July 16, 1935. A. W. FRASER 2,008,640

REENFORCED CORRUGATED CAR ENDS

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Fig. 1.

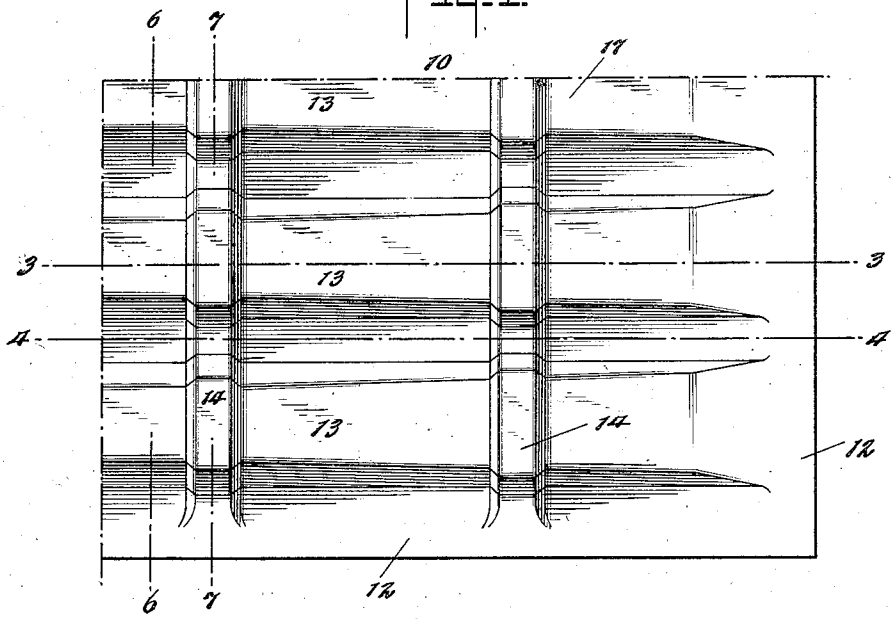
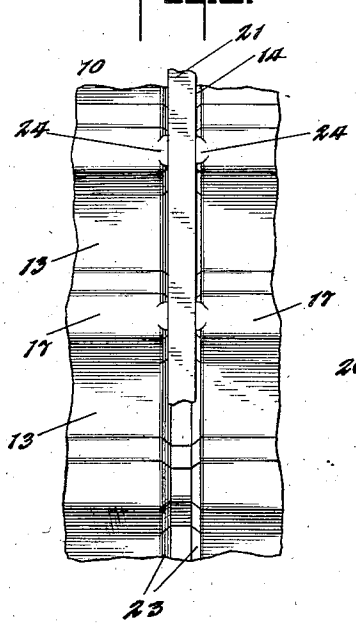


Fig. 9.



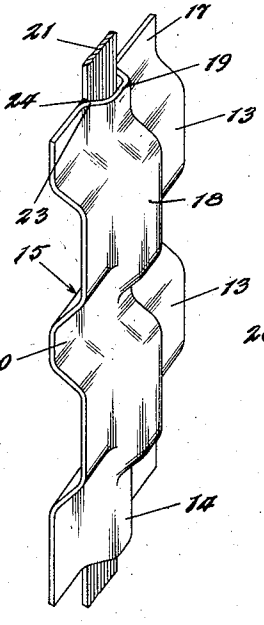


Fig. 10.

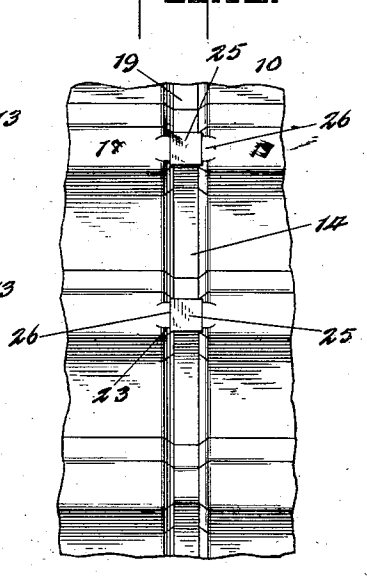


Fig. 2.

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Fig. 3.

