Feb. 7, 1961 J. W. ALLEN 2,970,553

TRUSS PANEL

Filed Feb. 6, 1958

2 Sheets-Sheet 1

Fig. 1

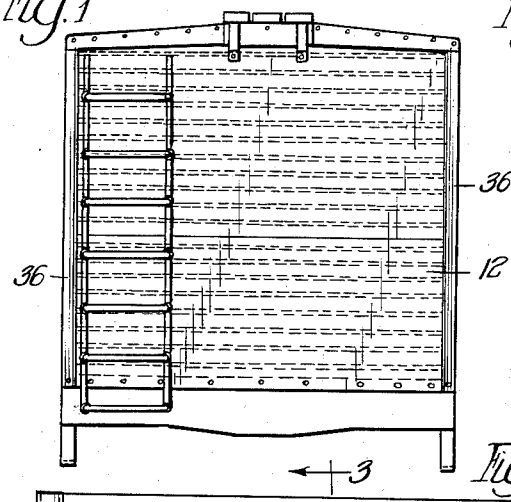


Fig. 3

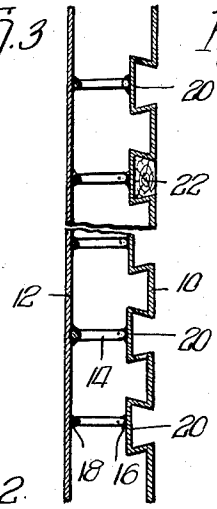


Fig. 5

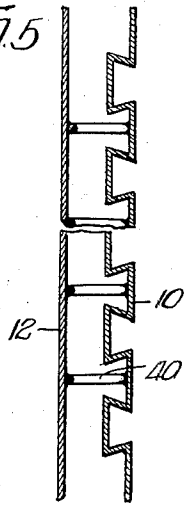


Fig. 2

