Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2771960 C 2014/02/11

(11)(21) 2 771 960

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 2001/03/12

(41) Mise à la disp. pub./Open to Public Insp.: 2002/05/02

(45) Date de délivrance/Issue Date: 2014/02/11

(62) Demande originale/Original Application: 2 660 154

(30) Priorité/Priority: 2000/11/02 (US09/705,056)

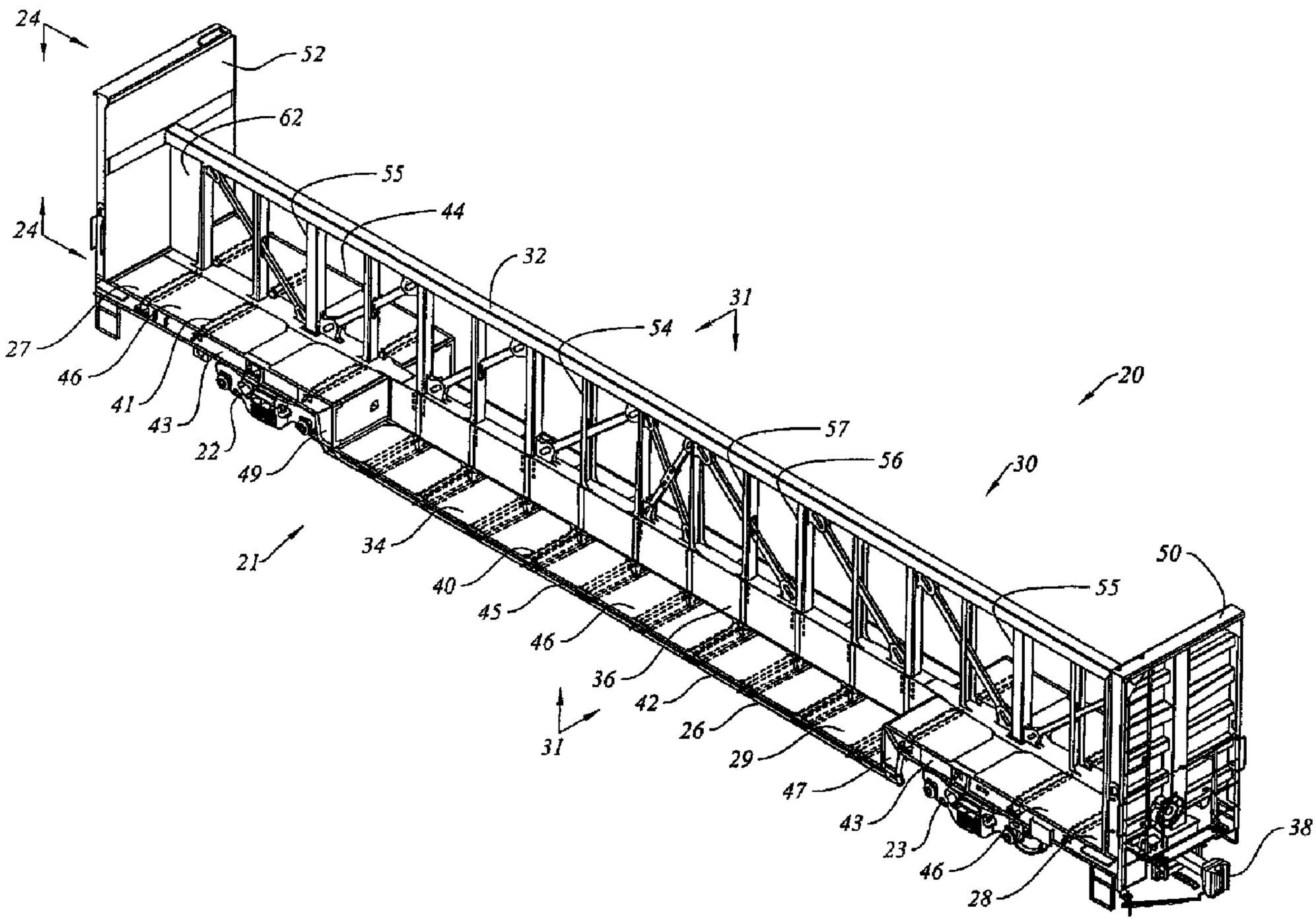
(51) Cl.Int./Int.Cl. *B61D 3/08* (2006.01),
B61D 17/10 (2006.01), *B61D 3/00* (2006.01),
B61D 45/00 (2006.01)

(72) Inventeur/Inventor:
FORBES, JAMES W., CA

(73) Propriétaire/Owner:
NATIONAL STEEL CAR LIMITED, CA

(74) Agent: BERESKIN & PARR LLP/S.E.N.C.R.L.,S.R.L.

(54) Titre : WAGON A SUPPORT CENTRAL ET A PLANCHER SURBAISSE
(54) Title: DROPPED DECK CENTER BEAM RAIL ROAD CAR



(57) Abrégé/Abstract:
A center beam car has a main deck and a vertically oriented central beam structure defining bunks for lading. The beam structure includes a top chord running between two end bulkheads. The top chord is lower than the end bulkheads. The deck has a central

CA 2771960 C 2014/02/11

(11)(21) 2 771 960

(13) C

(57) Abrégé(suite)/Abstract(continued):
portion and end portions. The end portions of the deck are higher than the center portion by the height of a bundle of lumber. The center sill is as deep as the deck step. The center sill has an internal draft gear pocket upper wall. The medial portion of the center sill is deeper and narrower than the end portion. Web separators are mounted in the medial portion of the center sill. The main posts may have flange continuity across the center sill above and below the top flange thereof. As the end deck is carried at a high level, the bolster is abnormally deep.

DROPPED DECK CENTER BEAM RAIL ROAD CAR

Abstract of the Disclosure

A center beam car has a main deck and a vertically oriented central beam structure defining bunks for lading. The beam structure includes a top chord running between two end bulkheads. The top chord is lower than the end bulkheads. The deck has a central portion and end portions. The end portions of the deck are higher than the center portion by the height of a bundle of lumber. The center sill is as deep as the deck step. The center sill has an internal draft gear pocket upper wall. The medial portion of the center sill is deeper and narrower than the end portion. Web separators are mounted in the medial portion of the center sill. The main posts may have flange continuity across the center sill above and below the top flange thereof. As the end deck is carried at a high level, the bolster is abnormally deep.

DROPPED DECK CENTER BEAM RAIL ROAD CAR

FIELD OF THE INVENTION

This invention relates generally to center beam rail road cars.

BACKGROUND OF THE INVENTION

Center beam rail road cars, in cross-section, generally have a body having a flat car deck and a center beam web structure running along the longitudinal center-line of, and standing upright from, the deck. The center beam structure is carried on a pair of rail car trucks. The rack, or center beam structure, has a pair of bulkheads at either longitudinal end that extend transversely to the rolling direction of the car. The lading supporting structure of the beam includes laterally extending deck sheets or bunks mounted above, and spanning the space between, the trucks. The center beam web structure is typically in the nature of an open frame truss for carrying vertical shear and bending loads. It stands upright from the deck and runs along the longitudinal centerline of the car between the end bulkheads. This kind of webwork structure can be constructed from an array of parallel uprights and appropriate diagonal bracing. Most often, a top truss assembly is mounted on top of the vertical web and extends laterally to either side of the centerline of the car. The top truss is part of an upper beam assembly, (that is, the upper or top flange end of the center beam) and is usually manufactured as a wide flange, or wide flange-simulating truss, both to co-operate with the center sill to resist vertical bending, and also to resist bending due to horizontal loading of the car while travelling on a curve. Typically, a center sill extends the length of the car. The center beam thus formed is conceptually a deep girder beam whose bottom flange is the center sill, and whose top flange is the top truss (or analogous structure) of the car.

Center beam cars are commonly used to transport packaged bundles of lumber, although other loads such as pipe, steel, engineered wood products, or other goods can also be carried. The space above the decking and below the lateral wings of the top truss on each side of the vertical web of the center beam forms left and right bunks upon which bundles of wood can be loaded. The base of the bunk often includes risers that are mounted to slant inward, and the vertical web of the center beam is generally tapered from bottom to top, such that when the bundles are stacked, the overall stack leans inward toward the longitudinal centerline of the car.

Lading is most typically secured in place using straps or cables. Generally, the straps extend from a winch device mounted at deck level, upward outside the bundles, to a top

fitting. The top fitting can be located at one of several intermediate heights for partially loaded cars. Most typically, the cars are fully loaded and the strap terminates at a fitting mounted to the outboard wing of the upper beam assembly. Inasmuch as the upper beam assembly is narrower than the bundles, when the strap is drawn taut by tightening the winch, it binds on the upper outer corner of the topmost bundle and exerts a force inwardly and downwardly, tending thereby to hold the stack in place tight against the center beam web.

Each bundle typically contains a number of pieces of lumber, commonly the nominal 2" x 4", 2" x 6", 2" x 8" or other standard size. The lengths of the bundles vary, typically ranging from 8' to 24', in 2' increments. The most common bundle size is nominally 32 inches deep by 49 inches wide, although 24 inch deep bundles are also used, and 16 inch deep bundles can be used, although these latter are generally less common. A 32 inch nominal bundle may contain stacks of 21 boards, each 1 - 1/2 inch thick, making 31 - 1/2 inches, and may include a further 1 - 1/2 inches of dunnage for a total of 33 inches. The bundles are loaded such that the longitudinal axes of the boards are parallel to the longitudinal, or rolling, axis of the car generally. The bundles are often wrapped in a plastic sheeting to provide some protection from rain and snow, and also to discourage embedment of abrasive materials such as sand, in the boards. The bundles are stacked on the car bunks with the dunnage located between the bundles such that a fork-lift can be used for loading and unloading. For bundles of kiln dried softwood lumber the loading density is typically taken as being in the range of 1600 to 2000 Lbs. per 1000 board-feet.

It has been observed that when the straps are tightened, the innermost, uppermost boards of the topmost bundle bear the greatest portion of the lateral reaction force against the center beam due to the tension in the straps or cables. It has also been observed that when these bundles bear against the vertical posts of the center beam, the force is borne over only a small area. As the car travels, it is subject to vibration and longitudinal inertia loads. Consequently the plastic sheeting may tend to be torn or damaged in the vicinity of the vertical posts, and the innermost, uppermost boards can be damaged. The physical damage to these boards may tend to make them less readily saleable. Further, whether or not the boards are damaged, if the plastic is ripped, moisture can collect inside the sheeting. This may lead to the growth of molds, and may cause discolouration of the boards. In some markets the aesthetic appearance of the wood is critical to its saleability, and it would be advantageous to avoid this discolouration.

In part, the difficulty arises because the bearing area against the posts may tend to be too small. Further, the join between the upstanding web portion of the center beam and the upper beam assembly can coincide with the height of the topmost boards. This join is not

always smooth. Further still, when the posts are fabricated the flanges may not stand perfectly perpendicular to the web, such that one edge of the flange may bear harder against the bundles than another. It would be advantageous to present a larger, smoother, and more homogenous surface to the bundles, or to reduce the force acting at the interface between the bundles and the beam. Use of a roll-formed section, as opposed to a fabricated (i.e., welded) flange assembly may tend to increase the probability that the facing part will be oriented correctly, will tend to have appropriately planar surfaces with smoothly radiused corners, and will tend to present fewer asperities (such as may otherwise arise with distortion and errors in welding) to the lading. Use of smoothly radiused posts, such as can be obtained with roll-formed sections, whether channel or structural tubes for the vertical posts may tend to be advantageous in this regard. Use of a smooth longitudinal beam, whether channel, rectangular tube, or square tube, of somewhat greater outside dimension than the vertical posts may also tend to be advantageous as the quality of the primary bearing surface, namely the longitudinal chord surface rather than the vertical post surface, will be determined by the quality and consistency of the roll-forming process, typically quite high, as opposed to the quality and repeatability of a manual welding process, typically much lower by comparison.

Existing center beam cars tend to have been made to fall within the car design envelope, or outline, of the American Association of Railroads standard AAR Plate C, and tend to have a flat main deck that runs at the level of the top of the main bolsters at either end of the car. In U.S. Patent 4,951,575, of Dominguez et al., issued August 28, 1990, a center beam car is shown that falls within the design envelope of plate C, and also has a depressed center deck between the car trucks. It would be advantageous to be able to operate center beam cars that exceed Plate C and fall within AAR Plate F, with a full load of lumber in bundles stacked 5 bundles high. A five bundle high load of 33 inch bundles requires a vertical clearance in the left and right hand bunks of at least 165 inches. This significantly exceeds the vertical loading envelope of a plate C car.

Increased vertical loading to exceed Plate C, as in a Plate F car, may tend also to increase the height of the center of gravity of a loaded car above the allowable vertical center of gravity height limit of 98 inches measured from top-of-rail (TOR). Consequently it may be desired to drop the center portion of the deck further to once again lower the center of gravity. However, as the deck is dropped further, the deck must also become narrower to remain within the AAR design envelope, whether of Plate C or Plate F. Further still, when the truck centers of the car exceed 46 ft. 3 in., the mid-span car width must be reduced due to swing out as the car travels through corners. That is, the car must lie within the design envelope of a 10'- 8" wide car with 46' – 3" truck centers, on a 13° curve (equivalent to a track center radius of 441.7 ft.). A car having a nominal length of 73 ft, and a 40' – 6" well,

will tend to have a distance between truck centers of the order of 56 to 60 ft. The allowance for swing out, (that is, the reduction in width to match a car having 46' – 3" truck centers), for such a car is significant.

As the allowable car width becomes narrower, either due to increasing the truck centers beyond 46 ft. 3 in., or due to lowering the height of the decking, it is highly desirable to retain as much of the remaining lateral width as possible to support the bundles. Moreover, it has become desirable to provide a bunk width sufficient to carry 51 inch wide bundles, as well as 49 inch wide bundles. In the past, as shown in U.S. Patent 4,951,575 winches have been installed outboard of the side sills at longitudinal stations corresponding to the longitudinal stations of the outboard ends of the cross bearers. These winches are used to cinch the strapping that is used to secure the load to the center beam top compression member wings, or, in the case of a partially loaded car, to the center beam main vertical web assembly. The winches tend to extend further laterally outboard, relative to the longitudinal centerline, than any other part of the car. Given the inwardly angled profile of the lower portions of the Plate C and Plate F envelopes, each incremental decrease in overall car width measured from the centerline to the outboard extremity of the winch permits an incremental lowering of the loaded center of gravity of the car. Consequently, it is advantageous to make the winch mounting as laterally compact as possible.

Further, given that the allowable width of the car decreases as truck center distance increases, and given that the allowable width envelope is fixed for a given truck center distance, for cars in which the center sill extends above the lading interface of at least a portion of the decking structure, as is the case in a dropped deck center beam car, another way of widening the effective bunk width on which to carry lading is to employ a relatively narrow center sill. However, the width of the center sill outboard of the truck center generally defines the width of the draft pocket. Since coupler sizes are standard for interchangeable service, the minimum inside width of the draft-pocket is generally considered to be a fixed pre-determined dimension, typically 12 – 7/8". Therefore it would be advantageous to employ a draft sill of varied width, having a first, relatively wide longitudinally outboard portion in which to mount draft gear and a coupler, and a second, relatively narrower mid-span, or waist, portion between the trucks. Similarly, given that the allowable car width envelope is narrowest at mid-span, and widest at the truck centers, it may be advantageous for a portion of the deck at mid-span to be narrower than another portion of the deck either (a) closer to, or at, the truck centers; or (b) at a higher elevation at which the underframe envelope may be wider; or both.

In known center beam cars, such as those shown in U.S. Patent 4,951,575 and in U.S. Patent 4,802,420 of Butcher et al., issued February 7, 1989, the deck structure of the cars has included inwardly tapering risers mounted above the cross bearers, with longitudinally extending side sills running along the ends of the cross-bearers. The side sills have been angle or channel sections. In U.S. Patent 4,951,575 the side sills are Z-sections with the upper leg of the Z extending outward, the lower leg extending inward, and the web between the two legs running vertically. In U.S. Patent 4,802,420 of Butcher et al., the side sill is a channel section, with the legs extending laterally outward and the web, being the back of the channel, extending vertically between the two legs. In both cases the winch is mounted outward of the vertical web.

It is advantageous to be able to carry loads other than, for example, bundles of lumber, on at least a part of the return journey. While this can be done with center beam cars presently in use, the overhanging wings of the top truss may tend to complicate loading of the car from above. For example, it may be more convenient to load pipe, or other objects, using an overhead crane rather than to employ side loading using a fork-lift of perhaps more limited lifting capacity. Such loading would be facilitated by removal of the top truss. Further still, in addition to removal of the top truss, truncation of the central web at a level below the bottom of the uppermost row of bundles permits the top row of bundles to be loaded side by side. Strapping for securing the load, rather than being attached to the wings of the top truss, can be carried fully over the load to the winches at deck level on opposite sides of the car. In addition, the top chord can be made wider than the posts, such that the bundles bear against the smooth outside face of the top chord at a stand-off distance clear of the flanges of the posts.

When a reduced height top chord is used, the junction of the top chord with the end bulkheads occurs at a mid-height level. This juncture may tend to act as a discontinuity, or weakness in the end bulkhead structure. Particularly when dealing with an end impact in which the load may tend to want to drive into the bulkhead, it is desirable that there be web continuity (a) between the webs of the top chord member and the vertical posts of the bulkhead member; and (b) between the web formed by the shear panel of the end-most bay and the webs of the vertical posts of the end bulkhead. In past center beam cars, the web of the end-most bay has been mounted to the leg of a vertically extending T-shaped beam, with the flange of the T-shaped member lying in the plane of the skin of the end bulkhead. When the end post of the car is a channel, or rectangular tube, the webs of the channel stand in planes lying to either side of the plane of the shear panel of the endmost bay. As described herein below, the cross-members of the bulkhead have flange continuity through the end post, such that a continuation of the web or the

shear panel on the inside of the skin of the bulkhead can extend between the legs of the laterally extending cross-members. Shear can then be transferred from the shear panel into the cross-members and thence into the webs of the end post.

