United States Patent Application Publication	20250263095
Kind Code	A1
Publication Date	August 21, 2025
Inventor(s)	Veit; Oliver

RAILROAD COIL CAR STRUCTURE

Abstract

A transverse trough coil car has a straight-through center sill. It has a pair of truck centers. It has a set of trough slope sheet assemblies mounted to the center sill between a pair of side sills. The slope sheet assemblies include intermediate slope sheet assemblies that are pin-jointed connected to the center sill. The pin joint connection has a tongue and clevis form that is aligned with the webs of the center sill. The car may have stub bolsters that are surmounted by pre-fabricated trough assemblies that mate with the stub bolsters and extend to the side sills.

Inventors: **Veit; Oliver (Hamilton, CA)**

Applicant: **NATIONAL STEEL CAR LIMITED** (Hamilton, CA)

Family ID: **1000008578281**

Assignee: **NATIONAL STEEL CAR LIMITED (Hamilton, CA)**

Appl. No.: **19/201484**

Filed: **May 07, 2025**

Related U.S. Application Data

parent US continuation 17394571 20210805 parent-grant-document US 12319323 child US 19201484

Publication Classification

Int. Cl.: **B61D3/16** (20060101)

U.S. Cl.:

CPC **B61D3/16** (20130101);

Background/Summary

FIELD OF THE INVENTION

[0001] This invention relates to railroad freight cars, and more particularly to a railroad coil car.

BACKGROUND OF THE INVENTION

[0002] Railroad coil cars are used for carrying heavy coils of materials, quite often heavy coils of sheet steel such as are used in automobile manufacturing or other sheet metal manufacturing industries.

[0003] In a coil car, the coils can be carried with the axis of the coils parallel to the long axis of the railroad car. Such a coil car is termed a longitudinal coil car because it has a lengthwise running trough in which however many coils are carried. Such cars often have lateral coil stops to prevent the coils from moving axially in the trough. Alternatively, the coils can be transported with their axes oriented cross-wise to the long axis of the railroad car. In such a case, rather than having a single, central V-shaped trough running the length of the car, the coil car has several shorter troughs running across the car. Where the troughs run cross-wise, the railroad car is termed a “transverse trough coil car”.

[0004] It is not desirable for a heavy coil of steel to be free to roll during carriage in the car. Coil cars are designed so that the weight of the lading coils is carried into the trough structure at points of tangency of the coil with the sloped sides of the trough. That is, the coil is effectively wedged between the sloped side sheets of the trough. This condition tends to prevent the coils from moving when the railroad car is in motion. The trough is designed such that the bottom of the trough has an included radius that is smaller than the lading coils for which the car is designed so that the points of tangency (or, really, given that the coils are cylindrical, the lines of tangency) lie on the sloped side sheets of the trough, not the bottom of the trough. When the coil sits in the trough, the bottom of the coil is suspended above the underlying structure at the bottom of the trough.

[0005] It may be that a coil of steel sheet may be relatively easily damaged by undesirably rough treatment during transport. Accordingly, coil cars may have long-travel draft gear or end of car cushioning units to soften deceleration. Where a coil car has a transverse trough, in addition to the structure for supporting the coils of lading during normal operation, there is also a requirement that the trough have a “trough peak” at either side of the trough to discourage escapement of the coils in the event that the coil car should stop abruptly. The trough peak is not intended normally to be contacted by the coils, but only in an abnormal operating condition.

[0006] The attachment of the trough structure to the center sill may tend to be challenging. The junction of the structure of the trough and the top flange of the center sill tends to cause a sharp change in the stress distribution in the structure. Additionally, it may be helpful for the trough structures to be manufactured and installed consistently, rather than varying from one assembly to the next.

SUMMARY OF THE INVENTION

[0007] In an aspect of the invention there is a railroad coil car. It has a straight-through center sill and a set of transverse troughs that includes at least a first transverse trough and a second transverse trough. There is an intermediate slope sheet assembly that defines a first slope sheet of the first trough and a first slope sheet of the second trough. The intermediate slope sheet assembly is pin-joint connected to the straight-through center sill.

[0008] In a feature of that aspect, the center sill has a planar top cover plate. In another feature, the center sill has a top cover plate and the pin-joint connection has a root having web continuity through the top cover plate of the center sill. In a further feature, the center sill is a fish belly center sill. In still another feature, the first slope sheet of the first trough is pin-jointed to both the center sill and pin-joint connected to a first trough peak. In an additional feature the center sill has one of

