May 9, 1933. W. H. HIMES 1,907,967

ELEVATOR CAR

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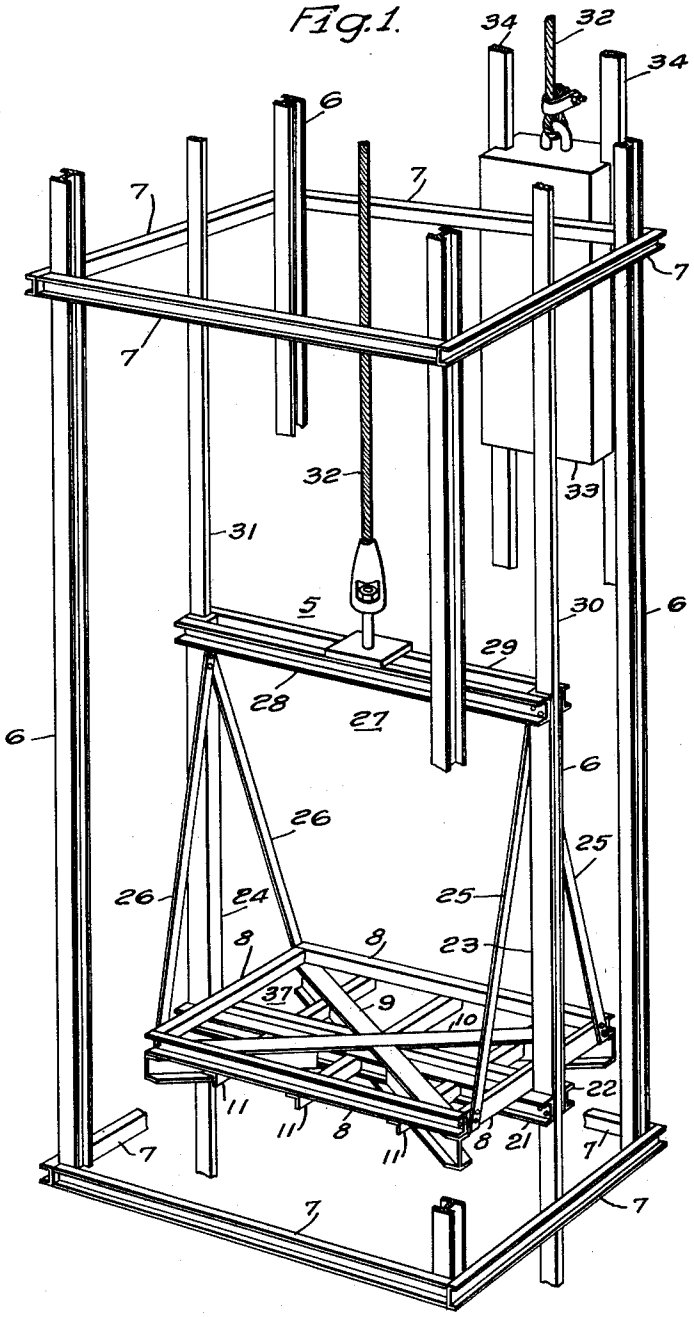
Fig. 1.



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ELEVATOR CAR

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Fig. 2.

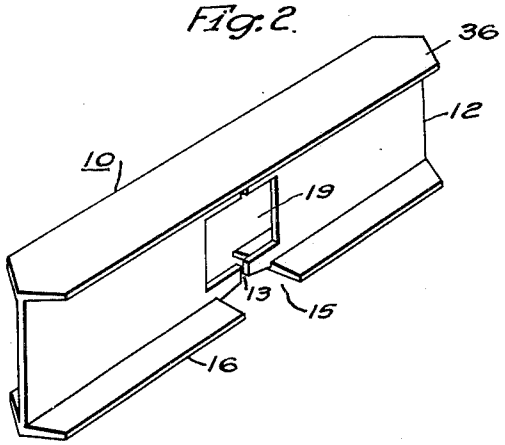


Fig. 3.