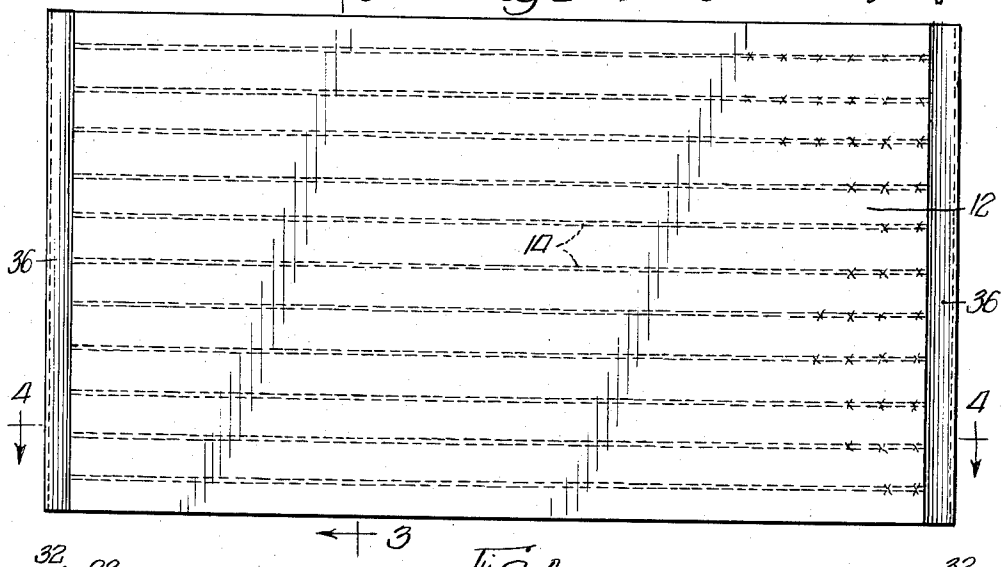


Fig. 4

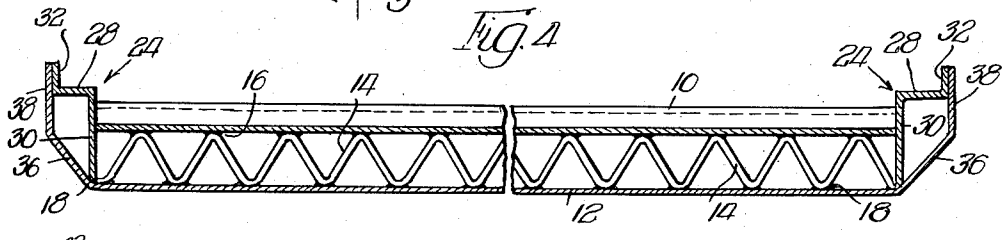
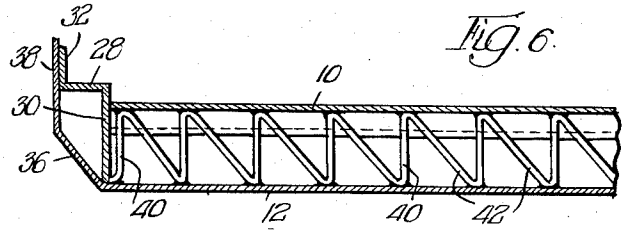


Fig. 6



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Fig. 7.

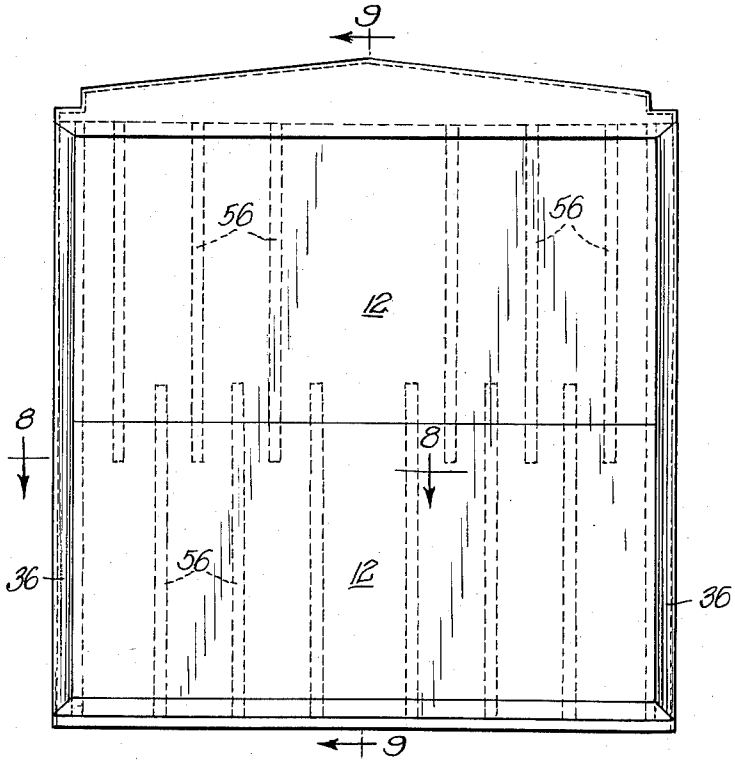


Fig. 8.

