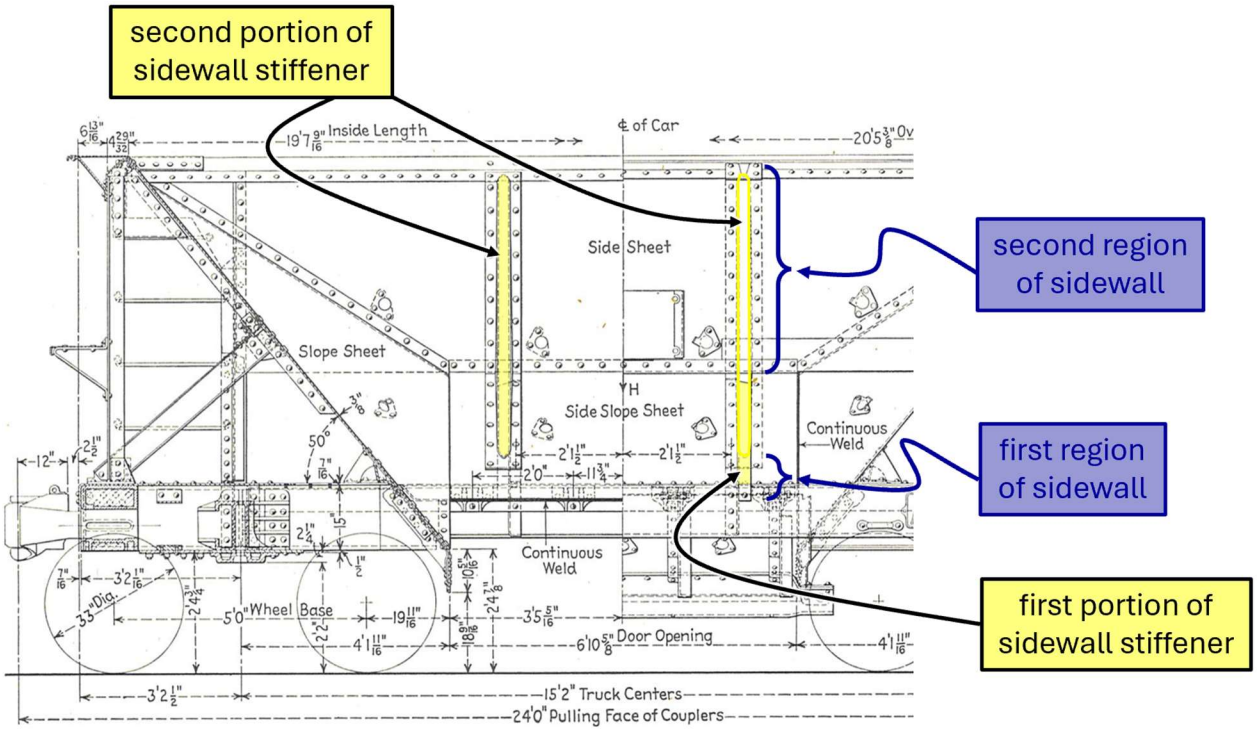


EX1004 at 294.

h. [40h] "said side wall stiffener having web continuity between said first and second portions thereof"

The 1946 Cyclopedia's NSC ore car discloses this limitation, as shown below. The two portions of the side-wall stiffener are positioned on either side of the side wall and arranged in the same vertical plane, as in the '515 patent. Accordingly, the 1946 Cyclopedia's NSC ore car discloses each limitation of claim 40 of the '515 patent.