(a) a clevis; and (b) a tongue. The first slope sheet has the other of (a) a tongue and (b) a clevis, and the respective tongue and clevis are connected by a pin to define the pin joint.
[0009] In another feature, the intermediate slope sheet assembly includes at least one A-frame structure having a pair of first and second legs, each of the first and second legs having a foot that is pin-joint connected to the straight-through center sill. In an additional feature, the intermediate slope sheet assembly has two of the A-frame structures. A first of the A-frame structures is aligned with a first web of the center sill, and a second of the A-Frame structures is aligned with a second web of the center sill spaced apart from the first web. In still another feature, the intermediate slope sheet assembly includes a head frame member, and the first and second legs of the at least one A-frame have uppermost ends connected to the head frame. In another feature, the head frame has a web that has a profile defining a trough peak form of the intermediate slope sheet assembly.
[0010] In yet another feature, the first slope sheet has at least a first lateral reinforcement, the first lateral reinforcement having a termination at a side sill of the coil car. and the reinforcement having a cuff rigidly connected to the side sill, the cuff being adjustable on fit-up during assembly, and the cuff being rigidly fixed to the reinforcement on assembly. In a still further feature, the first slope sheet has at least a first lateral reinforcement and a second lateral reinforcement extending cross-wise behind the slope sheet. The first lateral reinforcement being a lower reinforcement and the second lateral reinforcement being an upper reinforcement. The upper reinforcement has a different cross-section from the lower reinforcement.
[0011] In still another feature, the upper reinforcement has at least one of: (a) a greater second moment of area in bending perpendicular to the first slope sheet than has the lower reinforcement; (b) a greater sectional thickness than the lower reinforcement; and (c) a greater weight of metal per lineal unit of run than the lower reinforcement. In another feature, the lower reinforcement is a channel section and the channel section has splayed legs. In another feature the upper reinforcement is a channel section having parallel legs. The lower reinforcement is a channel section having splayed legs. and the upper reinforcement has a greater flexural modulus, EI, than has the lower reinforcement. In another feature the intermediate slope sheet assembly has end cap plates, and the end cap plates are welded to side sills of the coil car.
[0012] In yet another aspect, there is a transverse trough coil car having a stub bolster and a transverse trough mounted across the stub bolster. The transverse trough defines a bolster extension extending laterally across the car outboard of the stub bolster.
[0013] These and other aspects and features of the invention may be understood with reference to the illustrative drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0014] In the description that follows there is reference to the drawings in which:
[0015] FIG. **1***a* is a general arrangement isometric view of a railroad coil car viewed from the “B” end of the car;
[0016] FIG. **1***b* is a side view of the railroad coil car of FIG. **1***a;*
[0017] FIG. **1***c* is an end view of the railroad col car of FIG. **1***a;*
[0018] FIG. **2***a* is a sectional view of the railroad coil car of FIG. **1***c* taken on a central vertical plane in the middle of the center sill on section ‘**2***a*-**2***a*’ of FIG. **1***c;*
[0019] FIG. **2***b* is an enlarged near-end portion of the view of FIG. **2***a;*
[0020] FIG. **2***c* is an is a view similar to FIG. **2***b* from the opposite direction;
[0021] FIG. **3** is an enlarged sectional view through the section of the trough structure of the coil car of FIG. **2***a;*
[0022] FIG. **4***a* is an isometric section from underneath of the trough structure of FIG. **3**; FIG. **4***b* is

an enlarged detail of the structure of FIG. **4***a;*
[0023] FIG. **5***a* is partial isometric view of the underside of the center sill of the coil car of FIG. **2***a;*
[0024] FIG. **5***b* is an enlarged sectional detail on FIGS. **5***b*-**5***b* of FIG. **5***a;*
[0025] FIG. **5***c* is an enlargement of a portion of the detail of FIG. **5***b;*
[0026] FIG. **6** is a perspective view from below of the juncture of an intermediate slope sheet assembly and a side sill of the railroad coil car of FIG. **1***a;*
[0027] FIG. **7***a* is a perspective view of the main bolster of the coil car FIG. **1***a;*
[0028] FIG. **7***b* is an end view along the draft sill of the main bolster of FIG. **1***a*; and
[0029] FIG. **7***c* shows a view of the main bolster of FIG. **7***b* on section '**7***c*-**7***c*'; and
[0030] FIG. **8** shows a view showing an alternate arrangement to that of FIG. **5***a.*
DETAILED DESCRIPTION
[0031] The description that follows, and the embodiments described therein, are provided by way of illustration of examples of, particular embodiments of the principles, aspects or features of the present invention. These examples are provided for the purposes of explanation, and not of limitation, of those principles and of the invention. In the description, like parts are marked throughout the specification and the drawings with the same respective reference numerals. The drawings may be taken as being to scale unless noted otherwise.
[0032] The terminology in this specification is thought to conform to the customary and ordinary meanings of those terms as they would be understood by a person of ordinary skill in the railroad industry in North America. Following the decision of the CAFC in *Phillips* v. *AWH Corp*., the Applicant expressly excludes all interpretations that are inconsistent with this specification, and, in particular, expressly excludes any interpretation of the claims or the language used in this specification such as may be made in the USPTO, or in any other Patent Office, other than those interpretations for which express support can be demonstrated in this specification or in objective evidence of record in accordance with *In re Lee*, (for example, earlier publications by persons not employed by the USPTO or any other Patent Office), demonstrating how the terms are used and understood by persons of ordinary skill in the art, or by way of expert evidence of a person or persons of at least 10 years' experience in the industry in North America.
[0033] In terms of general orientation and direction, for railroad car body units described herein the longitudinal direction is defined as coincident with the rolling direction of the railroad car when on tangent (that is, straight) track. In a Cartesian frame of reference, this is the x-axis, or x-direction. The longitudinal direction is parallel to the center sill, and parallel to the top chords and side sills. Unless otherwise noted, vertical, or upward and downward, are terms that use top of rail, TOR, as a datum. In a Cartesian frame of reference, this may be defined as the z-axis, or z-direction. In the context of the railroad car as a whole, or any car body unit thereof, the term lateral, or laterally outboard, or transverse, or transversely outboard refer to a distance or orientation relative to the longitudinal centerline of the railroad car, or car body unit, or of the centerline of a centerplate at a truck center. Given that the railroad car or railroad car body units described herein may tend to have both longitudinal and transverse axes of symmetry, unless noted otherwise, a description of one half of the car may generally also be intended to describe the other half as well, allowing for differences between right-hand and left-hand parts. As such, the term "longitudinally inboard", or "longitudinally outboard" is a distance taken relative to a mid-span lateral section of the car, or car unit. Pitching motion is angular motion of a railcar unit about a horizontal axis perpendicular to the longitudinal direction (i.e., rotation about an axis extending in the y-direction). Yawing is angular motion about a vertical or z-axis. Roll is angular motion about the longitudinal, or x-axis. The abbreviation kpsi, if used, stands for thousands of pounds per square inch. Where this specification or the accompanying illustrations may refer to standards of the Association of American Railroads (AAR), such as to AAR plate sizes or lading rules, those references are to be understood as at the earliest date of priority to which this application is entitled. Unless otherwise noted, it may be understood that the railroad cars described herein are of welded steel construction. The commonly

