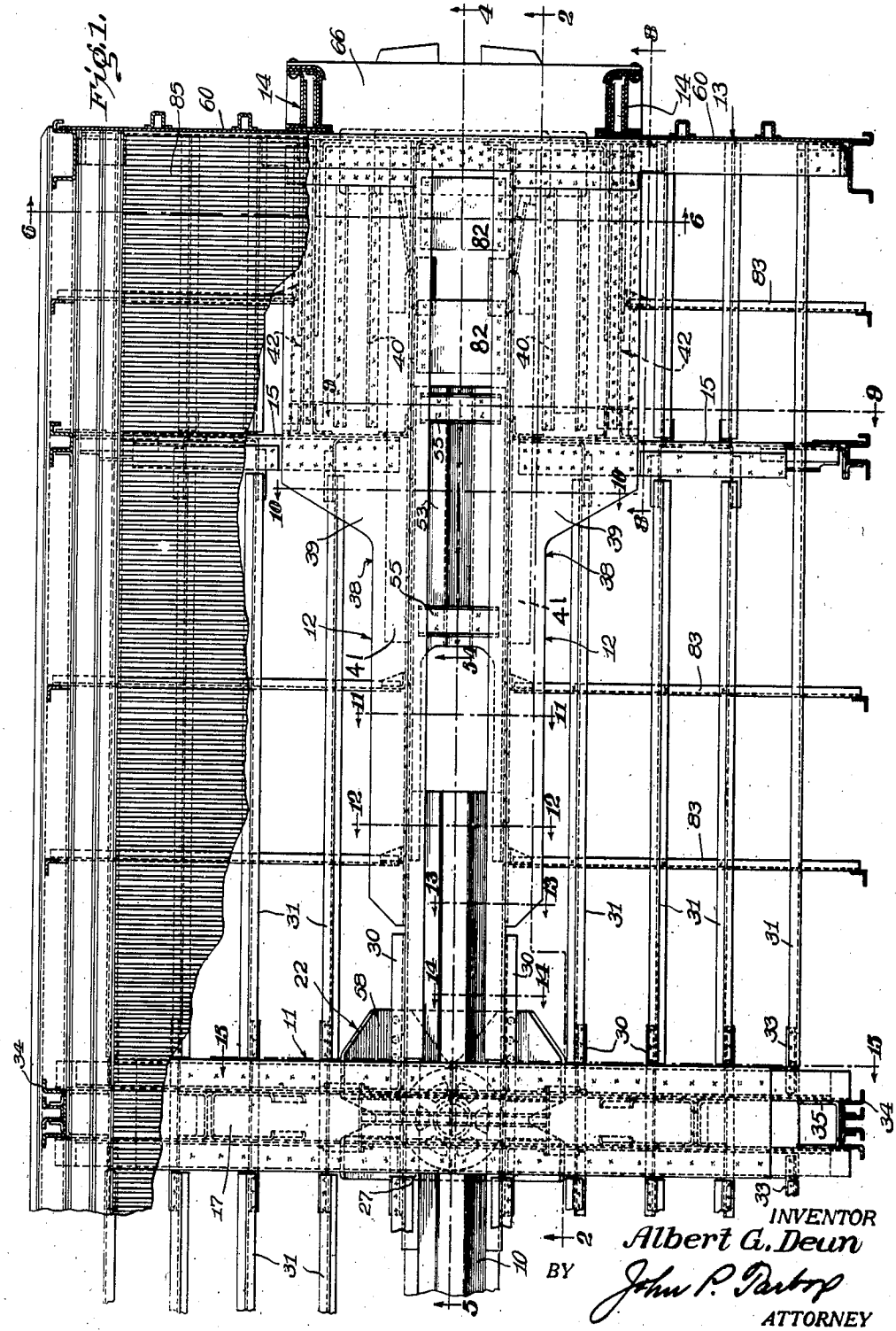
Oct. 19, 1943. A. G. DEAN 2,331,891

END UNDERFRAME CONSTRUCTION FOR RAIL CARS

Filed Nov. 21, 1941 6 Sheets-Sheet 1

Fig. 1.



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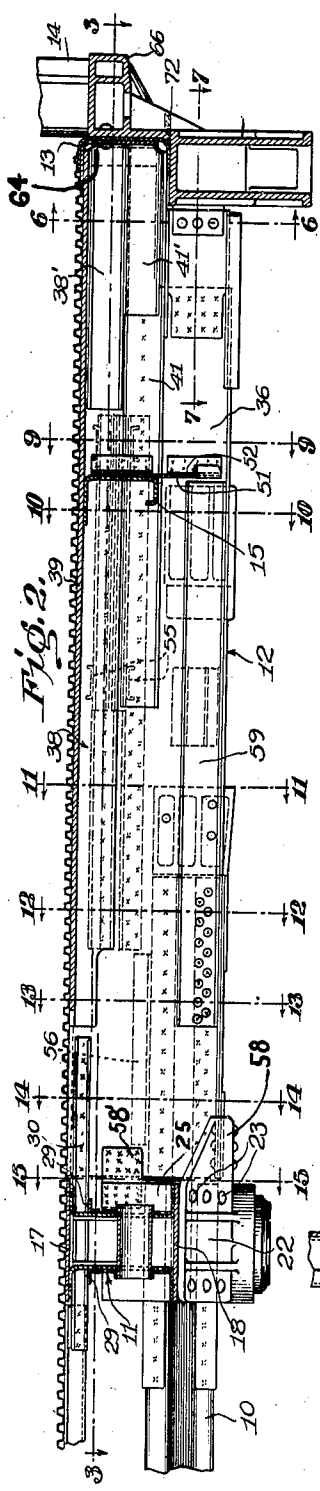


Fig. 2.

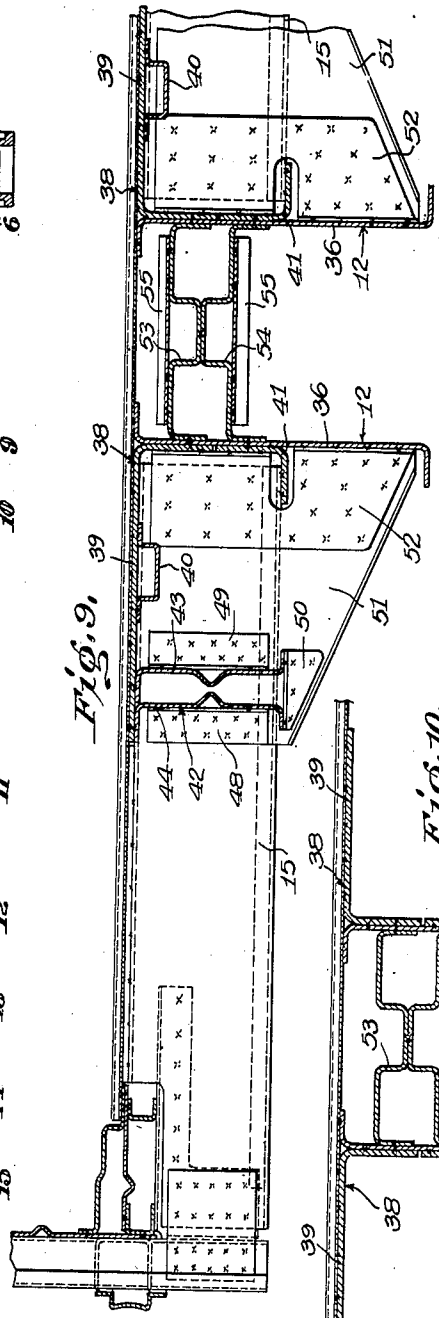


Fig. 9.

