March 30, 1943. F. M. GUNN 2,314,979

RAIL CAR

Filed May 9, 1941 4 Sheets-Sheet 1

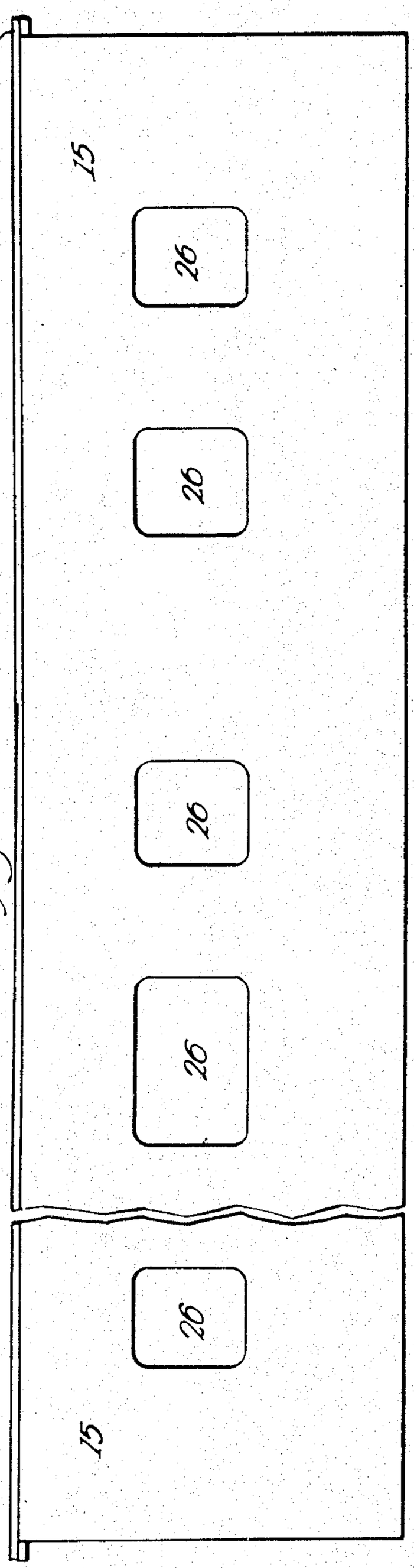

Fig. 1

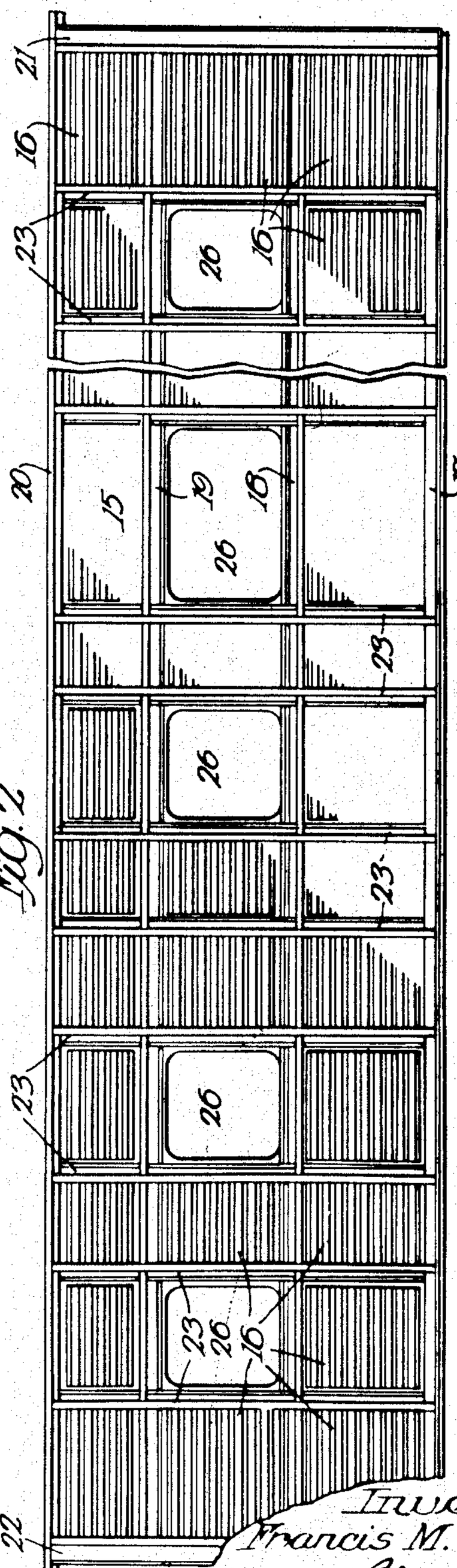

Fig. 2