used engineering terms “proud”, “flush” and “shy” may be used herein to denote items that, respectively, protrude beyond an adjacent element, are level with an adjacent element, or do not extend as far as an adjacent element, the terms corresponding conceptually to the conditions of “greater than”, “equal to” and “less than”.

[0034] Railroad coil cars are the predominant car type for carrying metal coils, and particularly coils of steel. The coil car may be covered or uncovered, depending on the circumstances. Cars for carrying transversely-oriented coils are described herein. The coil cars describe herein have a longitudinally running center sill and a pair of side sills located to either side of the center sill.

[0035] In the past, coil cars have had straight-through center sills that carry the longitudinal buff and draft loads to which the car is subjected, and also the vertical bending load. The center sill may have had a flat horizontal upper flange extends the full length of the car from draft sill to draft sill. Transverse troughs are then mounted above the center sill. Coil cars may have “fish belly” center sills. The term “fish belly” arises from the shape of the beam in side view in which the bottom flange of the center plate dips downward between the trucks, giving a greater depth of section in the middle portion of the car than at the draft sills, and hence a higher flexural moment, EI, for resisting bending, giving the general appearance of a “fish belly”.

[0036] In railroad terminology the “draft sill” is that portion of the center sill lying longitudinally outboard of the truck center. A single unit rail car typically has two draft sills, one at each end of the car. In some instances, e.g., where the draft sill is made as a unitary casting or as a pre-fabricated assembly, the draft sill extends inboard of the truck center for a short distance to allow for the draft sill to mate with the main portion of the center sill inboard of the truck center and inboard of the main bolster. The draft sill is typically sized to fit the draft gear. That is, the draft sill typically has two vertical webs that are laterally spaced apart a distance sufficient to form a draft pocket in which to mount the draft stops and to receive the draft gear, the yoke, and the coupler. The draft sill has a top cover plate, or top flange to which the webs are welded. The draft sill also typically has a bottom sill that extends outboard of the truck center and that bifurcates to permit the draft gear to be installed in the draft pocket. The top cover plate of the draft sill is usually considered to be the top of the center sill, and is located at a height determined by the requirements of the coupler centerline height. Generally, the top cover plate of the draft sill is located roughly **41**″-**42**″ above Top of Rail. The flange defined by the top cover height of the draft sill is a defined datum height in this specification.

[0037] The term “stub bolster” is used in this specification. A stub bolster is a laterally fore-shortened bolster having a bottom flange, a top flange and at least one vertical web inter-connecting the top and bottom flanges. The bottom flange extends laterally to define a seat for the side bearing, and is truncated outboard of the side bearing mount. Likewise, the bolster web, or webs, terminate outboard of the side bearing mount. A stub bolster, by definition, does not extend to the side sills of the car.

[0038] FIG. **1***a*, **1***b*, **1***c*, and **2***a* show a railroad coil car, generally as **20**. Other than as indicated, the major structural elements of coil car **20** are symmetrical about the longitudinal vertical plane (or x-z plane) of the car and also about the lateral vertical plane. Coil car **20** has a railcar body unit **22** supported upon railcar trucks **24** for rolling motion in the longitudinal direction along the rails.

