March 16, 1965 W. S. EGGERT, JR 3,173,383

RAILWAY VEHICLE FLOOR STRUCTURE

Filed April 24, 1962 3 Sheets-Sheet 1

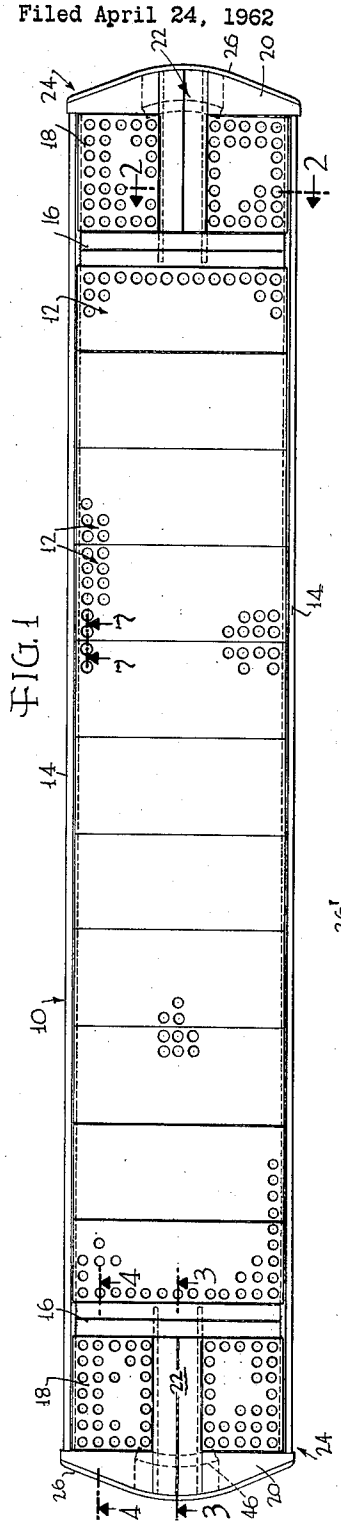

FIG. 1

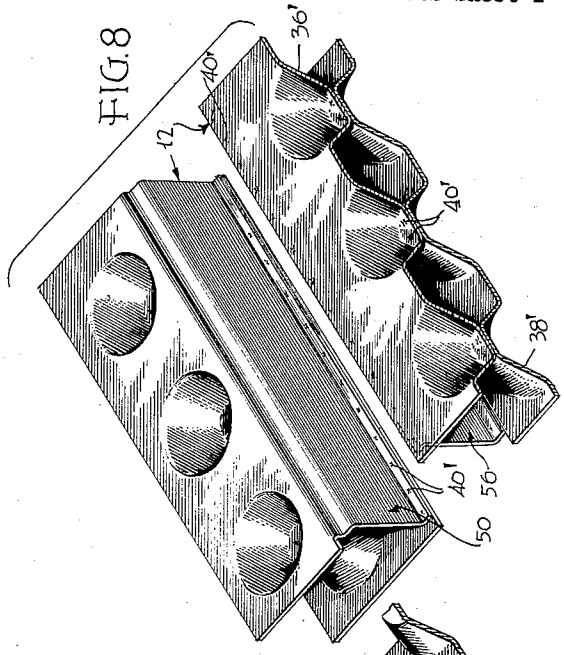

FIG. 8

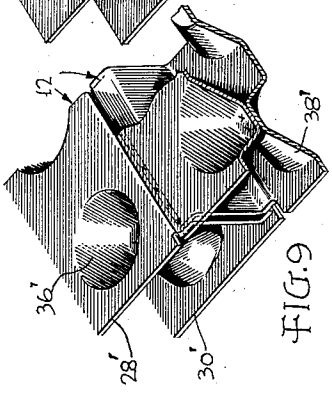

FIG. 9

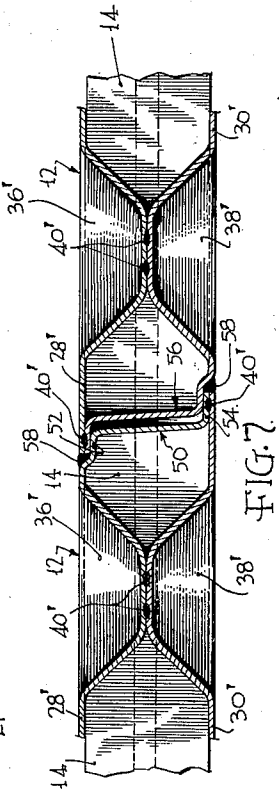

FIG. 7

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RAILWAY VEHICLE FLOOR STRUCTURE