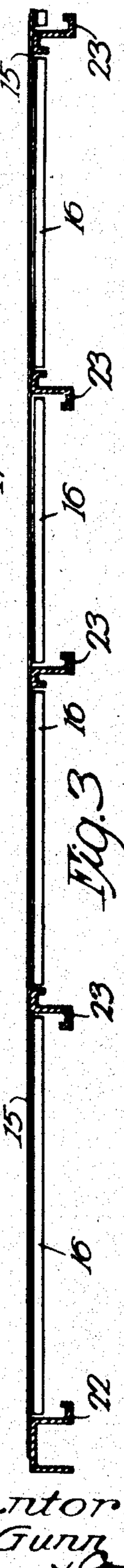

Fig. 3

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Fig. 5

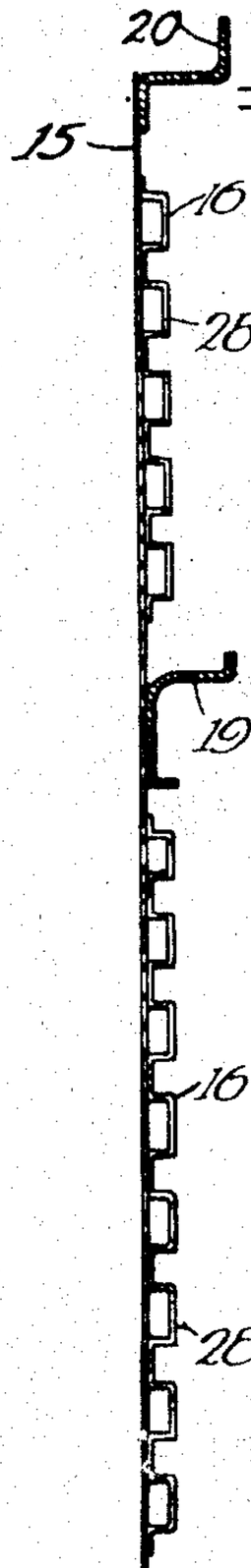
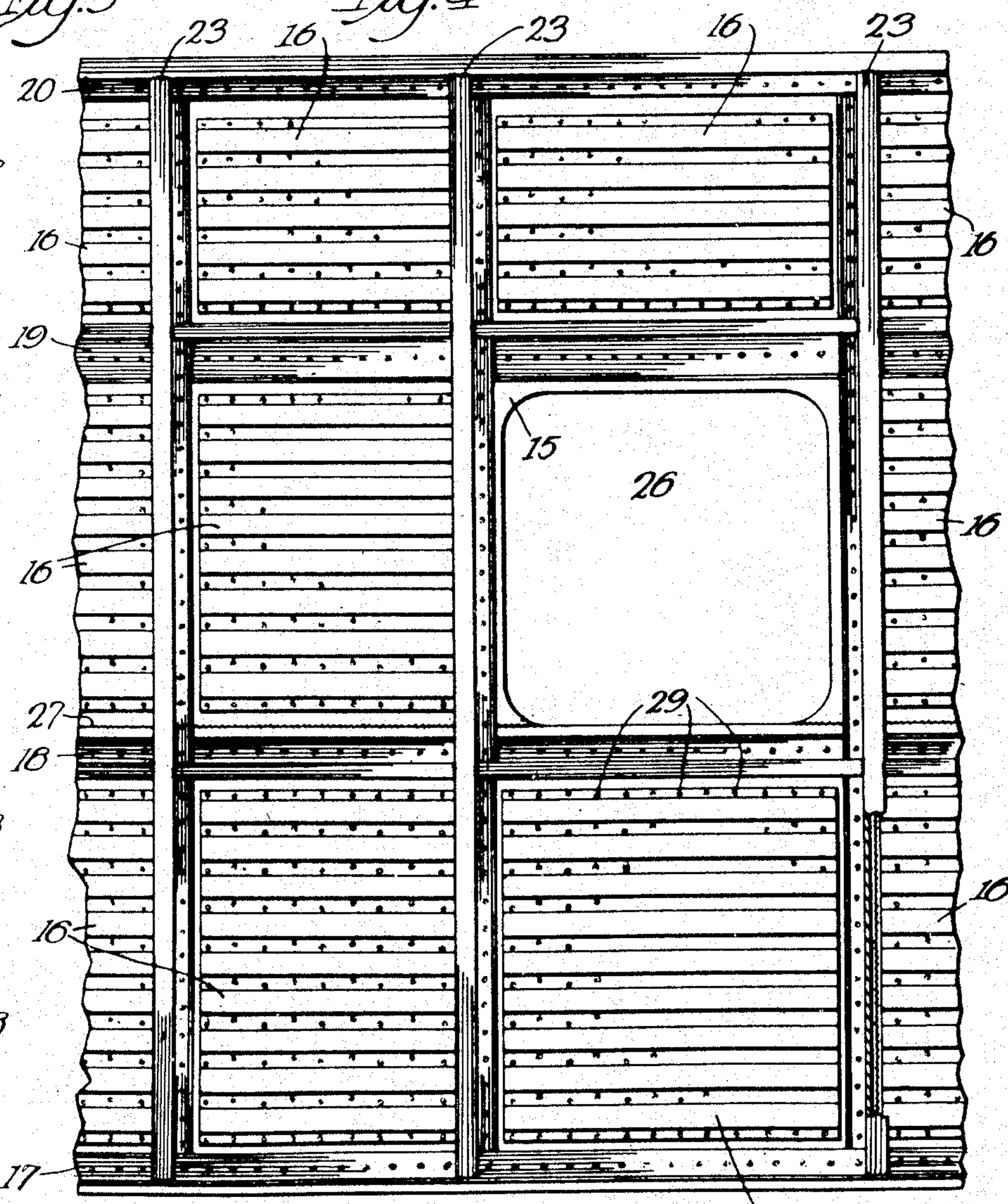