[0039] Railcar body unit **22** includes a center sill **26** and a pair of first and second, spaced apart side sills **28**, **30**. Coil car **20** has a set of troughs **32**. In the example shown the troughs are transverse and include first, second, third, fourth and fifth troughs **34**, **36**, **38**, **40** and **42**. There could be fewer troughs, but there could also be more troughs, as many as ten or twelve, depending on the maximum size and type of coils of lading that the car is intended to carry. These troughs are supported by center sill **26** and extend between, and are bounded laterally by, side sills **28** and **30**. Between pairs of adjacent troughs there are slope sheet assemblies **44** and at the ends of the car are end slope sheet assemblies **46**. Trough slope sheet assemblies **44** are double-sided and end slope sheet assemblies **46** are single-sided. Slope sheet assemblies **44** and **46** mount to center sill **26**.

[0040] These various components of coil car **20** will now be described in greater detail, commencing with center sill **26**.
[0041] Center sill **26** is a straight-through center sill (as opposed to a stub center sill). It forms the central spine of the car and carries the buff and draft loads along the trainline from coupler to coupler. It also provides the dominant resistance to vertical bending, although part of the car's resistance to vertical bending is also contributed by side sills **28** and **30**. In the example shown, center sill **26** includes draft sills **48** and a central or intermediate center sill portion **50** that extends the length of the car between the truck from draft sill to draft sill. Draft gear, including couplers **52**, are mounted at the outboard ends of draft sills **48**. Coil car **20** may have, and in the example illustrated does have, either long-travel draft gear or and end-of-car-cushioning (EOCC) unit.
[0042] Each of draft sills **48** has a pair of side webs **54** and a top cover plate **56**, and a bifurcated bottom flange, or flanges **58** that form a top hat section that is open from the bottom to admit installation of the EOCC in the draft pocket **60**. Coupler **52** has a coupler centerline height h.sub.52 relative to Top of Rail (TOR). The top cover plate of draft sill **48** also has a height, h.sub.56, relative to TOR that is a datum height in this discussion. Draft sill **48** may have, and as illustrated does have, a welded-fabrication truck center assembly. This assembly, and the draft sill generally, may alternatively be a single-piece casting.
[0043] In the fabricated assembly of draft sill **48** shown, a main bolster **62** intersects draft sill **48** at the truck center. Main bolster **62** may be a bolster that extends fully across the car and has and connections to side sills **28**, **30**. Alternatively, main bolster may be, and in the example illustrated is, a stub bolster that terminates immediately outboard of the side bearing mount **64**.
[0044] A draft sill may include, and in the example illustrated does include, a transition, or stub **66** that extends for some distance longitudinally inboard of the truck center. Transition stub **66** mates with one end of central or intermediate center sill portion **50**.
[0045] Intermediate center sill portion **50** has a top flange or top cover plate **72**, a bottom cover plate, or bottom flange **74**, and first and second side webs **76**, **78**. They co-operate to form a hollow section in which side webs **76** and **78** are spaced apart and parallel, and lie in vertical planes. Similarly top cover plate **72** and bottom flange **74** are spaced apart, and at any given longitudinal section they are parallel in the y-axis. In the embodiment illustrated, top cover plate **72** of center sill intermediate portion **50** lies in the same plane as top cover plate **56** of draft sill **48**. In the embodiment as shown top cover plate **56** may be a straight continuation of top cover plate **72**, formed from the same monolith of material, i.e., rather than butt-welding the parts together.
[0046] Bottom flange **74** could be flat and horizontal. Alternatively, as seen in FIG. **1***a*, **1***b* and **1***c*, center sill **26** is a fish belly center sill, the deeper portion of the center sill that defines the fish belly as indicated at **75**. Bottom flange **74** may be, and in the embodiment illustrated is, a “fish belly” bottom flange, i.e., the depth of the bottom flange **74** below the coupler centerline datum height (or, expressed differently, the draft sill cover plate datum height) increases toward the longitudinal center of the car such that the bottom flange is lower at the location of maximum bending moment than it is at the truck centers and at the bottom flange of the draft sill.
[0047] As noted, top cover plate **72** can also be named the top flange of center sill **26**. It can be seen that top cover plate **72** of center sill **26** is at the datum height of draft sill top cover plate **56** at the truck center. First trough **34** and fifth trough **42** are centered over the respective truck centers at opposite ends of car **20**. Three full troughs **36**, **38**, and **40** are space along, and mounted to, central portion **50** of center sill **26**.
[0048] The next structural components of the underframe of coil car **20** are side sills **28** and **30**. Side sills **28**, **30** run parallel to and are spaced laterally from center sill **26**. Side sills **28** and **30** each have a top chord **68**, a bottom chord **70**, and a web **69** that extends and joins top chord **68** and bottom chord **70** together. In the illustrations, top chord **68**, bottom chord **70**, and web **69** are formed as a single formed section, which may be a pressing. The pressing may include an upwardly protruding, longitudinally extending stand-off bad formed in top chord **68**, and may carry a seal

upon which the coil car cover may sit, if provided.

[0049] In FIG. **3** there is a cross-section of an intermediate slope sheet assembly **80**, such as would lie between, and define, the sides of the respective troughs. There is a trough slope sheet assembly between troughs **34** and **36**, a second between troughs **36** and **38**, a third between troughs **38** and **40**, and a fourth between troughs **40** and **42**.