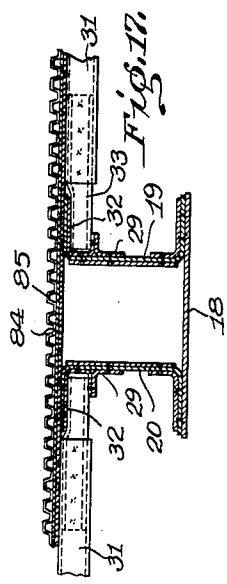


Fig. 11.

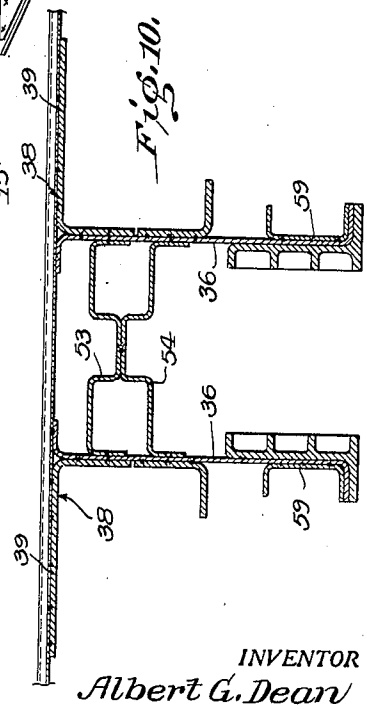


Fig. 10.

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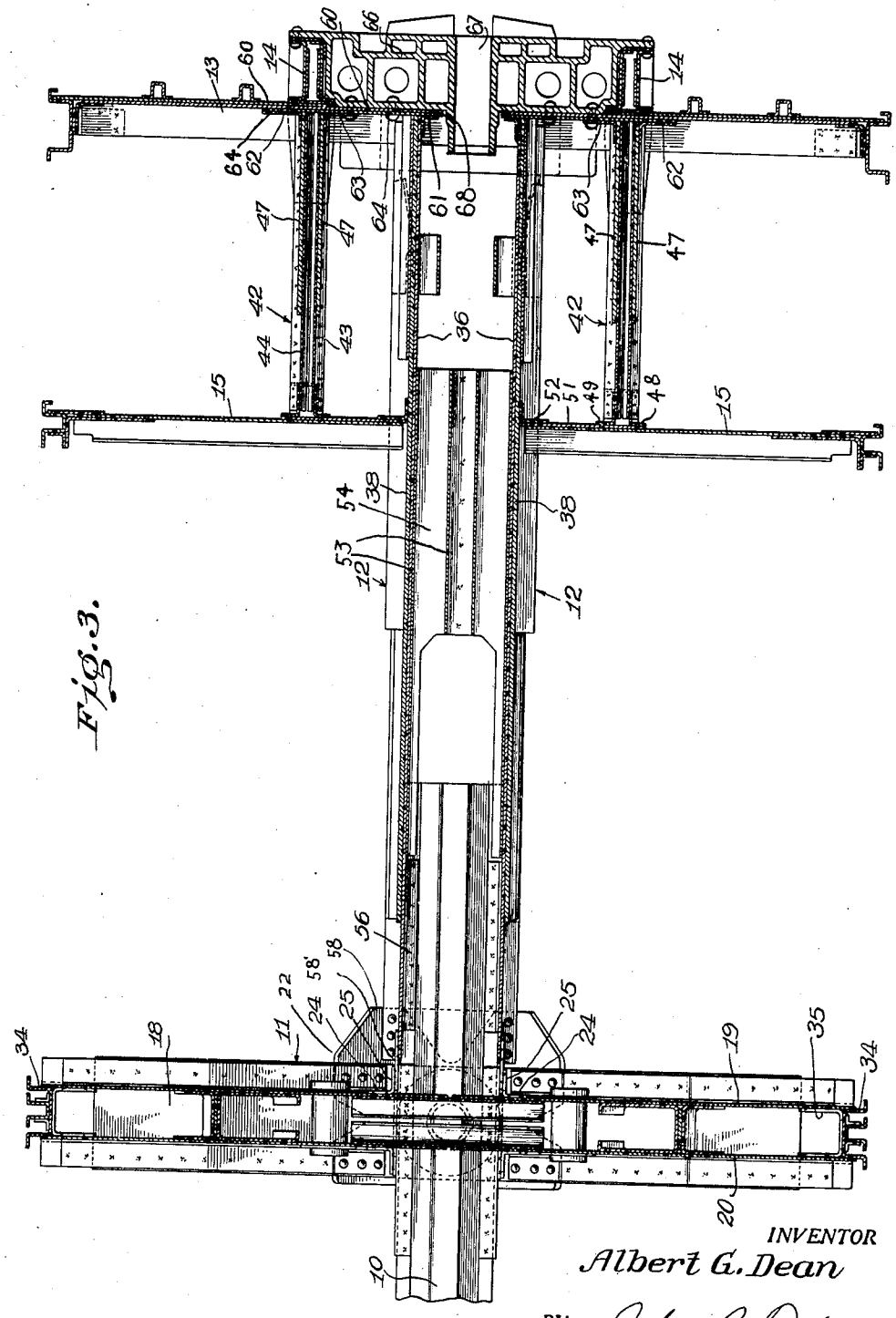


Fig. 3.