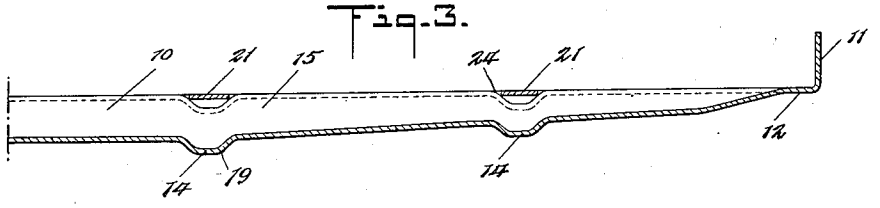


Fig. 4.

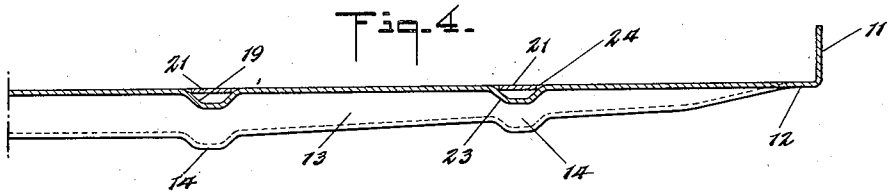


Fig. 5.

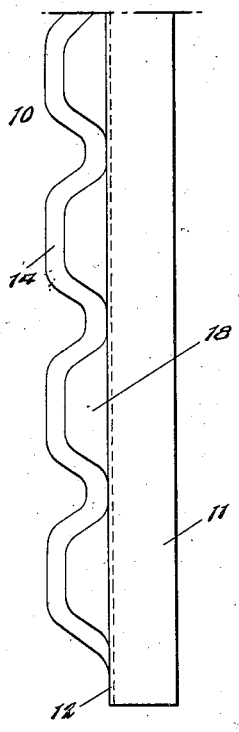


Fig. 6.

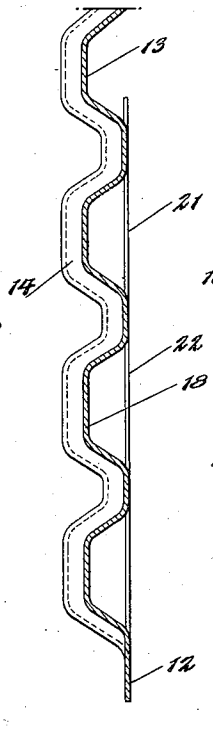


Fig. 7.

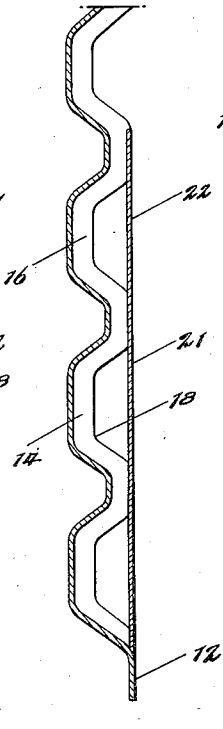
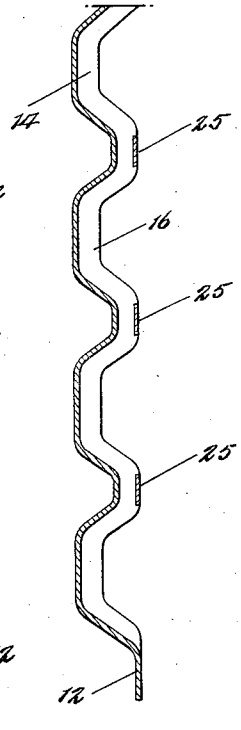


Fig. 8.



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REENFORCED CORRUGATED CAR ENDS

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Application March 17, 1934, Serial No. 716,137

16 Claims. (Cl. 189—34)

The invention relates in general to a sheet metal structural unit of corrugated form to provide integral reenforcements and the invention specifically relates to a structural panel or unit of general application but herein particularly designed to constitute the whole or a portion of a railroad car side or end and the present disclosure constitutes a further development of the invention disclosed in my co-pending application on Corrugated structural units, Serial No. 700,098 filed November 28, 1933.