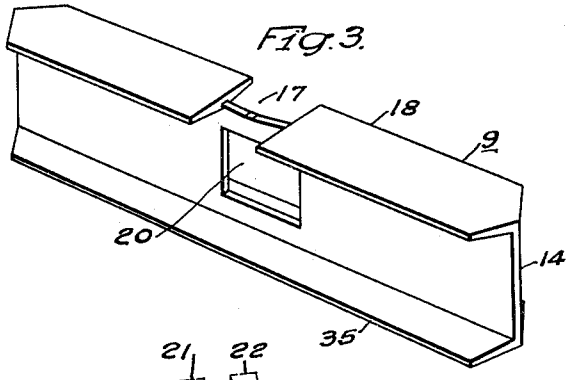
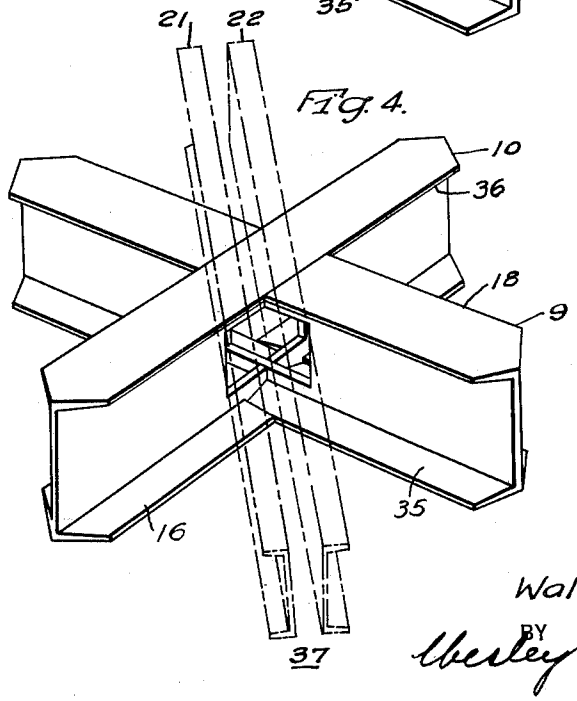


Fig. 4.



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ELEVATOR CAR

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Fig. 5.

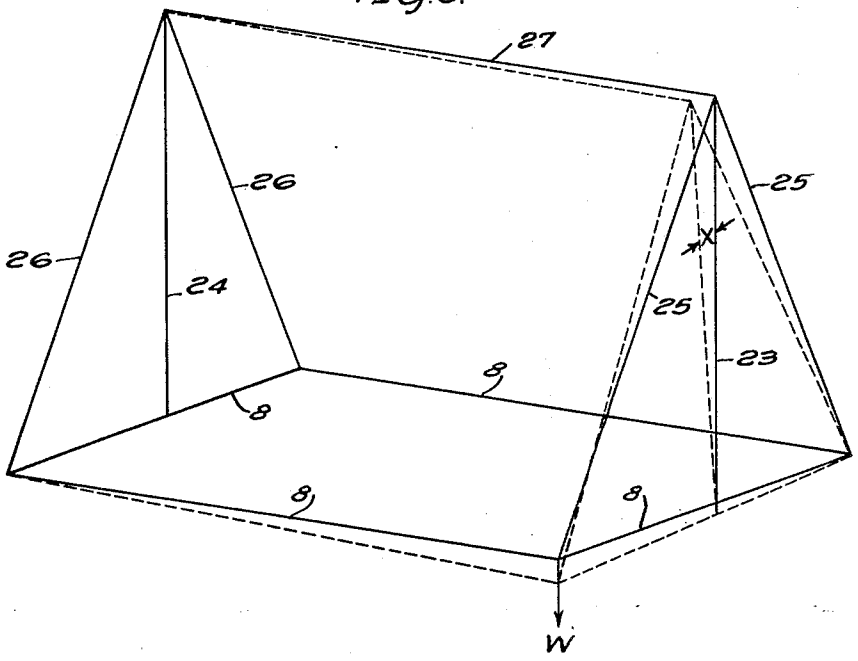
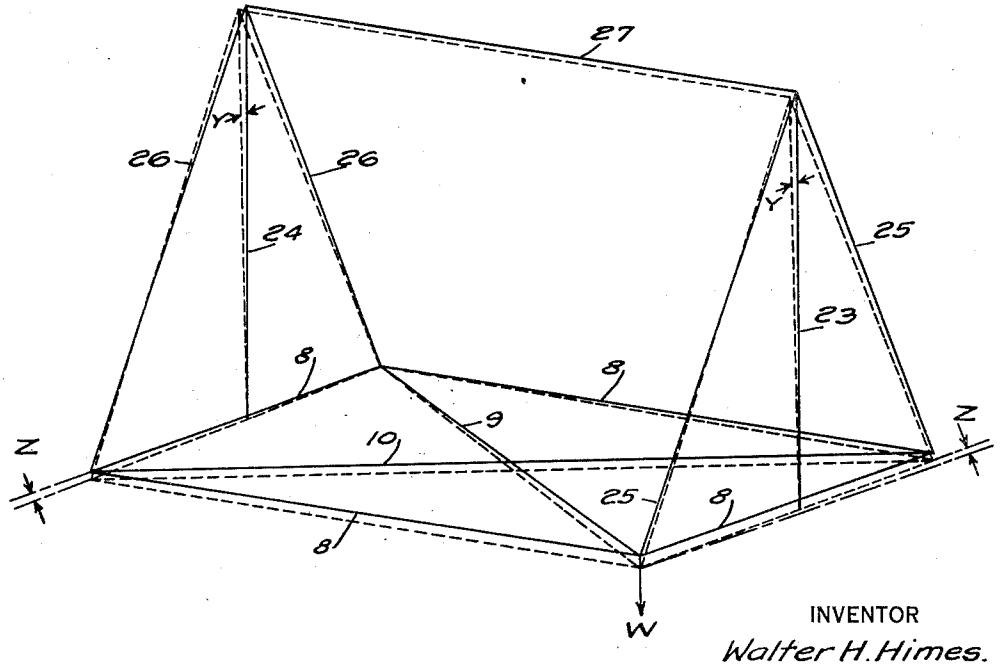