Filed April 24, 1962 3 Sheets-Sheet 2

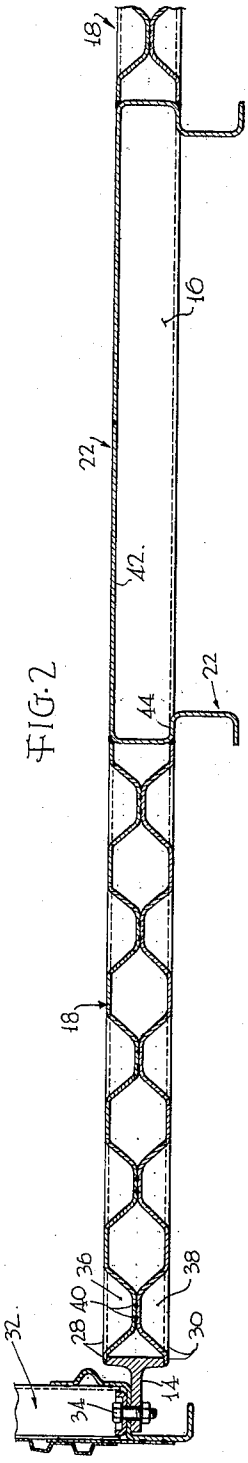

FIG. 2

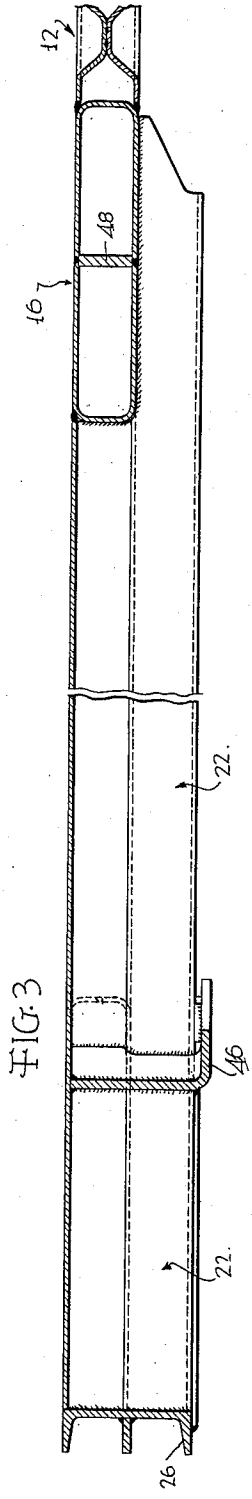

FIG. 3

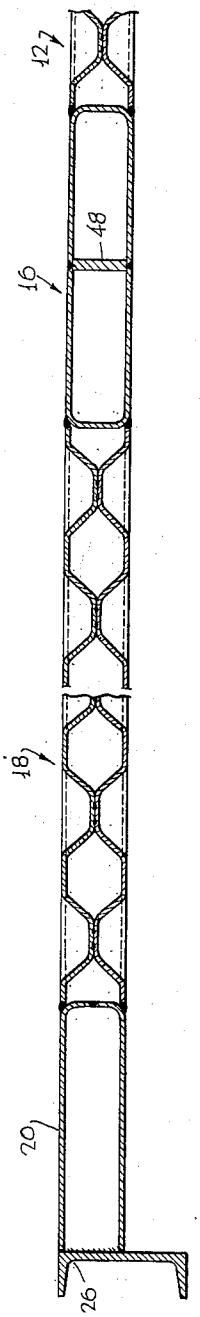

FIG. 4

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RAILWAY VEHICLE FLOOR STRUCTURE

