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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 IPR2025-01047
Patent 8,132,515

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

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1004	Excerpts from *1946 Car Builders' Cyclopedia*, 17th ed. ("1946 Cyclopedia")
1005	U.S. Patent No. 1,321,928 ("Lindström")
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1008	U.S. Patent No. 992,192 ("Hart")
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1012	U.S. Patent No. 1,537,051 ("Campbell '051")
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1017	Excerpts from *Modern Private Owner Wagons on British Rail*, by David Ratcliffe, Copyright 1989 ("Ratcliffe 1")
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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.
3	The railroad hopper car of claim 1 wherein: said hopper car has at least one longitudinally hinged discharge door, said discharge door being movable cross-wise between open and closed positions; and a longitudinally acting pneumatic actuator is at least partially lodged in said machinery space directly above said draft sill.

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

Limitation	Claim Language
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; 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;
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.

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

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

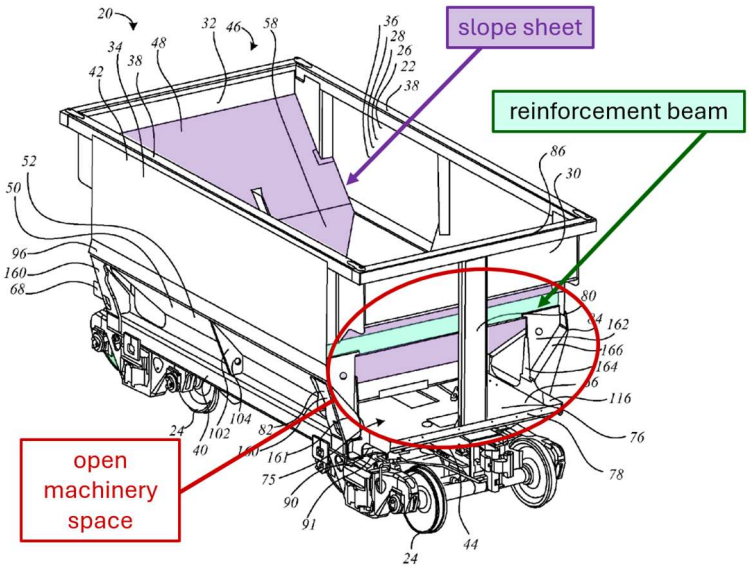
GROUND	Claims	Obviousness References
1	1–2	Hart and the 1906 Cyclopedia
2	3	Hart, the 1906 Cyclopedia, and Schuller
3	4	Hart, the 1906 Cyclopedia, Schuller and Karig
4	5–6	Hart, the 1906 Cyclopedia, and Campbell '652
5	7–16, 20, 23, 24–28, 30–31	Hart, the 1906 Cyclopedia, and Wong
6	17–19	Hart, the 1906 Cyclopedia, Wong and Campbell '051
7	21–22, 29	Hart, the 1906 Cyclopedia, Wong and Schuller
8	32–34	Lindström, Wong, Ratcliffe 1 and Hart.
9	35–44	Lindström, Wong, Ratcliffe 1, Hart and the 1946 Cyclopedia.

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. For example, the primary prior art reference in this petition—U.S. Patent No. 992,192—issued to Harry Hart in 1911. Many other hopper cars from the first half of the twentieth century also used support beams 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.

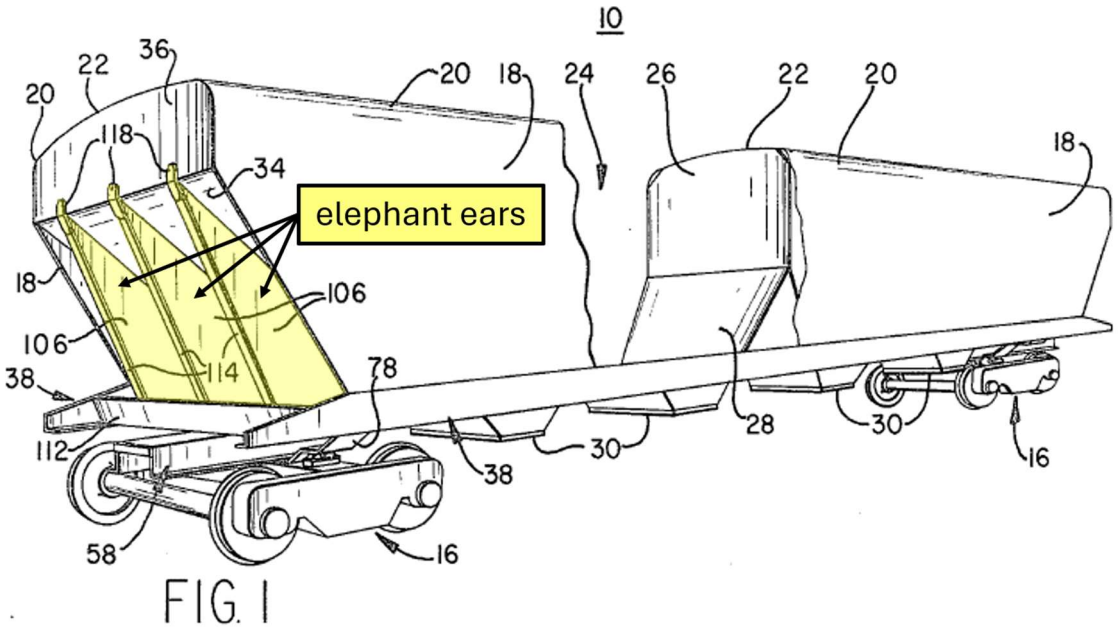
II. PRELIMINARY MATTERS

A. Priority Date

The ’515 patent was filed as U.S. Application No. 12/816,660 on June 16, 2010. EX1002 at 1. 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.



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.

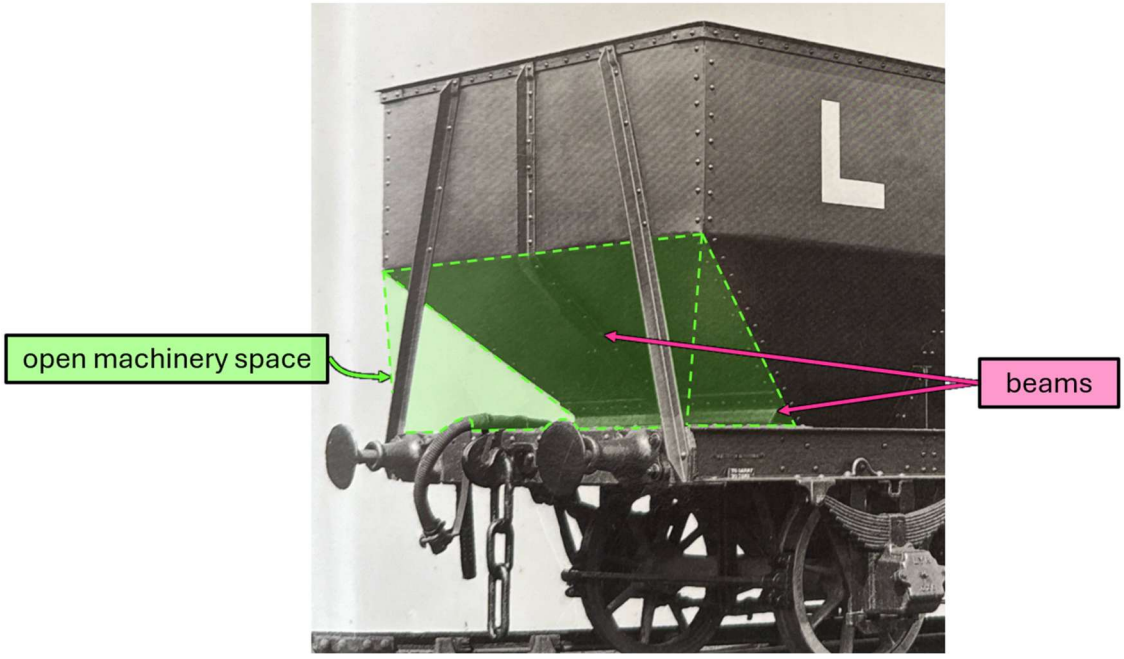
On November 1, 2011, the Examiner allowed all pending claims without applying or discussing any prior art submitted with the RCE. *Id.* at 305–39.

C. Prior Art

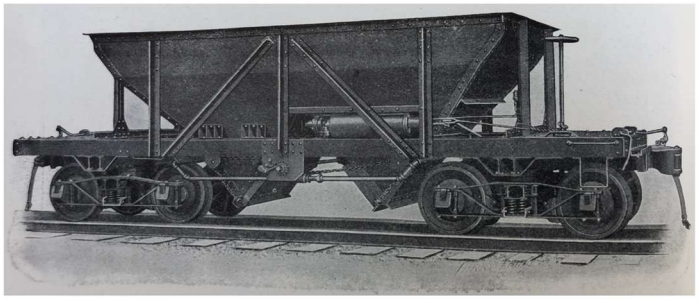
However, the Patent Office did not have the most relevant evidence. The prior art contained numerous hopper cars with open machinery spaces. To keep their machinery spaces unobstructed, these hopper cars used reinforcement beams that extended along the underside of the slope sheet, either crosswise or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

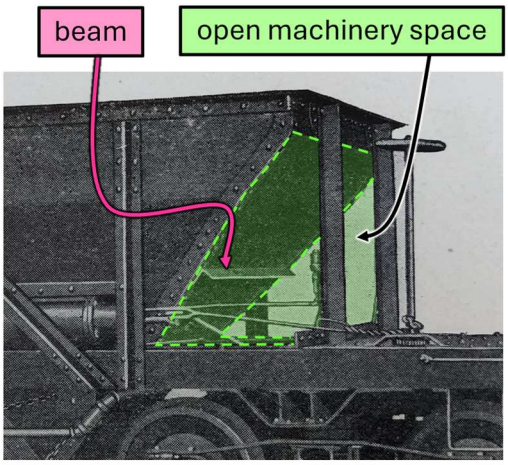
The L&Y car supported its slope sheet with one crosswise beam and one longitudinal beam, creating the unobstructed machinery space shown below. *Id*. The car had two end posts but, like the end post and corners posts of the '515 patent's sole embodiment, these posts were at the car's perimeter, not in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

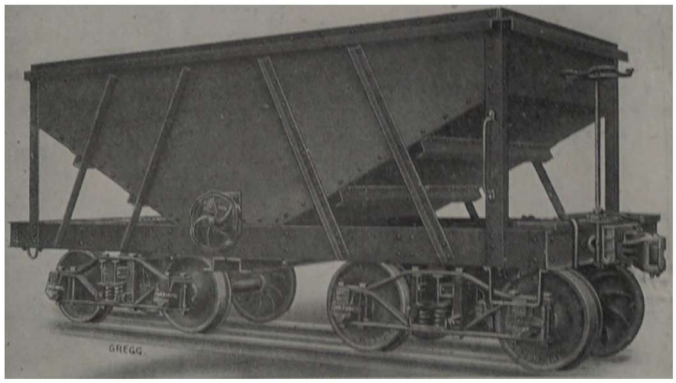


Later hopper cars also employed reinforcement beams to achieve an open machinery space. A few examples are shown below.

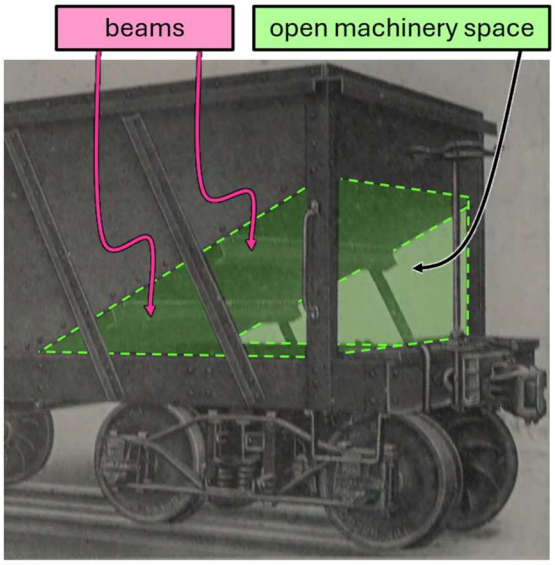


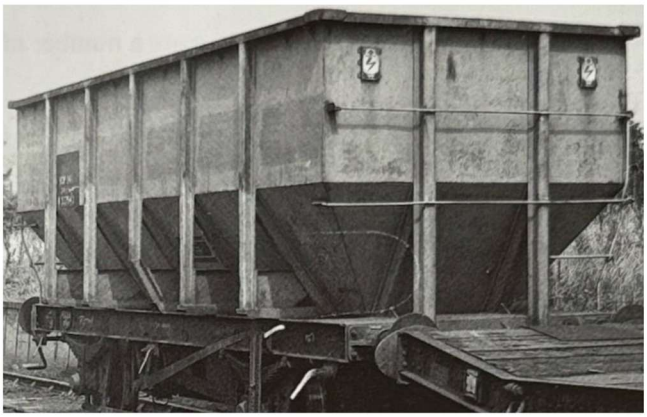
Kilbourne & Jacobs Hopper Car (1912)

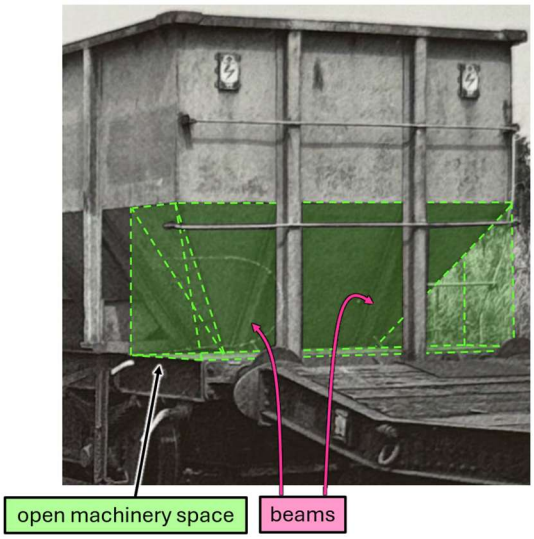




Gregg Co. Hopper Car (1922)

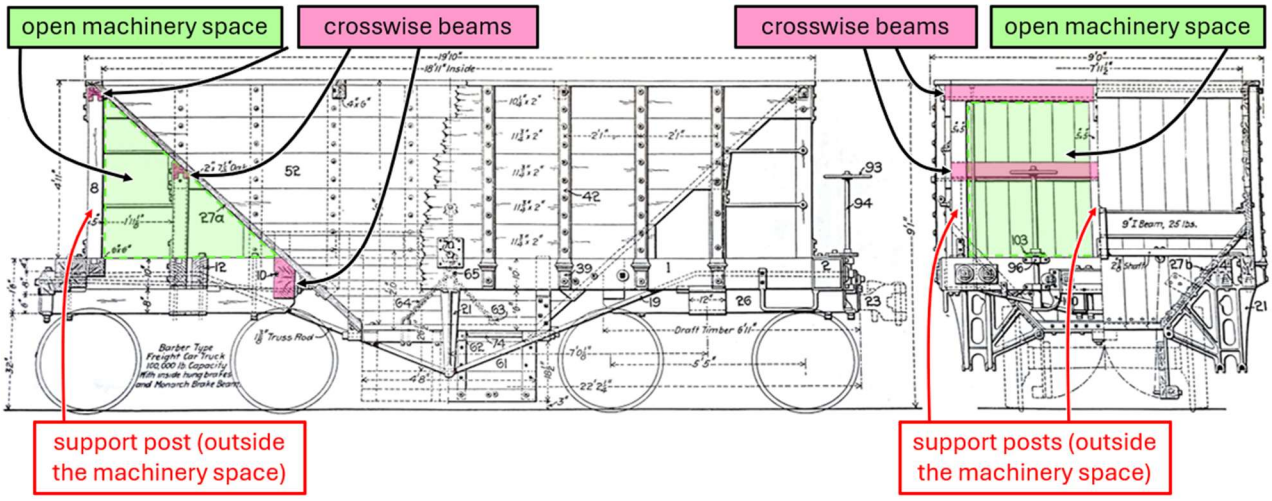






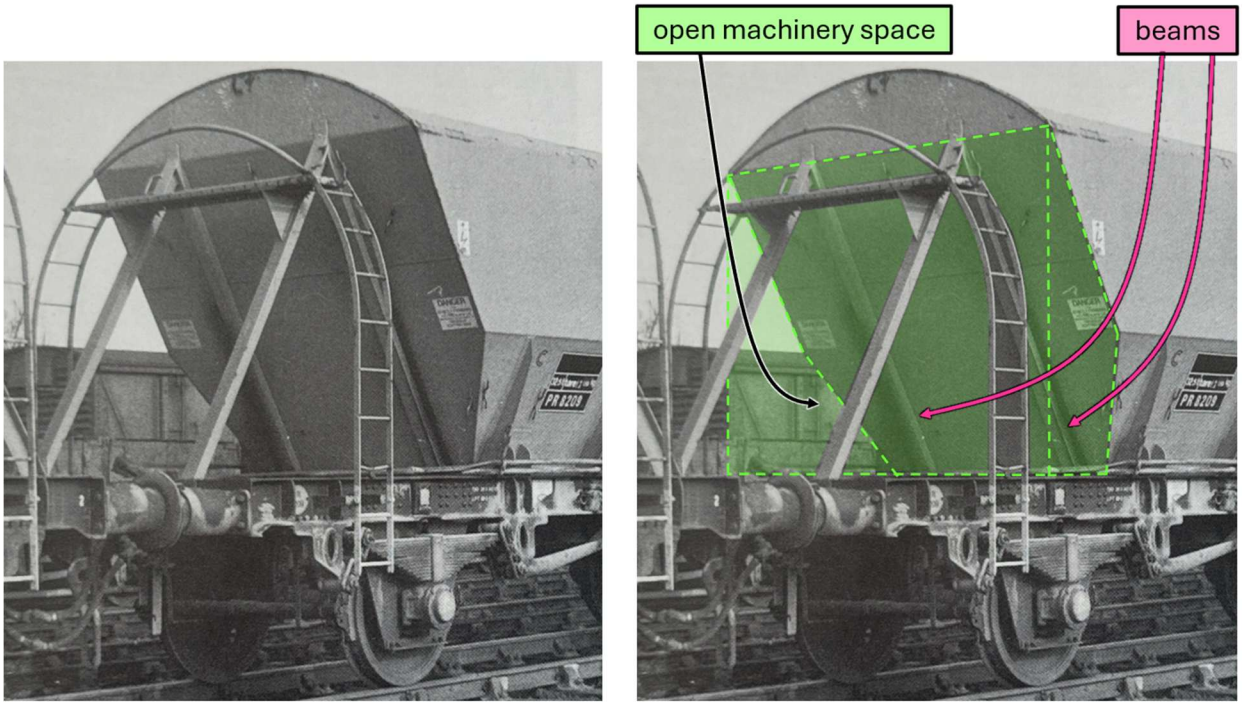
BR Shildon Hopper Car (1963)

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



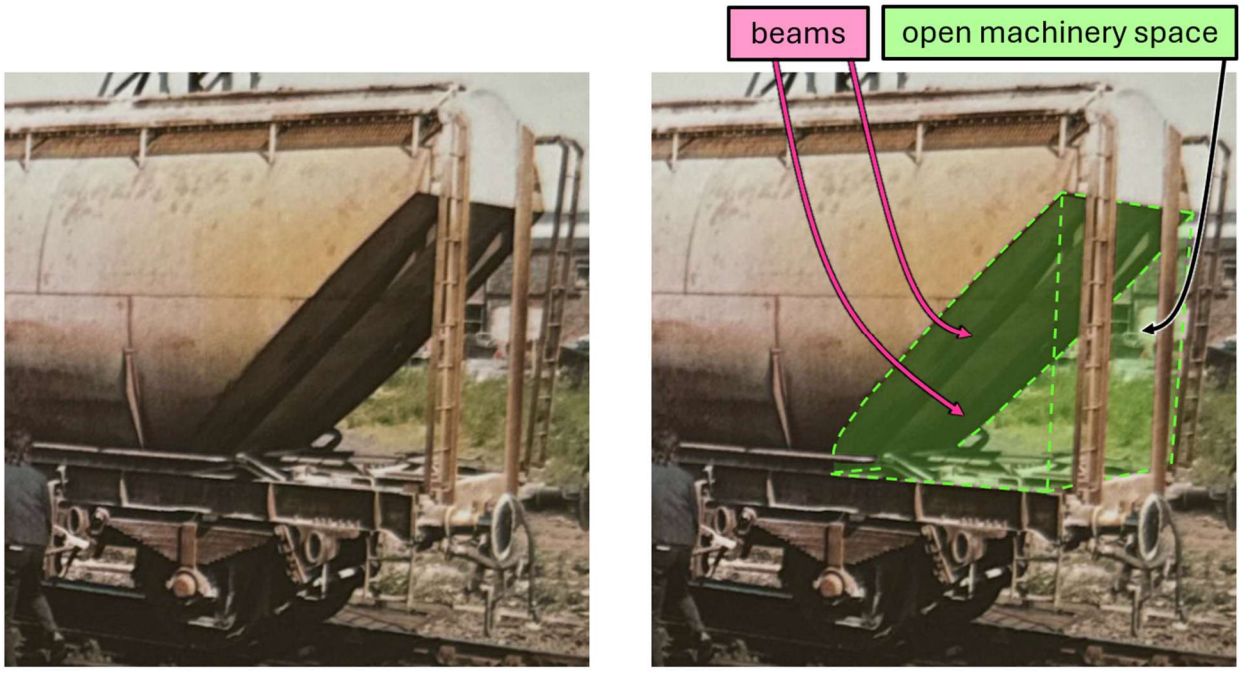
M&SP Ore Car – 1906 Cyclopedia

EX1009 at 118.



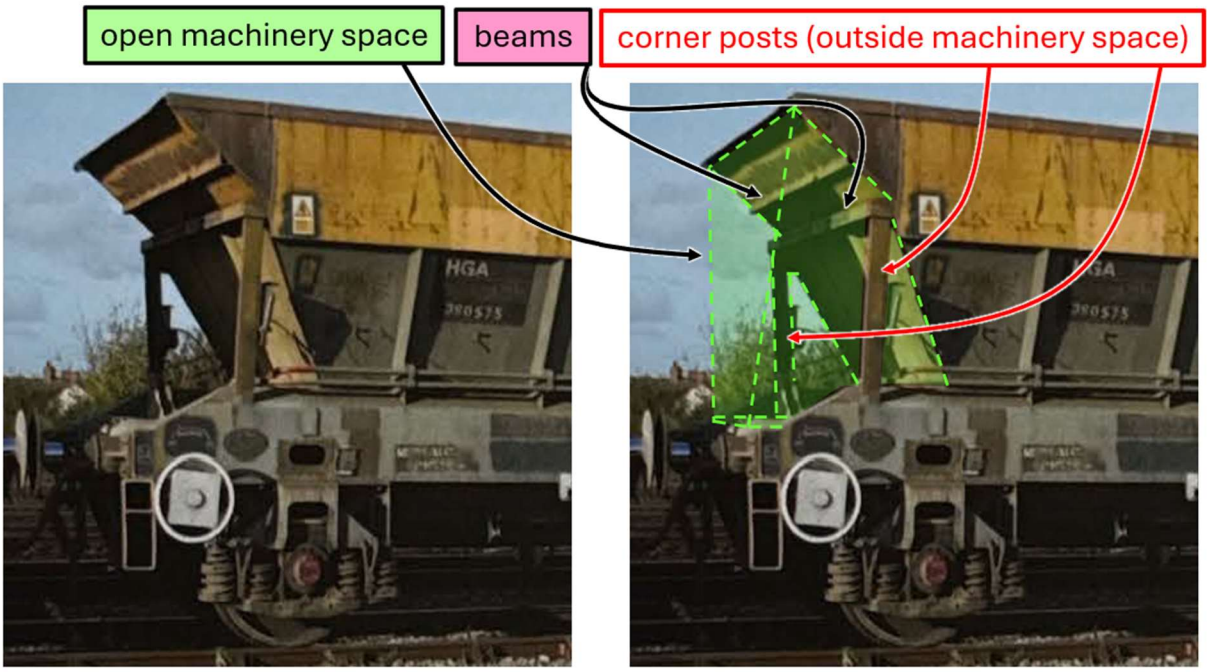
BP Chemicals Hopper Car (1971)

EX1020 at 62.



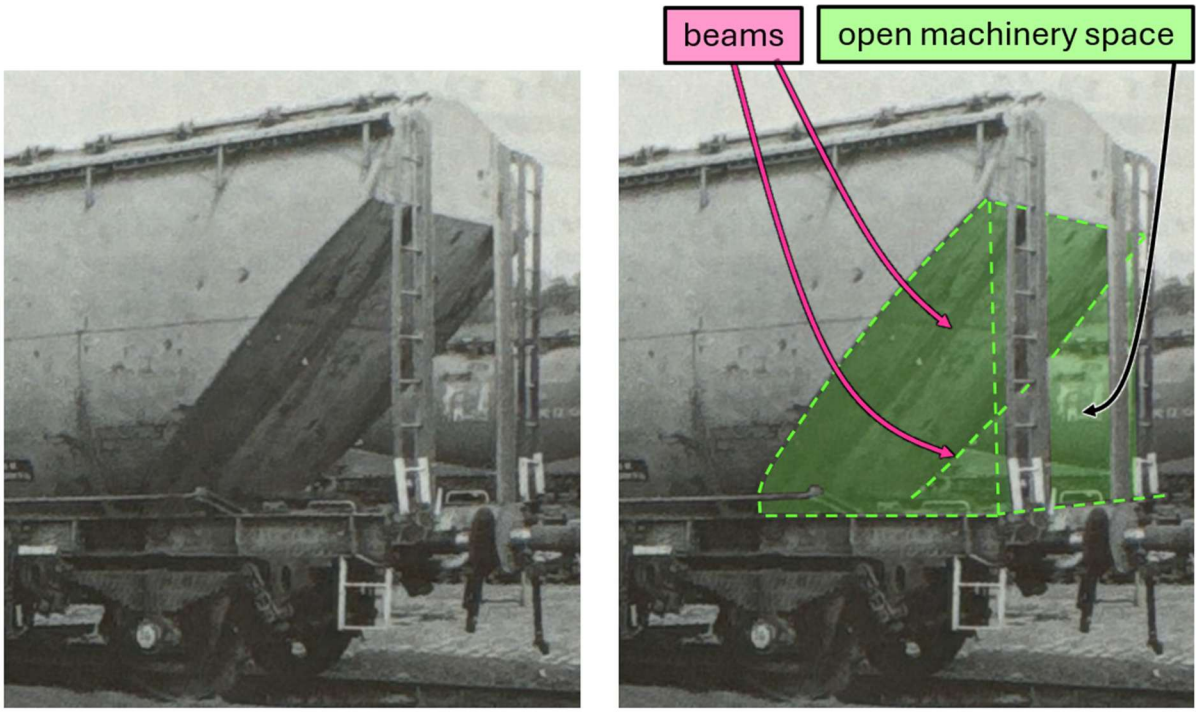
British Steel Hopper Car (1971)

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. As the principal reference in this petition, Hart is discussed in detail below.

D. Claim Construction

No claim terms require construction to resolve the issues 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. 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. For example, certain claim terms commonly used in the rail-car field require a brief explanation. 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 ¶¶42–46.

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

Exhibit No.	Description	Publication/Issue Date
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

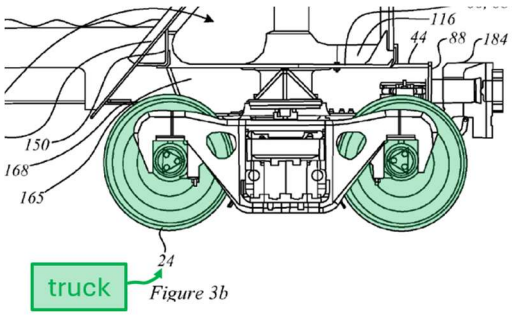
Claims 1–44 of the '515 patent would have been obvious in view of the prior art. The references discussed below disclose every limitation of these claims, though not always using identical terminology. *See In re Bond,* 910 F.2d 831, 832 (Fed. Cir. 1990) (disclosure need not be *ipsissimis verbis*).

A. Ground 1: Claims 1–2 are obvious over Hart and the 1906 Cyclopedia.

1. Independent Claim 1

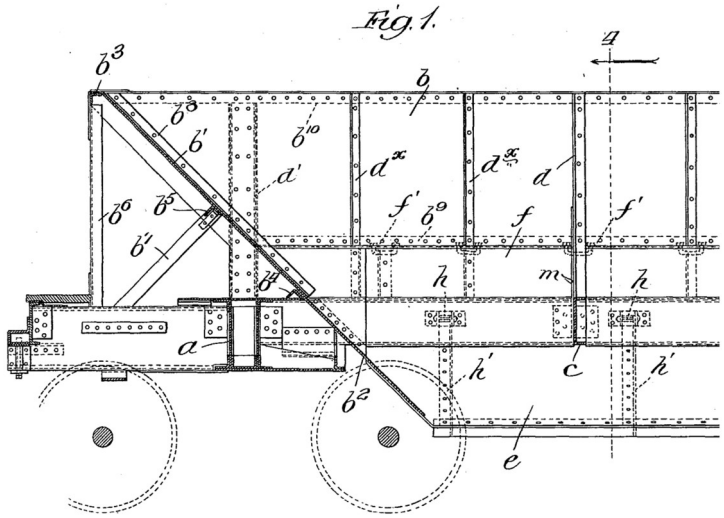
a. [1a] "A railroad hopper car for carrying particulate material, said hopper car comprising: a hopper; first and second end sections for carriage by respective first and second rail road car trucks for rolling motion along railroad tracks in a longitudinal direction; said hopper being suspended between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

Hart describes a railway hopper car called a "dump car." EX1008 at 1:105 ("car with hopper portions"). The '515 patent explains that trucks 24 carry car body 22 along railroad tracks. EX1001 at 12:55–57. A truck 24 is shown below.



EX1001, Fig. 3b.

Hart's Figure 1 illustrates one of the claimed "end sections" and the truck that supports that end of the car.



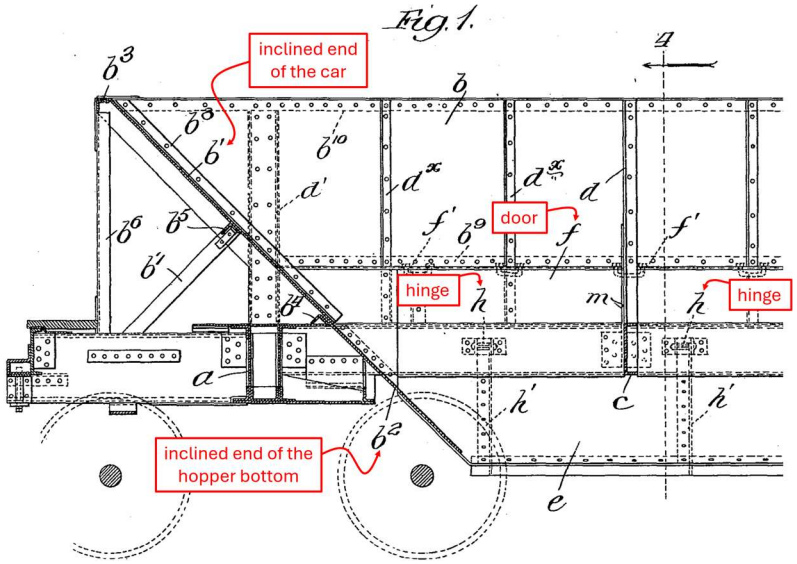
EX1008, Fig. 1; EX1003, ¶ 61.