The primary object of the present invention, as was the object of the previously filed disclosure, is to provide an improved form of one-piece reenforced sheet metal unit in which integrally formed beams are disposed in intersecting relation to provide the maximum resistance to distortional strains.

In the prior application the beams are formed by corrugating a sheet metal plate to form integral intersecting corrugations coacting to define a reenforced area within the outlines of the sheet and this feature is also utilized in the present disclosure.

The novel feature of this invention is to provide one or more of the corrugations, either wholly or in part as a beam in the form of a hollow tube, or differently expressed to interiorly reenforce or stiffen that corrugation or corrugations most liable to become distorted while in use with the reenforcement disposed to resist tendencies of the corrugation to flatten out or otherwise become distorted under load.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings, and in part will be more fully set forth in the following particular description of one form of structure embodying the invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

Fig. 1 is a view in elevation of the lower right hand half of a car end constituting a preferred embodiment of the invention;

Fig. 2 is a perspective view constituting a detailed showing of one of the posts in its relation to a pair of adjacent girders;

Figs. 3 and 4 are each horizontal sectional views taken respectively on the lines 3—3 and 4—4 of Fig. 1;

Fig. 5 is a vertical edge view looking at the construction shown in Fig. 1 from the right hand side of the figure;

Figs. 6 and 7 are vertical sectional views taken respectively on the lines 6—6 and 7—7 of Fig. 1 showing in longitudinal section the long bridging strip form of stiffening reenforcement also shown in Figs. 2 and 9;

Fig. 8 is a view similar to Fig. 7 showing the short plate form of stiffening reenforcement also shown in rear elevation in Fig. 10;

Fig. 9 is a view in rear elevation of the inner side of the panel shown in Fig. 1 showing the trough side of the corrugations at the line 7—7 and

Fig. 10 is a view similar to Fig. 9 showing the short plate form of trough reenforcement.

The showing illustrates the lower right corner of a single plate of which the lower left corner corresponds to the illustrated portion except for reversal in disposition of parts so that the car end will be symmetrical relative to a medial plane through the car. The plate thus described may extend upwardly for any desired distance, or to the roof of the structure. Further, in the structure from which these drawings were made the car end was formed of two similar plates, one disposed above the other and with their adjacent edges overlapping and riveted together following conventional practices in this respect. Further following conventional practices, the upper plate was provided with an inturned roof engaging flange as well as corner flanges. In general it is to be understood that the invention herein disclosed is applicable to conventional car end and side panel constructions which heretofore have used a different form of corrugation arrangement.

Referring to the drawings there is disclosed a substantially flat sheet metal plate or panel 10 having inturned side flanges 11 and an outlining flat uncorrugated edge portion 12 and which flanges 11 and flat edge portion 12 are usually perforated to form bolt or rivet holes by means of which the panels are secured to adjacent structural parts of the car.

Within the outlining flat edge area 12 the plate is provided with two sets of corrugations to form a central reenforced area to the panel as a whole. One set of corrugations 13 extends horizontally in parallel relation and are substantially equidistantly spaced apart vertically to form integral girders. The other set of corrugations 14 extend vertically in substantially equidistantly spaced apart horizontal relation to form upstanding integral posts. The girder forming corrugations are relatively much wider than the post forming corrugations 14. These corrugations intersect each other at right angles to form an

elongated block-like or checker-board design over the entire reenforced area. It will be seen from Fig. 3 that the trough or channel 15 of the girder forming corrugation 13 is continuous across the entire reenforced area and in this case is straight from end to end. By reference to Fig. 7 it will be noted that the trough or channel 16 of the post forming corrugation 14 is likewise continuous from end to end across the reenforced area but, of course, is not straight being of undulatory form.