Fig. 4



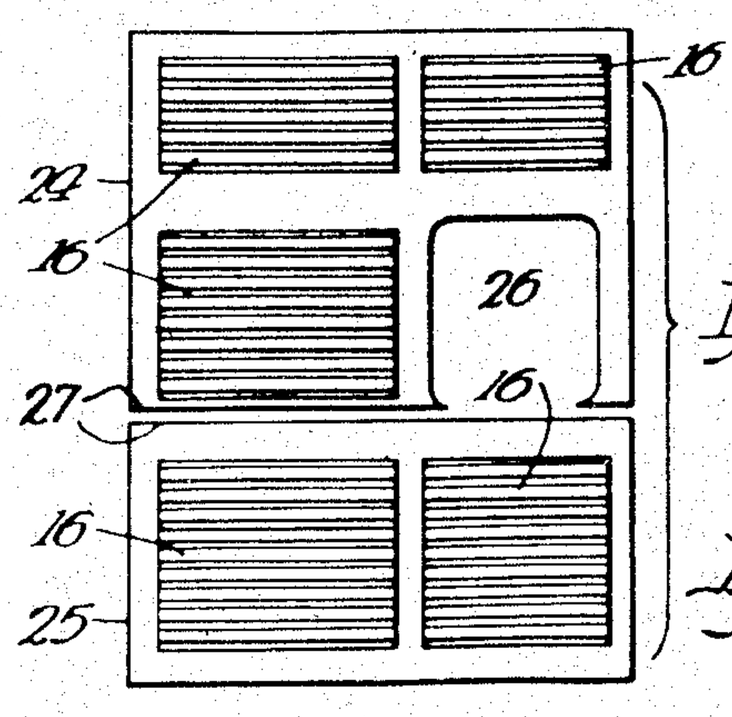


Fig. 6

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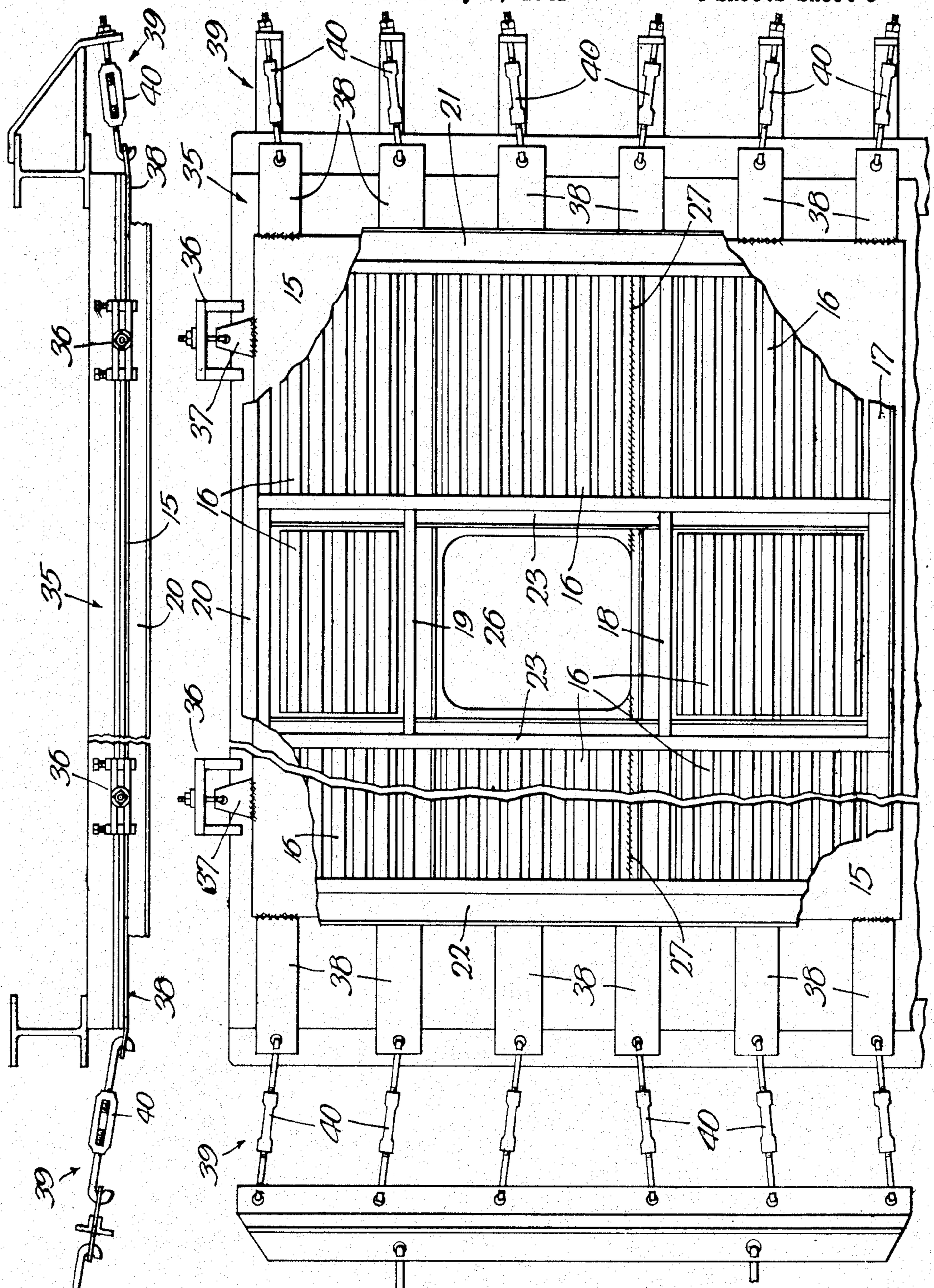

