Dec. 3, 1940. G. G. GILPIN 2,223,609

RAILWAY CAR CONSTRUCTION

Filed Dec. 21, 1938 3 Sheets-Sheet 1

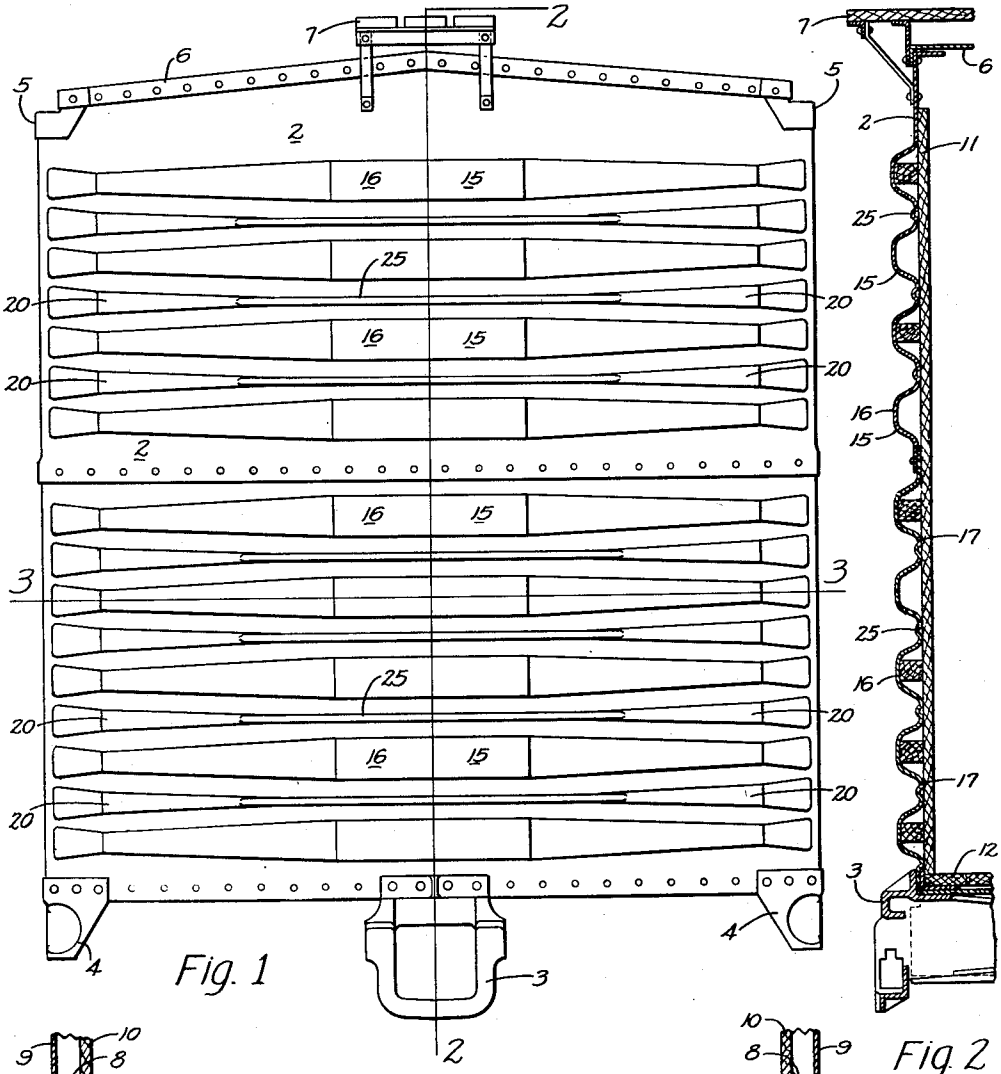


Fig. 1

Fig. 2

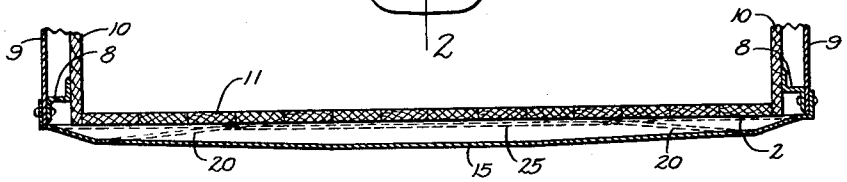


Fig. 3

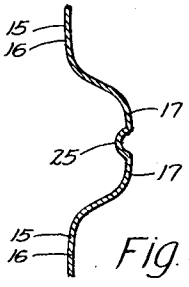


Fig. 4

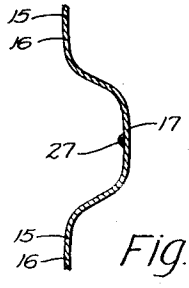


Fig. 5

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RAILWAY CAR CONSTRUCTION

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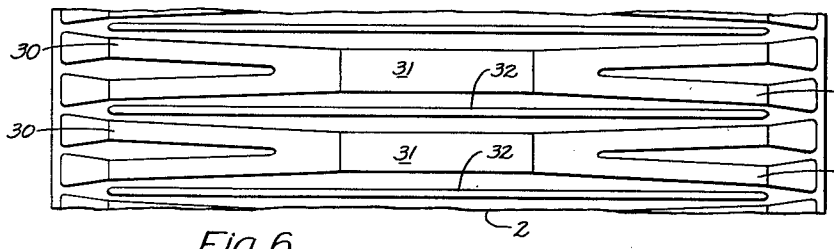