One of the features of novelty in this disclosure is that the post forming corrugations 14 are continuous and project outwardly not only from the flat, uncorrugated portion of the plate as shown at 17, Fig. 2, but extend up the sides of, pass over and project beyond the corrugations 13 as shown at 18, Fig. 2. This means, of course, that a transverse cross section taken through a corrugation 14 at any point along its length will show the U-shaped or substantially U-shaped configuration shown at 19 in Figs. 3 and 4, even though the post considered longitudinally in side elevation is of the wavy form shown in Figs. 5 to 8. The post extends over the girder forming corrugations 13 and along the trough or uncorrugated space 20 formed between adjacent pairs of the girder forming corrugations 13. The girder forming corrugations 13 are of maximum beam depth, that is, have their maximum horizontal offset at their mid-length to provide maximum strength at the longitudinal medial plane of the car and progressively decrease in depth from their centers towards their opposite ends as shown in the right half in Figs. 3 and 4. Maximum strength to resist bending of the car end is of greatest importance at the center of the car to resist strains from shifting loads in the car but this necessity rapidly diminishes towards the vertical edges of the car end. At their ends the girders merge at a sharp angle into the unreenforced vertical marginal portion shown at 12 in Figs. 3 and 4.

The sections shown in Figs. 3 and 4 show that the plate cannot be bent about any vertically extending axis because such bending would be resisted by the horizontally extending corrugations 13. Similarly, the vertical sections shown in Figs. 6, 7, and 8 show that the plate cannot be bent about any horizontally extending axis as any such bending would be resisted by the vertically extending corrugations 14. It would likewise be apparent that bending of the plate cannot take place about any inclined axis for such bendings would be resisted by both the vertical and horizontally extending corrugations. It will be seen that no line can be drawn through the reenforced area which would indicate an axis of bend, because any such line would be intersected by the corrugations of one or the other sets, or by both sets of corrugations.

As the plate or panel can be formed by simple die-stamping operation it is possible to provide economically a form of corrugated car end or other structural part which will provide for maximum rigidity and resistance to distorting strain in all directions throughout the corrugated reenforced area of the unit.

The construction as thus far described is complete and of sufficient strength to maintain its manufactured form under normal service conditions and has been claimed in the above identified co-pending application. In those situations where it is desired to make the panel of relatively thin gauge or weaker metal or where additional structural strength is desired at some portion or portions of the corrugated areas it is suggested that a supplemental reenforcing or tying strip or stiffener be bridged across the trough of those corrugations where such additional strength is desired.

There is disclosed herein two forms of this supplemental reenforcement and the same have been illustrated in connection with the vertical, post-forming corrugations 14 as this is where such additional strength is most likely to be needed, but it is to be understood that the girders 13 may likewise be bridged, their sides or walls tied together, and thus reenforced if it is desired to resist any tendency of the corrugations 13 to open or belly out under load.

In the preferred form the reenforcement is in the form of a long, thin, flat, vertically disposed metal stiffening strip 21, extending lengthwise of the corrugation 14, and transversely across the corrugations 13 as shown at 22 in Figs. 6, 7 and 9. The strip forms a rear wall for the post and constitutes in effect a continuation of the uncorrugated portions 17 (see Fig. 2) and is disposed in the plane of the marginal portions 12. The strip 21 is disposed as a whole within the transversely projected outline of the corrugation 14 and at spaced apart points fits in the base of those portions of the trough of corrugations 14 at the flat portions 17 which form the uncorrugated places or troughs between the horizontal corrugations 13. The strip is secured in place as by welding at its edges to the inclined walls 23 of the corrugations 14 as indicated at 24. The strip may extend from top to bottom of the post forming corrugation 14 thus forming the post substantially in the form of a hollow tube as shown in section in Fig. 4.

Where it is desired simply to tie together the base of one of the corrugations to prevent it from spreading, short plates 25 as shown in elevation in Fig. 10 and in section in Fig. 8 are positioned in spaced apart relation in place of the long girder bridging strip 21 and are similarly welded at their edges as indicated at 26 to the flat uncorrugated portions.

The resulting structure is that there is formed a single one-piece unit in which there is integrally incorporated a plurality of upstanding hollow posts each of which is of tubular form at least in the parts thereof which are on opposite sides of the horizontal girder forming corrugations. Further the long flat strips 21 or the short plates 25 are disposed in a single plane and coact to form in part a flat face to the inner side of the unit. Where the unit is used to form a car end the flat parts 17 and 21, or 17 and 25, coacting to form laths or strips extending in the plane of the marginal portions 12 and to which the inner car wall, sheathing or lining may be secured. In this case care is taken to see that the welded areas 24 or 26 are smooth on their exposed or inner faces.