In center beam cars it is desirable that the main center sill be aligned with the couplers to reduce or avoid eccentric draft or buff loads from being transmitted. In dealing with lateral loads, the side sills act as opposed flanges of a beam and the floor sheets act as the web. The loads in the side sills, whether in tension, compression, vertical shear or lateral bending, tend to be transferred to the main sill through a main bolster assembly at each end of the car. In general the main bolster is located at a level corresponding to the height of the main sill, and the shear plate, if one is used, is typically at a level corresponding to the level of the upper flange of the main sill.

It is desirable to have a well deck, also called a depressed center deck or dropped deck, between the trucks, to increase the load that can be carried, and so to increase the overall ratio of loaded weight to empty weight of the car, and also to reduce the height of the center of gravity of the car when loaded, as compared to a car having a flat, straight through deck from end to end carrying the same load. In the case of a well deck, longitudinal compression and tension loads in the side sills must be carried from the level of the side sills in the well, to a second, higher level of the side sills to clear the trucks, and then through the bolster structure and into the main sill. The transmission of forces through the vertical distance of the eccentricity of the rise from the side sills height in the well to the side sill height of the end deck adjoining the bolster results in the generation of a moment. When the side sill has a knee at the transition from the well to the end structure of the car, the height of the knee defines the arm of the moment.

The coupler height of rail road cars is 34 1/2" above top of rail (TOR). This is a standard height to permit interchangeable use of various types of rail cars. The main sill, or stub sill if used, tends to have a hollow box or channel section, the hollow acting as a socket into which the draft gear and coupler are mounted. The minimum height of the top flange of the main sill at the trucks (or stub sill, if one is used) and the top flange of the end structure bolsters tends to be determined by the coupler height. The depth of the main bolster is limited by the need to lie high enough to clear the wheels plus a height to accommodate that portion of the coupler and draft gear about the coupler center line. At the same time, the height of the well deck is limited by the design envelope, be it Plate C, Plate F, or some other. In general, however, the rise to the height of the shear plate, or top flange of the bolster, from the well decking is less than the desired 33 inch bundle height. It is desirable for the top of the first layer of bundles stacked in the well to be at a

height that permits the next layer of bundles to match the height of bundles stacked over the trucks. Consequently, it would be advantageous to have an end deck, or staging, mounted above the shear plate, or if there is no end structure shear plate, then above the bolster, at a level to match the level of the top of the bundles carried in the well between the trucks. However, increasing the height of the end deck implies an increase in the height of the knee.

One way to reduce the maximum stress at the knee is to make the side sill section of the end portion of the sill deeper. Another way to reduce the maximum stress at the knee is to make the knee member wider. On the longitudinally inwardly facing side of the knee (that is, the side oriented toward the lading in the well) the flange of the vertical leg of the knee may tend to extend perpendicularly. On the longitudinally outboard side, that is, the side facing the truck, the longitudinally outboard flange can be angled, or swept, resulting in a tapering leg, rather than one with parallel flanges. An increase in the section width, due to tapering the longitudinally outboard flange is desirable, as it may tend to permit a reduction in the maximum local stress levels in the side sill assembly at the knee, and tends to provide greater truck clearance.

When a relatively deep, relatively narrow, center sill is employed, such as in a dropped-deck center beam car having a full bundle step height, it is desirable both to discourage the center-sill from collapsing in a parallelogram manner, and to provide web continuity at the base of the center beam posts such that in terms of structural analysis, their footing may tend more closely to approximate a built-in connection, as opposed to a pin-jointed connection. Similarly, where there would otherwise be no web continuity of the cross-bearers through the center sill, such as when the cross-bearers are underslung beneath the centersill, and the cross-bearers may transmit laterally unequal loads tending to twist the center sill, it is advantageous that the center sill be discouraged from deformation in the parallelogram mode. For these reasons, is advantageous to provide internal filler braces, or webs within the center sill, and preferable to provide that bracing, or webbing, at the longitudinal stations corresponding to the locations of the webs of the vertical posts.

When the center sill is relatively deep, and narrow, installation of internal webs may challenge the skill of the fitters. It may be preferable to be able to attach at least a portion of the web from outside the center sill. That is, where either the upper, or lower flange of the center sill and the two webs have been welded together and the center sill has a high aspect ratio of depth to width, and only one flange remains to be attached, making internal welds to a gusset plate may be rather difficult. The welder may only be

able to weld the portion of the gusset near to the open end of the center sill. Hence it is advantageous to provide pre-attached wleding backing means, such as angles, and making welding slots in the web of the side sills at the desired gusset locations. This tends to permit the relatively inaccessible end of the gussets to be joined to the webs through a welded connection made from outside the center sill.

Torsional loads applied to the center beam assembly are transmitted through the trucks and reacted at the rails. A significant portion of this load is transferred into the deck and main sill structure at the longitudinal location of the truck center by the main posts that extend upwardly from the deck above the truck center. It may be that the main post is narrower than the center sill top cap (i.e., upper flange), and narrower than the underlying center sill webs. It such circumstances it may be advantageous to provide web and flange continuity in the center sill beneath the main post.

SUMMARY OF THE INVENTION

In an aspect of the invention there is a center beam rail road car. It has a deck structure carried by rail car trucks. The deck structure has first and second end portions and a medial portion lying between the first and second end portions. The medial portion is stepped downward relative to the end portions. First and second end bulkheads extend upwardly from opposite ends of the deck structure. A central beam assembly runs lengthwise along the rail road car between the bulkheads. The beam assembly stands upwardly of the deck structure. The bulkheads extend to a greater height relative to top of rail than the central beam assembly.

In an additional feature of that aspect of the invention, the bulkheads extend to a height extending beyond AAR plate 'C'. In another feature, the bulkheads fall within AAR Plate 'F'. In another additional feature, the rail road car has a loading height limit, H1, measured upwardly from the medial deck portion. The central beam assembly has an uppermost portion lying at a height, H2, measured upwardly from the medial deck portion, and H1 exceeds H2 by at least 33 - 5/8 inches. In another feature, the loading height limit is within AAR Plate F. In a further additonal feature, the loading height limit exceeds AAR plate C.

In a further additional feature, the bulkheads have a height, H1, measured relative to the medial deck portion, and the central beam assembly has a height H2 measured

relative to the central beam assembly; and the ratio of H1 to H2 is at least as great as 4 : 3. In an additionally further feature, the ratio of H1 to H2 is at least as great as 5 : 4. In still another feature, the medial portion of the deck structure is stepped downward relative to the end portions by a third height, H3, and the ratio of (H1 – H3) : H2 is at least as great as 3 : 2. In a still further feature, the medial portion of the deck structure is stepped downward relative to the end portions by a third height, H3, and the ratio of (H1 – H3) : H2 is at least as great as 4 : 3.

In still another feature, the medial portion of the deck is stepped downward relative to one of the end portions of the deck a distance of at least 30 inches. In a further additional feature, the medial portion of the deck is stepped downward relative to one of the end portions of the deck a distance of at least 33 5/8 inches. In still another feature, the bulkheads exceed the central beam assembly in height by a distance that is at least 33 – 5/8 inches.

In yet a further feature of that aspect of the invention, the central beam assembly includes a top chord member extending between the end bulkheads. In an additional feature, the top chord member is a beam having smooth sides, the smooth sides each presenting a smooth surface against which to place lading. In another feature, the central beam assembly includes at least one post standing upwardly of the deck structure, and the top chord is wider than the at least one post. In still another feature, the post presents a smoothly radiused surface to lading placed next to the central beam assembly. In a further feature, the medial deck portion lying between the two trucks is at least 28' - 0" long. In a further additional feature the medial deck portion lying between the two trucks is at least 40' - 0" long.

In another feature of that aspect of the invention, the rail road car further includes a center sill extending along the rail road car. The center sill has an upper flange, a lower flange, and at least one upright web connecting the upper and lower flanges. The upper flange lies at a height corresponding to the first end portion of the deck structure. The lower flange lies at a height corresponding to the medial portion of the deck structure. In still another feature, the car has a pair of side sills extending along the deck structure. The side sills each have a medial side sill portion mounted to the medial deck portion. The medial side sill portion having a first depth of section. The side sills each have end side sill portions mounted to the end deck portions. The end side sill portions have a second depth of section, and the first depth of section is less than the second depth of section.

In another feature, the end deck portions each have a lading interface upon which lading can be carried, and the respective lading interfaces each lie at a height greater than 42 inches above top of rail. In stillanother feature a center sill extends along the deck structure, the center sill includes an end portion extending longitudinally outboard of one of the trucks, and the end portion of the center sill has an upper flange lying at a height corresponding to the height of the lading interfaces of the end portions of the deck structure.

In still yet another feature, a center sill extends along the deck structure. The center sill has an end portion extending longitudinally outboard thereof. The end portion of the center sill includes a top flange and a pair of spaced apart webs extending downwardly of the top flange. The webs define sides of a draft sill portion of the center sill. The end portion of the center sill includes a plate mounted between the webs below the top flange, and the plate defines a top cap of the draft sill portion of the center sill. In a further feature, the the top flange of the end portion of the center sill lies at a height greater than 42 inches above top of rail, and the end portions of the deck structure include deck plates mounted to the top flange.

In still another feature, the car has a pair of side sills extending along the deck structure. The side sills each have a side sill medial portion mounted to the medial decking portion, the medial side sill portion having a first depth of section. The side sills each have side sill end portions mounted to the end decking structures, the end side sill portions having a second depth of section. Each of the side sills has a knee joining the side sill medial portion to each of the side sill end portions. Each knee has a longitudinally inboard flange, a longitudinally outboard flange, and webbing extending therebetween. The longitudinally outboard flange has a lower extremity and an upper extremity; and the lower extremity lies at a longitudinally inboard station relative to the upper extremity.

In still yet another feature, the car has a pair of side sills extending along the deck structure. The side sills each have a medial side sill portion mounted to the medial decking portion. The side sills each have end side sill portions mounted to the end decking structures. The medial side sill portion has a medial portion side sill web extending from a first margin to a second margin, the first margin lying at a greater height than the second margin, and the first margin lying a further distance transversely outboard than the second margin. In a further feature, the medial decking portion has at least one lading securement apparatus mounted to the medial portion side sill web.

In yet another additional feature, the medial portion of the deck structure is connected to the first end portion of the deck structure at a transition member, the transition member including a foothold to facilitate ascent of the first end portion of the deck structure from the medial portion of the deck structure. In another feature, the transition member includes a vertical transition bulkhead extending between the medial portion of the deck structure to the first end portion of the deck structure, and the foothold is a step formed in the vertical transition bulkhead.

In still another feature of that aspect of the invention the center beam rail road car further includes a center sill running along the deck structure. The first end portion of the deck structure having a first end deck sheet. The center sill has a first center sill end portion. The center sill end portion has an upper flange and a pair of spaced apart webs extending downwardly from the upper flange. A draft pocket cap plate is mounted within the first center sill end portion between the pair of spaced apart webs. The draft pocket cap plate lies at a lower level than the deck sheet, and a draft pocket is defined between the pair of webs and below the draft pocket cap plate. In another feature of that additional feature, a first bolster extends laterally from the main sill to support the first end portion of the deck structure, the bolster having a upper flange extending in a plane lying at a greater height from top of rail than the draft pocket cap plate. In still another additional feature, the center sill has a central portion adjacent to the medial portion of the decking structure and first and second end portions adjacent to the first and second end portions of the decking structure. The central portion of the center sill has an upper flange, a pair of spaced apart webs extending downwardly from the upper flange and a lower flange mounted to the webs. The upper flange, the lower flange and the webs of the center sill define a hollow box beam. The medial portion of the deck structure has a deck sheet; and the lower flange of the central portion of the center sill is mounted at a level corresponding to the deck sheet of the medial portion of the decking structure. In an additional feature, the center sill has a depth of section between the upper flange and the bottom flange of at least 30 inches.

In another additional feature, side sills extend along either side of the deck structure. The side sills each have a medial portion running along the medial portion of the deck structure, and first and second end portions running along the first and second end portions of the deck structure. The end portions of the side sills have a greater depth of section than the medial portions of the side sills.

In another aspect of the invention, there is a center beam rail road car having a deck structure carried on railcar trucks for rolling motion in a longitudinal direction. A pair of first and second bulkheads extend upwardly of the deck structure at either end thereof. A central beam assembly stands upwardly of the deck structure and runs lengthwise along the deck structure between the bulkheads. The central beam assembly has a top chord spaced upwardly from the deck structure. The top chord is rigidly connected to the bulkheads. The first bulkhead has a bulkhead sheet having a first face oriented longitudinally inboard, and a central vertical post mounted longitudinally outboard of the bulkhead sheet. The central vertical post includes a pair of first and second spaced apart webs extending longitudinally outboard of the sheet. The central beam assembly including a shear panel extending longitudinally inboard of the bulkhead sheet, the shear panel lying in a plane offset from the webs. The bulkhead has transverse beams mounted between the webs of the central vertical post. The bulkhead has at least one shear panel extension member mounted to the bulkhead sheet and extending longitudinally outboard therefrom. The shear panel extension is connected to at least one of the transverse beams.

In an additional feature of that aspect of the invention, the shear panel extension is co-planar with the shear panel. In another additional feature, the central vertical post includes a flange spaced longitudinally from the bulkhead sheet, the flange, the sheet and the webs of the vertical post forming a hollow box section. In a further feature, the transverse beams form closed hollow sections when mounted to the bulkhead sheet. In still another feature, the transverse beams are channel sections having toes mounted to the bulkhead sheet.

In still another feature, at least one of the transverse beams includes arms extending transversely outboard of the webs of the vertical post along the bulkhead sheet. In yet another feature, the central beam assembly includes a top chord mated with the bulkhead in line with the central vertical post, and the bulkhead includes a cross beam mated to the central vertical post at a level corresponding to the top chord. In another feature, the cross beam lies longitudinally outboard of the bulkhead sheet and includes an arm having a proximal portion mounted to the vertical post, and a distal portion lying transversely outboard thereof, the arm being tapered to a smaller section at the distal portion than at the proximal portion.

In a further aspect of the invention there is a center beam rail road car having a

deck structure carried on railcar trucks for rolling motion in a longitudinal direction, a pair of first and second bulkheads extending upwardly of the deck structure at either end thereof, and a central beam assembly standing upwardly of the deck structure and running lengthwise along the deck structure between the bulkheads. The central beam assembly has a top chord spaced upwardly from the deck structure at a first height relative to top of rail, the top chord being rigidly connected to the bulkheads. The first bulkhead has a bulkhead sheet having a first face oriented longitudinally inboard, and a central vertical post mounted longitudinally outboard of the bulkhead sheet. The central beam assembly includes a top chord mated with the bulkhead in line with the central vertical post. The first bulkhead has a cross beam mated to the central vertical post at a height corresponding to the first height of the top chord. The cross beam lies longitudinally outboard of the first bulkhead sheet and includes a pair of first and second extending to either side of the central vertical post. Each of the arms has a proximal portion mounted to the vertical post, and a distal portion lying transversely outboard thereof. Each arm is tapered to a smaller section at the distal portion than at the proximal portion, whereby the connection of the top chord to the first bulkheads is reinforced both vertically and transversely. In an additional feature of that asapect of the invention, the first bulkhead extends to a second height relative to top of rail, the second height being greater than the first height.

In still another aspect of the invention, there is a center beam rail road car having a deck structure carried by rail car trucks, each of the cars having a truck center. A central beam assembly runs lengthwise along the rail road car, the central beam assembly standing upwardly of the deck structure. A center sill supports at least a portion of the deck structure, the center sill extending longitudinally above at least one of the trucks. The center sill has a top flange and a pair of spaced apart webs extending downwardly from the top flange. A bolster supports at least a portion of the deck structure. The bolster extends laterally from the center sill abreast of the truck center. The central beam assembly having a post extending vertically upward above at least one of the truck centers, the post having a first pair of flanges each lying in a longitudinal vertical plane, and a second pair of flanges each lying in a cross-wise vertical plane. The post is mounted to the center sill in a mounting arrangement having flange continuity above and below the level of the top flange of the center sill.

In an additional feature of that aspect of the invention, the bolster has a pair of longitudinally spaced vertical webs. The bolster includes gussets mounted between the

webs of the center sill in line with the spaced vertical webs to provide web continuity through the center sill. First and second longitudinal gussets extend in vertical spaced apart planes between the spaced vertical webs, the first and second longitudinal gussets providing flange continuity to the first pair of flanges of the post. In another additional feature, the bolster has a pair of longitudinally spaced vertical webs; the bolster includes gussets mounted between the webs of the center sill in line with the spaced vertical webs to provide web continuity through the center sill. First and second longitudinal gussets extend in vertical spaced apart planes between the spaced vertical webs, the first and second longitudinal gussets providing flange continuity to the first pair of flanges of the post. Third and fourth cross-wise gussets are mounted between the first and second gussets, the third and fourth gussets to provide flange continuity to the second pair of flanges of the post.

In another aspect of the invention, a center beam rail road car has a deck structure carried on railcar trucks for rolling motion in a longitudinal direction. A pair of first and second bulkheads extend upwardly of the deck structure at either end thereof. A central beam assembly stands upwardly of the deck structure and runs lengthwise along the deck structure between the bulkheads. The deck structure is supported by a center sill. The center sill has a first, longitudinally outboard portion and a second portion between the rail car trucks. The second portion is narrower than the first portion.