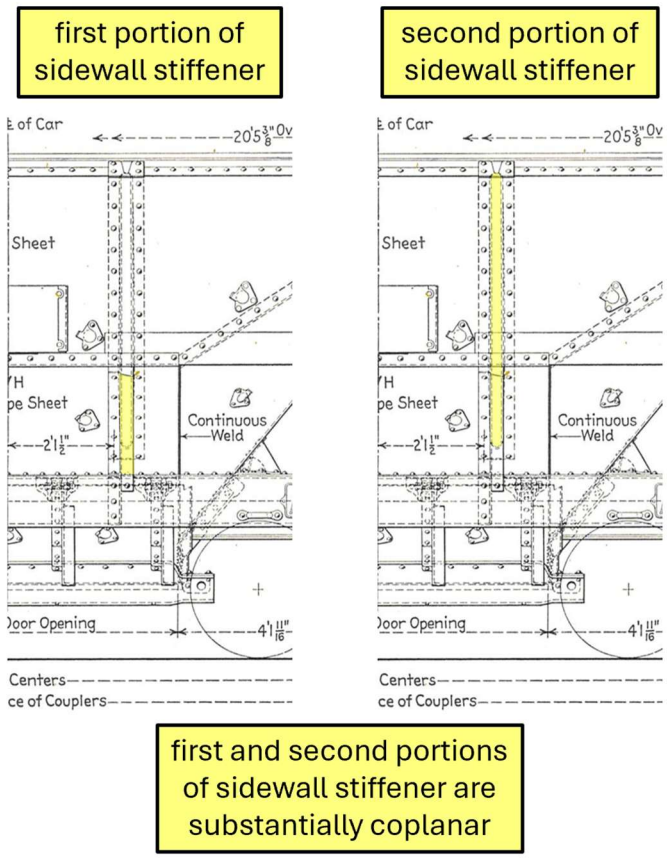




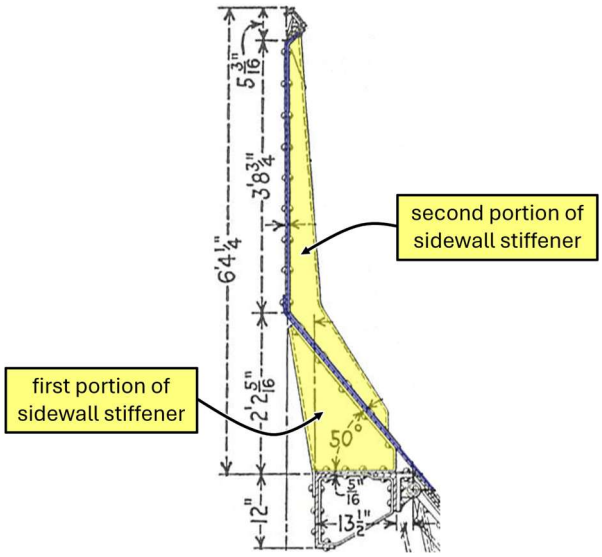
EX1004 at 294.

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

The 1946 Cyclopedia's NSC ore car discloses this limitation. As the side view below shows, the two portions of the sidewall stiffener lie in substantially the same vertical plane, one that extends transversely, *i.e.*, perpendicularly to the rail car's longitudinal axis.



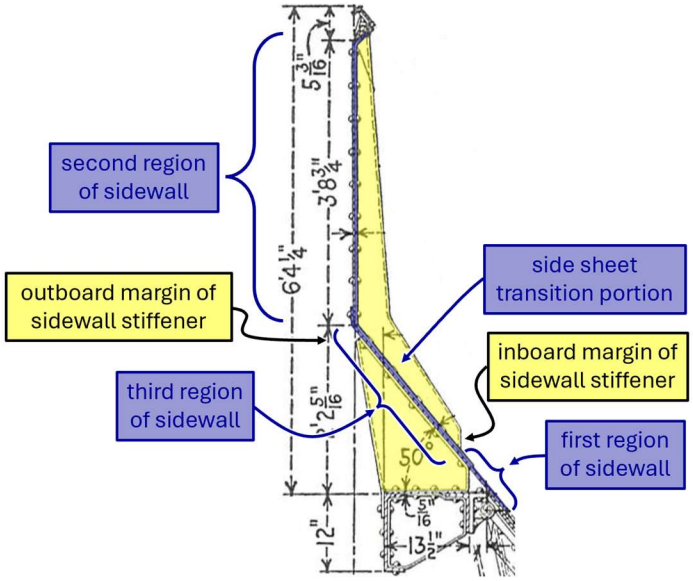
EX1004 at 294. Further, as shown below, the two portions of the sidewall stiffener are substantially vertically aligned when seen in a sectional view looking along the car.