In those cases where a car end or similar structural unit is made up of two or more superposed sections, following the usual practice of having adjacent edges of corrugated ends lapped and riveted together, the vertical posts herein featured will also in such case be continuous across the lap joint.

While the invention has been specifically described with reference to a car side panel or end section, it is obvious that the same scheme of integral part corrugated and part tubular or hollow reenforcements may be employed to form

other sectional units, such, for instance, as a pressed steel door, as a side door for box cars, or as bottom drop doors for gondola cars and may be utilized wherever pressed steel panels are used at present.

While there has been shown, described and pointed out in the annexed claims, certain novel features of the invention, it will be understood that various omissions, substitutions and changes in the form and details of the structure illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

I claim:

1. A sheet metal structural unit having a reenforced area formed of a set of vertically extending corrugations forming integral posts and a set of horizontally extending corrugations forming integral girders, the corrugations of one set intersecting the corrugations of the other set forming a checkerboard design to the reenforced area, the corrugations forming the girders having greater width than the corrugations forming the posts and being substantially flat at their crown portions, the corrugations forming the posts being substantially flat at their crown portions, and each post forming corrugation having the same cross sectional form at any place along its length and projecting beyond the girder forming corrugations at their intersecting areas, and a reenforcing strip extending lengthwise of one of the post forming corrugations and extending transversely across and thus bridging the girder-forming corrugations, said strip having its long edges secured to the flat portions forming the bottoms of the troughs between the girder forming corrugations and said strip forming in effect a continuation of said flat portions and coacting with its associated vertical corrugation to form thereof in effect a hollow tubular post.

2. A sheet metal structural unit having a reenforced area formed of a set of vertically extending corrugations forming integral spaced apart posts and a set of horizontally extending spaced apart integral girders with the posts and girders mutually intersecting each other, each of the post forming corrugations extending in a vertical plane from edge to edge of the reenforced area and extending continuously in said plane tortuously following the undulations formed by the horizontally extending girder forming corrugations and projecting beyond the girders at their intersecting areas, and said posts at said intersecting areas having the same cross-sectioned configuration as they possess on opposite sides of said intersecting areas, and a plurality of bridge strips, one for each vertically extending corrugation, each extending lengthwise of its associated vertically extending corrugations for substantially the entire length thereof, fitted in portions of the trough thereof and secured thereto to form in effect a hollow vertical post, said strips bridging across all of the vertical corrugations at the otherwise uncorrugated portion of the unit.

3. A sheet metal panel, said panel provided with a set of vertically spaced horizontally extending corrugations constituting integral girders and a set of horizontally spaced vertically extending corrugations constituting integral posts with the posts and girders extending continuously across each other without change of cross sectional configuration and each corrugation having substantially the same depth where it intersects another corrugation as it has on opposite sides of said other corrugation, and each post including a reenforcing strip extending lengthwise thereof from top to bottom thereof and integrally connecting opposite walls of the post forming corrugation on opposite sides of the girder-forming corrugations.

4. A substantially flat sheet metal panel having a flat outlining edge area adapted to be fastened to an adjacent structural part of the car, said panel provided within the flat outlining area with intersecting corrugations forming a reenforced center area of checkerboard design, said corrugations extending transversely of the plane of the panel and in the same direction from said flat area and the trough of each corrugation extending without interruption continuously from end to end, one of said corrugations extending continuously over another corrugation whereby at the point of intersection the overlapping corrugation projects a greater distance from the flat area than does the overlapped corrugation, and a plurality of reenforcing plates extending lengthwise of certain of the corrugations, disposed within the transversely projected outlines thereof and disposed in the plane of the flat outlining edge area.

5. A corrugated sheet metal panel, the corrugations forming vertically extending posts and horizontally extending girders, with the posts extending tortuously and without change in cross sectional configuration over the girders, and a flat metal strip forming a real wall to the post connecting a plurality of the horizontally extending girders and connecting opposite walls of the post to form the same substantially as a hollow integral and partly tubular member.