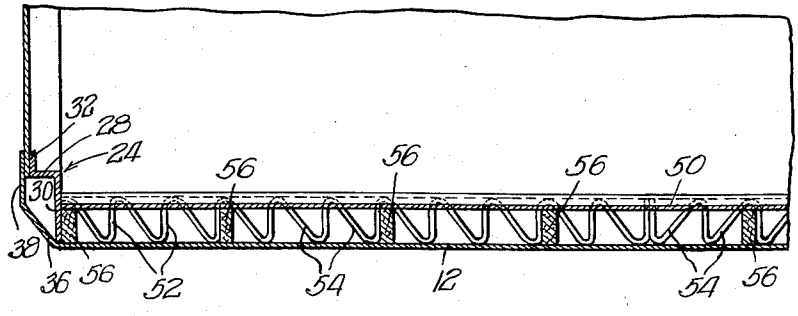
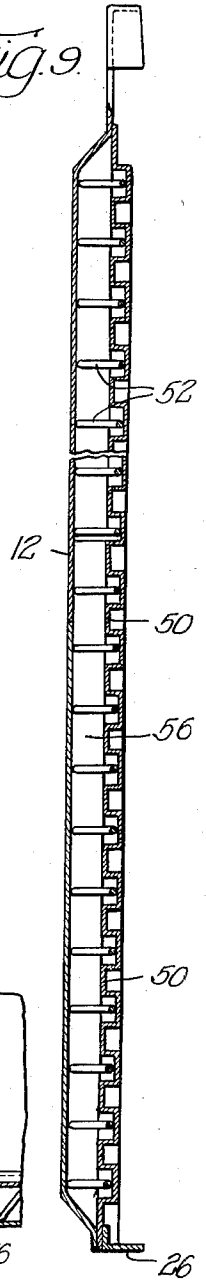


Fig. 9.



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2,970,553

TRUSS PANEL

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7 Claims. (Cl. 105—410)

This invention relates to panels and more particularly to a truss web sandwich panel especially adapted for use as a railway freight car end.

The walls of railway cars are often subjected to high stresses. Loads carried by cars weigh many tons and are, frequently, bulk commodities or articles not securely braced within the car. The sudden starting, stopping, accelerating and decelerating, in addition to the constant swaying to which cars are subjected during service, imparts severe stresses to the walls thereof. This condition exists particularly in the end walls of cars. A common type of end wall is one in which a metallic plate is formed with a plurality of substantially parallel corrugations which extend between spaced apart posts or frame members. The design of corrugated end walls have undergone changes from time to time to increase the strength thereof without increasing weight until the ultimate in strength of corrugated plate of a given material and weight has been reached and, consequently, if further strength is desired with the same material and weight, other factors must contribute thereto. Due to the increasing speeds at which trains are run, a proportionate increase in the strength of the car walls is necessary.

It is the principal object of this invention to provide a railway car end comprising a truss panel of sandwich construction which provides greater strength than a corrugated plate of the same weight.

Another object is to provide a laminated panel for use as a railway car end comprising a thin flat outer sheet, a corrugated inner sheet, and spacing and reinforcing members in the form of bars, or rods, of uniform cross section. The shape and disposition of the reinforcing bars, or rods, may be widely varied but in a preferred arrangement the rods are bent into a sinuous or wavy shape, the alternate crests of which are secured to the sheets by welding. The corrugations in the inner sheet and the rods are horizontal and extend from side to side of the panel which is secured at its side margins to the corner posts of the car, and thus the rods and corrugations function as beams between the corner posts.

In the drawings, forming part of this application, and wherein like reference characters indicate like parts:

Figure 1 is a reduced end elevation of a railway car showing one application of the invention as a railway car end.

Figure 2 is an enlarged view of a portion of Figure 1.

Figure 3 is a vertical section on the line 3—3, Figure 2.

Figure 4 is a horizontal section on the line 4—4, Figure 2.

Figure 5 is a section similar to Figure 3 of a modified form of the invention.

Figure 6 is a horizontal section similar to Figure 4, but of the modified form shown in Figure 5.

Figure 7 is an end elevation of a railway car showing a further modified form of the invention.

Figure 8 is an enlarged section on line 8—8 of Figure 7.

Figure 9 is an enlarged vertical section on line 9—9, Figure 7.

It is a relatively simple matter to increase the strength of a railway house car end wall by increasing the thickness of the metallic plate from which it is made from the usual one-quarter inch to say three-eighths inch, but this would also increase the weight fifty percent, as well as increase the cost of the material and the cost of pressing the heavier material.