Fig. 6

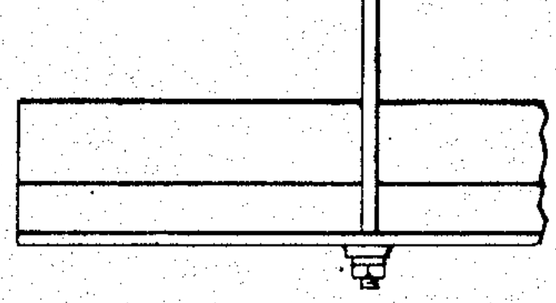

Fig. 7

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Fig. 9

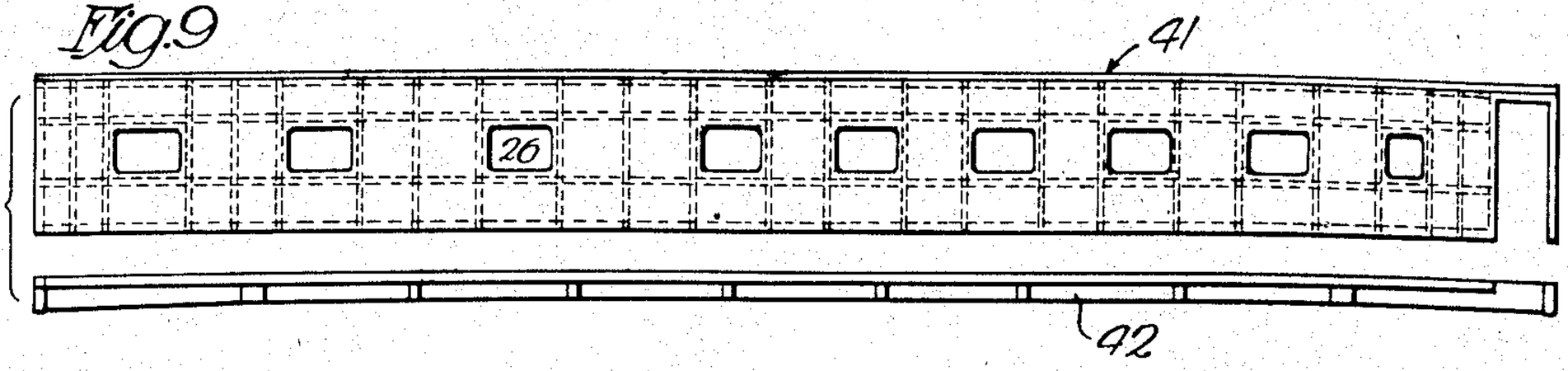


Fig. 10

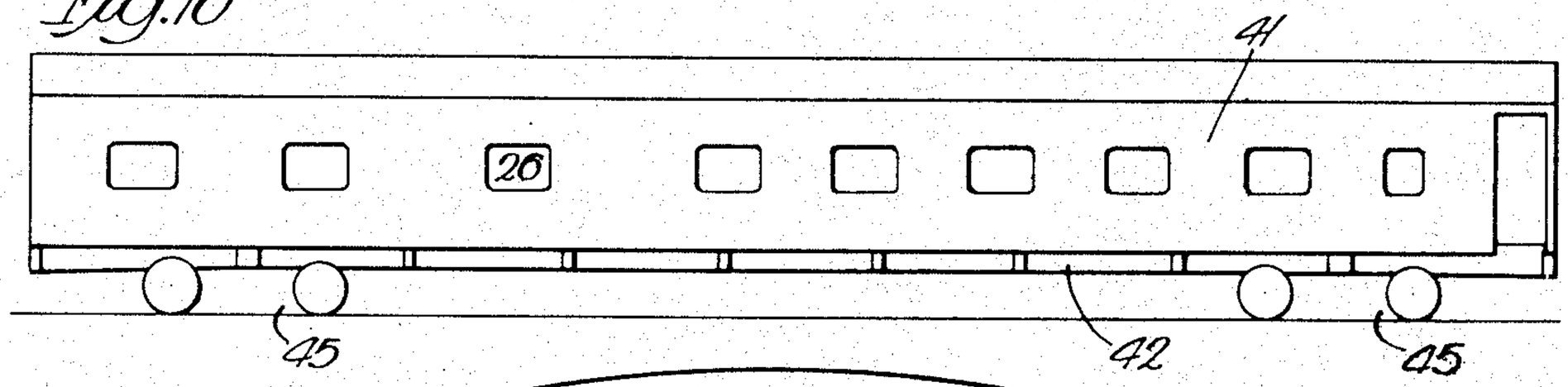
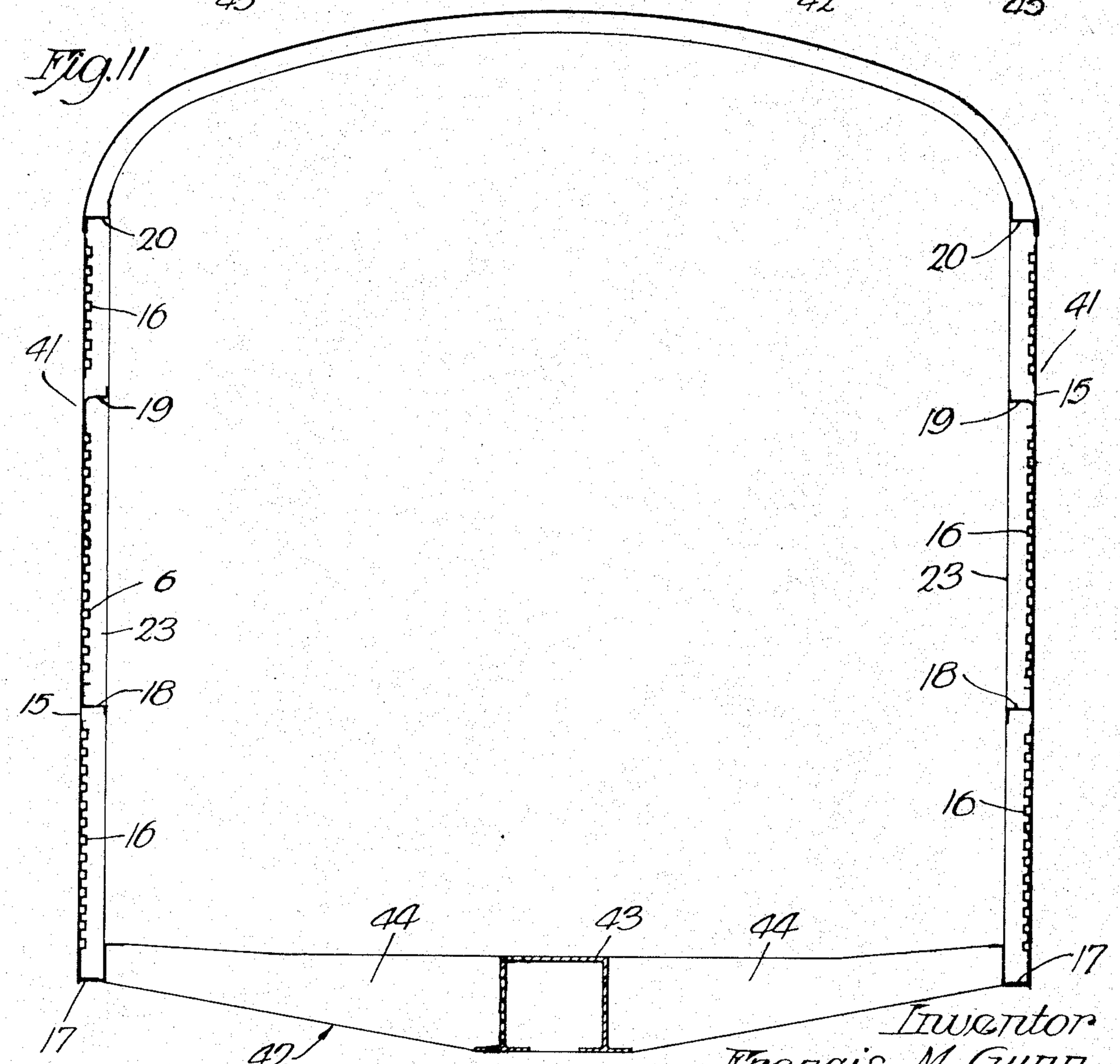