6. A sheet metal panel provided with corrugations all projecting from one side and with certain of the corrugations extending at right angles to other corrugations and each without change in configuration to form in effect a corrugated area of checkerboard design, the opposing walls forming the trough of each of said other corrugations extending continuous and in undulatory form from edge to edge of said area, and tying members connecting the walls of certain of said corrugations to resist the walls from spreading apart.

7. A sheet metal panel having a substantially flat reenforced area formed with corrugations extending in two sets, with the corrugations of one set extending at an angle to the corrugations of the other set and intersecting each other to form the area as a checkerboard design, with the corrugations of one set overlapping and thus extending with uniform cross sectional configuration beyond the corrugations of the other set, and tying members offset from the points of intersection of the corrugations, bridging across and thus connecting the side walls of certain of the corrugations to resist distortion of the panel at the points so bridged.

8. A sheet metal panel provided with corrugations forming a reenforced area, with one of the corrugations intersecting two other parallel corrugations, the first named corrugation being continuous with uniform cross sectional configuration and projecting in offset relation beyond the two parallel corrugations and beyond the intervening trough between the parallel corrugations, and a bridge piece tying together the walls of said first named corrugation at a point thereon between the said two other parallel corrugations.

9. A sheet of metal having a reenforced area, said area formed in part of a pair of intersecting

corrugations projecting from one side of the sheet, with the part of the sheet forming one of the corrugations extending continuously and with uniform cross section configuration over the other, and a flat reenforcing strip secured to and forming a back for said continuous corrugation.

10. A sheet metal panel provided with a pair of intersecting corrugations and with one projecting beyond and thus overlapping the other with uniform cross sectional configuration and maintaining a continuously uniform depth to the overlapping corrugation, and a tying member connecting the side walls of the overlapping corrugation on opposite sides of the overlapped corrugation.

11. A structural unit comprising a sheet metal plate having a corrugated reenforced area with the corrugations extending in intersecting relation forming flat uncorrugated portions therebetween disposed in a single plane, and with certain corrugations intersecting every line which can be drawn across the corrugated area thereby to resist bending of the unit which might form about any such line as an axis from strains imposed perpendicularly on the corrugated area, and a plurality of spaced apart members disposed in the plane of said uncorrugated portions and having opposite edges welded to the walls forming certain of said corrugations and said members thus forming bridge members tying together said walls and resisting tendency of the walls to separate when load is imposed on the unit.

12. A sheet of metal having a portion corrugated with flat portions between the corrugations and disposed in the same plane, and with the corrugations intersecting and each corrugation being continuous across the corrugated portion and every cross section through said portion being of a wavy design irrespective of where or in what direction the cross section is taken, and flat plates disposed in the same plane with the flat, uncorrugated portions for tying together the walls forming certain of said corrugations and forming in each case a back wall for its associated corrugation.

13. A metal car end comprising a flat portion having attaching flanges projecting in one direction from the flat portion, said end provided with reenforcing corrugations projecting from the flat portion in the opposite direction and bridging members extending across certain of the corrugations in the plane of the flat portion.

14. A sheet metal panel adapted to constitute a car end, provided with corrugations forming a reenforced area, and with means forming uncorrugated flat areas within the outlines of the reenforced area, said flat areas forming vertically spaced horizontal strips, each continuous within said reenforced area and disposed in a plane defining the inner side of the car end.

15. A one-piece metal car end including a vertically extending corrugation substantially of uniform cross-sectional configuration throughout its length and a horizontal corrugation intersecting said vertical corrugation and forming a pair of flat, uncorrugated portions on opposite sides thereof, and bridging means disposed in the channel of the vertical corrugation and connected to the vertical channel for tying together its opposite walls and for tying together the pair of flat portions thereby to resist any tendency of either corrugation to become flat.

16. A sheet metal plate provided with a set of parallel or substantially parallel corrugations forming flat uncorrugated portions therebetween and another corrugation intersecting the parallel corrugations and means at the place of intersection of said other corrugation with one of the parallel corrugations and secured to the plate at the base of the corrugations to tie together the opposite walls of said other corrugation and thus prevent them from spreading apart and to tie together the two flat portions on opposite sides of said parallel corrugation and thus prevent them from spreading away from each other.

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