Dec. 27, 1966 J. H. VAN MOSS, JR 3,294,036

FLOOR CONSTRUCTION

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Fig. 1.

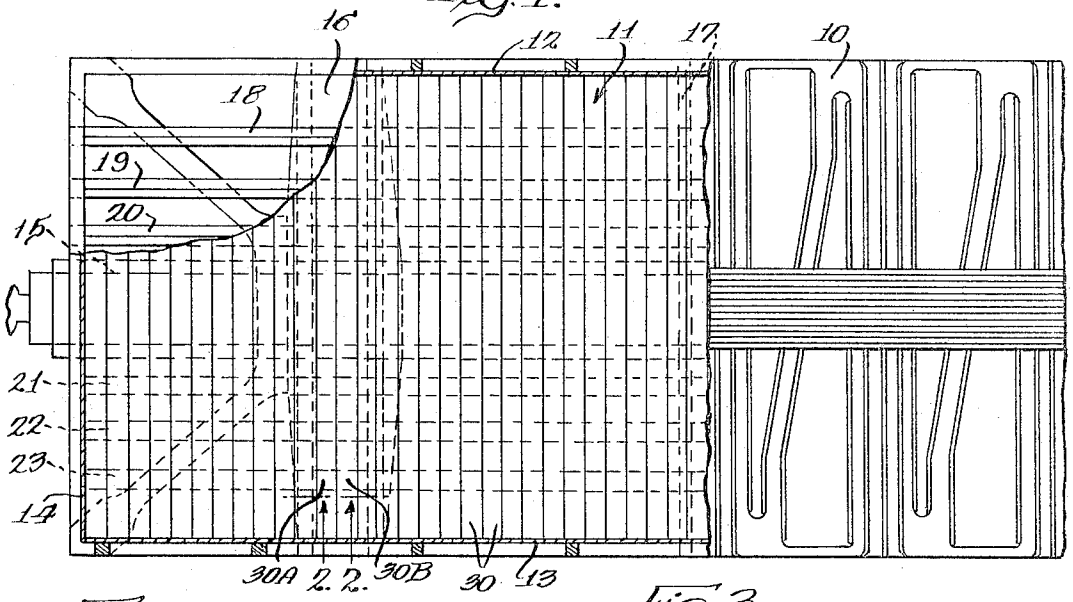


Fig. 2.

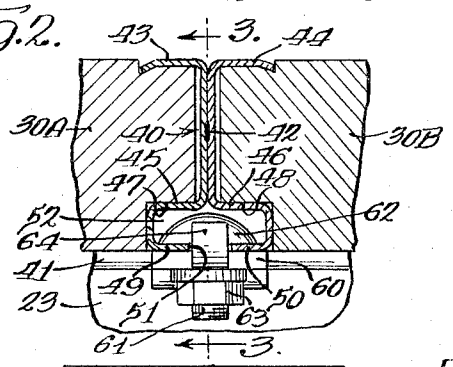


Fig. 3.

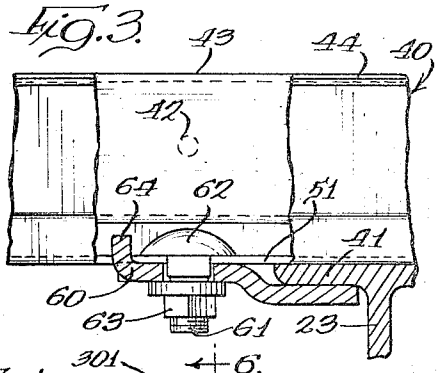


Fig. 4.

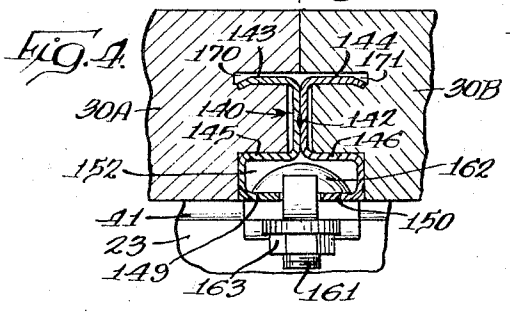


Fig. 5.