Hart teaches a hopper comprising a central hopper portion and two lateral hopper portions. EX1008 at 1:58–108. Although Hart's Figure 1 shows only one end of the rail car, the written description refers to the "ends of the car" in the plural. *See, e.g., id.* at 2:46–47, 59. The longitudinal ends of the hopper are formed by "the inclined ends of the car" *b'* and the "inclined ends of the hopper bottom" b^2. *Id.* at 2:46–62. Based on this disclosure, a "POSITA" would have understood that Hart's hopper is suspended between two end sections. EX1003, ¶ 62.

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;"

Hart's "central hopper is provided with doors g," EX1008 at 1:72–74, and the doors and other disclosed structures constitute "means for dumping the load from the hopper bottom," *id.* at 2:63–68. Hart also discloses the claimed end slope sheets,

e.g., where it states that "*b'* represents the inclined ends of the car and b^2 the inclined ends of the hopper bottom." *Id.* at 2:46–48.

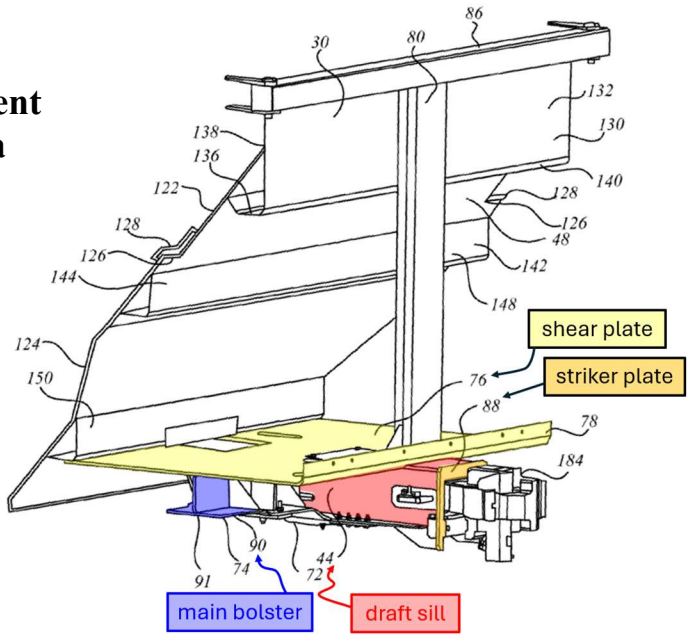


See Id., Fig. 1. Hart thus discloses end slope sheets "inclined in the longitudinal direction to feed [a respective] discharge section," as claimed.

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;"

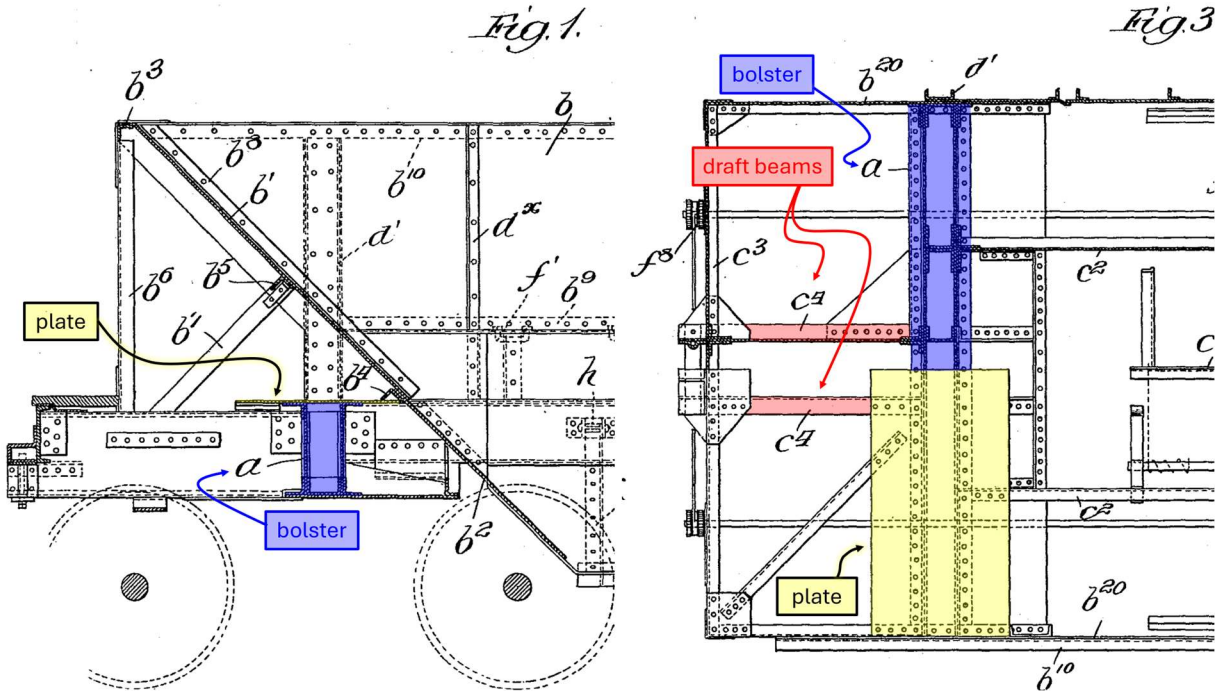
The '515 patent expressly defines "draft sill": "In the terminology of the industry, the portion of the center sill 44 (be it a stub center sill or a straight through center sill) that lies longitudinally outboard of the truck center … may also be referred to as the draft sill." EX1001 at 14:36–39. Figure 3a of the '515 patent illustrates a longitidinally oriented draft sill, a main bolster extending crosswise to the draft sill, and a shear plate mounted on the draft sill and bolster.

'515 patent Fig. 3a



Id., Fig. 3a.

Hart discloses these structures in the claimed arrangement. Hart discloses "bolsters *a,*" *id.* at 1:31, and states that "draft beams c[4] are connected to the end sill and to the bolster," *id*. at 1:101–03. Although not discussed in the patent, Hart shows a shear plate (colored yellow in Figs. 1 and 3 below). EX1003, ¶ 64. Hart's shear plate extends a certain distance along the draft sill, as shown in Fig. 3 below. Hart also states that "Fig. 3 is a plan view of a portion of our car, certain parts being removed to show the construction of the underframe." EX1008 at 1:21–24. A POSITA would understand that Fig. 3 shows only one half of the plate, and that the shear plate is attached to each side sill *b*[20] and extends from side to side. EX1003, ¶ 64.



EX1008, Figs. 1, 3.

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

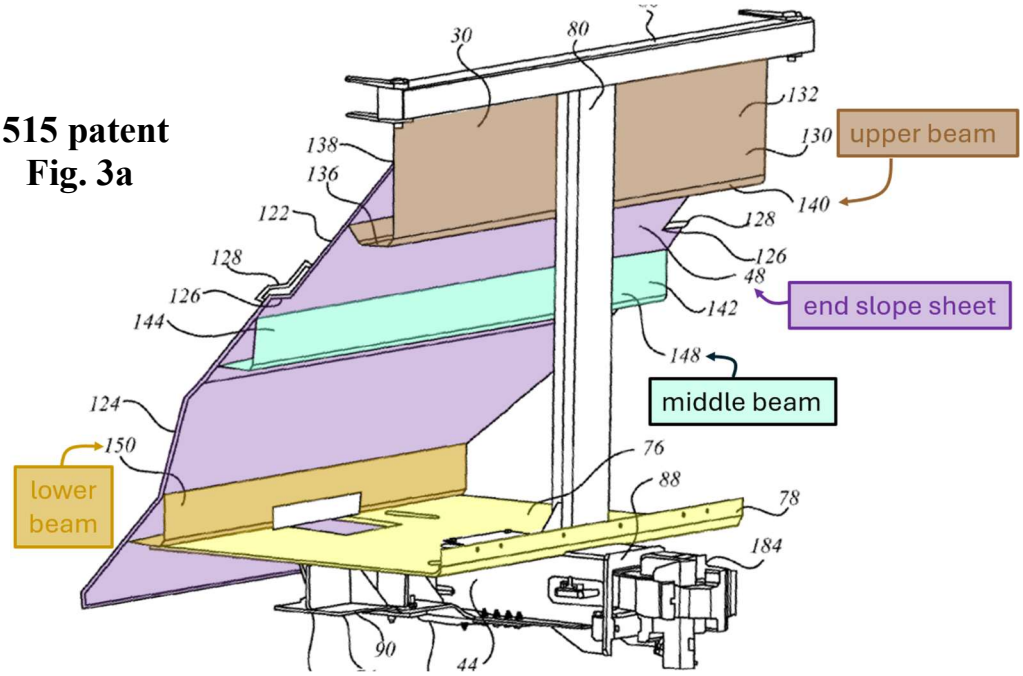
As shown above, Hart's end slope sheet over hangs the shear plate.

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;"

Hart's hopper car is "free of primary structure directly above" the shear plate and under the overhanging slope sheet.

In the only embodiment disclosed in the '515 patent, the slope sheet is reinforced by three beams extending crosswise along the underside of the slope sheet. Fig. 3a shows this arrangement:

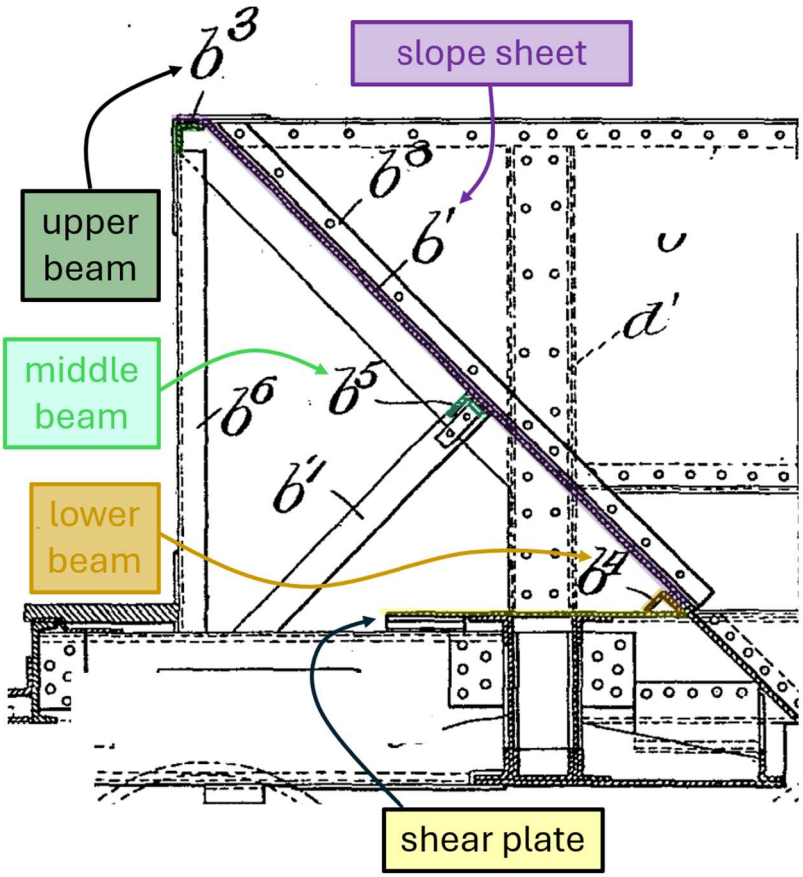
'515 patent Fig. 3a



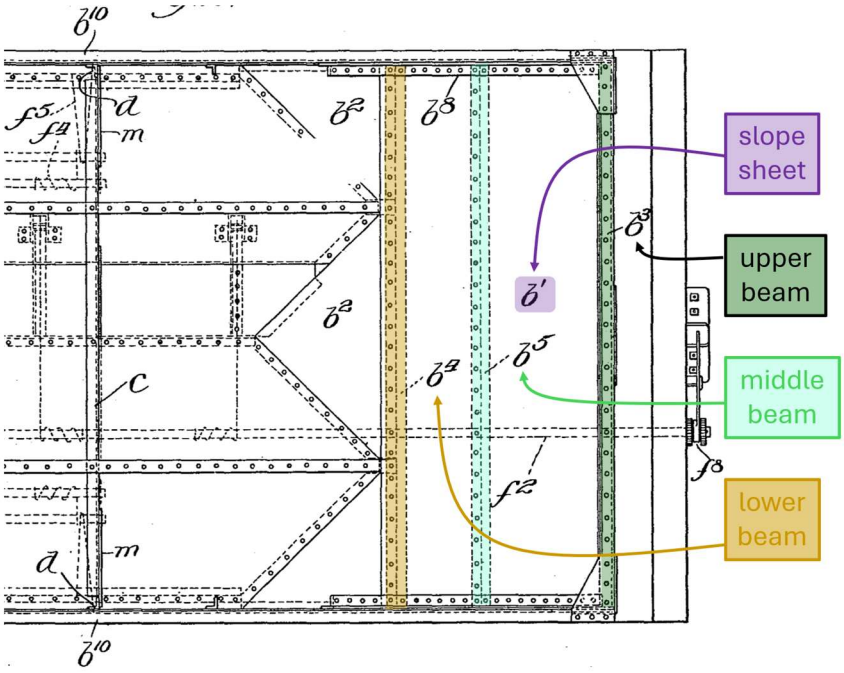
EX1001, Fig. 3a.

Because limitation [1e] should be interpreted to cover the only embodiment in the '515 patent, the reinforcement beams shown in Fig. 3a do not constitute "primary structure" prohibited by limitation [1e].

Hart also discloses reinforcement beams extending crosswise along the underside of the slope sheet, as shown below. As with the '515 patent, Hart's reinforcement beams do not constitute "primary structure" discussed in limitation [1e].



Hart Fig. 1



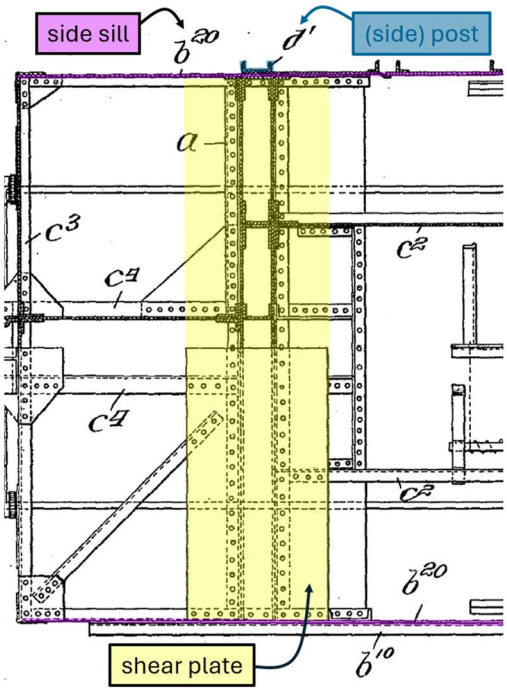
Hart Fig. 2

EX1008, Figs. 1, 2.

Hart's slope sheet is not supported by elephant ears (e.g., large triangular, longitudinal plates), struts, transverse plates, or any other primary structure directly above the shear plate and below the slope sheet. EX1003, ¶ 69. This can be seen in Figs. 1 and 2 above. Those figures show three other structures at the end of the rail car: (corner) post b^6, (side) post d', and inclined brace b^7. *See id.* However, none of these structures intrudes into the region prohibited by the claim. *Id.*.

Post b^6 is not directly above the shear plate, but longitudinally outboard of the shear plate, as shown in Fig. 1 above. *Id.* at ¶ 70.

Post d' is mounted on the outside of side sill b^{20}, laterally outboard of the shear plate. *Id.* at ¶ 71. As shown in Fig. 3 below, the shear plate is attached to a flange that is laterally inward of the side sill, while post d' is laterally outward of the sill.

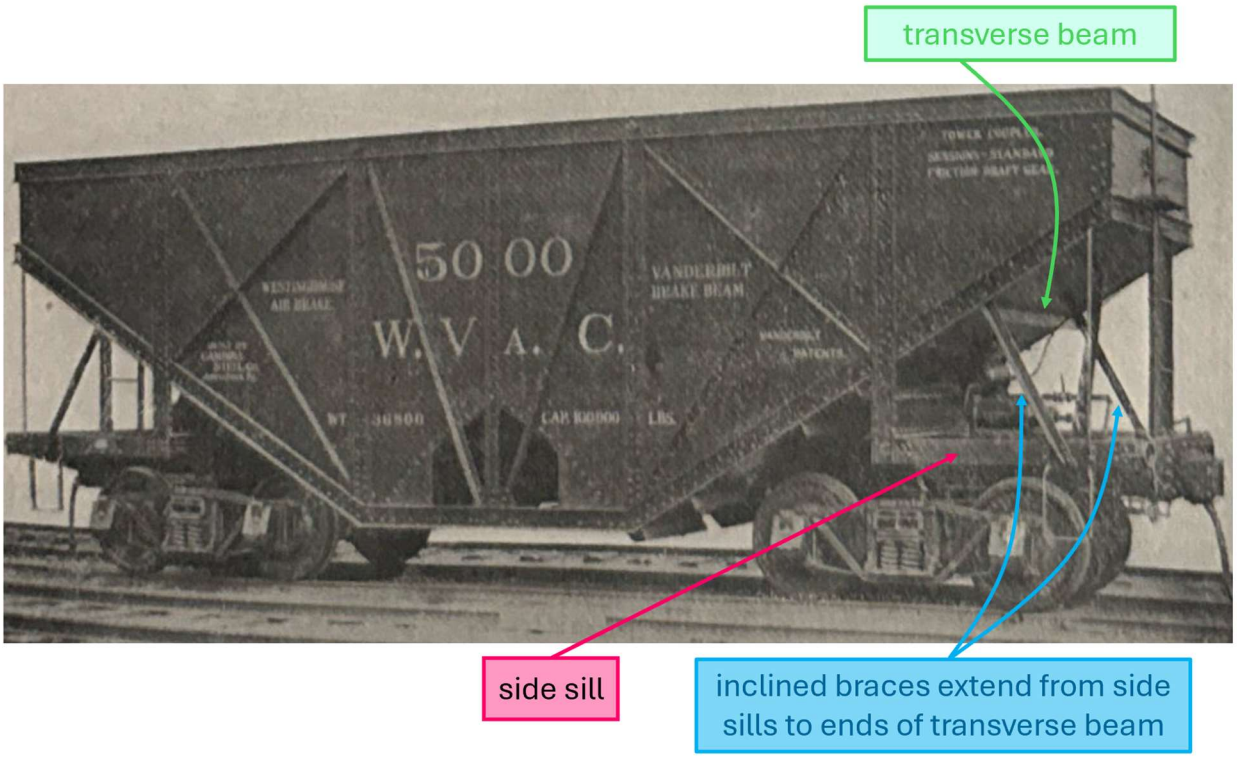


Hart Fig. 3

EX1008, Fig. 3.

Finally, inclined brace b^7 is mounted to the side sill and extends upwards in a vertical plane, without extending laterally inward into the machinery space or above the shear plate. EX1003, ¶ 72. If inclined brace b^7 extended laterally inward, it would be visible in Fig. 2, an upper plan view of the hopper car. *Id.* But it is not.

A POSITA would know that inclined braces such as brace b^7 were often used to support the ends of a transverse beam, just as brace b^7 supports the ends of beam b^5. *Id.* at ¶ 73. In such cases, the lower end of the inclined brace is mounted to the side sill, and no part of the inclined brace extends laterally inward of the sill. *Id.* The 1906 *Car Builders' Dictionary*, a handbook for train manufacturers ("1906 Cyclopedia"), contains a photo of a railcar manufactured by the Cambria Steel Co. ("Cambria Steel car") with this sort of inclined brace:



EX1009 at 13, Fig. 53.

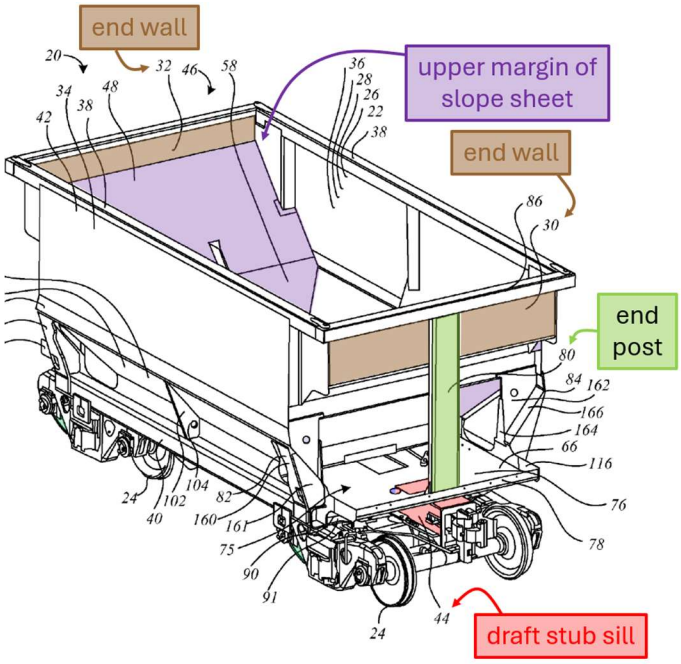
Thus, like the '515 patent, Hart teaches supporting the slope sheet with transverse beams, without relying on primary structure directly over the shear plate or in the machinery space. Hart therefore discloses limitation [1d].

Even if Hart did not disclose that its inclined brace is laterally outboard of the shear plate, it would have been obvious to mount the brace to the outside of the side sill, as in the 1906 Cyclopedia, so that it would not be directly above the shear plate or in the machinery space. EX1003, ¶ 75. A POSITA would have been motivated to do this for rigidity, load transfer, and to create a strong base for the braces. *Id.*

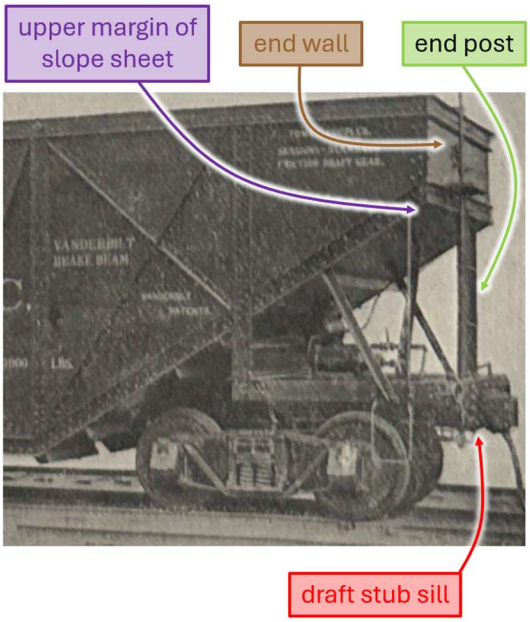
f. [1f] "one of: (a) said first end slope sheet has an upper margin and said hopper car includes an end post extending upwardly from said draft sill to said upper margin of said first end slope sheet; and (b) said first end slope sheet has an upper margin terminating at an end wall, and said hopper car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

The 1906 Cyclopedia's Cambria Steel car discloses option (b) of this limitation, as shown below.

[1] The '515 patent uses "draft sill" and "stub sill" interchangeably. EX1001 at 17:32–33 ("draft sill (i.e., the stub sill)").



'515 patent
Fig. 1



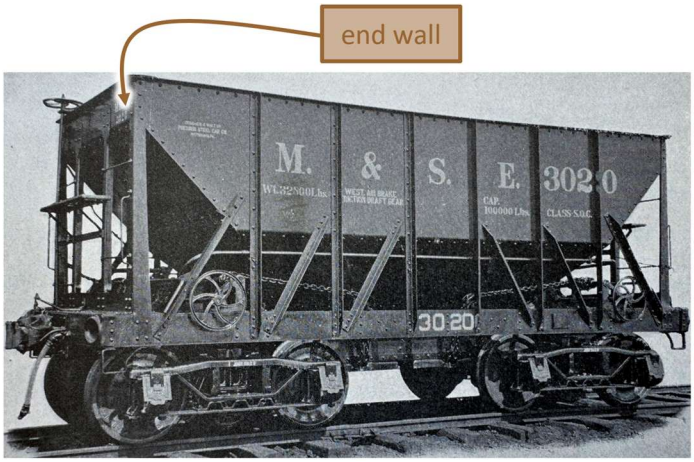
1906
Cyclopedia

EX1001, Fig. 1; EX1009 at 13, Fig. 53

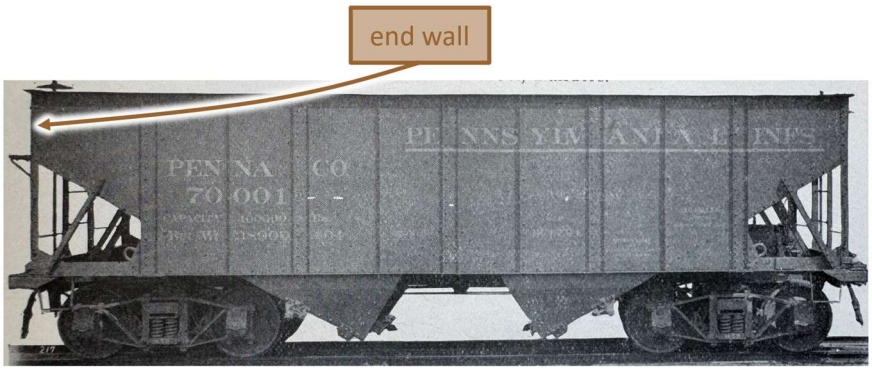
It would have been obvious to modify Hart to add an end wall supported by an end post. The modification could be made either (i) by leaving the end slope sheets in place and increasing the overall height of the hopper; or (ii) by reducing the inclination of the slope sheets so that their outboard ends terminate at a lower height (*i.e.*, lower along the end wall). EX1003, ¶ 77.

A POSITA would have had reason to modify Hart to incorporate an end wall supported by an end post extending upward from the draft sill, as in the Cambria Steel car. *Id.* at ¶ 78. First, doing so increases the hopper's volume without increasing the rail car's length or width (or even its height, if the end wall is added by lowering the slope sheets). *Id.*

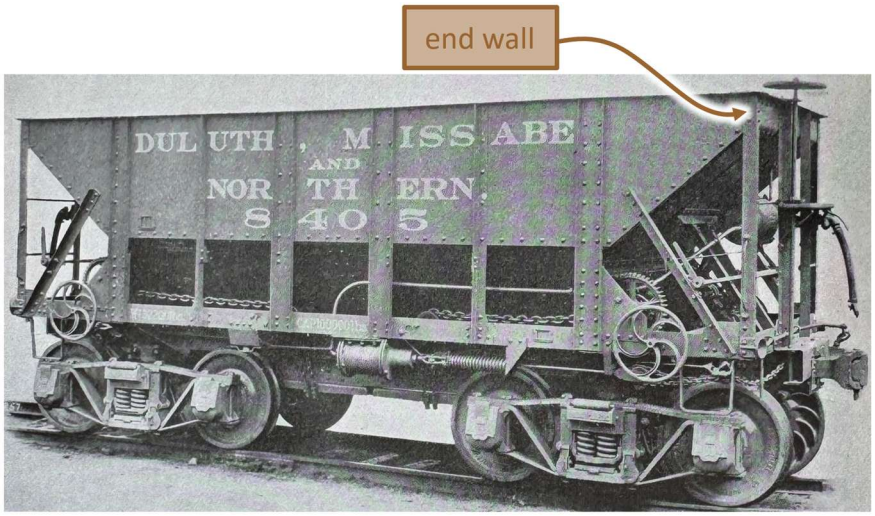
Second, by 2009, end walls were common and well-known optional features of hopper cars. *Id.* at ¶ 79. Indeed, end walls were common and well-known even by 1906, a century before the '515 patent application, as demonstrated by the many examples below of hopper cars with end walls in the 1906 Cyclopedia. *Id.* Each example below has at least one end post supporting the end wall, either a single end post extending upward from the center of the draft sill, or two posts extending from the sides of the draft sill. *Id.*



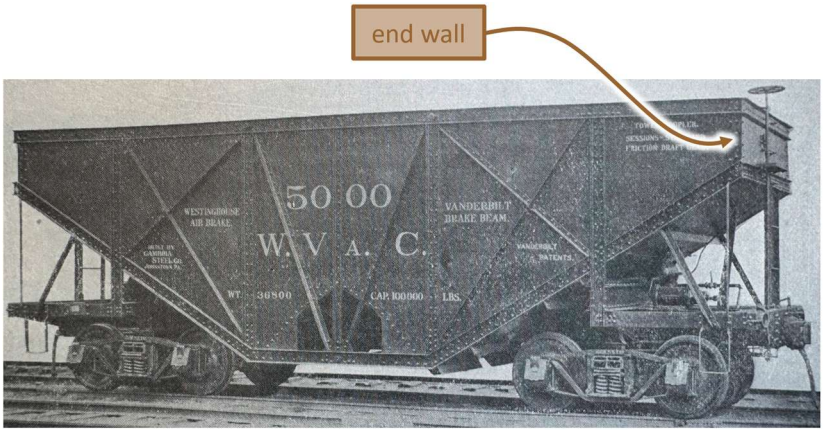
EX1009 at 14, Fig. 54.



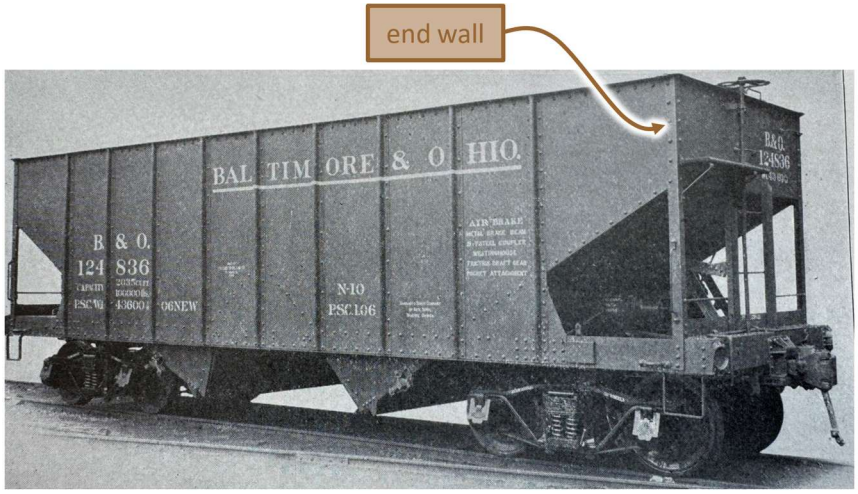
Id. at 13, Fig. 52.



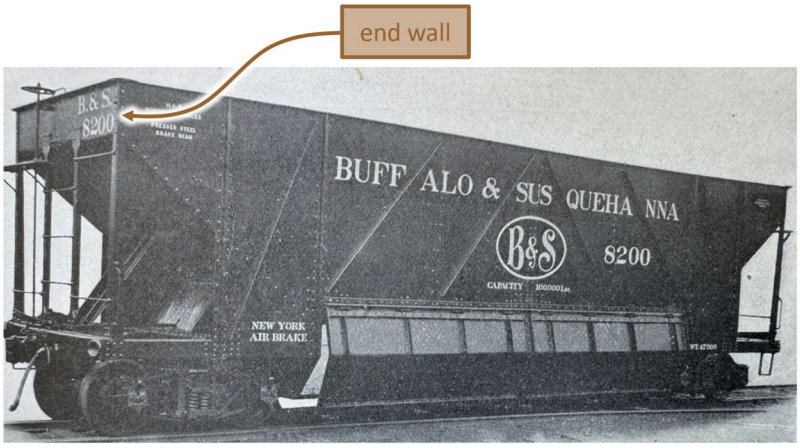
Id. at 14, Fig. 55.



Id. at 13, Fig. 53.



Id. at 13, Fig. 50.



Id. at 14, Fig. 56.