In yet another aspect of the invention, there is a center beam rail road car having a deck structure carried on railcar trucks for rolling motion in a longitudinal direction, and a central beam assembly standing upwardly of the deck structure and running lengthwise along the deck. The deck structure being supported by a center sill. The center sill has a first portion mounted between the trucks, the first portion having a height and a width, the height being greater than the width. The center sill has at least one internal web member mounted therewithin. The center sill has welding apertures formed therein, the welding apertures permitting at least a portion of the web member to be welded in place from outside the center sill.

In a still further aspect of the invetnion, there is a center beam rail road car having a deck structure carried on railcar trucks for rolling motion in a longitudinal direction, and a central beam assembly standing upwardly of the deck structure and running lengthwise along the deck. The deck structure being supported by a center sill. The deck structure includes a first portion mounted above one of the trucks, and a second portion mounted

between the trucks. The second portion of the deck structure being stepped downwardly relative to the first portion of the deck structure. The center sill has a first portion mounted between the trucks. The first portion has a height and a width, the height being greater than the width in a ratio of at least 2.0 : 1.0. The center sill has at least one internal web member mounted crosswise therewithin.

These and other aspects and features of the invention may be understood with the assistance of the Figures and description as provided hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure **1** shows an isometric, general arrangement view of a center beam rail road car having a depressed center deck;

Figure **2a** shows a side view of a center beam rail road car similar to the center beam car of Figure **1**;

Figure **2b** shows a top view of the center beam rail road car of Figure **2a**;

Figure **2c** shows a side view of an alternate configuration of car to that shown in Figure **2a**;

Figure **2d** shows a top view of the center beam rail road car of Figure **2c**;

Figure **3** shows a perspective view of a detail of a deck transition section of the center beam car of Figure **2a**;

Figure **4a** shows a cross-section of the car of Figure **2a** taken on section '**4a - 4a**';

Figure **4b** shows a cross-section of the car of Figure **2a** taken on section '**4b - 4b**';

Figure **4c** shows a cross-section of an end deck looking toward the main bolster of the car of Figure **2a** taken on Section '**4c – 4c**';

Figure **4d** shows a cross-section of an end deck looking toward a cross-tie of the car of Figure **2a** taken on Section '**4d – 4d**';

Figure **4e** is a cross-section of the center sill of the railcar of Figure **2a** looking horizontally on a vertical plane, indicated as '**4e – 4e**' in Figure **2b**;

Figure **4f** is a partial top view of the center sill of Figure **4e**, in a region inboard of the main bolster with top flange removed;

Figure **4g** is a partial sectional view of a detail of the center sill of Figure **4f** taken at the main bolster;

Figure **4h** is a cross section of a portion of the center sill of Figure **4e** as viewed from above, taken on a horizontal plane, indicated as '**4h – 4h**' in Figure **2a**;

Figure **4i** shows a cross section of a deck knee of the rail car of Figure **2b** taken on '**4i – 4i**';

Figure **5a** shows an isometric view of the end bulkhead of the center beam car of Figure **2a**;

Figure **5b** shows a half section of the bulkhead of Figure **2a** looking vertically downward on section '**5b – 5b**'; and

Figure 5c shows a partial section of the bulkhead of Figure **2a** looking horizontally inboard on section '**5c – 5c**'.

Detailed Description Of The Preferred Embodiment

The description which follows, and the embodiments described therein, are provided by way of illustration of an example, or examples of particular embodiments of the principles 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 which follows, like parts are marked throughout the specification and the drawings with the same respective reference numerals. The drawings are not necessarily to scale and in some instances proportions may have been exaggerated in order more clearly to depict certain features of the invention.

In terms of general orientation and directional nomenclature, for each of the rail road cars described herein, the longitudinal direction is defined as being coincident with the rolling direction of the car, or car unit, when located on tangent (that is, straight) track. In the case of a car having a center sill, whether a through center sill or stub sill, the longitudinal direction is parallel to the center sill, and parallel to the side sills, if any. Unless otherwise noted, vertical, or upward and downward, are terms that use top of rail **TOR** as a datum. The term lateral, or laterally outboard, refers to a distance or orientation extending cross-wise relative to the longitudinal centerline of the railroad car, or car unit, indicated as **CL - Rail Car**. The term "longitudinally inboard", or "longitudinally outboard" is a distance or orientation relative to a mid-span lateral section of the car, or car unit.

A center beam railroad car is indicated in Figure **1** generally as **20**. It has a center beam rail road car body **21** supported by, or carried on, a pair of longitudinally spaced apart railroad car trucks **22** and **23** and is operable to roll in a longitudinal rolling direction along rails in the generally understood manner of rail cars. Car **20** has a longitudinal centerline **25** lying at the center of the coupler height and lying in a longitudinal plane of symmetry, indicated generally as **24**. Plane **24** intersects pin connections of trucks **22** and **23** at the center plates of the trucks. Car **20** has a lower deck structure **26** upon which cargo can be placed. Deck structure **26** has elevated end deck portions **27**, **28** and a medial deck portion

29, carried between the trucks at a height, relative to the top of rail (TOR) that is lower than the height of the end deck portions 27, 28.

The structure of a center beam car is analogous to a girder deep beam having a tall central structure to approximate the web of a beam, or a web-like structure or truss assembly, a wide flange at the bottom, and a longitudinally extending chord member at the top. In the case of car 20, the central web assembly is indicated generally as 30 and runs in the longitudinal direction (that is, the rolling direction of the car), the top flange function is served by a top chord 32, and the lower flange function is performed by an assembly that includes a lateral support structure 34, and a main center sill 36. Lateral support structure 34 generally includes deck structure 26, and its outboard left and right hand side sills 42 and 44.

It will be appreciated that aside from fittings such as hand grabs, ladders, brake fittings, and couplers, the structure of car 20 is symmetrical about the longitudinal plane of symmetry 24, and also about the transverse plane of symmetry 31 at the mid-length station of the car. In that light, a structural description of one half of the car will also serve to describe the other half. The features of car 20 thus enumerated are basic structural features of a center beam car having a depressed center deck.

In detail, main center sill 36 is a fabricated steel box beam that extends longitudinally along centerline 25 of car 20 throughout its length, having couplers 38 mounted at either end. Cross bearers 40 and cross-ties 41 extend outwardly from center sill 36 to terminate at left and right hand side sills 42, 44 that also run the length of the car. These cross bearers 40 and cross ties 41 extend laterally outward from center still 36 on approximately 4 ft centers. Deck sheeting, identified as decking 46, is mounted to extend between cross-bearers 40 and cross-ties 41, providing a shear connection between opposing side sills when side loads are imposed on the car, as in cornering. The combined structure of center sill 36, cross-bearers 40, cross-ties 41, side sills 42, 44 and decking 46 provides a wide, lading support assembly extending laterally outward from the longitudinal centerline 25 of car 20.

As noted above, deck structure 26 has a first end portion, namely end deck portion 27, a second end deck portion, namely end deck portion 28, and a medial deck portion 29. At each of the transitions from either end deck portion 27 or 28 to medial deck portion 29 there is a knee, indicated respectively as 47 or 49. Not only is deck structure 26 stepped in this manner, but so too are side sills 42 and 44, each having first and second end members, or end portions, 43, and a medial member, or medial side sill portion 45.

At either end of car **20** there are vertically upstanding fore and aft end bulkheads **50** and **52** which extend from side to side, perpendicular to the central longitudinal plane **24** of car **20**. Running the full length of car **20** between end bulkheads **50** and **52** is an array **54** of upright posts **56, 57**. Array **54** is reinforced by diagonal braces **63, 64, 67, 68** that provide a shear path for vertical loads. The array **54** of posts **56, 57** is surmounted by an upper beam, namely top chord **32** to form a central beam assembly standing upwardly of the deck structure. In this central beam structure, array **54** and the diagonal braces co-operate to provide a shear transfer web-like structure between center sill **36** and top chord **32**. As shown, end bulkheads **50** and **52** are taller than the central beam assembly. That is, taken relative to top of rail, the height of the top of the bulkheads is greater than the height of the upper extremity of top chord **32**.

Array **54** includes square tube main posts **55** extending upwardly at the longitudinal station of the main bolster at the truck centers, posts **56** made of rectangular steel tube, and posts **57** having a generally C-channel shaped section, both types being more fully described below. The end bays have solid panels **61, 62** respectively. End diagonal struts **63, 64** extend upwardly and longitudinally outboard away from the respective truck centers. Structural reinforcement members in the nature of left and right hand two-bay inboard diagonal braces, are indicated as **67, 68**. The mid-span bay has a pair of crossing, single bay diagonal braces **66**.

In Figures **2c** and **2d**, a car **70** is similar to car **20**, except insofar as single bay diagonal braces **74** are used rather than double bay braces. In both of cars **20** and **70**, the respective end deck portions are offset upwardly from the lading supporting structure of medial deck portion **29** by a height increment indicated as δ (Figure **2a**). In the embodiments illustrated in Figures **2a, 2b, 2c** and **2d**, the step increment corresponds to the height of a nominal 31 1/2 inch bundle of lumber, plus dunnage, (that is, 31½ inches of lumber plus 1 – ½ inches of dunnage), totalling 33 inches plus a ⅝ inch tolerance for an actual step height of 33⅝" (+/ - ⅛"). If the bundle of lumber is a lesser height, such as 30 inches, the discrepancy may be made up by additional dunnage.

Figure **4a** is a half sectional view of center beam railroad car **20** taken at mid-span of medial deck portion **29**, looking toward the nearest adjacent cross-bearer **40**. Figure **4b** is a half sectional view of facing knee **47** (or **49**). The outline of AAR Plate **F** is indicated generally as '**F**'. The main center sill is indicated, as above, as **36**. It has an

upper horizontal member in the nature of main sill upper flange **102**, and a pair of spaced apart vertical shear carrying members in the nature of left and right hand main sill webs **103, 104,** thus forming three sides of a box. The fourth side of the box is formed by a lower horizontal member, in the nature of a main sill lower flange **106**. Lower flange **106** has an end portion, running along the outboard portion of main sill **36**, in a manner similar to a stub sill, indicated in Figure **4e** as **108** at a height for mounting upon truck **22** or **23** as the case may be. An internal web, or false flange, **226**, noted below, is mounted between webs **103** and **104** at a height part way between the height of portion **108** and upper flange **102**. Rectangular draft pocket **224** is defined between items **226, 103**, and **104** and is of a size and shape to receive draft gear and the shank of a coupler, such as coupler **38**.

As seen in Figure **4e** the inboard portion of lower flange **106** of main sill **36**, such as extends along medial deck portion **29**, is indicated as **110** and lies at a height relative to TOR that is lower than portion **108**. Lower flange portions **108** and **110** are joined by a kinked, swept transition section **109**.

As seen in Figure **3** in the medial, or drop deck portion of the car, indicated as **29**, there are cross-bearers, **40**, as noted above. The endmost cross-bearer of portion **29** next to knee **47** is indicated as **112**. It is suspended from, and extends transversely to, main center sill **36**. Cross bearer **112** has a vertically standing web, **114**, and left and right hand upper flanges **115, 116** (Figure **4a**). Flanges **115, 116** lie flush, and co-planar, with the outboard extremities of lower flange portion **110**. (That is, flush with the portions of flange portion **110** that stand outwardly proud of vertical webs **103** and **104**). The join between flanges **115, 116** and flange portion **110** is smoothly radiused.

Web **114** has left and right hand tapered portions **117, 118,** and a continuous lower flange **120** that follows the profile of the lower edge of portions **117, 118**. Longitudinal gussets **122, 123** are placed between adjacent cross-bearers **40** to encourage the transfer of vertical loads from web **114** of cross bearers **40** to webs **103, 104** of center sill **36**. The ends of upper flanges **115, 116** and lower flange **120** are flared and radiused to meet the inner face of longitudinally extending medial side sill portion **45**. The upper flange **130** of medial side sill portion **45** lies flush, and co-planar with, upper flange **115**, (or **116** as may be). Those portions of flange **110**, flange **115** (or **116**) and flange **130** that remain exposed provide a peripheral lap surface upon which floor sheets **127, 128** can be welded, providing a shear connection between those elements.

As seen in Figures **4a** and **4b**, medial side sill portion **45** has a channel-like profile, having top or upper flange **130**, noted above, a bottom or lower flange **132**, and a back, or web, **134**. However, while top flange **130** and bottom flange **132** lie in parallel horizontal planes, web **134** does not stand perpendicular to them, and does not stand vertically perpendicular. Rather, web **134** is canted upward and outward at an angle **β** measured from the vertical, such that flange **130** is displaced, or skewed, or stepped, outward relative to flange **132**. As seen in Figure **4a**, the extent of this outward positioning is such that both upper and lower flanges fall within the envelope of Plate **C**. A load securing device in the nature of a winch **138** is mounted to the outboard face of web **134** for tightening strapping **136** about the lading **137**. The slanted incline of web **134** permits the center of rotation of winch **138** to be drawn inward toward the center line of rail car **20** (or **70**), thus tending to permit the medial portion **29** of deck structure **26** to be carried at a lower height than might otherwise be the case.

Straps **136** (Figure **4a**) are provided to wrap about the load, and to be tightened by a winch type of mechanism, noted above as **138**, or similar tightening device mounted to the respective side sill **42** or **44**. An operator turns winch **138** with the aid of an extension bar or handle (not shown). When tightened, straps **136** bear against the outboard, upper corners of the **L5** bundles, tending to force their inboard, upper regions, indicated tightly together, and tending to cause the **L5** bundles to be drawn down tightly atop the **L4** bundles, thus tightening the stack from **L1** to **L5**. Straps **136** are anchored on the far side of the car to load securing, or anchoring, means in the nature of bent-rod hooks **139**.

The construction of end deck portion **28** (or **27**), is shown in Figures **1**, **2**, and **3**. Main bolster **200** (Figures **2b**, **4c**) extends laterally outward from the main sill **36** at the longitudinal station corresponding to the truck center, whether of truck **22** or **23**, the car being symmetrical about its mid span transverse plane **31**. The lower flange **208** of bolster **200** (Figure **4c**) is formed to follow an upwardly and outwardly stepped profile to clear the wheels of truck **22** (or **23**) through the turning envelope of the truck relative to the car body generally. End deck structure **140** (Figure **3**) includes a cross tie **146** located roughly 8 ft longitudinally outboard of main bolster **200**, (Figure **4c**); cross tie **148** (Figure **2b**) located roughly 4 ft. longitudinally outboard of main bolster **20c**; and cross tie **150** (Figure **2b**) located roughly 4 foot longitudinally inboard of main bolster **200**. A side sill end portion is indicated as **43** (Figure **3**), and extends along the transversely outboard, or distal, ends of main bolster **200**, and cross ties **146**, **148** and **150** (Figure **2b**).

Knee **47** (or **49** of opposite hand) is located at the transition, or step, between end portion **28** (or **27**) and medial deck portion **29**. Knee **47** is located at a mid-bay longitudinal station between the longitudinal stations of formed post **152** and post **154** (Figure **2a**). As above, the dropped deck portion of the deck (that is, medial deck portion **29**) ends at left and right hand knees, indicated as **47, 49**. Other than being of opposite hands, they are of identical construction. The medial portion of the side sills, **45**, has been described above. The end portions **43** are formed from deep wide flange beams. As noted above, in the preferred embodiment the depth of the beam is determined at the lower flange by the height required to give adequate clearance over the wheels when the car is fully loaded and cornering, and the upper height limit of the upper flange corresponds to the 33⅝" (+/- ⅛") height increment of the layers of bundles at the step in the deck at knees **47** and **49**. End portions **43** terminate, at their inboard ends at knees **47** and **49**, at a corner, **160**, (Figure **49**) that is enclosed with an angled end gusset **162** running on the diagonal between the upper and lower flanges of end portion **43**.

The upright portion, **164** (Figure **3**) of side sills **42** and **44**, has a front flange member **166** facing the well, a rear facing flange member **168** facing the adjacent truck, an irregular quadrilateral lower web portion **170** (Figure **3**) and a trapezoidal upper web portion **172**. Front flange member **166** is a formal metal plate, with one leg mounted in a vertical plane. The metal plate is trimmed to provide smoothly radiused transitions to mate with an upper cross member **174**, a medial bulkhead stiffener **176**, and a bottom cross member **178**. At its lower extremity front flange member **166** has a sill engagement fitting, or seat, in the nature of a hook-shaped cut-out conforming to the inward profile of medial side sill portion **45**. That is, the cut-out conforms to the medial side sill portion, the outboard edge of the inwardly curving leg **182** conforms to the back, or web, of the medial side sill portion, and the smoothly curved toe **184** conforms to the bottom flange of the medial side sill portion. A gusset **186** seats within medial side sill portion **45**, in the plane of front flange member **166**, providing flange continuity to complete the section. The upper bent back leg of front flange member **166** extends in the plane of the upper flange of side sill and portion **43**. The inward cant of the bottom portion of knee **47** (or **49**) is such that medial decking portion **29** is narrower than end decking portions **27** or **28**. That is, the laterally outboard edge of the upper flange of medial side sill portion **45** lies closer to central plane **24** than does the laterally outboard edge of end side sill portion **43**, the margin of the lading supporting decking of medial decking portion **29** lying laterally inboard relative to the laterally outboard margin of end decking portion **27** or **28**.

Longitudinally outboard rear facing flange member **168** is made from a bent plate cut to the desired profile. An upper leg **188** of member **168** runs along the lower edge of upper web portion **170** to abut the lower flange **187** of side sill end portion **43**; and a lower leg **190** that runs downwardly from the end of leg **188** on an angle along the edge of quadrilateral web portion **170**. Leg **190** also has an inwardly tending toe **192** cut to a similar profile to leg **182** and toe **184**. A gusset **194** seats within the end section of side sill medial section **45** in the plane of toe **192**, in a manner similar to gusset **186**.

