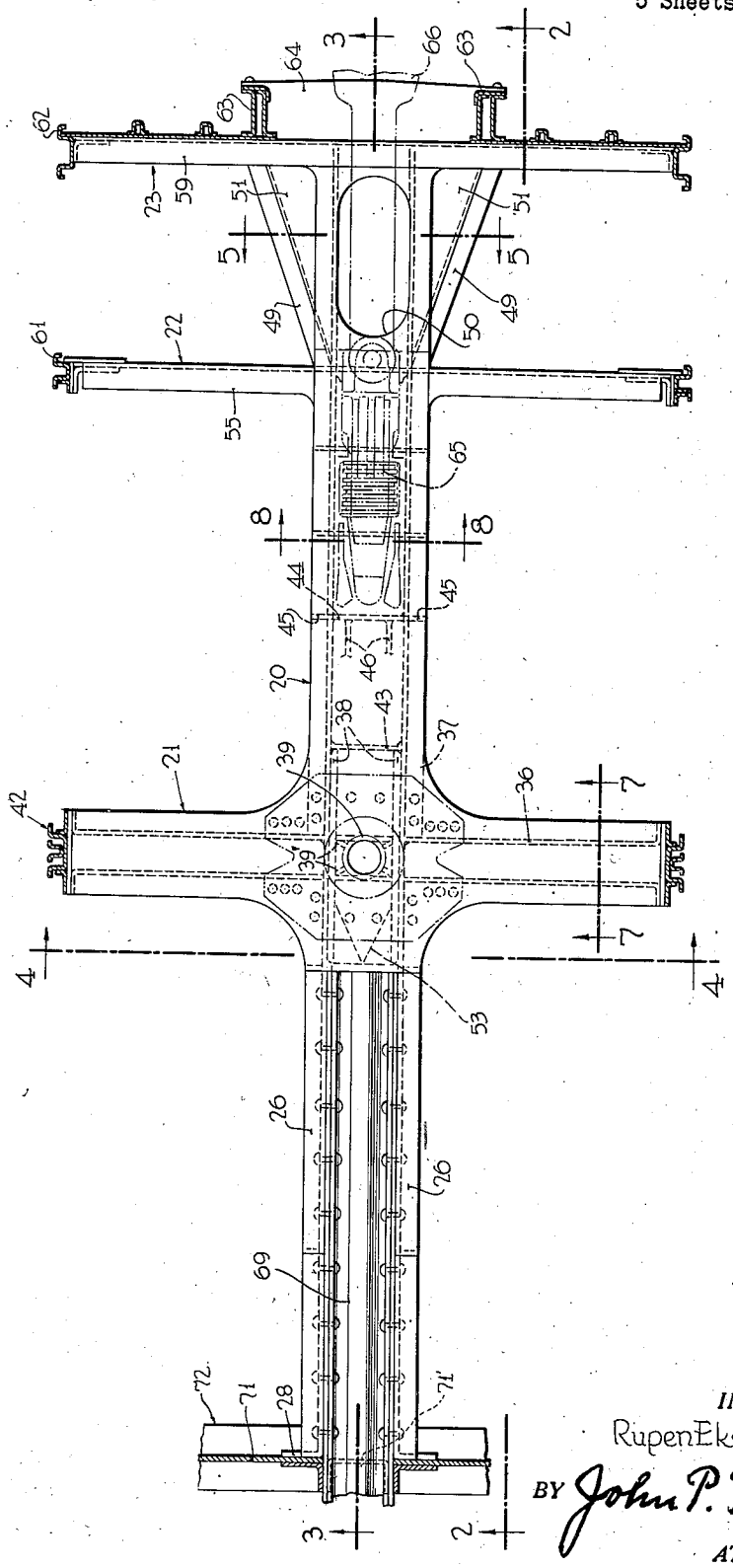
Dec. 13, 1949 R. EKSERGIAN 2,490,788

UNDERFRAME WITH CENTER SILL FOR LAND VEHICLES SUCH AS RAILWAY CARS

Filed Jan. 22, 1945 5 Sheets-Sheet 1

FIG. 1



Dec. 13, 1949 R. EKSERGIAN 2,490,788

UNDERFRAME WITH CENTER SILL FOR LAND VEHICLES SUCH AS RAILWAY CARS

Filed Jan. 22, 1945

5 Sheets-Sheet 2

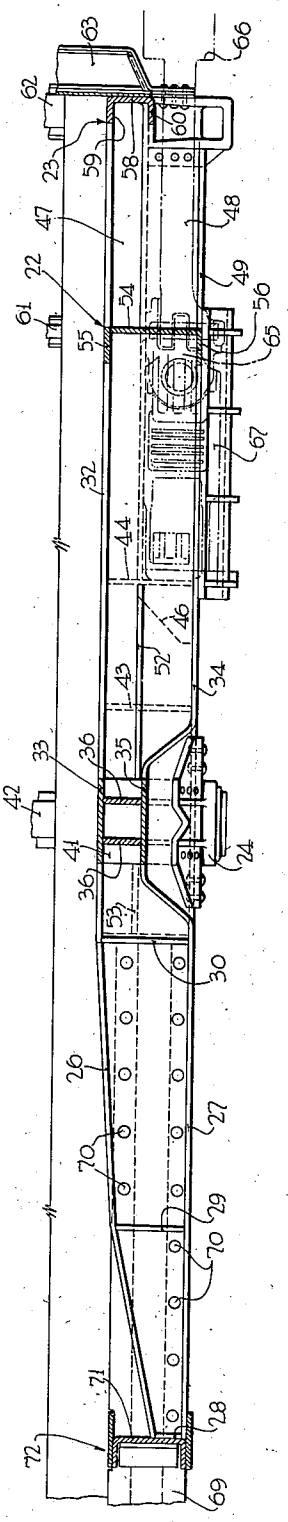


FIG. 2

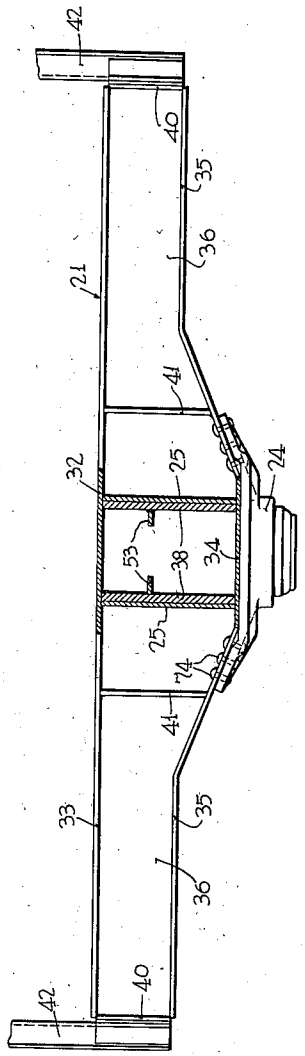


FIG. 4

INVENTOR
Rupen Eksergian
BY John P. Tarbox
ATTORNEY

Dec. 13, 1949 R. EKSERGIAN 2,490,788

UNDERFRAME WITH CENTER SILL FOR LAND VEHICLES SUCH AS RAILWAY CARS

Filed Jan. 22, 1945 5 Sheets-Sheet 3

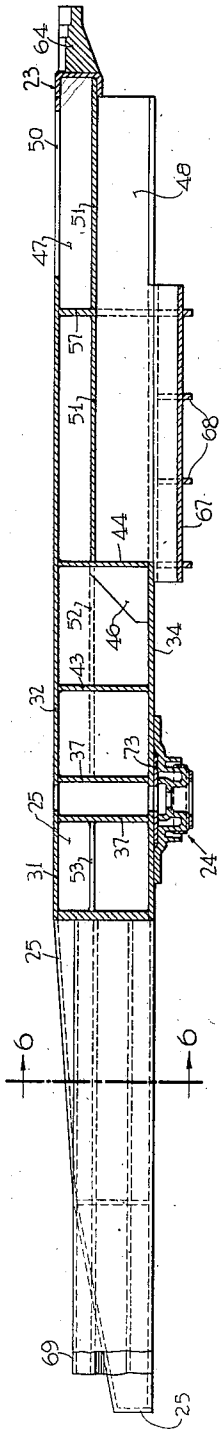


FIG. 3

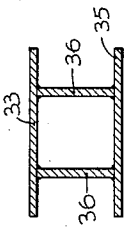


FIG. 7

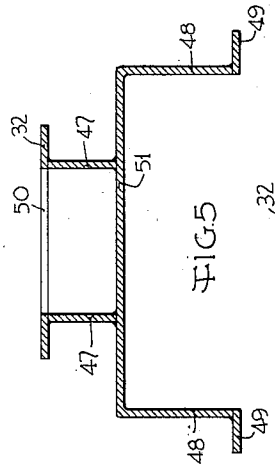


FIG. 5

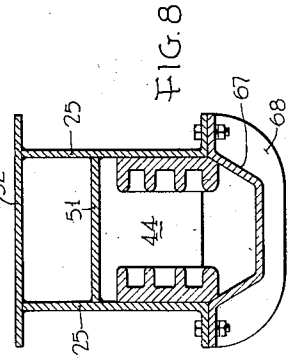


FIG. 8

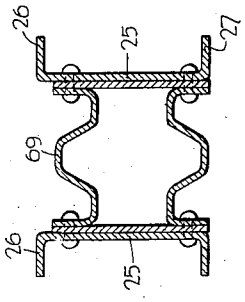


FIG. 6

INVENTOR
Rupen Eksergian
BY John P. Tarbox
ATTORNEY

Dec. 13, 1949 R. EKSERGIAN 2,490,788

UNDERFRAME WITH CENTER SILL FOR LAND VEHICLES SUCH AS RAILWAY CARS

Filed Jan. 22, 1945 5 Sheets-Sheet 4

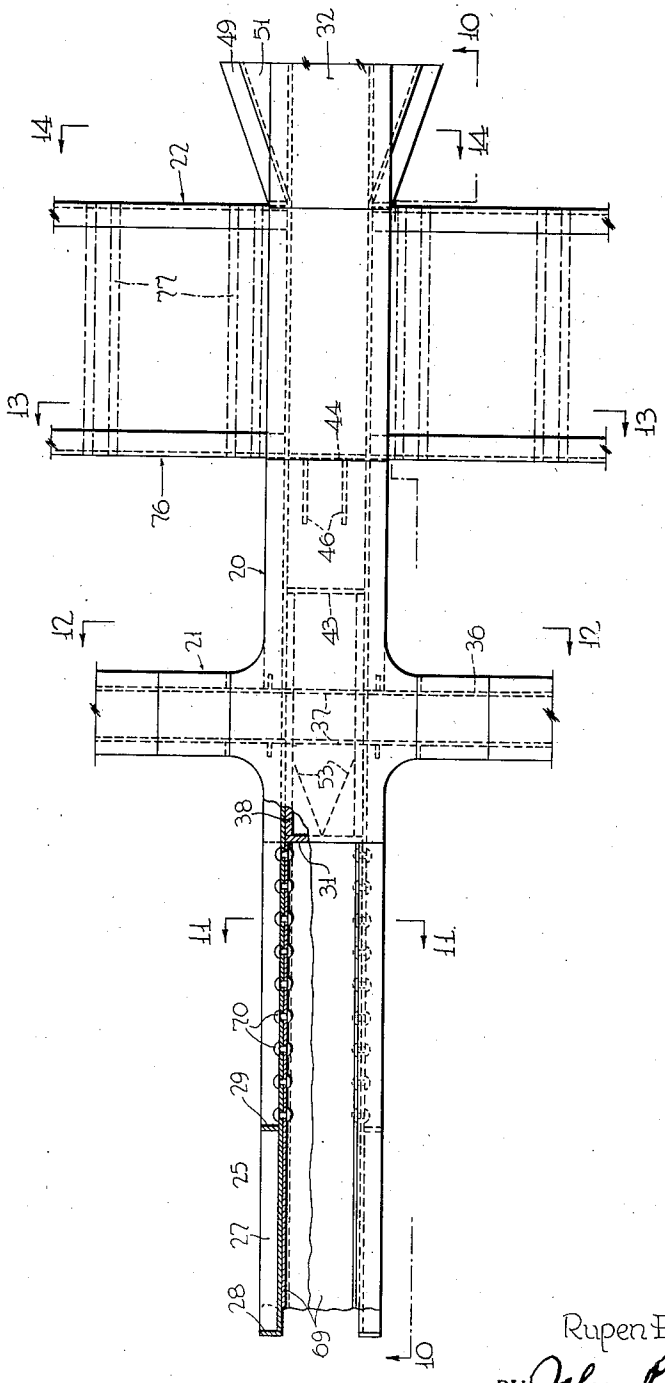


FIG. 9

INVENTOR
Rupen Eksergian
BY John P. Tarbox
ATTORNEY

Dec. 13, 1949 R. EKSERGIAN 2,490,788