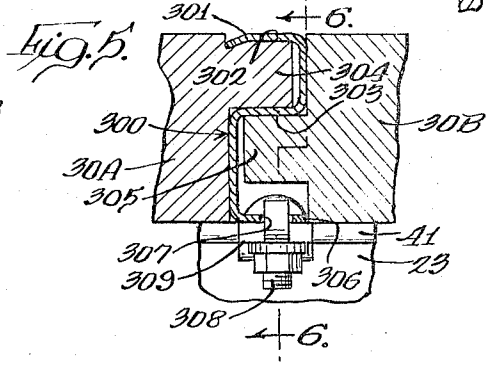
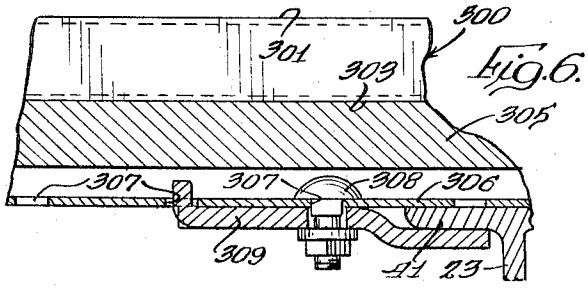


Fig. 6.



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FLOOR CONSTRUCTION

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Fig. 7.

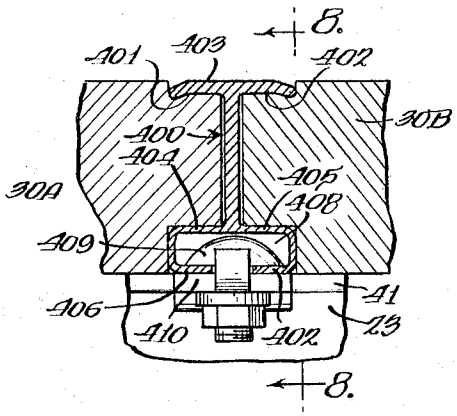


Fig. 9.

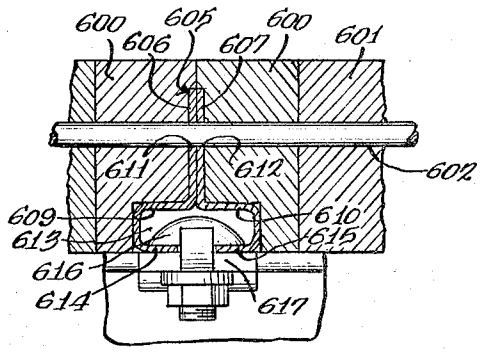


Fig. 8.

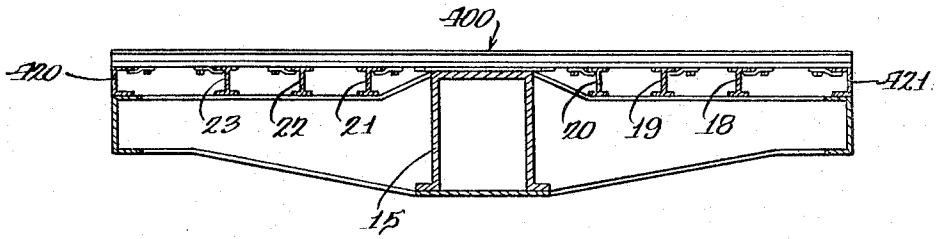
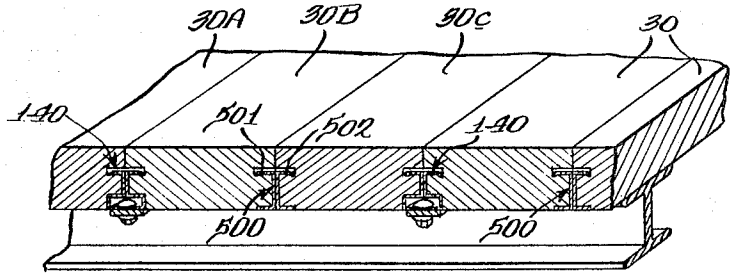


Fig. 10.



