

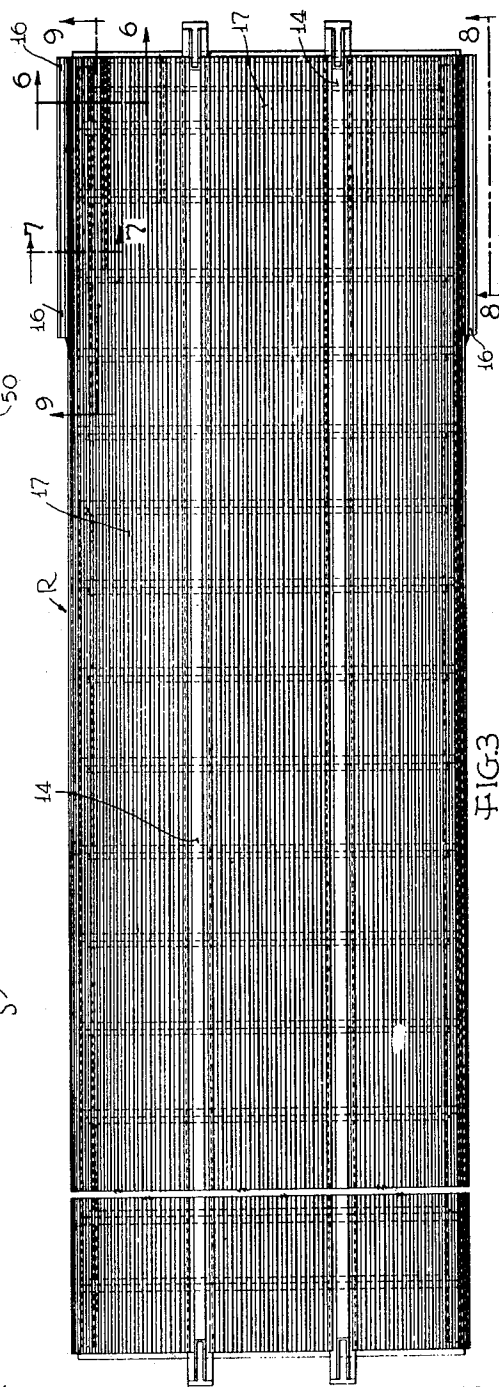
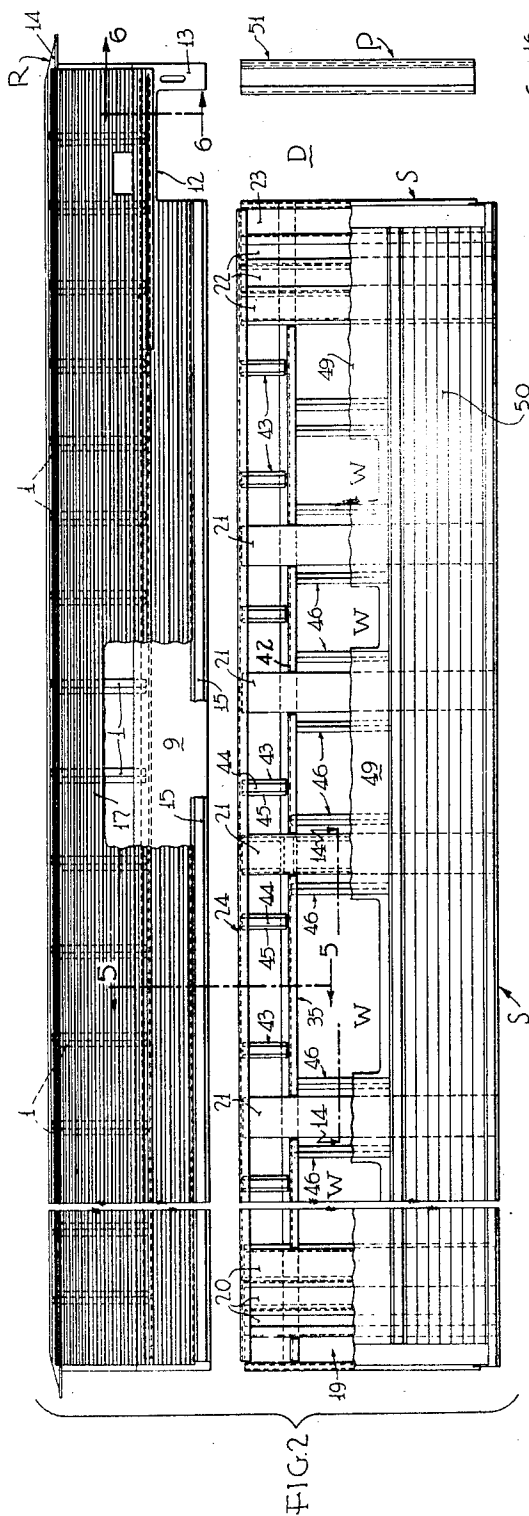
April 18, 1950