Fig. 6.



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UNITED STATES PATENT OFFICE

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ELEVATOR CAR

Application filed December 20, 1929. Serial No. 415,481.

My invention relates to elevator cars, particularly to elevator cars for freight service and more particularly to such construction of freight elevator cars as to impart inherent rigidity thereto, and specifically to the construction of a freight elevator car in which interfastened members connect diagonally opposite corners of the car platform to effect inherent rigidity of the car.

In freight elevators, it has long been a recognized problem to construct a car in such manner as to resist the distortion effects caused by unsymmetrical loading of the car platform. With the recent advent of automobile parking and storage buildings, in which the automobiles are elevated to upper or lower floors of the building, designers of elevator cars have again been confronted with this problem. Heretofore, the platforms for elevator cars have been of a "grid-like" construction, that is, of a construction comprising a quadrangular frame having cross members connecting opposite sides of the frame and disposed perpendicular thereto. The rigidity of such platform for elevator cars, while perhaps sufficient for passenger elevator cars, has been insufficient to resist the warping effect on the platform caused by the unsymmetrical loading thereof. This lack of rigidity of the elevator platform of the old grid type is a serious problem in a multiple-car platform on which two or more automobiles are to be loaded side by side and an automobile enters the car platform entirely to one side of the platform's center line. The platform, as well as the entire elevator car, is distorted, and the vertical braces on each side of the elevator car, known in the art as "stiles", which engage the guide rails vertically disposed in the hatchway to maintain the path of travel for the car, are subjected to unequal distortion which results directly in excessive wear on the stiles and guide rails, thus increasing maintenance and repair costs as well as demanding increased power to overcome excessive friction.

My invention comprises an elevator-car platform having interfastened members connecting its diagonally opposite corners to impart an inherent rigidity to it and to the elevator car itself which has hitherto never obtained in any of the elevator car structures. By reason of the specified structure, an equal distribution of stresses on the guide rails and stile members at each end of the elevator car is effected and a reduction in the wear on the guide rails and on the stile members is ensured.

The use of members connecting diagonally opposite corners of an elevator platform presented the additional problem incident to the effecting of the joinder of a third member thereto, that is, the joinder of the safety-platform member and the two intersecting members connecting diagonally opposite corners at the point of intersection of the latter two members in a practical and economical way without sacrificing any of the strength of the joint, and my invention discloses a solution thereof.

It is, therefore, the object of my invention to construct an elevator-car platform which has its diagonally opposite corners connected by interfastened members to impart an inherent rigidity to both the platform and the elevator car itself, and an equal distribution of the loading stresses between the guide rails which engage the stile members of the elevator car.

Another object of my invention is to so effect the intersection of two structural members as to permit joining a third structural member to them at the intersection thereof without sacrificing any of the strength of the joint at such intersection.