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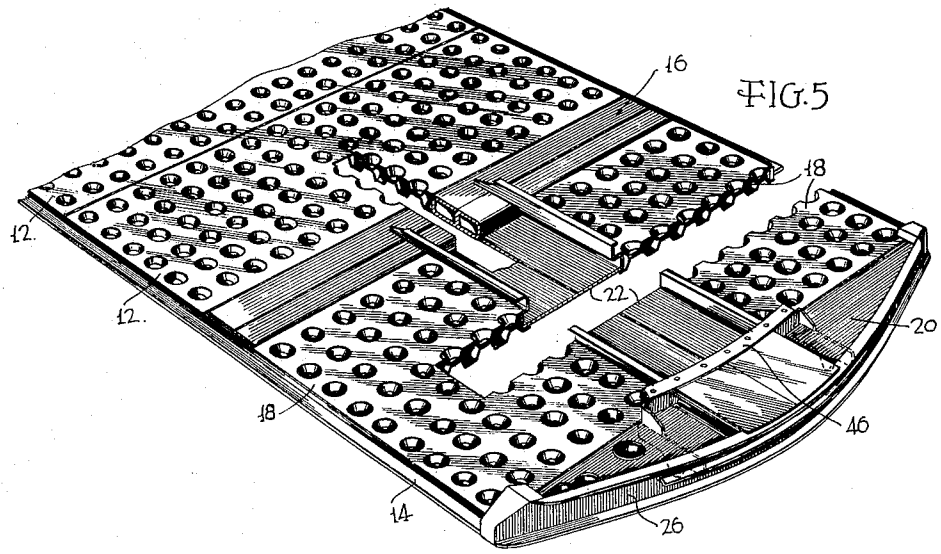

FIG. 5

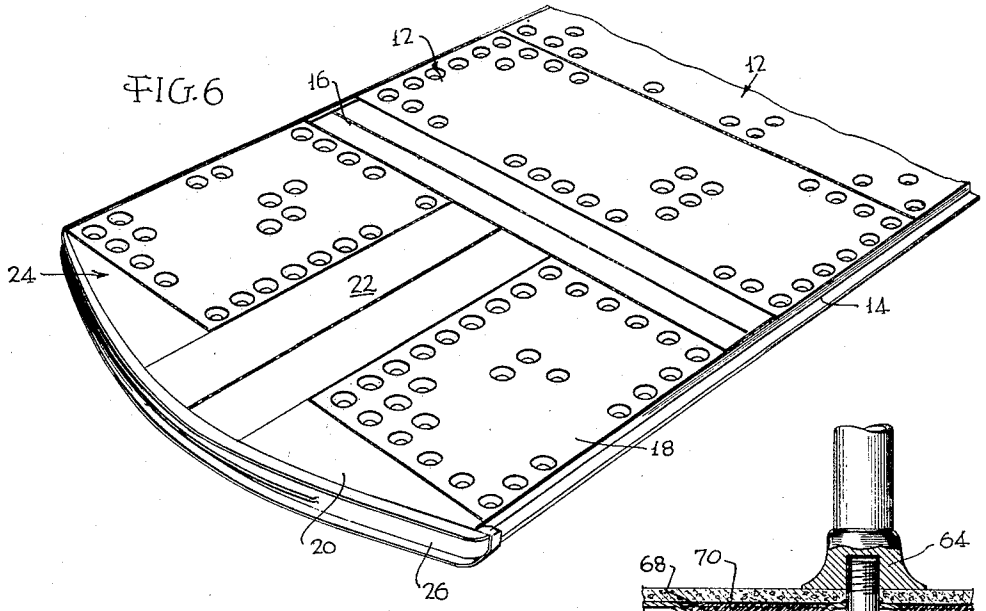

FIG. 6

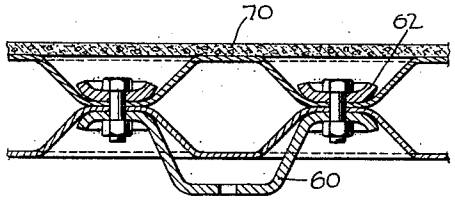

FIG. 10

FIG. 11

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United States Patent Office 3,173,383 Patented Mar. 16, 1965

3,173,383

RAILWAY VEHICLE FLOOR STRUCTURE

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Filed Apr. 24, 1962, Ser. No. 189,750
7 Claims. (Cl. 105—422)

This invention relates to a new and improved railway vehicle floor structure and more particularly to a self-contained reinforced sandwich panel railway car floor which eliminates the need for an underframe.