As thus described, the upright portion of knee **47**, (or **49**) is tapered, being narrower at the bottom and wider at the top. That is, the width measured between items **166** and **168** at the level of lower flange **187** of side end portion **43** is greater than the width measured between items **166** and **168** at the level of upper flange **130** of side sill portion **45**.

Lower cross member **178** is a fabricated T-section having leg **196** lying in a vertical plane, perpendicular to the longitudinal centerline of car **20**, between side web **103** (or **104**) of main sill **36** and the trimmed transition of front flange member **166**. The horizontal other leg **195** of member **178** lies in a horizontal plane between, and is welded to, the outer edge of bottom flange **106** of main sill **36** and the juncture of the back, or web **134**, and upper flange **130** of medial side sill portion **45**. An intermediate bulkhead sheet **180** is welded between web **104** (or **103** as may be) and overlapping flange member **166**, the vertical leg of angle section member **174**, channel stiffener member **176**, and leg **196** of lower cross member **178**.

A stringer in the nature of a U-section with the legs orientated up, longitudinally extending stiffening member, in the nature of a channel **198** extends from a hangar bracket web mounting on the underside of member **178** to the first cross-bearer **112**. The lower framework of the medial deck portion, namely that extending between the lower flange of main sill **36**, the top flange of side sill medial portion **45**, and the top flanges of the cross-bearers of medial portion **29** and of channel **198** are overlain by, and welded to, the deck sheets **193** of medial portion **29**.

Another longitudinally extending stiffener, in the nature of a channel member **179** is mounted between bolster **200**, stringer **150** and cross member **174** about half way between main sill **36** and side sill end portion **43**. The upper flange **102** of main sill **36** is carried at a height corresponding to the height of the end deck portions **27** or **28**. The

overlying shear panel sheet 199 lying at that height is welded to the upper flange 102 of main sill 36, overlaps the upper flange of side sill end portion 41 (or 43), and overlies the upper flanges of the cross-ties and bolsters of end decking portion 27 (or 28), and the upturned toes of channel member 179.

The height of the knee, preferably roughly 33 to 34 inches, may tend to be a bit large for a person to ascend comfortably as a single step. For the purpose of facilitating end deck access, a vertically extending, transversely oriented intermediate bulkhead sheet 180 has a perforation formed in it at the height of medial cross-member 176 to define a foothold, rung, or step, 181 (on Figure 3). Medial cross-member 176 has reinforcement gussets 183 to either side of step 181; reinforcing flat bars 185 mounted against sheet 180 and abutting the top and bottom edges of channel 176; and a drain hole to discourage accumulation of water in the step.

Figure 4c shows the deep main bolster 200 at section 4c- 4c (on Figure 2a). Main bolster 200 has left and right hand arms 202 and 204 which each extend from the root, that is the inner portion of the bolster adjacent to center sill 36, to outer, or distal extremities 205 adjacent to side sill end portion 43. The root of main bolster 200 at the juncture of main sill 36 has a depth extending from the lower flange end portion 108 to the height of the upper deck. Distal extremities 205 have the same depth of section as side sill end portion 43. The lower surface of main bolster 200 is defined by bottom stepped flange 210 which extends from the root to distal extremities 205. Stepped flange 210 has inner shoulders 206 proximate to center sill 36, outer shoulders 209 and sloped intermediate portions 208 extending between inner shoulders 206 and outer shoulders 209. At this section, namely the longitudinally outboard section of main sill 36 the walls or webs, 103, 104 of main sill 36 are identified as plates 212, 214. A heavier top flange 216 forms the top plate of the end portion of main sill 36.

Figure 4d shows the second last cross-tie 148 located at the longitudinal station longitudinally outboard of post 55 and main bolster 200. A coupler and draft gear pocket, indicated generally as 224 is defined in the bounded space formed by welding an internal web or cross plate 226 between plates 212 and 214 at a height partway between the height of lower flange portion 108 and upper flange 102. Plate 226 serves as the draft pocket cap plate, or top flange, of the draft pocket portion of main sill 36 at the height at which the top flange of main sill 36 might tend otherwise to be but for the depth of the step height at knees 47, 49. Pocket 224, and main bolster 200 are shown in Figure 4e. Draft

pocket **224** is of a size and shape for receiving draft gear and the shank of a coupler, such as coupler **38**.

Each of center beam cars **20** and **70** has an array of center beam web posts, indicated generally as **54** in the context of Figure **1**. As shown in Figure **3**, a horizontal cross-section of post **56** generally has a hollow rectangular shape and has smoothly radiused corners as received, typically from a rolling mill or other roll forming or pressing apparatus. Post **57**, by contrast, has a horizontal cross-section of a C-shaped channel, with its web being the back of the C, and the flanges being a pair of legs extending away from the back. Post **57** is preferably a roll formed sheet, or pressing, having smoothy radiused corners. Posts **56, 57** (and **55**) thus present smooth, planar surfaces to the lading with smoothly radiused corners. Each diagonal member, whether struts **63, 64** (Figure **2a**) or braces **66, 67, 68** (or **74**) has a first end rooted at a lower lug such as lower lug **230**, welded at the juncture of one of posts **56** (or **55**) with main center sill **36**; and a second diagonal end rooted in an upper lug **232** (Figure **2a**) at the juncture of another adjacent post **56** and top chord **32**. Midway along its length, the diagonal member, whether struts **63, 64** or braces **67, 68**, passes through the post **57** intermediate the pair of posts **56** (or **55** and **56**) to which the diagonal member is mounted. It is intended that the respective sides of posts **55** and **56**, and flanges of posts **57** lie in the same planes on either side of the central plane **24** of car **20** to present an aligned set of bearing surfaces against which lading can be placed. The side faces of posts **56** lie roughly at right angles to end deck portions **27, 28** and medial deck portion **29**. This facilitates the placement of generally square cornered bundles in stacks in the bunks defined to either side of central web **30** (Figure 2a).

Each post **55** is, as noted above, a square steel tube extending upwardly from the deck above the respective truck centers. Post **55** is narrower (in the longitudinal direction of car **20**) than the spacing of the webs of main bolster **200**, and consequently narrower than main bolster web continuation plates **201, 203** mounted within main sill **36** in line with the bolster webs at the truck center. Similarly, post **55** is narrower (in the lateral direction across car **20**) than the spacing of that portion of webs **103** and **104** of main sill **36** extending outboard of '**X1**', past main bolster **200** toward coupler **38**, namely plates **212, 214** defining the width of the draft pocket. Top flange **102** of main sill **36** has an access opening in the nature of a rectangular cut-out **101** at the truck center. Post **55** is welded, at its lower, or base end, to a matching rectangular plate **105** that mates with cut-out **101**. A pair of first and second web continuation plates in the nature of gussets **207, 209** extend in longitudinally oriented vertical planes from the bottom side of plate **105**. A pair of first and second flange

continuation plates, in the nature of gussets **211** and **213** extend in transversely oriented vertical planes from the bottom of plate **105**. Gussets **211** and **213** are welded along the side edges of gussets **207** and **209**. Gussets **211** and **213** extend beyond gussets **207** and **209** to meet web continuation plates **202** and **204**. This structure provides longitudinal and lateral reinforcement to the built-in connection of post **55** to main sill **36**.

Figure **4h** shows a horizontal cross-section of a portion of center sill **36** underneath a four sided hollow section post **56**. Center sill **36** is reinforced along its length with vertically extending, transversely oriented webs separator plates, indicated as webs **290, 292** extending between vertical webs **103** and **104**. Transverse webs **290, 292** are situated so as to provide web reinforcement to center sill **36** at the location of posts **56** and **57** respectively, tending to encourage the cross-section of main sill **36** to remain rectangular. Steel bars **294** are places on the outboard side of vertical webs **103** and **104** to act as spacers between center sill **36** and the lading, bars **294** being thick enough to stand outwardly from web **103** or **104** a distance at least equal to the overhang of upper flange **102** beyond webs **103** and **104**. The outboard corners of bars **294** are smoothly radiused to avoid presenting a sharp edge to the lading. Transverse webs **296** are shown in Figure **4e** at the location of the webs of C-channel posts **57**.

The steps of assembly of center sill **36** are such that web one side of each of webs **290** and **292** is welded to the inside face of web **103**, and one side is welded to top flange **102** before the other main sill web, web **104**, is placed in position and joined to top flange **102**. Prior to installation of webs **290** and **292** against web **103** and flange **102**, one leg of angle brackets **291, 293** is welded along the opposite edge (that is, the edge not to be welded to web **103**) of webs **290** and **292** respectively. Web **104** of center sill **36** has welding access fittings, namely an array of vertically spaced slots **295** (Figure **3**) that line up with the free legs of angles **291** and **293**. The internal periphery of slots **295** is then welded to the free legs (that is, the legs not welded to webs **290** or **292**) of angles **291, 293**, thus connecting webs **290** and **292** to web **104**. Although slots **295** could extend over the full depth of center sill web **104**, it is preferred that they extend only part way. The remainder of the weld of bracket **291** (or **293**) and web **290** (or **292**) is welded for the inside of center sill **36**, through the access provided before bottom flange **106** is welded in place. Web **296** is also provided with an angle **291**, that is welded in place in the manner described above. While it is advantageous for webs **290** and **292** (and **296**) to extend close to bottom flange **106**, in the embodiment shown each of webs **290, 292** and **296** has a perpendicular leg **297** bent to lie in a plane parallel to the plane of bottom flange **106**. The edges of leg **297** are welded to webs **103** and **104** respectively such that the load path discontinuity at the lower end of web **290**,

292 and 296 may tend to be spread along a line rather than concentrated at a point.

As shown in Figure 4f plates 212 and 214 terminate longitudinally inboard of the truck center at a location indicated as 'X1'. Similarly, the inboard, mid-span portion of webs 103 and 104 of center sill 36 ends at a location indicated as 'X2'. In the transition region, or portion, between 'X1' and 'X2', main sill 36 narrows on a taper defined by converging side sill web portions 215, 217. When viewed in the side view of Figure 4e, it can be seen that portions 215 and 217 are trapezoidally shaped, and that while main sill 36 is narrowing in the lateral direction, it is also deepening in the vertical direction, as noted above. Internal gusset plates 219, 221 are mounted inside center sill 36 at locations 'X1' and 'X2' and tend to maintain the desired sectional profile at the transition junctions. By providing this transition section, center sill 36 has a first, relatively wide portion extending longitudinally outboard from location 'X1', and a second, relatively narrow middle, or waist, portion lying between 'X2' at either respective end of the car longitudinally inboard of the transition. In the preferred embodiment the outboard portion is 12 – 7/8" inside to suit the draft gear and coupler, and 14" outside, measured across the webs; the inboard portion is 9" inside and 10" outside width, measured across the webs.

Posts 55, 56 and 57 (Figure 1) are surmounted at their upper ends by top chord 32. Top chord 32 extends longitudinally between end bulkheads 50 and 52. Top chord 32 is a four sided, preferably square, steel tube that presents horizontal top and bottom flanges 234, 236, (Figure 4a) and a pair of first and second vertical webs 238, 240. Vertical webs 238 and 240 lie slightly proud of (that is, laterally outboard relative to) the planes of the flanges of posts 56 and 57, and present a smooth planar bearing surface against which bundles of lumber, or other lading, can bear.

As shown in Figure 4a, the longitudinal web structure of the rail road car 20 (or 70) that includes array 54 of vertical posts 56 and 57, and top chord member 32 extends to a first height H1 at the level of the top of the top chord, measured from top of rail, and the top of the end bulkheads, 50 and 52 extends to a second height H2, measured relative to top of rail. H2 is greater than H1, that is, the end bulkheads are taller than the central web structure. In the preferred embodiment H2 exceeds the maximum height permitted under AAR Plate C, but falls within the maximum height envelope of AAR Plate F.

As seen in the end view of Figures 4a and 4c, bundles of lumber are stacked in layers and labelled, in ascending order, as L1, L2, L3, L4 and L5. The height of top flange 234 of top chord 32 is lower than the height of the bottom of the uppermost bundles of lumber, L5, that can be stacked in the bunks. In this way the left and right hand top bundles, L5, can seat laterally inboard relative to the remainder of the bundles upon which they are stacked, and

can abut each other sideways above top chord **32** along the longitudinal centerline plane **24** of rail road car **20** (or **70**). That is, as measured upwardly from medial deck portions **29**, the top of the top chord, positioned at height **H1**, lies a distance **D1** above the height **H3** of medial decking portion **29**, (relative to TOR) that is less than **D2**. **D2** is the distance obtained by multiplying (N-1) by the bundle height plus dunnage, roughly 33 - 5/8 inches. N is the maximum number of layers of bundles that can be stacked on medial decking portion **29** within the AAR plate limit, be it AAR plate F, as in the preferred embodiment, or AAR plate C, or some other plate, and 33 – 5/8 is roughly the height, in inches, of the average layer of nominal "32 inch" bundles. In that way the height of **N** bundles (that is, the top of bundle **L5**, as indicated) is the last incremental bundle height that falls within the Plate F limit and so tends to define the load limit height for bundles carried on the car Where the end deck portions **27** and **28** are located one bundle upwardly of medial decking portion **29**, the relative height of lading on the end deck portions is one bundle less. Similarly **D3**, being (N-2) multiplied by 33 – 5/8 inches, represents roughly the height of the top of bundle **L3**, is less than the height of bottom flange **240**. In the preferred embodiment, the load limit height, measured upwardly from the medial decking portion exceeds the height of the uppermost portion of the top chord by more than a full bundle height, i.e. at least 33 5/8 inches. It is preferred that the load limit height of 5 bundles exceed Plate C, but fall within Plate F.

As webs **238** and **240** stand marginally (less than one inch) proud of the flanges of the posts, bundles **L4** are stepped laterally outboard relative to bundles **L1**, **L2** and **L3** that lie flush against the flanges of posts **56** and **57** as shown in Figure **4a**. When straps **136** are tightened, there is some lateral inboard force applied to bundles **L4** at their uppermost outboard corners, but the majority of the inboard tension is applied at the uppermost, outboard corners of bundles **L5**, squeezing them together, and urging them to seat tightly upon bundles **L4**, **L3**, **L2** and **L1**. The lateral inboard force on bundles **L4** is reacted by the large, smooth bearing faces of webs **238** and **240** of top chord **32**. Since these webs lie outboard of the vertical side flanges of posts **56** and **57**, there is some tolerance of misalignment of those flanges on fabrication. This may tend to permit some misalignment of the flanges without giving rise to as great an amount of chafing of the bundles as might otherwise have been the case.

It may also be noted that center beam **36** has deep section as compared to center beam cars of which the inventor is aware. That is, the depth of the center beam, taken at mid-span between the trucks, corresponds to the depth of a loaded bundle of lumber, that depth being over 30 inches, namely 33 – 5/8 inches (+/-) measured from lower flange **106** to upper flange **102**, such that the deck sheets of medial portion **29** extends laterally outward

from lower flange **106**, and the deck sheets of end portion **27** and **28** extend laterally outboard away from upper flange **102**. At mid-span center sill **36** has an aspect ratio of height (measured over upper and lower flanges, **102** and **106**) to width (measured between the outside faces of webs **103** and **104**) that is more than 2.4 : 1, lying in the range of 3.0 : 1 to 5.0 : 1. In the preferred embodiment the aspect ratio about 3.4 : 1 A high aspect ratio beam, as shown, tends to permit the deck sections to be mounted at heights corresponding to the center sill flanges, without tending to require relatively more complicated intermediate deck staging above the upper flange of the center sill, or other complications.

Similarly, the end portions of center sill **36** at the location of the draft pocket are correspondingly taller than otherwise, being more than **18** inches deep, and preferably about 27 inches deep. The end portions of center sill **36** lying outboard of bolster **200** have an aspect ratio of height (measured over the outboard end portion of upper flange **102** and the outboard portion **108** of lower flange **106**), to width (measured across the inside faces of the webs that accommodate the draft gear) greater than 1: 1, lying in the range of 1.5 : 1 to 3.0 : 1, and, in the preferred embodiment, of about 2:0 : 1, namely 27 inches as compared to 12 – 7/8 inches. As above, a relatively taller main sill end portion may tend to simplify construction.

As noted above, with the exception of brakes and minor fittings, the primary structural elements of rail road car **20** (and **70**) are symmetrical about plane **24** of the longitudinal centerline, and also about the transverse, mid-span plane **31** between trucks **22** and **23**. In that light a description of end bulkhead **50** will serve also to describe end bulkhead **52**. End bulkhead **50** (or **52**) is joined to top chord **32** at a transition, or knee fitting, indicated generally as **250**. Figures **5a, 5b and 5c** provide detailed illustrations of this junction.

End bulkhead **50** (or **52**) is a welded structure having three vertical posts, namely a central beam **252** and a pair of first and second laterally outboard, Z-section corner posts **254** and **256**. All three vertical posts are mounted to extend upwardly from end sill **258** of end decking portion **27** (or **28**, as may be). Transverse beams **261, 262, 263, 264** and **265** extend cross-wise (that is, perpendicularly) between corner posts **254** and **256**, and a cap **266** extends across the top of end bulkhead **50** (or **52**) to enclose the upper ends of corner posts **254, 256** and beam **252**. An end sheet **268** forms a skin on the longitudinally inboard face of posts **254, 256**, beam **252**, and transverse beams **261, 262, 263, 264**, and **265**. In this way end sheet **268** presents a face toward the ends of bundles loaded on the car. Sheet **268** includes a lower portion **267** extending between deck level and the height of lower flange

236 of top chord 32, and an upper portion 269 extending from the height of the top flange 234 of top chord 32 to the top of bulkhead 50 (or 52).