W. B. DEAN
BODY, ESPECIALLY ROOF FOR VEHICLES,
SUCH AS RAILWAY CARS

2,504,111

Filed March 31, 1945

4 Sheets-Sheet 2



INVENTOR
Walter B. Dean
BY *John P. Torbert*
ATTORNEY

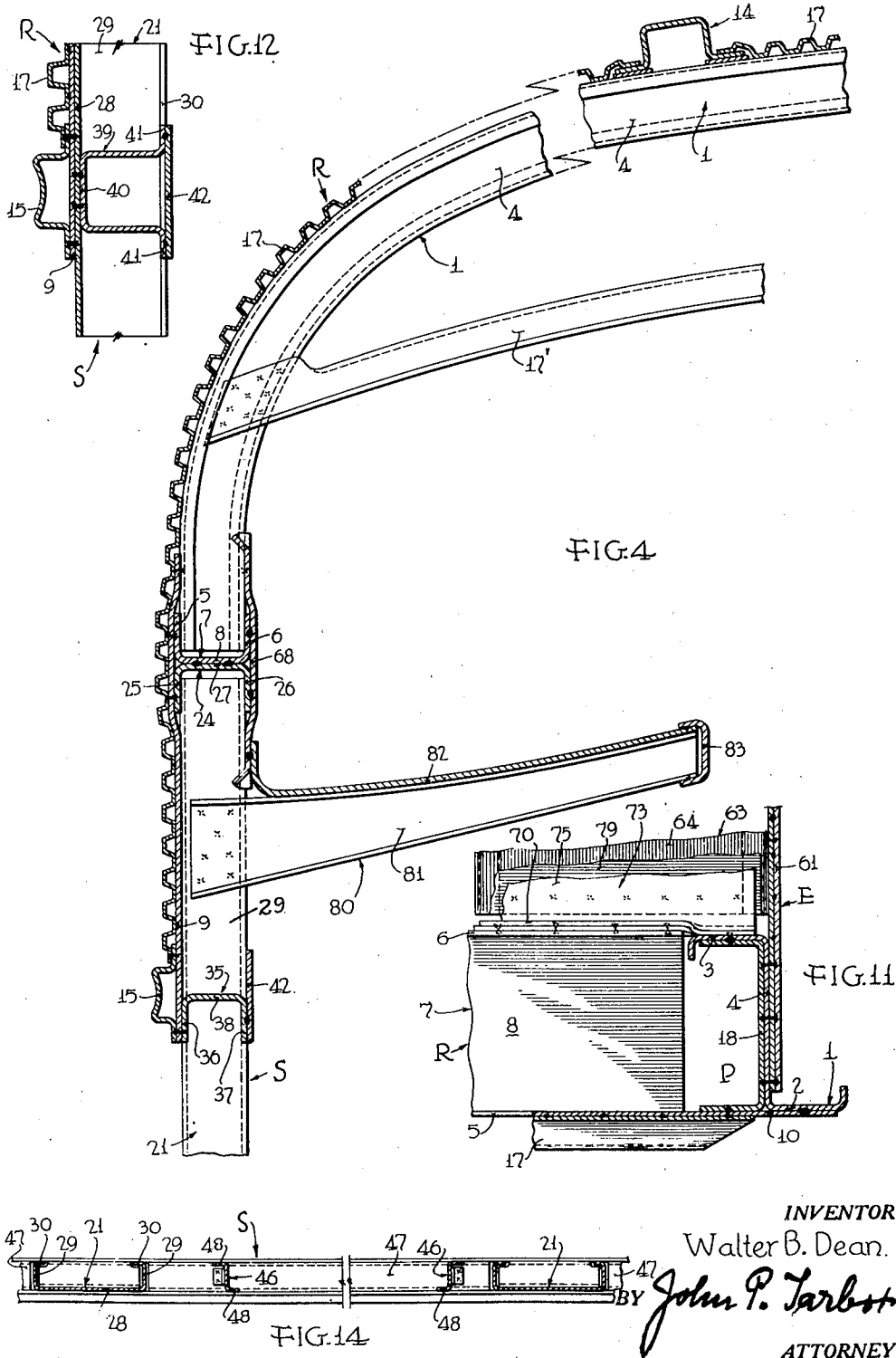
April 18, 1950

W. B. DEAN
BODY, ESPECIALLY ROOF FOR VEHICLES,
SUCH AS RAILWAY CARS

2,504,111

Filed March 31, 1945

4 Sheets-Sheet 3



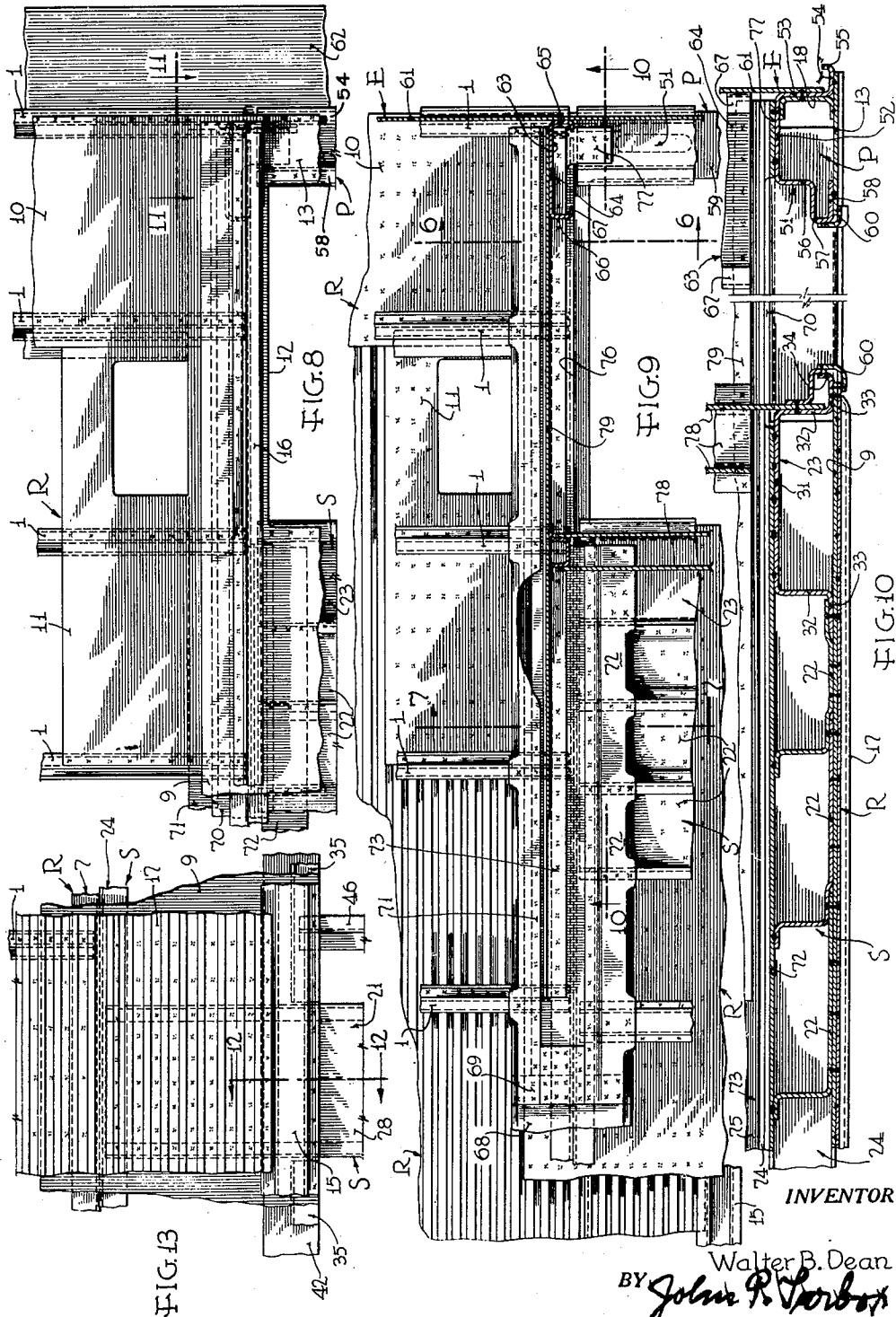
April 18, 1950

W. B. DEAN
BODY, ESPECIALLY ROOF FOR VEHICLES,
SUCH AS RAILWAY CARS

2,504,111

Filed March 31, 1945

4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,504,111

BODY, ESPECIALLY ROOF FOR VEHICLES
SUCH AS RAILWAY CARSWalter B. Dean, Narberth, Pa., assignor to The
Budd Company, Philadelphia, Pa., a corpora-
tion of Pennsylvania

Application March 31, 1945, Serial No. 585,900

19 Claims. (Cl. 105—397)

1

The invention relates to a railway car body structure and more particularly to the construction of a body roof and to the connection between a roof sub-assembly unit and adjoining side and end wall units.

Of course, the invention is not necessarily restricted to railway car bodies but may be applied to similar structures such as, for instance, bus or truck bodies.

Among the objects of the invention is a vehicle body composed of sub-assembly units which can easily be assembled and then joined together into a complete body structure, which lend themselves to the manufacture of sheet metal and in particular of high tensile material such as cold-rolled stainless steel, the marginal portions of which constitute final assembly joints imparting great strength to the body especially in regions likely to be severely stressed in case of heavy impacts, and which give great supporting strength and durability to the body while in ordinary use coupled with light weight and low manufacturing cost.