Fig. 6

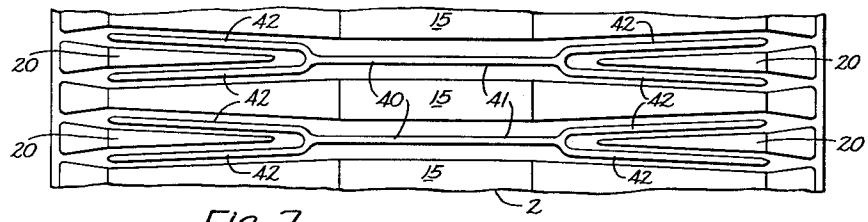


Fig. 7

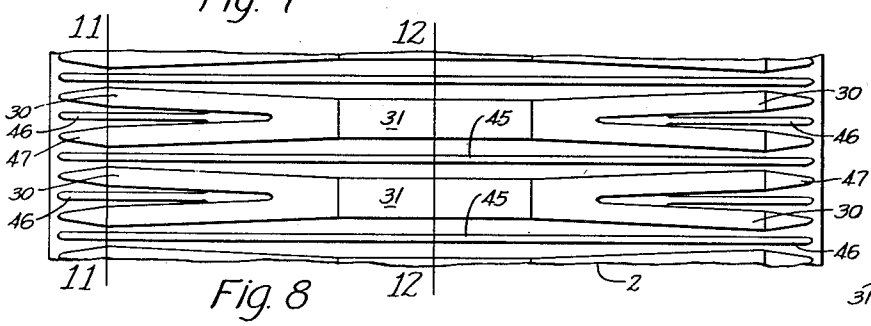


Fig. 8

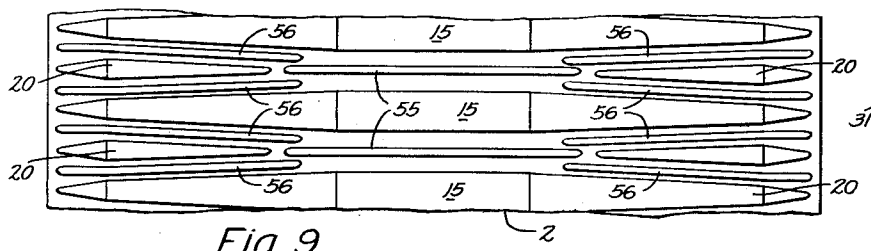


Fig. 9

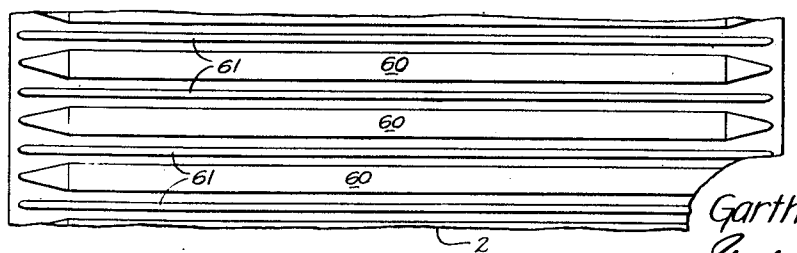


Fig. 10

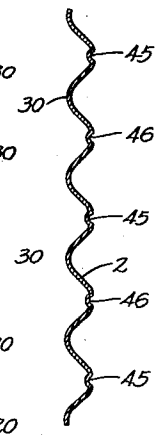


Fig. 11

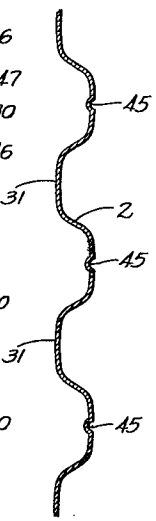


Fig. 12

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RAILWAY CAR CONSTRUCTION

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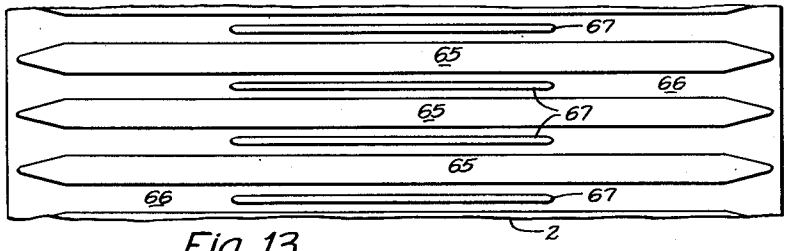