UNDERFRAME WITH CENTER SILL FOR LAND VEHICLES SUCH AS RAILWAY CARS

Filed Jan. 22, 1945 5 Sheets-Sheet 5

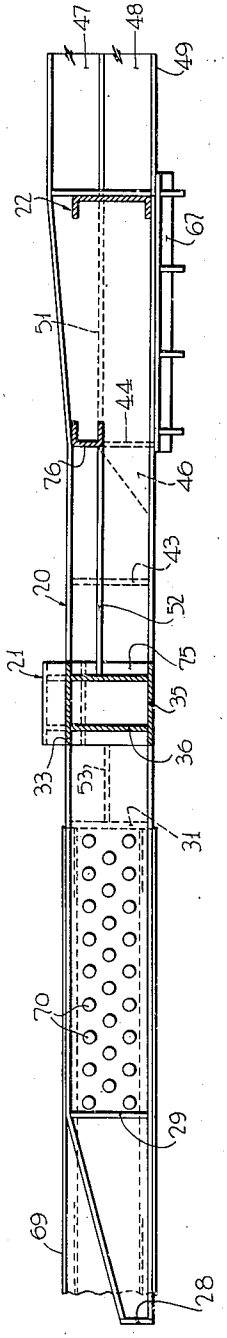


FIG. 10

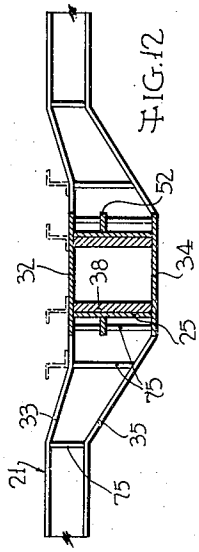


FIG. 12

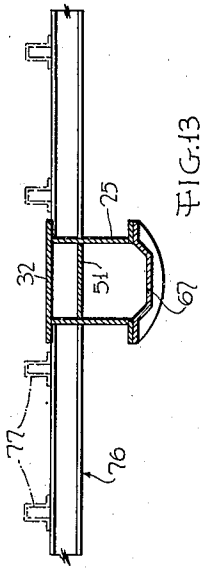


FIG. 13

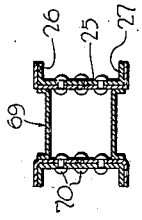


FIG. 11

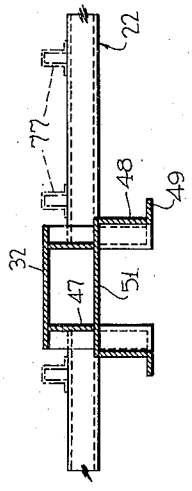


FIG. 14

INVENTOR
Rupen Eksergian.
BY John P. Tarbox
ATTORNEY

Patented Dec. 13, 1949

2,490,788

UNITED STATES PATENT OFFICE

2,490,788

UNDERFRAME WITH CENTER SILL FOR LAND VEHICLES SUCH AS RAILWAY CARS

Rupen Eksergian, Media, Pa., assignor to The Budd Company, Philadelphia, Pa., a corporation of Pennsylvania

Application January 22, 1945, Serial No. 573,878

10 Claims. (Cl. 105—416)

1

The invention relates to bodies of land vehicles such as railway cars and more specifically to the end underframe thereof. The invention relates also to the body structure adjoining and connected with such end underframe.

Among the objects of the invention is a vehicle body structure which is strong, rigid, light in weight, durable and easy to manufacture.