In greater detail, beam 252 is a fabricated channel section having a back in the nature of a plate 270 lying in a vertical plane spaced away from end sheet 268, and a pair of first and second (or left and right hand) spaced apart parallel legs 271, 272. The toes of legs 271 and 272 are welded to the longitudinally outboard face of sheet 268. The longitudinally outboard ends of legs 271, 272 are formed into transversely outwardly bent flanges that lie in a common plane, and that present a flat, overlapping surface against which to weld the laterally outboard margins of plate 270. A plate 273 extends vertically along the longitudinally inboard face of sheet 268 between posts 254 and 256. In this way plate 270, legs 271, 272 and the combination of sheet 268 and 273 co-operate to form a four sided box beam, plate 270 and plates 268, 273 being flanges in this context, and legs 271 and 272 forming webs between the flanges. The bottom end of the box beam is welded to end decking portion 27 (or 28) at the top flange of main center sill 36 (whether for car 20 or car 70 as may be).

Each of the webs of the box beam, namely legs 271 and 272, has been trimmed to have U-shaped reliefs, or recesses, to accommodate transverse beam 264. Each of these beams is a C-shaped channel 261, 262, 263, and 265 of constant cross-section running without interruption between corner posts 254 and 256, with backs standing longitudinally outwardly of, and parallel to sheet 268, and legs, or webs running inward in horizontal planes to mate with the longitudinally outboard face of sheet 268.

Transverse beam 264, by contrast, is an assembly of members. It includes left and right hand tapered channels 274 and 276 mounted to either side of box beam 252. Channels 274 and 276 have a cross-section of similar depth to transverse beam 261 at its juncture with corner posts 254 and 256, and the cross-sections deepening (that is, the horizontal legs extending longitudinally outboard of sheet 268) toward box beam 252. Thus, the portion of transverse beam 264 closest to box beam 252 has a greater resistance to flexure due to longitudinal loading of the center beam rail car than the portion of transverse beam 264 closest to corner posts 254 and 256. A spacer or stub portion 278 of a C-shaped channel is welded inside box beam 252 between legs 271 and 272 to give web and flange continuity between channels 274 and 276. Further, sheet 268 has been sectioned, to allow for a transverse plate 277 of greater thickness than sheet 268, to be inserted between portions 267 and 269 to form a longitudinally inboard flange of transverse beam 264. This reinforced beam of deeper section is provided to tend to address the relatively concentrated loading, similar to a point loading, imposed on bulkhead 50 (or 52) at the location of the junction of

junction of top chord **32** under a longitudinal end load against the face of the bulkhead. That is, reinforcement is provided in both the vertical (or z) axis by means of box beam **252**, and in the transverse horizontal (or y) axis by means of transverse beam **264**. This bi-directional reinforcement intersects at the junction with chord **32**.

The last bays of the central web structure are shear bays. That is, solid panels **61**, **62** (Figure **2a**) are shear panels, or webs, welded along the longitudinal centerline of car **20** (or **70**) between the web of the nearest post **219** to end bulkhead **50** (or **52**) and the inner flange of beam **252**, namely end sheet **268**, and also between the shear plate of end decking portions **27** (or **28**) and top chord **32**. When car **20** (or **70**) is subject to an end load, such as an end impact when carrying a load of bundles of lumber, the nearest post **219** and box beam **252** act as the flanges of a deep beam whose web is the shear panel provided by solid panel **61** or **62**.

The juncture of the web, namely panel **61** (or **62**) is not aligned (i.e., is not co-planar with) with either leg **271** or leg **272** of box beam **252**, but rather is welded amidst sheet **268** between them. This alone may not necessarily provide a fully satisfactory joint. Gusset plates **280**, **281**, **282** and **283** are welded in the same plane as panel **61** (or **62**) to the back side, namely the longitudinally outboard face, of sheet **268** interstitially between the longitudinally inwardly extending horizontally planar legs of transverse beam members **261**, **262** and **263**, the end deck top flange102, and the lower leg of C-channel stub portion **278**. Gusset plates **280** to **283** act as web extensions such that the web formed by the combination of panel **61** (or **62**). Conceptually, the central portions of transverse beams **261** to **265**, welded with toes against sheet **268** form hollow section structural members of low aspect ratio (that is, their length between the legs of box beam **252** is short relative to their depth of section in the vertical direction). The vertical shear load imposed in gusset plates **280** to **283** (and in panel **60** or **61**) is reacted at either end of the transversely extending hollow sections. Thus the shear transfer may tend to occur over a distance corresponding to the overlap, and the tendency to out-of-plane deflection may tend to be reduced since the junction of panel **60** (or **61**) and sheet **268** is reinforced vertically, longitudinally, and in the transverse horizontal direction.

Various embodiments of the invention have now been described in detail. Since changes in and or additions to the above-described best mode 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 construction of the appended claims as required by law.

Claims

We Claim:

1. A center beam rail road car comprising:

a deck structure carried by rail car trucks, each of said cars having a truck center;

a central beam assembly running lengthwise along said rail road car, said central beam assembly standing upwardly of said deck structure;

a center sill supporting at least a portion of said deck structure, said center sill extending longitudinally above at least one of said trucks;

said center sill having a top flange and a pair of spaced apart webs extending downwardly from said top flange;

a bolster supporting at least a portion of said deck structure, said bolster extending laterally from said center sill abreast of said truck center;

said central beam assembly having a post extending upwardly of said deck structure above at least one of said truck centers, said post having a first pair of flanges each lying in an upwardly extending longitudinally running plane, and a second pair of flanges each lying in an upwardly extending cross-wise plane; and

said post being mounted to said center sill in a mounting arrangement having flange continuity above and below the level of the center sill top flange.

2. The center beam car of claim 1 wherein:

said bolster has a pair of longitudinally spaced vertical webs;

said bolster includes gussets mounted between said webs of said center sill in line with said spaced vertical webs to provide web continuity through said center sill; and

first and second longitudinal gussets extend in vertical spaced apart planes between said spaced vertical webs, said first and second longitudinal gussets providing flange continuity to said first pair of flanges of said post.

3. The center beam car of claim 1 wherein:

said bolster has a pair of longitudinally spaced vertical webs; said bolster includes gussets mounted between said webs of said center sill in line with said spaced vertical webs to provide web continuity through said center sill;

first and second longitudinal gussets extend in vertical spaced apart planes between said spaced vertical webs, said first and second longitudinal gussets providing flange continuity to said first pair of flanges of said post; and

third and fourth cross-wise gussets are mounted between said first and second gussets, said third and fourth gussets to provide flange continuity to said second pair of flanges of said post.

4. The center beam car of claim 1 wherein said center beam car is a dropped deck center beam car.

5. The center beam rail road car of claim 1 wherein the post is a four sided steel tube.

6. The center beam rail road car of claim 1 wherein abreast of said bolster said center sill has a greater width than said post.

7. The center beam rail road car of claim 1 wherein said center sill has a first end and a draft pocket at said first end, said flange continuity is provided by web members mounted within said center sill, and one of said web members providing web continuity has a vertical extent greater than said draft pocket.

8. The center beam rail road car of claim 1 wherein said center sill has a first end and a draft pocket at said first end, a coupler mounted in said draft pocket, said coupler having a coupler centerline height, said flange continuity is provided by web members mounted within said center sill, and one of said web members providing web continuity has a vertical extent greater than said draft pocket, and has a lower margin extending lower than said coupler centerline height.

9. A center beam rail road car having a deck, and a main post mounted over a truck center, the main post extending upwardly of the deck, the main post having a hollow four-sided section, and web continuity being provided to said main post on all four sides thereof above and below said deck.

10. The center beam car of claim 9 wherein said rail road car has a center sill, said center sill having a pair of spaced apart longitudinally running webs extending downwardly of said deck, and, at said truck center, said center sill, measured across said webs thereof, is wider than said main post.

11. The center beam car of claim 9 wherein said rail road car has a main bolster extending cross-wise under said deck, said main bolster having a pair of spaced apart, transversely running webs extending downwardly of said deck, said main post has a pair of transversely oriented webs extending upwardly of said deck, said webs of said bolster being spaced apart a distance greater than said transversely oriented webs of said main post.

12. The center beam rail road car of claim 9 wherein:

said rail road car has a longitudinally running center sill and a main bolster extending cross-wise under said deck;

said center sill has a pair of spaced apart, first and second longitudinally running webs extending downwardly of said deck;

said main bolster has a pair of spaced apart, first and second transversely running webs extending downwardly of said deck;

said main bolster intersects said center sill; and

said center sill has first and second webs mounted therewithin providing web continuity to said bolster webs across said center sill.

13. The center beam rail road car of claim 12 wherein said center sill is wider than said main post.

14. The center beam rail road car of claim 12 wherein said main post includes first and second longitudinally spaced apart, upwardly extending webs, those webs being more closely spaced than the webs of said main bolster.

15. The center beam rail road car of claim 12 wherein said four sides of said main post include two sided parallel to said webs of said center sill, and two sides parallel to said webs of said main bolster, and first and second lateral web continuity gussets mounted beneath said deck in line with said two sides of said main post that are parallel to said webs of said main bolster, and first and second longitudinal web continuity gussets that are parallel to said webs of said center sill.

16. The center beam rail road car of claim 15 wherein said longitudinal web continuity gussets extend longitudinally to mate with said first and second webs providing web continuity to said bolster webs across said center sill.

17. The center beam rail road car of claim 9 wherein said rail road car has a center sill and a coupler draft pocket defined at one end thereof, and said web continuity is provided by gusset members mounted within said center sill, one of said gussets having a vertical extent greater than said coupler draft pocket.

18. The center beam rail road car of claim 9 wherein:

said rail road car has a center sill, the center sill has a first end and a draft pocket at said first end;

a coupler is mounted in said draft pocket, said coupler having a coupler centerline height;

said flange continuity is provided by web members mounted within said center sill; and

one of said web members providing web continuity has a vertical extent greater than said draft pocket, and has a lower margin extending lower than said coupler centerline height.

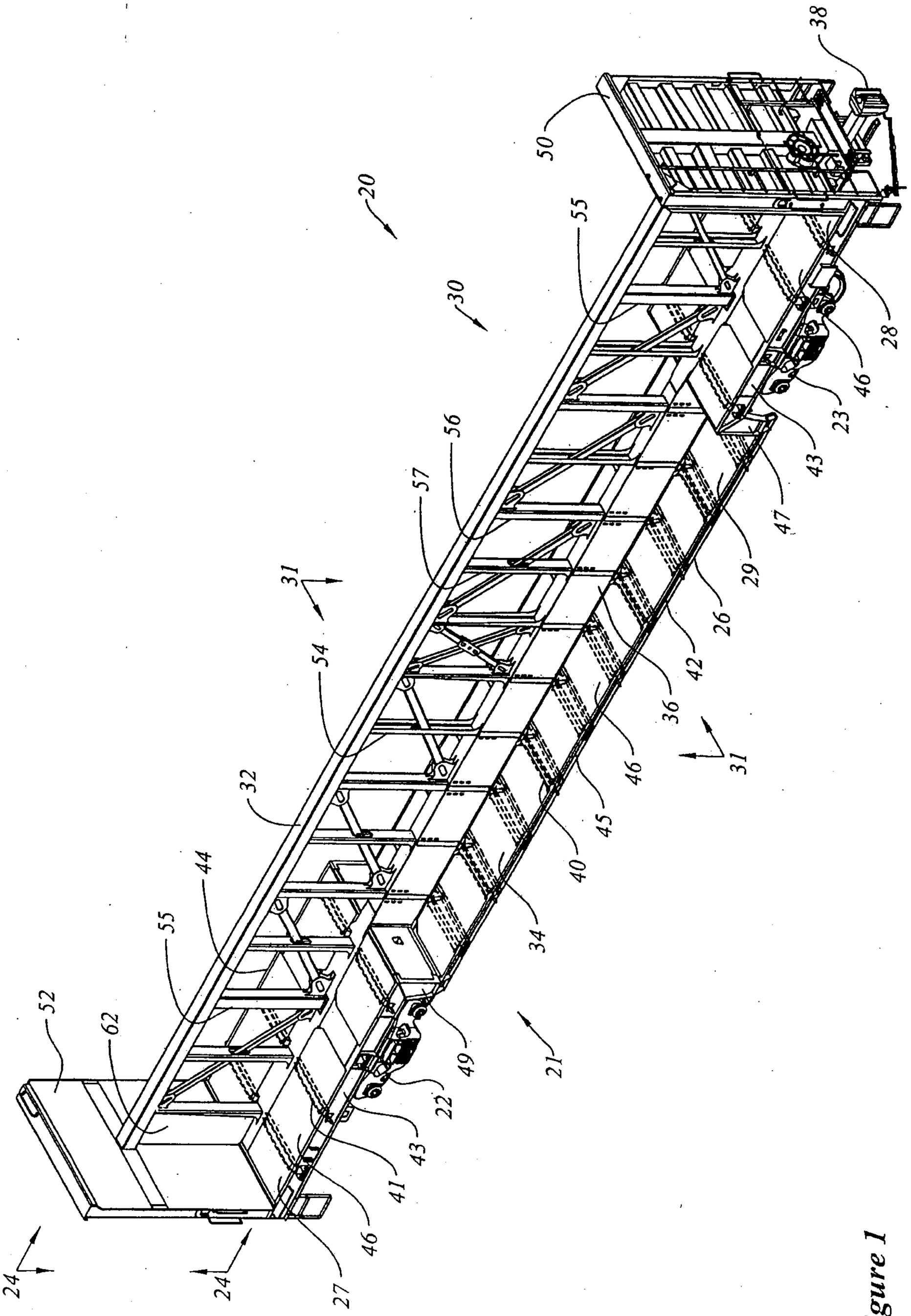

38
50
55
20
30
56
57
31
54
32
44
55
52
62
24
24
27
46
41
43
22
49
21
34
40
45
46
36
31
42
26
29
47
43
23
46
28