The invention, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood by reference to the accompanying drawings, in which

Figure 1 is a perspective view showing an elevator car constructed according to the principles of my invention and positioned in a hatchway within which it moves;

Fig. 2 is a perspective view of one of the structural members connecting diagonally opposite corners of the elevator car platform, portions of the structural members being cut away in order to effect a joinder with the

other members connecting the other two diagonally opposite corners;

Fig. 3 is a perspective view of another structural member connecting the other two diagonally opposite corners of the elevator car platform, portions being cut away to effect a joinder with the structural member shown in Fig 2, and

Fig. 4 is a composite perspective view of the structural members shown in Figs. 2 and 3, and shows the manner in which the safety platform members pass through the intersection of those two members;

Fig. 5 is a diagrammatic view illustrating, by solid and broken lines, respectively, the unloaded and the loaded positions of an elevator car having no members connecting diagonally opposite corners of the car platform, and

Fig. 6 is a diagrammatic view illustrating, by solid and broken lines, respectively, the unloaded and loaded positions of an elevator car having interfastened members connecting diagonally opposite corners of the car platform.

In Fig. 1, is shown an elevator car 5 in a hatchway comprising vertically disposed structural members 6 held in spaced relation to each other by the horizontally disposed structural members 7. The elevator car 5 comprises a platform defined by structural members 8, welded, bolted or otherwise suitably fastened together to constitute a quadrangular frame and members 9 and 10 which connect diagonally opposite corners of the quadrangular frame defined by the members 8, and angle bar members 11 constituting an additional support between members 8 and the intersecting members 9 and 10. The members 9 and 10 are suitably fastened together and to the members 8 at the corners of the quadrangular frame in a suitable manner, such as by welding or bolting. Portions of the members 9 and 10 are cut away, as shown in Figs. 3 and 2, respectively, so that they may fit together. That is, the lower flange 16 of the member 10 is cut away at 15 to receive the lower flange 35 of the member 9, and a slot 13 is cut in the web 12 perpendicularly to the flange 16 so that its opposite sides engage opposite sides of the web 14 of the member 9. The upper flange 18 of the member 9 is cut away, as shown at 17, in Fig. 3, to receive the upper flange 36 of member 10.

A rectangular hole 19 is cut in the web 12 of the member 10 and is so located that two opposite sides are parallel to the flanges of that member. A similar rectangular hole 20 is cut in the web 14 of the member 9 and is correspondingly located.

Channel members 21 and 22, constituting a safety plank 37, extend through the opening formed by the holes 19 and 20 at the intersection of the two members 9 and 10, as shown in Fig. 4. The two members 9 and 10 are suitably fastened together, either by welding along the edges of the joint or by other suitable means, as well as being welded to the safety-platform channel members 21 and 22 and the members 8 of the quadrangular frame.

The safety-plank channel members 21 and 22 project beyond the members 8 at opposite ends of the quadrangular frame and their opposite ends are attached, respectively, as by welding or bolting, to vertically disposed channel members 23 and 24, technically known in the art as stiles.

Bracing members 25 rigidly connect the top of the stile 23 to the corners of the quadrangular frame on the same end of the elevator car to maintain the former in perpendicular relation to the member 8.

Bracing members 26 rigidly connect the top of the stile 24 to corners of the quadrangular frame at the same end of the car to support the former in perpendicular relation to the member 8 at that end.

A cross head 27, comprising the channel members 28 and 29, serves to connect the top ends of the stiles 23 and 24 rigidly together.

The stiles 23 and 24 are lined with a suitable bearing material (not shown) to engage the vertically disposed guides 30 and 31, respectively, which are attached to the members 7 constituting portions of the hatchway, to guide the elevator car 5 in its up and down movements.

A cable 32 is suitably attached to the cross head 27, passes over a drum of the driving motor (not shown) and is suitably fastened to a counterweight 33 which engages guides 34 to move up and down in a vertical path.

In order to fully understand the basic principle of my invention, an analysis of the loaded and the unloaded positions of the elevator car and the various structural members comprising it will be set forth. Referring to Figs. 5 and 6, which are diagrammatic views representing, respectively, an elevator car without and with interfastened members 9 and 10 connecting diagonally opposite corners of the car platform. Corresponding members in the two figures are designated by the same numerals and, in both figures, these numerals correspond to those used for corresponding members represented in Fig. 1.