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FLOOR CONSTRUCTION

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Fig. 11.

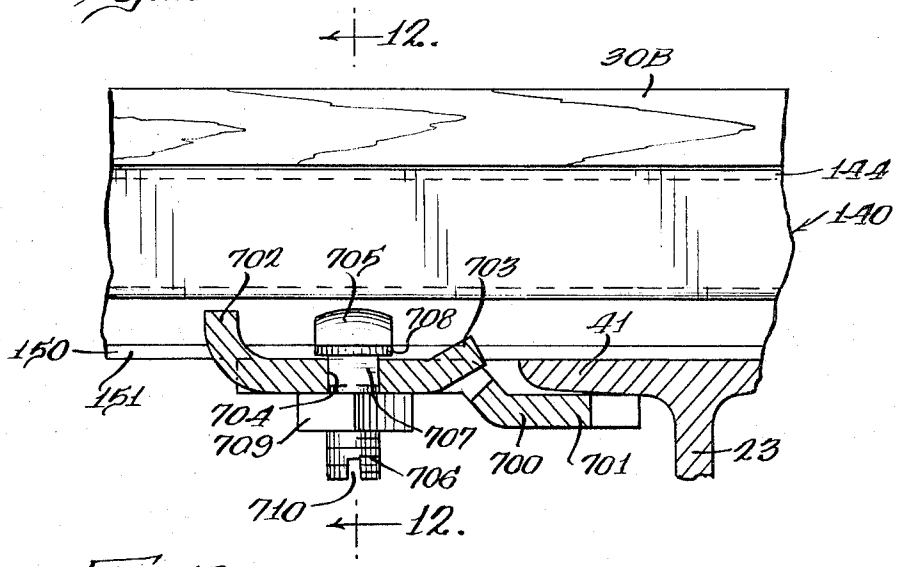


Fig. 12.

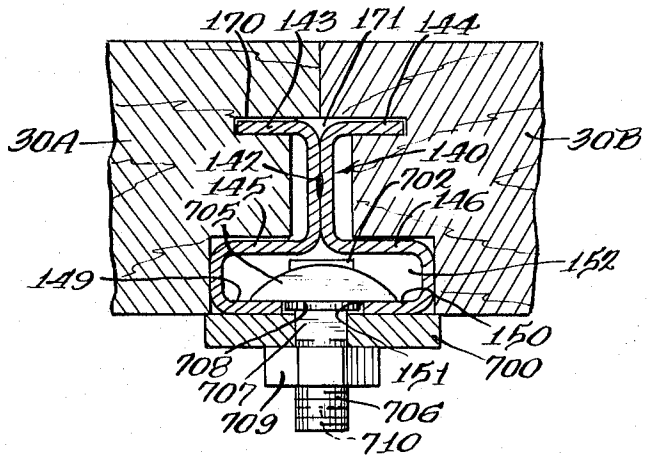
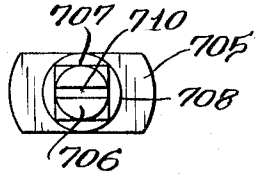


Fig. 13.



United States Patent Office

3,294,036

Patented Dec. 27, 1966

3,294,036

FLOOR CONSTRUCTION

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Filed Sept. 9, 1965, Ser. No. 492,970
6 Claims. (Cl. 105—422)

This application is a continuation-in-part of application Serial No. 409,191, filed November 5, 1964, now abandoned.