Among the more specific objects of the invention is an end underframe for railway cars or similar vehicles which effectively transmits all stresses, including collision shocks into the adjoining body structure with a minimum of bending moments, and which transmits stresses due to unequal loading and the overhang of the body beyond its support on the trucks without greatly stressing the connections with the body.

The aforesaid and other objects and advantages are achieved according to some aspects of the invention by an end underframe which has a transverse bolster connected to a center sill and by such connection between the center sill of the end underframe and the adjoining body center sill that abrupt changes in stress are avoided and so that collision shocks are safely transmitted into the body even if the connecting means between the center sill of the end underframe and the adjoining center sill portion should give way.

The aforesaid and other objects, advantages and features of the invention will be more clearly understood from the embodiments illustrated in the atttached drawings and described in the following.

In the drawing:

Fig. 1 is a plan view of one of the end underframes of a railway car and the adjoining portion of the body center sill and one of its cross members, certain body posts being shown in section;

Figure 2 is a side elevation of the same structure partly in section along line 2—2 of Figure 1;

Figure 3 is a vertical longitudinal section through the center sill substantially along the line 3—3 of Figure 1;

Figure 4 is an end elevation of the bolster of the underframe with the center sill in section along line 4—4 of Figure 1;

Figures 5 through 8 are sections through the center sill and the bolster beam respectively, substantially along the correspondingly numbered lines of Figures 1 and 3;

Figure 9 is a fragmentary plan view of the underframe according to a second embodiment;

Figure 10 is a side elevation partly in section along line 10—10 of Figure 9; and

2

Figures 11 to 14 are fragmentary sectional views along the correspondingly numbered lines of Figure 9.

The end of the underframe illustrated in Figures 1 to 8 is a unitary integral sub-assembly. This assembly may be manufactured by welding, particularly arc-welding, together appropriately shaped plates of a material such as steel. The main elements of the end underframe are the center sill 20, the bolster beam 21, an intermediate transverse beam 22 and the end beam 23. Secured to the under side of the end frame at the intersection of the sill 20 and the bolster beam 21 is the center bearing 24 serving for the support of the body on a truck (not shown).