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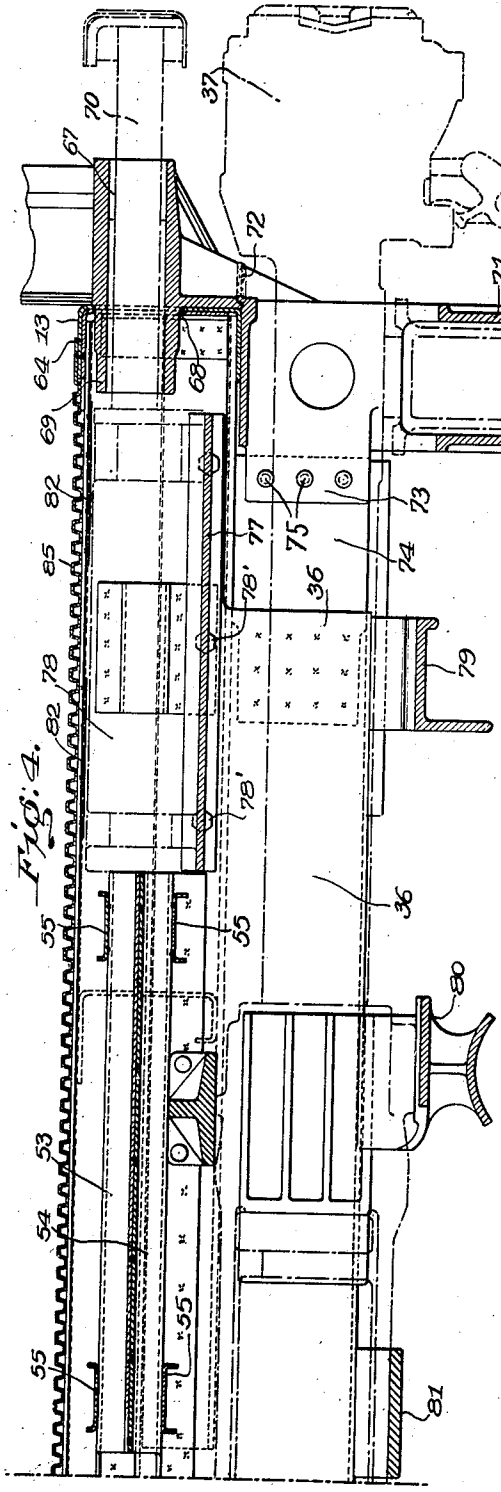


Fig. 4.

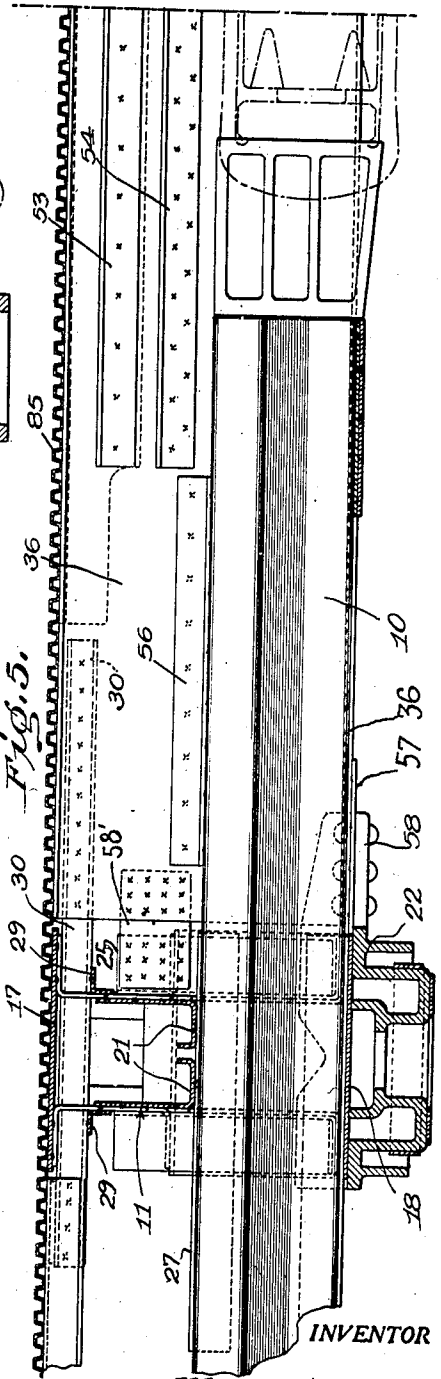


Fig. 5.

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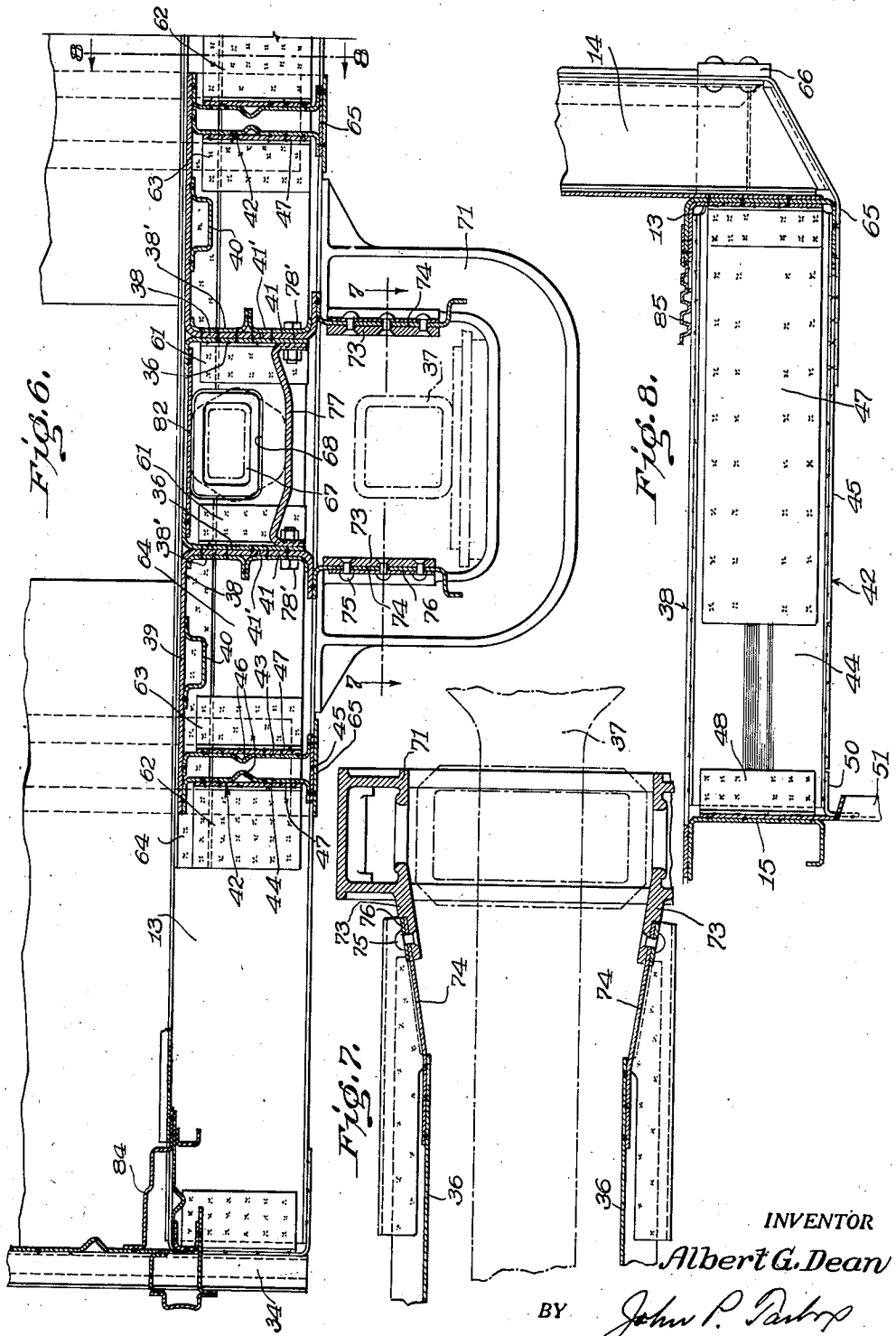


Fig. 6.