This invention relates to flooring structure and more particularly to such flooring usable in the transportation and containerization fields and also for industrial flooring.

In the foregoing fields and particularly with railroad box cars, problems are being encountered with ever-increasing loading particularly that encountered when the car is being loaded by wheeled lift trucks. Added overall strength is required. Added desirable features are smooth floor surfaces with maximum strength, and increase in the total cube or cubic footage available within the car. The obvious solutions that have been practiced embody the use of thicker floors for added strength with the resultant disadvantage of having a reduction in the cubic footage within the car or providing various structures of stronger wood built up and glued or interlocked which add to the expense due to the use of more costly woods and construction thereof for assembly.

An object of this invention is to provide flooring structure which can take heavier loads with no decrease in available cubic footage and which have minimum thickness while having a smooth upper surface and no protrusions for damage to material supported on the flooring.

Another object of the invention is to provide a flooring structure having one or more stiffening members which supplement the strength of the normal flooring and which hold down the flooring to the underframe without any bolting or other similar type of attachment directly to the wooden floor members.

Still another object of the invention is to provide a flooring structure permitting a customary type of installation in which the floor boards are pushed together by pressure and fastened to an underframe while under pressure while permitting replacement of floor boards in a simple manner and wherein the boards are fastened to the underframe without any structure capable of working above the flooring surface due to vibration.

An additional object of the invention is to provide a flooring structure comprising a combination of floor boards extending in parallel relation with a plurality of stiffening members, and each stiffening member located between a pair of adjacent boards with the widths of the floor boards being related to the spacing of the stiffening members whereby the stiffening members add to the strength of the floor boards to support substantial loads particularly as encountered in loading of a railroad boxcar, with at least some of the stiffening members being attached to an underframe structure to hold down the flooring with this attachment embodying clips connected to the stiffening member by fasteners universally adjustable along the length of the stiffening member for proper positioning relative to an attaching member of the underframe structure.

A further object of the invention is to provide a flooring structure for a railroad boxcar or the like comprising, a series of boards extending in parallel relation, a support beam positioned beneath the flooring and extending in a direction normal to the length of said boards for supporting engagement with said boards, and means for holding the boards associated with the beam including a stiffening member positioned between and extending for substantially the entire length of a pair of boards and interlocked therewith, said stiffening member having a hollow interior with a pair of spaced apart flanges extending lengthwise along the lower part thereof providing a slot therebetween for access to the interior of said member, a clip for fastening said member to said beam, and fastening means connecting the clip to said member including an element having a head positioned in the interior of said member and supported by said flanges whereby the clip and element are adjustable along said slot and flanges to the location of said beam.

Still another object of the invention is to provide a flooring structure which can have all the floor boards and stiffening members positioned in assembled relation and an attaching clip and bolt structure can then be associated with the stiffening members from beneath the stiffening members by use of an insertable T-shape bolt having an elongate head to fit within the stiffening member and then be rotated to holding position, and a multi-sided section on the bolt body to engage a multi-sided opening in the clip with the clip engaging the stiffening member to hold the clip and bolt against rotation while a nut is attached to the bolt to hold the parts in assembled relation.

Further objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a partial plan view of a railroad boxcar with a part of the top broken away at the left-hand part of the figure and with a part of the flooring broken away at the upper left corner of the figure;

FIG. 2 is a vertical section on an enlarged scale taken generally along the line **2—2** in FIG. 1;

FIG. 3 is a vertical section taken generally along the line **3—3** in FIG. 2 with parts shown in elevation;

FIG. 4 is a view similar to FIG. 2 showing a second embodiment of the stiffening member utilized in the invention;

FIG. 5 is a view similar to FIG. 2 showing a third form of the stiffening member;

FIG. 6 is a vertical section taken generally along the line **6—6** in FIG. 5;

FIG. 7 is a view similar to FIG. 2 showing a fourth embodiment of the invention;