[0050] Each trough sheet assembly **80** includes a pair of central A-frames **82**, **84**; and a pair of first and second slope sheets **86**, **88**. Slope sheets **86**, **88** extend from side to side of car **20** and are joined at their ends to side sills **28**, **30**. Each slope sheet is backed by first and second reinforcements **90**, **92** that run laterally behind them. The top of each assembly **80** includes a trough peak assembly **94**.

[0051] Each A-frame **82** or **84** has first and second legs **96**, and **98** that underlie the respective slope sheets **86** and **88**. There is a head frame, or head frame assembly, **100** at the apex of the A-frame. Each of first and second legs **96**, **98** is a formed structural member, such as an I-bean, a wide-flanged beam, or a hollow structural section. In the example illustrated they are I-beams in which the upper flange underlies, and is welded to the respective slope sheet, be it **86** or **88**. First and second legs **96**, **98** each have a footing **102** that has the form of a cap, or end plate **104** welded across the lower end of the I-beam of leg **96** or **98**, and a tongue **106** welded to the end plate. Tongue **106** protrudes from plate **104** perpendicularly to seat between a pair of side plates **108**, **110** that form a clevis. A pin **112** passes through bores in side plates **108**, **110** and through tongue **106** in a double shear arrangement. Tongue **106** thereby has a degree of freedom of motion relative to the clevis, that degree of motion being a rotational degree of freedom about the axis of pin **112**. The bottom edges of side plates **108**, **110** are welded to the top flange, i.e., the top cover plate **72** of center sill **26**.

[0052] As seen in FIGS. **5***a*, **5***b* and **5***c*, a web reinforcement, or doubler, **114** is welded to the outside face of the respective ones of webs **76**, **78** immediately abutting the underside of top cover plate **72**, opposite tongue **106**. As seen in FIG. **5***c* the combined width of web **76**, **78** and doubler **114** is the same as the thickness of tongue **106** such that they effectively form the root of the clevis formed by side plates **108**, **110**, whose inside faces are co-planar, or roughly co-planar with the corresponding faces of web **76**, **78** and doubler **114**.

[0053] At the top of legs **96**, **98** head frame **100** has a cap plate **116** that has portions **118** that define lands that are welded across the top ends of the I-beam legs **96**, **98**. Cap plate **116** also has a central portion **120** that ties portions **118** together. Head frame **100** also has a central web **122** that is welded to, and forms a stem of, portions **118** and **120**. Additionally, trough peak assembly **94** has a cover **124** that includes first and second members, or first and second sides identified as a pair of first and second skirts **126**, **128** that are welded to remaining edge portions of central web **122**. Head frame **100** is effectively a structural knee.

[0054] Additionally, trough slope sheet assembly **44** has a set of laterally extending reinforcement **90**, **92** in which first reinforcement **90** is a lower stringer **130** and second reinforcement **92** is an upper stringer **132**. Lower stringer **130** and upper stringer **132** extend across the rail car from side sill to side sill. They have web continuity through the I-beams of the A-frames. At the laterally outboard ends there are sockets or cuffs **134**, **136** that are welded to the respective side sills on installation. Cuffs **134**, **136** are able to slide on stringers **130**, **132** such that their axial position can be adjusted on fit up, and once installed stringers **130**, **132** are welded in place in the cuffs.

[0055] Upper stringer **132** may be different from lower stringer **130**. That is, to the extent that coils engage the slope sheets, larger diameter, heavier coils will engage the slope sheets at a higher location. Accordingly, upper stringer **132** may have a heavier section, or specifically, a larger second moment of area and a larger flexural modulus than lower stringer **130**. Moreover, whereas upper stringer **132** may have the form of a channel with parallel legs welded toes-in to the back side of the respective slope sheet **86**, **88**, lower stringer **130** may have toes that are splayed apart, such that the lower leg is welded closer to the lower margin of slope sheets **86**, **88** to provide more proximate reinforcement to that edge than if lower stringer **130** had been a channel with square legs rather than splayed legs.

[0056] Trough peak assembly **94** extends across the car between side sills **28**, **30**. At the laterally outboard ends there are end plates **140** that cap the ends of cover **124**, and to which the ends of skirts **126**, **128** are welded. Skirts **126**, **128** are inclined upwardly toward each other, and are joined at the peak where cover **124** is bent between them. The slope of inclination of skirts **126**, **128** is steeper than the slope of slope sheets **86**, **88**. End plates **140** have an upper portion that is generally triangular to correspond to the slope of skirts **126**, **128** and to extend slightly beyond them. End plates **140** have a lower portion that forms a generally polygonal-shaped foot or base that has angled upper side margins that run along the upper portions of the outboard edges of slope sheets **86**, **88**, a truncated edge that runs away from that edge, and a bottom edge that runs horizontally. The base or bottom edge overlaps, and is lap welded to, the inside margin of the top chord of the side sill **28**, **30**.