Fig. 8.

Fig. 7.

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END UNDERFRAME CONSTRUCTION FOR RAIL CARS

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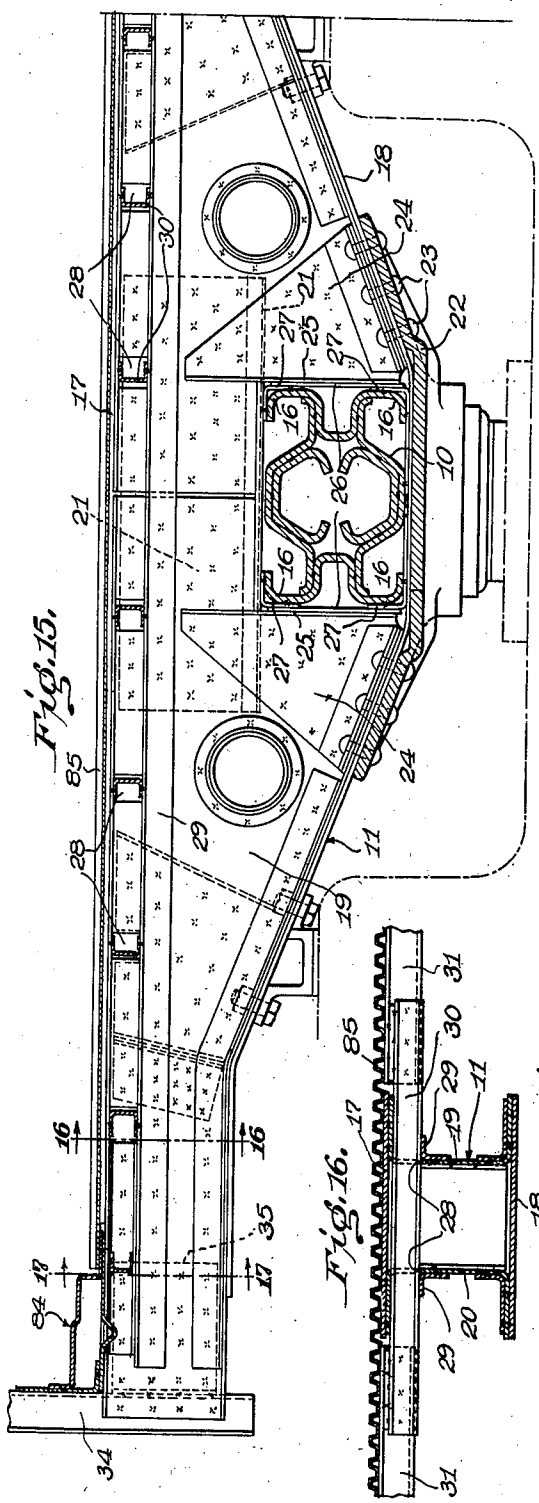


Fig. 15.

Fig. 16.

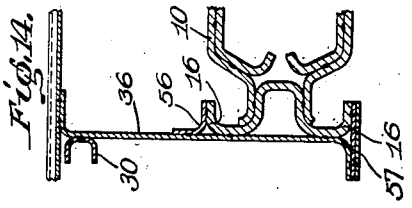


Fig. 14.

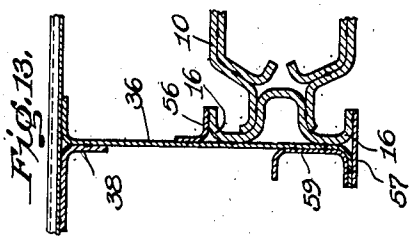


Fig. 13.

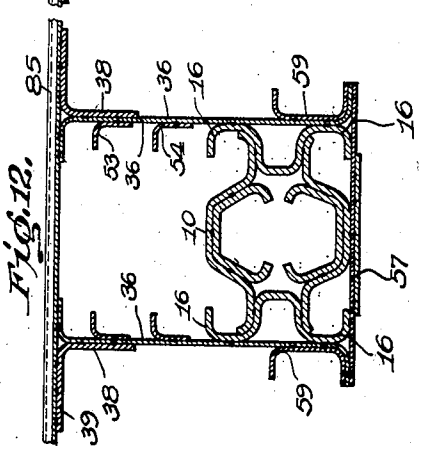


Fig. 12.

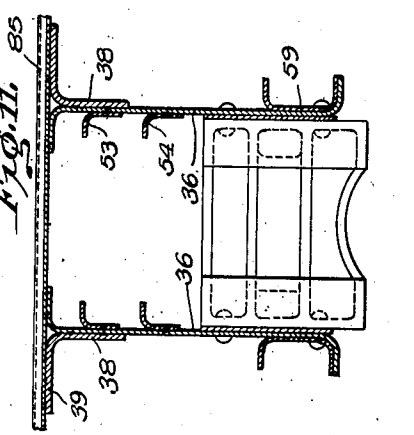


Fig. 11.

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Patented Oct. 19, 1943

2,331,891

UNITED STATES PATENT OFFICE

2,331,891

END UNDERFRAME CONSTRUCTION FOR RAIL CARS

Albert G. Dean, Narberth, Pa., assignor to Edward G. Budd Manufacturing Company, Philadelphia, Pa., a corporation of Pennsylvania

Application November 21, 1941, Serial No. 419,816

20 Claims. (Cl. 105—414)

The invention relates to rail car underframe construction and particularly to the end portion of the underframe including the bolster and end sill.

The invention disclosed in this application is an improvement over the construction disclosed in applicant's co-pending application Serial No. 296,026, filed September 22, 1939, and entitled Rail car underframe, and of which earlier application this application is a continuation-in-part.

As in the prior application one of the main objects of the invention is to provide an underframe of the class which for standard size railway cars is of light weight as compared with known such underframes and yet one which acts to absorb the heavy draft and buffing loads as well as to take the extremely heavy collision shocks incident to railway car operation and which meets with A. A. R. requirements to substantially the same or even greater degree as previous much heavier underframes.

It is a further object to provide an end underframe structure which can be readily assembled in subassemblies by spot welding, and which subassemblies are as readily joined together in final assembly and to adjoining side and end wall structures of the body, the latter also being preferably of light-weight construction.