The aforesaid and other objects and advantages are mainly achieved by a roof unit and side wall units which overlap each other in a wide continuous region and are joined together over the entire width of such region.

Another feature of the invention contributing to the achievement of the aforesaid and other objects, resides in a roof unit which extends across an end door opening and forms the connecting means with the upper portion of an end door post.

The application is related to the simultaneously filed applications on Body side wall for vehicles, especially railway cars, Serial No. 585,899, the same inventor and on Reinforcing structure for vehicle bodies, especially for railway cars, of Raymond J. Theriault, Serial No. 585,908, both of which are directed to features which in part are also disclosed in the present application so as to give a complete picture of the construction embodying the invention.

The above outlined and other objects, advantages and features of the invention will be more easily and clearly understood from the embodiment illustrated in the attached drawing and described hereinafter.

In the drawing:

Fig. 1 is a small-scale diagrammatic side elevation of a railway car;

Fig. 2 is a fragmentary exploded view on a larger scale of the one side wall and of the roof

2

of the same car body on a larger scale, certain parts of the outer paneling being omitted;

Fig. 3 is a fragmentary plan view of the body, on the scale of Fig. 2, showing mainly the roof;

Fig. 4 is fragmentary section through the adjoining marginal portions of the roof and one side wall substantially along line 4—4 of Fig. 1, yet on a substantially larger scale than the preceding figures;

Fig. 5 is an exploded fragmentary sectional view of about the same parts shown in Fig. 4 prior to the final assembly of the roof and the side wall, the location of the section being indicated by line 5—5 of Fig. 2 and line 4—4 of Fig. 1;

Figs. 6 and 7 are fragmentary sectional views through the connection between the roof and side wall taken respectively along lines 6—6 and 7—7 of Figs. 2, 3 and 9;

Fig. 8 is a fragmentary side elevation of the region surrounded by dot-and-dash line 8 in Fig. 1 and viewed in the direction of the arrows 8—8 in Fig. 3 but on a larger scale and parts of the outer paneling omitted;

Fig. 9 is a sectional fragmentary inside elevation of the roof and side wall connection, the section being taken substantially along line 9—9 of Fig. 3;

Fig. 10 is a fragmentary section through the end portion of the side wall and the end post along line 10—10 of Fig. 9 but on a larger scale;

Fig. 11 is a fragmentary section through the connection between the roof and wall taken along line 11—11 of Fig. 8 yet on a larger scale;

Fig. 12 is a vertical fragmentary section through one of the posts between two window openings taken substantially along lines 12—12 of Fig. 13;

Fig. 13 is a fragmentary elevation of adjoining portions of the roof and a side wall in the region between two window openings on a smaller scale than Fig. 12; and

Fig. 14 is a fragmentary horizontal section through the post structure between two windows taken substantially along line 14—14 of Figs. 1 and 2.

The body illustrated in the drawing comprises an underframe or floor unit U, two side wall units S, a roof unit R, two end wall units E, and separate door post units P. Window openings W and a door and door opening D at the vestibule end are provided in the sides of the body. The underframe unit and its connection to the side wall units, which are indicated only diagrammatically in Fig. 1 may be constructed in accordance with the applications Serial No. 580,646, W.

3

B. Dean for Body for vehicles, especially rail cars, and Ser. No. 580,647, R. J. Theriault, for Body construction especially for rail cars, both filed March 2, 1945.

The roof unit R comprises Z-section carlines 1 longitudinally spaced from each other and each having an outer arm 2 and inner arm 3 and a web 4 (Figs. 5 and 11). The carlines are downwardly curved at the sides and have their ends telescoped between and their arms 2, 3 secured to the side walls 5 and 6 of longitudinal upwardly facing channel section chord members 7. The bottom walls 8 of the members 7 are arranged substantially horizontally.

A wide elongated metal sheet 9 is secured on each side of the roof by its upper marginal portion to the arms 2 of the carlines and to the wall 5 of the respective chord member 7 so that its main portion projects downwardly beyond the member 7. Another metal sheet 10 at each end of the roof is arranged between and secured to the last two carlines 1 and the lateral sheets 9 (Figs. 6, 8, 9 and 11). A further sheet 11 on each longitudinal side of the roof is connected to the inboard margin of the sheet 10 at the vestibule end, to the upper margins of the sheets 9 and to the third and fourth carlines 1 (Figs. 7, 8 and 9). These sheets 11 extend only over the marginal side portions of the roof. Each sheet 9 has a cut-out portion 12 at the vestibule end for the upper portion of the door opening D leaving a downwardly projecting portion 13 for the attachment of the door post P (Figs. 2, 8 and 10).

A pair of longitudinal inverted hat section members 14 are secured on both sides of the longitudinal middle line by their flanges to the arms 2 of the carlines (Figs. 3 and 4).