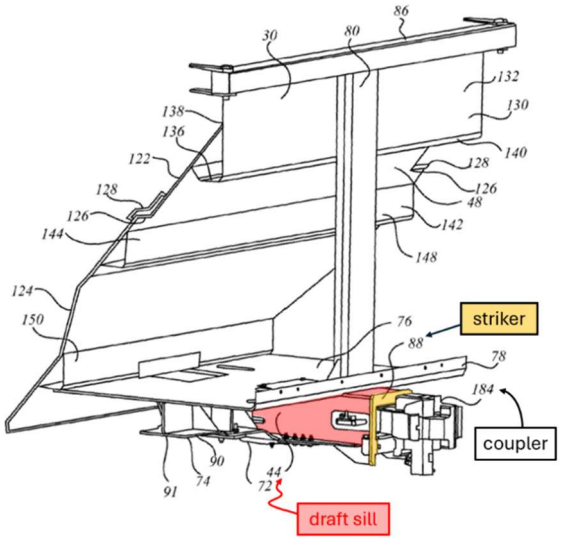
Third, incorporating an end wall and post (as in the Cambria Steel car) in Hart's design would have been obvious to a POSITA because it is one of a finite number of well-understood options for the end of a hopper car, *i.e.*, (i) incorporating an end wall or (ii) extending the slope sheet to the top cord. EX1003, ¶ 80. 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*.

Because end walls and posts had been used for a century before 2009, a POSITA would have successfully incorporated them into Hart's design.

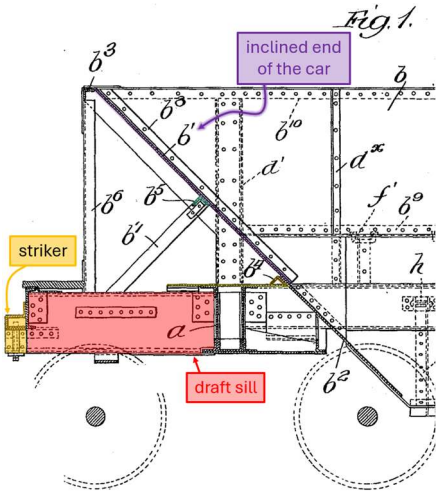
g. [1g] "said shear plate has a longitudinally outboard margin and said draft sill has a striker located outboard of said longitudinally outboard margin of said shear plate, and said end post is one of: (a) rooted to said draft sill adjacent to said striker; (b) rooted to said shear plate adjacent to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

Strikers or "strike plates" are plates mounted on the outward end of a draft sill to protect the rail car from impact with the coupler that connects the adjacent rail car. EX1003, ¶ 82. The '515 patent discloses a striker 88 at the end of draft sill 44:

'515 patent Fig. 3a

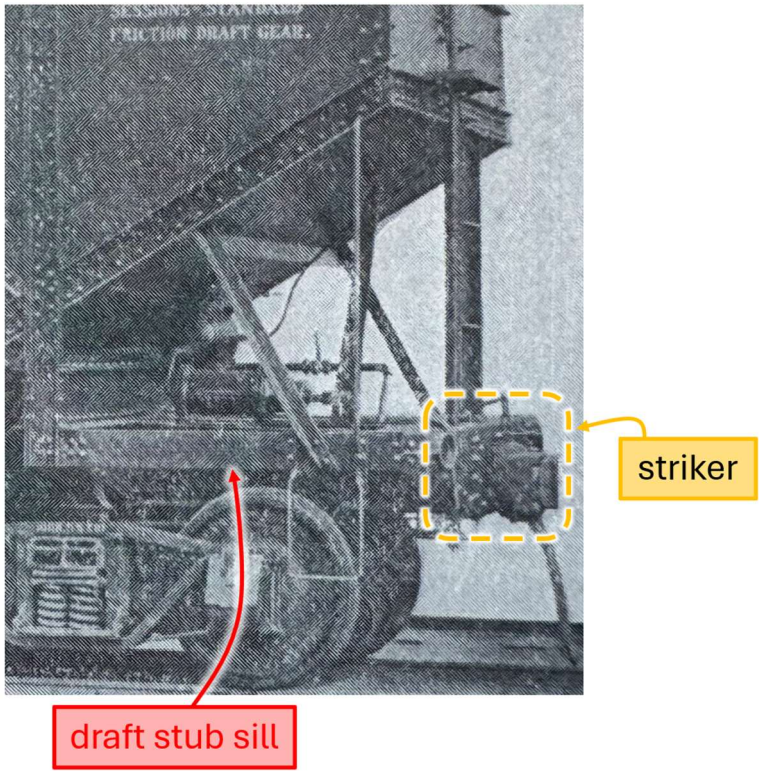


EX1001, Fig. 3a. Hart discloses a structure at the end of its draft sill, as shown below.



EX1008, Fig. 1. A POSITA would have understood that the structure attached to the end of the draft sill is a striker. EX1003, ¶ 83.

The 1906 Cyclopedia's Cambria Steel car also discloses a striker at the end of the draft sill, as shown below.



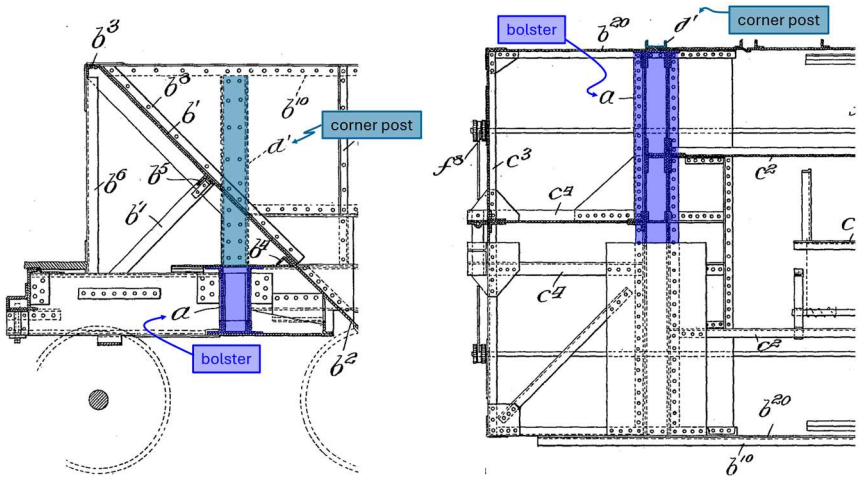
EX1009 at 13, Fig. 53. As the photograph shows, the striker plate is attached to the end of the draft sill with rivets.

Even if Hart did not expressly disclose a striker at the end of its draft sill, it would have been obvious to add one, as in the Cambria Steel car. A POSITA would have been motivated to do so because a striker is a standard component that protects the rail car from damage. Adding a strike plate is a simple matter that would pose no challenge to a POSITA in 2009. EX1003, ¶ 89.

Finally, as discussed above in connection with limitation [1f], it would have been obvious to modify Hart to add an end wall supported by an end post extending vertically from the draft sill, as in the 1906 Cyclopedia's Cambria Steel car. So modified, Hart would disclose an end post rooted to the draft sill, adjacent the striker.

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"

Hart discloses the claimed corner posts, denominated "supporting post *d'*":



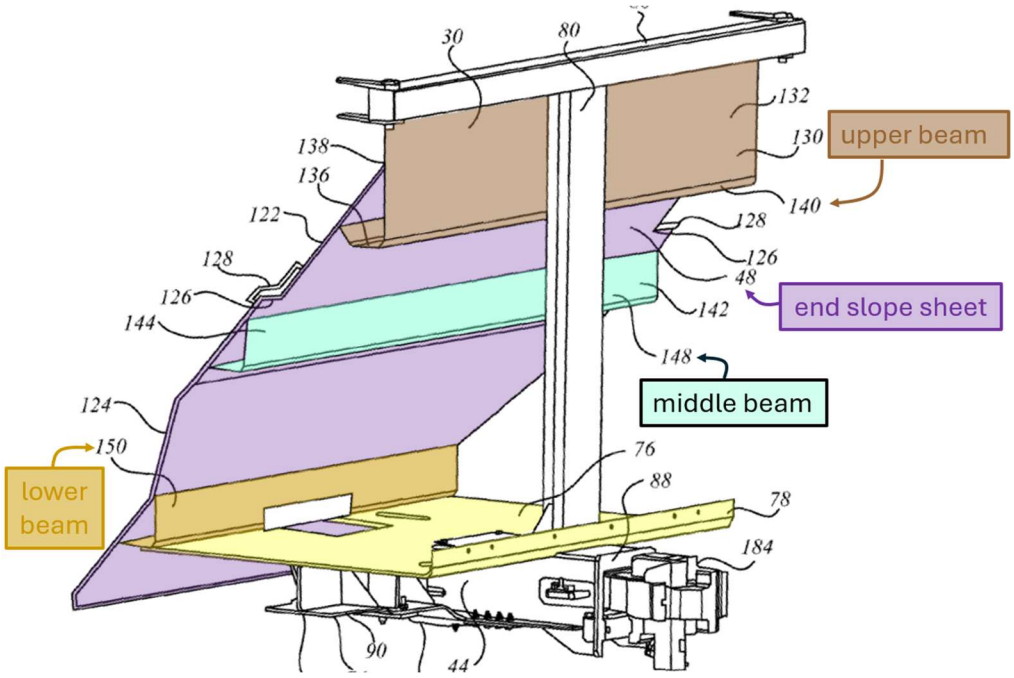
See EX1008, Figs. 1, 3.

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."

Hart discloses this limitation. Hart's hopper car has no primary structure within the the area defined by the shear plate, slope sheet, corner posts and end post. As discussed in connection with limitation [1e], Hart discloses transverse beams

extending along the underside of the slope sheet, just like the '515 patent. *See supra*, at § IV.A.1.e. Hart also discloses posts and inclined braces that are at the sides of the car, rather than in the machinery space, just like the corner posts of the '515 patent. *Id.* Further, modifying Hart to add an end post, as discussed above, would not add any structure to the machinery space, which is longitudinally inward of the end post. EX1003, ¶ 93.

Even if Hart's crosswise beams were deemed to slightly impinge upon the machinery space, they would be no different than the '515 patent's crosswise beams, which extend slightly below the slope sheet. *Id.* at ¶ 94.



EX1001, Fig. 3A.

If claim 1 is construed to cover the preferred embodiment, as it should be, then a machinery space is free of primary structure even if primary structure at the

perimeter of the machinery space extends a *de minimis* amount into that space. EX1003, ¶ 94. Alternatively, it would have been obvious to shift Hart's corner posts or inclined braces slightly outward, as the precise positions and points of attachment of these structures is a matter of design choice. *Id*.

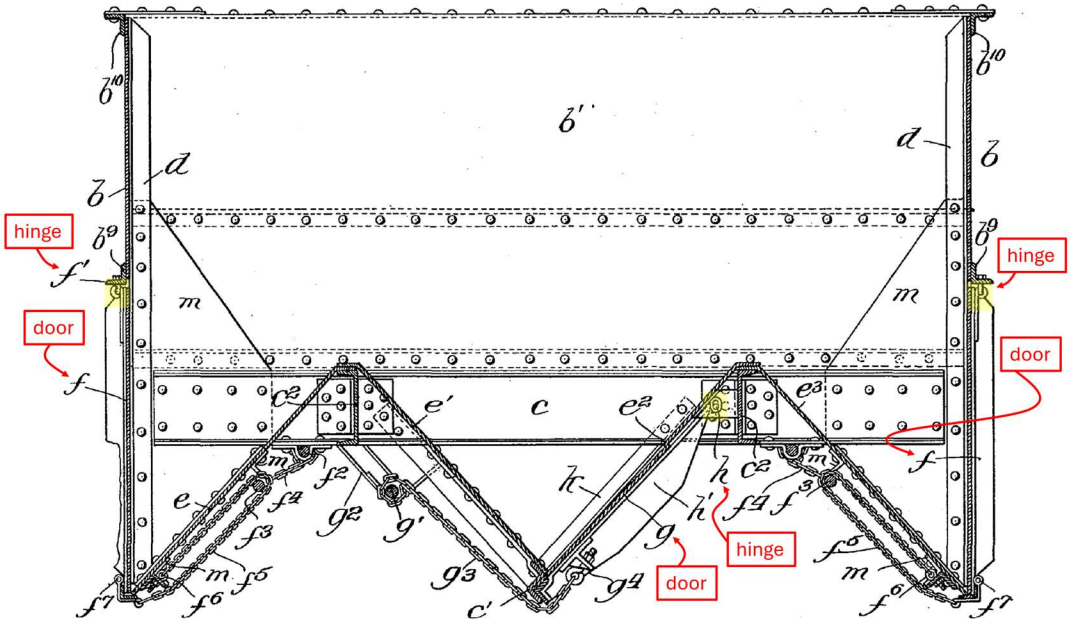
2. Claim 2: "The railroad hopper car of claim 1 wherein said bolster has first and second laterally outboard distal ends, and said hopper car has corner posts extending upwardly from said distal ends of said hopper [*sic*: bolster] to said first end slope sheet;

Claim 2 is nearly identical to limitation 1f except that the word "said hopper" appears to have been inadvertently used in place of "said bolster." This is a clear typographical error. Properly construed, Claim 2 is obvious for the reasons discussed in connection with limitation [1f].

B. Ground 2: Claim 3 is obvious over Hart, the 1906 Cyclopedia and Schuller.

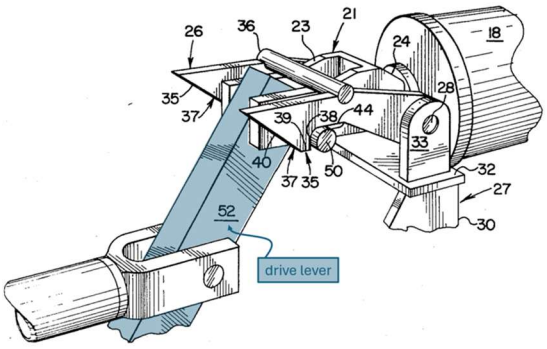
1. Claim 3: "The railroad hopper car of claim 1 wherein: said hopper car has at least one longitudinally hinged discharge door, said discharge door being movable cross-wise between open and closed positions; and a longitudinally acting pneumatic actuator is at least partially lodged in said machinery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

In Hart, "[t]he central hopper is provided with doors *g* provided upon their under sides with braces *h'*." EX1008 at 1:72–77. These doors are longitudinally hinged, as shown below.

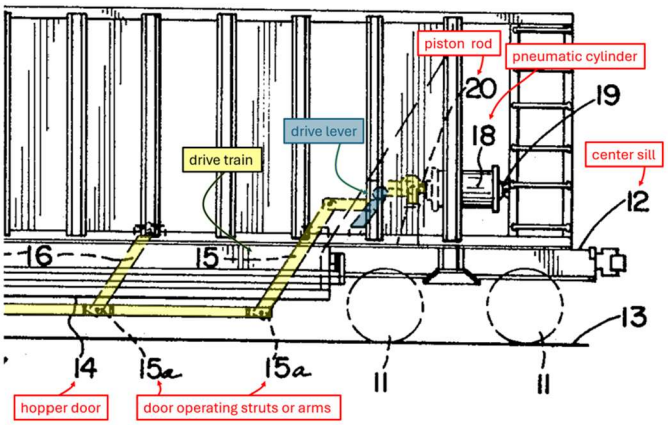


Id., Fig. 4. To operate the doors, Hart uses longitudinal shafts (*e.g.*, f^2, f^3, g') and chains (f^4, f^5, g^3). *Id.* at 2:11–62.

Schuller also discloses longitudinally hinged discharge doors: "Hopper doors 14 are pivoted on a longitudinal axis and open downward to discharge lading." EX1014, 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. As shown below, Schuller's pneumatic actuator 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, ¶ 96.



Schuller
Fig. 5



Schuller
Fig. 1

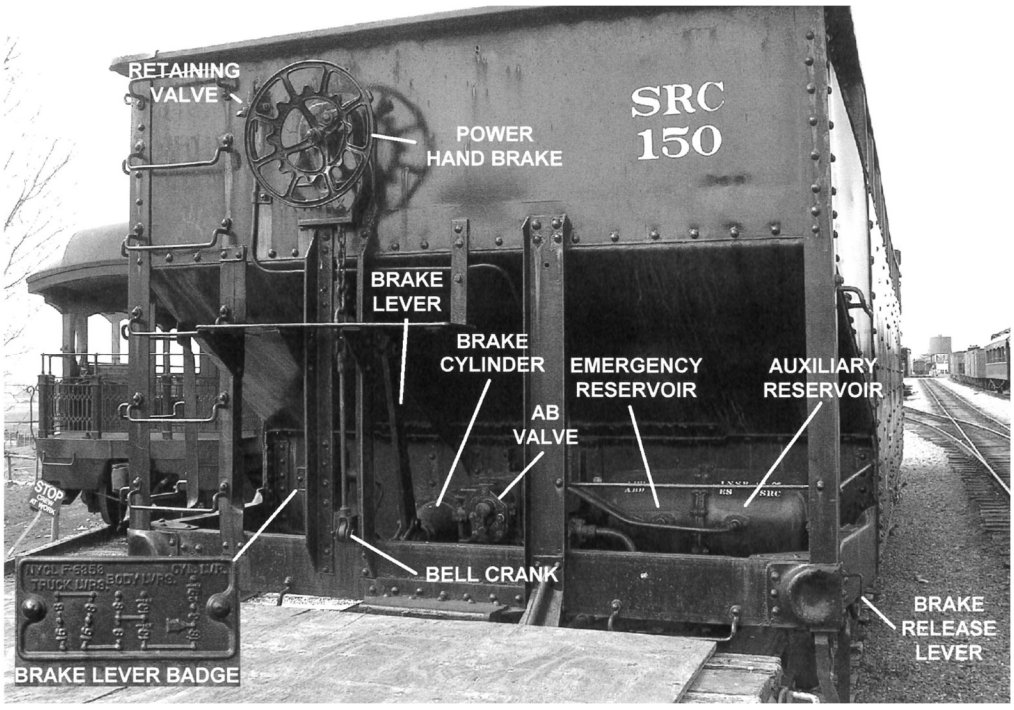
EX1014, Figs. 1, 5. Finally, as Fig. 1 shows above, Schuller's pneumatic cylinder 18 is mounted in the machinery space. It is also directly above the draft sill. *Id*. at 2:7–9 (supporting means 27, shown directly below the pneumatic cylinder 18 in Fig. 5 above, is "attached to the top 29 of the center sill 12").

It would have been obvious in 2009 to replace Hart's doors and door-opening mechanism with Schuller's doors and door-opening mechanism. In 2009, a POSITA would have wanted to update Hart's century-old, manually operated discharge mechanism by automating the door-opening process, to reduce the manual labor required and the risk of injury. EX1003, ¶ 97. In addition, in 2009, a POSITA would not have needed Hart's side doors *f* because virtually all railyards facilitated discharge through the bottom center of the rail car, as taught by Schuller. *Id.* A POSITA therefore would have been motivated to use Schuller's conventional hopper doors and automated door-operating mechanism. *Id.*

C. Ground 3: Claim 4 is obvious over Hart, the 1906 Cyclopedia, Schuller and Karig.

1. Claim 4: "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, ¶ 98. For example, Karig discloses multiple hopper cars with this conventional configuration. *See, e.g.*, EX1016 at 127, 129. One example is shown below.



Id. at 129 (annotations in the original).

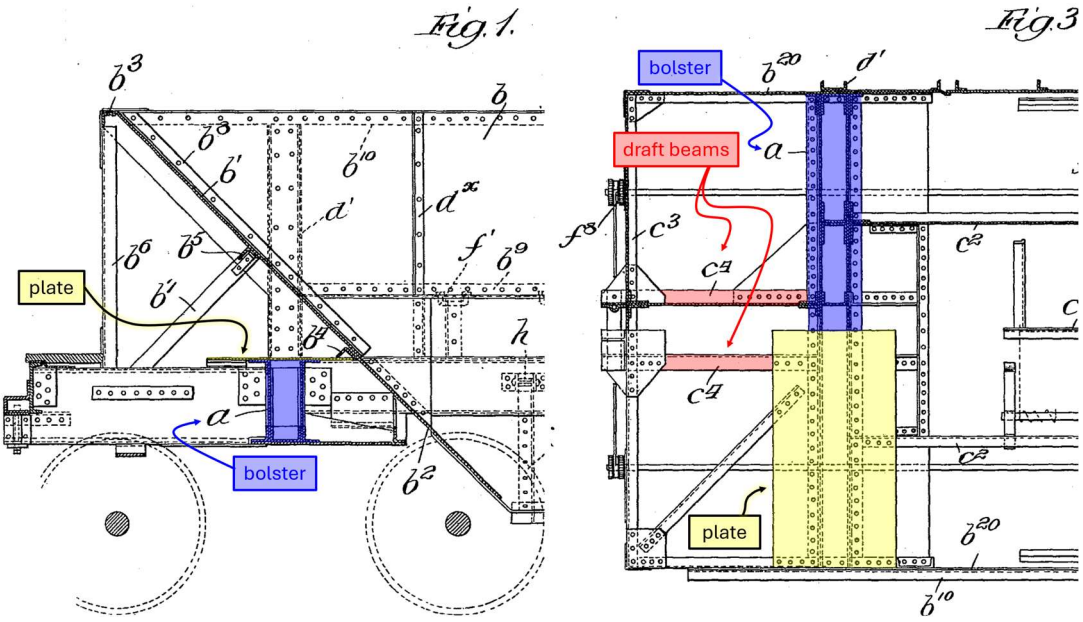
By 2009, it would have been obvious to use a conventional air brake system in Hart's design, and to lodge the brake reservoir in the conventional place: the machinery space at one end of the rail car. EX1003, ¶ 99. So modified, Hart's design would embody Claim 4.

D. Ground 4: Claims 5–6 are obvious over Hart, the 1906 Cyclopedia and Campbell '652.

1. Claim 5

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

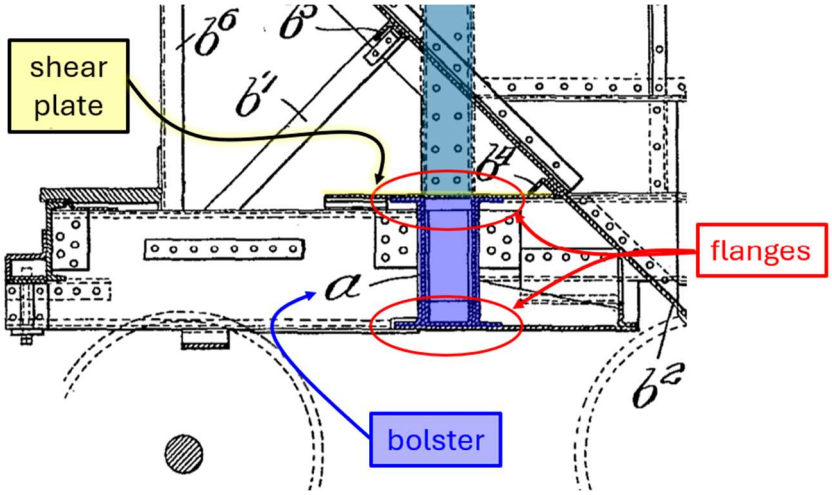
Hart discloses this limitation, as shown below.



EX1008, Figs. 1, 3.

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;"

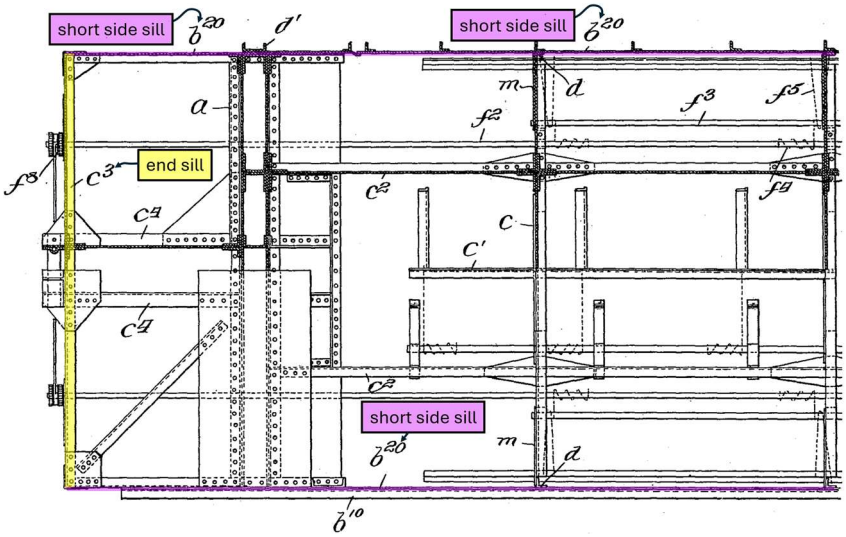
Hart discloses this limitation. Fig. 1 below shows that Hart's bolster has upper and lower flanges, and Fig. 3 above shows that Hart's bolster extends from one side of the rail car to the other.



EX1008, Fig. 1 (detail).

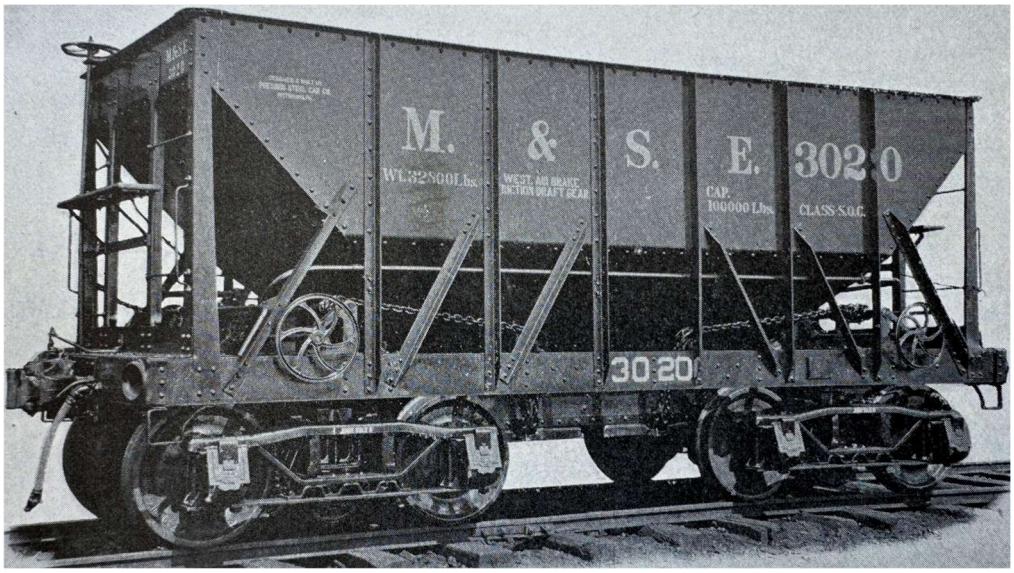
c. [5c] "said car includes a side sill running along said car between said first and second end sections;"

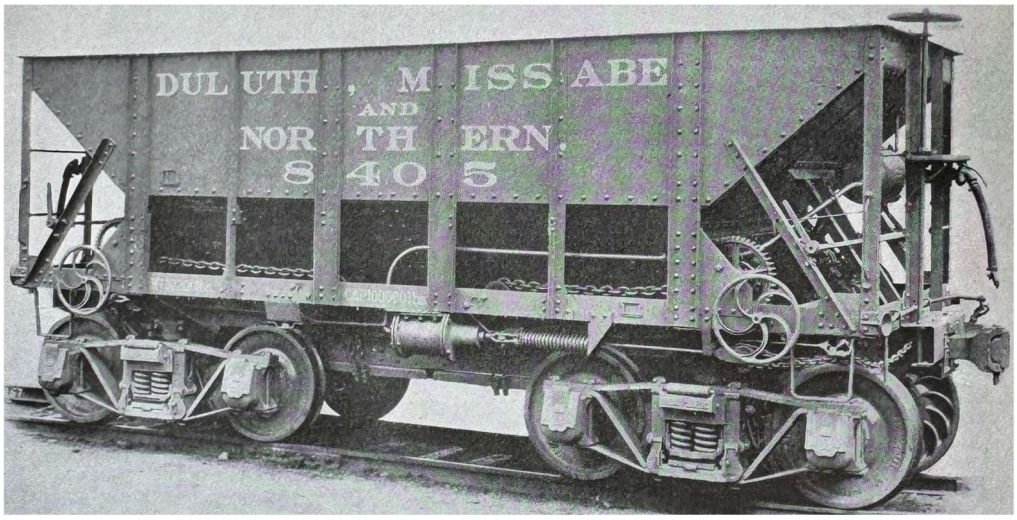
Hart discloses "a short side sill b^{20}" extending longitudinally along the sides of the rail car. EX1008 at 1:96–99.



Id., Fig. 3. Fig. 3 above, including the location of the three labels b^{20}, shows that the side sills extend the entire length of the car. EX1003, ¶ 102. The modifier "short" in "short side sill" therefore refers to the side sill's height. *Id.*

Even if Hart did not disclose side sills that extended from one end section to another, such side sills were commonplace long before 2009. EX1003, ¶ 103. This is reflected in the 1906 Cyclopedia, which contains many examples of hopper cars with such side sills, including the following:

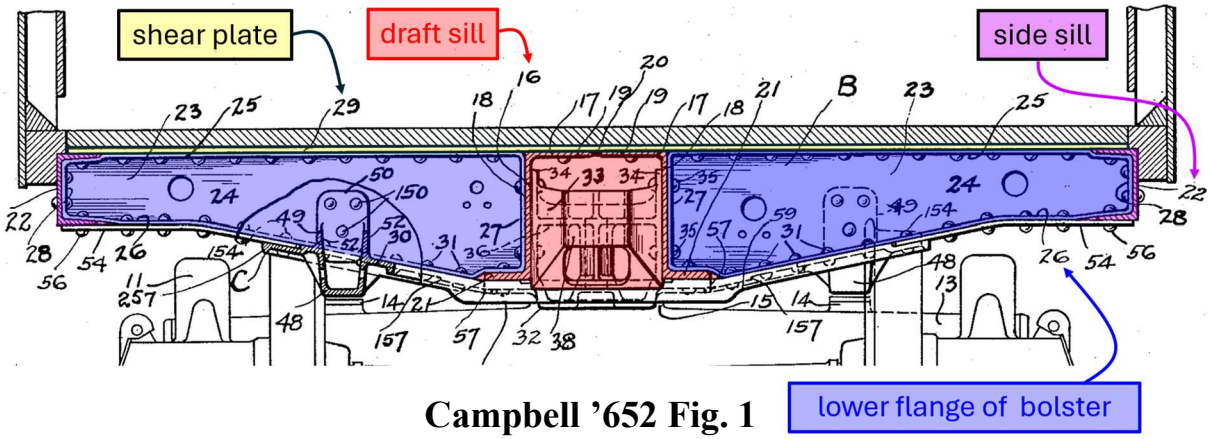




EX1009 at 14, Figs. 54, 55. A POSITA would have been motivated to modify Hart to include such side sills, because doing so would strengthen the undercarriage or base of the hopper car. EX1003, ¶ 103.

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"

Hart's figures do not show the vertical position of the side sills' flanges. However, as shown in Fig. 1 below, Campbell '652 teaches a side sill whose upper flange is substantially coplanar with and connected to the shear plate.



Campbell '652 Fig. 1

EX1013, Fig. 1 (detail). It would have been obvious to make Hart's side sill flanges, shear plate, bolster flanges and draft sill substantially coplanar with one another, as in Campbell '652, to facilitate their interconnection to form a single strong undercarriage structure. EX1003, ¶ 104.

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."

As discussed with limitation [5d], it would have been obvious to position side sills such that Hart's side sill flanges, shear plate, draft sill and bolster flanges are substantially coplanar with one another, as in Campbell '652.

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

As discussed with limitation [5d], it would have been obvious to make Hart's shear plate coplanar with the upper flanges of the draft and side sills, as in Campbell '652.