To the end of achieving these objects, substantially all the parts entering into the structure are constructed, in the main, of light gauge members which may be rolled or drawn of strip stock preferably high tensile stainless steel, and which are so formed in their margins as to facilitate joinder in subassembly and final assembly by spot welding.

To this end also the center sill extensions interconnecting the center sill proper and the bolster to the end sill and the center sill proper and bolster may all be assembled as separate subassemblies, the parts of which are so formed as to be readily so subassembled and joined together in final assembly.

It is a further object of the invention to provide an end underframe construction in which the buffing, draft and collision forces, and particularly the latter, because of their magnitude, are directly transmitted to longitudinal members of the underframe without the necessity of providing large gussets and so as to minimize fatigue stresses in the joints to a maximum. To this end the buffing forces are not only directly transmitted to the center sill proper over its end area by buffer mechanism arranged in line with the center sill but the longitudinal center sill extensions flanking the buffer mechanism and which are strongly tied into the center sill proper to transmit collision forces thereto are also made to directly abut the end sill, against the outer face of which the collision posts of the end structure abut. The strength of the longitudinal members transmitting these forces from the collision posts is increased by making them progressively of increased width from the region of the bolster to the end sill and bracing them laterally by a shear plate interconnecting them. In the present construction eccentricity of loading is to a large extent eliminated by raising this shear plate to the floor level and greater simplicity of construction involving less joints is achieved by incorporating the shear plates on opposite sides of the center line in one piece with one of the major elements of the center sill extensions. Finally, a buffer beam casting extending between the spaced collision posts and the end sill and abutting and secured to the outer faces of the posts and the portion of the end sill bridging the space between the main longitudinal members of the end underframe insures that the collision shocks are transmitted directly to the longitudinal members of the underframe and, by reason of the connection of the integral shear plates directly to the flooring, are distributed throughout the entire width of the underframe.

Other and further objects and advantages will become apparent from the following detailed description when read in connection with the accompanying drawings, forming a part hereof.

In the drawings,

Fig. 1 is a plan view of the end of the underframe according to the invention, parts being shown in section and parts broken away.

Fig. 2 is a vertical longitudinal sectional view, the section being taken substantially along the line 2—2 of Fig. 1.

Fig. 3 is a sectional plan view of the end of the underframe, the section being taken substantially along the line 3—3 of Fig. 2.

Fig. 4 is an enlarged vertical longitudinal sectional view taken substantially on the line 4—4 of Fig. 1.

Fig. 5 is a similar view on the same scale as Fig. 4, this section being an extension of the section shown in Fig. 4 and taken substantially along the line 5—5 of Fig. 1.

Fig. 6 is an enlarged scale transverse sectional view through a portion of the underframe, the section being taken substantially along the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary horizontal sectional

view taken substantially along the line 7—7 of Fig. 6.

Fig. 8 is a fragmentary longitudinal sectional view taken substantially along the line 8—8 of Fig. 1.

Figs. 9, 10, 11, 12, 13, 14 and 15 are fragmentary enlarged transverse sectional views through portions of the underframe, these sections being taken, respectively, substantially along the line 9—9, 10—10, 11—11, 12—12, 13—13, 14—14 and 15—15 of Fig. 1.

Figs. 16 and 17 are fragmentary detail sectional views through the bolster taken, respectively, substantially along the lines 16—16 and 17—17 of Fig. 15.

The sectional views appear as if viewed in the direction of the arrows at the ends of the section lines.

Referring to the drawings, Figs. 1 to 5, it will be seen that the underframe comprises a center sill proper 10 extending through the bolster 11 and having the end extensions 12 forming draft gear and buffer pockets between them and overlapping the end of the center sill proper and rigidly secured thereto and abutting at their outer ends the end sill 13. These end extensions are transversely widened stepwise from their inner ends adjacent the bolster to their outer ends abutting the end sill and they are also vertically of a depth exceeding the depth of the center sill proper so as to bring their upper faces in the plane of the floor. They are also transversely interconnected by numerous elements and this together with the tranverse widening at their outer ends provides a very strong collision or anti-telescoping structure in the region inwardly of the end collision posts, indicated at 14, overlapping the outer face of the end sill. A secondary end sill 15 connects the widened end extensions 12 intermediate their ends to the side walls of the body.

For convenience of assembly the end sills 13 may form part of an end wall subassembly including the collision posts 14, and the center sill proper 10, bolster 11 and the end sill extensions 12 may also be subassembled in separate subassemblies brought together in the final assembly in a suitable final assembly jig.

The center sill proper may comprise, as appears in Figs. 1, 3, 12, 13, 14 and 15, a compact columnar structure, built up of a plurality of sheet metal sections secured together as by spot welding. It is of generally rectangular form and the corners of the rectangle are formed by angular formations 16 which provide accessibility for the ready attachment of the parts thereto. This form of sill is fully described and claimed in the application above-referred to and further description herein is believed unnecessary, except as it enters into the end underframe construction of this invention.

The bolster 11 is also built up in the main of sheet metal parts and comprises a box section structure built up in the main, of top and bottom plates 17 and 18 joined together by flanged outwardly facing channel form side plates 19 and 20 overlapping the top and bottom plates through their channels sides and secured thereto. As shown in Fig. 15, the opposite halves of the side plates 19 and 20 may be made of separate pieces which are interconnected by J section members 21, Fig. 5, having a wide overlap therewith and secured thereto by numerous spot welds.

The top of the bolster is arranged substantially in the plane of the flooring while the bottom has its central portion downwardly offset to provide a deeper construction at the center. Between the central portion of the bottom plate 18 and the bottom of the J members 21 the bolster is provided with a rectangular opening to receive the correspondingly shaped center sill proper. The center plate casting 22 spans this opening and extends at the sides a substantial distance therebeyond and is secured to the bottom flanges of the bolster formed by the bottom plate 18 and the overlapping flanges of the side plates 19 and 20 and additional reinforcing plates to provide a strong laminated attachment, by a series of rivets 23. One of these reinforcements may comprise a pair of flanged triangular gussets 24 arranged on opposite sides of the opening in the bolster at the inner and outer faces thereof and having flanges as 25 paralleling the opening. The flanges 25 on opposite faces of the bolster may be connected by a plate 26. To provide means for securing the bolster to the sill the corners of the opening may have secured therein angles 27 which extend beyond the inner and outer faces of the bolster and overlap the angular formations 16 of the center sill and are secured thereto in the overlap.