Heretofore, the floor of a railway car has been supported by a structural underframe. Most common among structural underframes is the center sill type. Typical modern center sill underframe structures are shown in U.S. Patents 2,946,297 and 2,620,751. A variation from the center sill structure is known as a ladder structure wherein the center sill is substantially divided and becomes two structural longitudinally through-running side sills connected by laterally extending cross members. A center sill structure is usually preferred because the draft loads and buff loads may be applied directly into the center sill which is the backbone of the underframe.

One of the problems associated with underframes is that they require laterally extending cross members which have considerable depth in order to provide sufficient strength and stiffness. The load on the car floor from above and the load of equipment suspended below the floor must be tied into the underframe structure by subframing. Equipment suspended below railway cars is fitted between the cross members and interconnected by conduits extending through apertures in the cross members. Heretofore, it has been necessary to first place the equipment between cross members and then connect with a conduit the individual pieces of equipment. Elimination of the cross frames and sills by the provision of a thin floor structure without an underframe enables free placement of prefabricated conduit carriers.

Therefore, it is a primary object of the present invention to provide a railway car floor structure which is light in weight and economical and easy to manufacture and can meet the ICC and AAR strength requirements.

Another object of the present invention is to provide a sandwich panel floor structure adapted for interconnection to end frames and to other sandwich panels.

Another object of the present invention is to provide a sandwich structure with formed skin sheets which provide reinforcements and connection points between adjacent sandwich panels.

Another object of the present invention is to provide a sandwich panel railway car floor which has a bolster and side sill between the skin sheets of the sandwich structure.

A further object is to provide a railway car floor structure of great strength and rigidity and of uniform thickness over its entire area.

A still further object is to provide a strong rigid railway car floor structure for attachment to trucks without an underframe.

A further object is to provide a universal floor structure adapted to all types of railway cars.

Other objects and advantages and the manner in which they are obtained will become evident from the following detailed description when read in connection with the drawings forming a part of this specification.

In the drawings:

FIG. 1 is a top plan view of a typical passenger railway vehicle employing the present invention;

FIG. 2 is a section in elevation taken through the floor panel of FIG. 1 in section 2—2 showing the side sill and draft sill arrangement;

FIG. 3 is a section in elevation taken through the draft pocket at sections 3—3 of FIG. 1 showing the mounting bracket, end sill and bolster arrangement;

FIG. 4 is a section in elevation taken through the end frame at sections 4—4 of FIG. 1 showing the end sill and bolster;

FIG. 5 is a perspective view of the bottom of the end frame inverted to show the draft gear pocket and draft sill connections to the upper body bolster;

FIG. 6 is a perspective view of the top of the end frame in its normal upright position showing the smooth end frame floor structure;

FIG. 7 is a section in elevation taken at sections 7—7 of FIG. 1 showing the novel sandwich panel connection joint;

FIG. 8 is a perspective view showing the joint of FIG. 7 in an exploded view;

FIG. 9 is a perspective view of the joint shown in FIG. 8 assembled;

FIG. 10 is a section through one of the panels of FIG. 1 showing the hanger bracket;

FIG. 11 is a section in elevation of a typical sandwich panel showing a floor stanchion connection.

Refer now to FIG. 1 wherein a complete floor of a typical railway car is shown. The floor 10 consists of a plurality of sandwich panels 12 interconnected at their outer edges to side sills 14 and connected at the inner edges to similar panels 12 or terminating at the upper body bolster 16. Another sandwich panel 18 similar to sandwich panel 12 is connected between the body bolster 16 and end sills 20 at the inner edges of the panel and between the side sill 14 and the draft sill 22 at the outer edges of the panel 18.