For the purpose of analysis, let it be assumed that a concentrated load W is impressed downwardly at one corner of the car-platform frame comprising members 8, as indicated in Fig. 5, representing an unsymmetrical loading of the platform.

Such an unsymmetrical loading may occur when the front wheels of an automobile rest on the car entirely at one side of the center line of the platform, in being driven thereon, or when the rear wheels of the automobile rest on the platform as the automobile is

leaving it, or when the automobile is entirely on the platform wholly at one side of the platform's center line, or when the automobile, being wholly on the platform in a position, not entirely at one side of the platform's center line, is of such character as to effect unequal loads upon the front and rear pairs of wheels.

It will be understood that, with a quadrangular frame for the car platform, such as is indicated in Fig. 5, a sufficient load at one corner thereof causes that corner to move downwardly relative to the others, premising that no supporting force other than the quadrangular frame itself is effective. That is, this one corner will leave the plane of the other three corners which, in effect, means that the platform frame assumes a warped or distorted shape.

Assuming then that the corner, at which the concentrated load W is impressed, moves downwardly, and also that the vertical members 23 and 24 remain perpendicular to the members 8 at their corresponding ends of the car (since the triangular construction comprising the two bracing members 25 and the bottom member 8 may be considered to be a rigid body), it will be seen that the member 23 will be inclined at an angle X from the original vertical position which it occupied and thus the car itself, will assume a distorted shape, as shown by the doted lines in Fig. 5.

Obviously, the restraining force tending to prevent movement of the car to this distorted position lies in the force exerted by the vertically disposed guide rail which the stile 23 engages. It is understood that a small portion of the load W is transmitted indirectly to the guide rail which the stile 24 engages, but it will be clear that, nevertheless, the major portion of the load is carried by the one guide rail engaged by the stile 23, and the other guide rail, engaged by the stile 24, contributes a much smaller share of the supporting force for the load W. The direct result of this distortion effect of unsymmetrical loading is the excessive wear on the one guide rail and the corresponding stile, as well as the extra amount of power required to move the car. Clearly, then, from a mechanical design as well as from a maintenance and a cost-of-operation standpoint, the use of an elevator car of the foregoing type of construction, is undesirable.

Referring now to Fig. 6 and assuming that a concentrated load W is impressed at a corner of the car platform corresponding to that corner at which the load is impressed in Fig. 5. Because of the fact that structural members 9 and 10 connect diagonally opposite corners, and the fact that they are fastened together at their mid-points, it will be understood that the platform is, in effect, a rigid body. That is, more specifically, since members 9 and 10 do not bend, (the depth of the members 9 and 10 is such that, theoretically, no bending may be assumed), it will be understood that a downward movement of one end of member 9, as when a load is impressed thereon, results directly in a proportionate downward movement of both ends of member 10, which amount of movement is equal to the downward movement of the center of member 10 which is, in turn, equal to the amount of downward movement of the center of member 9, since the centers of the two members 9 and 10 may, for the purpose of our analysis, be considered identical. Thus, members 9 and 10 cause the car platform to be, in effect, a rigid body, since all four corners of the platform frame remain always in the same plane. As will be remembered, this was not true of the car platform illustrated diagrammatically in Fig. 5.

Premising both members 23 and 24 to be fixed in a perpendicular position with respect to the members 8 at their corresponding ends of the car, due to the fact that the triangular structure comprising the two members 25 and the member 8 on one end and the two members 26 and the member 8 on the other end may be considered rigid bodies, it follows that, upon the impression of the load W, both of the stiles 23 and 24 are caused to incline equal angles Y from the original vertical position which they occupied because angle Z between the end members 8, as shown by the dotted lines in Fig. 6, and their original positions as shown by the solid lines, is the same on each side of the car.

There are several conclusions to be drawn from the fact that the members 23 and 24 are inclined equal angles Y from their original positions. One is that the load is equally distributed upon each of the stiles 23 and 24 and, therefore, the supporting forces exerted by the guide rails which they engage are equal. Another is that, for the same load W, (other conditions being the same in the two cases), the supporting forces exerted by the guide rails engaging the stiles 23 and 24 in Fig. 6 are about one-half of the force exerted by the one guide rail, which stile 23 engages in Fig. 5. Another is that there is no distortion of the shape of the car, as in Fig. 5.