A hat section molding 15 is secured to the lower margin of each sheet 9. These moldings extend from the non-vestibule end of the roof to the inboard margin of the cutout 12. A drip channel 16 is welded to each sheet 9 above the cut-out 12 and extends from about the vestibule end of the roof to a point on the inboard side of the cut-out 12. The entire outside of the roof unit between the hat sections 14, 14 and 14, 15 and between the sections 14 and the drip channel 16 is covered with longitudinally corrugated sheathing 17 which is welded to the arms 2 of the carlines 1, to the sheets 9, 10 and 11 and to the adjoining flanges of the sections 14 and 15 as well as the attachment arm of the drip channel 16. The connection of the different members of the roof unit to the adjoining units will be described later on. See Figs. 4 to 6.

As customary, braces 17' are secured to the carlines for supporting an intermediate ceiling; these braces and the panels and members attached thereto are not further illustrated and described because they may be of conventional construction. The ceiling supports 17' and the members attached thereto may constitute parts of the roof sub-assembly unit or they may be connected with the roof after the final assembly of the main units.

Further reinforcements may be provided at appropriate places of the roof unit such as for instance the channel sections 18 connected with web 4 and inner arm 3 of the end carlines, the post P and with sheets 9 and 10 (Figs. 10 and 11).

Each side wall unit S comprises a plurality of vertical posts 19, 20, 21, 22 and 23 which extend from the lower margin of each unit uninterruptedly to the upper margin thereof, and an inverted channel section top chord member 24 having side

4

walls 25 and 26 and a bottom wall 27. The posts 21 between the window openings W constitute inwardly facing channel sections with a bottom wall 28, side walls 29 and marginal flanges 30 (Figs. 5 and 14). The posts 19 and 23 at the two ends of the units S are in the form of outwardly facing channels having a bottom wall 31, side walls 32, and marginal flanges 33; the flange 33 on the outboard side is supplemented by an inwardly directed narrow flange 34. The posts 20 and 22 are in the form of Z-section members which overlap each other by the margins of one of their arms and constitute together with the end posts 19 and 23, respectively, wide shear panels (Figs. 2 and 8 to 10).

The shear panel construction which extends also beneath the end window openings forms the subject matter of the simultaneously filed application of the same inventor on Body side wall for vehicles, especially railway cars, mentioned hereinbefore.

The posts 20, 21 and 22 are interconnected along the upper margins of the window openings W by inverted channel section chord members 35 which are spaced from the upper marginal chord member 24 and have side walls 36, 37 and a bottom wall 38. The ends of adjacent chord members 35 are interconnected by short hat sections 39 which have a bottom wall 40 secured to the bottom wall 28 of the respective post whereas its flanges 41 are connected by covering plate or band 42 to the flanges 30 of the posts 21 and to the inner surfaces of the posts 19, 20 and 22. The plate 42 extends preferably over the entire length of each side wall unit and has its lower margin connected to the inner wall 37 of the members 35. See Figs. 2, 4, 5 and 12.

Between the posts, the chord members 24 and 35 are interconnected at certain distances by short hat section braces 43. The bottom wall 44 on the outside and the flanges 45 on the inside of the braces 43 are connected at the ends to the walls 25, 26 of the chord member 24 and to the plate 42 on the members 35 (Fig. 2).

Window frame members 46 of Z-section are inserted between the chord members 35 and similar chord members 47 along the lower margins of the window openings and have their arms 48 secured to the walls 36, 37 of the members 35 and their webs to the members 47 (Figs. 2, 13 and 14). The members 46 permit the adaptation of a standard side wall construction to any desired window size which is smaller than the distance between adjacent posts.

The outside of the side walls below the chord members 35, that is, from the upper margins of the window openings downwardly is covered in customary fashion, by panels 49 and panel strips 50.

The braces 43, members 46 and panels 49 are omitted from Figs. 4 and 5 so as to expose the post 21.

The end posts P comprise an outwardly facing channel member 51 having a bottom wall 52, an outboard side wall 53 provided with a longitudinally and then inwardly extending angle section flange 54, 55, with an inboard side wall 56 continued by an outboard facing channel section flange 57 having an outer wall or flange 58. The mouth of member 51 is closed by a cover plate 59 which is secured to the flanges 54 and 58 and the door margin of which is covered by a molding 60. See Figs. 2, 8, 9 and 10. The post P is fastened in any appropriate, not shown, manner to the underframe unit U.

5

After the sub-assembling of the roof unit R, certain details of which will be described later on, and of the side wall and post units S and P, this roof unit and the two other units are connected with each other after, simultaneously with or before the connection of the last-named units with the underframe unit and/or the end wall units, respectively.

