Nov. 5, 1968 J. W. ALLEN ET AL 3,408,779

X TYPE PANEL ROOF SHEET

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Fig. 1

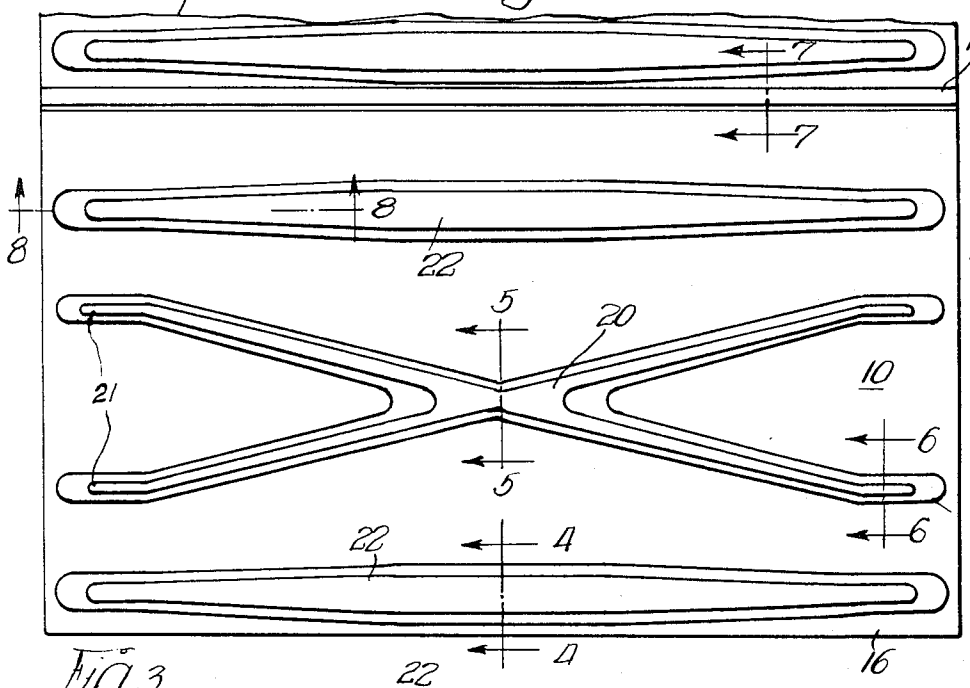


Fig. 2

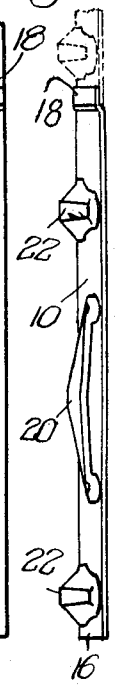


Fig. 3

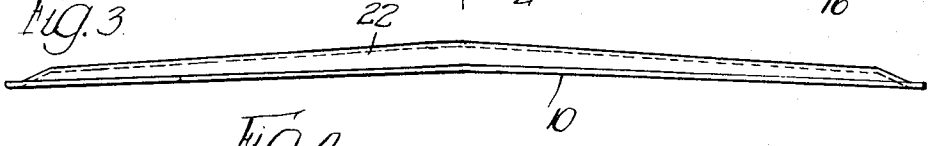


Fig. 4

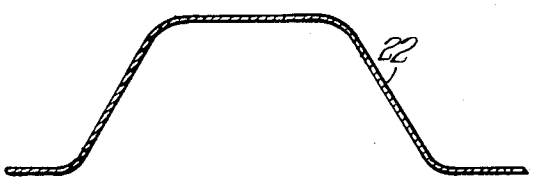


Fig. 5

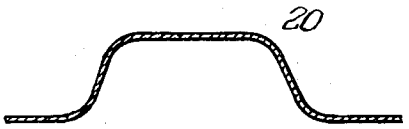


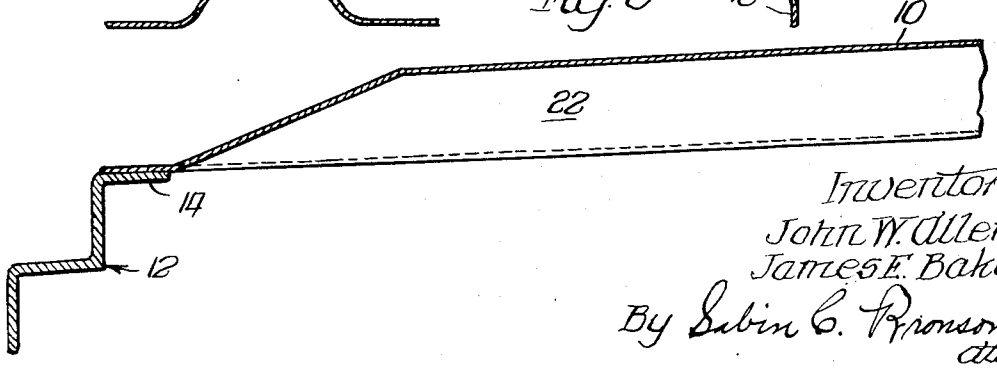
Fig. 6



Fig. 7



Fig. 8



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Fig. 9

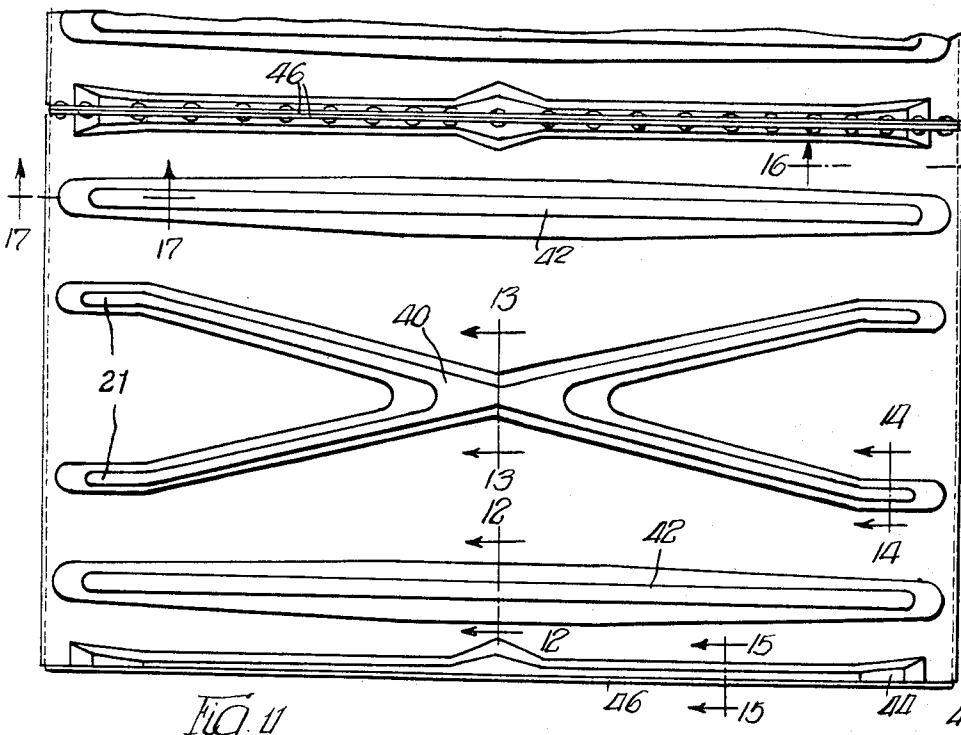


Fig. 10

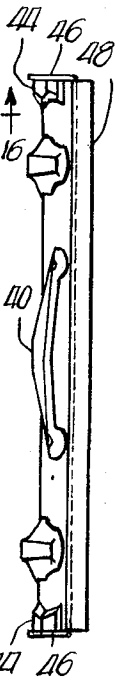


Fig. 11

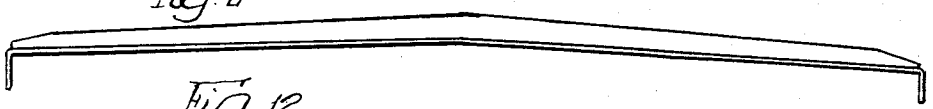


Fig. 12



Fig. 13



Fig. 15

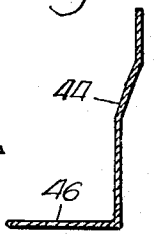


Fig. 17

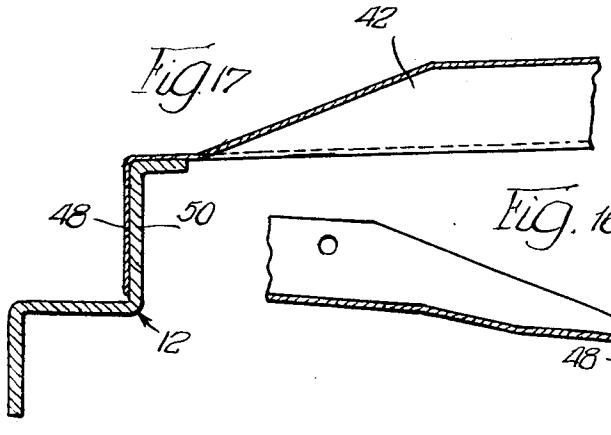
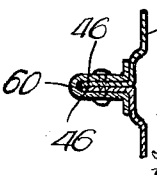


Fig. 14



Fig. 16.

Fig. 18.



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United States Patent Office

3,408,779

Patented Nov. 5, 1968

3,408,779

X TYPE PANEL ROOF SHEET

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Filed June 27, 1966, Ser. No. 560,734
3 Claims. (Cl. 52—53)

ABSTRACT OF THE DISCLOSURE

A railroad freight car roof composed of paneled roof sheets extending from side plate to side plate of a car, secured at their ends thereto and at their sides to each other, each of said roof sheets provided with a pair of upwardly pressed corrugations adjacent the side margins thereof and an upwardly pressed X-type corrugation between the pair of corrugations, whereby the roof is strengthened against tortional and racking stresses imposed thereon by service movements of the car.