[0057] As indicated, the ends of trough peak assembly **94** are capped by end plates **140** and fixed in position by the welded connection of end plates **140** to side sills **28**, **30**. The central portion of trough peak assembly **94** is mounted to the laterally spaced apart head frames **100** of A-frames **82**, **84**. In addition, there is a pair of internal gussets **142**, **144** that each have an upstanding web **146** that conforms to, and reinforces, the profile of peak assembly **94**. A horizontally extending flange **148** runs along the bottom edge of web **146** and has broadened end tabs that butt against, and are welded to the lower margins of skirts **126**, **128** immediately upward of the bend of those lower margins. Internal gussets **142**, **144** function as formers or frames to hold the shape of trough peak **94**, and are located mid-way between end plates **140** and A-frames **82**, **84** respectively.

[0058] The lower edges of skirts **126**, **128** are bent to conform to the slopes of slope sheets **86**, **88**. These lower edges lap over the upper edge of slope sheets **86**, **88**, to which they are welded. Internal corner gussets **150**, **152** lie in a horizontal plane at the corner of the bends of the lower margins of the skirts, as seen in FIG. **6**. Similarly, additional corner gussets **154**, **156** are located in a horizontal plane level with, or approximately level with, the top chord flange of side sills **28**, **30**, with one leg welded to end cap **140** and the other leg welded to the underside of slope sheet **86**, **88**.

[0059] The lower edges of slope sheets **86**, **88** underlie, and are mated in a lap joint with, a trough bottom in the form of a pan **160** that has a central web **162** and upturned edges **164** that may be bevelled upwardly as shown. The bevelled edges, or flanges, are on the same slope as the slope sheets **86**, **88**. When assembled in this manner, each pan **160** and adjoining pair of slope sheets **86**, **88** combine to form a V-shaped channel, in which the pan functions as the back or flange of the channel, and the slope sheets function as the legs or webs of the channel.

[0060] As may be noted, each intermediate slope sheet assembly **80** can be assembled as a module, or sub-assembly, and then be inserted into the car between side sills **28**, **30** as a unit. It is secured to center sill **26** at pins **112**. Pins **112** are not able to transmit a bending moment in the x-z plane. That is, when car **20** is subject to buff and draft loads, center sill **26**, and therefore top cover plate **72**, may tend to stretch or compress. This action causes shear loads in the x-direction to be transmitted into intermediate slope sheet assemblies **80** at pins **112**. However, that force transfer may tend not to be accompanied by a moment about the y-axis that might otherwise tend to want to impose a bending moment on center sill **26**, and top cover plate **72**, otherwise tending to rotate the element and to cause a local rotational discontinuity in the stress field in the center sill at that location.

[0061] Center sill **26** and side sills **28**, **30** form the dominant structural members of the underframe of coil car **20**. The center sill and side sills are joined by lateral structural members. In car **20** there are also lateral structural members joining center sill **26** to side sills **28** and **30**. There are end sills **158** at either end of the car, and laterally extending stub walls **180**. There are lateral catwalks **184** that run across the end of car **20** inboard of end sill **158** and stub wall **180**. The major lateral structural connection along the car is provided by the transverse trough assemblies of troughs **34** to **42**.

[0062] Half-trough peak assemblies **170** are located at the ends of the car opposite the slope sheet of the next inboard slope sheets of the intermediate slope sheet assemblies **80**. Half-trough peak assemblies **170** include a roof or hat **168**, a pair of end plates **172**, and a set of internal webs **174**. The roof or hat **168** may be a bent single sheet that forms the roof peak **166** and, in contrast to the intermediate trough peak assemblies, has only a single side sheet, or skirt, **176**, that faces across the trough toward the interior of the car.
[0063] The roof or hat or cap **168** may be formed from a bent sheet to form the ridge cap that has an inboard web or skirt **176** and an outboard leg **178** that conform to the profile of internal webs **174**. Internal webs **174** have one side that has the same dog-leg profile as webs **146**. Outboard leg **178** follows the contour of the outboard edge of webs **174** and terminates at the upper edge of a lateral stub wall **180** that runs across the end of car **20** from the end of side sill **28** to the end of side sill **30**. There are webs **182** that lie in the respective planes of webs **54** of draft sill **48** and support the inclined slope sheet support and center sill top flange extension horizontal flange portion **186**, and consequently lateral cover plate **188** that extends across car **20** from top chord to top chord of side sills **28**, **30**. Accordingly, the structure defines a continuous stub wall at the end of car **20**. The trough facing skirt, namely skirt **176**, is mounted with a gap between its lowermost margin and the uppermost margin of the nearest slope sheet **86**, **88** such that there is no shear web continuity between the skirt and the slope sheet.
[0064] First trough **34** and last trough **42** are centered on the respective truck centers. As seen in FIGS. **7***a*, **7***b* and **7***c*, there is a stub bolster **190**. It has a bottom flange **192**, a pair of vertical webs **194**, **196** spaced apart from each other and that stand upwardly from bottom flange **192**. At the location of the truck centers, the top flange **72** of center sill **26** is broadened locally. At these locations, the respective trough bottoms **198** are welded to the upper margins of webs **194**, **196**. Vertical webs **194**, **196** and bottom flange **192** terminate laterally outboard of the side bearing mount. From that point to side sill **28**, **30**, trough **34** and trough **42** function as the lateral bolsters of the car. That is, trough bottom **198** forms the flange of the bottom of a channel, and slope sheets **86**, **88** form the legs of that channel, with that hybrid channel performing the role of the main bolster.
[0065] This approach may tend to make manufacture easier, and to reduce the amount of material used. The geometry of the trough sheet at the bolster location is a large, wide, flat-bottomed V-shape. This geometry, by itself, has a large second moment of area, reducing dependence on the bolster for stiffness in transferring side bearing loads to the center sill and carrying the side sill. By using the natural beam-like properties of the trough sheet and its geometry, the bolster can be reduced to a stub-bolster that bears the side bearing loads, and a trough sheet that performs the beam function customarily provided by a traditional bolster. In the example, the bolster top flange is partially or wholly eliminated relative to standard designs.
[0066] In an alternate embodiment shown in FIG. **8**, there is a railroad coil car **220** that can be taken as being the same as coil car **20**. It differs insofar as legs **222** and **224** are pin jointed not only at the lower end at pin **112**, but also at the upper end at pins **226**. That is, head frame **230**, rather than being rigidly welded to the upper ends of legs **222**, **224** has hard points **232** than engage upper clevises **234** of legs **222**, **224**, at a tongue-and-clevis joint, being joined by pins **226** in double shear. Given that the axis of pins **226** is in the y-direction, the pin joint is not able to transmit a bending moment in the x-z plane.
[0067] In review, there is a railroad coil car **20**. It has a straight-through center sill **26** and a set of transverse troughs **32** that includes at least a first transverse trough **34** and a second transverse trough **36**. There is an intermediate slope sheet assembly **44** having a first slope sheet **86** of first trough **34** and a first slope sheet **88** of second trough **36**. Intermediate slope sheet assembly **44** is pin-joint connected to straight-through center sill **26**.
[0068] Center sill **26** has a planar top cover plate **72**. The pin-joint connection has a root or footing **102** having web continuity through top cover plate **72** of said center sill **26** by means of side plates **108**, **110** and a doubler **114**. Center sill **26** is a fish belly center sill, the fish belly being identified at