The connection between the roof unit and the side wall units is clearly shown in Figs. 4 and 7. The bottom walls 8, 27 of the roof chord member 7 and of the upper side wall chord member 24 are brought in back-to-back relation and then connected with each other, preferably by spot welding. The panel 9 of the roof overlaps the outer walls 28, the flanges 33 and the outer arms, respectively, of the posts 19 to 23, and the outer walls 25, 36 of the chord members 24, 35, 39, and it is secured in all regions of overlap to the side wall unit by a plurality of spot welds such as indicated by asterisks in the views, Figs. 9 and 13, and black dots in the sections (Figs. 4, 7, 10 and 12) of the drawing.

At the opening for the vestibule door D, the downwardly depending end portion 13 of the panel 9 is connected in final assembly to the flanges 54 and 58 of the end post.

The panels 61 of the end walls E overlap and are secured to the webs 4 of the end carlines 1 and to the outboard walls 32, 53 of the post members 19, 51, respectively. The end collision posts 62 of the end wall have their upper ends secured to the outwardly projecting ends of the members 14 of the roof structure. Each end wall unit E is reinforced by an inverted channel section beam 63 having its bottom wall 64 horizontally arranged and its outboard side wall 65 secured to the end wall panel 61 and the collision posts 62. Both side walls 65 and 66 are stiffened by marginal turned flanges 67. See Figs. 6 and 8 to 11.

After the units have been connected with each other in the indicated manner, the connections and the body as a whole are further reinforced by a number of additional structures which will now be described. Yet, it should be understood that certain or even most of the further reinforcements may be pre-assembled with one or the other of the adjoining sub-assembly units.

An elongated sheet metal strip 68 is placed across the inner walls 6 and 26 of the chord members 7 and 24 and is secured to these walls as well as to the adjacent inner arms, flanges or walls 3, 30, 45, 31 of the carlines 1, posts 19, 20, 21, 22, 23 and braces 43, respectively. See Figs. 4 and 5. This member 68 may extend to the end post P, but in the illustrated construction it ends in the region indicated by the numeral 69 in Fig. 9. From the region 69 to the post P, the member 68 is continued by three members 70, 71 and 72 and by an angle section strip 73 having a downwardly depending flange 74 and an inwardly extending flange 75 (Figs. 6, 7, 9 and 10).

The member 72 ends with the inboard door post 23, whereas the members 70, 71 and 73 extend across the door opening. The member 68 is secured in overlapping relation to the inboard ends of members 70, 71, 72 in the region 69, if advisable partly by means of one or more splicing plates. The member 70 has a cut-out 76 and a downward extension 77 at the end similar to the cut-out 12 and extension 13 of the outer depending roof sheet 9. The downwardly directed extension 77 overlaps and is secured to the bottom wall 52 of the end post P so that the latter is tied hereby and the extension 13 on the

6

inside and the outside into the roof structure. See Figs. 6, 8, 9 and 10.

Connected with the beam 63, the inwardly extending flanges 75 of the members 73 on both sides of the body and with partition wall 78 as well as with a further, not shown, transverse member or members are outwardly facing angle- and U-section members or pans 79. These pans 79 are connected with each other by their up-standing side arms or walls and constitute a reinforcing shear panel. This shear panel, which forms the subject matter of the before-mentioned simultaneously filed application of R. J. Theriault, Reinforcing structure for vehicle bodies, especially for railway cars, strengthen the car body where it is weakened by the door openings D and transmit stresses from the end wall F with its collision posts 62 into the roof R and side wall S across said openings. See Figs. 6, 9, 10 and 11.

Further reinforcement of the side walls in the region of its connection to the roof is achieved by the baggage rack 80 (Figs. 4 and 5) which comprises brackets 81 attached to the side walls 29 of the posts 21, a panel 82 structurally connected to the brackets and to the posts by the intermediary of the member 68, and a longitudinal U-section 83 interconnecting the inner ends of the brackets 81.

The entire illustrated and described structure consists preferably of high-tensile sheet metal such as cold-rolled stainless steel and the different members are connected with each other in sub-assembly and final assembly preferably substantially throughout by electric spot or seam welding. It will be noted that the members entering into the construction lend themselves to the fabrication of strip material and that the structure lends itself for the convenient application of the welds.

The invention is, of course, not restricted to the specific details of the illustrated and described embodiment but its principles may be applied to modified structures. As an example, it is pointed out that the wide overlapping connection between roof unit and side wall units might be achieved by providing a wide panel on the side wall unit extending upwardly beyond the uppermost side wall chord member and overlapping two spaced chord members of a roof unit. All modifications and adaptations of the invention as well as such features thereof which might be used separately from other features are intended to be covered by the spirit and language of the attached claims.