Fig. 13

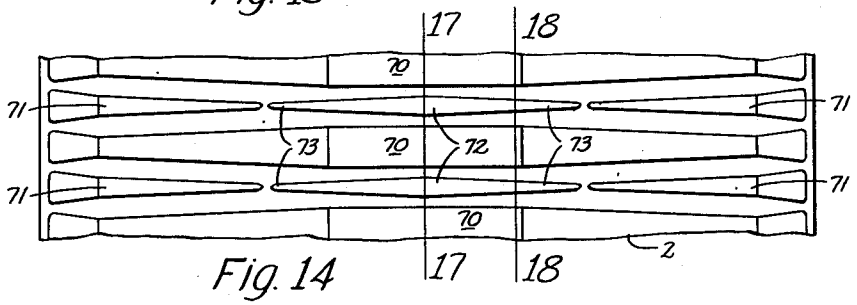


Fig. 14



Fig. 17

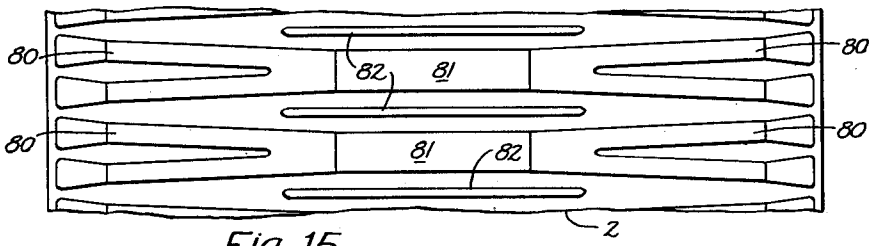


Fig. 15

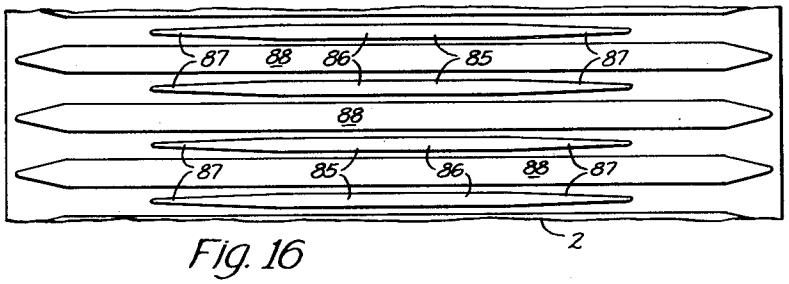


Fig. 16



Fig. 18

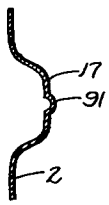


Fig. 19

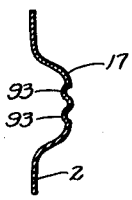


Fig. 20

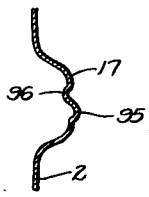


Fig. 21

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UNITED STATES PATENT OFFICE

2,223,609

RAILWAY CAR CONSTRUCTION

Garth G. Gilpin, Riverside, Ill., assignor to Standard Railway Equipment Manufacturing Company, Chicago, Ill., a corporation of Delaware

Application December 21, 1938, Serial No. 246,968

9 Claims. (Cl. 105—410)

The invention relates to railway cars and more particularly to the walls of railway cars. End walls are commonly made of metallic plate having substantially parallel corrugations which function as beams between the corner posts. I will describe my invention as adapted to an end wall, although I do not wish to limit it thereto for it is also applicable to side walls, doors, roofs or floors.

Recent trends in the design of railway cars have been toward the reduction of weight of the cars. In order to effect economies of operation, the railroads are endeavoring to increase the ratio of revenue loads to total loads and are now making extensive use of high strength, low alloy steels, such as Cor-Ten, Yoloy and similar steels. These steels have considerably greater strength than the carbon steels commonly used which makes it possible, from a strength consideration, to use thinner members with a consequent saving of weight.

Corrugated plates are commonly used for end walls, the corrugations functioning as beams between the corner posts so that the portion of the corrugations adjacent the interior of the car serve as compression members of the beams, while the portions adjacent the exterior of the car serve as tension members. A plate is not well suited to resist compressive loads on account of its tendency to buckle