E. Ground 5: Claims 7–16, 20, 23, 24–28, and 30–31 are obvious over Hart in view of the 1906 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,"

Hart 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;"

Hart 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;"

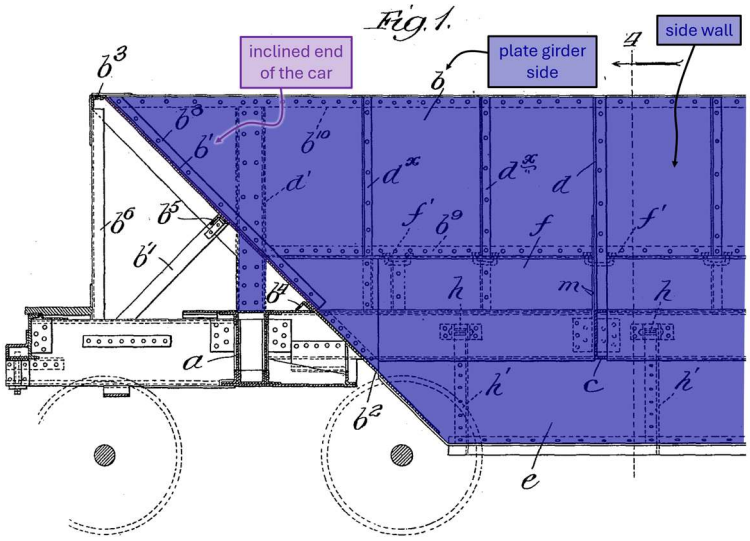
Hart discloses this limitation for the same reason it discloses limitation [1c].

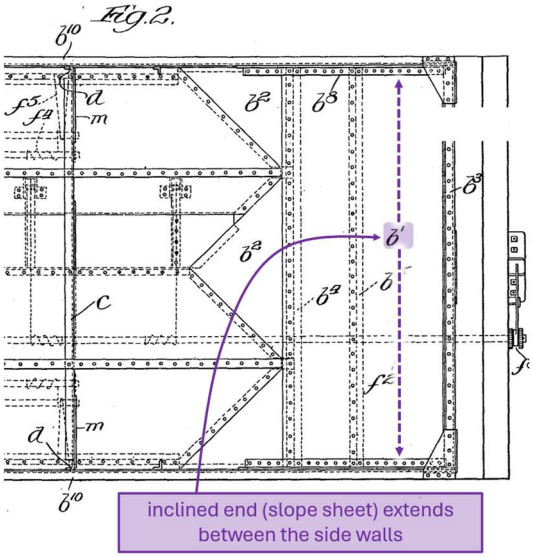
d. [7d] "said first end slope sheet of said hopper over hanging said shear plate of said first end section;"

Hart 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;"

Hart discloses limitation [7e], as shown below.

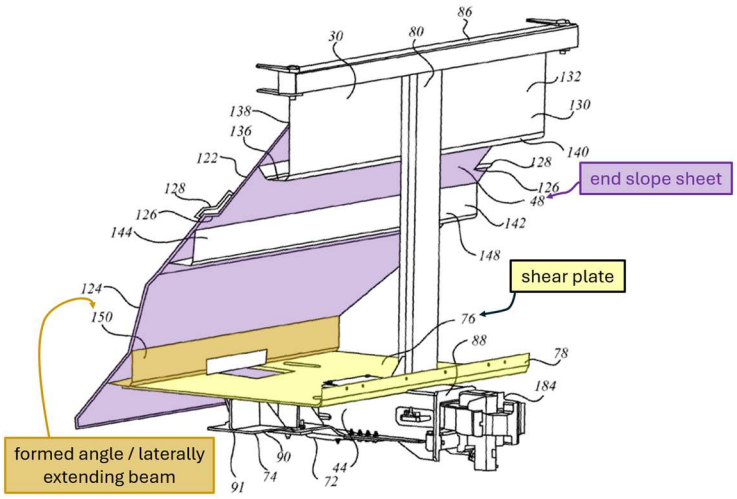




EX1008, Figs. 1, 2.

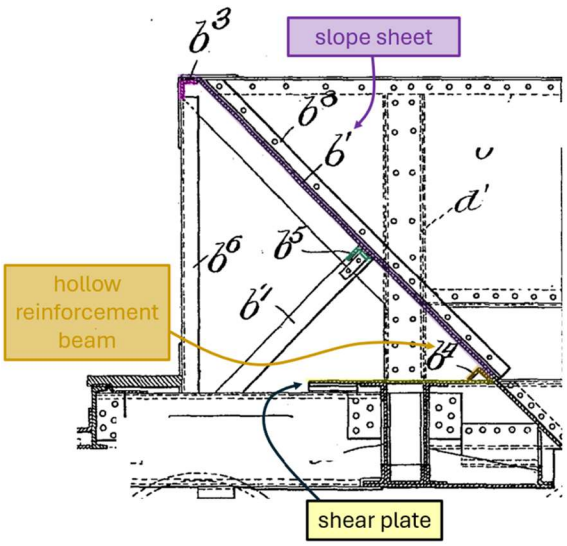
f. [7f] "a first laterally extending reinforcement mounted cross-wise to said first end slope sheet adjacent to said shear plate; said shear plate of said first end section being connected to said first laterally extending reinforcement; said first end slope sheet of said first end section being connected 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 '515 patent discloses a laterally extending hollow reinforcement beam that is connected to both the slope sheet and the shear plate, as shown below.

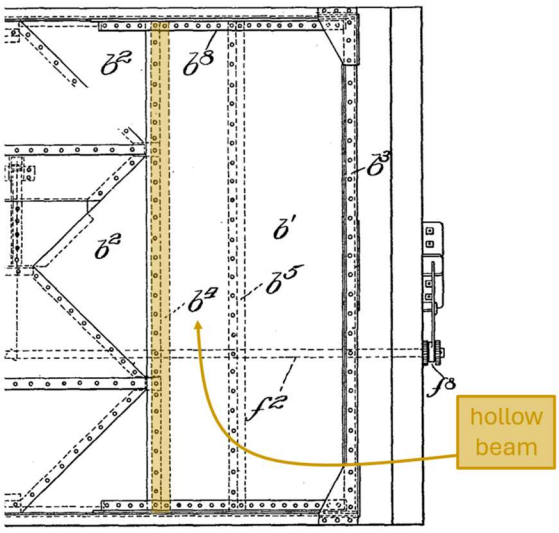


EX1001, Fig. 3a,

Hart also discloses limitation [7f], including the laterally extending, hollow reinforcement beam ("transverse member b^4"), as shown below.



Hart Fig. 1



Hart Fig. 2

EX1008, Figs. 1, 2. Hart explains that the "ends of the car being suitably supported by upper and lower transverse brace members b^3 and b^4, respectively." *Id.* at 2:48–57.

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

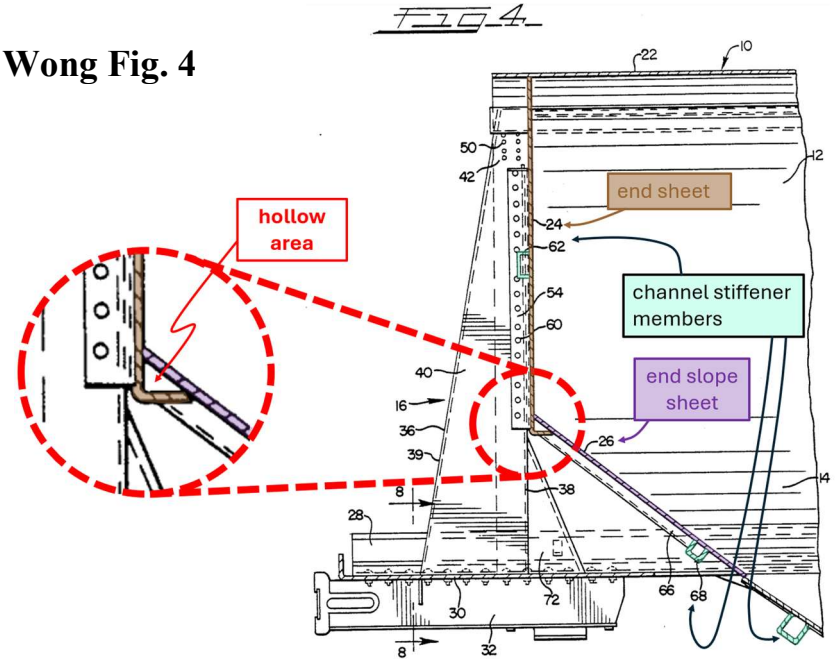
Hart discloses this limitation. As discussed with limitation [1e], Hart's hopper car has no elephant ears between its draft sill and slope sheet, or anywhere else in its machinery space.

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."

As discussed above in connection with limitation [1f], it would have been obvious to modify Hart to add an end wall supported by an end post extending from the draft sill, as in the 1906 Cyclopedia's Cambria Steel car.

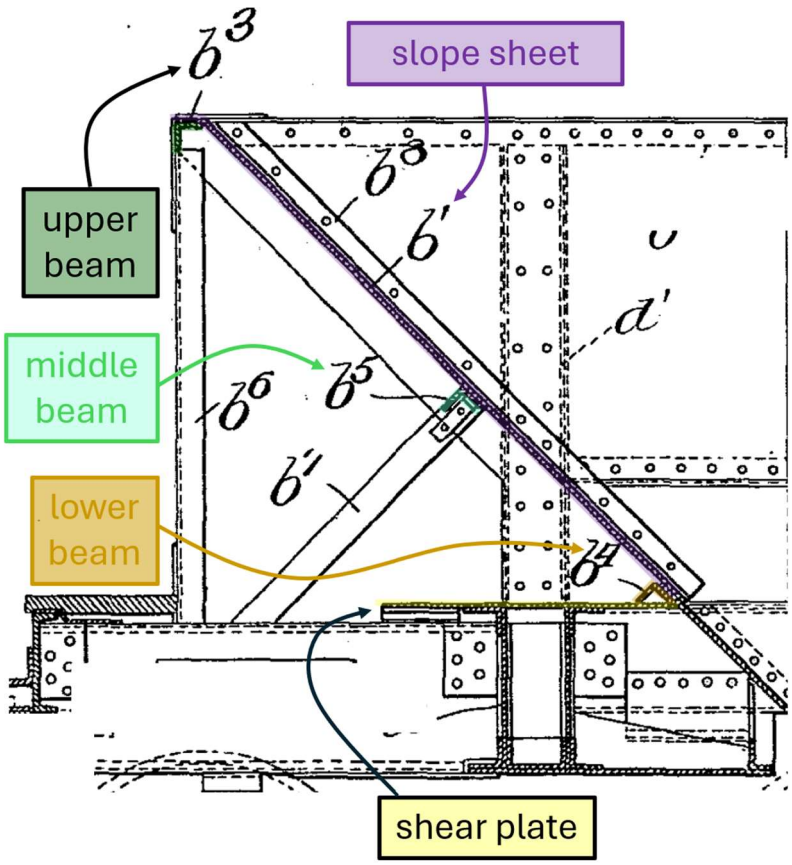
Wong discloses an end wall and a hollow section beam defined by the lower portion of the end wall and the slope sheet, as shown below.

Wong Fig. 4



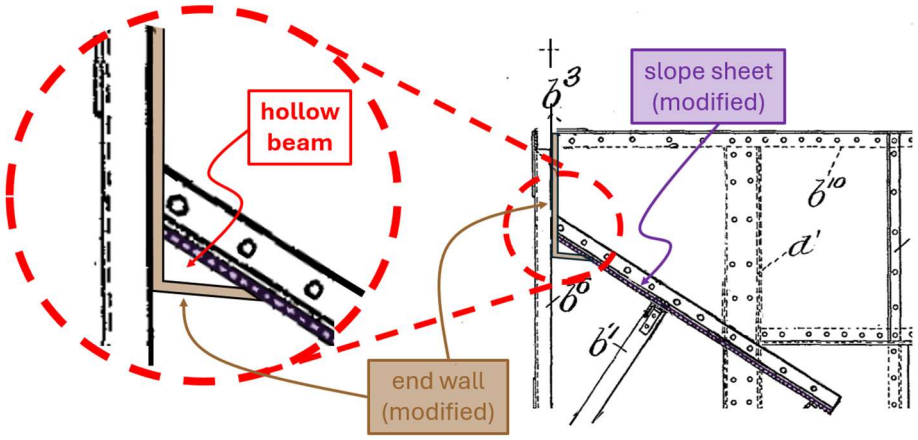
EX1006, Fig. 4.

It would have been obvious to modify Hart to further support the upper, outboard end of the slope sheet with a crosswise, L-shaped beam as in Wong. A POSITA would have been motivated to modify Hart because Wong and Hart are in the same field, and because a POSITA would have understood the benefits of reinforcing the slope sheet at its upper end, where its connection with another structure creates a stress concentration. EX1003, ¶ 108. In addition, Hart discloses a transverse beam b^3 that supports the upper end of the slope sheet, as shown below.



EX1008, Fig. 1. This suggests using a transverse beam like Wong's in the modified Hart design, in which the slope sheet is no longer supported by the upper beam b^3. A POSITA would have had a reasonable expectation of success in making this

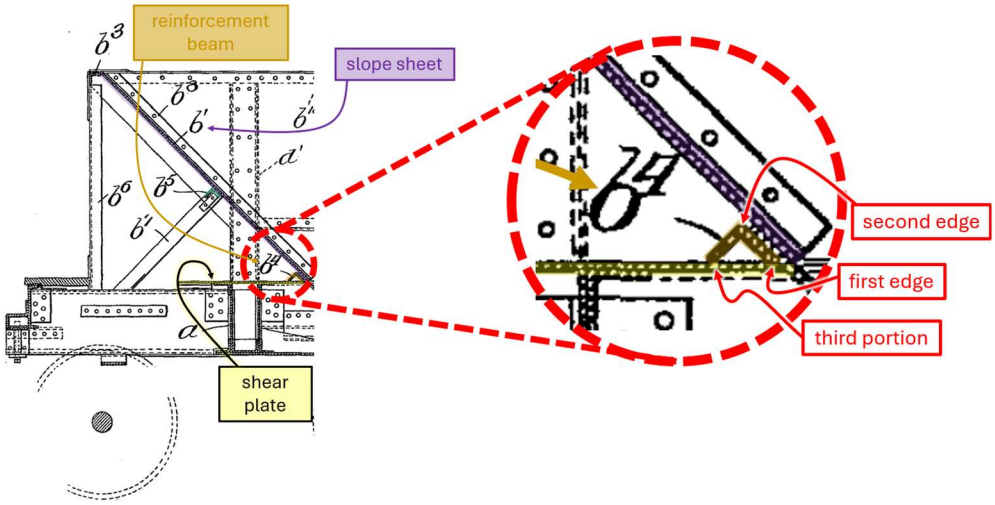
modification because it would be a straightforward addition of a simple structure, as shown below.



EX1008, Fig. 1 (detail) (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."**

Hart discloses the elements of claim 8:

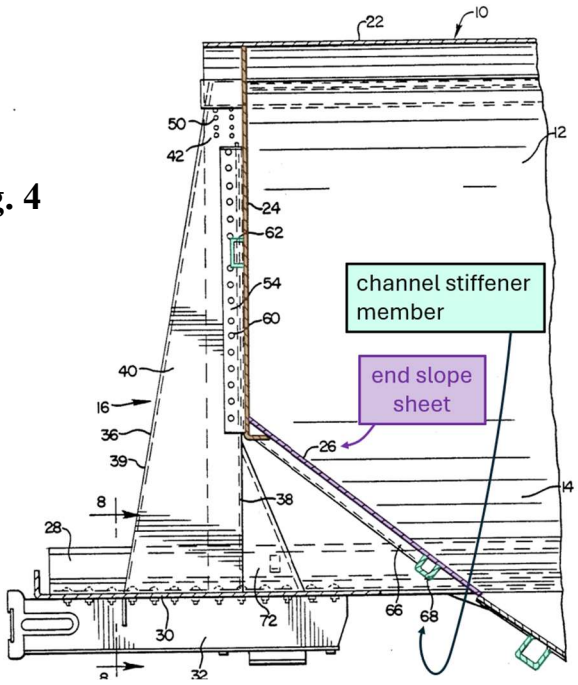


EX1008, Fig. 1 (detail) (modified).

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

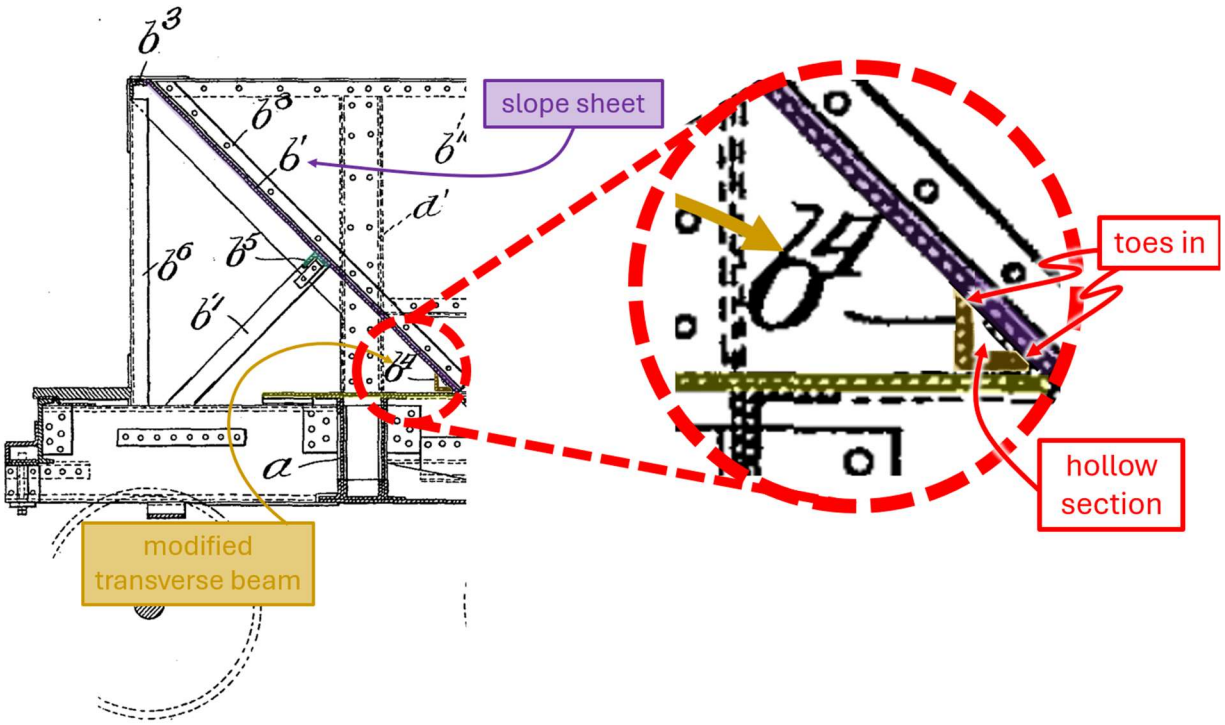
Hart's transverse brace member b^4 is mounted "toes-in" against the shear plate, rather than against the slope sheet. However, Wong discloses a hollow beam ("channel stiffener member 68") mounted "toes-in" along the underside of the slope sheet, as shown below.

Wong Fig. 4



EX1006, Fig. 4. A POSITA would have found it obvious to rotate Hart's lower beam so that its toes were oriented toward the slope sheet instead of the shear plate. EX1003, ¶110. A POSITA would have considered the orientation of the support beam to be a matter of design choice, and would have thought to try the claimed

orientation because there are only a finite—and very limited—number of ways to orient an L-shaped beam such as Hart's lower support beam. *Id.* The POSITA would have had a reasonable expectation of success, because the modification is very simple, as shown below. *Id.*



See EX1008, Fig. 1 (detail) (modified).

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."**

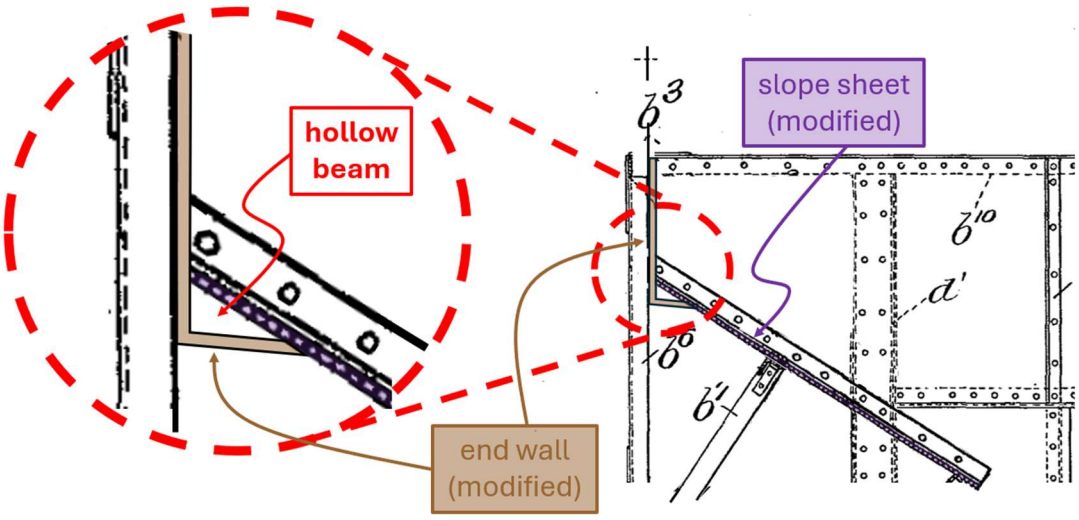
The obvious modification of Hart in view of Wong, discussed in connection with Claim 9, discloses this limitation.

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 written description of the '515 patent 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, ¶111 (quoting Merriam Webster).[2] Applying this definition, or any reasonable definition, Hart's lower support beam satisfies the limitation of Claim 11.

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 Hart in view of Wong, discussed in connection with limitation [7h], discloses this limitation:



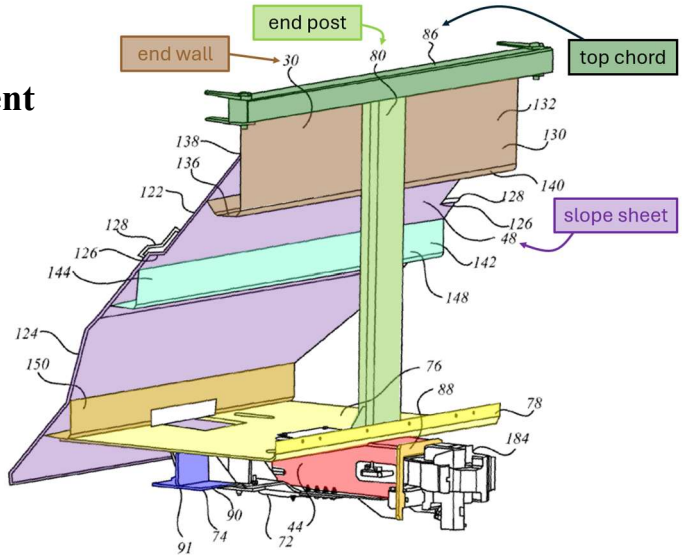
See EX1008, Fig. 1 (detail) (modified).

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

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 '515 patent depicts the elements of Claim 13:

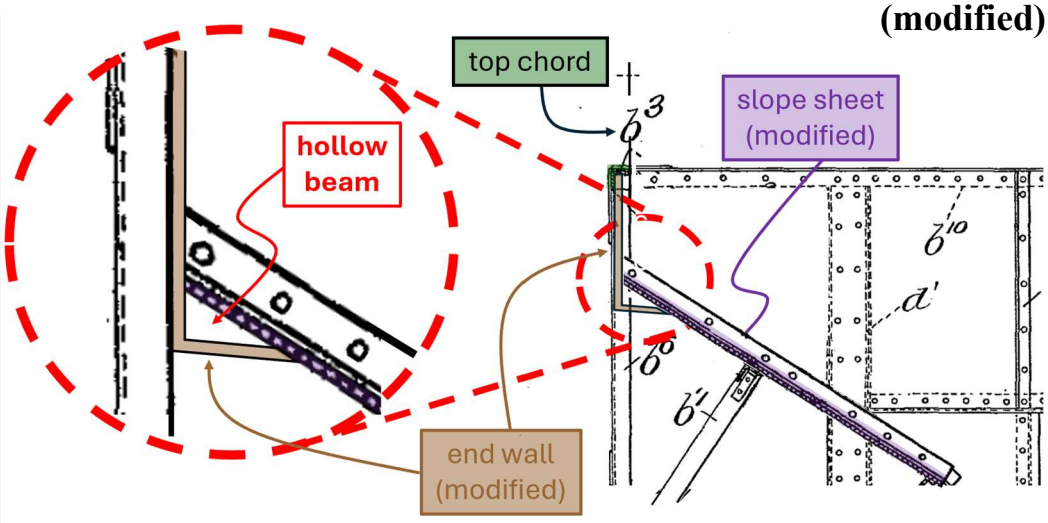
'515 Patent Fig. 3a

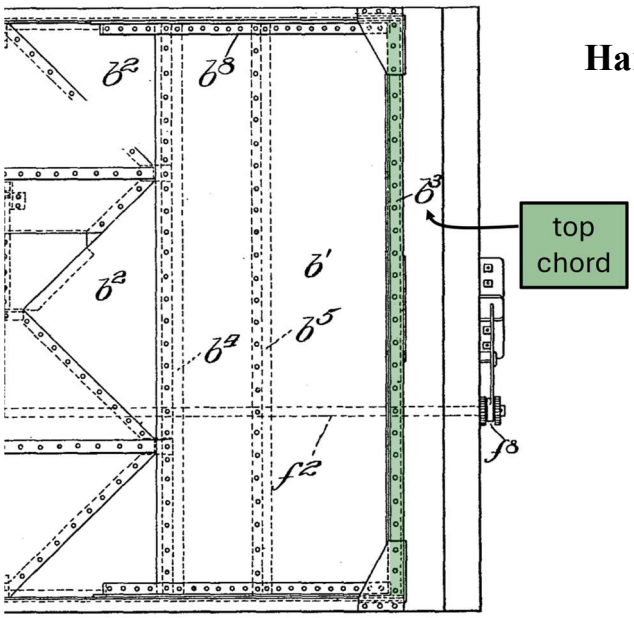


EX1001 at 13:4-14, 14:24-25, Fig. 3a.

Hart, as previously modified by Wong, discloses the elements of Claim 13:

Hart Fig. 1 (modified)



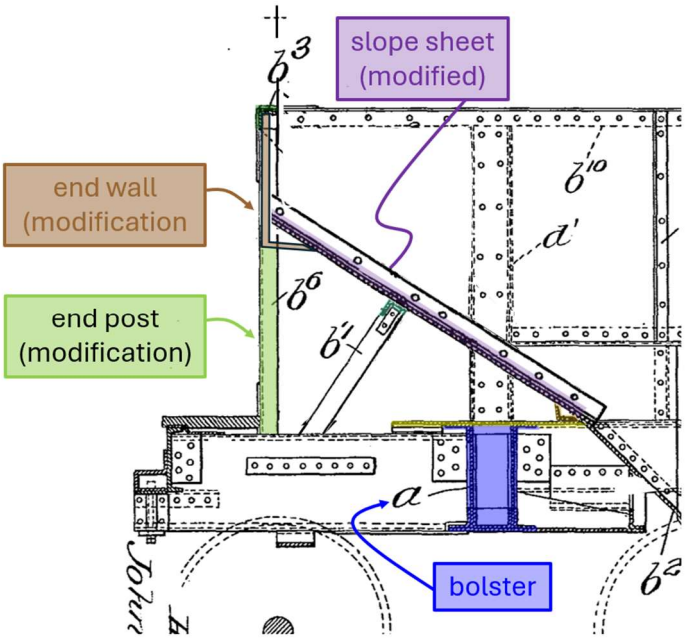


Hart Fig. 2

EX1008, Fig. 1 (detail) (modified), Fig. 2.

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."

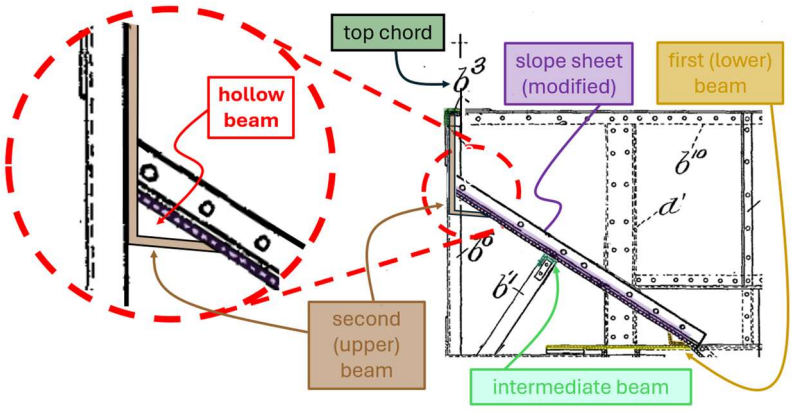
As discussed with limitation [1f], it would have been obvious to modify Hart to add an end wall supported by an end post extending from the draft sill, as in the 1906 Cyclopedia's Cambria Steel car. Because the post would be vertically below the end wall, it would be longitudinally outboard of the main bolster, as shown below.



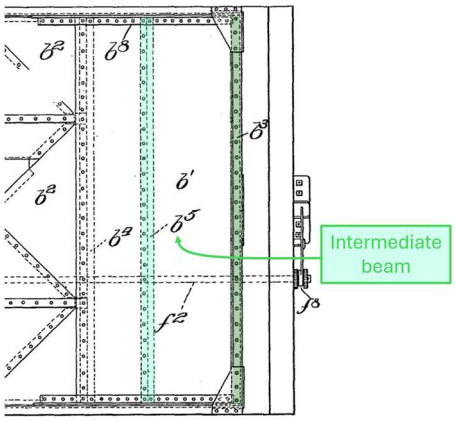
EX1008, Fig. 1 (modified). Thus, modified as described in connection with limitation [1f], Hart discloses Claim 14.

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."**

Hart discloses the claimed intermediate beam: "brace member b^5."



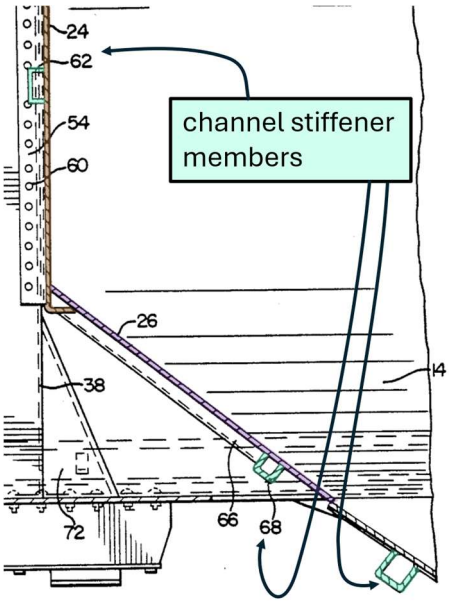
EX1008, Fig. 1 (detail) (modified).



EX1008, Fig. 2.