What is claimed is:

1. In a vehicle body: independently sub-assembled side wall units and an independently sub-assembled roof unit, the latter curved downwardly along its longitudinal sides, window openings in said side wall units and a longitudinal chord structure along the upper margins of said openings, side wall posts projecting upwardly beyond said chord structure of the respective side wall unit, said roof unit having along each longitudinal side a downwardly extending longitudinally continuous panel which overlaps and is connected to said chord structure and thereabove to the posts of the respective side wall.

2. In a vehicle body: an independently sub-assembled side wall unit and an independently sub-assembled roof unit which is curved downwardly along its longitudinal sides so as to merge into the adjoining portion of the side wall unit, a pair of longitudinal chords forming part of said

7

side wall unit, one chord along and the other chord spaced a considerable distance from the upper margin of said side wall unit, said roof unit having along its longitudinal side adjoining the side wall unit a downwardly projecting longitudinally continuous panel which bridges the space between, overlaps and is connected to said chords of the side wall unit.

3. A railway car body provided with a side door opening adjacent one of its ends and comprising: a side wall unit terminated by the inboard margin of said door opening, a separate door post on the outboard side of the door opening, an underframe and a roof unit extending across the door opening and secured to the upper margin of the side wall unit and the upper end of the door post, said side wall unit and said post being furthermore integrally connected with each other at the bottom by the underframe.

4. In a vehicle body such as for railway cars provided with a door opening adjacent one of its ends in the side wall thereof, said body comprising: a side wall unit enclosing a plurality of window openings and terminated by the inboard margin of said door opening, a separate door post on the outboard side of the door opening, and a roof unit extending across the door opening and secured to the upper margin of the side wall unit and the upper end of the door post, said roof unit extending at least on one side of said door opening downwardly beyond the level of the upper margin of the door opening.

5. Roof unit for vehicle bodies, such as for railway cars, comprising: longitudinal chord members along its lateral margins adapted for the connection with the upper margins of adjoining side wall units, transverse carlines having their ends secured to said chord members, a roof sheathing extending substantially over the length and width of the roof and connected to said chord members and carlines, vertically wide and longitudinally continuous extensions of said roof sheathing projecting for a considerable distance downwardly beyond said chord members and presenting final assembly means for overlapping securement to the upper marginal outside portions of adjoining side wall units and simultaneously outer sheathing for the side walls upon their connection with the roof unit.

6. Vehicle body, such as for railway cars, comprising: a roof and a side wall and a longitudinal chord structure in the region where the lateral margin of the roof merges into the upper margin of the adjoining side wall, transverse carlines having their ends secured to said chord structure, a roof sheathing extending substantially over the length and width of the roof and connected to said chord structure and carlines, a continuation of said roof sheathing extending for a considerable distance downwardly beyond said chord structure and overlappingly secured to the upper marginal outside portion of the adjoining side wall, and a reinforcing sheet underlying said roof sheathing in the regions above and below said chord structure.

7. Roof for vehicle bodies, such as for railway cars, comprising: longitudinal chord members along its lateral margins adapted for the connection with the upper margins of adjoining side wall units, transverse carlines secured by their ends to said chord members, a longitudinally corrugated roof sheathing extending substantially over the length and width of the roof and connected to said carlines, continuations of said roof sheathing extending for a considerable dis-

8

tance downwardly beyond said chord members and without interruption over a large part of the length of the body, a substantially plane panel underlying and secured to the continuations of the roof sheathing on both sides thereof and also secured to said chord members, said sheathing and panels being adapted for overlapping securement to the upper marginal outside portions of adjoining side wall units and to constitute a reinforcement for and part of the connection of the roof unit with adjoining side wall units.

8. In a vehicle body comprising a pre-assembled side wall unit, a pre-assembled roof unit and a chord member provided along the meeting margins of said units, said chord member constituting part of the final assembly connection of the units with one another, at least one of said units having one chord structure vertically spaced from said meeting margins and the other one of said units having a longitudinally continuous skirt or panel projecting beyond the location of said first-named chord member and being of such great width as to overlap and being connected not only to said first-named chord member but also to the adjacent marginal portion and said second-named chord member of the adjoining unit.

9. In a vehicle body comprising a pre-assembled side wall unit and a pre-assembled roof unit each provided along their meeting margins with a chord member, the adjoining chord members constituting part of the final assembly connection between the units, at least one of said units having a second chord structure spaced from its respective chord member in the direction toward the other margin of the unit, and the other unit having a skirt or panel of considerable length and width projecting beyond its respective chord member and bridging the space between, overlapping and being connected to the adjacent chord member and the chord structure of the said one unit.

10. In a vehicle body according to claim 8 having said panel or skirt arranged on one side of said units and a reinforcing band extending across said chord members and secured to the marginal portions of both units on the opposite side thereof.