The longitudinal center sill 20 comprises two vertical transversely spaced walls 25 which are on the inboard side, that is in the drawing on the left hand side, of the center plate 24 reinforced by outwardly directed marginal flanges 26 and 27. The inboard portion of the center sill is furthermore reinforced by webs 28, 29 and 30 inserted between and secured to the flanges 26, 27 and the outside of the walls 25. A further web or bulkhead 31 is inserted between and secured to the walls 25 at the location of the aforesaid webs 30, that is inboard of and close to the center bearing. It will be noted that the bottom flanges 27 are substantially straight whereas the upper margins of the walls 25 and the flanges 26 slope from about the webs and bulkhead 30, 31 to the webs 29 and then more steeply from the webs 29 to the end of the sill and its webs 28. The purpose of this formation and of the webs 28 and of the bulkhead 31 will be described later on.

The ends of the flanges 26 and 27 merge into and are integrally connected with generally T-shaped top and bottom plates 32, 33 and 34, 35 which in turn have their middle portions 32, 34 connected with the walls 25 on the outboard side of the bulkhead 31 and their arms 33, 35 with longitudinally spaced vertical walls 36 of the bolster 21 so as to form substantially closed box sectional center sill and bolster beam structures. The walls 25 and 36 intersect each other such as by webs 37 arranged between the two walls 25 and inner reinforcing plates 38 thereof so as to obtain continuous shear web both for the bolster beam and the center sill. The bottom plates 35 of the bolster are upwardly and outwardly inclined in their mid portions whereas their outer portions extend about parallel to the horizontal arranged top plate 33. A tubular member 39 for the center pin (not shown) is arranged coaxially with the center plate 24 and integrally secured

to the top and bottom plates 32, 34 and the webs 37 partly by diagonals 39'.

Stiffeners 40 and 41 are secured between the walls 36 and the top and bottom plates 33 and 35 of the bolster. The stiffeners 40 at the outer ends of the bolster beam are adapted for fastening thereto the body side wall structures such as by the lower ends of the posts 42 diagrammatically illustrated in Figure 1.

The aforesaid reinforcing plates 38 extend from the bulkhead 31 to a similar bulkhead 43 arranged at about an equal distance from but on the outboard side of the center plate 24. A further web or bulkhead 44 is secured between the vertical walls 25 and the top and bottom plates 32, 34 of the center sill at a distance from the aforesaid web or bulkhead 43 and is supplemented by stiffeners 45 secured between the aforesaid top and bottom plates 32, 34 and to the walls 25 of the outside of the latter. The bulkhead 44 constitutes the end of the draft gear pocket, to be described in the following, and is for this reason additionally reinforced by triangular brackets 46 inserted between its inboard side and the bottom plate 34 in the interior of the center sill.

The center sill bottom plate 34 ends at about the bulkhead 44 beyond which point the walls 25 of the center sill continue in full height and spaced parallel relation to about the location of the intermediate transverse sill 22. Beginning at about the beam 22 the walls 25 are split up into two sections, an upper section 47 which continues straight to the end sill 23 and a lower section 48 which extends diagonally outwardly until it reaches the sill 23. The bottom plate 34 is continued beyond the bulkhead 44 by marginal flanges 49 extending outwardly from the walls 25 and their diagonal extensions 48. The top plate 32 is continued to the end sill 23 but is provided between the beams 22 and 23 with a large opening 50. An intermediate bottom plate 51 is inserted at about half height between the walls 25 in the region between the bulkhead 44 and the beam 12 and is continued so as to bridge the gap between the upper and lower margins respectively of the extensions 47 and 48 of the walls 25.

Horizontal stiffener fins 52 are secured to the outside of the walls 25 between the bulkhead 44 and the outboard bolster wall 36. Horizontal brackets 53 are secured in the interior of the sill on the inboard side of the bolster between the reinforcing plates 38 and the bulkhead 31 and constitute in a way continuations of the fins 52.

The intermediate sill or beam 22 comprises vertical webs 54 and top and bottom walls 55, 56 which latter are arranged at the level and form continuations of the top wall 32 and the bottom flanges 49 of the center sill. The webs 54 do not extend across the space between the sections 48 of the center sill but they are continued by webs 57 inserted between and secured to the walls 32, 47 and 51 of the upper portion of the center sill.

The end beam or sill 23 is likewise of inwardly facing U-section with a vertical web 58, a top wall 59 in continuation of the top wall 32 of the center sill and a bottom wall 60 which is secured to the intermediate horizontal wall 51 of the center sill. Secured to the ends of the transverse sills 22 and 23 are body posts 61 and 62 and to the end sill 23 opposite the ends of the inclined braces 48 is secured the collision post 63. Other reinforcements for the end wall and a cross bumper 64 of adequate bending capacity are likewise secured to the outside of the beam 23.