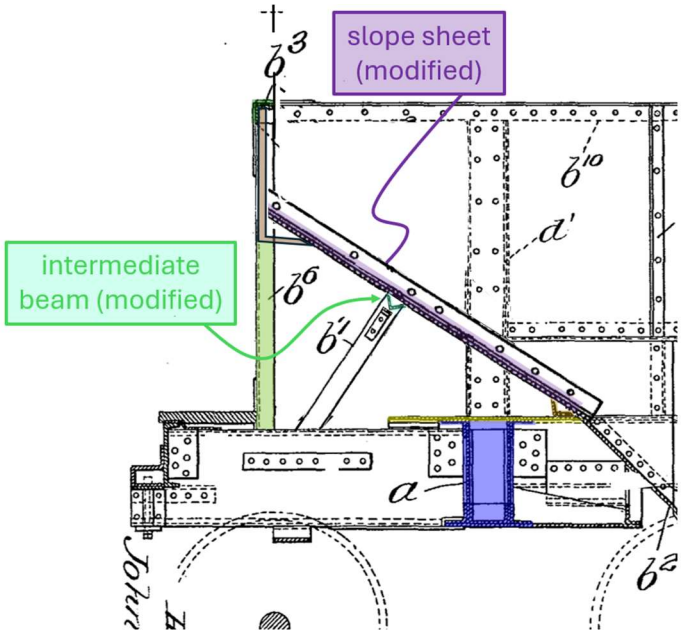
10. <u>Claim 16</u>: "The railroad hopper car of claim 15 wherein said intermediate beam includes a cross-wise extending structural member mounted toes-in against said first end slope sheet to define a closed hollow section."

Wong's "channel stiffener members" are mounted to the slope sheet "toes-in":



EX1006, Fig. 4. It would have been obvious to a POSITA in 2009 to mount Hart's intermediate beam "toes-in," as in Wong, to obtain the greater stability afforded by

a hollow-beam structure, and because there are only a finite number of orientations the beam can have with respect the slope sheet. EX1003, ¶112. A POSITA would have a reasonable expectation of success in making this modification because of its simplicity. *Id.* The modified version of Hart, shown below, would embody Claim 16.



EX1008, Fig. 1 (modified).

11. 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,"

Hart 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;"

Hart 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;"

Hart 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;"

Hart discloses this limitation for the same reason it discloses limitation [7d].

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;"

Hart discloses this limitation for the same reason it discloses limitation [7e].

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;"

Hart discloses this limitation for the same reason it discloses limitation [7f].

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

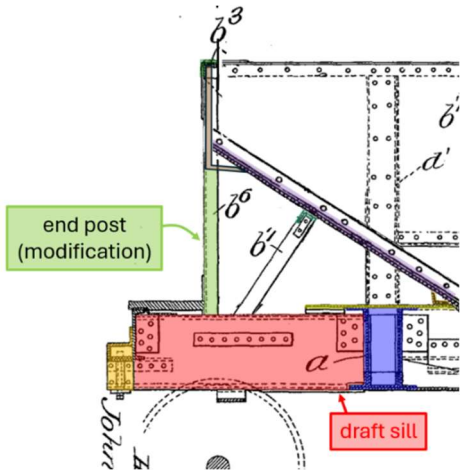
Hart discloses this limitation for the same reason it discloses limitation [7g].

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;"

Hart 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;"

This limitation is like Claim 14 except that the end post must extend from the longitudinally outboard end of the draft sill. In the modification of Hart discussed with limitation 1f, the end post stands at the draft sill's longitudinally outward end, not its longitudinally inward end, as shown below.



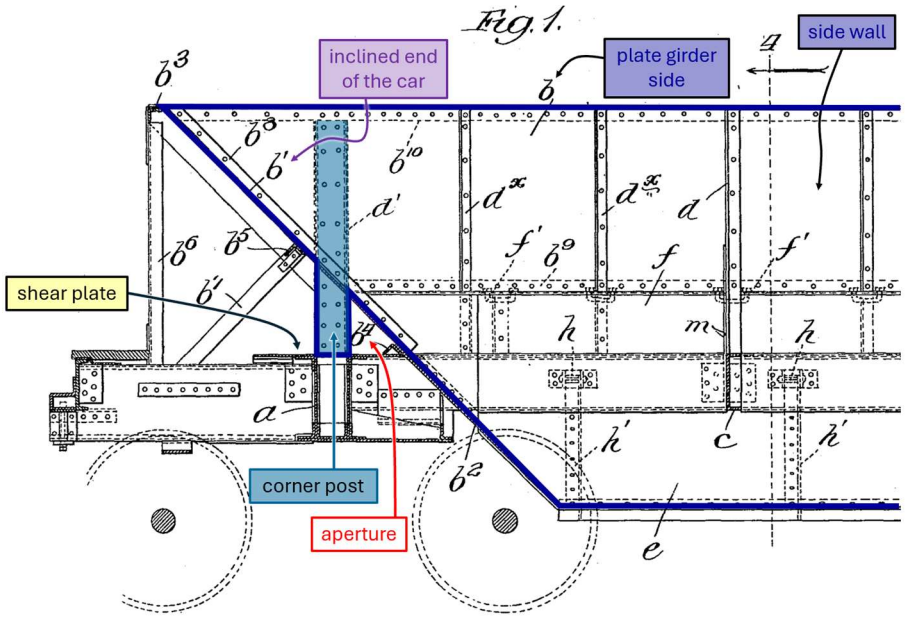
EX1008, Fig. 1 (modified).

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."

Hart discloses this limitation for the same reason it discloses limitation [1i].

12. <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 '515 patent's inclusion of the corner posts in Fig. 2b, "a side view of the sidewall," EX1001 at 10:54, demonstrates that they are part of the hopper car's side wall. Hart's corner posts are therefore also part of his sidewall, and Hart discloses openings (or apertures) in the sidewall in the claimed location:



EX1008, Fig. 1. The image above is the unmodified Fig. 1 from Hart, but none of the modifications discussed in this petition would affect the existence or position of

the claimed aperture. Thus, Hart discloses the limitation of Claim 22, regardless of whether Hart is modified.

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,"

Hart 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;"

Hart 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;"

Hart 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;"

Hart discloses this limitation for the same reason it discloses limitation [7d].

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;"

Hart discloses this limitation for the same reason it discloses limitation [7e].

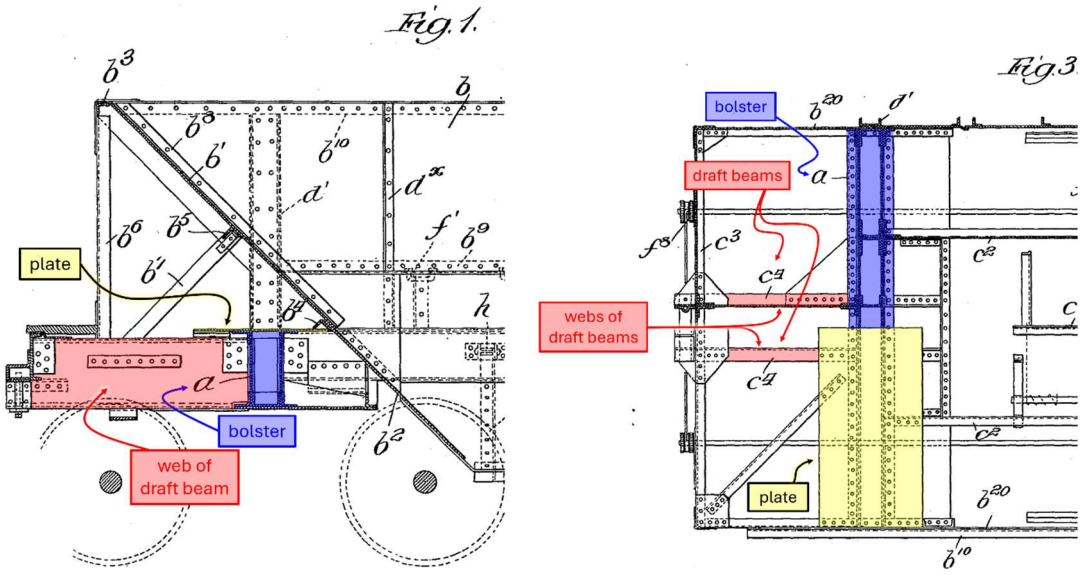
f. [24f] "there being a first end wall extending between said first and second side walls; said first end slope sheet having an uppermost margin, said uppermost margin meeting said first end wall at a first junction; said hopper car having a first beam extending cross-wise between said first and second 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 Hart in view of Wong, discussed in connection with limitation [7h], discloses this limitation.

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

The '515 patent states that "the draft sill has a pair of vertically oriented, longitudinally running spaced apart side webs." EX1001 at 10:16-17.

Hart states that "draft beams *c*[4] are connected to the end sill and to the bolster." EX1008 at 1:101-03. Those beams have vertical webs:



Id., Figs. 1, 3; EX1003 ¶113.

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

Hart discloses this limitation for the same reason it discloses limitation [7g].

i. 24[i] "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."

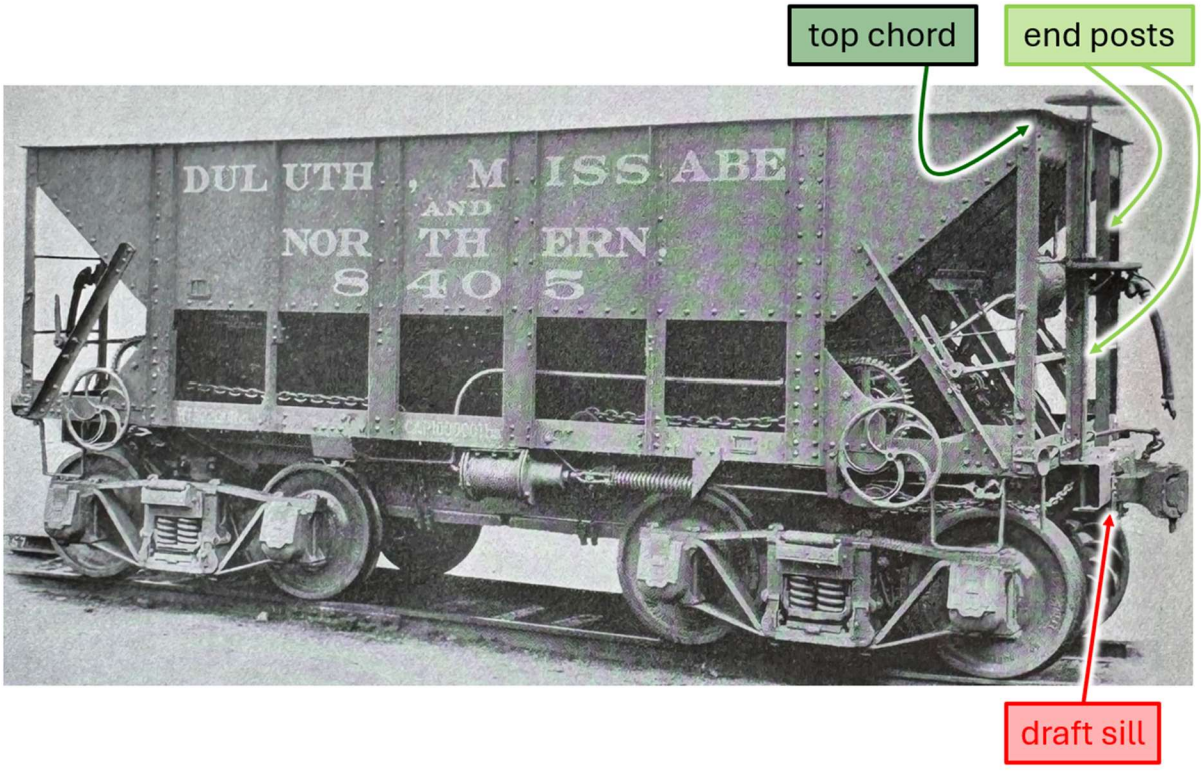
The obvious modification of Hart in view of Wong, discussed in connection with limitation [7h], discloses this limitation.

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."

The obvious modification of Hart in view of Wong, discussed in connection with Claim 14, discloses this limitation.

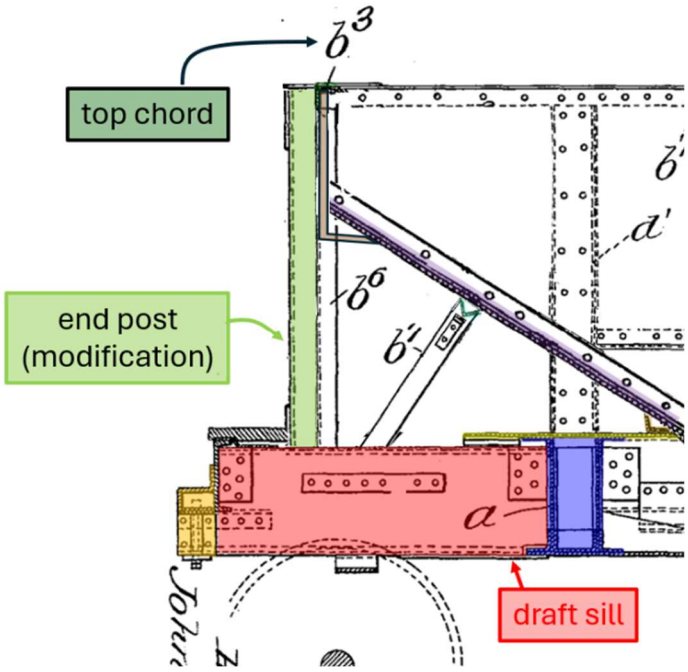
15. **<u>Claim 26</u>: "The railroad hopper car of claim 25 wherein: said upper portion of said first end wall extends upwardly of said first junction to end at a top chord; said top chord extends across said hopper car between said first and second side walls; and said end post extends past said first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

As discussed above with limitation [1f], it would have been obvious to modify Hart to add an end wall supported by an end post extending from the draft sill, as in the 1906 Cyclopedia's Cambria Steel car. The end post of the Cambria Steel does not extend all the way to the top chord of the end wall. EX1009 at 13, Fig. 53. However, as shown below, the 1906 Cyclopedia also shows a hopper car made by the Standard Steel Car Co. that has two end posts extending from the left and right sides of the draft sill. *Id.* at 14, Fig. 55. These end posts extend to the top chord.



EX1009 at 14 (Fig. 55).

A POSITA would have been motivated to extend the end post in the modified Hart design to the top chord because the chord is a secure and logical structure for attaching the upper end of the end post. EX1003, ¶116. In addition, a POSITA would have thought to attach the end post to the top chord because end posts are typically attached either to the top chord or, if the rail car has an end wall, to the lower portion of the end wall. *Id.* Choosing one of these two common options is a simple design choice that would immediately occur to a POSITA. *Id.* Finally, a POSITA would have a reasonable expectation of success in attaching the upper end of the end post to the top chord. *Id.* The modified Hart design, shown below, would embody Claim 19.



EX1008, Fig. 1 (modified).

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

Hart discloses this limitation for the same reason it discloses limitation [1h].

17. **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."**

Hart discloses this limitation for the same reason it discloses limitation [1i].

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

The obvious modification of Hart in view of Wong, discussed in connection with limitation [7h], discloses this limitation.

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

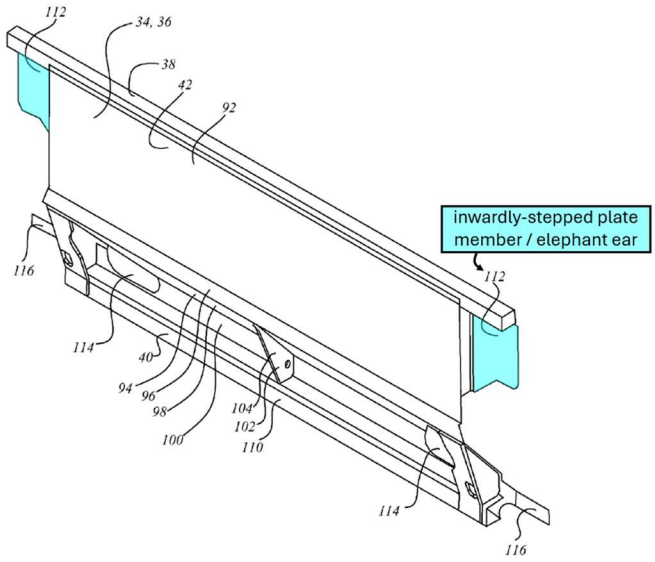
The obvious modification of Hart in view of Wong, discussed in connection with Claim 16, discloses this limitation.

F. Ground 6: Claims 17–19 are obvious over Hart in view of the 1906 Cyclopedia, Wong and Campbell '051

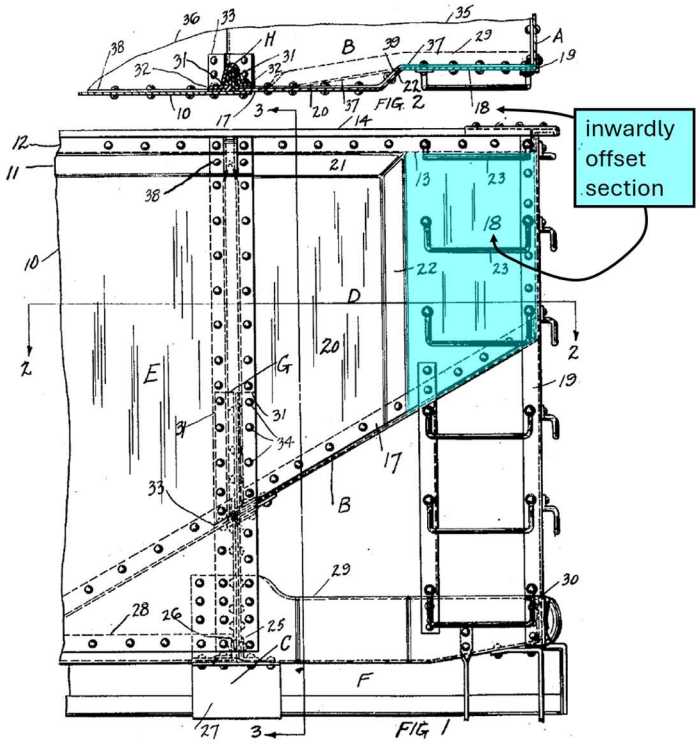
1. **Claim 17: "The railroad hopper car of claim 7 wherein said first and second side walls of said hopper car define sidewalls of said hopper, and said first and second side walls include end portions that are stepped laterally inboard, and said second hollow section**

beam extends between said end portions of said first and second side walls that are stepped laterally inboard."

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



EX1001, Fig. 2a. Campbell disclosed stepped side walls in 1925:



EX1012, Figs. 1, 2. Campbell '051 explains that the stepped design "provide[s] 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 Hart to provide stepped end portions of the side walls to obtain these benefits and would have had a reasonable expectation of success. EX1003, ¶114. With this obvious modification, Hart embodies Claim 16.

2. <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,"

Hart 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;"

Hart 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;"

Hart 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;"

Hart discloses this limitation for the same reason it discloses limitation [7d].

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;"

Hart discloses this limitation for the same reason it discloses limitation [7e].

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;"

Hart discloses this limitation for the same reason it discloses limitation [7f].

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

Hart discloses this limitation for the same reason it discloses limitation [7g].

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;"

The obvious modification of Hart in view of Wong, discussed in connection with limitation 16, discloses this limitation.

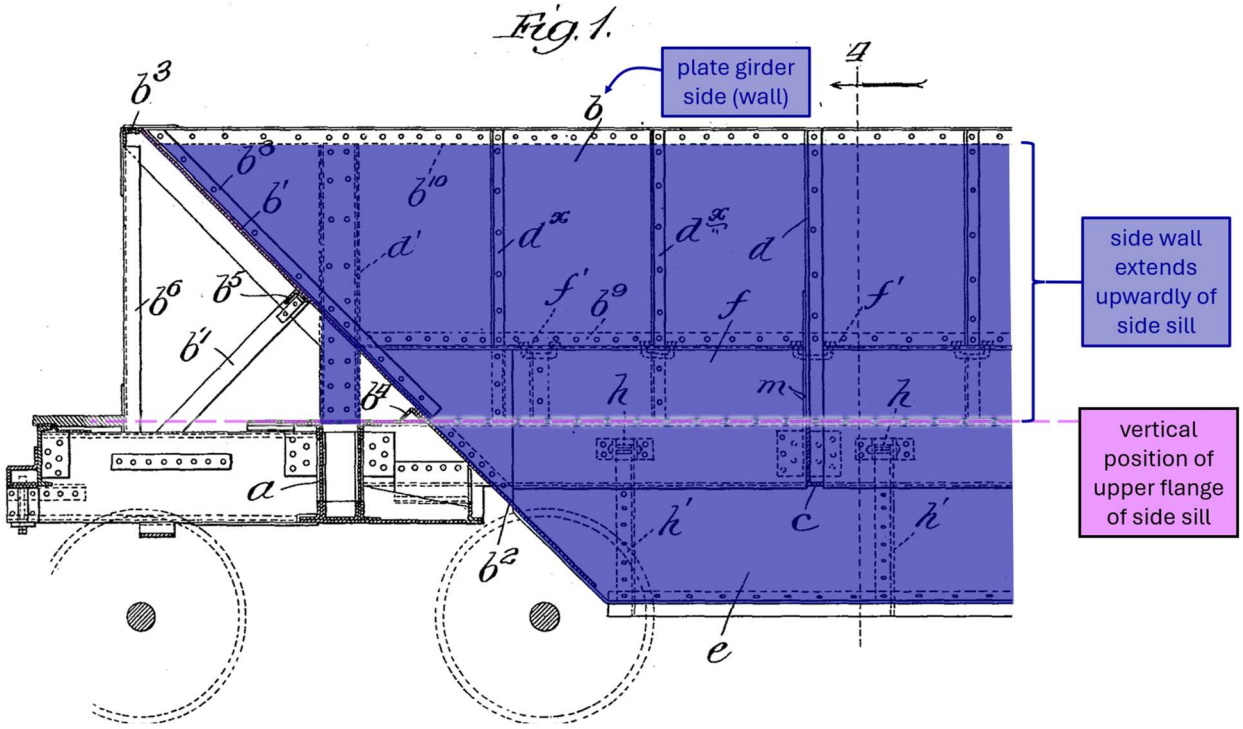
i. **[18i] "said hopper car has an end post mounted over said draft sill, said end post being located longitudinally outboard of said main bolster of said first end section; said end post extends upwardly to meet said second hollow section beam;"**

The obvious modification of Hart in view of Wong, discussed in connection with limitation [1f] and Claim 14, 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 said first and second side sills have upper flanges that mate with said shear plate of said first and section."**

The obvious modification of Hart discussed with limitation [5d] satisfies the second and third clauses of limitation [18j].

Regarding the first clause, in the modified Hart design, the upper flange of the side sill will be substantially coplanar with, and therefore at substantially the same vertical position as, the shear plate and the upper flange of the bolster. Thus, at least a portion of Hart's side wall would extend upwardly of the side sill, as shown below.



See EX1008, Fig. 1.

3. **<u>Claim 19:</u> "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."**

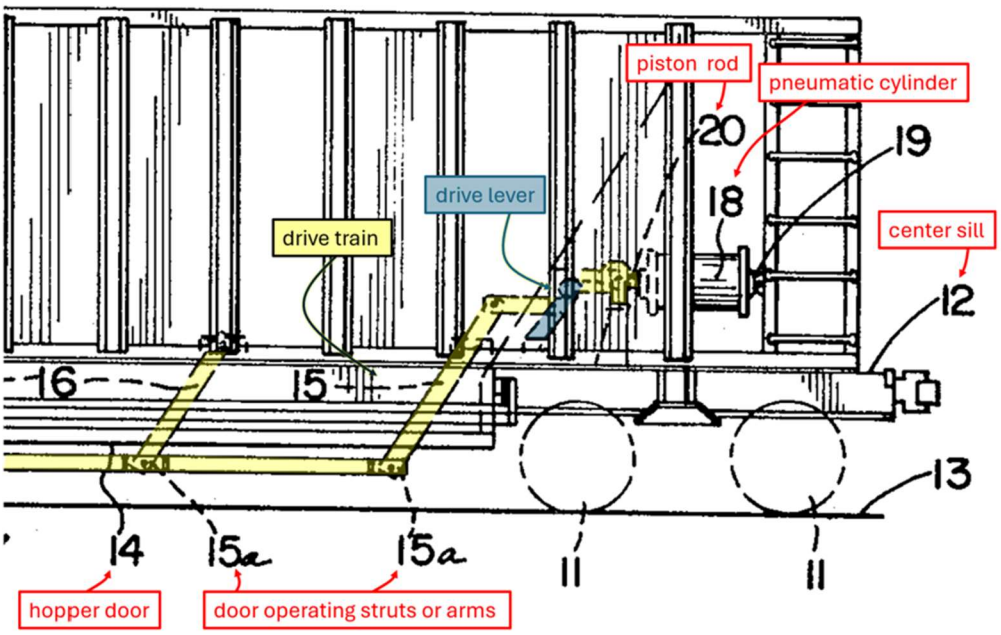
The obvious modification of Hart in view of the 1906 Cyclopedia, discussed in connection with Claim 26, discloses this limitation.

G. Ground 7: Claims 21–22 and 29 are obvious over Hart in view of the 1906 Cyclopedia, Wong and Schuller.

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

As discussed with Claim 3, it would have been obvious in 2009 to replace Hart's doors and door-opening mechanism with Schuller's doors and a door-opening mechanism. That obvious modification of Hart embodies most of Claim 21.

Claim 21 also requires (i) a drive train that connects the actuator and the hopper doors, and (ii) that the actuator be "mounted in," rather than "at least partially lodged in," the machinery space. Schuller discloses both claim elements, as shown below.



Schuller Fig. 1

EX1014, Fig. 1. A POSITA would understand Schuller's pneumatic actuator, used with Hart's design, would need to be mounted in Hart's machinery space. EX1003 at 117. Thus, the obvious modification of Hart in view of Schuller embodies Claim 21.

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

Hart discloses this limitation for the same reason it discloses the limitation of Claim 23.

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

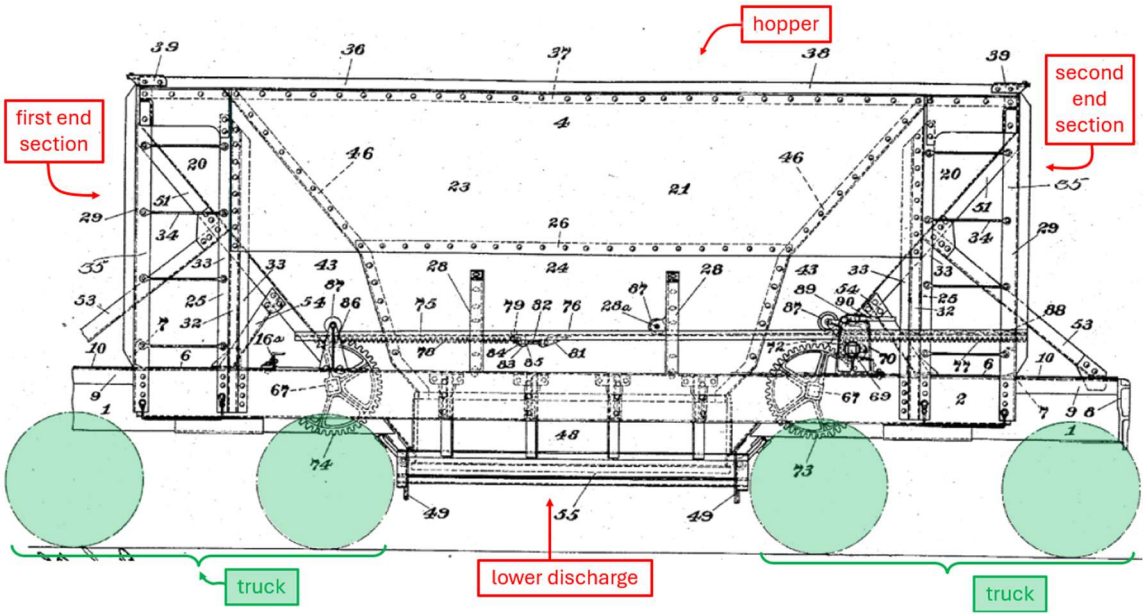
This is very similar to Claim 22, which requires an aperture, and Claim 21, which recites a moveable door and an actuator. Hart discloses this limitation for the same reason it discloses the limitation Claim 22.

H. Ground 8: Claims 32–34 are obvious over Lindström in view of Wong, Ratcliffe 1 and Hart.

1. Independent Claim 32

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,"

U.S. Patent No. 1,321,928 was granted to Lindström on Nov. 18, 1919. EX1005 ("Lindström"). Lindström discloses a "dump car," a railroad hopper car that discharges lading through "discharge doors 48." *Id.* at 3:123-25 ("referring to "track rails"), 4:64 ("discharge doors 48"), 2:56-59 (the car permits "the free discharge of the lading through the single central unobstructed discharge opening 22"). Lindström discloses limitation [32a], as shown below.

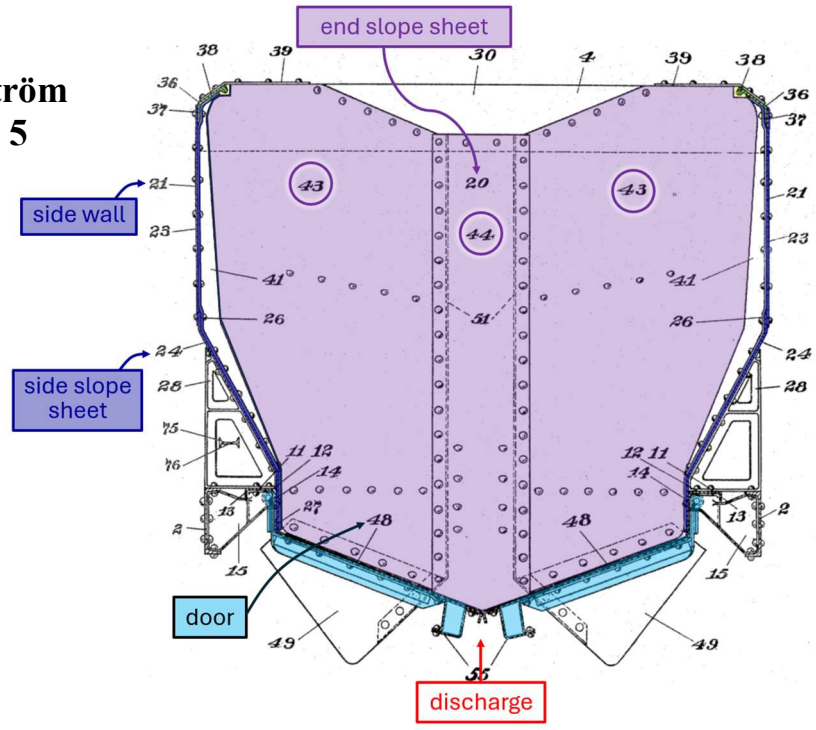


Id., Fig. 2.

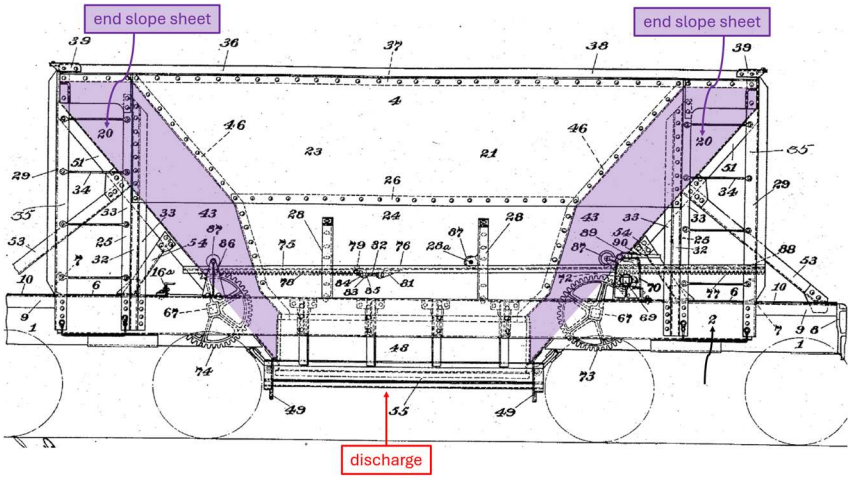
b. [32b] "said hopper having a discharge section through which to release lading, and a first end slope sheet oriented toward said first end section, said first end slope sheet being inclined in the longitudinal direction to feed said discharge section;"

Lindström's slope sheet, which he calls "sloping end floor 20," comprises a center portion 44 and two side portions 43. *Id*. at 2:52, 3:74-77.