Figure 1

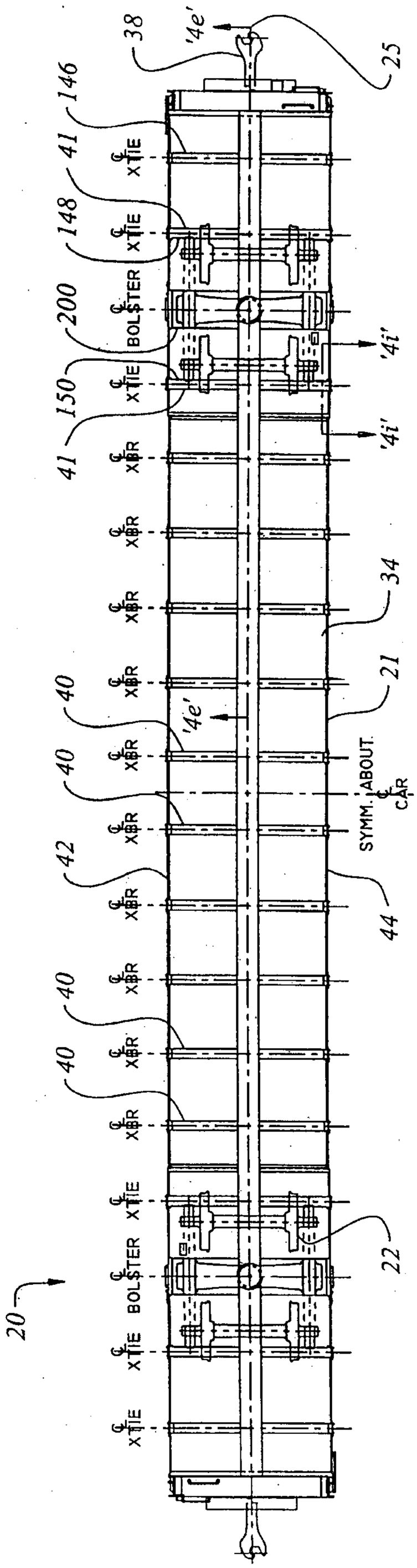


Figure 2b

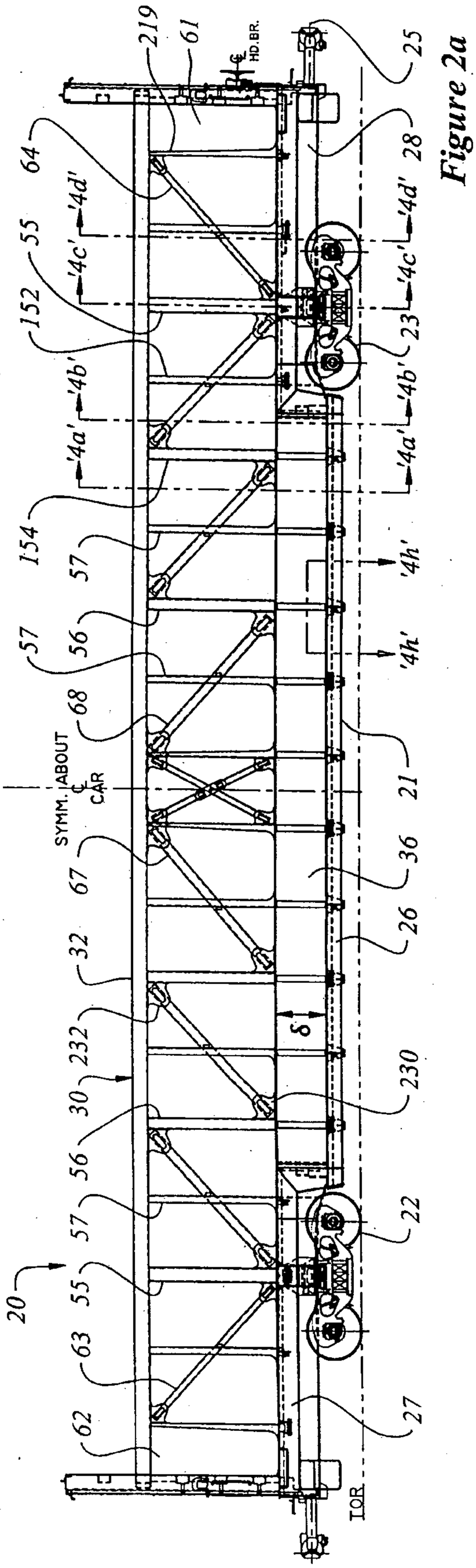


Figure 2a

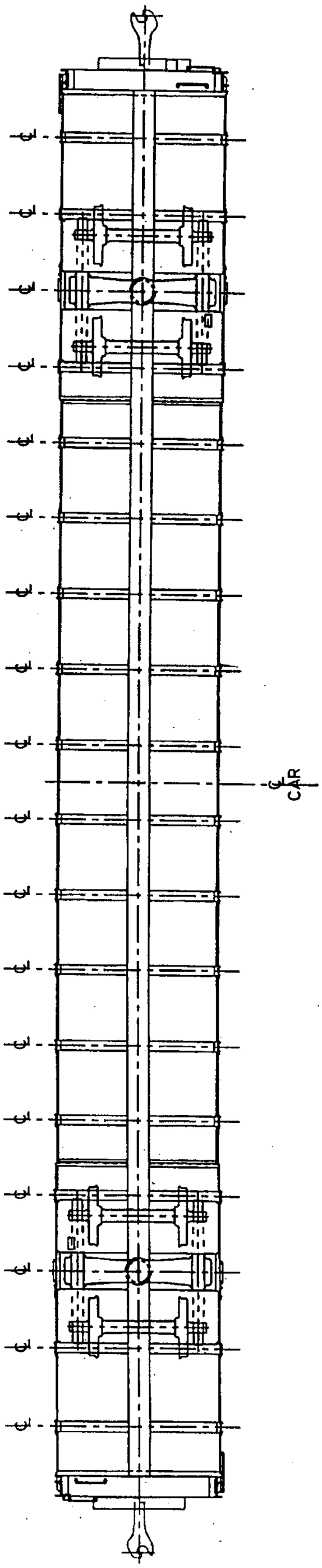


Figure 2d

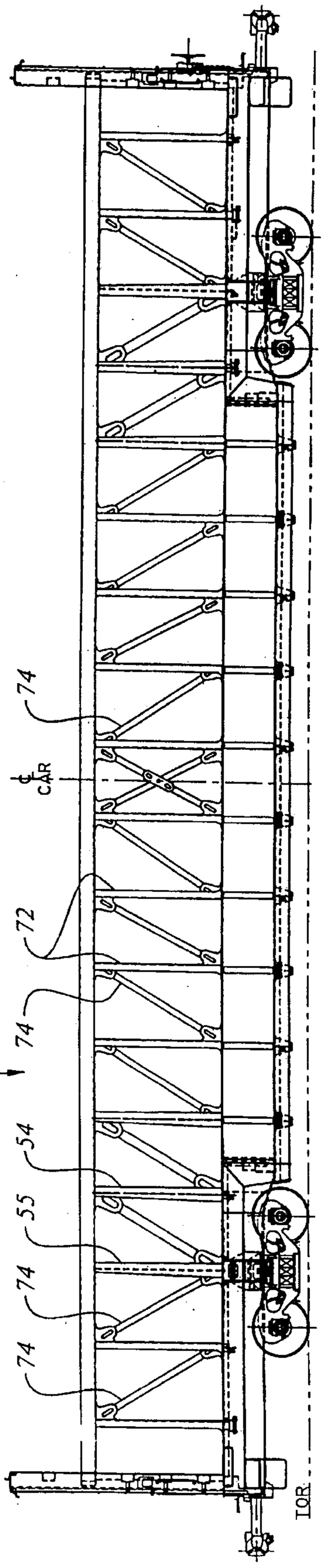


Figure 2c

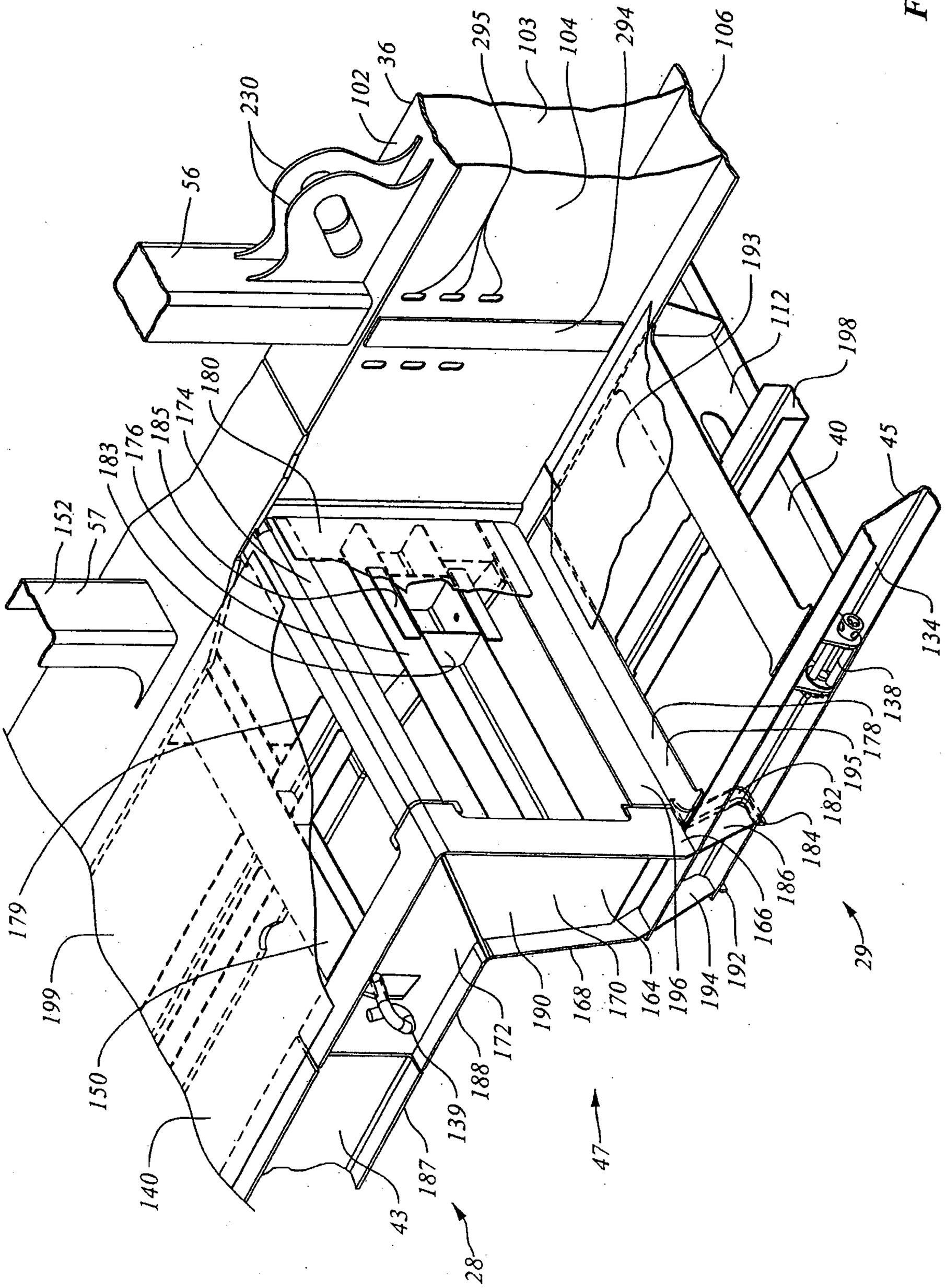

230
102
36
295
103
104
294
106
56
193
112
198
40
45
134
138
152
57
183
176
185
174
180
179
199
150
140
43
139
187
188
172
190
168
170
164
196
194
192
166
186
184
182
195
178
47
29
28

Figure 3

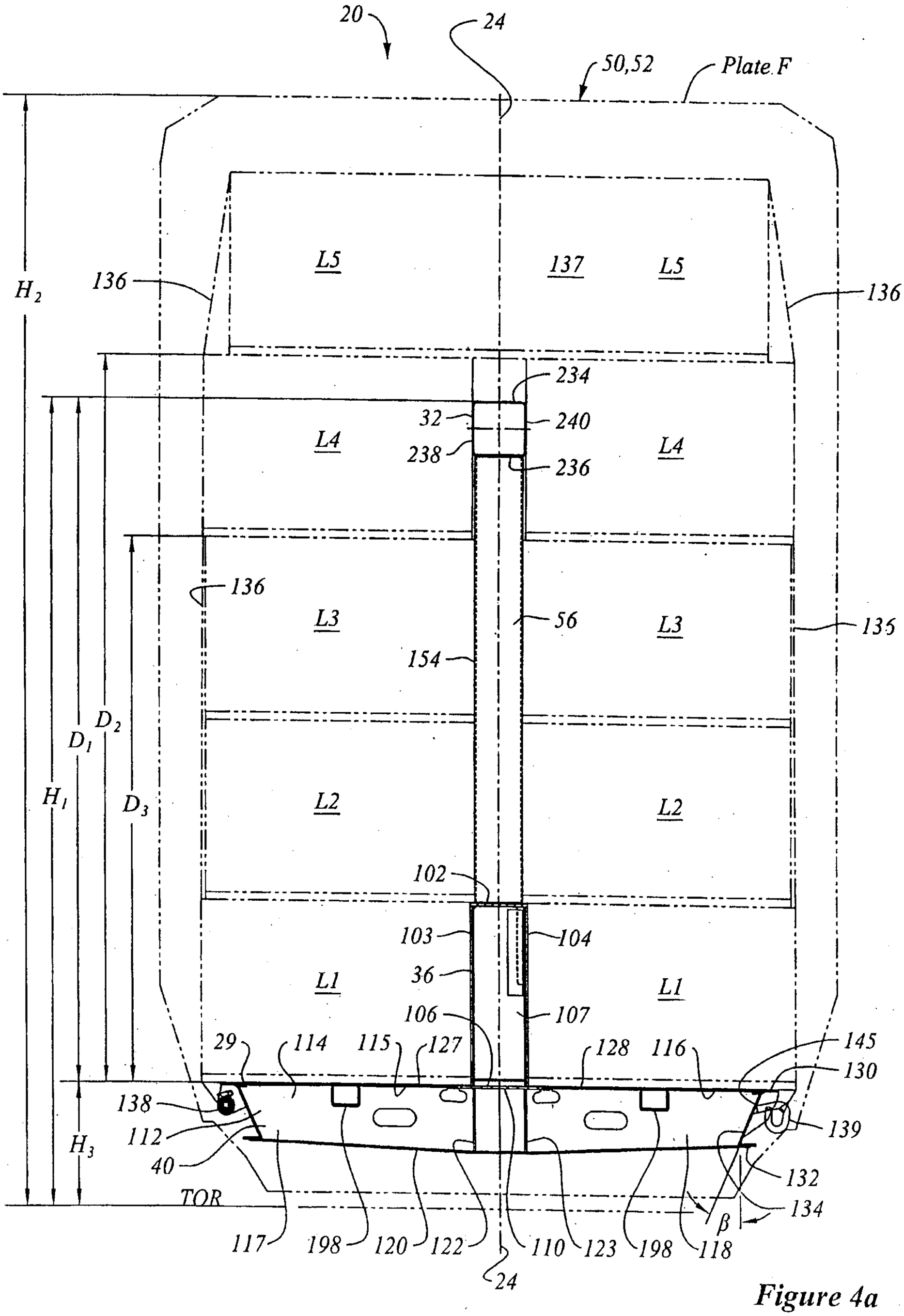

20
24
50,52
Plate F
H_2
136
L5
137
L5
136
234
32
240
238
236
L4
L4
136
L3
56
L3
135
154
D_2
D_1
H_1
D_3
L2
L2
102
103
104
36
L1
L1
106
107
29
114
115
127
128
116
145
130
138
139
112
H_3
40
132
TOR
134
β
117
198
120
122
110
123
198
118
24

Figure 4a

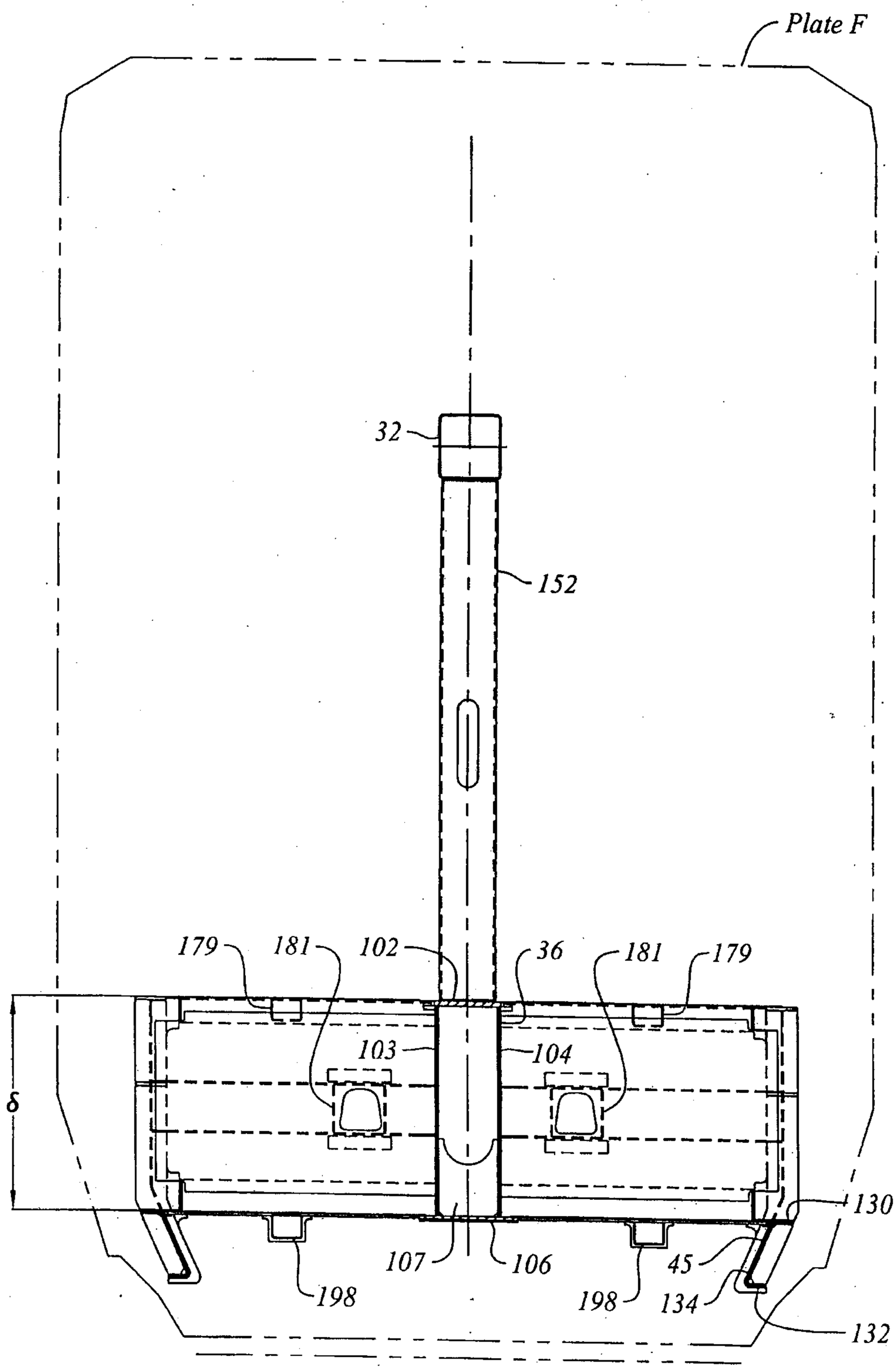

Plate F
32
152
179
181
102
36
181
179
103
104
δ
130
107
106
45
198
198
134
132

Figure 4b

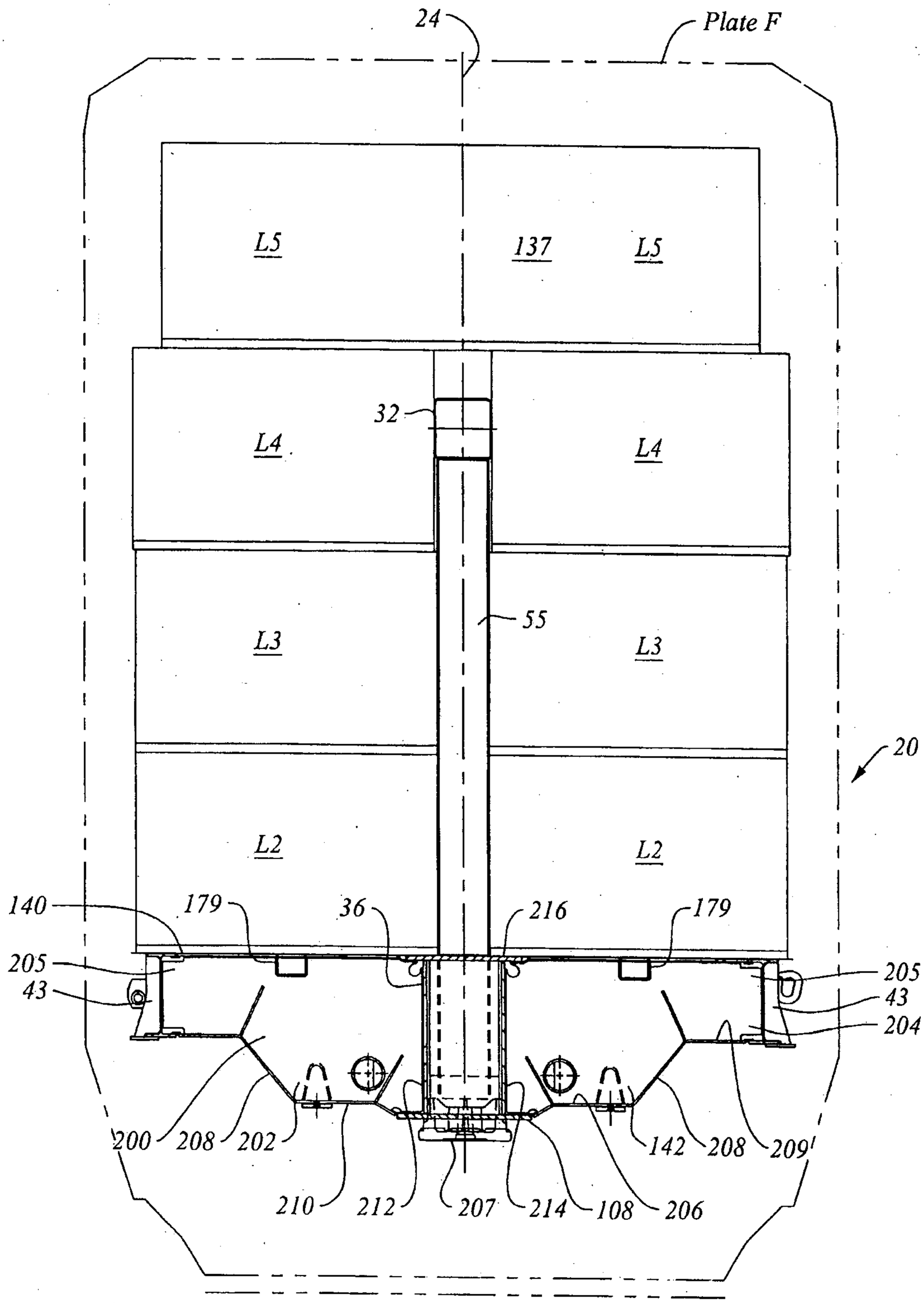

24
Plate F
L5
137
L5
L4
32
L4
L3
55
L3
L2
L2
20
140
179
36
216
179
205
43
205
43
204
200
208
202
210
212
207
214
108
206
142
208
209