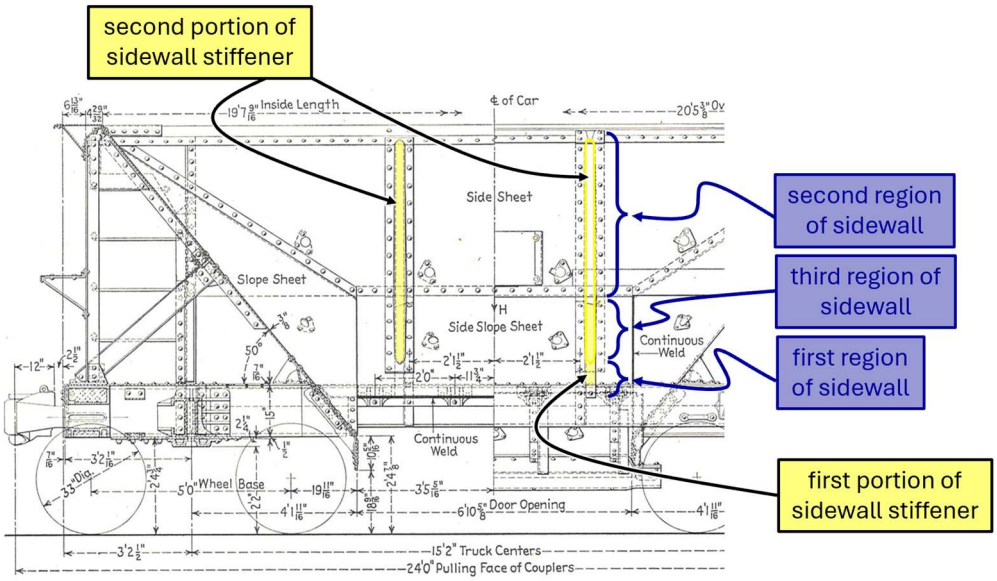


Id.

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

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



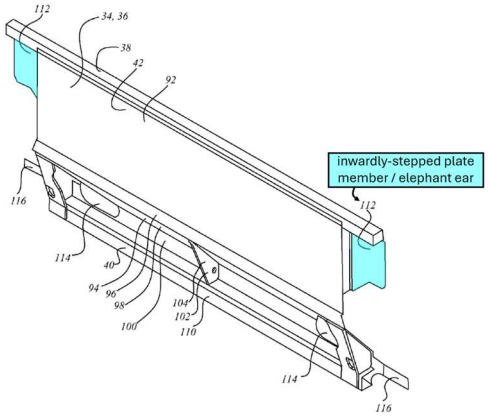


EX1004 at 294.

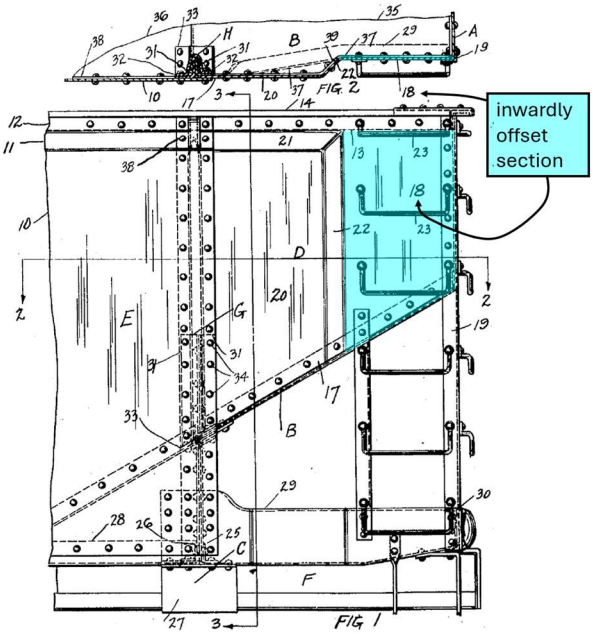
E. Ground 5: Claim 17 is obvious over the 1946 Cyclopedia, Wong, and Campbell '051.

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

The 1946 Cyclopedia's NSC ore car, as modified in view of Wong and Campbell '051, discloses this limitation. The '515 patent illustrates side walls with end portions that are stepped laterally inboard:



EX1001, Fig. 2a. However, stepped side walls were well known long before 2009. As shown below, they were disclosed by Campbell '051 as early as 1925.