Lindström Fig. 5



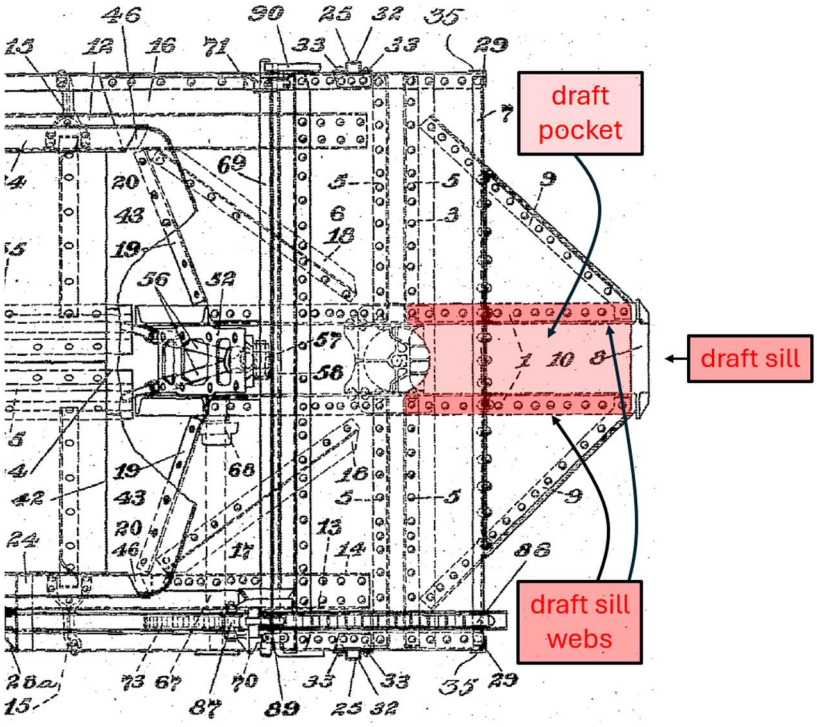
Lindström Fig. 2



Id., Figs. 2, 5.

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;"

Lindström discloses limitation [32c], as shown below.

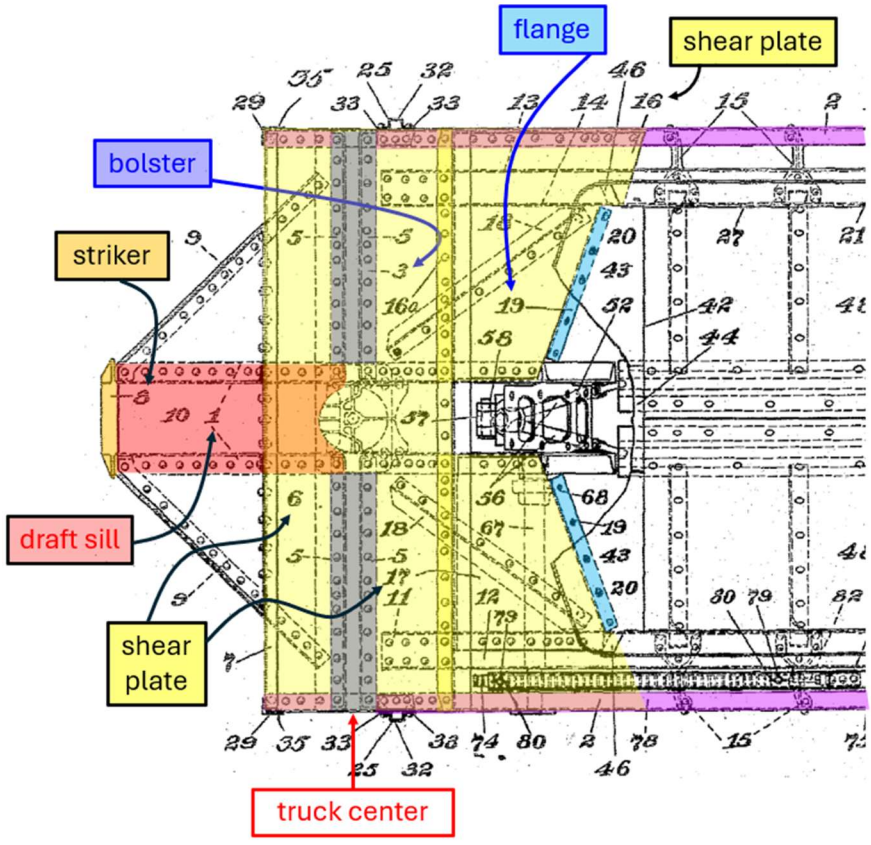


Id., Fig. 3.

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;"

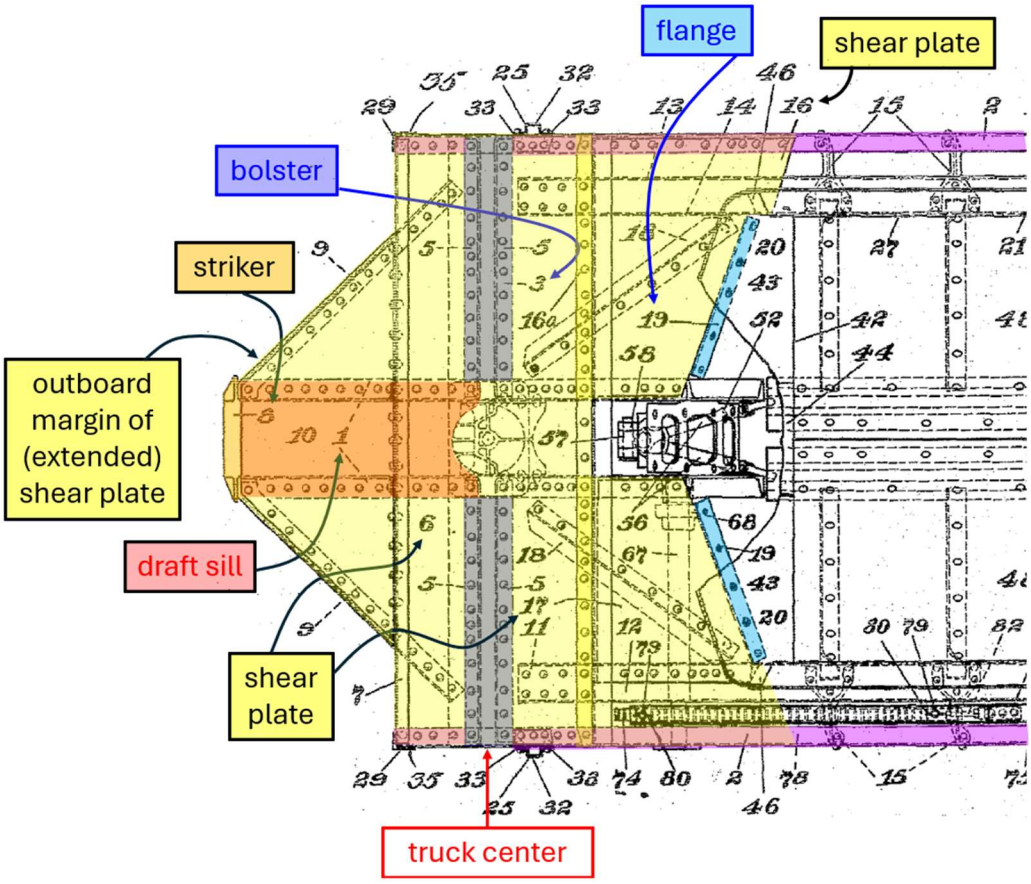
The ’515 patent discloses shear plate 76, which it describes as “defining the top cover plate” of the draft sill, extending “laterally from side sill to side sill,” and extending longitudinally from the slope sheet to end sill 78. EX1001 at 14:12-18.

The corresponding structure in Lindström comprises three plates that together are Lindström’s shear plate: plate 6, plate 16 and plate 17. EX1003, ¶121. The inboard ends of plates 16 and 17 have downwardly angled flanges 19 riveted to the underside of the slope sheet, specifically, to the sloping end plates of the slope sheet. *Id.*; EX1005 at 2:36-39, 4:29-33. Lindström discloses the bolster, draft sill, and shear plate recited in the first five clauses of limitation [32d].



EX1005, Fig. 3.

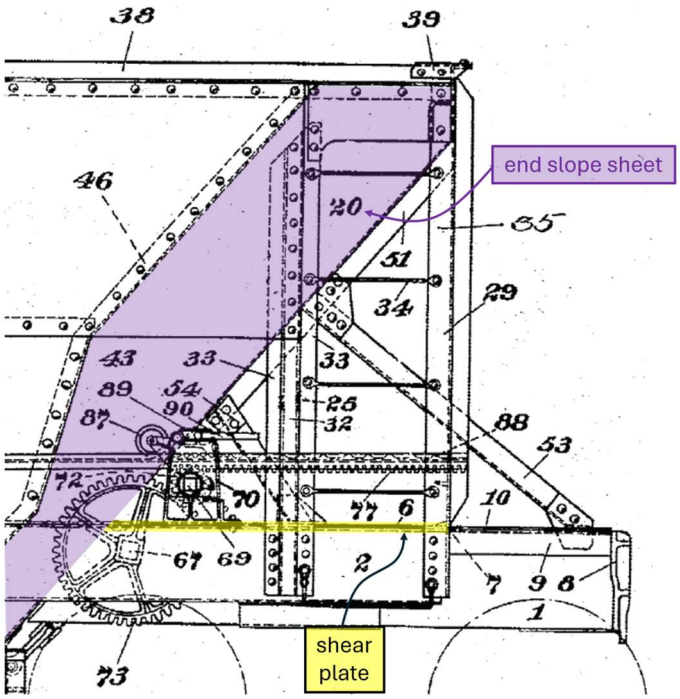
The final clause of limitation [32d] requires the outboard margin of the shear plate to be proximate the striker and distant from truck center. Lindström teaches that plate 10 optionally may be formed as part of plate 6, which is part of the shear plate. EX1005 at 2:4-8 ("These [draft] sills 1, 1 are further strengthened and braced by a member 10 which is preferably in the form of a flat plate. This member 10 may be a continuation or part of the horizontal plate 6."). In this embodiment of Lindstrom, shown below, the shear plate's outer margin is proximate the striker 8 and distant from truck center.



Id., Fig. 3.

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

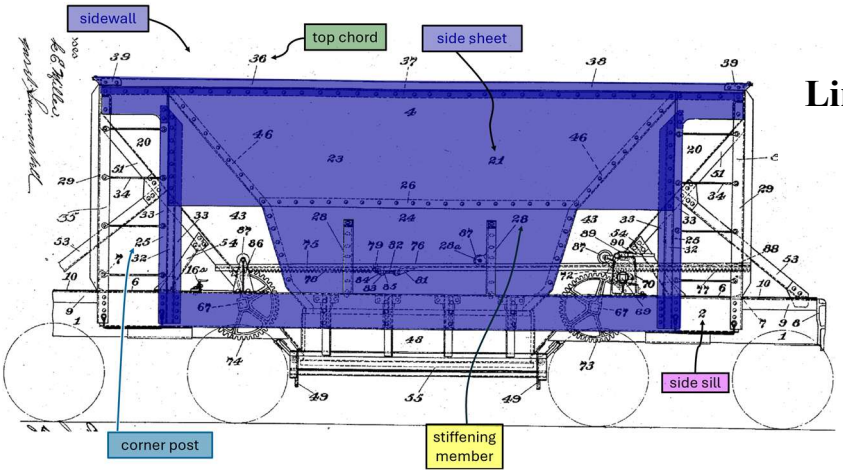
Lindström discloses limitation [32e]:



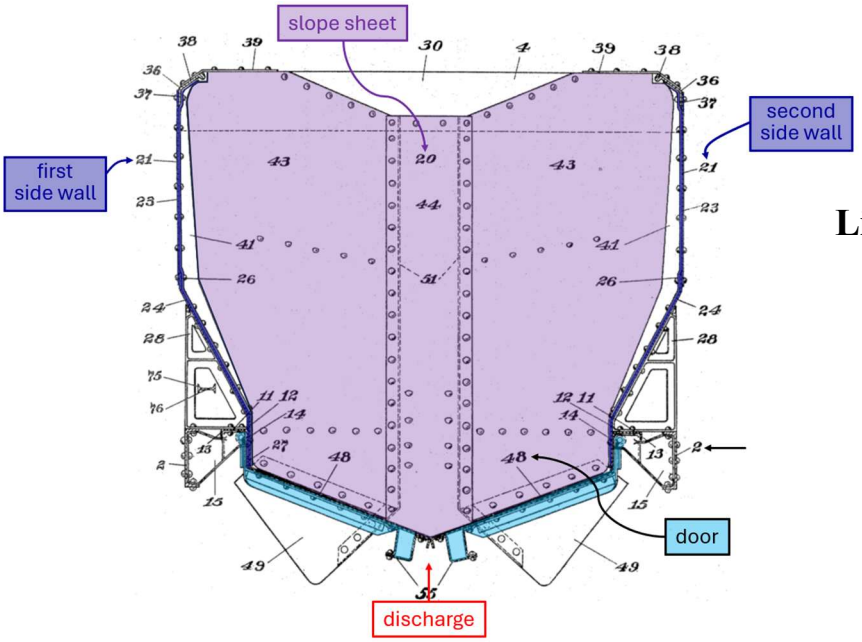
Id., Fig. 2.

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;"

Lindström discloses limitation [32f]:



Lindström Fig. 2

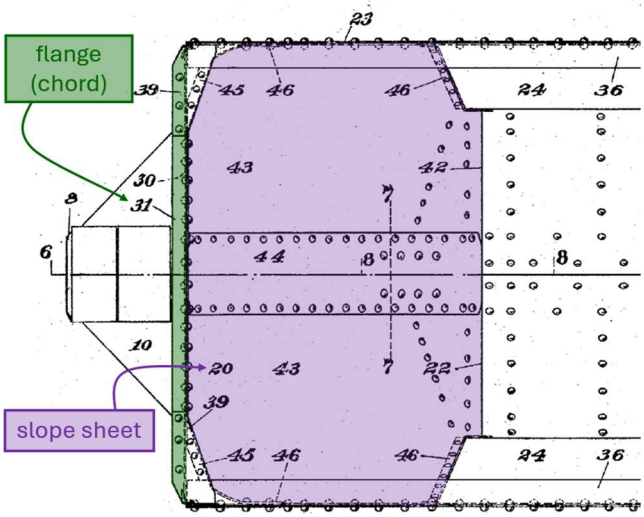


Lindström Fig. 5

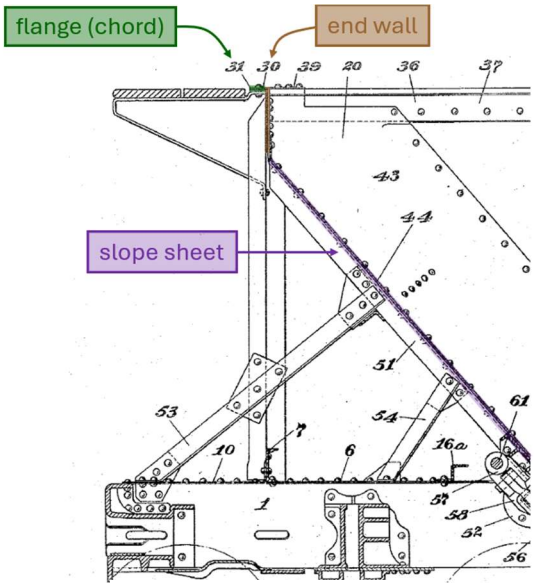
Id., Figs. 2, 5.

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;"

Lindström discloses the claimed end wall:



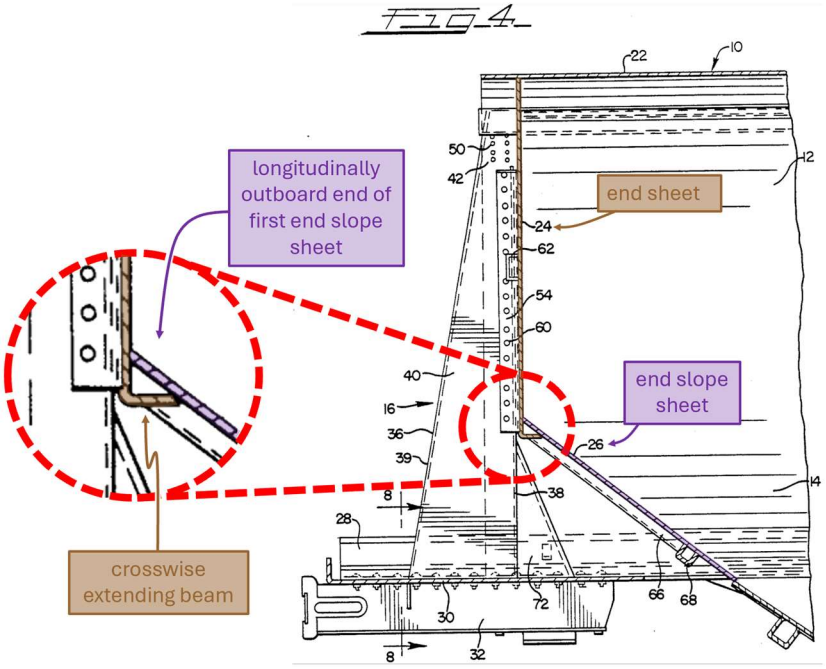
Lindström Fig. 1



Lindström Fig. 6

Id., Figs. 1, 6.

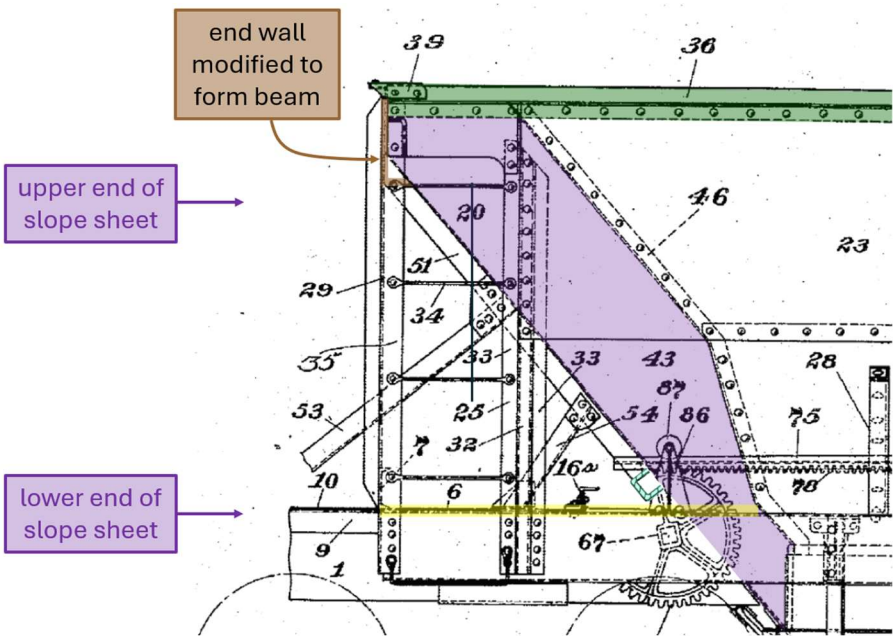
Wong discloses an "end slope sheet" 26 whose upper, longitudinally outboard margin is reinforced by a crosswise, hollow beam:



EX1006, Fig. 4.

It would have been obvious to modify Lindström's design to support the upper margin of the slope sheet with a crosswise, hollow beam as in Wong. A POSITA would have been motivated to make the modification because Wong and Lindström are in the same field, and because a POSITA would have understood the benefits of further reinforcing the slope sheet at its upper end, where its connection with another structure creates a stress concentration. EX1003, ¶127.

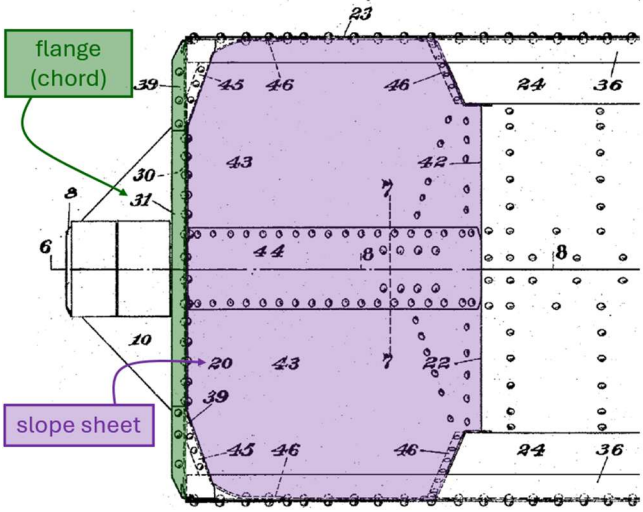
A POSITA would have had a reasonable expectation of success in making this modification because it is a straightforward modification of Lindström's existing end wall 30. EX1003, ¶128; EX1001 at 2:123-27 (plate 30 "forms an end wall of the car body"). Specifically, Lindström's end wall would be slightly lengthened and bent inward at its lower end, as shown below. EX1003, ¶128.



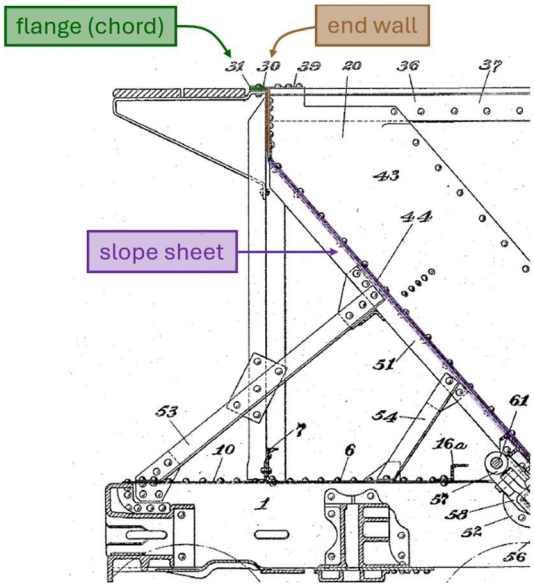
EX1005, Fig. 2 (modified). So modified, Lindström would disclose limitation [32g].

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;"

Lindström discloses this limitation:



Lindström Fig. 1



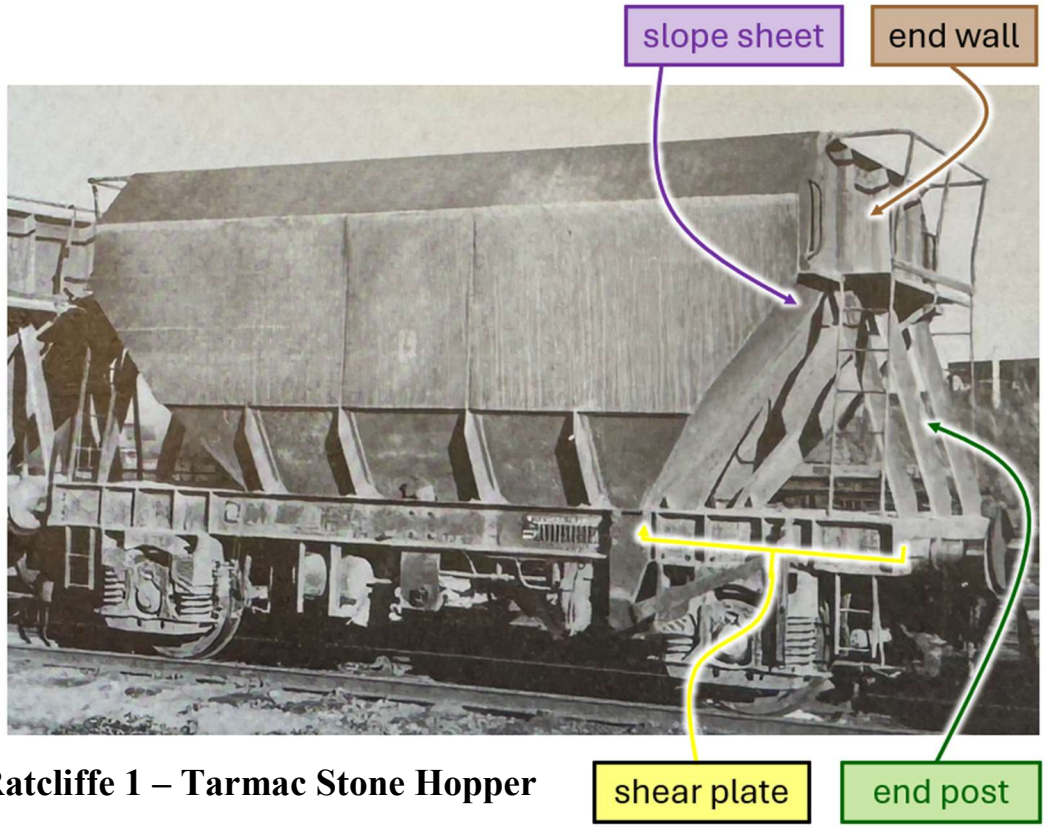
Lindström Fig. 6

Id., Figs. 1, 6.

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;"

Ratcliffe 1 discloses a British hopper car owned by Tarmac Roadstone which, according to Radcliffe, was manufactured by the Standard Wagon Company in 1974. EX1017 at 55. As shown below, the Tarmac Roadstone car discloses three end posts extending from the laterally outboard margin of the shear plate to the lower margin

of the end wall. *Id.* Because the central post is located at the lateral center of the shear plate (and the rail car), the post is positioned above the draft sill. EX1003, ¶130.

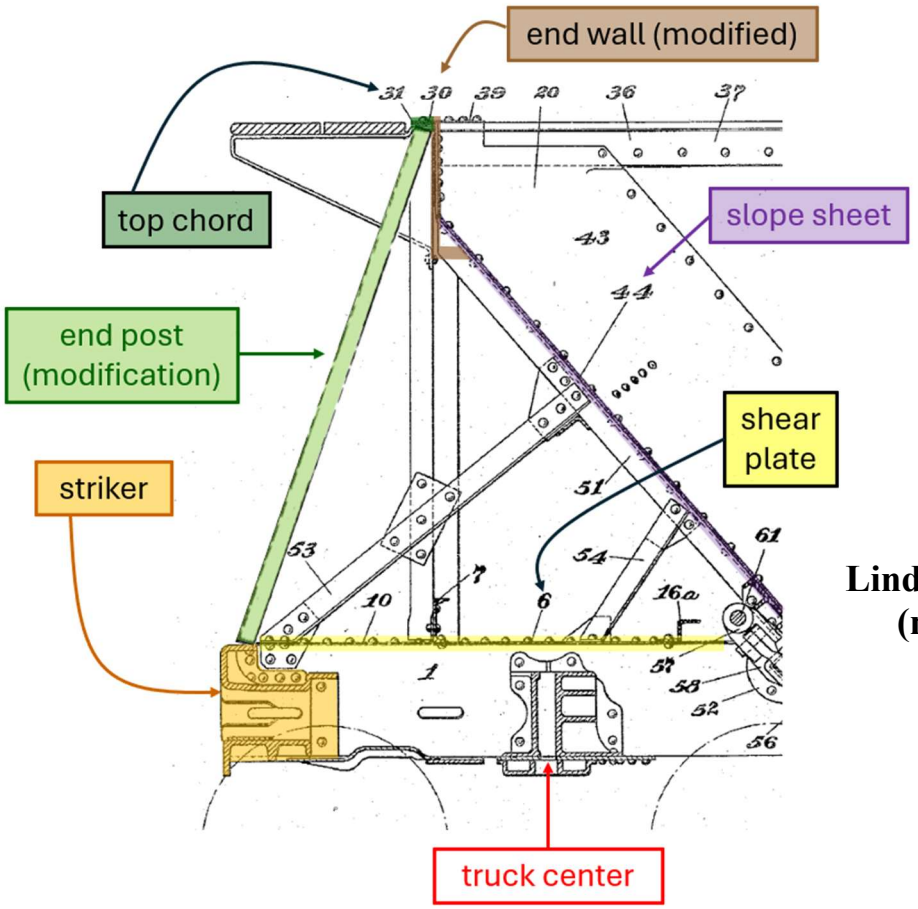


Ratcliffe 1 – Tarmac Stone Hopper

EX1017 at 55.

It would have been obvious to modify Lindström to incorporate an end post like the central end post in Ratcliffe 1 (either alone or with an end post on each side) to support the longitudinal end of the rail car, e.g., because the end wall creates extra loads at the end of the car, compared to designs where the slope sheet extends to the end top chord. EX1003, ¶131. A POSITA would have been motivated to place the base of the end post as close as possible to the outboard margin of the draft sill, as

in Ratcliffe 1, to maximize the usable space of the shear-plate platform. *Id.* In that position, the end post would be proximate Lindström's striker and distant from Lindström's truck center, as shown below.



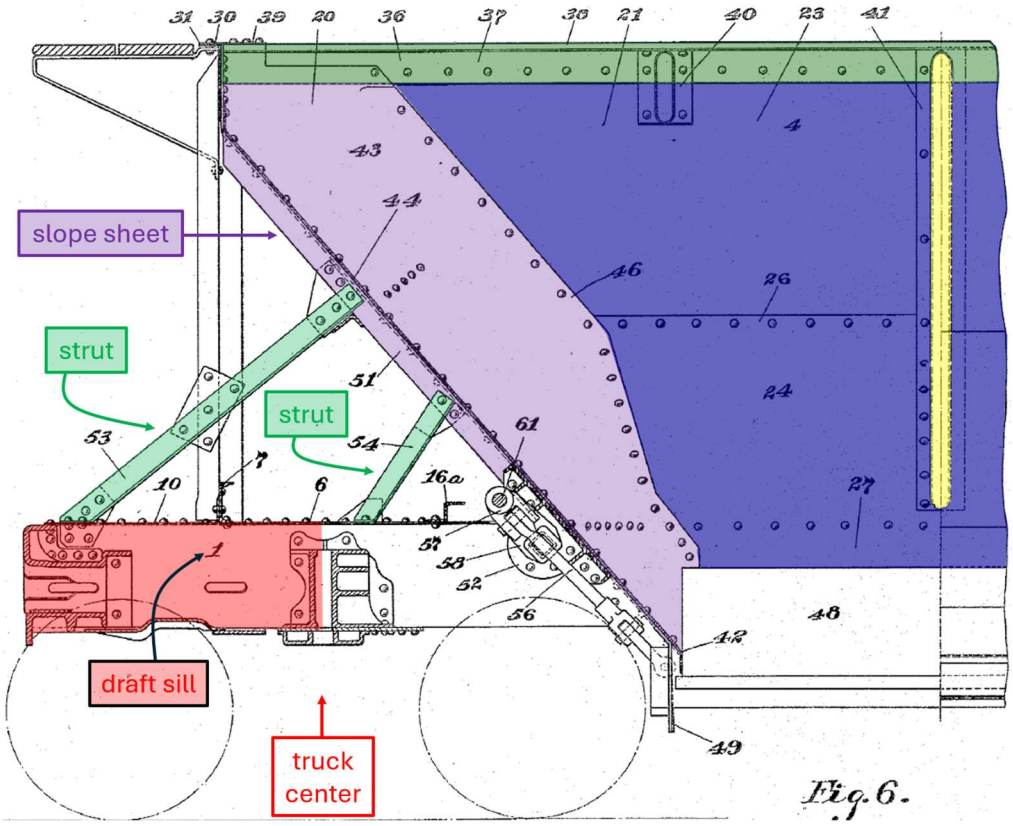
Lindström Fig. 6 (modified)

EX1005, Fig. 6 (modified). So modified, Lindstrom would embody limitation [32h].