The end frame 24 of the floor structure 10 is shown in FIGS. 5 and 6 which includes bolster 16, panels 18 and their associated side sill 14, end sill 20, draft sills 22 and a striker plate 26. The curved striker plate 26 shown in FIGS. 1, 5 and 6 provides clearance between adjacent cars when it is necessary for the cars to execute tight turns such as those encountered in subway or rapid transit service. However, if the floor structure is to be employed on railway cars for inter-city rapid transit service the striker plate would be completely flat and normal to the side walls. This would enable extending the usable car room to the outer end limits of the floor structure 10. Thus, it is understood that the end frame and striker plate 26 may be modified to provide for maximum utilization of the end frame space.

The end frame basically consists of a super structure interconnected by reinforcing panels 18. Under maximum stress loads, encountered in buff loading, striker plate 26 distributes loads into the end sill 20. End sill 20 distributes loads into the draft sills 22, side sills 14 and panels 18. Draft sills 22 and side sills 14 distribute shear loads into panels 18. It can be seen from FIGS. 5 and 6 that any buff load applied at any point along the striker plate 26 is distributed in compression through the sills to the sandwich structure panels 18, and that any compression load applied to the end sill is picked up by the panel 18 and transferred to the side sills and sandwich structure panel 18 giving a uniform loading effect. The reverse effect is also true when a draft load is applied causing the sills to transfer tension loads to the panels in shear.

Only a slight modification of the end frame is necessary to adapt the floor structure to most known types of railway service. The side sill 14 is shown as a straight structural shape connected to the end sills 20 but it is to be understood that the portion of the side sill 14 between

the bolster 16 and the end sill 20 may be formed to curve inward thus providing an access for steps for loading passengers from ground level.

The side sill 14 is shown as a T-section in FIG. 2 welded to the upper skin sheet 28 and the lower skin sheet 30 by continuous fusion weld along the vertical web of side sill 14. The side wall 32 of the railway car is shown attached to the side sill 14 by bolt connectors 34. Part of the rigidity of the floor structure 10 is supplied by the side wall 32 bolted at intervals to the side sill 14 along its entire length. While the T-section is representative of a preferred structure for the side sills, other structural shapes may be substituted in lieu thereof. The upper skin sheet 28 is substantially flat except for the dimples or lowered formed shapes 36 formed therein. Lower skin sheet 30 is substantially flat except for the dimples or raised shapes 38 formed therein. The bottom of the shapes or dimples are formed substantially flat and are welded together as by resistance welds 40 off center as shown. The upper skin sheet 28 is shown welded to the draft sill 22 at its upper end to form a continuous flat surface with the upper horizontal web 42 of the draft sill 22. The lower skin sheet 30 is connected to the center horizontal web of the draft sill 22 along the entire length of the panel 18. As shown in FIG. 3, draft sill 22 extends from the striker plate 26 rearward to body bolster 16 and the upper horizontal web 42 is welded to the body bolster 16 at the edge of the bolster forming a continuous flat panel therewith. The center horizontal web 44 of the draft sill 22 is welded to the striker plate 26 and extends rearward terminating at the edge of body bolster 16. The center horizontal web 44 is cut away permitting the lower vertical web 46 of the draft sill 22 to be welded to the body bolster 16.

Bracket 46 shown in FIGS. 1, 3 and 5 provides a means for attachment of a draft coupler or spring buffer. The vertical web 48 of the body bolster 16 provides a spacing and connecting means for the two symmetric channels which form the body bolster. Panels 12 and 18 are preferably formed from deep drawing steel such as AISA 1010 in such a manner that the edges of the panels remain straight and the surface of the panels remain flat. A method of drawing panels 12 and 18 to obtain flat rectangular panels from flat sheets of material is disclosed in my copending application S.N. 189,887, entitled Method and Means of Deep Forming Sandwich Structures, filed April 24, 1962. The manner in which the straight edges of the panels are connected to the sills and bolster is illustrated in FIGS. 2 to 4 wherein the main body of the sill 20 and bolster 16 are of the same thickness as the panels 12 and 18. Bolster 16 and sill 20 are provided with curved edges which abut the straight edges of the sandwich panels. A continuous fusion weld is provided to connect the skin sheets to the heavier structural formed plate member (bolster 16 and sill 20) by known arc welding techniques.