and this tendency has become more pronounced with the increased use of thinner plates. Consequently, the strength of walls made of thin plate is less than is indicated by calculations based on the design of the structure and the strength of the steel. The difference is caused by buckling of the compression members of the corrugations. It is an object of this invention to provide a stiffening corrugation in said compression member to resist buckling.

Lading hauled in railway cars is often of a type which is thrown against the end wall by the service movements of the car. Some commodities, such as lumber, have projecting parts which strike localized areas with great force. There is a danger, which is greatly increased by the use of thinner end wall plates, of denting the compression members of the corrugations. A dent greatly weakens a compression member and, therefore, the wall as a whole against loads from within the car. An object of the invention is that the stiffening corrugation, in addition to resisting buckling, should also resist localized dents which greatly impair the strength of a corrugated wall.

A further object of the invention is to increase the strength of an end wall without decreasing the resiliency thereof. The above mentioned stiffening corrugation which strengthens the end wall by resisting buckling and denting may be proportioned so as to leave the section modulus of the wall substantially similar to that of a wall without a stiffening corrugation. Since resiliency is directly related to section modulus, I claim to have very considerably increased the strength of a corrugated wall without impairing the resiliency thereof.

Another object of my invention is to increase the strength of the end wall without increasing the cost thereof. Only a very small amount of material is required to form the stiffening corrugation and there are no labor expenses because the stiffening corrugations may be formed simultaneously with the forming of the other corrugations.