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;"

As discussed above, the '515 patent defines elephant ears as "large, substantially triangular planar plates." *See supra*, at § IV.A.1.e. As shown below,

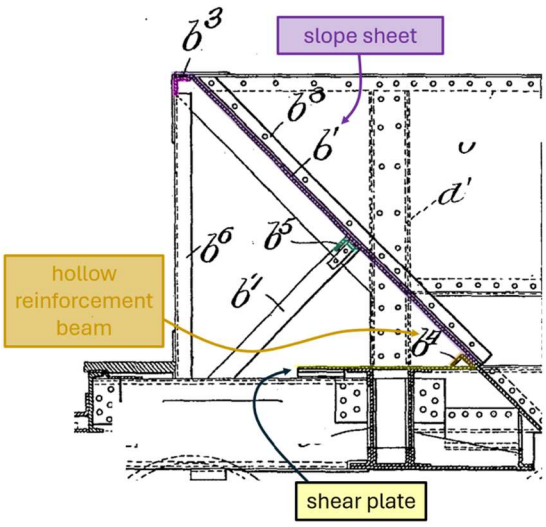
neither of Lindström's slope sheets is supported by larger strut 53 and a smaller strut 54—not by elephant ears. EX1003, ¶132; EX1005 at 4:34-42.



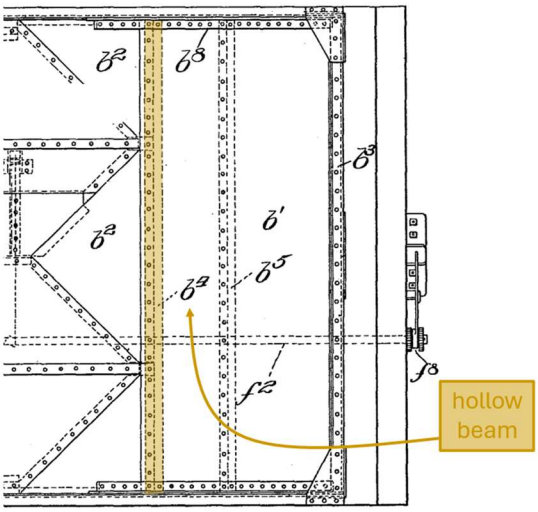
EX1005, Fig. 6. In addition, the smaller strut does not extend between the draft sill and the slope sheet. *Id.* Thus, Lindström discloses limitation [32j].

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."

Hart discloses a crosswise, hollow reinforcement beam ("transverse member b^4"):



Hart Fig. 1



Hart Fig. 2

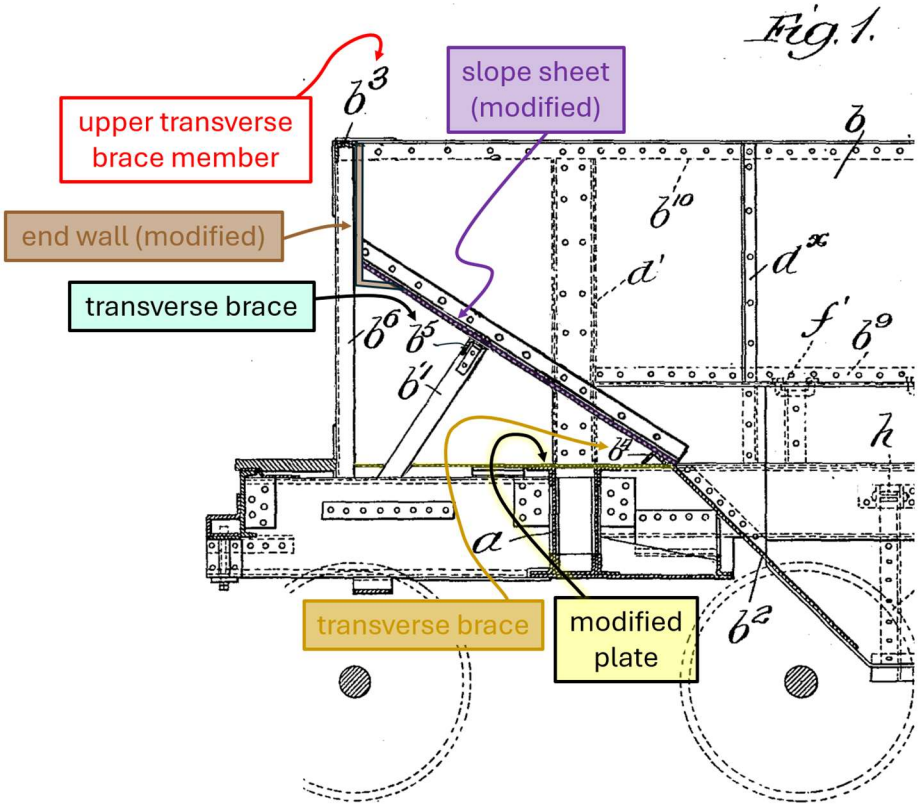
EX1008, Figs. 1-2. It would have been obvious to modify Lindström's design to further support the lower end of the slope sheet with a cross-wise, hollow beam as in Hart. The beam could be formed of two parts and placed just longitudinally outboard of the flanges 19 that connect the slope sheet and the shear plate. EX1003, ¶133. A POSITA would have been motivated to make the modification to further reinforce the slope sheet at its lower end, where its connection with another structure creates a stress concentration. *Id.*

A POSITA would have had a reasonable expectation of success in making this modification because it is a straightforward addition of a simple structure. *Id.*

2. <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."

Wong and Hart disclose a third crosswise beam intermediate the lower and upper beams. *See supra*, at §§ IV.E.9 (Hart), IV.E.10 (Wong). It would have been

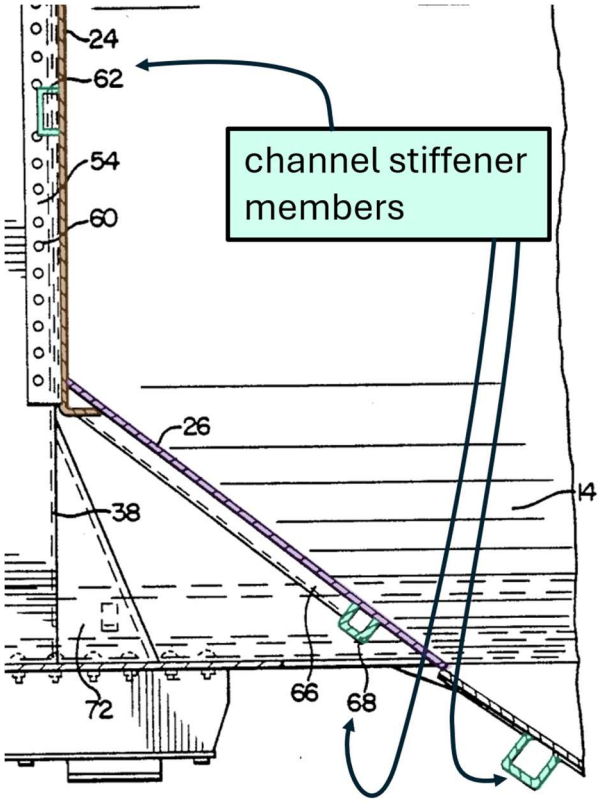
obvious to a POSITA to use either of these beams to further support the slope sheet. EX1003, ¶134.



See EX1006, Fig. 1.

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

As discussed with Claim 33, it would have been obvious to use Wong's intermediate beam in Lindström's design. As shown below, Wong's intermediate and lower beams—called "channel stiffener members"—are U-shaped, hollow beams welded "toes-in" to the underside of the slope sheet. Thus, as modified to include Wong's intermediate beam, Lindström would embody Claim 34.



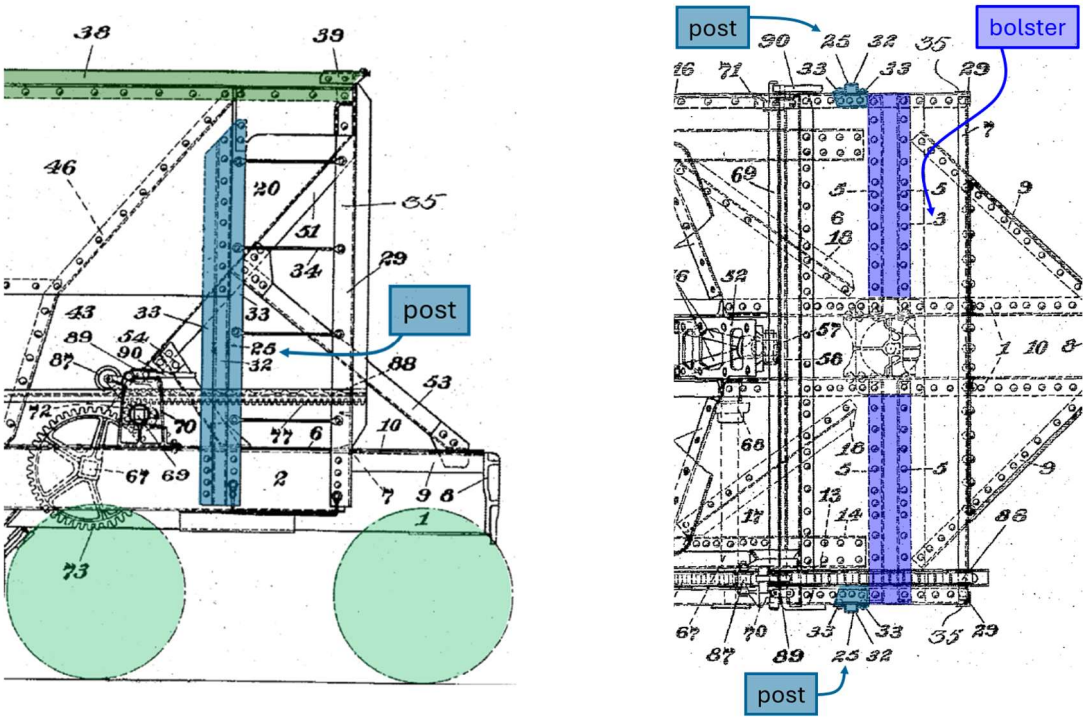
EX1006, Fig. 4.

I. Ground 9: Claims 35–44 are obvious over Lindström in view of Wong, Ratcliffe 1, Hart and the 1946 Cyclopedia.

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

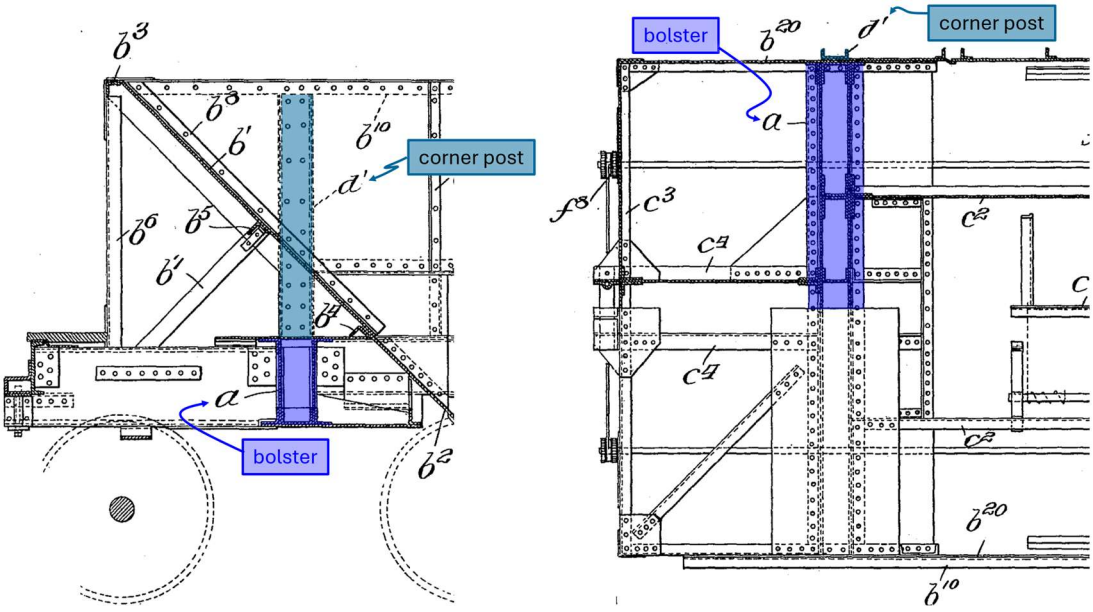
The '515 patent discloses "corner posts" 82 and 84 that each extend up from the junction of a bolster and a side sill. EX1001 at 14:26–31.

Lindström's posts 25 are positioned immediately adjacent the bolster ends:



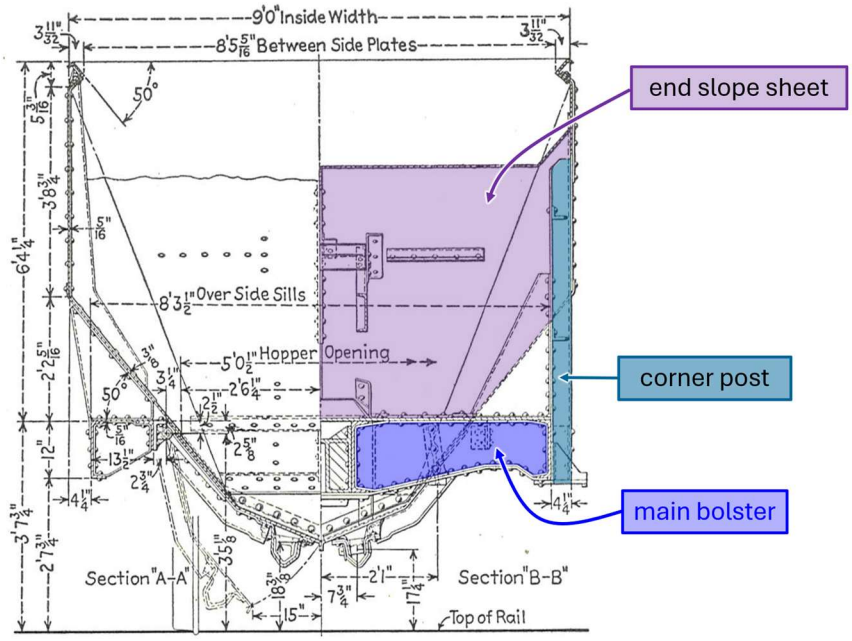
Id., Figs. 2–3.

Hart's "supporting post *d'*," shown below, extends from the end of the bolster to the end slope sheet *b'*.



See EX1008, Figs. 1, 3.

The 1946 Cyclopedia's NSC ore car has corner posts extending from the end of the bolster to the slope sheet:



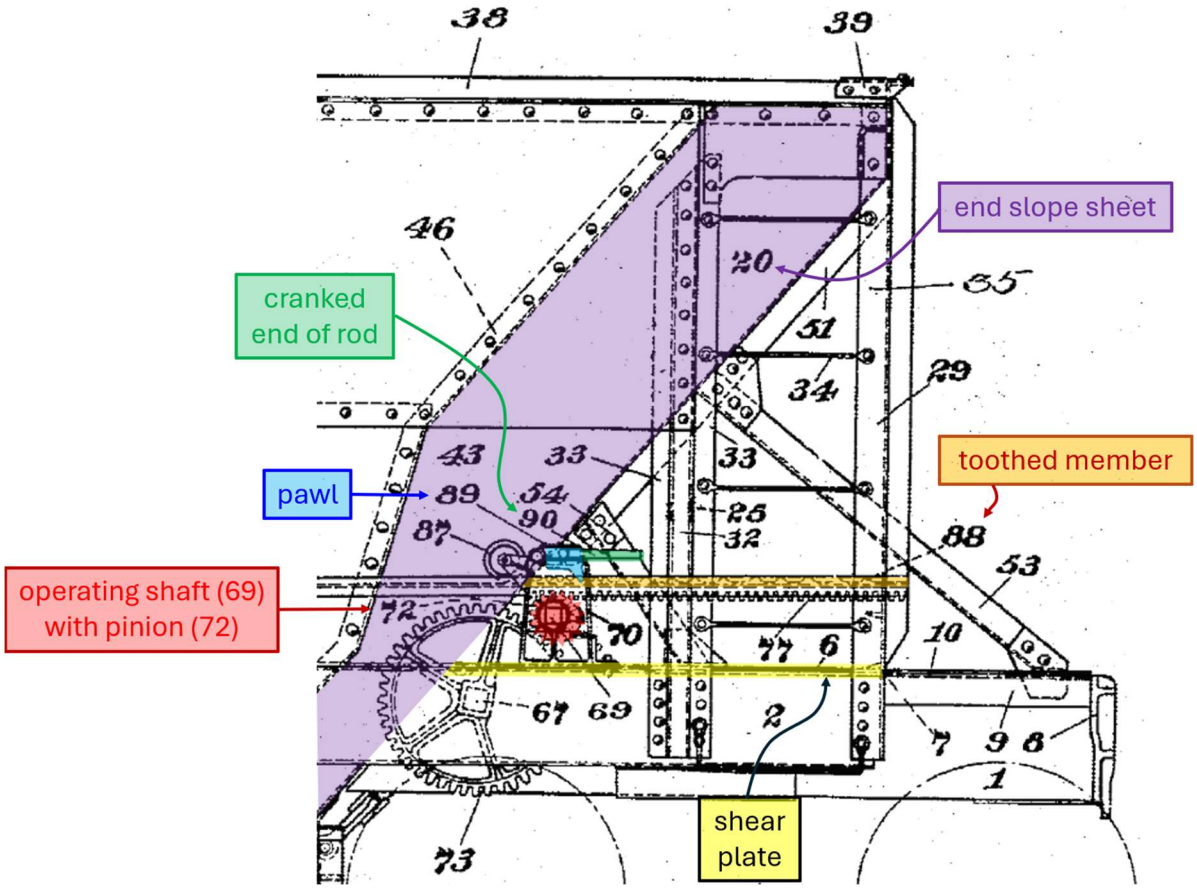
See EX1004 at 294.

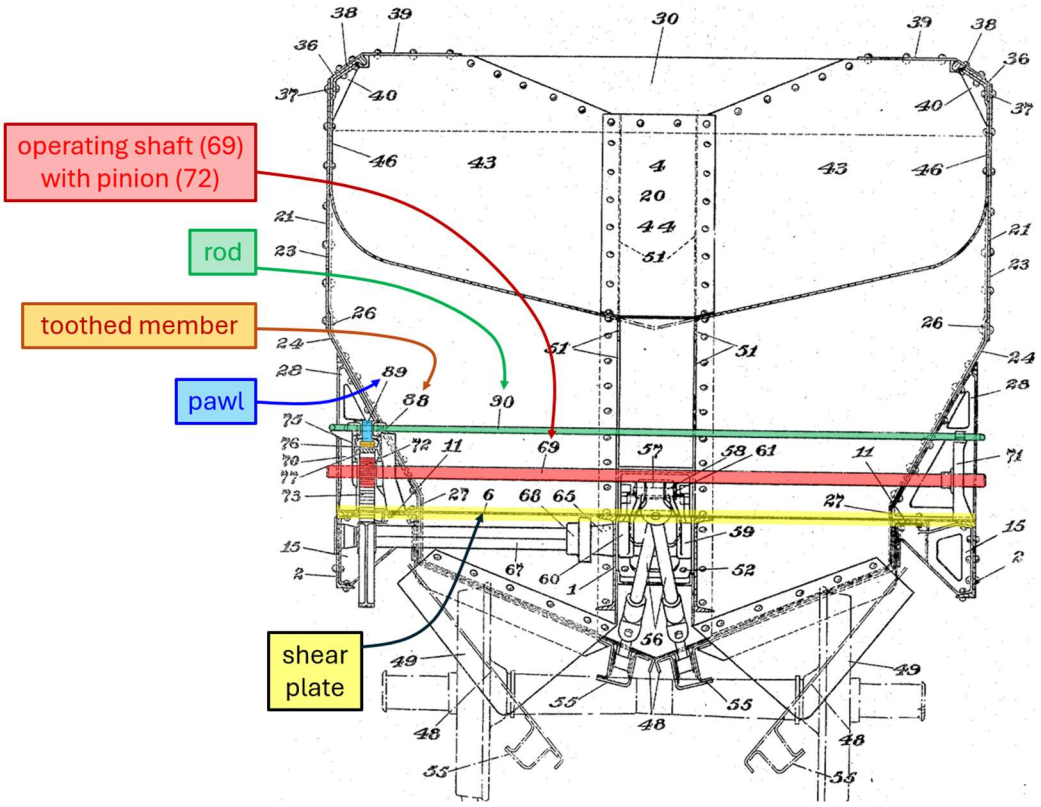
A POSITA would consider Lindström's posts 25 to extend upwardly from the ends of the bolster, as required by Claim 35. However, at a minimum, it would have been obvious in view of Hart or the NSC ore car to move Lindström's posts 25 slightly inward longitudinally, so that they could be more directly supported by the bolster. EX1003, ¶138. So modified, Lindström would embody Claim 35.

2. **<u>Claim 36</u>: "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."

Lindström discloses a hopper car with a machinery space over a shear plate (6) and under an end slope sheet ("sloping end floor" 20). Lindström also discloses a door actuator comprising an operating shaft 69 with a pinion 72, a toothed member 88, a pawl 89 and a rod 90:



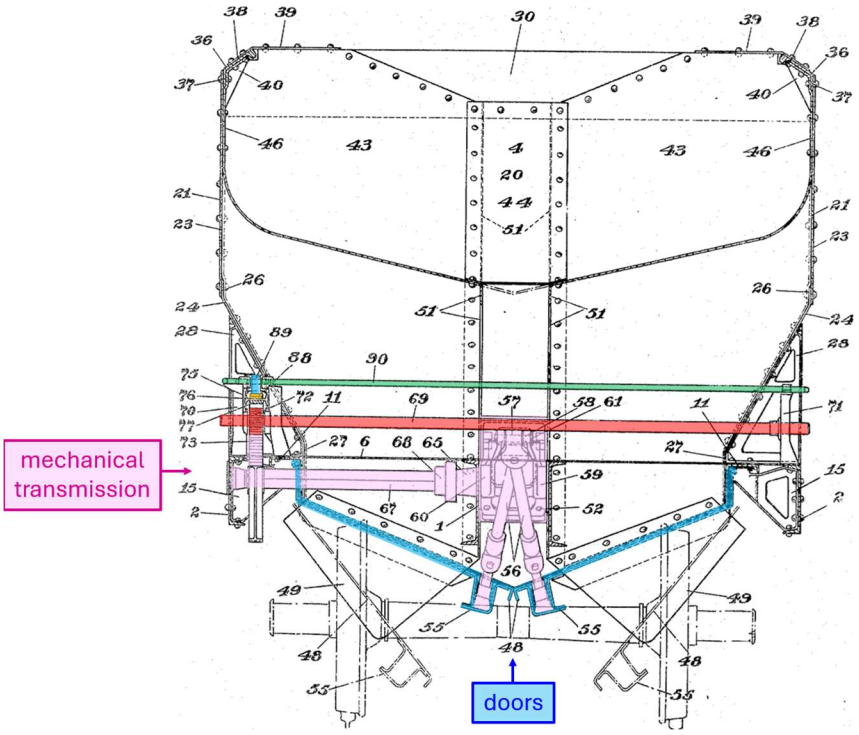


EX1005, Figs. 2, 4. To open the hopper doors:

> the operator grasps the rod 90 by one of its cranked ends and through its operation throws the pawl 89 out of engagement with the toothed member 88. A crank or wrench is then applied to the end of the shaft 69, which is then operated in the direction of the arrow, as shown in Fig. 2.

Id. at 5:115–122.

Shaft 69 is connected to the hopper doors by a mechanical transmission that includes gears and linkages, as shown in the annotated figure below. *Id.* at 4:43–5:96; EX1003, ¶141.

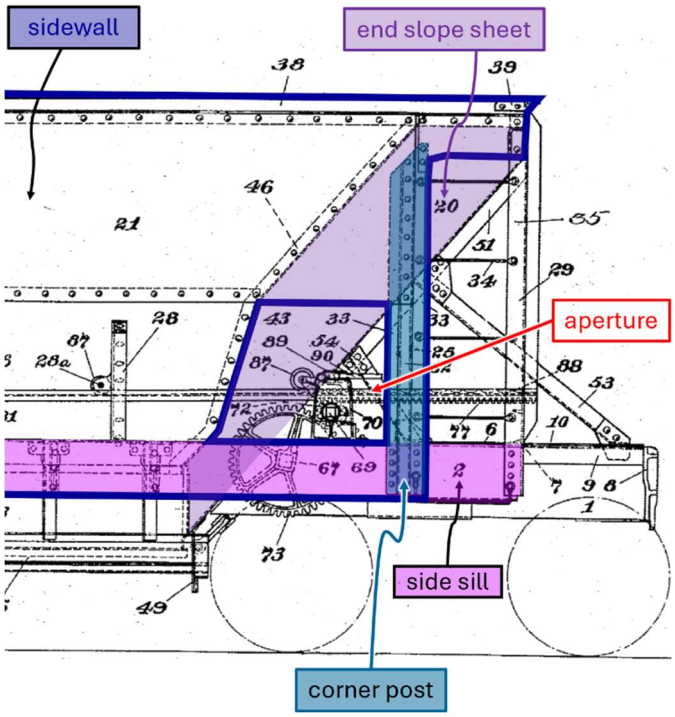


EX1005 at Fig. 4. Thus, Lindström's door actuator is mounted above said shear plate and under said first end slope sheet.

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

The evidence provided above for Claim 36 demonstrates that Lindström discloses the claimed movable gate (hopper doors), actuator (operating shaft 69, pinion 72, toothed member 88, pawl 89, rod 90), and drive train (mechanical transmission).

Finally, Lindström discloses the claimed aperture:



See EX1005, Fig. 2.

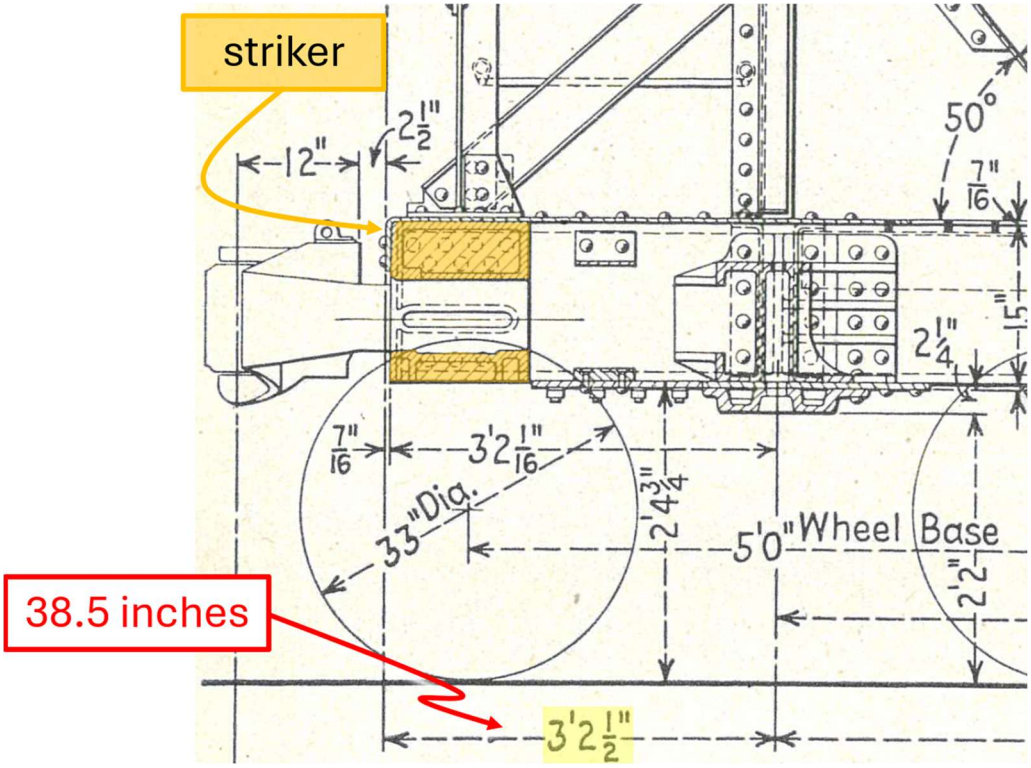
4. **<u>Claim 38</u>: "The railroad hopper car of claim 32 wherein: said main bolster has first and second ends; and respective first and second corner posts are mounted to said first and second ends of said main bolster and extend upwardly therefrom; said first side wall has an opening formed therein,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

Lindstrom discloses this limitation for the same reason it discloses the limitation of Claim 37.

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

Lindström discloses striking plate 8 at the end of draft sill but does not provide specific dimensions.

The 1946 Cyclopedia's NSC ore car discloses a striker whose outboard end is 38.5 inches from truck center:



EX1004 at 294. It would have been obvious to use the NSC dimension with the Lindstrom hopper-car design, making any necessary adjustments to related structures, because the specific distance between the striker and truck center is a routine design choice. EX1003, ¶146.

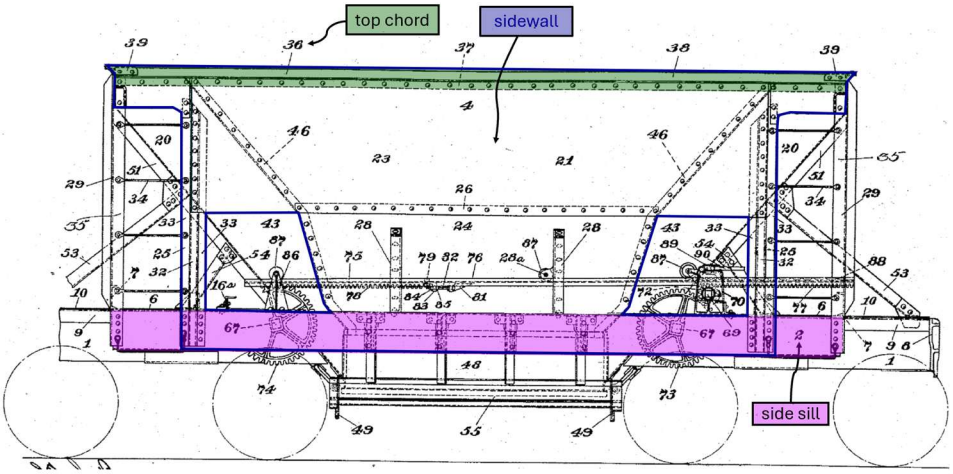
6. Claim 40:

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;"

Lindstrom discloses this limitation for the same reason it discloses limitation [32a].