Figure 4c

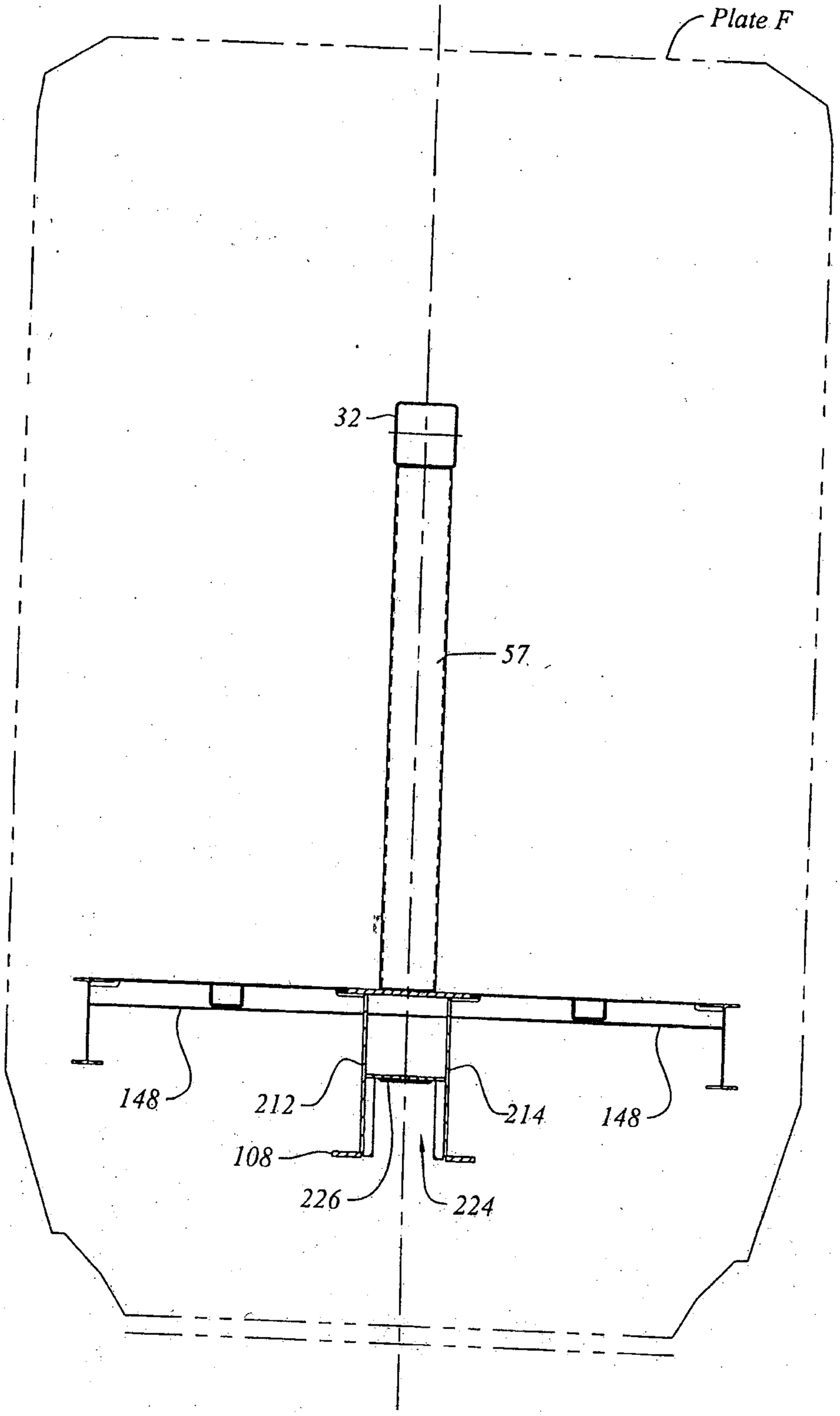


Figure 4d

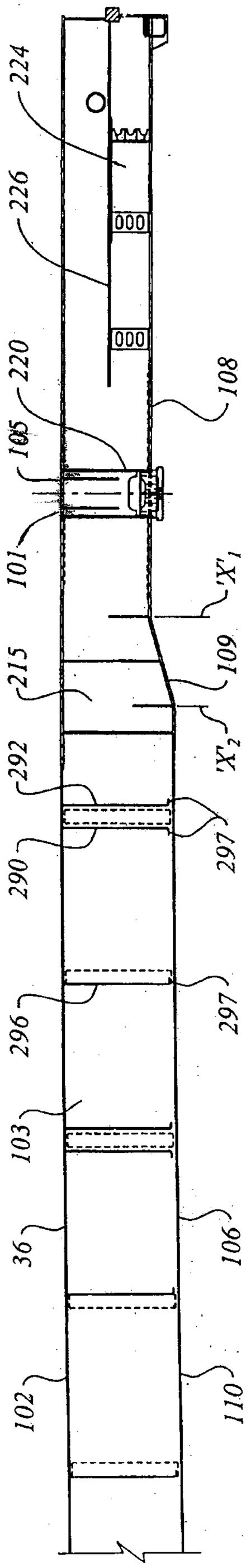


Figure 4e

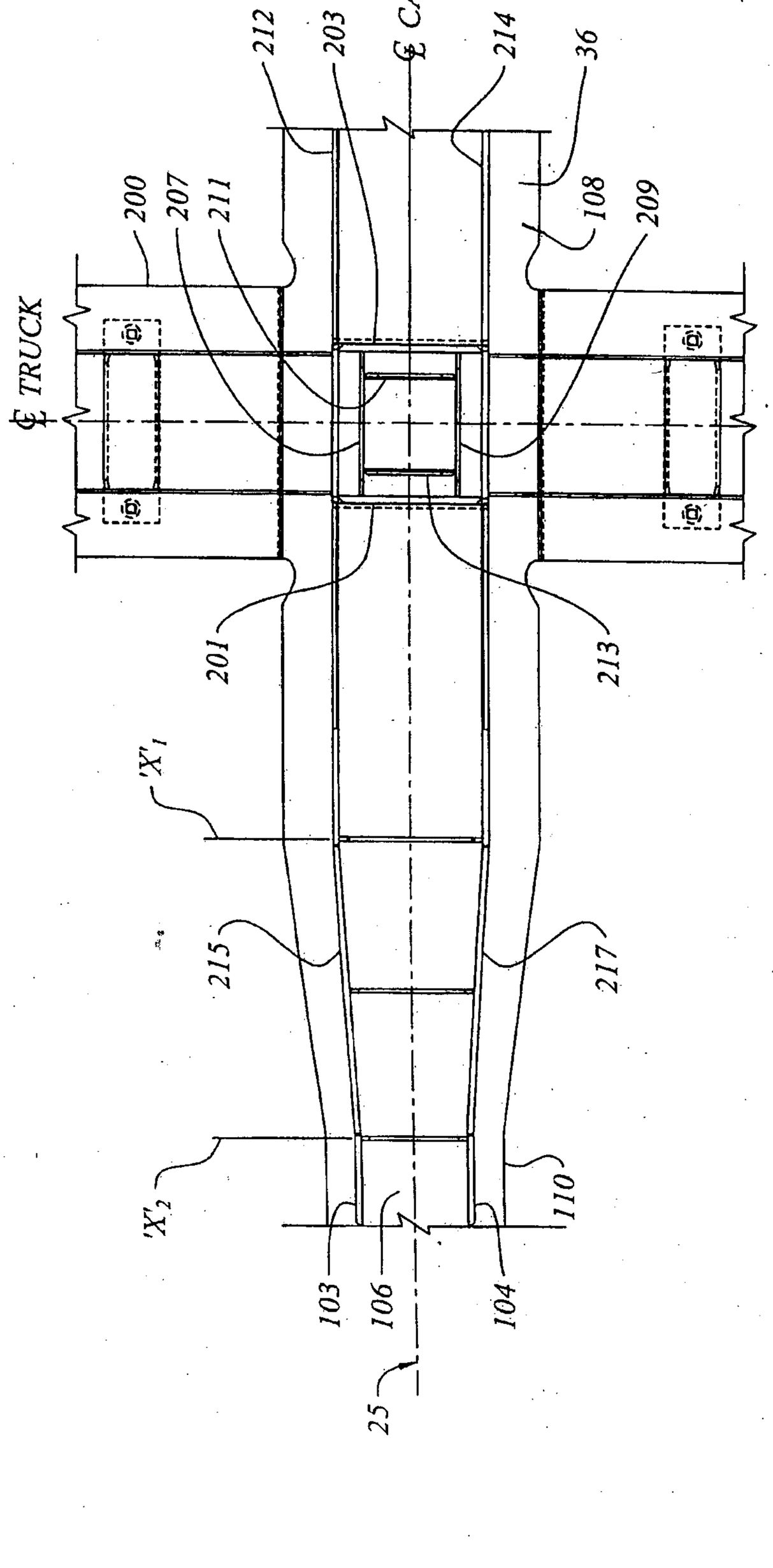


Figure 4f

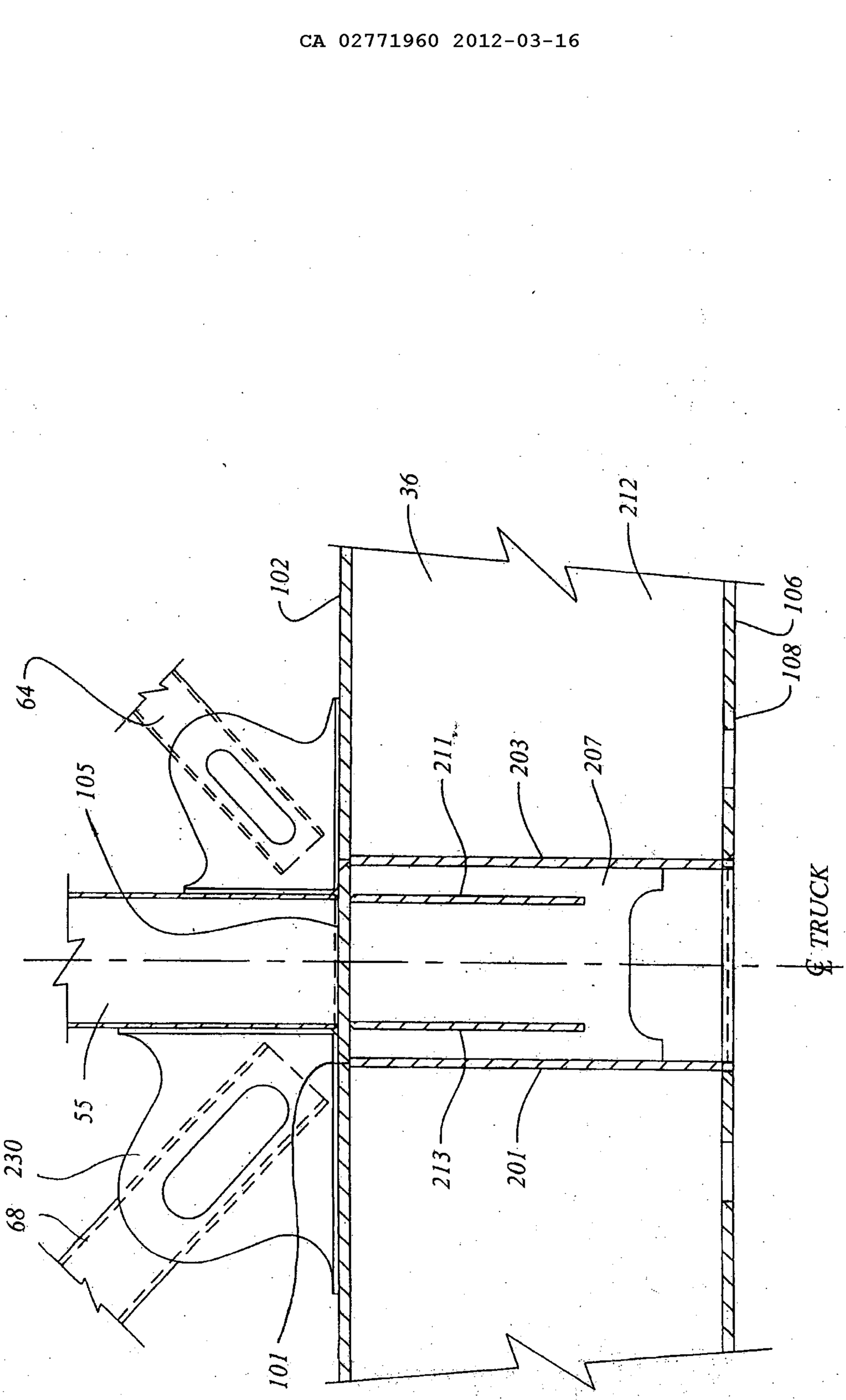


Figure 4g

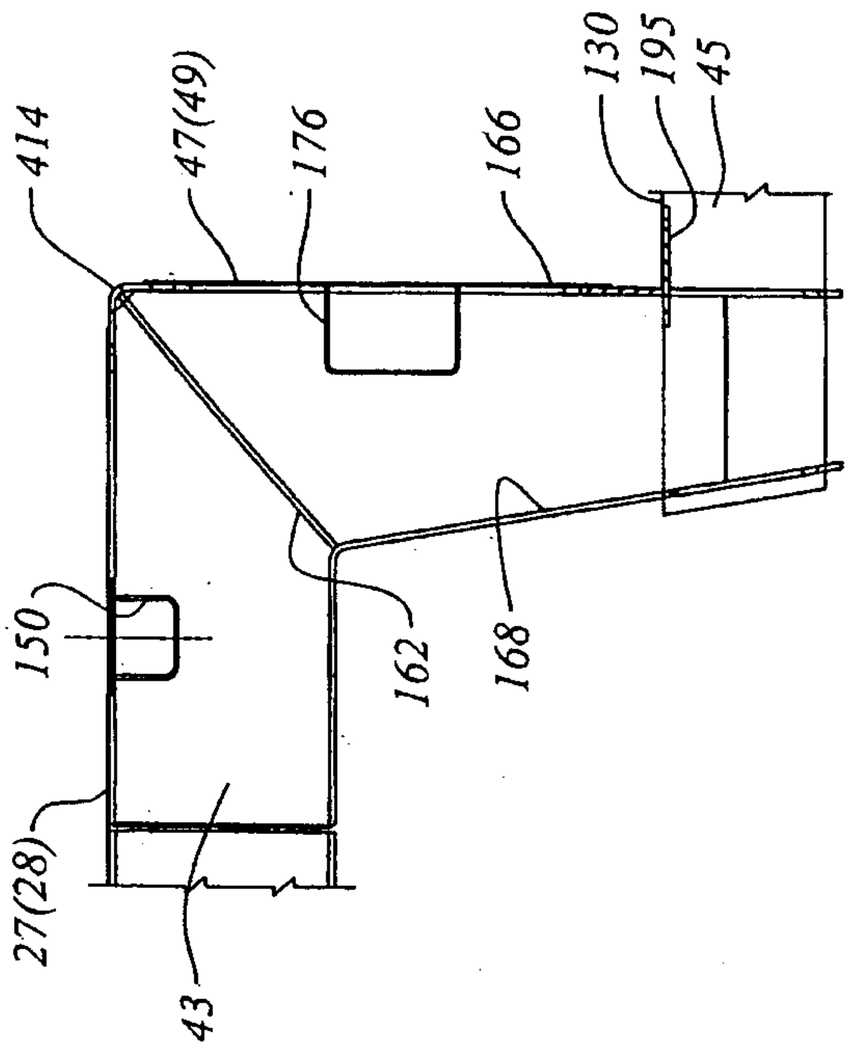


Figure 4i

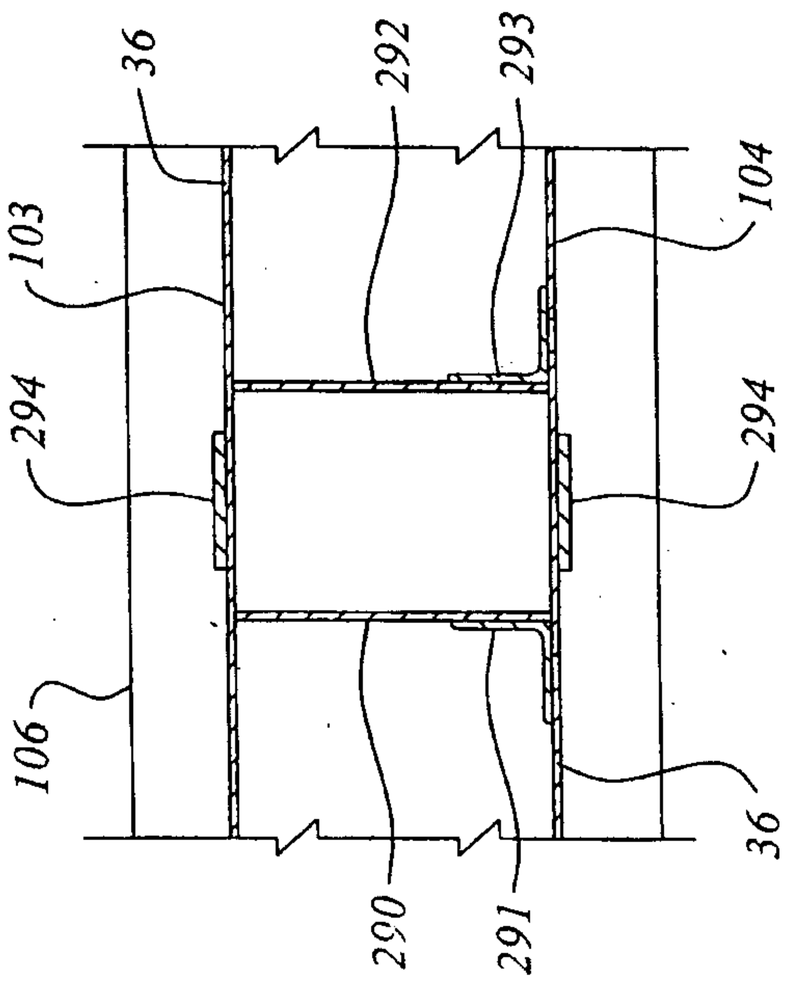