The stiffening corrugation is particularly adapted to end walls made of relatively thin plate and was developed particularly for use therein. Its value decreases as the thickness of the plate increases but tests show that some benefits would probably be derived in the use thereof for plates less than one-quarter inch thick.

Other objects and advantages of my invention will be apparent from the following detailed description taken with reference to the drawings in which:

Fig. 1 is an end view of a railway car embodying my invention.

Figs. 2 and 3 are sections on lines 2—2 and 3—3 respectively of Fig. 1.

Fig. 4 is a portion of Fig. 2 enlarged to show the details of the stiffening corrugation.

Fig. 5 shows a modified form of stiffener.

Figs. 6–10 inclusive show alternate positions for the stiffening corrugations.

Figs. 11 and 12 are enlarged sections on lines 11—11 and 12—12 respectively of Fig. 8.

Figs. 13–16 inclusive show modified constructions.

Figs. 17 and 18 are enlarged sections on lines 17—17 and 18—18 respectively of Fig. 14.

Figs. 19–21 inclusive show modified forms of stiffening.

Figs. 1 to 3 show the end portion of a railway car, including end wall plate 2; striking casting 3; lower corner caps 4; upper corner caps 5; roof 6; running board 7; corner posts 8; side sheathing 9; side lining 10; end lining 11 and floor 12. The end wall plate 2 is formed with a plurality of substantially parallel major corrugations 15 which function as beams between the corner

posts 8. The portions 16 of the plate 2 adjacent the exterior of the car function as the tension members of said beams, while the portions 17 adjacent the interior of the car are preferably tapered adjacent their opposite ends and minor corrugations 20 formed between the corrugations 15 adjacent the ends thereof.

Stiffening corrugations 25 are formed in the compression members 17 of the end wall plate 2. The stiffening corrugations 25 preferably extend between and merge into the minor corrugations 20.

Fig. 4 shows an enlarged view of a stiffening corrugation 25 and Fig. 5 shows a relatively small member or bead 27 welded to the compression members 17 to stiffen said compression member.

In the modification shown in Fig. 6, the end wall plate 2 is formed with a plurality of corrugations 30 which merge together to form a lesser number of wider and deeper corrugations 31. Stiffening corrugations 32 are provided between the corrugations 31 and extend to adjacent the ends of the corrugations 30.

Fig. 7 shows an end wall plate 2 provided with a plurality of substantially parallel corrugations 15 with minor corrugations 20 between the corrugations 15 and adjacent the ends thereof. Stiffening corrugations 40 have central portions 41 between the corrugations 15 and extending substantially between the minor corrugations 20. The stiffening corrugations 40 divide to form a greater number of corrugations 42, each being between a major corrugation 15 and a minor corrugation 20.

In Fig. 8 the end wall plate 2 has formed therein a plurality of corrugations 30 which merge together to form a greater number of wider and deeper corrugations 31. Stiffening corrugations 45 are provided between the corrugations 31 and other stiffening corrugations 46 are provided between the corrugations 30. The terminations or end portions 47 of the corrugations 30 are tapered so that the stiffening corrugations 45—46 may extend substantially to the corner posts 8.

Fig. 9 shows the end wall plate 2 formed with a plurality of substantially parallel corrugations 15 with minor corrugations 20 between the corrugations 15 and adjacent the ends thereof. Stiffening corrugations 55 are provided between the major corrugations 15 and extend substantially between the minor corrugations 20. Other stiffening corrugations 56 are disposed between the major corrugations 15 and minor corrugations 20 and extend substantially to the corner posts 8.

In the modification shown in Fig. 10 the end wall plate 2 is formed with a plurality of parallel corrugations 60 which extend substantially between the corner posts 8. Stiffening corrugations 61 are disposed between the corrugations 60 and also extend substantially between corner posts.