Fig. 11



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Patented Mar. 30, 1943 2,314,979

UNITED STATES PATENT OFFICE

2,314,979

RAIL CAR

Francis M. Gunn, Chicago, Ill., assignor to Pullman-Standard Car Manufacturing Company, Chicago, Ill., a corporation of Delaware

Application May 9, 1941, Serial No. 392,621

23 Claims. (Cl. 105—401)

Due to the extremely high speeds attained by passenger trains today, it is of considerable importance to reduce to a minimum the wind resistance of a train. Indentations, bulges, projections, and sharp corners extending outwardly on the surface of the car sides are very objectionable, and, as a result of considerable wind tunnel testing conducted in 1932 and 1933 and prior to that time on streamline trains, it was definitely concluded that even the presence of rivet heads on the side of a car would produce a substantial dragging effect due to the resistance of turbulent air.

In addition to the advantage of streamlining from the standpoint of aerodynamics, there is considerable demand today for railway cars having a smooth and plain outward appearance. This is probably due to the wide publicity given streamlined trains and the ever increasing public demand for greater speeds and more modern transportation equipment.

In order to have a streamlined appearance and the improved aerodynamic characteristics, a car side should be free from rivet heads, unnecessary bulges and indentations in the side sheathing, and, although the rivets have been eliminated for sometime in the car building industry by the use of welding, irregularities such as bulges and pitting left after the welding operation has been completed have not disappeared. Attempts have been made to hide these blemishes by the use of paint in various manners, but their presence can be detected. The present invention completely eliminates these undesirable irregularities so that good aerodynamic qualities can be obtained and the outer appearance of a car incorporating this invention is smooth, regular, and plain.

In a girder type construction of a car side frame, the sheathing plays an important part in carrying stresses. Because of this, it is extremely difficult to eliminate the ripples and buckles occurring in the side sheathing, and prior to the present invention this problem had not been solved.

Heretofore, when performing the welding operation on a car side when attaching the sheathing to the framing members, it was necessary to use a special jig for each individual car design in order to locate the framing members for the welder. This necessitated building a new jig each time a newly designed car was being constructed. The present invention eliminates this objection and is a definite step toward simplification in car building and reduction in construction costs.

In prior methods of constructing car sides, the expansion and contraction occurring in the sheathing during the welding operation has been resisted by the side frame, resulting in the setting up of stresses in the side sheathing, thereby producing buckles. The present invention prevents these initial stresses from forming, thereby completely eliminating the buckles.

The foregoing constitute some of the principal objects and advantages of the present invention, another advantage being to provide a car side having a smooth, flush outer surface free from wrinkles, buckles, and other like surface irregularities. Other objects and advantages, in addition to those enumerated above, will become apparent from the following description and drawings, in which

Fig. 1 is an elevational view of a car side employing the present invention viewed from the outer side of the car, a portion of the car side being broken away;

Fig. 2 is an elevational view of the car side shown in Fig. 1, but viewed from the inside of the car;

Fig. 3 is an enlarged longitudinal sectional view through a portion of the car side shown in Fig. 2 showing the relationships of the side sheathing, the stiffeners, and certain side framing members;

Fig. 4 is an enlarged fragmentary elevational view of a small portion of the car side shown in Fig. 2;

Fig. 5 is a vertical transverse sectional view of the car side showing the relationships between the side sheathing, reinforcing stiffeners, and longitudinal side framing members;

Fig. 6 is a detail view of individual side sheet segments before being welded together showing the stiffeners in place;

Fig. 7 is a fragmentary side elevational view of the car side showing the mechanism employed for stretching the sheathing during the fabrication of the side, the view showing the inside face of the sheathing with the stiffeners in place and the car side frame welded to the sheathing;

Fig. 8 is a top plan view of the assembly shown in Fig. 7;

Fig. 9 is a diagrammatic view of the car side and an underframe showing in an exaggerated manner the camber in the side and underframe;

Fig. 10 is a diagrammatic view showing the car side mounted on the underframe showing the condition which they assume after the car is

completed and the camber has been almost completely straightened out; and

Fig. 11 is a vertical transverse sectional view through the car the view being enlarged and with parts omitted for the purpose of clarity.

For the purpose of disclosing the invention in compliance with section 4888 of the Revised Statutes, a specific embodiment of the present invention has been selected. Obviously certain modification can be made without departing from the scope of the invention.

This application is a continuation in part of applicant's copending case Ser. No. 297,559, filed October 2, 1939, and a continuation-in-part of Serial No. 380,694, filed February 26, 1941.

A completed car side forming the subject matter of the present invention viewed from the exterior of the car may be perfectly plain, as shown in Fig. 1, and is smooth and practically free from surface irregularities. Broadly, the side includes an integral sheathing 15, reinforced by stiffeners 16 (Fig. 2) extending substantially over the entire inner face of the sheathing. These stiffeners are placed on the sheathing so as to provide room for side framing members which comprise longitudinal members (Figs. 2 and 5), including a side sill 17, a belt rail 18, a window header 19, a side plate 20, end posts 21 and 22 (Figs. 2 and 3), and a plurality of vertical side posts 23.

The integral sheathing 15 comprises a plurality of relatively small sheathing segments or sheets 24 and 25 (Fig. 6), the former of which may be referred to as letter board panel sheets and the latter as girder sheet segments. In fabricating the side sheathing, the window openings 26 are cut out of a plurality of letter board panels 24, and then the stiffeners 16 are spot welded to the inner surface of all the letter board panels and girder sheet segments making up the side sheathing. This welding operation is performed is such a manner that each individual sheet is perfectly straight upon cooling.