EX1012, Fig. 1.

Campbell '051 explains that the purpose of the stepped design "is to provide a car . . . having the maximum over-all width possible," *id.* at 1:14–23, while also having an "offset section 18 for the purpose of accommodating the usual ladder rungs 23 within the permissible overall width of the car," *id*. at 1:90–94. A POSITA

in 2009 would have been motivated to modify the NSC ore car to provide stepped end portions of the side walls to obtain these benefits and would have had a reasonable expectation of success in making that simple modification. EX1003, ¶ 115. So modified, the 1946 Cyclopedia's NSC ore car would embody Claim 17.

F. Ground 6: Claim 28 is obvious over the 1946 Cyclopedia, Wong and Coates or the 1922 Cyclopedia.

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

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong and either Coates or the 1922 Cyclopedia's Gregg ore car, discussed in connection with limitations [7h] and [1i], discloses this limitation.

G. Ground 7: Claim 29 is obvious over the 1946 Cyclopedia, Wong, Coates or the 1922 Cyclopedia, and Schuller.

1. Claim 29

a. [29a] "The railroad hopper car of claim 28 wherein: said first side wall has an aperture formed therein in a location that is longitudinally inboard of said first corner post, above said shear plate, and leeward of said first end slope sheet;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses the limitation of Claim 23.

b. [29b] "said hopper has a movable gate operable to govern egress of lading from said hopper; there is an actuator

mounted in said machinery space, and a drive train connecting said actuator to said gate."

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong and Schuller, discussed in connection with limitations [7h] and [3b], discloses this limitation.

H. Ground 8: Claims 36-37 are obvious over the 1946 Cyclopedia, Wong and Schuller.

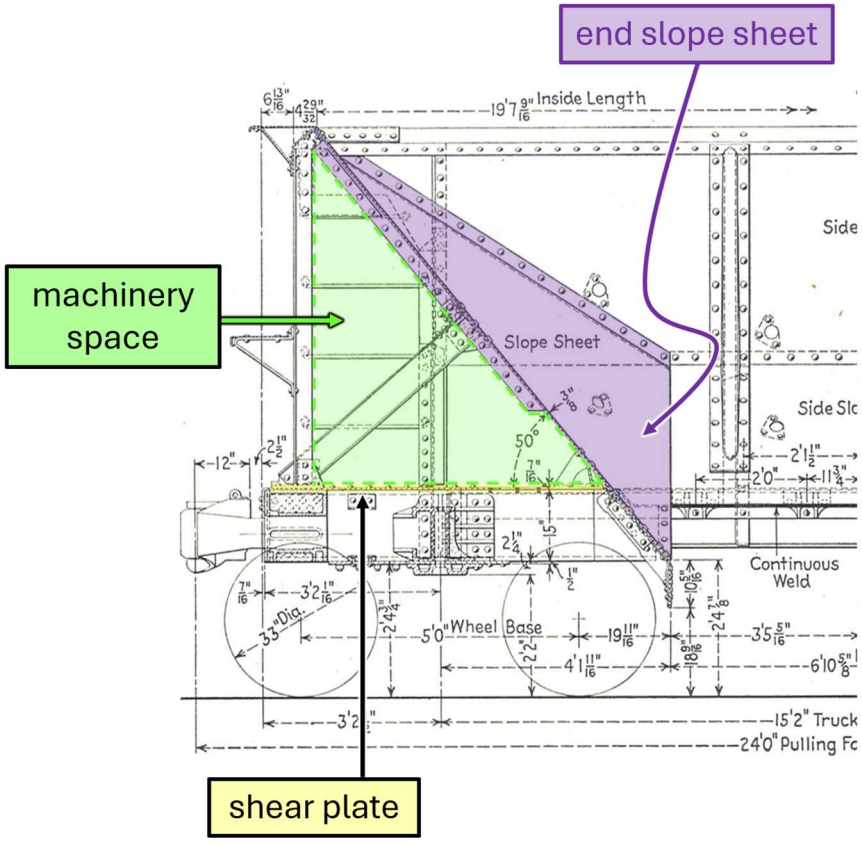
1. Claim 36: "The railroad hopper car of claim 35 wherein: a machinery space is defined above said shear plate and under said first end slope sheet; and a door actuator is mounted above said shear plate and under said first end slope sheet."