The draft gear 65 and the coupler 66 are arranged in the pocket formed between the side walls 25 and 48 of the center sill beneath the intermediate bottom wall 49 and terminated by the bulkhead 44. The pocket and the draft gear are closed at the bottom by a cover 67 secured to the flanges 49 of the center sill and reinforced by ribs 68. This cover 67 extends in both directions slightly beyond the bulkhead 44 and the web 54 of the beam 22 and has one of the reinforcing webs 57 arranged at the location of each of the aforesaid two members.

The main center sill 69 of the body fits with its outboard end between the inboard ends of the walls 25 and abuts the aforesaid bulkhead or web 31. The underside of the sill 69 is substantially flush with the underside of the center sill of the end underframe. The side walls of sill 69 are secured by rivets 70 to the walls 25 of the end underframe. The extreme inboard end of the end underframe with its reinforcing webs or brackets 28 rests against the web 71 of a transverse needle beam 72 which is connected to the body center sill 69. A shear web or plate 71' extends the web 71 through the interior of the center sill 69 and helps in the efficient transmission of stresses.

A reinforcing plate 73 is secured to the bottom plates 34, 35 at the intersection of bolster beam and center sill, and the center bearing 24 is secured in the region of this plate 73 to the end underframe such as by rivets 74.

It will be noted that the draft gear 65, 66 is arranged substantially at the same level as the horizontal center line of the center sill 69 so that no or only small bending moments will occur. It will be noted, furthermore, that the end of the center sill 69 rests against the web 31 of the end underframe and the web 28 of the end underframe against the needle beam 72 of the body so that collision shocks will be safely transmitted between the body proper and the end underframe even in case the rivets 70 should give way. Finally, it will be noted that the underframe structure extends in both directions for nearly the same distance from the location of the center bearing 24 so that unequal loading, for instance, when a great number of persons crowd the end platform, will not unduly stress the connection between end underframe and center sill because this connection is at a comparatively great distance from the center plate 24.

The floor may be arranged at about the height of the top plate 32 of the end underframe and may be supported in the region of the body center sill 69 by transverse members whereas in the region of the top plate 32 the floor may be supported by longitudinal members fitted between the bolster beam 21 and the transverse sills 22 and 23, or secondary transverse floor beams may be connected preferably by brackets or a continuous rail arc welded to the side walls of the end underframe. By these members, which are not shown, a continuous floor system can easily be provided. The floor panel constitutes preferably the customary shear panel for transmitting the stresses between the end underframe and the adjoining body structure especially the side walls.

The second embodiment illustrated in Figures 9 to 14 is quite similar to the first embodiment so that the same numerals have been used for corresponding parts and a complete description of the second embodiment is deemed unnecessary.

Substantially such features only by which the second embodiment differs from the first one will now be described.

The height of the end frame center sill 20 between the reinforcing webs 29 and the bulkhead 44 equals about the height of the body center sill 69 so that the same floor construction may be used all the way from the bulkhead 44 on the one end of the car to the corresponding location near the other end. From the bulkhead 44 to the intermediate transverse sill 23, the height of the center sill structure increases so that the outboard end between the sill 23 and the end sill 23 is substantially identical with the height and construction of the first embodiment.

The bolster beam 21 has a dip at the center in order to provide continuous flanges and top walls 32 and 33 respectively for both bolster beam and center sill of the end underframe.

The transverse sill 22 is of U-section having its web secured to a web 75 inserted between the top and bottom walls of the center sill. A second transverse member 76 is secured at the location of the bulkhead 44. The cross members 22 and 76 are connected by longitudinal floor supports 77.

In both embodiments the top and bottom plates of center sill and bolster beam merge into each other by generous curves for efficient transmission of stresses and greater rigidity. The same principle is also employed at other points such as between center sill and end beam.

The extent and shape of the component plates entering into the described and illustrated structures, that is, the location of the welding seams, is in many cases a question of choice and expediency. For instance, it may be found desirable to make in one piece each side wall and the connecting web of the bolster beam as a one-piece plate and to build up the side walls of the center sill from sections which end at the side walls of the bolster beam.

After having described two embodiments of the invention it seems appropriate to specifically point out features and advantages which are of primary importance.

Starting at the forward end, it will be noted that the collision post is backed up directly by a diagonal channel. This is very important for minimum weight. The center portion is taken care of by the cross bumper of adequate bending capacity.

A second point of primary importance is the intersecting connection of the bolster beam and the center sill comprising through webs for both.