Figure 4h

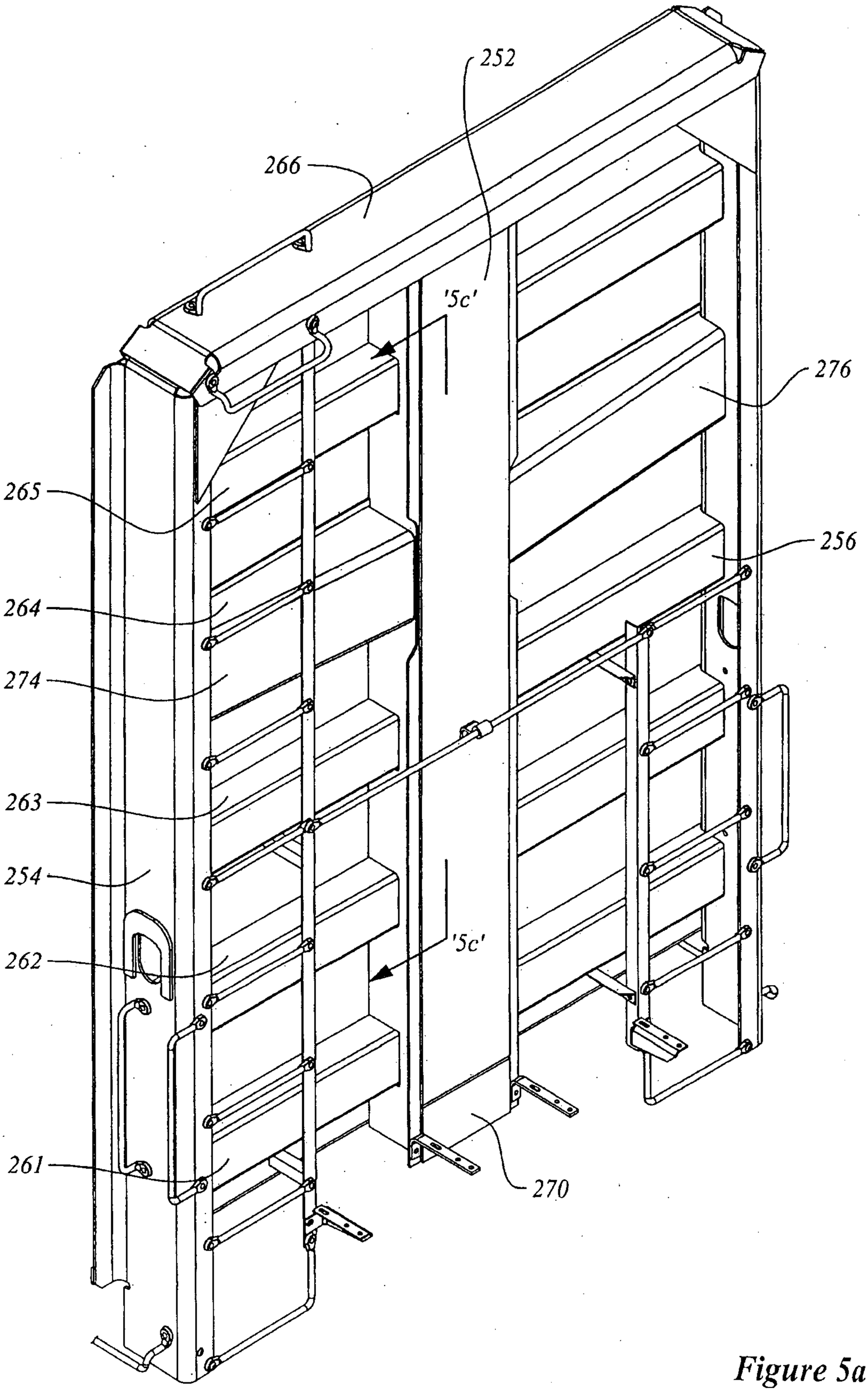


Figure 5a

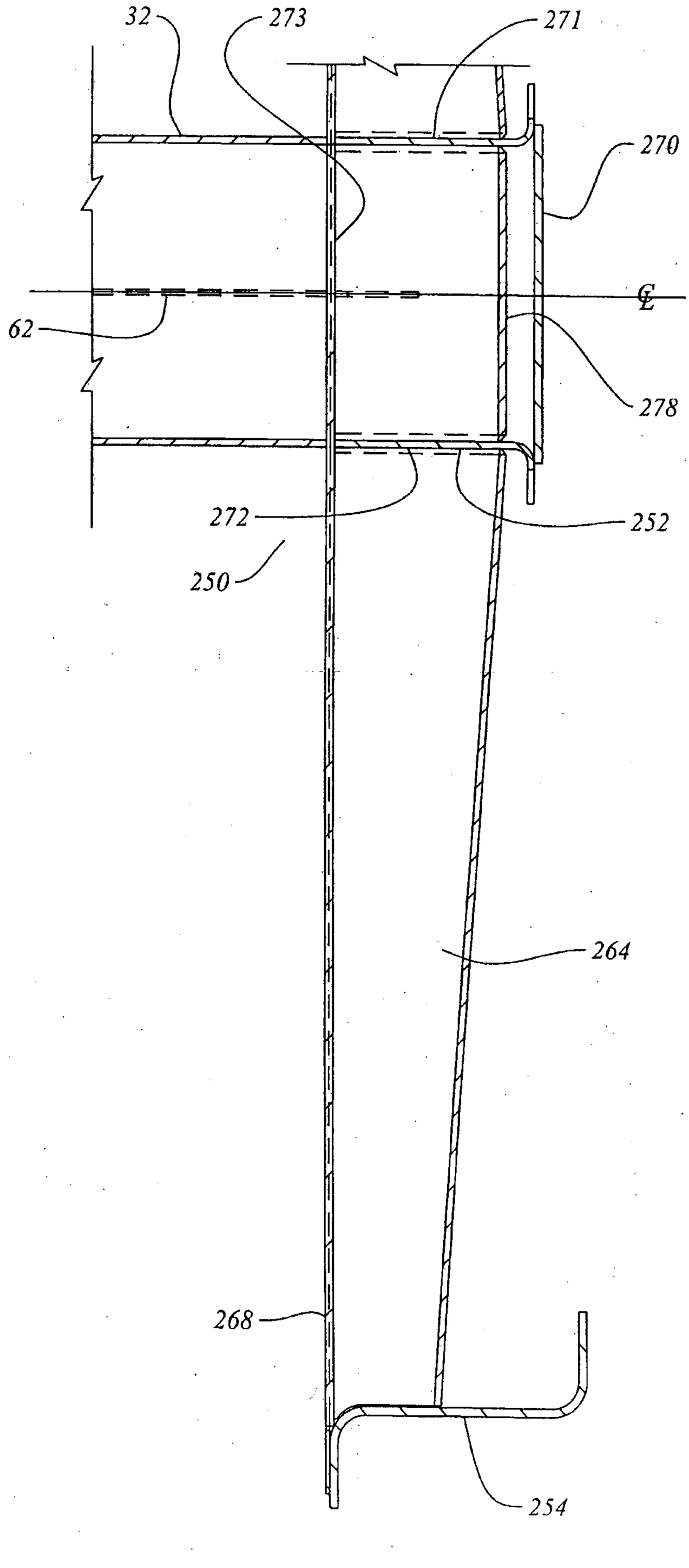


Figure 5b

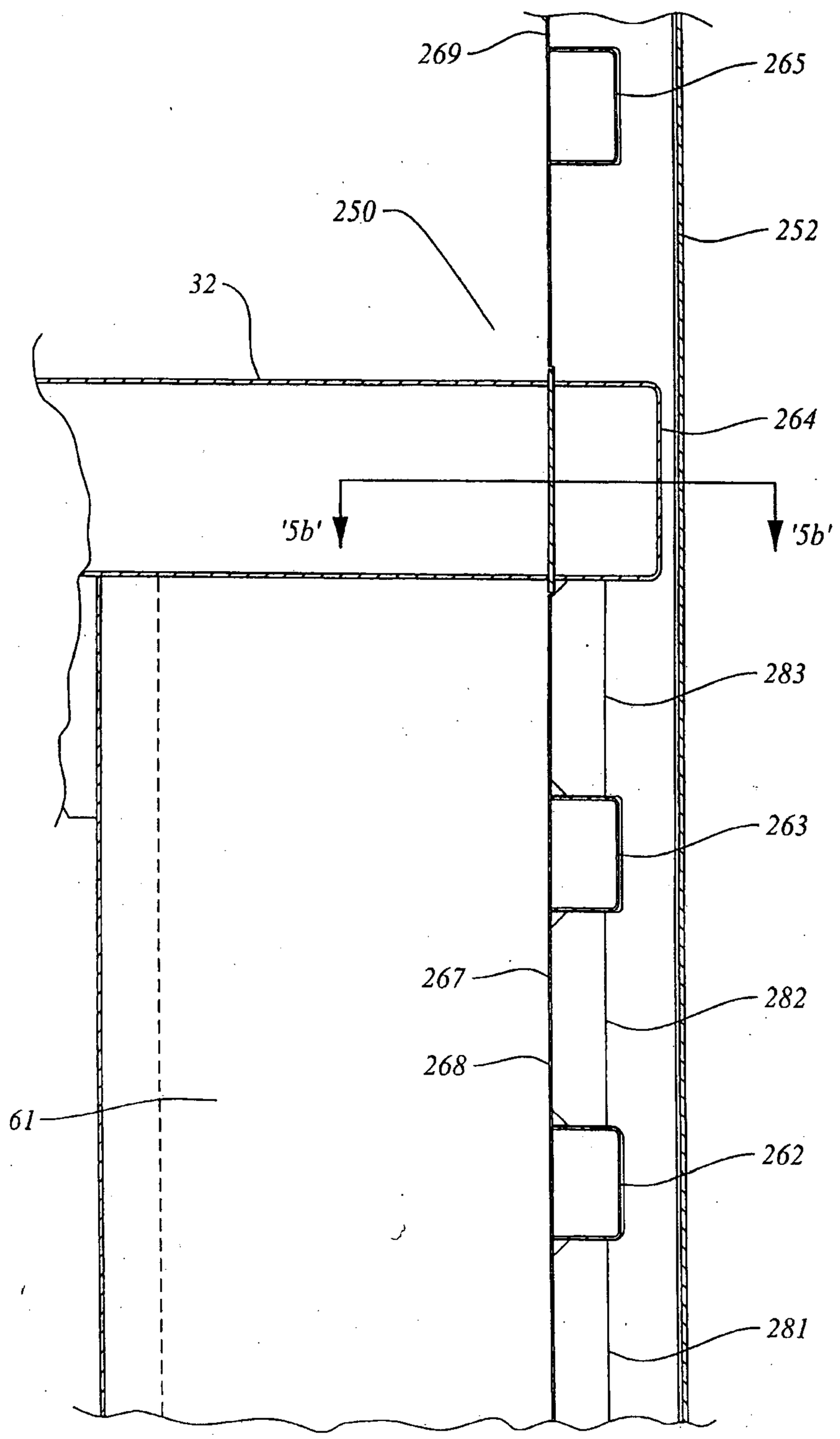
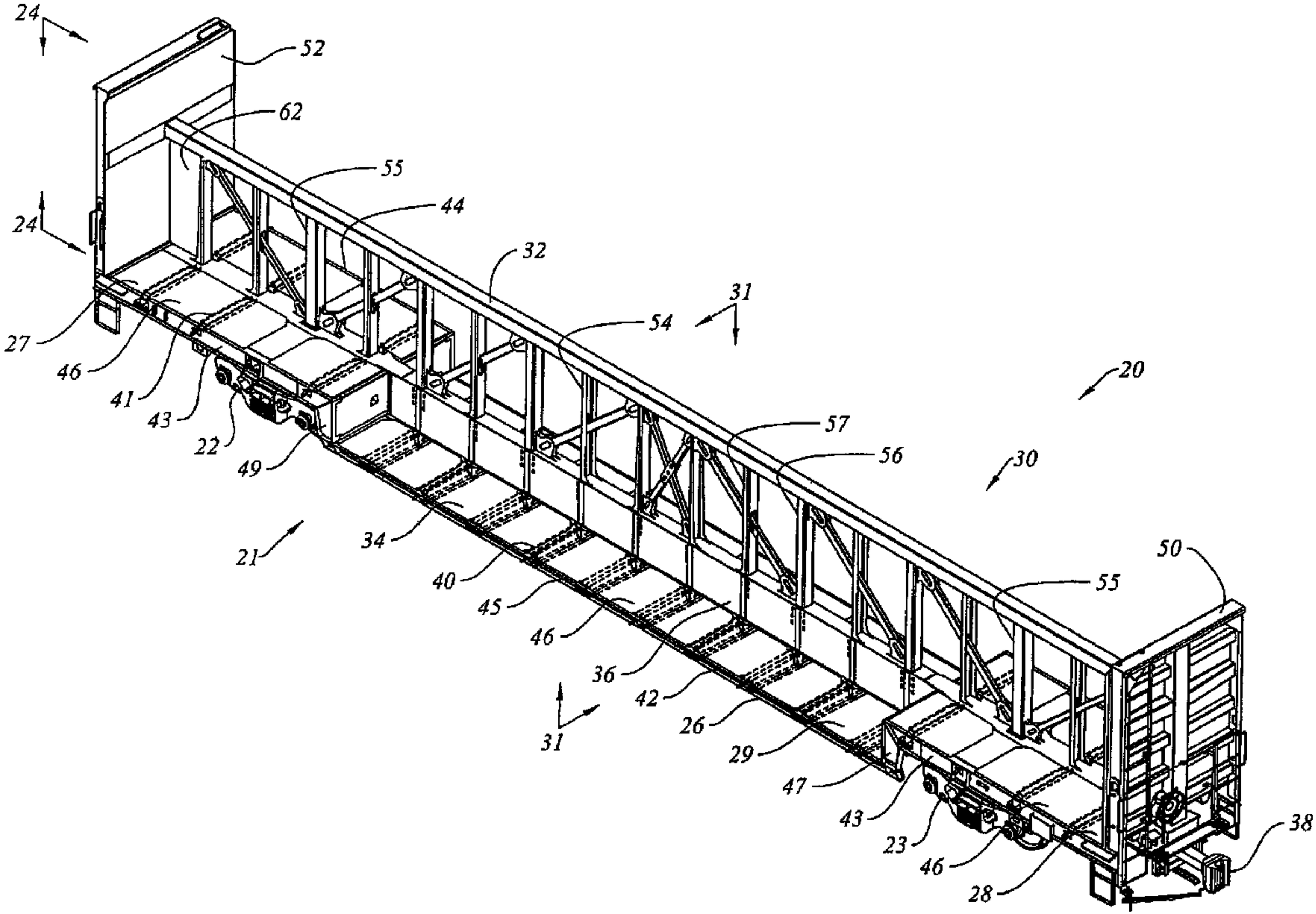


Figure 5c


24
52
62
55
44
24
32
31
54
27
46
41
43
22
49
57
56
30
20
21
34
40
45
46
36
42
26
29
47
43
23
46
28
38
50
55
31