At the top, the bolster may have its side plates formed with cut out openings, as at 28, at spaced locations, see Figs. 15 and 16, and reinforced below said openings by angles, as 29, extending substantially the length of the bolster. These cut out openings 28 receive, in the subassembly of the bolster, short channels 30 extending beyond the inner and outer faces of the bolster and secured to angles 29, and the top flanges of the side plates 19 and 20 through their side walls, the extended portions serving as final assembly joint parts to connect the floor stringers 31, see Figs. 1 and 16. For the last stringer at the side, the cut out opening is not provided to avoid weakening the bolster in this region of connection to the side wall of the body. At this location the construction is that shown in Fig. 1 and the section of Fig. 17. An outwardly facing channel 32 is secured to the angle 29 and the adjacent top flange of the side plate of the bolster and a short channel, as 33, is telescoped into this channel and secured to its side walls, this channel projecting, like the channels 30, to serve as final assembly joints to secure the adjacent end of a floor stringer 31.

The side plates of the bolster are extended at their ends to overlap the side walls of the posts 34 of the side walls for securement thereto. Additionally, a channel 35 telescoped within and secured to the opposed side plates of the bolster is, in final assembly, secured through its bottom wall to the overlapping face of the post 34.

Additional reinforcements are provided within the bolster and along its bottom margin in certain locations where needed to take the loads, as pointed out in the above-referred to application, but detailed description thereof herein is believed unnecessary.

Since the end extensions 12 of the center sill are similar in construction, but rights and lefts, only one need be described in detail. These end extensions 12 may be independently assembled in subassembly and may comprise as a main element thereof a strong main columnar structure built up of a vertically deep member 36 of Z-section having its top flange in the plane of the flooring, this member extending from the bolster 11 to the end sill 13. At the end, however, it is cut away in its lower portion (see Figs. 6 and 7)

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to afford clearance for the lateral movements of the coupler 37 located in this region in a manner to be described hereinafter. At the top the member 36 is reinforced by an angular section member 38 of heavier gauge extending from an inner point adjacent the bolster 11 outwardly to the end sill 13, see Fig. 4, the upper flange 39 of this member 38 being in the plane of the upper flange of the member 36, as shown in the sectional views of Figs. 6, 9, 10, 11, 12 and 13, and is stepped in width, being widest at the outer end where it abuts the end sill in final assembly, see Figs. 1 and 3. As appears in Figs. 1, 6 and 9 the endmost widened part of the flange 39 is reinforced and stiffened by a longitudinally extending flanged channel 40 secured to its under face.

The member 36 is further stiffened by an angle 41, see Figs. 1, 2, 6, 9, 10 extending from the end sill 13 through and a substantial distance inwardly beyond the cut away outer portion of the member 36. This angle 41 may be of the same heavier gauge as the member 38 and arranged so as to form therewith an outwardly facing channel section. As shown in Figs. 2, 4 and 6, this outwardly facing channel section is further reinforced by a pair of light gauge channels 38' and 41' having their adjacent side walls welded together and being welded through their bottom walls to the vertical flanges, respectively, of the members 38 and 41. These channels provide additional area through which the main columnar structures may abut the end sill.

The lateral edge of the widened flange 39 of the angle 38 may be further strongly reinforced in longitudinal alignment with the adjacent collision post 14 by a box section secondary columnar structure 42 which may be built up of a generally Z-section member 43 and a channel 44 spaced slightly therefrom and both secured through their top flanges to the flange 39 from angle 38. The bottom flanges of members 43 and 44 may be connected, see Fig. 6, by a plate 45 to close the box cross-section. To further stiffen the column 42 the webs of the members 43 and 44 may be formed with beads, as 46, and the major portion of the lengths of said webs may be welded to a heavier gauge stiffening plate, 47, see Figs. 3, 6 and 8.

A laterally extending secondary end sill 15 may also be secured in subassembly to the center sill end extension structure 12 so far described. This secondary end sill comprises a channel extending from the main columnar structure formed by elements 36, 38, 41 laterally to the side wall of the body to which is adapted to be secured in final assembly. The channel sill 15 faces inwardly from the end of the car, see Figs. 2, 3 and 8 and has its bottom wall secured to the end of the secondary columnar structure 42 through angles 48, 49 and 50. (See Figs. 8 and 9.) It is also strongly secured through its top and bottom flanges to the lateral flanges of angles 38 and 41, see Fig. 9, and through its bottom wall, by a vertically deep gusset 51 and angle 52, to the main columnar structure 36, 38, 41 through substantially the full depth of the latter, see Fig. 9, this gusset and angle being cut out to receive the laterally projecting flange of angle 41.

The right and left center sill extensions 12 so constituted may now be brought together and interconnected adjacent the top of their main columnar structures 36, 38, 41 by a buffer abutment structure, see Figs. 1, 3, 9, 10, 11 and 12, this structure extending longitudinally from a point some distance in front of the secondary end sill 15 to and some distance inwardly beyond the outer end of the center sill proper 10. This buffer abutment structure comprises, when assembled, a multiple box section structure and may be formed by offsetting the bottoms of two channels 53 and 54, see Fig. 9, in opposite directions and securing the offset portions together and securing the side walls of the channels to the vertical webs of the main columnar structures 36, 38, 41. Additional strength and stiffness may be secured by bridging the offsets of the channels 53 and 54 at spaced points by transverse channels, as 55, secured to the bottoms of the channels, see Figs. 1 and 9. As shown in Figs. 1, 3, 11 and 12, at its inner end the buffer structure is cut away for the most part leaving only the angles formed by the side walls and a portion of the bottom of the channels 53 and 54.

The center sill end extensions 12, as described, may be assembled to the bolster and center sill proper in the manner now to be described. As shown in Figs. 3, 12, 13 and 14, the webs of the members 36 of the main columnar extension structures 36, 38, 41 overlap the opposite faces of the center sill proper and are secured to the angular formations 16 at the corners thereof by spot welding. The top angular formations of the center sill may be further secured to the webs by angles, as 56. At the bottom the angular formations 16 are secured to the bottom flanges of the members 36 by transverse plates 57 overlapping and secured thereto, see Figs. 12, 13 and 14. These figures show that the thickness and extent of these plates may vary at different locations, as desired.

To secure the inner ends of the main columnar structures 36, 38 and 41 directly to the bolster, the center plate casting, as 22, is formed with an outward extension 58 extending toward the car end and the inner ends of members 36 reinforced by plates 57 overlap this extension and are riveted thereto, as appears in Figs. 1, 3 and 5. The extra thickness plate of Figs. 5 and 14 in this region affords a stronger riveted joint. At the top, the short channel extensions 30 secured to the bolster, as hereinbefore described, overlap the members 36 and are secured thereto as by spot welding, see Figs. 1, 2, 5 and 14. As shown in Figs. 2, 3 and 5, the vertical walls of members 36 are further secured to the bolster by plates, as 58', overlapping and secured in final assembly, respectively, to the flanges 25 of gussets 24 on the bolster sub-assembly and to the adjacent walls of the members 36. The lower margin of member 36 may be further reinforced intermediate its ends and in overlapping and secured relation to the center sill proper, by a channel 59 secured in the angle formed by its body web and bottom flange (see Figs. 2, 12 and 13).