75. In an alternate version, first slope sheet **86** of first trough **34** is pin-jointed to both center sill **26** and pin-joint connected to a first trough peak assembly **94**. Center sill **26** has one of (a) a clevis such as defined by root side plates **108**, **110**; and (b) a tongue, such as tongue **106**; and first slope sheet **86** has the other of (a) a tongue such as tongue **106** and (b) a clevis such as defined by root side plates **108**, **110**, and the respective tongue and clevis are connected by a pin such as pin **112** to define the pin joint, i.e., a joint that functions as a hinge and does not transmit a bending moment.
[0069] Intermediate slope sheet assembly **44** has at least one A-frame structure **82**, **84** having a pair of first and second legs **96**, **98**, each of first and second legs **96**, **98** having a foot that is pin-joint connected to center sill **26**. Intermediate slope sheet assembly **44** has two of said A-frame structures **82**, **84**. A-frame structure **82** is aligned with first web **76** of center sill **26**, and second A-Frame structure **84** is aligned with second web **78** of center sill **26** spaced apart from first web **76**. Intermediate slope sheet assembly **44** includes a head frame **100**. First and second legs **96**, **98** of A-frame structure **82**, **84** have uppermost ends connected to head frame **100**. Head frame **100** has a web **122** that has a profile of trough peak **94** of intermediate slope sheet assembly **44**.
[0070] First slope sheet **86** has a first lateral reinforcement **90**. It has a termination at side sill **28**, **30** of coil car **20**. Reinforcement **90** is a stringer **130** that has a cuff **134** rigidly connected to side sill **28**, **30**. Cuff **134** is adjustable on fit-up during assembly, and is fixed rigidly to stringer **130** on assembly. First slope sheet **86** has a second lateral reinforcement **92** in the form of a stringer **132** that extends cross-wise behind slope sheet **86** (or **88**). Stringer **130** is a lower reinforcement and stringer **132** is an upper reinforcement. Upper stringer **132** has a different cross-section from lower stringer **130**. Upper stringer **132** has a greater second moment of area in bending perpendicular to said first slope sheet than has lower stringer **130**, a greater sectional thickness, and a greater weight of metal per lineal unit of run. Lower stringer **130** is a channel section having splayed legs. Upper stringer **132** is a channel section having parallel legs. Upper stringer **132** has a greater flexural modulus, EI, than lower stringer **130**. Intermediate slope sheet assembly **44** has and cap plates **140**. End cap plates **140** are welded to side sills **28**, **30** of coil car **20**.
[0071] Various embodiments have been described in detail. Since changes in and or additions to the above-described examples may be made without departing from the nature, spirit or scope of the invention, the invention is not to be limited to those details but only by a purposive reading of the claims as required by law. As may be understood without further multiplication and repetition of description, the various features of the several embodiments may be mixed and matched as appropriate.