Fig. 13 shows a plate 2 formed with a plurality of substantially parallel corrugations 65 which provide a series of beams extending between opposite edges of said plate. The compression members 66 are provided with shallow stiffening corrugations 67 which terminate intermediate the terminations of the corrugations 65. Stiffening corrugations may be considered unnecessary adjacent the edges of the plate 2 because the stresses are relatively low in those portions of the plate.

In the modification shown in Fig. 14 the plate 2' is formed with a plurality of substantially parallel corrugations 70 with minor corrugations 71 disposed therebetween and adjacent the ends thereof. The stiffening corrugations 72 are between the corrugations 70 and are tapered (73) at their ends.

In Fig. 15 the plate 2 is formed with a plurality of corrugations 80 which merge together between their opposite ends to form a lesser number of wider and deeper corrugations 81. Shallow stiffening corrugations 82 are provided which are similar to the stiffening corrugations 67 of Fig. 13 in that they terminate intermediate the edges of the plate 2.

The stiffening corrugations 85 of Fig. 16 have a central portion 86 of constant depth and width and tapered portions 87. The corrugations 85 may be used to stiffen a plate having parallel corrugations 88, as shown in Fig. 16, or corrugations of the types shown in Figs. 14 and 15.

In the modification shown in Fig. 19 the compression members 17 of the corrugated plate 2 are provided with inwardly projecting stiffening corrugations 91. Fig. 20 shows a compression member 17 formed with a plurality of stiffening corrugations 93. In Fig. 4 an inwardly projecting stiffening corrugation 95 is adjacent an outwardly projecting stiffening corrugation 96.

I have illustrated several arrangements of end wall plates to which are adapted stiffening corrugations in various forms. It is not intended that my invention be limited to the arrangements shown; rather, my invention includes any arrangement in which a stiffening corrugation is used to reinforce the compression side of the corrugated plate.

Tests have been made on corrugated plates supported as beams. It was found that a plate 2, as shown in Figs. 1 to 4 inclusive, developed a considerably greater strength than a plate similar in every respect except for the omission of the stiffening corrugation 25. The stiffening corrugation 25 increased the strength of the plate by 12.6% in the case of a $\frac{1}{8}$" plate and 9.0% in the case of a $\frac{5}{32}$" plate. It is evident from these tests that, in a car wall of the type tested, the stiffening corrugations added considerable strength to plates thinner than $\frac{3}{16}$". The strengthening effect of the stiffening corrugations would vary, however, with various configurations of main corrugations and stiffening corrugations. Consequently, the term "relatively thin," as used in the claims, should be interpreted to mean any plate having a thickness and configuration such that a stiffening corrugation of the general type disclosed would have a strengthening effect.

It is evident from the above cited tests that thin corrugated plates sometimes fail by buckling of the corrugations which have compressive stresses induced therein and that the possibility of such buckling is considerably reduced by the provision of the shallow stiffening corrugations herein disclosed. If the configuration of the tension and compression corrugations is such that the unit stress in the tension corrugation is greater than the unit stress in the compression corrugation and the difference between such unit stresses is so great that the plate fails by failure of the tension corrugations, it would obviously not increase the strength of the plate to stiffen the compression corrugations. The shallow stiffening corrugations then would have no function. However, if the tension and compression unit stresses are nearly enough alike

that the compression corrugations tend to fail, due to the aforementioned buckling, the corrugations may be said to project substantially equal distances on opposite sides of the neutral axis plane and the shallow stiffening corrugations in such cases increase the strength of the plate.

The accompanying drawings illustrate the preferred form of the invention, though it is to be understood that the invention is not limited to the exact details of construction shown and described, as it is obvious that various modifications thereof, within the scope of the claims, will occur to persons skilled in the art.