It will, therefore, be seen that my invention comprises an elevator car having two interfastened members, connecting diagonally opposite corners of the car platform, which effect an inherent rigidity of the car platform and the car itself and cause an equal distribution of stresses between the stiles on each end of the car and the guide rails which they engage, as well as prevent distortion of the car and platform by unsymmetrical loading of the car and platform.

Furthermore, my invention comprises an elevator car platform in which a third structural member is joined to two intersecting members connecting diagonally opposite corners of the platform at the intersection of the latter two members without sacrificing any of the strength of the joint.

I do not wish to be restricted to the specific structural details and arrangement of parts, as herein set forth, since other modifications thereof may be effected without departing from the spirit and scope of my invention. I desire, therefore, that only such limitations shall be imposed as are set forth in the appended claims.

I claim as my invention:

1. In an elevator, a car including a platform comprising structural members defining a quadrangular frame and additional intersecting members fastened together at their intersection for connecting diagonally opposite corners of said frame to give inherent rigidity to said frame, and a supporting sling for said platform, said sling comprising a member disposed to pass through the intersection of said intersecting members.

2. In an elevator, a car including a platform comprising structural members defining a quadrangular frame, a supporting sling for said platform disposed perpendicularly thereto and comprising a pair of stiles, a crosshead connecting the top ends of said stiles, a safety plank connecting the bottom ends of said stiles and fastened to said platform, bracing members connecting said platform and said stiles, intersecting members fastened together and connecting diagonally opposite corners of said quadrangular frame to distribute mechanical stresses and impart an inherent rigidity to said car, the said safety plank extending through the intersection of said intersecting members.

3. In an elevator, a car including a platform comprising structural members defining a quadrangular frame, a supporting sling for said platform disposed perpendicularly thereto and comprising a pair of stiles, a crosshead connecting the top ends of said stiles, a safety plank connecting the bottom ends of said stiles and fastened to said platform, bracing members connecting said platform and said stiles, intersecting members fastened together and connecting diagonally opposite corners of said quadrangular frame to distribute mechanical stresses between said pair of stiles and impart an inherent rigidity to said car, the said safety plank passing through the intersection of said intersecting members and fastened thereto.

4. In an elevator system, means defining a hatchway, a car movable therein, means for moving said car, guide rails mounted in said hatchway for guiding said car, said car including a platform comprising structural members defining a quadrangular frame, said car also including a supporting sling for said platform disposed perpendicularly thereto and comprising a pair of spaced-apart stiles which engage said guide rails, a crosshead connecting the top ends of said stiles, a safety plank connecting the bottom ends of said stiles and fastened to said platform, said car also including bracing members connecting said platform and said stiles and intersecting members fastened together and connecting diagonally opposite corners of said quadrangular frame to distribute mechanical stresses between said pair of stiles and thereby impart an inherent rigidity to said car, the said safety plank extending through the intersection of said intersecting members.

5. In an elevator system, a means defining a hatchway, a car movable therein, guide rails mounted in said hatchway for guiding said car, said car including a platform comprising structural members defining a quadrangular frame, said car also including a supporting sling for said platform disposed perpendicularly thereto and comprising a pair of spaced-apart stiles which engage said guide rails, a crosshead connecting the top ends of said stiles, a safety plank connecting the bottom ends of said stiles and fastened to said platform, said car also including bracing members connecting said platform and said stiles and intersecting members fastened together and connecting diagonally opposite corners of said quadrangular frame to distribute the mechanical stresses between said pair of stiles and impart an inherent rigidity to said car, the said safety plank extending through the intersection of said intersecting members and fastened thereto.

6. A platform comprising a quadrangular frame and interfastened intersecting structural members disposed to rigidly connect diagonally opposite corners of said frame, said structural members each having an opening extending transversely therethrough at the intersection thereof to provide a passageway through the intersection.

7. A platform comprising a quadrangular frame and interfastened intersecting structural members disposed to rigidly connect diagonally opposite corners of said frame, said structural members each having an opening extending transversely therethrough at the intersection thereof in substantially symmetrical relation to the neutral axis of the corresponding member, the openings cooperating to provide a passageway through the intersection.

In testimony whereof, I have hereunto subscribed my name this 12th day of December, 1929.

WALTER H. HIMES.