Claims

1-36. (canceled)
37. A transverse trough coil car having a stub bolster and a first transverse trough mounted across said coil car, a portion of said first transverse trough being located above said stub bolster, said transverse trough defining a bolster extension extending laterally across said car outboard of said stub bolster.
38. The transverse trough coil car of claim 37 wherein said stub bolster has a side bearing mount, and said stub bolster is truncated outboard of the side bearing mount.
39. The transverse trough coil car of claim 37 wherein said first transverse trough is centered on said stub bolster.
40. The transverse trough coil car of claim 37 wherein said stub bolster includes a bottom flange and a web upstanding from said bottom flange; said transverse trough has a trough bottom and first and second slope sheets; said first and second slope sheets being inclined and extending upwardly away from said trough bottom; and said trough bottom being mounted to said web of said stub bolster to define a top flange of said stub bolster.
41. The transverse trough coil car of claim 40 wherein said coil car has first and second spaced

apart side sills; and said trough bottom and said first and second slope sheets of said first trough continue outboard beyond said stub bolster to mate with said side sills.

42. The transverse trough coil car of claim 37 wherein said coil car has a straight-through center sill, said center sill having a first truck center and a second truck center distant therefrom; said center sill has a broadened top cover plate at said first truck center; said stub bolster extends laterally away from said center sill at said first truck center; said stub bolster includes a bottom flange and a pair of first and second spaced apart webs upstanding from said bottom flange; said transverse trough has a trough bottom and first and second slope sheets; said first and second slope sheets being inclined and extending upwardly away from said trough bottom; and trough bottom being mounted to said pair of first and second webs of said stub bolster to define a top flange of said stub bolster; and said trough bottom being welded to said widened portion of said top cover plate of said center sill at said truck center.

43. The transverse trough coil car of claim 37 including said first transverse trough, said first transverse trough having a pair of first and second opposed slope sheets that, in use, co-operate to define a cradle in which to receive lading; and first and second trough peaks mounted to either side of said first transverse trough, said trough peaks having respective skirts oriented to face toward said first trough; and said slope sheets being free of a shear connection to said respective skirts.

44. The transverse trough coil car of claim 43 wherein said skirts of said trough peaks are more steeply inclined than said slope sheets.

45. The transverse trough coil car of claim 37 wherein said coil car has a straight-through center sill.

46. The transverse trough coil car of claim 45 wherein said center sill has a planar top cover plate.

47. The railroad coil car of claim 37 wherein said transverse trough coil car has a fish belly center sill.

48. The transverse trough coil car of claim 37 wherein said transverse trough coil car has: a pair of truck centers and a straight-through center sill; a set of transverse troughs that includes at least said first transverse trough and a second transverse trough; an intermediate slope sheet assembly defining a first slope sheet of said first transverse trough and a first slope sheet of said second transverse trough; and said intermediate slope sheet assembly being pin-joint connected to said straight-through center sill.

49. The railroad coil car of claim 48 wherein said center sill has a top cover plate and said pin-joint connection has a root having web continuity through said center sill top cover plate.

50. The railroad coil car of claim 48 wherein said first slope sheet of said first trough is pin-jointed to both said center sill and pin-joint connected to a first trough peak.

51. The railroad coil car of claim 48 wherein said center sill has one of (a) a clevis; and (b) a tongue; and said first slope sheet has the other of (a) a tongue and (b) a clevis, and the respective tongue and clevis are connected by a pin to define said pin joint.

52. The railroad car of claim 48 wherein said intermediate slope sheet assembly includes at least one A-frame structure having a pair of first and second legs, each of said first and second legs having a foot that is pin-joint connected to said straight-through center sill.

53. The railroad coil car of claim 52 wherein said intermediate slope sheet assembly has two of said A-frame structures, a first of said A-frame structures being aligned with a first web of said center sill, and a second of said A-Frame structures being aligned with a second web of said center sill spaced apart from said first web.

54. The railroad coil car of claim 52 wherein said intermediate slope sheet assembly includes a head frame member, and said first and second legs of said at least one A-frame have uppermost ends connected to said head frame.

55. The railroad coil car of claim 37 wherein said first slope sheet has at least a first lateral reinforcement, said first lateral reinforcement having a termination at a side sill of said coil car; and said reinforcement having a cuff rigidly connected to said side sill, said cuff being adjustable on fit-

up during assembly, and said cuff being rigidly fixed to said reinforcement on assembly.
56. The railroad coil car of claim 48 wherein said first slope sheet has at least a first lateral reinforcement and a second lateral reinforcement extending cross-wise behind said slope sheet; said first lateral reinforcement being a lower reinforcement and said second lateral reinforcement being an upper reinforcement; and said upper reinforcement has a different cross-section from said lower reinforcement.
57. The railroad coil car of claim 56 wherein said upper reinforcement has at least one of: (a) a greater second moment of area in bending perpendicular to said first slope sheet than has said lower reinforcement; (b) a greater sectional thickness than said lower reinforcement; and (c) a greater weight of metal per lineal unit of run than said lower reinforcement.
58. The railroad coil car of claim 56 wherein said upper reinforcement is a channel section having parallel legs; said lower reinforcement is a channel section having splayed legs; and said upper reinforcement has a greater flexural modulus, EI, than has said lower reinforcement.
59. The railroad coil car of claim 48 wherein said intermediate slope sheet assembly has end cap plates, and said end cap plates are welded to side sills of said coil car.