FIG. 8 is a transverse section taken through the flooring and underframe structure of a railroad boxcar showing the stiffening member of FIG. 7 as taken generally along the line **8—8** in FIG. 7;

FIG. 9 is a view similar to FIG. 2 showing a fifth embodiment of the invention;

FIG. 10 is a perspective view of an alternate form of flooring structure shown fragmentarily in which stiffening members provided with hold-down structure are shown alternated with stiffening members not having hold-down structure;

FIG. 11 is a vertical central section of the second embodiment of the invention with a different clip and attaching bolt structure;

FIG. 12 is a vertical section taken generally along the line **12—12** in FIG. 11; and

FIG. 13 is a bottom plan view of the attaching bolt.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail an embodiment of the invention together with modifications thereof with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated. The scope of the invention will be pointed out in the appended claims.

The invention disclosed herein has uses in various applications where flooring structure of substantial

strength and having other desirable features is required. Such uses are industrial flooring and containers and for the purpose of describing the invention it is shown embodied in a railroad boxcar.

A portion of a boxcar is shown in FIG. 1 in which the car has a roof **10** broken away to show interior flooring structure **11** with side walls **12** and **13** and end wall **14**. The car has underframe structure including a center sill **15** extending longitudinally of the car with cross bearers **16** and cross ties **17** extending transversely of the car and supported by the center sill **15**. Under present requirements for new railroad boxcars a plurality of stringers extend longitudinally of the car with stringers **18**, **19** and **20** extending in spaced apart relation along and to one side of the center sill **15** and stringers **21**, **22** and **23** extending along the length of the car at the other side of the center sill **15**. Each of the stringers is formed as a beam with a laterally extending flange at the upper end thereof with an I-beam being typical of such a stringer. The lower flange of the beams rests on the cross bearers and cross ties as shown more particularly in FIG. 8.

It is known in the art to have decking or floor structure supported upon the stringers in the form of boards extending transversely of the car. In the invention embodied herein floor boards are used extending transversely of the car with these boards identified at **30**. For purposes of describing the structure herein with clarity a pair of adjacent boards are referred to as **30A** and **30B** with this pair of boards forming with a stiffening member to be described a more sturdy and economical construction than heretofore known.

Referring to FIGS. 2 and 3, a first embodiment of the new and improved flooring structure is shown in which a stiffening member indicated generally at **40** is positioned between the adjacent floor boards **30A** and **30B** with this structure shown in association with the stringer **23** having a flange **41**. The stiffening member **40** is formed with a body having two parts of generally mirror-image sections suitably secured together by means of welding as indicated at **42**; however, the connection could be formed in other suitable ways and the section could either be hot rolled or extruded. The stiffening member **40** has three pairs of oppositely directed flanges with the flanges **43** and **44** being adjacent the upper end of the member and positioned to overlie parts of the adjacent boards **30A** and **30B**. The boards are slightly recessed as shown in FIG. 2 whereby the flanges **43** and **44** may lie flush with the top surfaces of the boards. These flanges function to hold down the boards as more fully described subsequently.

A second pair of oppositely extending flanges **45** and **46** provide bearing support for surfaces **47** and **48** of the floor boards. The third pair of flanges **49** and **50** extend toward each other in spaced apart relation to define a slot **51** along the length of the stiffening member. Additionally, the flanges **49** and **50** engage against the top flange of the stringers **18–23** to provide support for the stiffening members and the floor boards.

The stiffening member **40** extends across the width of the car and thus is substantially the same length as the floor boards and extends to side sills at the floor of the car. The stiffening member has part of its body formed with a hollow interior indicated at **52** with the slot **51** providing continuous access to the interior along the entire length of the stiffening member. The stiffening member with the flanges provides substantial beam strength to add greatly to the over-all strength of the floor with minimum cost.