After the stiffeners have been applied to the inner faces of all of the individual side sheets, complementary letter board panels and girder sheet segments 24 and 25 are placed with their adjoining edges 27 abutting, and are then arc welded together to make up units of letter board panels and girder sheet segments 24 and 25, respectively. Next, a plurality of these units, sufficient in number to make up the entire car side sheathing, are placed with their complementary vertical edges abutting, and then are arc welded to form the integral sheathing 15 reinforced by stiffeners 16.

The sheathing so constructed and reinforced is straight and the outer sheathing surface is smooth and substantially free from buckles and other irregularities.

This is particularly true when the stiffeners are spot welded to the individual sheets by applying the electrodes to the inner surface of the stiffeners so that the cavities caused by electrode pressure appear on the stiffeners rather than on the outside of the sheets. It is contemplated in the present invention that the welding shall be done in this manner.

The car side frame is completely welded together in a separate jig apart from the side sheathing in any well known manner and then, after it has been straightened, it is placed against the inner face of the completed side sheathing, after first grinding flush the weld beadings on the sheathing, with its various framing members fitting into their proper spaces between the reinforcing stiffeners 16. The frame is then welded to the sheathing by applying electrodes to the inner faces of the framing members, thereby again preserving the smoothness on the outer surface of the sheathing.

As best shown in Fig. 5, the stiffeners 16 comprise a plurality of longitudinally extending corrugations 28 pressed into a sheet. There is a definite purpose in extending the corrugations lengthwise to the car because the cumulative contraction in the length of a car side after the welding operation has been completed is very much greater than the contraction in the height of the car, and sometimes may be as much as five-eighths of an inch. By extending the corrugations in the longitudinal direction, greater support is given in that direction, so as to give added reinforcement to the sheathing to take care of this greater contraction.

In Fig. 6, the window opening is indicated as being entirely in the letter board panel sheets, but obviously it can be divided between the adjoining letter board panel sheets and girder sheet segments.

The spot welding of the stiffeners to the sheets is performed so that the spots are staggered, as indicated at 29 in Fig. 4, with each spot being as far as possible from the longitudinal center line of the stiffener area engaging the sheet, thus making the welded joint as strong as possible.

By welding the stiffeners to the inner face of each small side sheet segment prior to the welding of these sheets together, added reinforcement is given to the sheathing in resisting stresses caused upon cooling of the metal after the sheets have been arc welded together. This is very important, because it is practically impossible to prevent buckling in the relatively thin sheets when they are welded together without any reinforcing stiffeners. It is possible, then, to obtain a substantially smooth integral side sheathing member extending the full length and height of the car before it is applied to the side framing members, and by having these stiffeners on the rear face of this large, relatively flexible member prior to welding it to the side frame, internal stresses set up in the sheathing as the result of welding the frame to the sheathing can be carried by the stiffeners themselves without buckling. The important thing is that each reinforced sheet 24 and 25 must be straight before the entire sheathing is welded together, and this straightness must be "frozen" into the sheet.

As a specific example of a car side using Corten steel, the outside sheathing may be .078 of an inch in thickness. This relatively thin sheet, reinforced by stiffeners of approximately .018 of an inch in thickness, fabricated as previously described, is placed against a large copper plate in the welding jig. The side frame, made up of framing members of approximately one-eighth inch thickness, is placed in the jig against the sheathing, and then the welding operation is performed by applying the electrode pressure to the framing members, with a relatively large copper plate backing the sheathing and serving to conduct the welding current between spaced electrodes. Because of the large area of the copper plate contacting the outer surface of the sheathing and further because the concentrated pressure of the relatively small electrodes is placed against the framing members, the welding is completed without in any way marring the outer face of the sheathing. It is important that this

copper plate be relatively large so as to distribute the pressure on the outer face of the thin sheathing over a relatively large area.

As shown in Fig. 7, the sheathing 15 may be supported on a vertical jig, generally indicated at 35, by clamps 36, which suspend the sheathing from the top. Ears 37 are welded to the top edge of the sheathing, and the clamps grasp these ears as best shown in Fig. 7.

On the opposite vertical edges of the sheathing 15 are a plurality of straps 38 welded to the sheathing and a suitable stretching device, generally indicated at 39, is used to stretch the sheathing in a lengthwise direction. Turn buckles 40, properly anchored at one of their ends, are fastened to the straps 38, and they are tightened to stretch the sheathing. This stretching is made substantially uniform throughout the area of the sheathing by proper adjustment in the turn buckles. The stretching of the sheathing is done before the car side frame is welded to the sheathing, and the stretching condition is maintained while the frame is being welded in place. Thus, the frame serves to hold the sheathing in its stretched condition at all times.

As shown in Fig. 6, the stiffeners 16 are spaced apart so as to allow clearance for the side framing members, so that the side frame may be applied directly against the sheathing 15. The frame, then, is welded directly to the sheathing, and the stiffeners 16 substantially cover the inner face of the sheathing in the areas between framing members.

The side frame and sheathing are each fabricated separately so that the shrinkage of each during the welding heat takes place before the two are joined. In this manner the side frame is free to expand and contract without in any way affecting the sheathing and likewise the sheathing can expand and contract without being restrained by the frame.

The car side is fabricated separate and apart from the remainder of the car. The underframe likewise is fabricated separately. Both the side and the underframe may be cambered to compensate for bending caused by the added weight on the underframe of the various parts and equipment making up the completed car body.

Referring to Fig. 9, the car side is indicated at 41 and an underframe is shown at 42. In this view the camber in these two members has been exaggerated in order to make it visible on such a small scale. The degree of camber in the side and the underframe is approximately the same so that these two parts can be joined. When the car is completed the weight due to the various members making up the structure and the equipment causes the camber to be practically eliminated and this condition is shown in Fig. 10 where the car appears to be substantially straight from end to end.

Though the underframe per se forms no part of the present invention, for purpose of illustration in Fig. 11 the underframe is shown to include a center sill 43 and cross bearers 44. The car sides and the underframe are joined at the side sills in some suitable manner.