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with limitation 3b, discloses this limitation.

2. Claim 37

a. [37a] "The railroad hopper car of claim 35 wherein: a machinery space is defined above said shear plate and under said first end slope sheet;"

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



EX1004 at 294.

b. [37b] "said first side wall has an aperture formed therein in a location that is longitudinally inboard of said first corner post, above said shear plate, and leeward of said first end slope sheet;"

The 1946 Cyclopedia's NSC ore car discloses this limitation for the same reason it discloses the limitation of claim 23.

c. [37c] "said hopper has a movable gate operable to govern egress of lading from said hopper; there is an actuator mounted in said machinery space, and a drive train connecting said actuator to said gate."

The obvious modification of the 1946 Cyclopedia's NSC ore car in view of Wong, discussed in connection with limitation 3b, discloses this limitation.

I. Ground 9: Claims 43-44 are obvious over the 1946 Cyclopedia, Wong and Lindström.

1. Claim 43

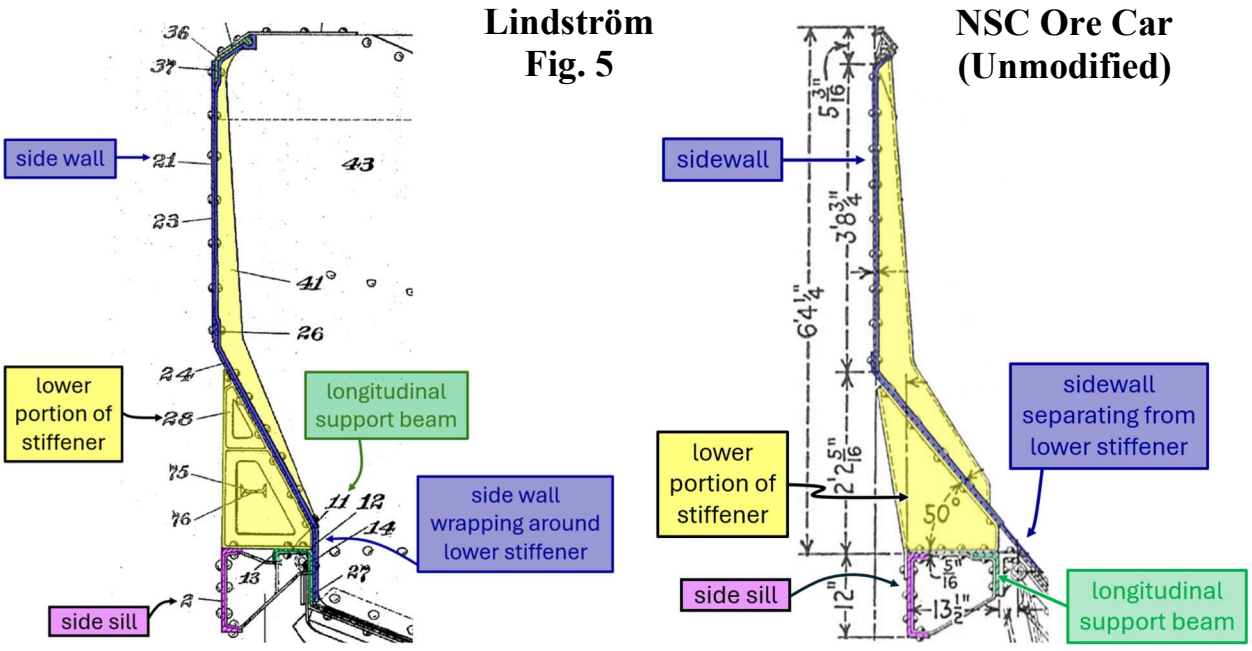
a. [43a] "The railroad hopper car of claim 40 wherein: said first side wall has a third region intermediate said first and second regions, said third region including a side sheet transition portion passing across said side wall stiffener from an inboard margin thereof to an outboard margin thereof;"

The 1946 Cyclopedia discloses this limitation for the same reason it discloses the limitation of Claim 42.

b. [43b] "said hopper includes first and second sloped side sheets; and said first sloped side sheet meets said first side wall at said transition portion."