The top plate and flanges of both the bolster beam and the center sill are continuous and at the same level at least in the central portion so as to render the structure adequate to carry bending stresses across the bolster beam.

The deep cross beam or so-called "needle" beam at the inboard end of the underframe center sill should have the characteristics of a deep through beam. This beam is preferably connected at its ends to strong carlines extending uninterruptedly across the body, and similar transverse frames each including a needle beam may be arranged at certain intervals so as to transmit stresses from the center sills into the side wall and roof structures.

On account of the continuation of the end underframe beyond the bolster, back into the car body, and on account of the termination of the end underframe in a deep cross beam, inboard beyond the truck, a proper reactionary support for the termination of the end underframe is provided. This results in a structure sufficiently strong that it can withstand fatigue loadings and a secondary bending moment aft of the bolster beam. While such secondary moment is generally not large, it has been in previous constructions a source of trouble due to the oscillation of this bending moment with varying coupler loads and has resulted in fatigue failure of bolster beam connections which were adequately strong from a static point of view.

Another reason for continuing the end underframe inboard is to provide an adequate riveted connection to the center sill as well as to provide a suitable bulkhead for backing up the center sill. It will be noted that this bulkhead 31 shown in the drawing is several inches inboard of the bolster beam. This is done for several reasons. One is that it must provide for the heel of a generous fillet arc connecting both top and bottom cover plates to the bolster beam top and bottom flanges. The other reason is that it must provide sufficient length for inserting arc welded webs and reinforcements to carry the load from the center sill abutment to the side walls of the end underframe. While in ordinary operation the rivets will have a generous capacity of taking the entire compression load, this bulkhead will, in general, provide a safety device for direct compression loads in case of ultimate failure of the rivets.

The double web structure of the bolster beam provides a more or less closed section which can withstand lateral loads for transferring fore and aft compression loads to the side frames. Hereby the important condition is achieved that the bolster beam is strong enough to take the place of a so-called "shear panel" or to transmit collision shocks into the side walls if, as it often happened in the case of severe collisions, the shear panel is torn up.

The vertical component of the thrust along the inclined body flange of the bolster beam is transmitted by the center plate itself. In this connection, it is of great importance that a clean cut vertical reinforcement is provided at the change in section of the lower flange where a connection to the beam flange and center plate occurs.

On account of the through webs for the bolster beam, the center plate can be riveted to the bottom flange or plate. Furthermore, a vertical pin can be inserted at the center of the rectangle between the connections of the two wabs of the bolster beam and the two walls of the center sill which passes through the bolster beam.

With the new construction it has been possible to reduce the reactions on the bolster beam when the car body is subjected to a fore and aft loading, as compared with previous structures. This reduces an additional loading on the bolster beam from that required to carry the dead loads of the car structure. Moreover, the extension of the end underframe causes a more desirable distribution of the reactions that take place in a collision in transmitting the loadings from the end underframe into the car body itself.

While the invention is not restricted to the use of any specific material for the underframe, it is obviously entirely possible to use almost any alloy, including some types of stainless steel, that can be suitably arc or gas welded. The arc or gas welding is more or less a necessity brought about by the necessity of providing continuous webs at the intersection of the bolster beam and end underframe. Any form of built-up structure

with connections to a cast sill block would be more complicated and above all a continuous shear plate through the intersection of bolster beam and center sill is very important to maintain in the new bolster beam design.

Not only the bolster beam but all other cross beams designed for lateral strength should have integral and through shear webs.

The connections between the side frames and the bolster beam and the adjacent parts of the side frames should be such that at least two or more posts are brought into direct action in supporting the car from the bolster beam.

The center sill, only the end which is shown in the drawing, should continue from the end underframe connection without too rapid a change in section and should be treated as part of the floor structure rather than as an isolated compression beam for the more remote collision stresses. It is felt that a few deep floor beams with integral shear webs across the center sill and with adequate connections to the side truss should be employed.

The extension of the underframe inboard beyond the truck thus separating the reaction points will tend to relieve the pull down on the end truss overhang. The main underframe of the body is mainly carried at a considerable distance inboard of the reaction cross support represented by the bolster beam. The entire end underframe outlay may be regarded as a three-point or -region suspension system, one point or region being located at or near each end of the center sill and the third point or region being located at the center plate.

The invention is not restricted to the illustrated embodiments but it is susceptible to modifications and to adaptations to special conditions. All such modifications and adaptations based upon the spirit of the invention are intended to be covered by the attached claims.