During the normal operation of the car numerous stresses are placed into the car side due to the normal distortions of the underframe since the latter is supported only in the regions of the trucks, the latter of which are diagrammatically shown in Fig. 10, at 45. These stresses heretofore have been the cause of numerous wrinkles and buckles in the side sheathing. The present invention has completely overcome this difficulty. The stresses normally set up during the welding operation when the car side is fabricated are successfully resisted so as not to produce wrinkles and buckles in the side sheathing. All of this has been accomplished and the car side forming the subject matter of the present invention produces a smooth outer appearance substantially free of wrinkles and buckles and like surface irregularities normally caused by stresses in the side.

I claim:

1. In a vehicle having a side frame comprising intersecting load carrying members, flat side sheathing for attachment to the frame comprising a flat integral sheet of relatively thin material extending the full length and height of the vehicle, and stiffeners secured to the inner face of the sheet in the areas between the framing members, the stiffeners stopping short of the framing members and being connected to said members only by the sheathing.

2. In a car side, an integral thin sheet of sheathing extending the full length and height of the car, a frame comprising intersecting framing members welded together and having their outer faces welded to the inner face of the sheathing and stiffeners welded to the inner face of the sheathing between adjacent framing members and stopping short of the framing members, the sheathing constituting the only connection between the stiffeners and the frame.

3. A girder type side for a railway car, comprising a load-carrying frame including intersecting framing members, a relatively thin integral sheathing extending the full length and height of the car welded to the frame on the outer face thereof, with the welding scars appearing only on the inner faces of the framing members, and stiffeners welded to the inner face of the sheathing in the areas between the framing members, the stiffeners stopping short of the framing members and being connected to said members only by the sheathing, all of the latter welding scars appearing only on the inner faces of the stiffeners.

4. A girder type side for a railway car comprising a load-carrying frame, including intersecting framing members, relatively thin sheathing welded to the frame on the outer face thereof, and stiffeners welded to the inner face of the sheathing in the areas between the framing members, the stiffeners stopping short of the framing members and being connected to said members only by the sheathing, all of the latter welding scars appearing only on the inner faces of the stiffeners.

5. A car side comprising a plurality of flat sheets butt welded together to form an integral sheet having a length and height corresponding to the length and height of the car, a frame comprising intersecting framing members welded together and having their outer faces welded to the inner face of the sheet, and stiffeners welded to the inner face of the sheet in the areas between the framing members and stopping short of the framing members and being connected to said members only by the sheet.

6. In a vehicle having a side frame comprising intersecting load carrying members, flat side sheathing for attachment to the frame comprising a flat integral sheet of relatively thin material extending the full length and height of the vehicle and being under continuous substantial

tension lengthwise of the car, the tension being substantially uniform throughout the length of the car side, and stiffeners secured to the inner face of the sheet in the areas between the framing members.

7. In a vehicle, a side including a frame comprising intersecting load carrying members, flat integral side sheathing attached to the frame and extending over a substantial portion of the car side and being under continuous substantial tension lengthwise of the car, the tension being substantially uniform throughout the length of the sheathing, and stiffeners secured to the inner face of the sheathing in the areas between the framing members.

8. In a vehicle, a side including a frame comprising intersecting load carrying members, flat integral side sheathing attached to the frame and extending over a substantial portion of the car side and being under continuous substantial tension lengthwise of the car, the tension being substantially uniform throughout the length of the sheathing, and stiffeners comprising corrugated metal sheets secured to the inner face of the sheathing in the areas between the framing members, the corrugated sheets being substantially coextensive in length and width with the corresponding areas between the framing members.

9. In a car side, an integral thin sheet of sheathing extending substantially the full length and height of the car, a frame comprising intersecting framing members welded together and having their outer faces welded to the inner face of the sheathing, the sheathing being under continuous substantially uniform tension lengthwise to the sheathing throughout substantially its length, and stiffeners welded to the inner face of the sheathing between adjacent framing members.

10. A car side comprising a plurality of flat sheets having stiffeners welded to the inner faces thereof, the sheets being butt welded together to form an integral sheet having a length and height substantially corresponding to the length and height of the car, a frame comprising intersecting framing members welded together and welded to the inner face of the integral sheet, the stiffeners being spaced apart sufficiently to permit the framing members to engage the integral sheet.

11. In a railway car having an underframe supported adjacent to the opposite end on wheeled trucks, a car side comprising a plurality to flat sheets having corrugated stiffeners welded to the inner faces thereof over the major portions of their areas, the sheets being butt welded together to form an integral sheet having a length and height substantially corresponding to the length and height of the car, the stiffeners being organized and arranged to resist buckling of the sheathing due to deflections of the car, and a side frame comprising intersecting framing members welded together and welded to the inner face of the integral sheet, the stiffeners being spaced apart to permit the framing members to engage the integral sheet, and the car side being secured to the underframe.

12. A side wall for a railway car comprising a side sill, an upper side frame member extending longitudinally of the car, a pair of upright posts spaced apart and rigidly connected to said side sill and side frame member, a plurality of side posts spaced apart and rigidly secured to said side sill and side frame member between said upright posts, a sheet metal outer sheathing having a smooth outer surface rigidly secured to said side sill, side frame member, and side posts and having its end portions secured to said upright posts, said sheathing being under substantial tension lengthwise of the car, said tension being continuous and substantially uniform throughout the length of said side wall between said uprights, and corrugated stiffening sheets secured to the inner face of said sheathing in the free areas between the upright posts.

13. A side wall for a railway passenger car having windows and comprising a side sill, an upper side frame member extending longitudinally of the car, a belt rail below the windows, a window header above the windows, a pair of upright posts spaced apart and rigidly connected to said side sill, side frame member, belt rail, and window header, a plurality of side posts spaced apart and rigidly secured to said side sill, side frame member, belt rail, and window header between said upright posts, a sheet metal outer sheathing having a smooth outer surface rigidly secured to said side sill, side frame member, belt rail, and window header, and having its end portions secured to said upright posts, said sheathing being under substantial tension lengthwise of the car, said tension being continuous and substantially uniform throughout the length of said side wall between said uprights, and corrugated stiffening sheets secured to the inner face of said sheathing in the free areas between the posts and the longitudinal framing members.