In the assembly of the end sill 13 with the outer ends of the laterally widened end extensions 12 of the center sill the main and secondary columnar structures are telescoped into the inwardly facing channel of the end sill 13, see Figs. 2, 3 and 6, which sill has its bottom wall reinforced by the thickness of the end wall panel 60. As shown in Figs. 2, 3 and 6, the main columnar structures 36, 38, 41 are then secured to the reinforced bottom wall of the sill, not only through their top and bottom flanges overlapping the top and bottom side walls of the sill, but also, each by an angle, as 61, securing their vertical webs, respectively, to the bottom of the channel of the sill 13 while the box section secondary columns 42 are secured not only to the

top flange of the end sill by the overlapping widened flange 39, but also, each by a pair of angles 62 and 63 securing the respective secondary column to the bottom of the channel of the end sill. As shown in Fig. 2, the top and bottom flanges of the abutting columnar structures are cut back to insure a solid abutment of the webs thereof with the end sill. As shown in Figs. 2, 3, 4 and 6, the end sill channel 13 may be reinforced in the region between the collision posts 14 by an interposed angular section plate, 64.

As shown in Figs. 6 and 8, the secondary columns 42 are each additionally joined to the end sill 13 by an extension plate 65 from the adjacent collision post 14 which overlaps the bottom side wall of the end sill and the bottom plate 45 of the associated column and is secured thereto by spot welding.

The end sill is further reinforced between the collision posts 14 by a buffer supporting casting 66 (see Figs. 1, 2, 3, 4 and 6). This casting overlaps the end sill and the outer faces of the posts and is secured thereto by rivets (see Figs. 1, 3 and 4). At the center, this casting has an opening 67 which is extended inwardly through an opening 68 in the end sill by a hollow extension 69 (see Fig. 4). This opening 67 supports and guides the buffer stem indicated at 70.

At the bottom the buffer supporting casting 66 is integrally united to a U-shaped coupler support 71 which overlaps the bottom of the end sill, the connection between the parts 66 and 71 being preferably by a continuous arc weld 72 extending throughout their lateral extent. As shown in Figs. 6 and 7, the main longitudinally extending columnar structures 36, 38, 41 are additionally joined to the coupler support 71. To this end, the support is formed with integral inwardly extending flanges 73. Each of these flanges being overlapped on its outer face by the bottom wall of a channel 74 and secured thereto by a vertical line of rivets 75. To provide a strong riveted joint the bottom of the channel 74 is reinforced in this region by a plate 76. As shown in Fig. 6, the top side wall of the channel 74 is secured to the laterally projecting flange of the adjacent angle 41 and the bottom side wall of the channel which is provided with an edge stiffening flange is extended inwardly and is secured to the bottom flange of the member 36, see Fig. 7. The lower portions of the webs of the members 36 are cut away at their forward ends and the connecting channels 74 bridge the space between the cut-away webs and the adjacent extensions 73 from the coupler support. The webs of channel 74, as clearly appears in Figs. 4 and 7, are secured to the webs of the members 36. The channels 74 and the extensions 73 are laterally outwardly inclined to provide room for the movement of the coupler stem 37.

In the final assembly, the main columnar structures 36, 38, 41 are further interconnected. One such connection is the buffer carrying plate 77 (see Figs. 4 and 6) supporting the buffer, indicated at 78, cooperating with the buffer stem 70 and interposed between the abutment formed by the interconnected channels 53, 54 and the enlarged inner end of the buffer stem 70. This plate 77 is flanged in its edges and securely bolted by the bolts 78' to the main columnar structures 36, 38, 41.

As shown in Figs. 1, 4 and 6, the top flanges of the main members 36 may be further interconnected in the buffer region by spaced plates 82.

The lower margins of the main columnar structures 36, 38, 41 are further interconnected by longitudinally spaced transverse coupler members 79, 80, 81. These members, in addition to so interconnecting the main longitudinal columnar structures, support and guide the draft gear and yoke connected with the coupler stem 37 which are arranged in line with the end of the center sill proper, 10.

Finally, the end underframe, hereinbefore described, is further stiffened and strengthened by the floor stringers 31 and the corrugated flooring 85 supported by and secured to the stringers and to the top flanges of the members 36 and 38 of the center sill end extensions, the top flange of the end sill 13 and the top plate 17 of the bolster, all of which lie in the same plane. The corrugated flooring is secured to these members at numerous points by spot welding and the flooring thus contributes very materially to the strength of the shear panel formed by the top flanges of members 36 and 38 of the center sill extensions 12 in taking the collision load. The construction so formed effects a very effective anti-telescoping structure and this is achieved by the use of relatively light members secured together at proper intervals.

It will be understood, of course, that each of the end sills 13, the auxiliary end sills 15 and the bolster 11 are strongly tied into the side frames, and, in addition, transverse members 83 secured to the longitudinal extensions 12 of the center sill and the side frame intermediate these main transverse members are provided to support the floor stringers in these regions and further tie the underframe and side frames together.

Strong columnar box section side sills 84, secured to the transverse members of the underframe and to the corrugated flooring, as shown in Figs. 15 and 17, form further reinforcements substantially in the plane of the flooring to take collision loads.

Though only a single form of the invention is illustrated and described the invention is not limited thereto but may be embodied in various forms as desired. As various changes in construction and arrangement of parts may be made without departing from the spirit of the invention as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. An end collision structure for rail cars including an end sill, a bolster longitudinally inwardly extending laterally spaced columnar structures abutting said end sill and extending inwardly for connection to a center sill proper projecting beyond the bolster and to the bolster, other laterally arranged longitudinally extending columnar structures also abutting the end sill and extended inwardly and secured by shear panels to said first columnar structures, and collision posts disposed longitudinally in alignment with said laterally arranged columnar structures and overlapping the outside face of the end sill and secured thereto.

2. An end collision structure for rail cars including an end sill, a bolster, longitudinally inwardly extending laterally spaced columnar structures abutting said end sill and extending inwardly for connection to a center sill proper projecting beyond the bolster and to the bolster,

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other laterally arranged longitudinally extending columnar structures also abutting the end sill and extending inwardly and each secured by shear panels arranged substantially in the floor plane to the adjacent one of said first columnar structures, said shear panels being each formed as an integral part of one of said associated columnar structures.

3. An assembly for use in a rail car underframe to transmit collision forces from the end sill to the center sill terminating inwardly of the car end, comprising a columnar structure including a vertically deep member having a vertical web flanged at top and bottom, and a heavier gauge reinforcement of substantially angular section secured through one of its arms to the web of said vertically deep member and having another arm extending laterally in the plane of the upper flange of said vertically deep member, the width of said last-named arm varying and being of greatest width toward the end sill.

4. An assembly according to claim 3 in which a further angular section member is secured to said web to form with the first-named angular section member, a laterally facing channel.