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;"

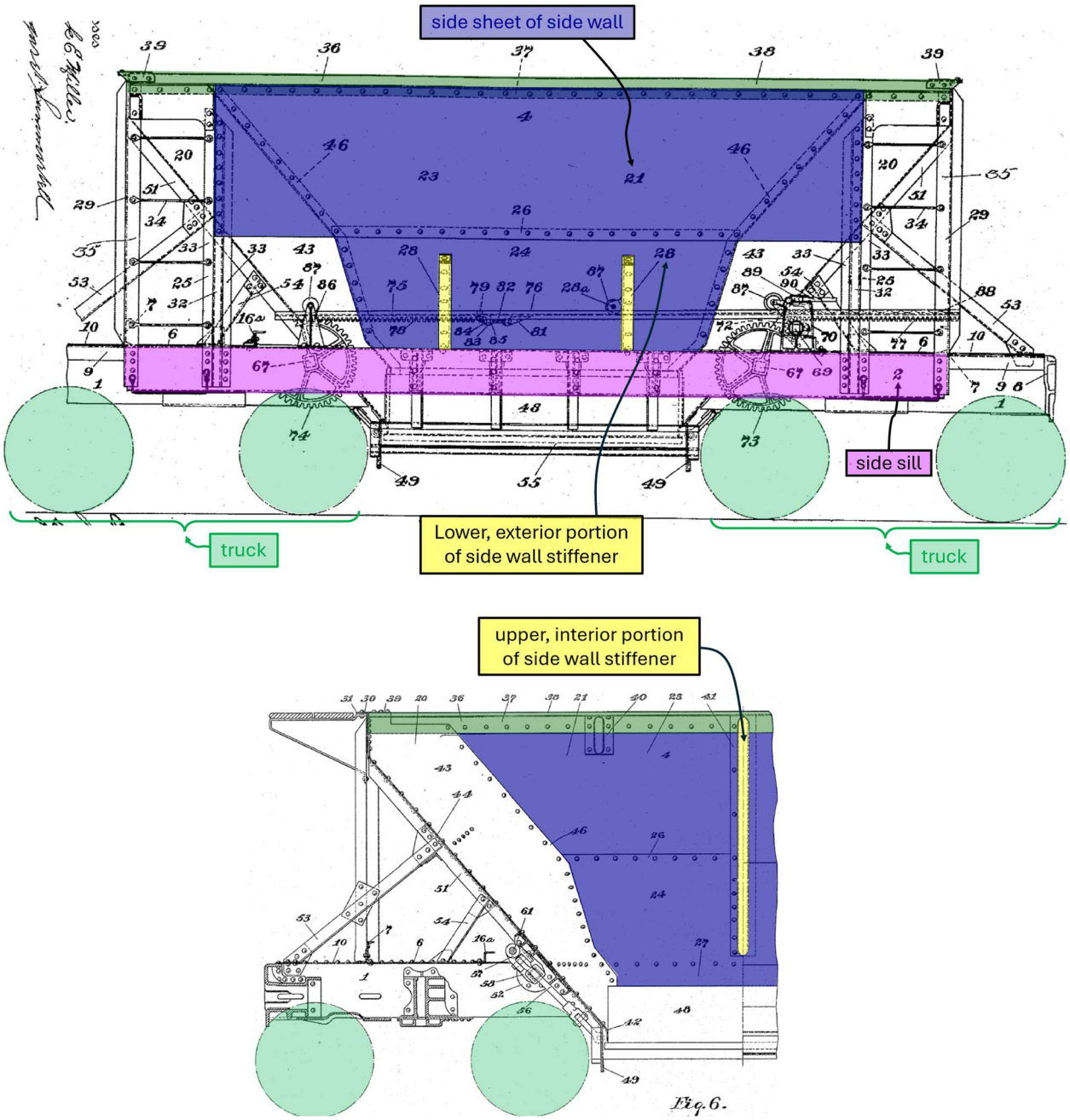
Lindström teaches the claimed side sill, side wall, and top chord:



EX1005, Fig. 2.

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;"

Lindström discloses this limitation, as shown below.

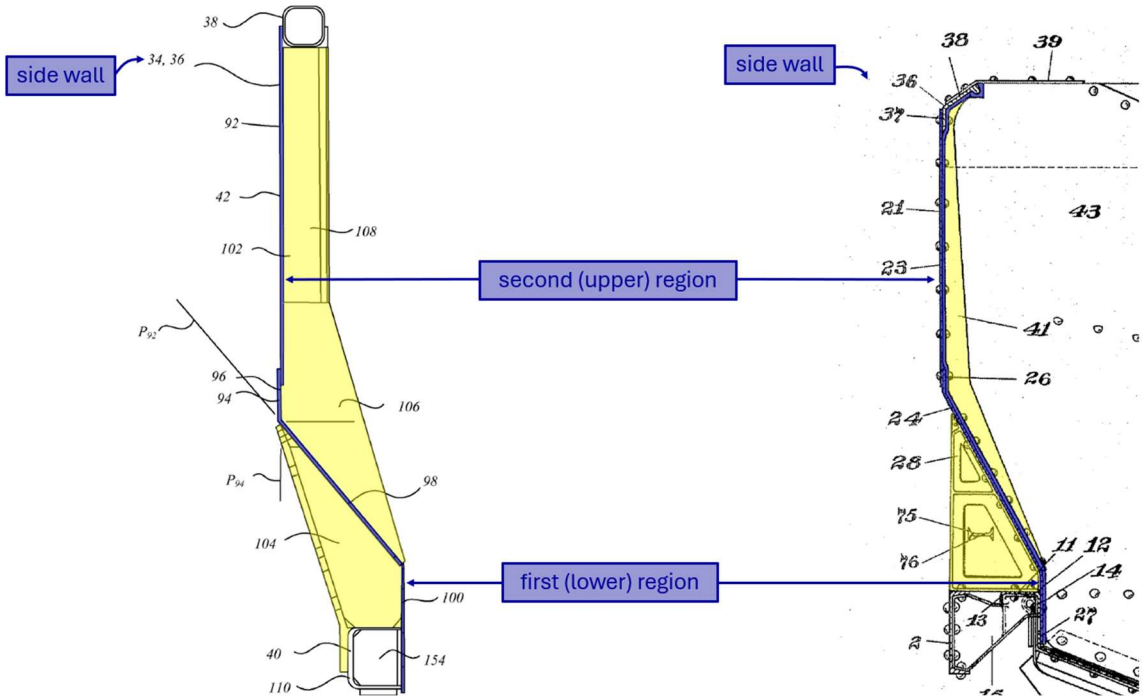


EX1005, Figs. 2, 6. Lindström states: "To assist in supporting and stiffening the combined side walls and sloping floor plate 21, 21, members 28 are provided which are preferably of triangular form . . . ." *Id*. at 2:111–115. He further states: "To further stiffen and strengthen the combined side walls and sloping floors 21, 21,

stakes 41 are provided which are preferably of U-shape in cross section having lateral flanges." *Id*. at 3:39–45.

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;"

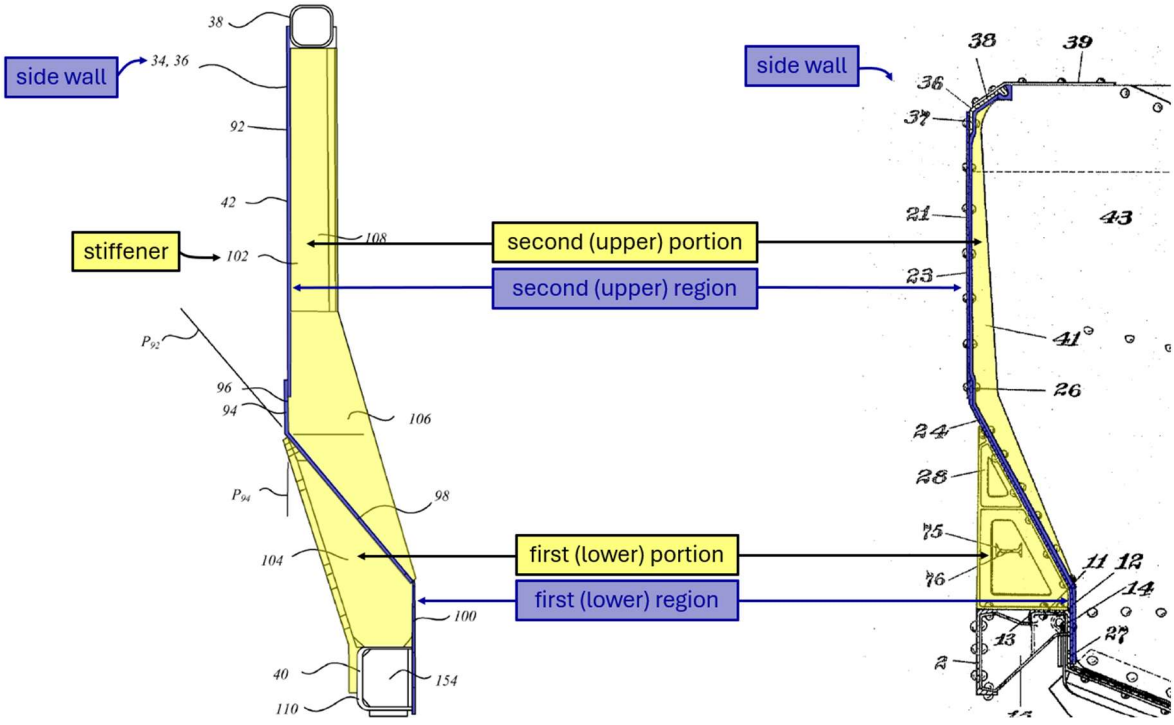
Lindström discloses this limitation. The figure below shows these features in the '515 patent on the left, and in Lindström on the right:



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

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 figure below shows these features in the '515 patent at the left, and in Lindström at the right:



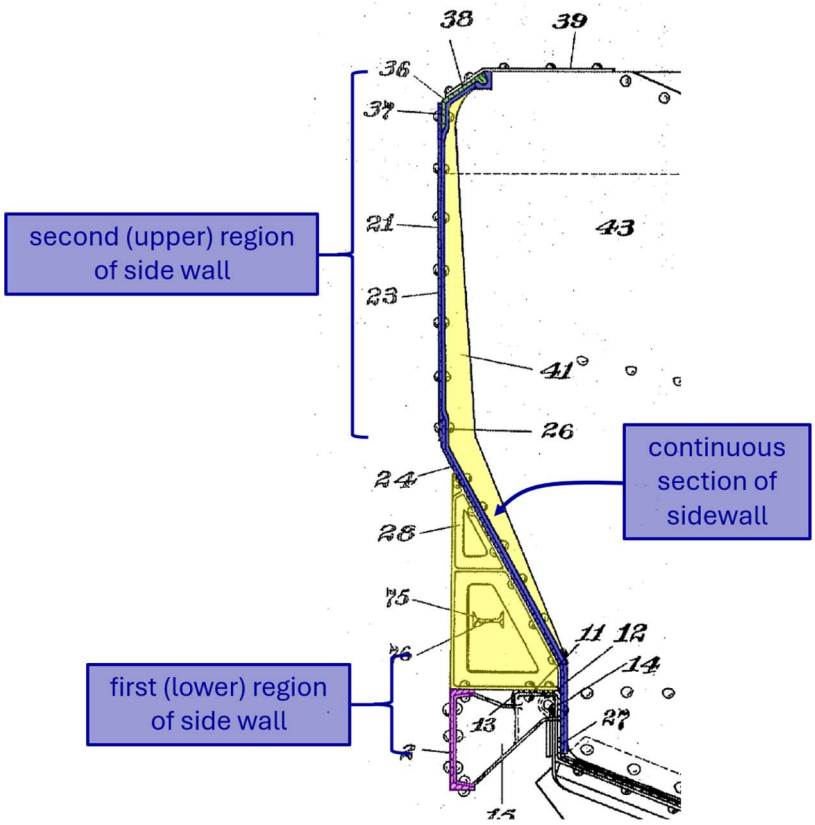
EX1001, Fig. 2c; EX1005, Fig. 5.

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;"

These features are disclosed by Lindström, as shown in the figures above.

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

This limitation is disclosed by Lindström:

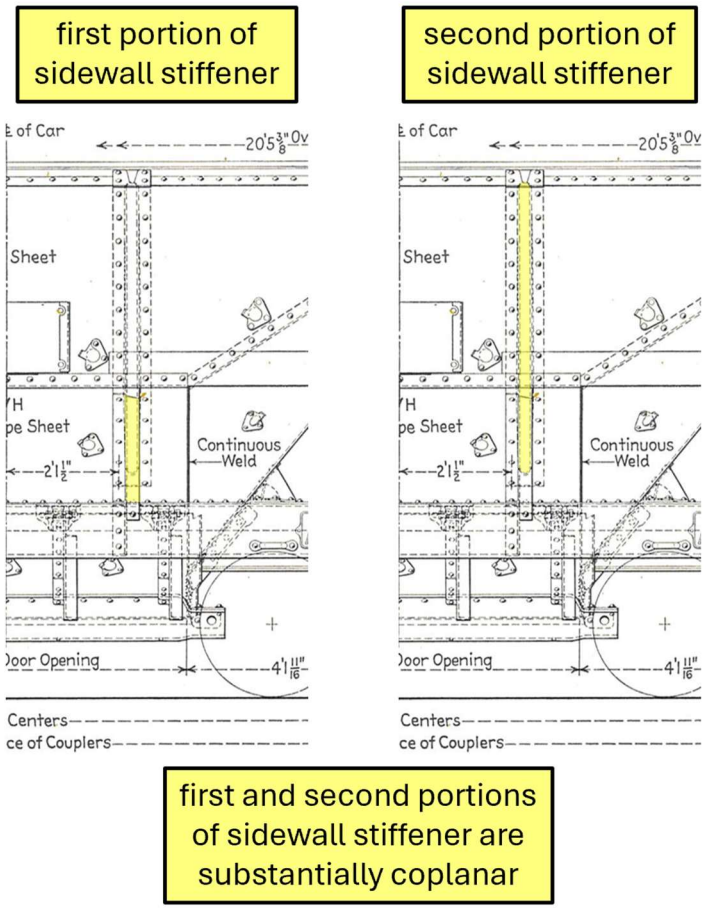


EX1005, Fig. 5.

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

A POSITA would understand that the two portions of Lindström's side-wall stiffener are arranged in the same vertical plane, and thus have web continuity, because any other arrangement would subject the side walls to bending moments that could damage them. EX1003, ¶149.

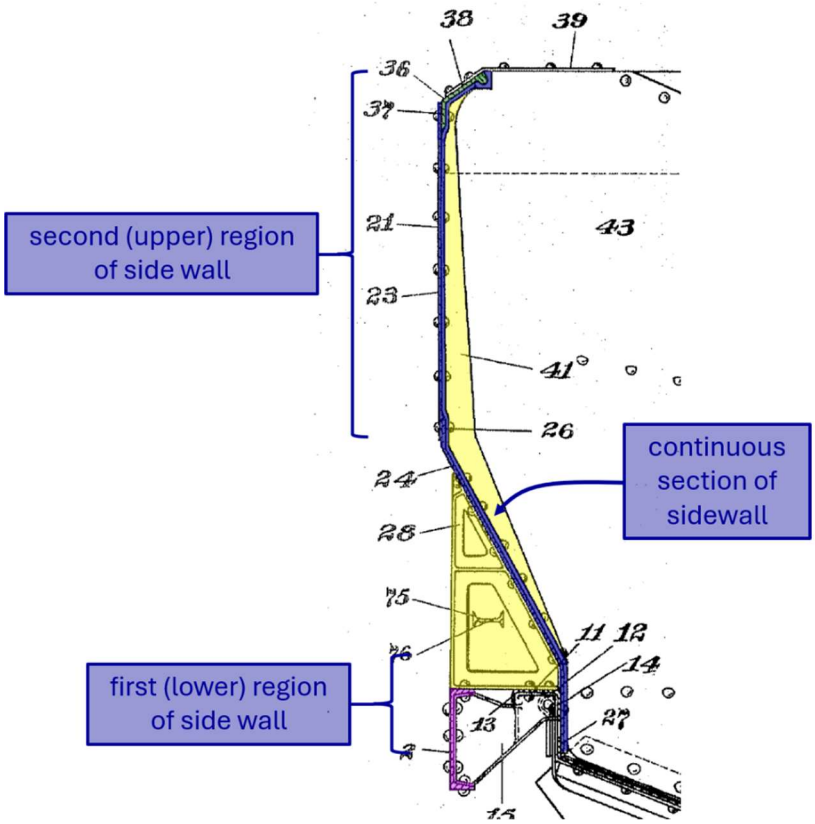
However, even if Lindström did not disclose web continuity, the 1946 Cyclopedia's NSC ore car drawings disclose two-part side-wall stiffeners with web continuity. The 1946 Cyclopedia's NSC ore car discloses outside and inside portions of a stiffener aligned in a vertical plane:



EX1004 at 294. A POSITA would have been motivated to align the portions of Lindström's side-wall stiffener in the same vertical plane, as in 1946 Cyclopedia's NSC ore car, to avoid the bending moments discussed above, and because such side-wall stiffeners had become commonplace at least by 1946. EX1003, ¶150.

7. **<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."**

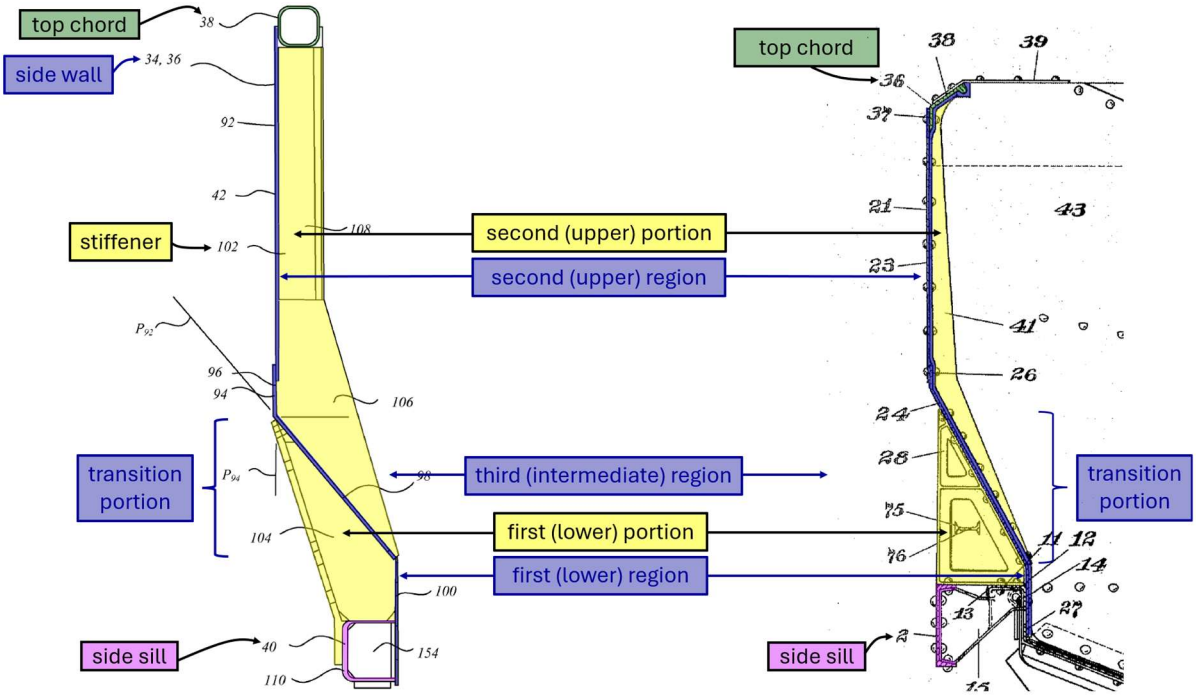
Claim 41 is disclosed by Lindström:



EX1005, Fig. 5.

8. **<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 elements of this claim are disclosed by Lindström, as shown below.

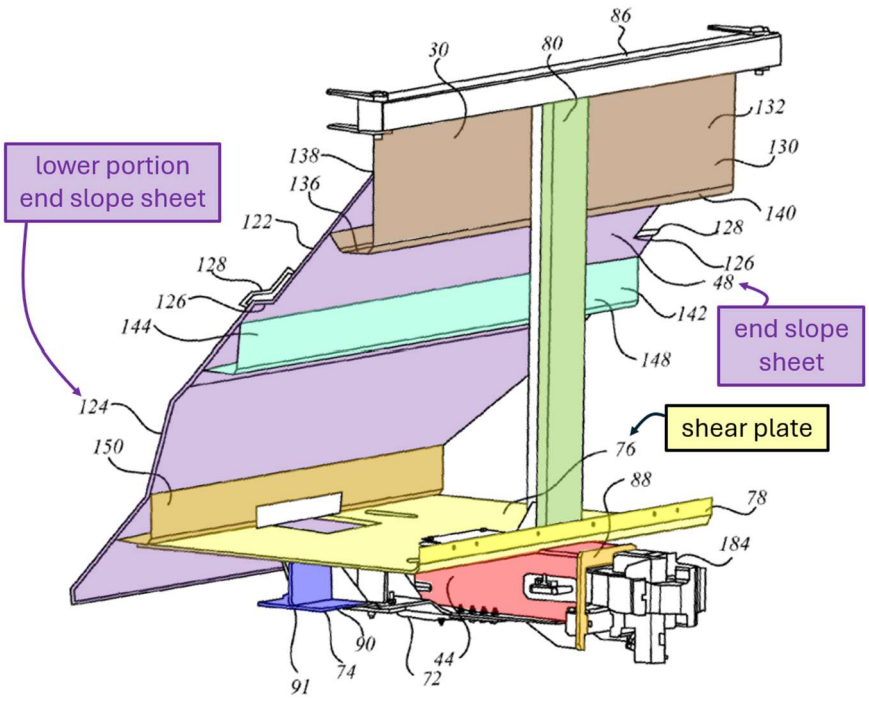


EX1001, Fig. 2c; EX1005, Fig. 5.

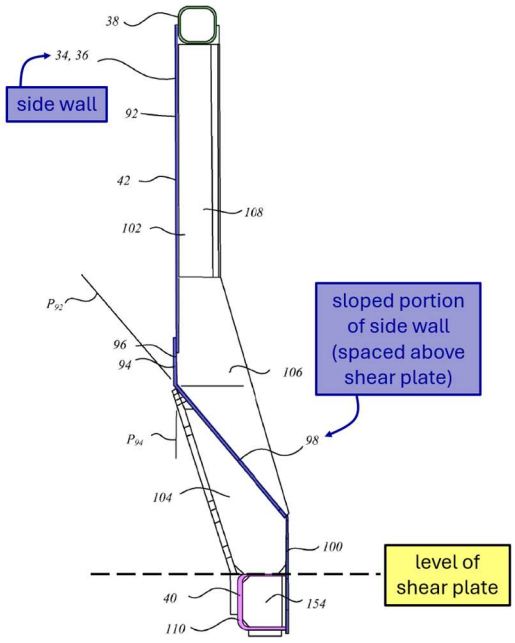
9. **<u>Claim 43</u>: "The railroad hopper car of claim 40 wherein: said first side wall has a third region intermediate said first and second regions, said third region including a side sheet transition portion passing across said side wall stiffener from an inboard margin thereof to an outboard margin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

As illustrated for Claim 42, Lindström has the claimed third (intermediate) region and side sheet transition portion.

The '515 patent states: "Lower portion 124 tapers in width to match the narrowing width between the ***sloped side sheets*** with which it mates." EX1001 at 16:39–41 (emphasis added).



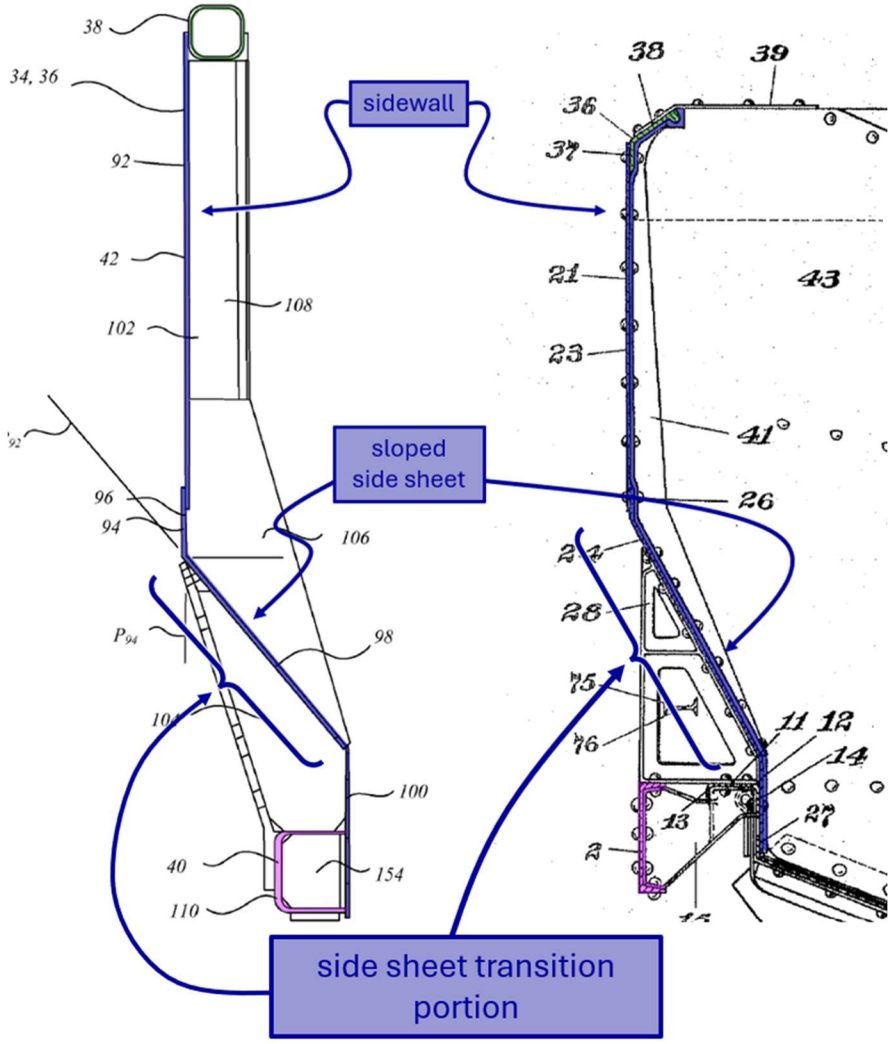
Id., Fig. 3a. As the figure shows, lower portion 124 is spaced above the (yellow) shear plate 76. Thus, the "sloped side sheets" that mate with the sides of lower portion 124 are the sloped portions 98 of the side walls, as these are sloped portions of the side walls spaced above the shear plate:



Id., Fig. 2c. Accordingly, the "sloped side sheets" recited in Claim 43 are the sloped portions 98 of side walls 34, 36. EX1003, ¶151-152.

Claim 43 recites that the first sloped side sheet, which is part of the first side wall, "meets" the first side wall at the transition portion. This is satisfied by a sloped side sheet that forms part of the side wall at the transition portion. *Id*. Lindström discloses this in the same manner as the '515 patent:

'515 patent Fig. 2c

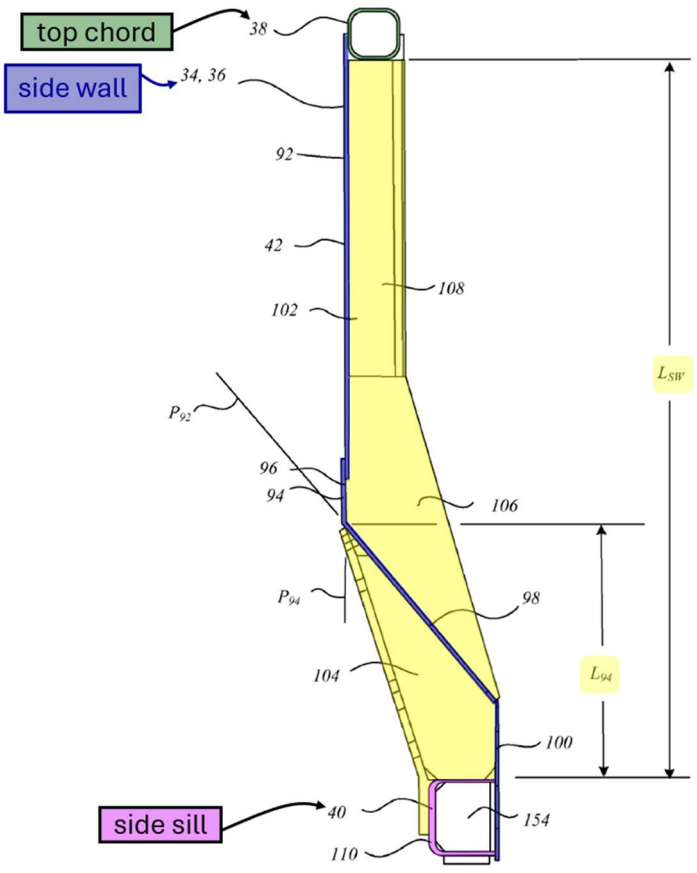


Lindström Fig. 5

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

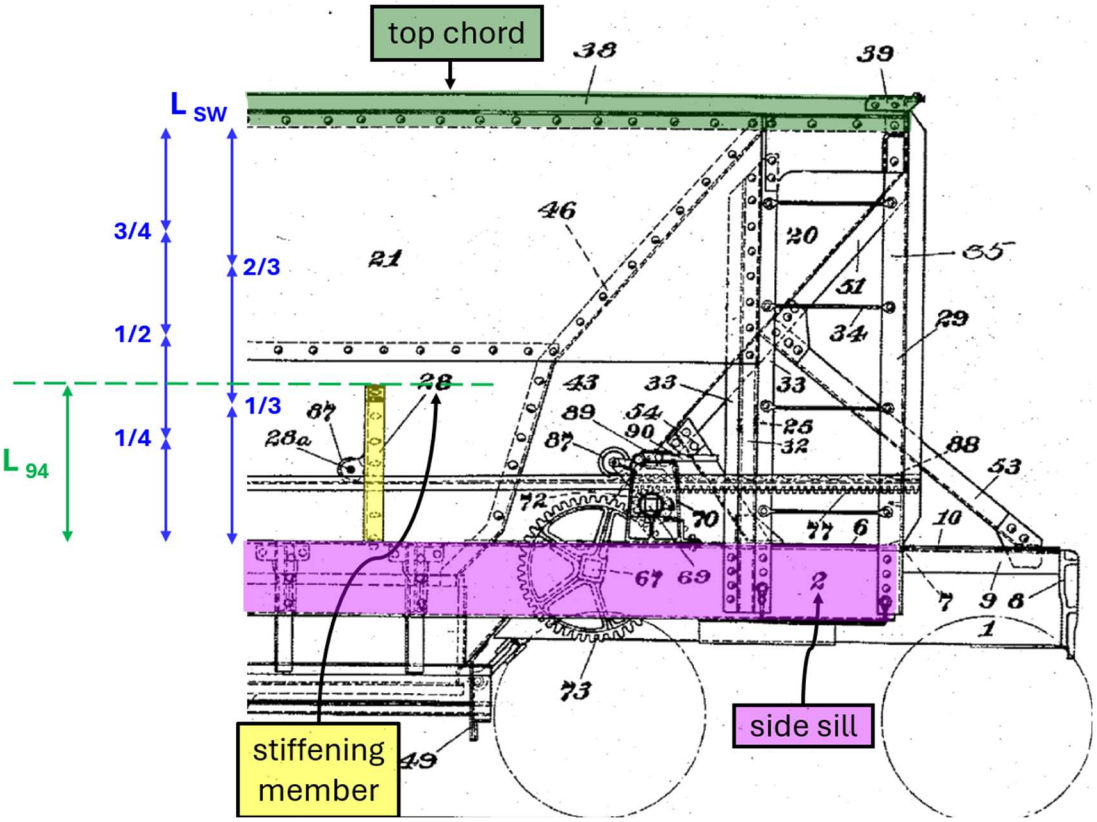
10. Claim 44: "The railroad hopper car of claim 43 wherein said first side wall has an overall height from said side sill to said top chord, L, and said transition portion is located a distance above said side sill that is in the range of ¼ to ⅔ L."

The '515 patent's only disclosure of this limitation is in Fig. 2c, shown below, and in the text in columns 15:63–16:5. As shown below, 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 ¼ to ⅔ of the distance **L_{SW}**." *Id.* at 15:66-67.



EX1001, Fig. 2c.

Lindström discloses that its distance **L94** is between 1/4 and 2/3 of **LSW**, as required by Claim 44. EX1003, ¶154.



EX1005, Fig. 2. Even if Lindström did not expressly disclose this limitation, it would have been obvious to select dimensions consistent with the Lindström's drawings and with the NSC ore car, as the precise dimensions are a matter of design choice. EX1003, ¶154.

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
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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-515-047@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 13,915 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 V.B of the Petition as follows:

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