14. In a railway car supported on wheeled trucks, an underframe supported as a simple beam on the trucks, a car side secured to said underframe and including a side frame and side sheathing, the side frame including a side sill, a side plate, a belt rail and a window header all extending substantially the full length of the car side and interconnected by spaced end posts and intermediate side posts, the sheathing comprising a prefabricated flat integral sheet substantially coextensive with the length and the height of the side frame and being substantially smooth on its outer face and having a plurality of stiffeners secured to the inner face of the sheet for reinforcing the major area of the sheet against deformation, the areas of the sheet corresponding to the locations of the side framing members being free from stiffeners, the side frame backing the sheet with the framing members engaging the stiffener free inner face of the sheet, the frame and the sheathing being secured together to form a car side.

15. In a railway car supported on wheeled trucks, an underframe supported as a simple beam on the trucks, a car side secured to said underframe and including a side frame and side sheathing, the side frame including a side sill, a side plate, a belt rail and a window header all extending substantially the full length of the car side and interconnected by spaced end posts and intermediate side posts, the sheathing comprising a prefabricated flat integral sheet substantially coextensive with the length and the height of the side frame and being substantially smooth on its outer face and having a plurality of stiffeners secured to the inner face of the sheet for reinforcing the major area of the sheet against deformation, the areas of the sheet corresponding to the locations of the side framing members being free from stiffeners, the frame backing the sheet with the framing members engaging the stiffener free inner face of the sheet, the frame and the sheathing being se-

cured together to form a car side, the sheathing being under substantial tension lengthwise of the car, said tension being continuous and substantially uniform throughout the length of said side wall between the end posts.

16. In a railway car supported on wheeled trucks, an underframe supported on the trucks, and a car side rigidly secured throughout its length to the underframe and comprising a unitary structure including interconnected intersecting load carrying members covered by flat sheathing, said sheathing being constructed as a separate unit from the side frame and comprising an integral flat sheet substantially coextensive with the length and height of the car side and having a smooth outer surface substantially free from surface irregularities, and stiffeners attached to the inner face of the sheet and reinforcing substantially the entire sheet against deformation, the portions of the sheathing engaging the framing members being devoid of stiffeners.

17. In a railway car supported on wheeled trucks, an underframe supported on the trucks, and a car side rigidly secured throughout its length to the underframe and comprising a unitary structure including interconnected intersecting load carrying members covered by flat sheathing, said sheathing being constructed as a separate unit from the side frame and comprising an integral flat sheet substantially coextensive with the length and height of the car side and having a smooth outer surface substantially free from surface irregularities, and stiffeners attached to the inner face of the sheet and reinforcing substantially the entire sheet against deformation, the portions of the sheathing engaging the framing members being devoid of stiffeners, and the sheathing being under substantial tension lengthwise of the car, said tension being continuous and substantially uniform throughout the length of said side wall.

18. In a vehicle having a side frame comprising intersecting load carrying members, flat side sheathing for attachment to the frame comprising a flat integral sheet of relatively thin material extending the full length and height of the vehicle, and stiffeners secured to the inner face of the sheet in the areas between the framing members, the sheathing being under substantial tension lengthwise of the car, said tension being continuous and substantially uniform throughout the length of said side wall between the end posts.

19. In a railway car supported on wheeled trucks, an underframe supported on the trucks, and a car side rigidly secured throughout its length to the underframe and comprising a unitary structure including interconnected intersecting load carrying members covered by flat sheathing, said sheathing comprising an integral sheet substantially coextensive with the length and height of the car and consisting of a plurality of initially reinforced panels welded together, the reinforcements comprising stiffeners welded to the inner face of each panel and reinforcing same against deformation over substantially the entire panel area, the sheet where it engages the framing members being devoid of stiffeners so that the framing members engage the inner face of the sheathing.

20. A car side wall comprising sheathing consisting of a plurality of substantially flat sheets welded together, reinforcing stiffeners fastened to the inner face of the sheathing, and a side frame made integral with the sheathing and comprising intersecting load carrying members, the side wall having the properties and characteristics of a wall fabricated by first welding reinforcing stiffeners to the inner faces of each of the flat sheets, then welding together the reinforced sheets into integral sheathing, and finally welding together the sheathing and the said side frame into a unitary structure, the intersecting load carrying members of the side frame having been previously secured together to form the said side frame.

21. In a railway car having an underframe mounted on wheeled trucks, a car side wall mounted on, substantially co-extensive with, and secured along its lower edge to said underframe in such a manner that stresses caused by deflections of the underframe are transmitted into the side wall, said wall comprising the combination of substantially flat integral sheathing and reinforcing stiffeners fastened to the inner face of the sheathing, said combination being pre-fabricated as a unit of substantially the length of the underframe, and a side frame comprising a plurality of intersecting, load carrying members fastened together into a separately pre-fabricated unitary structure, the sheathing and the side frame being secured together, and the stiffeners together with the intersecting framing members reinforcing substantially the entire sheathing area against deformation.

22. A car side wall comprising sheathing consisting of a plurality of substantially flat sheets welded together, reinforcing stiffeners fastened to the inner face of the sheathing, and a side frame made integral with the sheathing and comprising intersecting load carrying members, the side wall having the properties and characteristics of a wall fabricated by first welding reinforcing stiffeners to the inner faces of each of the flat sheets, then welding together the reinforced sheets into integral sheathing, then substantially uniformly tensioning the sheathing in a lengthwise direction and substantially throughout its entire length, and finally welding together the sheathing while so tensioned and the said side frame into a unitary structure, the intersecting load carrying members of the side frame having been previously secured together to form the said side frame.

23. A car side wall comprising two sub-assemblies including a pre-fabricated side frame of substantially the length of the car made up of intersecting, load-carrying members, and a separately pre-fabricated sheathing of substantially said length made up of flat, metal sheets welded together into integral sheathing, the side frame and the sheathing being welded together after individually separate pre-fabrication of each.

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