I claim:

1. A railway car wall comprising a relatively thin metallic plate secured to spaced apart frame members, said plate formed with a plurality of substantially parallel main corrugations which extend substantially between said frame members, said corrugations projecting substantially equal distances alternately on opposite sides of the neutral axis plane which is substantially parallel with the general plane of said wall and shallow stiffening corrugations in the portions of the inwardly projecting main corrugations which are substantially midway between said frame members.

2. A railway car wall comprising a relatively thin metallic plate secured to spaced apart frame members, said plate formed with a plurality of substantially parallel main corrugations which extend substantially between said frame members, said corrugations projecting substantially equal distances alternately on opposite sides of the neutral axis plane which is substantially parallel with the general plane of said wall and shallow stiffening corrugations in the apices of the portions of the inwardly projecting main corrugations which are substantially midway between said frame members.

3. A railway car wall comprising a relatively thin metallic plate secured to spaced apart frame members, said plate formed with a plurality of substantially parallel sinuous main corrugations which extend substantially between said frame members, said corrugations projecting substantially equal distances alternately on opposite sides of the neutral axis plane which is substantially parallel with the general plane of said wall and shallow stiffening corrugations in the portions of the inwardly projecting main corrugations which are substantially midway between said frame members.

4. A railway car wall comprising a relatively thin metallic plate secured to spaced apart frame members, said plate formed with a plurality of substantially parallel main corrugations which extend substantially between said frame members, said corrugations projecting substantially equal distances alternately on opposite sides of the neutral axis plane which is substantially parallel with the general plane of said wall and outwardly projecting shallow stiffening corrugations in the portions of the inwardly projecting main corrugations which are substantially midway between said frame members.

5. A railway car wall comprising a relatively thin metallic plate secured to spaced apart frame members, said plate formed with a plurality of substantially parallel main corrugations which project substantially equal distances alternately on opposite sides of the neutral axis plane which is substantially parallel with the general plane of said wall, the inwardly projecting main corrugations dividing at points adjacent their opposite ends to form a greater number of narrower corrugations which terminate adjacent said frame members and shallow stiffening corrugations in the parts of said inwardly projecting main corrugations between said points.

6. A railway car wall comprising a relatively thin metallic plate secured to spaced apart frame members, said plate formed with a plurality of substantially parallel main corrugations which project substantially equal distances alternately on opposite sides of the neutral axis plane which is substantially parallel with the general plane of said wall, the inwardly projecting main corrugations dividing at points adjacent their opposite ends to form a greater number of narrower corrugations which terminate adjacent said frame members, said inwardly projecting main corrugations formed with shallow stiffening corrugations which extend between and merge into said points.

7. A railway car wall comprising a relatively thin metallic plate secured to spaced apart frame members, said plate formed with a plurality of substantially parallel main corrugations which project substantially equal distances alternately on opposite sides of the neutral axis plane which is substantially parallel with the general plane of said wall, the outwardly projecting main corrugations dividing adjacent their opposite ends to form a greater number of narrower corrugations which terminate adjacent said frame members and shallow stiffening corrugations in the parts of the inwardly projecting main corrugations adjacent the undivided parts of the outwardly projecting main corrugations.

8. A railway car wall comprising a relatively thin metallic plate secured to spaced apart frame members, said plate formed with a plurality of substantially parallel main corrugations which extend substantially between said frame members, said corrugations projecting substantially equal distances alternately on opposite sides of the neutral axis plane which is substantially parallel with the general plane of said wall and shallow stiffening corrugations in the portions of the inwardly projecting main corrugations which are substantially midway between said frame members, said stiffening corrugations being tapered toward their opposite ends.

9. A relatively thin metallic plate adapted to be secured to spaced apart railway car frame members to form a wall of said car, said plate formed with a plurality of substantially parallel main corrugations which extend substantially between the parts of the plate adapted to be secured to said frame members, said corrugations projecting substantially equal distances alternately on opposite sides of the neutral axis plane of said plate, the said main corrugations which are arranged to project toward the interior of the car having shallow stiffening corrugations formed in the portions thereof which are substantially midway between said parts.

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