NSC has construed "sloped side sheet" to refer to the "side slope sheet" 50 in the '515 patent. EX1003 at ¶ 116. Accordingly, FCA adopts this construction for the purposes of this ground. So construed, limitation [43b] is satisfied by an obvious modification of the 1946 Cyclopedia's NSC ore-car design in view of Lindström.

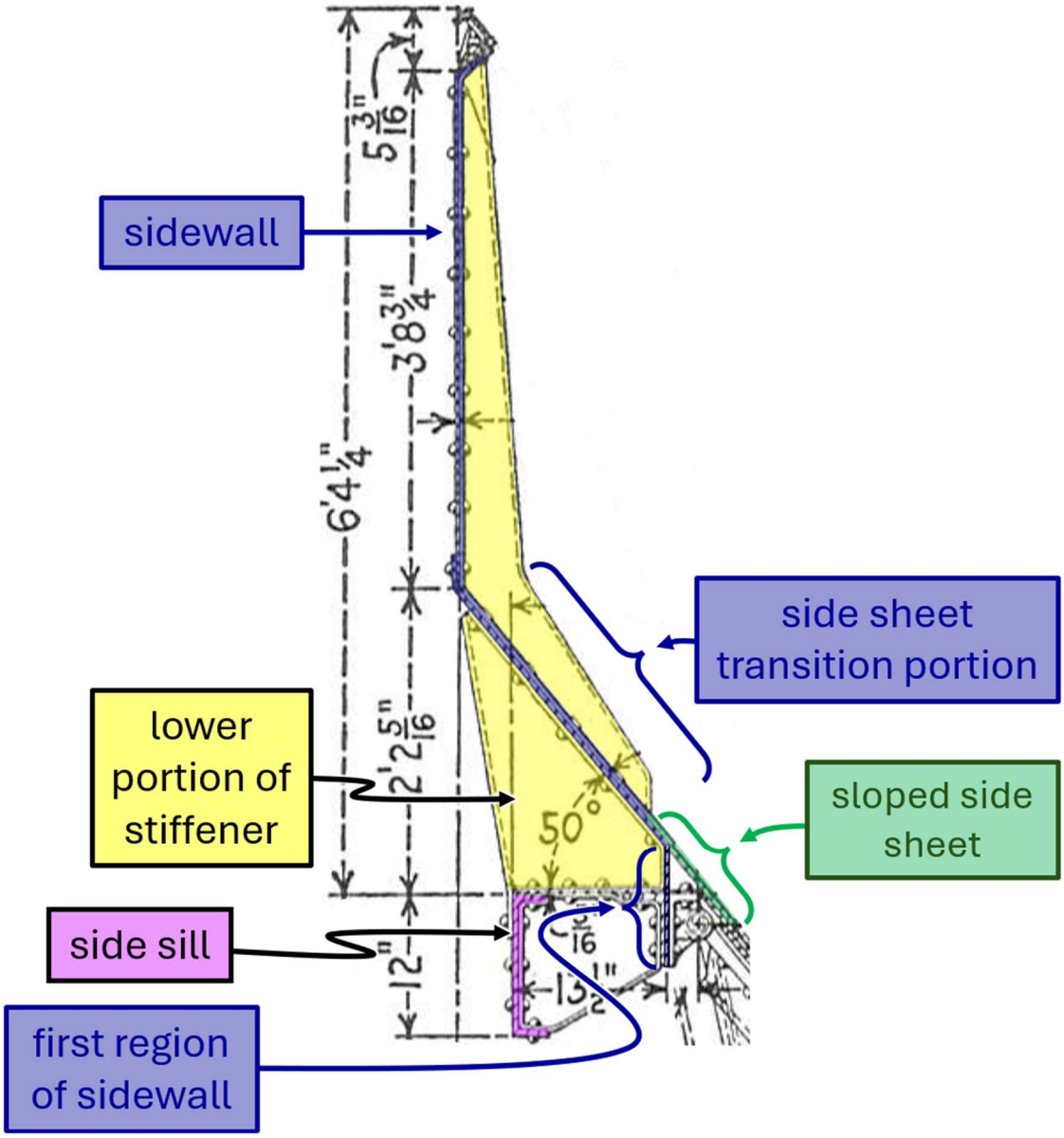
Lindström discloses a side wall that wraps around the inward side of the lower portion of the stiffener (28) and the longitudinally extending support member (11), as shown on the left below.