Background of the invention

Roofs for box cars are as old as box cars themselves. They were first constructed of wood; then to eliminate fire hazard of sparks, etc., they were metal clad; then, as speed of trains increased, causing more strain on the roof, the roofs were made of metal only; then panels were pressed in the roof sheets to increase the strength of the sheets and composite roof; then the panels were varied as to size, shape, depth, and length, each to strengthen in its own way the roof sheet primarily and the composite roof generally. Consequently, paneled roof sheets are old in the art.

Description of the invention

Our invention relates to a metal roof sheet, primarily, and to a roof formed of a plurality of such sheets secured together along their side edges and secured along their end edges to the side plates of the car to form the roof therefor. Panels and corrugations are pressed in one direction from the general plane of the sheet, and we have illustrated two different sheets, one being for welding to an adjacent sheet and the other being for riveting to an adjacent sheet, in making up the composite roof. The panels of the invention are to strengthen the sheet and provide resistance to twisting of the car during travel over rough track and/or at high speeds. This is the principal object of the invention.

It is another object of the invention to provide a roof of moderate thickness of material with corrugations so related as to provide adequate strength to resist vertical loads, such as snow or men thereon, and also to resist longitudinal racking of the car.

Still another object of the invention is to provide a corrugated roof sheet which gives the required strength and also produces the minimum air or void volume in the corrugated area.

A further object of the invention is to provide a roof sheet having a basic corrugation pattern for either welding or riveting of the sheets together to form the composite roof, and wherein said corrugation pattern may be readily extended for various width cars with a minimum of die changes.

Also it is an object of the invention to provide a corrugated roof sheet wherein the corrugation pattern requires the minimum of stretch of the material during the pressing operation, minimizing the danger of fracture of the material during forming.

It is a still further object of the invention to provide a corrugated roof sheet wherein the corrugations are designed so that there is as nearly uniform total take-up of material in the corrugations as possible to prevent undue distortions during forming.

Other objects and advantages thereof will appear in the following description of the invention.

Referring now to the accompanying drawing forming part of this application and wherein like reference characters indicate like parts.