In order to provide a reinforced sandwich structure and a means of connecting the edges of panels 12 to each other, a formed end structure is provided on each of the panels 12 as shown in FIGS. 7 to 9. The upper skin sheet 28' of panel 12 is formed with an offset and downturned Z-section 50. The upper horizontal web 52 of the Z-section 50 is offset twice the thickness of the skin sheet while the lower horizontal web 54 is offset a single thickness of the skin sheet. The other edge of the lower skin sheet 30' (not shown) is formed with an offset and upturned Z-section similar to Z-section 56 shown on the adjacent panel 12. The skin sheets of individual panels 12 are preferably spot welded together by welds 40' at the mating surfaces of the raised and lower shapes 36' and 38' and at the mating section of the skin sheet with a web of the Z-sections 50 and 56. In order to provide a reinforced sandwich panel a filler weld 58 is applied at the junction of the panels 12 providing a continuous panel of the same thickness. It will be noted that the sandwich panels 12 on either side of the joint shown in FIG. 7 act as reinforced trusses to stabilize the top and bottom chords for the I-beam formed by the Z-sections and the skin sheets. FIG. 8 shows two of the panels 12 removed from each other and from the side sill 14. Each inner edge of each panel 12 is provided with one oriented extending edge which overlaps and engages an offset and recessed portion on another panel thus providing a means for reinforcement and self alignment. The Z-sections 50 and 56 do not continue to the outer edges of the panels 12 as shown in FIGS. 8 and 9 which permits the edges of the skin sheets to overlap the side sills 14. Thus, the Z-sections also provide a means for alignment of the side sills 14 during fabrication.

In FIG. 10 a hanger bracket 60 is shown connected to the sandwich panel by means of bolted formed washers 62 which distribute the load applied to any dimple located anywhere in the sandwich structure uniformly and without stress concentrations. One of the assets of the novel floor structure resides in its ability to distribute concentrated loads. Loads which far exceed an expected uniform loading have been suspended in the manner shown in FIG. 10. It was found that individual panels reacted as I-beams regardless of where the load was hung and the deflection due to shear loading was much less than what would be theoretically expected. Thus, the floor is stiffer than floors with underframes and more resistant to fatigue failures.

A method of connecting floor stanchions and other equipments above the surface of the floor structure is shown in FIG. 11 where a threaded rod 66 is welded to apertures provided in both skin sheets of the sandwich panel structure.

In order to provide a durable and resilient floor covering for the floor structure it is only necessary to trowel on a cement like material 68 as shown in FIGS. 10 and 11 which may be colored with pigment and used as the finished surface, or covered over with any well known type of floor covering 70 if so desired.

In an actual embodiment of the above-described floor structure it was found that the floor was as strong as high tensile stainless steel floor structures employing the underframe principle while requiring only one-half the depth of the high tensile stainless steel underframe structure. Since the structure shown may be constructed from ordinary low carbon steel having only 25 percent of the tensile strength of cold rolled stainless steel it would be expected that the floor structure would be considerably heavier, but it was found that the novel structure was comparable in weight to stainless steel underframe type structures and costs only 20 percent as much while providing a superior structure in fatigue strength, equally as strong as stainless steel structures of the prior art.

It is to be understood that the present invention is not limited to the embodiments shown and described hereinbefore, and that various modifications and refinements may be employed in practice without departing from the present invention. For example, in a European passenger car two buffers are provided near the side sills. It is possible to eliminate the draft sills by providing sandwich structure panels like panels 12 between the bolster 16 and the end sill 20. In a gondola type car the side walls may be constructed as sandwich panels like the floor panels, and connected to the floor panels without requiring side sill structures. Drop center gondola cars are made in a similar manner by constructing the sides and bottom of the car with the novel sandwich panels. Since the novel floor structure completely eliminates the underframe it is possible to make larger freight cars by dropping the floor level. It is further possible to make hopper chute coal cars with lower center clearance and of larger volume because the center sill is eliminated.