EX1005, Fig. 5; EX1004 at 294.

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 wraps around the inward side of the lower stiffener and longitudinal support beam, as shown below. EX1003, ¶ 120. A POSITA would have been motivated to make the modification to provide additional lateral stability to the side wall. *Id.* A POSITA would understand that the lading in the hopper tends 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. *Id.* Finally, it would have been obvious to add a sloped

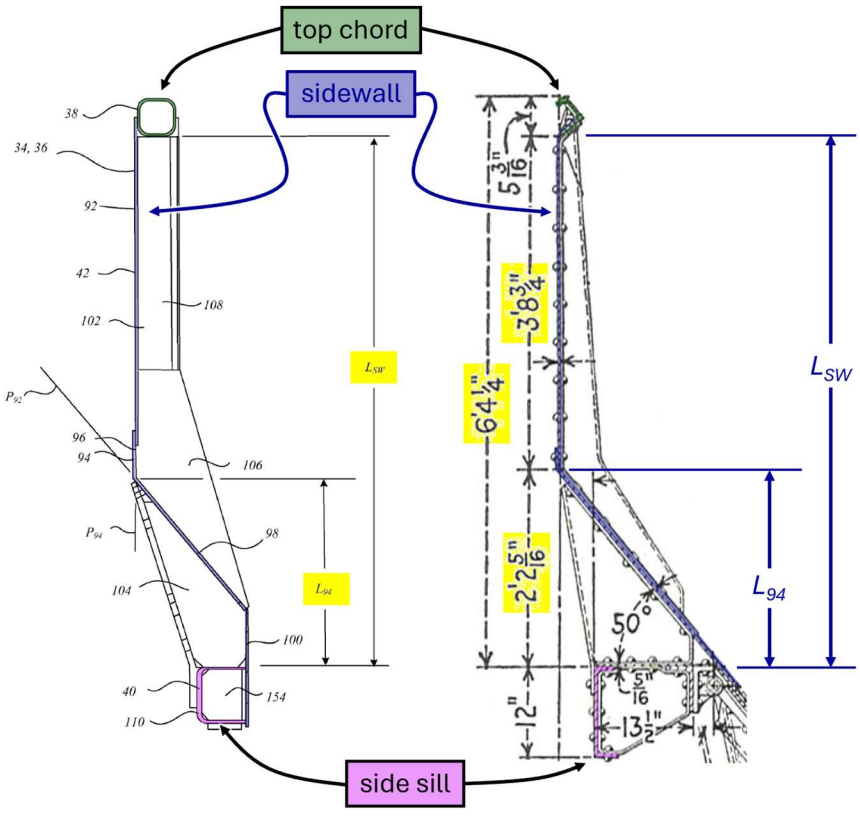
side sheet, as shown below in green, to ensure the side wall of the hopper has a continuous sloped surface without discontinuities that could impede the movement of the lading to the hopper doors. Id. at ¶ 121.



EX1004 at 294 (modified). So modified, the upper margin of the sloped side sheet would meet the side wall at the transition portion, as claimed. EX1003, ¶ 122.

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

The 1946 Cyclopedia's NSC ore car discloses this limitation. The '515 patent's only disclosure of this limitation is in Fig. 2c, shown below, and in the text in column 15 line 63 through column 16 line 1. As shown below and to the left, the '515 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. 2c. The text states that distance **L_{94}** "may lie in the range of 1/4 to 2/3 of the distance **L_{SW}**." *Id.* at 15:66–67.



EX1001, Fig. 2c; EX1004 at 294.