FIGURE 1 is a top plan view of a roof sheet for welded connection to an adjacent sheet, and showing the new design;

FIGURE 2 is an end view of FIGURE 1;

FIGURE 3 is a side elevation of FIGURE 1;

FIGURES 4, 5, 6, 7, and 8 are respectively sections on lines **4—4**, **5—5**, **6—6**, **7—7**, and **8—8** of FIGURE 1;

FIGURE 9 is a top plan view of a roof sheet for riveted connection to an adjacent sheet, and showing the new design;

FIGURE 10 is an end view of FIGURE 9;

FIGURE 11 is a side view of FIGURE 9; and

FIGURES 12, 13, 14, 15, 16, and 17 are respectively sections on lines **12—12**, **13—13**, **14—14**, **15—15**, **16—16**, and **17—17** of FIGURE 9;

FIGURE 18 is a section of a roof sheet joint with seam cap thereon.

A railroad car in motion weaves and rocks and the rectangular frame composed of the sides and ends frequently becomes distorted into a parallelogram. Such cars in motion sometimes twist on their longitudinal axis, setting up torsional stress, so that the roof sheets tend to slide relative to each other at their adjoining edges. As before stated, it is a function of the car roof to hold the sides and ends in square.

Referring now to the drawings and particularly to FIGURES 1 to 8, there is there shown a roof sheet embodying the invention, and of which there are several joined together by welding along their adjacent side edges, to form the composite roof for a railroad box car, which roof is then attached about its peripheral edges to the side and end plates of the car.

The roof sheet is shown at **10** and comprises a sheet of metal, preferably galvanized, although other non-corrosive materials such as aluminum, and the like, have been used for car roofs. The roof sheet **10** is rectangular in form, and of a length to span across the car from side plate **12** to side plate. Side plates **12** are of W section with an upper flange **14** facing inwardly and extending in plane with the pitch of the car roof.

Roof sheets **10** are formed of a relatively thin gauge galvanized material. One side edge **16** is flat while the opposite side margin **18** is offset the thickness of the material for a short distance to overlap the flat side edge **16** of an adjacent sheet for welding thereto.

Each roof sheet **10** is provided with an X type corrugation **20** pressed upwardly from the plane of the sheet with the legs of the X diverging and merging into the plane of the sheet at the eaves ends thereof.

Spaced equally from either side of the X corrugation are longitudinal corrugations **22** which are coextensive with the X corrugation and likewise terminate in the plane of the sheet adjacent the eaves ends thereof. These corrugations **22** are widest and deepest at the ridge of the sheet and become progressively narrower and shallower from the ridge toward the eaves ends where they terminate in the plane of the sheet.

The X corrugation **20** provides some resistance to bending moments but more importantly provides high diagonal strength to resist longitudinal relative movement of the sides of the car. The size of this corrugation is kept to a minimum so that the void volume is as small as is con-

sistent with the bending strength required. The center portion tapers to the junction of the X at the ridge so that the cross section at this junction along with the reduced straight corrugations is the same developed length as at the center line of the sheet. As the legs of the X corrugation approach the ends of the sheet they are turned from the diagonal direction to a direction parallel with the sides of the sheet as at **21** in which area they are uniform in cross section, so that for wider cars a longer terminal die may be used and thus compensate for various widths of cars with minimal die changes. The ends of all corrugations decrease in width and depth and merge into the plane of the sheet at the eaves ends thereof.

The straight side corrugations give the minimum void volume for maximum bending strength. These corrugations also are progressively smaller in width and depth from the ridge portion of the sheet toward the ends thereof to reduce the volume further, but the outer portions become uniform in cross section to also provide means whereby for wider cars a longer terminal die may be used and also compensate for various widths of cars with minimum of die change.

It is important that the void volume of the corrugations be kept at a minimum consistent with the required strength of the roof so that when foam-in-place insulation is applied, it fills this volume in the corrugations, but does not add materially to the total insulation of the car. Insulation is expensive and therefore the corrugation volume creates an extra expense due to the relative high cost of the insulation.