5. An end underframe construction for rail cars including an end sill, a bolster, and a pair of longitudinally extending columnar structures abutting the end sill and connected to the bolster, said columnar structures being vertically deep and for most of their length extending below the level of the end sill but cut away in their lower portions adjacent the end sill to provide space for the lateral swing of the coupler stem, the upper portions of said structures being arranged substantially in the plane of the flooring.

6. An end underframe construction for rail cars including an end sill, a bolster, a pair of longitudinally extending columnar structures abutting the end sill and connected to the bolster, said columnar structures being vertically deep level of the end sill but cut away in their lower and for most of their length extending below the portions adjacent the end sill to provide space for the lateral swing of the coupler stem, a coupler support extending below the end sill, and laterally flaring means joining the columnar structures, vertically in the region of the cut out portions, to the coupler support.

7. An end collision structure for rail cars comprising a bolster, an end sill, a center sill proper extending through and beyond the bolster, a pair of primary laterally spaced columnar structures flanking the center sill proper and secured thereto and extending longitudinally from the bolster to the end sill and arranged to receive buffer and draft gear between them, a secondary end sill comprising two parts each secured at its inner end to one of said columnar structures and at its outer end to the adjacent body side wall, a secondary pair of longitudinally extending columnar structures interconnecting the end sill and said secondary end sill, one laterally outwardly of each of said primary columnar structures, and a shear panel connecting each adjacent pair of primary and secondary columnar structures.

8. An end collision structure according to claim 7, in which the shear panels connect also the end sill and the secondary end sill.

9. In a rail car underframe, a center sill proper, a bolster having an opening in its lower central portion through which the center sill proper extends, said sill terminating some distance beyond the bolster, an end sill, spaced main columnar members flanking the sides of the center sill proper, overlapping them throughout an extensive area and secured thereto in the overlapped area, the outer ends of said members abutting the end sill, said columnar members extending vertically from substantially the bottom of the center sill proper to substantially the floor level, and being laterally flanged at the top, certain of said flanges being of increasing width toward the end sill and their outer ends overlapping and secured to the end sill for substantially their full width.

10. In a rail car, an end underframe including a bolster, an end sill, a center sill proper extending through and beyond the bolster, a pair of laterally spaced main central longitudinal columnar structures overlapping and secured to the opposite sides of the center sill proper and extending from the bolster to the end sill in abutting relation with the latter, a pair of secondary longitudinal columnar structures arranged one laterally outwardly of each of said main structures and extending inwardly from its abutting relation with the end sill a distance substantially less than said main columnar structures, all said columnar structures having their tops substantially in the plane of the floor and including shear plates interconnecting the adjacent pairs of main and secondary columnar structures.

11. In a rail car, an end underframe including a bolster, an end sill, a center sill proper, a pair of laterally spaced main central longitudinal columnar structures flanking the center sill proper and secured thereto and extending from the bolster to the end sill in abutting relation with the latter, a pair of secondary end sill members each strongly secured at its inner end to one of said columnar structures and at its outer end to an adjacent side wall, a pair of auxiliary longitudinal columnar structures, one arranged laterally of each main columnar structure and extending between the secondary end sill and the end sill and abutting the latter, a transverse shear member including the floor sheeting strongly interconnecting said main and auxiliary columnar structures, the end sill and the secondary end sill members.

12. In a rail car, an end underframe including an end sill, a bolster, a center sill proper extending through and some distance beyond the bolster, a pair of main central longitudinal columnar structures secured to the opposite sides of said center sill proper and extending from the bolster to the end sill and secured to the latter in abutting relation therewith, a pair of auxiliary longitudinal columnar structures arranged, one laterally of each of the main structures, secured to the end sill in abutting relation thereto and extending inwardly thereof a less distance than said main structures, means extending between the main and auxiliary structures and strongly tying them together to act together in shear, and a buffer structure reinforcing said end sill and extending outwardly thereof and laterally to overlap all said columnar structures.

13. In a rail car according to claim 12 in which said buffer structure includes collision posts abutting the outside of the end sill and having parts extending below the sill and secured to the auxiliary columnar structures.

14. In a rail car according to claim 12, in which said buffer structure includes collision posts overlapping the outer face of the sill, the body of

said posts being longitudinally deep box section structures, the lower ends of which taper to a reduced longitudinal extent as compared with the main bodies and are provided with extensions secured to the auxiliary columnar structures.

15. A subassembly for providing a center sill end extension extending from the bolster to the end sill of a rail car, comprising laterally spaced longitudinally extending columnar structures both extending inwardly from and arranged to abut an end sill, one extending inwardly a less distance than the other, and a shear plate connecting the tops of said structures throughout the extent of the shorter of said structures.

16. A subassembly for providing a center sill end extension extending from the bolster to the end sill of a rail car comprising laterally spaced longitudinally extending columnar structures both arranged to abut and be secured to an end sill and extending inwardly thereof different distances, and both having their top faces, arranged to lie when assembled substantially in the plane of the car floor and interconnected in said plane by a shear panel.

17. In a rail car, an end underframe including an end sill, a bolster, a center sill proper, a pair of laterally spaced center sill extensions flanking and secured to the center sill proper and extending from the bolster to the end sill in abutting relation with the latter, said extensions comprising vertically deep columnar structures, extending from a substantial distance below the end sill to substantially the floor level and providing space between them to house buffer and draft gears at different levels, the buffer housing including means transversely interconnecting said structures above and below the buffer location, and further means connecting said structures inwardly of the buffer location and providing an abutment for the buffer.

18. In a rail car, an end underframe comprising an end sill, spaced longitudinal members extending inwardly from the end sill and of a depth to house a buffer and draft gear at different levels, the buffer being housed at the higher level and an abutment for said buffer interconnecting the longitudinal members comprising a composite multi-box cross section structure fabricated of longitudinally extending sheet metal parts secured to each other and through flanges to the longitudinal members.

19. In a rail car underframe, a bolster, an end sill, a center sill proper, and laterally spaced center sill end extensions flanking the center sill proper and secured thereto and extending from said bolster to the end sill in abutting relation with the latter, all said elements having their top faces substantially in the plane of the flooring, floor stringers, spaced brackets secured to the bolster extending from the bolster at the opposite sides thereof, certain of said brackets being connected to the center sill extensions and certain to the floor stringers, the latter having their top faces in the plane of the top of the bolster, end sill and center sill extensions.

20. In a rail car, an end underframe including a bolster and end sill, a center sill portion extended through the bolster, secured thereto, and extending some distance therebeyond toward the end sill, a collision resisting extension structure, including vertically deep columnar structures of sheet metal connecting the opposite sides of the said center sill portion to the end sill, shorter column structures arranged outwardly of the main column structures and paralleling the same, and extending inward from the end sill, and a shear panel connecting said pairs of column structures.

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