The drawing above and to the right shows the distances **L_{SW}** (height of the side wall) and **L_{94}** (distance from the side sill to the juncture of the vertical and sloped regions of the side wall) in the NSC ore car. EX1004 at 294. The dimensions on the drawing show that **L_{94}** = 2' 2 5/16" and that **L_{SW}** = 71 1/16" (6' 4 1/4" – 5 3/16"). *Id.* Thus, the 1946 Cyclopedia's NSC ore car satisfies Claim 5 because its **L_{94}** is between 1/4 and 2/3 of its **L_{SW}**, specifically, 37% of its **L_{SW}**.

V. CONCLUSION

Petitioner respectfully requests that the Board institute an IPR and cancel claims 1–44 of the '541 patent.

VI. MANDATORY NOTICES, GROUNDS FOR STANDING, AND FEE PAYMENT

Pursuant to 37 C.F.R. §42.8(a)(1), the mandatory notices identified in 37 C.F.R. § 42.8(b) are provided below as part of this Petition.

A. Real Party-In-Interest (37 C.F.R. §42.8(b)(1))

FreightCar America, Inc., FreightCar North America, LLC, JAC Operations Inc., and FCA-FASEMEX, LLC, are real parties-in-interest.

B. Related Matters (37 C.F.R. §42.8(b)(2))

The parties are currently engaged in district-court litigation in *National Steel Car Limited v. FreightCar America, Inc., et al.*, C.A. No. 1:24-cv-00594-JLH (D.

Del.). National Steel Car Limited has asserted the '515 patent against Petitioner in the district-court litigation.

C. Lead and Backup Counsel (37 C.F.R. §42.8(b)(3))

Lead Counsel	Back-up Counsel
Philip M. Nelson (Reg. No. 62,676) 2PMN@knobbe.com Knobbe, Martens, Olson, & Bear, LLP Postal and Hand-Delivery Address: 2040 Main St., 14th Floor Irvine, CA 92614 Telephone: 949-760-0404 Facsimile: 949-760-9502	Ted M. Cannon (Reg. No. 55,036) 2TMC@knobbe.com Knobbe, Martens, Olson, & Bear, LLP Postal and Hand-Delivery Address: Same as lead counsel Justin Gillett (Reg. No. 71,099) 2JJG@knobbe.com Knobbe, Martens, Olson, & Bear, LLP Postal and Hand-Delivery Address: Same as lead counsel

Pursuant to 37 C.F.R. § 42.10(b), a power of attorney accompanies this petition. The above-identified lead and backup counsel are registered practitioners associated with Customer No. 20,995 listed in that power of attorney.

D. Service Information (37 C.F.R. §42.8(b)(4))

Service information above. Petitioner consents to electronic service by email to FCAIPR-515-048@knobbe.com.

E. Grounds for Standing (37 C.F.R. §42.104)

Petitioner hereby certifies that the '515 Patent is available for IPR and that Petitioner is not barred or estopped from requesting IPR.

F. Payment of Fees (37 C.F.R. §42.15(a))

The fee set forth in 37 C.F.R. § 42.15(a) has been paid. The undersigned further authorizes payment for any additional fees that may be due with this petition to be charged to Deposit Account 11-1410.

Dated: May 27, 2025

By: / Philip M. Nelson /
Philip M. Nelson (Reg. No. 62,676)
KNOBBE MARTENS OLSON & BEAR, LLP

Attorney for Petitioner FreightCar America, Inc.

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that this PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,132,515 contains 13,695 words according to the word-processing program used to prepare this paper. The foregoing word count complies with the 14,000-word type-volume limit specified by 37 C.F.R. § 42.24(a)(1).

Dated: May 27, 2025 By: / Philip M. Nelson /
Philip M. Nelson (Reg. No. 62,676)
KNOBBE MARTENS OLSON & BEAR, LLP

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on the date below a copy of this PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,132,515 PETITIONER'S POWER OF ATTORNEY, AND EXHIBITS 1001-1022 AND 1024, are being served by FedEx on the Patent Owner at the correspondence address of record for the subject patent as follows:

21324 - HAHN LOESER & PARKS, LLP
200 Public Square, Suite 2800
Cleveland, OH
UNITED STATES

A courtesy copy has been sent by email on this day to Patent Owner's counsel of record in the matter identified in Section VI.B of the Petition as follows:

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Dated: May 27, 2025 By: / Philip M. Nelson /
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