What is claimed is:

1. End underframe for vehicles such as railway cars having a box-sectional center sill and bolster beam each composed of spaced vertical walls and top and bottom plates all integrally secured together such as by arc welding, the inboard end of the center sill being free of the top and bottom plates between its vertical walls, a transverse bulkhead inserted between the vertical walls of the center sill at about the location of the ends of the top and bottom plates, which bulkhead constitutes an abutment for the outboard end of a body sill adapted to be telescopingly inserted between the inboard ends of the vertical walls and to be secured to them such as by rivets.

2. End underframe subassembly for railway cars comprising a bolster beam and a box-sectional center sill, spaced vertical walls and top and bottom plates integrally secured together constituting the main body of the center sill, the vertical walls of the center sill being split up into an upper and a lower section for a distance from the outboard end of the underframe, the upper sections of the vertical walls extending substantially straight to the outboard end together with the top plate, the lower sections of the vertical walls extending diagonally and having their upper margins connected by intermediate plates to the lower margins of the upper sections so as to form an open bottom box for a coupler.

3. End underframe subassembly according to claim 2 in which the bottom plate of the center sill ends at a distance inboard from the point where the diagonally arranged lower section of the vertical walls begins, a transverse bulkhead secured between the vertical walls at the end of the bottom plate forming a box open at the bottom for the reception of a draft gear.

4. End underframe subassembly according to claim 2 comprising a through-going end transverse beam integrally connected to the two sections of the vertical center sill walls and to the top plate and the intermediate plates connected therewith, said transverse beam being adapted for the attachment of the end of the body superstructure including such members as a collision post, corner posts and a cross bumper.

5. In a vehicle body, an end underframe subassembly adjoined by a body underframe, both underframes comprising a center sill each, the center sill of the end underframe extending inboard for a considerable distance beyond a bearing for a supporting truck and having its extended end connected to the end of the body underframe in overlapping relation, a transverse needle beam connected to the body center sill at the end of the center sill of the end underframe so that it is abutted by the latter for the transmission of severe collision shocks.

6. End underframe for railway cars and similar vehicles comprising a bolster beam and a box-section center sill, the center sill extending inboard beyond the bolster beam and having secured in its interior a bulkhead at a point between the beam and the inboard end of the sill, the inboard end of the sill being adapted for the telescoping reception of a body center sill and the bulkhead serving as an abutment for the entire end face of such sill.

7. End underframe subassembly for railway cars comprising a bolster beam and a box-sectional center sill, spaced vertical walls and top and bottom plates integrally secured together constituting the main body of the center sill, the vertical walls of the center sill being split up into an upper and a lower section for a distance from the outboard end of the underframe, the upper sections of the vertical walls extending substantially straight to the outboard end together with the top plate, the lower sections of the vertical walls extending diagonally and having their upper margins connected by intermediate plates to the lower margins of the upper sections so as to form an open bottom box for the coupler, the bottom plate of the center sill ending at a distance inboard from the point where the diagonally arranged lower section of the vertical walls begins, a transverse bulkhead secured between the vertical walls at the end of the bottom plate and an intermediate bottom plate secured between the vertical walls and to the bulkhead so as to form a box open at the bottom for the reception of the draft gear.

8. In a railway car end underframe assembly comprising a bolster beam and a box-section center sill, the latter adapted at one end for the connection to a body center sill at a certain height and at the other end for the reception of a draft gear at about the same height so that the horizontal center lines of body center sill and draft gear substantially coincide, said center sill of the end frame having adjoining its outboard end its top wall raised above the location for body center sill and draft gear, the upper side of the bolster beam and the top wall of the end frame center sill being arranged at about the same level at least at their intersection.

9. In a railway car according to claim 8, the raised portion of the end frame center sill being

confined to a region on the outboard side from the bolster beam, and the bolster beam having a dip center.

10. Underframe center sill for vehicles such as railway cars, comprising transversely spaced vertical walls, said walls having an upper and a lower section for at least a distance from and adjoining the outboard end of the sill, the lower sections of said walls diverging laterally so that their ends are laterally spaced from the ends of the upper sections, connecting webs between the lower margins of the upper sections and the upper margins of the lower sections so as to form by said webs and said sections a box-shaped structure adapted for housing a coupler.

RUPEN EKSERGIAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,035,848	Bettendorf	Aug. 20, 1912
1,097,800	Hamilton	May 26, 1914
1,114,209	Westlake	Oct. 20, 1914
1,378,645	Barrows	May 17, 1921
1,828,563	Goodwin	Oct. 20, 1931
1,987,134	Stertzbach	Jan. 8, 1935
1,988,729	Hallquist	Jan. 22, 1935
2,026,035	Hallquist et al.	Dec. 31, 1935
2,079,552	Fenstermacher et al.	May 4, 1937
2,185,976	Dean	Jan. 2, 1940
2,239,634	Thunstrom	Apr. 22, 1941