It will be noted in the plan view FIG. 1 that the corrugations **20** and **22—22** are not positioned exactly in the center of the sheet. In other words, one corrugation **22** is parallel to and more closely adjacent the flat margin **16** of the sheet than the other corrugation **22** is from the offset side margin **18** of the sheet. As will also be noted from FIGURE 1, the reason for this is that when sheets **10** are joined together along their side edges, as indicated, the corrugations **20** and **22—22** will be spaced symmetrically along the whole length of the roof.

The corrugations **22—22** on opposite sides of the X corrugation **20** are very important for they give stiffness along the side margins of the sheet for securing the edges together, either by welding or riveting. These corrugations **22—22** also give high strength as a beam across the sheet, and there is much less distortion of the sheet when the corrugation is near the side edge of the sheet. Furthermore, these corrugations have a practical advantage also, for they take up material in the sheet which would otherwise provide wrinkles therein. This would be a great disadvantage, particularly in the sheet shown in FIGURE 1 for welding to adjacent sheets.

The X type corrugation gives diagonal strength against twisting of the sheet due to service movements of the car and carries any stresses imposed thereon to the side plates of the car.

All corrugations are pressed upwardly in the sheet so that the roof on the inside of the car is in the original plane of the roof sheets.

In the modification shown in FIGURES 9–18, which is the design of sheet for riveting to adjacent sheets to provide the composite car roof, the main body portion of the sheet is the same, having an X type corrugation **40**, corrugations **42—42** on either side of the X type corrugation **40**, and these corrugations are identical to the corrugations **20** and **22—22** of the former modification.

In this instance, however, these corrugations are centrally disposed in the sheets as clearly shown in FIGURE 9. In these particular sheets, each side margin is provided

with an offset portion **44** which terminates in a flange **46** extending upwardly in the same direction as the corrugations. The flanges **46** of adjacent sheets are arranged in side by side abutting relation and covered by a seam cap **60** overlapping said flanges, and extending the full length thereof, terminating at the eaves end of said flanges. The flanges and seam cap are correspondingly punched and all riveted together as shown in FIG. 18 to make a weathertight connection of adjacent sheets. The seam caps also add considerable strength to the roof as a carline from side plate to side plate of the roof. When thus joined together with an adjacent sheet, the two offset margins **44** form another corrugation across the roof at the joint between adjacent sheets, further strengthening the roof at the joints. In this modification the ends of the roof sheet extend over the flanges **14** of the side plates and then are turned downwardly as at **48** against the vertical flange **50** of the side plate and are secured thereto along said flange. This provides a secure and watertight connection of the roof to the side plate.

From the above it is apparent that we have provided a roof composed of roof sheets having new and novel characteristics, which is of light weight yet strong, resistant to twisting forces, and providing great strength as a beam across the roof.

We claim:

1. A railroad car roof comprising roof sheets joined together at their side edges and having end margins adapted for attachment to car side plates, a pair of corrugations pressed from the plane of each sheet, extending parallel to and adjacent the sides thereof, said corrugations being of progressively decreasing depth and width from adjacent the ridge of the roof toward the ends of the sheet, providing strength as a beam across the roof, and minimizing distortion at the margins of the sheet, said pair of corrugations merging into the plane of the sheet adjacent the ends thereof, and an X type corrugation pressed from the plane of the sheet intermediate said pair of corrugations, to stiffen said sheet against twisting forces, said X type corrugation decreasing in width and depth from the center line of said sheet to a point near the ends, where the legs of said corrugation become of uniform cross section and of uniform depth as well as parallel to each other and terminate in the plane of the sheet near the ends of the sheet.

2. The structure of claim **1**, wherein the X type corrugation is symmetrically located between the pair of corrugations in each sheet, so that in combination with the straight and parallel corrugations the cross section at the ridge of the roof is the same developed length as at the center line of the sheet.

3. The structure of claim **1**, wherein said corrugations are symmetrical relative to each other but closer to one side edge of said sheet than to the other side edge, whereby when said sheets are secured together along adjacent side edges, the corrugations in the roof sheets are symmetrically arranged throughout the length of the roof.

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