Referring now to Figures 1, 2, 3 and 4 of the drawings, a composite steel end is shown which comprises a horizontally corrugated inner sheet 10, and outer flat sheet 12, and a core comprising a plurality of vertically spaced sinuous rods 14 which are parallel, horizontally disposed, and the crests of which rods are welded to the crests of the corrugations and to the outer sheet as at 16 and 18, respectively. The corrugations 20 of the inner sheet are trapezoidal in cross section and of uniform width and depth entirely across the sheet. Similarly shaped wood filler pieces 22 are installed endwise in the inwardly facing corrugations 20 so that lading band anchors or inner lining may be secured thereto as and when desired. The wood fillers 22 are held in position against lateral displacement by the shape thereof and of the corrugations. The rods 14 are secured to the inner and outed sheets 10 and 12, respectively, so that the rods 14 and corrugations 20 cooperate as beams between the corner posts of the car. The outer sheet acts in tension to resist outward pressure from the car lading. This tension is part of the horizontal beam action to carry the load to the corner posts indicated at 24. Also this sheet 12 acts as a vertical diaphragm to spread the force of a concentrated load to a large area in the vertical direction. It is secured across its top margin to the end plate of the car and across its bottom margin to the end sill 26 of the car.

The inner corrugated sheet 10 acts as the compression element of the horizontal beam. This corrugated sheet also acts as a steel liner for the car end and protects any desired non-metallic liner secured thereto (not shown).

The core of the sandwich panel consists of ⅜" round steel rods bent in sinusoidal form to form trusses in the horizontal direction. These rods are parallel, equally spaced, coincident with the spacing of the corrugations, and induce maximum efficiency to the inner and outer skin to act as flanges of the horizontal beams.

The corner posts of the car are indicated at 24 and extend at the corners of the car from end plate to end sill 26 (Fig. 9) as is common. The corner posts are of Z-section comprising angularly disposed arms 28 and 30, the arm 28 terminating in a flange 32 parallel with the car side, and arm 30 extending to the outer sheet 12 parallel with the side wall. The corrugated end sheet 10 extends from corner post to corner post, and is secured at its vertical margins to flanges 30 of the corner posts, as clearly shown in Fig. 4. End sheet 10 is also secured across its top margin to sheet 12 and across its bottom margin to the end sill 26.

The outer sheet 12 is for the most part flat and parallel with the corrugated sheet. The ends of the horizontal rods terminate in a vertical plane inwardly of the car sides somewhat, as indicated clearly in Figure 4. The sheet 12 extends over the rods 14 and flanges 30, and at the opposite vertical margins are turned diagonally as at 36 to a vertical plane parallel with the flange 32 of the corner post, where the sheet 12 terminates in a flange 38 overlapping and secured to the flanges 32.

The bends in the rods forming the core of the panel are resistance welded to the spaced sheets by making two welds simultaneously, using the rod as the center conductor between the welds.

In Figures 5 and 6 the rods forming the core of the composite end have alternate portions 40 which are normal to the sheets 10 and 12, and 42 which are diagonal to the sheets 10 and 12. In this modification the bends of the rods, which are welded to the corrugated sheet 10, are welded in the valleys of the corrugations, as clearly shown in Figures 5 and 6. The electrodes of the welding machine are placed at opposite ends of the portions 40 of the rod with less liability of the rods collapsing during the welding process. Otherwise, the structure is the same as that described in connection with Figures 1 to 4, and the same numerals of reference are applied to the corresponding parts and need not be again described.