11. In a vehicle body comprising separately assembled side wall units and a roof unit, said roof unit being provided with longitudinally extending chord members along its margins as part of final assembly means with said side wall units, said side wall units having posts with wide webs or flanges on the outside, the upper portion of said side wall unit being free of outer sheathing, a longitudinally continuous skirt portion connected with and projecting downwardly beyond each marginal chord member of the roof unit, said skirt portions overlapping the outsides of and being secured to said webs or flanges by means distributed over the width and length thereof and extending across the space between successive posts.

12. In a vehicle body comprising separately sub-assembled side wall and roof units provided along their meeting margin with final assembly means between the units, said side wall unit ending at one margin of a side door opening whereas the other margin of the door opening is formed by another separate unit, said roof unit extending uninterruptedly across the door opening and interconnecting the upper ends of the side wall unit and of said other separate unit, a longitudi-

nally extending web overlapping the connection between and being secured to the roof unit and the side wall unit and extending also across the door opening and being connected to the upper end of said other unit.

13. In a vehicle body comprising separately sub-assembled side wall and roof units, said side wall unit and roof unit being provided along their meeting margins with final assembly means between the units, said side wall unit ending at one margin of a side door opening whereas the other margin of the door opening is formed by a separate post, said roof unit extending uninterruptedly across the door opening and interconnecting the upper ends of the side wall unit and of said separate post, a longitudinally extending vertical web overlapping the connection between said units and being secured to the roof unit and the side wall unit and extending also across the door opening and being connected to the upper end of said post, the lower marginal portion of said web having a cut-out in the region of the door opening so that on both sides of the door openings it is of greater width than at the door opening for the connection of said roof unit with the side wall unit and said separate post.

14. In a vehicle body comprising a side wall and a roof, said side wall and roof merging into each other and being provided respectively with vertical posts and transverse carlines, an elongated longitudinally extending panel overlapping the meeting end portions of said posts and carlines over substantially the entire length of the body, a further panel extending between and secured to adjacent carlines at at least one end of the body, said further panel adjoining said elongated panel and extending upwardly therebeyond, said panels being adapted for the transmission of stresses from the end of the car into the longitudinal regions of the side wall and roof.

15. In a vehicle body comprising side walls and a roof merging into each other and provided respectively with vertical posts and transverse carlines, an elongated longitudinally arranged panel overlapping on each side of the body the meeting end portions of said posts and carlines over a large part of the length of the body, a further panel of less longitudinal extent bridging the space between and secured to adjacent carlines, said further panel extending across the width of the body and adjoining said elongated panels, said panels being adapted for the transmission of stresses.

16. In a vehicle body according to claim 15, a pair of additional panels, one on each side, adjoining the respective longitudinal panel and said further panel but extending only over marginal portions of the roof, said additional panels extending between and being secured to at least one pair of carlines.

17. Side wall for railway cars and similar vehicle bodies comprising a plurality of vertically spaced longitudinal chord structures and longitudinally spaced vertical posts, said posts presenting each a transversely shallow and longitudinally

dinally wide structure having its ends structurally connected over large areas to the chord structures so as to render the connection resistant against torsion and bending in the plane of the side wall, the space between said posts and their width corresponding respectively to the maximum desired width of window openings and to the minimum width of wall space between consecutive window openings, and additional braces inserted between upper and lower chord structures defining the horizontal margins of window openings and being arranged at the sides of the posts so as to form the side margins of window openings of a size smaller than the maximum size compatible with the space between consecutive posts, whereby a standard side wall is adaptable for different window and post widths.

18. In a vehicle body such as for railway cars, a roof unit and a side wall unit provided with final assembly means along their meeting margins, said side wall unit having a plurality of window openings separated by posts and extending upwardly a considerable distance beyond the upper margins of the window openings, a longitudinally continuous baggage rack arranged in the space between the upper margins of the window openings and the upper margin of the side wall unit having a longitudinally continuous top panel at least adjacent its side adjoining the side wall unit, said panel forming an extension of a panel strip overlapping the joint and constituting part of the final assembly means between the roof and the side wall units so that the baggage rack additionally reinforces the connection between the units.

19. Vehicle body, such as for railway cars, comprising: a roof and a side wall and a longitudinal chord structure in the region where the lateral margin of the roof merges into the upper margin of the adjoining side wall, transverse carlines having their ends secured to said chord structure, a roof sheathing extending substantially over the length and width of the roof and connected to said chord structure and carlines, a continuation of said roof sheathing extending for a considerable distance downwardly beyond said chord structure and overlappingly secured to the upper marginal outside portion of the adjoining side wall.

WALTER B. DEAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,143,547	Dean	Jan. 10, 1939
2,185,977	Dean	Jan. 2, 1940
2,223,746	Stoner	Dec. 3, 1940
2,249,703	Dean	July 15, 1941
2,267,702	Dean et al.	Dec. 23, 1941
2,294,357	Dean et al.	Aug. 25, 1942
2,310,497	Thunstrom	Feb. 9, 1943