In describing several modifications and embodiments it becomes apparent that the novel structure may be curved to desired shapes and will still retain its inherent strength

as self-reinforced panel structures. The side sills between the bolster 16 and the end sill 20 may be cut away or framed to provide an access for steps as required by some passenger cars.

Other changes and modifications will suggest themselves to those skilled in the art, all falling within the scope of the invention as defined by the appended claims.

What I claim is:

1. For use in a railway car floor having a framework defining a rectangular opening located centrally of the floor length: a plurality of rectangular, transverse sandwich panels having adjacent edges connected to each other and non-adjacent edges adapted to be connected to the framework to fill the opening; each of said panels comprising an upper skin sheet having a plurality of dependent formed shapes thereon, and a lower skin sheet having a plurality of raised formed shapes thereon abutting and welded to said formed shapes of said upper skin sheet; and, at said adjacent edges, said upper skin sheet of one of said panels having a down-turned first Z-shaped edge welded along its lower end to the associated lower skin sheet, and said lower skin sheet of said adjacent panel having an upturned, second Z-shaped edge welded along its upper end to the associated upper skin sheet, said Z-shaped edges being overlapped and seam welded between said upper skin sheets and said lower skin sheets to connect said adjacent edges of said panels.

2. The combination in accordance with claim 1 wherein said first Z-shaped edge has an upper flange offset from the plane of the associated upper skin sheet a distance twice the thickness of the upper skin sheet, a lower flange welded to the associated lower skin sheet, and a first web extending between said flanges; and said second Z-shaped edge has a lower flange offset from the plane of the associated lower skin sheet a distance twice the thickness of the lower skin sheet, an upper flange welded to the associated upper skin sheet, and a second web extending between said associated flanges; said skin sheets being of the same thickness to provide a flat surface at the joint between said panels.

3. In a railway car floor structure, the combination of: two, laterally-spaced side sills extending along the sides of said floor structure; two longitudinally-spaced end frames extending across and connected to the ends of said side sills and having transverse bolsters defining, in conjunction with said side sills, a rectangular opening; said bolsters and said side sills being of uniform, substantially equal thicknesses; and a rectangular floor section connected about its periphery to said side sills and said bolsters to fill said opening; said section comprising a plurality of rectangular, transverse panels disposed side-by-side and having adjacent edges connected to each other; each of said panels comprising flat, rectangular upper and lower sheets spaced apart a distance substantially the same as the thickness of said side sills and bolsters to provide a flat floor section of uniform depth, said sheets having evenly-spaced, abutted cup-shaped dimples thereon welded together to rigidly interconnect said sheets; said edges of said sheets that are connected to said sills and bolsters being straight and welded along their lengths to said sills and bolsters.

4. The combination of claim 3 wherein an end frame comprises: an end sill, a draft sill extending between said end sill and said bolster and defining two rectangular openings on each side of said draft sill between said end sill, said side sills and said bolster; and two rectangular panels fitted into said openings; each of said panels comprising flat, rectangular upper and lower sheets welded about their periphery to the members defining the opening in which said sheets are disposed and having abutting, evenly-spaced, cup-shaped dimples thereon welded together.

5. The combination of claim 3 wherein, at said adjacent edges of said panels, one of said panels comprises an offset Z-shaped first section integral with one of said skin sheets and welded to the other, and said adjacent panel has an offset Z-shaped second section inverted with respect to said first section and overlapped therewith so that said upper sheets of adjacent panels are closely adjacent to each other and said lower sheets of adjacent panels are closely adjacent to each other, and said adjacent sheets and sections are welded along their lengths to form an I-beam at said adjacent edges.

6. The combination of claim 5 wherein said sheets of said panels overlap said side sills, and the lengths of said Z-shaped sections are less than the lengths of said panels and abut, at their ends, and align said side sills.

7. The combination of claim 6 wherein each side sill is of T-shaped cross section having a vertical web extending between said sheets connected thereto and abutting said Z-shaped sections, and a horizontal web extending in an outboard direction away from said vertical web.

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