In Figures 7, 8 and 9, the corrugations 50 of the inner sheet are rectangular in cross section so that filler strips for the corrugations, or lining boards over the entire inside of the end, would have to be fastened thereto by nailing stud bolts, or other means of securement. The rods of this modification are like those shown in Figure 6, and comprise portions 52 which are normal to the corrugated sheet and outer sheet 12, and portions 54 which are diagonal to the sheet 12. On opposite sides of the vertical center line of the end, the diagonal portions extend in directions toward the said center line. In other words, the diagonal portions 54 converge toward a vertical plane passing through the center of the end and parallel to the car sides. In this modification, I have shown spaced vertical wood studs 56 in the core of the composite end. These studs are in length a little more than half the height of the end. An equal number of studs 56 are in the lower and the upper halves of the end, so that they overlap somewhat the transverse center of the end, as clearly shown in Figure 7. The studs perform several functions. It is a convenient method of aligning and holding the web members during the assembly process. They also act as nail holding areas to which the wood liner boards, or filler strips, may be secured, the nails piercing the corrugated liner sheet in the process. The studs also give the composite structure better energy absorption capacity to resist impact loads, and act in conjunction with the vertical diaphragm action of the outer sheet 12 to spread out the effect of a concentrated load to many horizontal beam elements. The filler blocks, or the wood liner boards, also act with the corrugated inner sheet to spread out horizontally the effect of concentrated impact loads.

From the above, it is apparent that I have devised a composite end structure having advantages over existing designs of the same weight in that it will provide greater strength in beam action between the corner posts. It will also increase the strength due to the vertical distribution effect of the outer skin and the core in spreading a concentrated load to a wide area. Thus this composite end will absorb higher concentrated impact loads before permanent yielding than the present corrugated ends of the same weight.

With the filler strips 22 applied in each corrugation, the end structure provides a smooth interior surface to the lading, and said strips cooperate with the corrugations and the web members in distributing a concentrated load to the corner posts. When a plywood, or other non-metallic, liner is applied over the whole corrugated sheet, said liner is completely backed up by the composite end structure.

I claim:

1. A composite truss panel comprising a flat metallic sheet, a corrugated metallic plate, the corrugations of which are parallel, spaced, and extend from side to side

of the plate, a plurality of substantially sinuous, spaced, parallel, elongated rods between said sheet and plate, the crests of said rods being secured to said sheet and plate, angles at the sides of the panel, each angle having an arm normal to said panel and an arm extending outwardly parallel thereto, said flat metallic sheet extending to and secured to the edges of said arms disposed normal thereto, turned thereover and secured to said parallel arms, and said corrugated plate and said sinuous rods extending between and secured to said arm disposed normal thereto within the bounding planes thereof, the arms of said angles and the included portion of the flat metallic sheet forming a hollow box section at the sides of the panel.

2. The structure of claim 1 wherein said rods are parallel to said corrugations and each rod is secured to a corrugation.

3. The structure of claim 1 wherein said rods are parallel to said corrugations and each rod is secured to the crest of a corrugation.

4. The structure of claim 1 wherein said rods are parallel to said corrugations and each rod is secured to the valley of a corrugation.

5. The structure of claim 1, and a plurality of spaced non-metallic studs between said sheet and plate and extending in a direction normal to said sinusoidal members from opposite ends of said panel to and overlapping each other somewhat at the transverse central portion of the panel.

6. A composite truss panel comprising a flat metallic sheet, a corrugated metallic plate, the corrugations of which are parallel, spaced, and extend from side to side of said plate, a plurality of substantially sinuous, spaced, parallel, elongated rods between said sheet and plate, and a plurality of spaced non-metallic studs between said sheet and plate and extending in a direction normal to said sinusoidal members from opposite ends of said panel to and overlapping each other somewhat at the transverse central portion of the panel.

7. As an article of manufacture, a composite end wall for a railway car, comprising spaced corner posts each having a flange normal to said end wall and a second flange parallel to said end wall, spaced parallel metallic sheets forming inner and outer faces of said end wall, the sheet forming the inner face of said end wall having a plurality of spaced parallel corrugations therein, said sheet extending between and secured at its side edges to the flanges normal to said end wall, the sheet forming the outer face of said end wall spanning the edges of said flanges of said corner posts, turned thereover and being secured to said second flanges, and a plurality of spaced parallel sinusoidal members between said sheets positioned in planes normal thereto and secured to said sheets by being resistance welded thereto at their points of contact therewith, said sinusoidal members extending between the flanges normal to said end wall within the bounding planes thereof, said corner post flanges and the included portion of said outer sheet forming hollow box sections at the sides of the panel.

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