Referring particularly to FIG. 8 showing a transverse section through the floor of the car with a different embodiment of stiffening member, it will be noted that a load exerted to the left of the center sill **15** will result in a lifting force on the part of the floor lying to the right of the center sill. In order to provide maximum strength this lifting force must be recognized and for this purpose at least a substantial number of the stiffening members are tied down to the stringers.

This tie-down is accomplished by means of a clip **60** having a generally planar body with an aperture through which the shank **61** of a threaded fastener such as a carriage bolt extends with the head **62** of the bolt lying within the interior **52** of the stiffening member and captured by the flanges **49** and **50** thereof. This enables free movement of the clip **60** along the length of the stiffening member **40** until a flange **41** of a stringer is encountered and the carriage bolt nut **63** can then be tightened as shown in FIG. 3. To facilitate quick assembly, the clip **60** has an upturned end **64** engageable within the slot **51** of the stiffening member to prevent rotation of the clip during tightening of the nut **63** as well as during adjusting movement of the clip along the stiffening member.

A second embodiment of the invention is shown in FIG. 4 in which parts have been given the same reference numeral as the parts in the embodiment of FIGS. 1, 2, and 3, but of the **100** series. The principles of the embodiment shown in FIG. 4 are the same as with respect to the embodiment of FIG. 2; however, the stiffening member **140** is of a lesser height with adjacent board members **30A** and **30B** having recesses **170** and **171** formed at a depth beneath the top thereof to receive the flanges **143** and **144**.

A third embodiment of the invention is shown in FIGS. 5 and 6 which has a number of advantages but does not have the full universal clip adjustment of the previously described embodiments. In this embodiment, the stiffening member indicated generally at **300** is formed as a single member having a top flange **301** engaging a recessed surface **302** in the floor board **30A**. An intermediate flange **303** provides a bearing support for a projection **304** of the floor board **30A** and a hold-down member for the floor board **30B** by engaging a projection **305** of the latter board. A lower flange **306** rests against the flange **41** of the stringer **23** and as shown in FIG. 6 is provided with a series of openings **307** along the length thereof for receiving a fastener **308** for the attaching clip **309** with the clip and fastener structure being comparable to that described in the preceding embodiments.

A fourth embodiment is shown in FIG. 7 which is generally comparable to the embodiments of FIGS. 2 and 4, but shows a stiffening member **400** which is formed as an integral extrusion with the upper hold-down flanges **401** and **402** joined by a tying section **403**. In this form, the floor boards **30A** and **30B** have the top recesses formed to a depth twice the thickness of the material to provide for the tying section **403** to lie flush with the tops of the floor boards. This embodiment has the bearing flanges **404** and **405** extending oppositely from each other as well as the support flanges **406** and **407** which rest on the flange of the stringer and which define an interior **408** for receiving the fastener **409** to which the clip **410** is connected for hold-down of the stiffening member **400** and the floor boards.

Any of the foregoing structures are suitable for use with solid lumber boards or with manufactured boards of glued-together edge grain lumber components.

A transverse section through the car is shown in FIG. 8 in which the stiffening member **400** shown in FIG. 7 is tied down to the stringers **18–23** as well as to the side sills **420** and **421**. It will be apparent from this view that the stiffening members contribute greatly to the over-all strength of the floor boards to thus provide a flooring structure which can handle increased loads while using floor board lumber of no greater thickness than the past or possibly lumber of a lesser thickness. Additionally, with the added strength provided by the stiffening members the boards can be of a minimal width to provide for full utilization of the strength of the stiffening members.

In situations where it is not necessary to provide for tie-down of each stiffening member, it is possible to use alternate stiffening members having tie-downs with inter-

mediate stiffening members omitting tie-down structure with this arrangement being shown in FIG. 10 utilizing the stiffening member of the embodiment shown in FIG. 4.

In FIG. 10, a series of floor boards **30** are shown again with boards **30A** and **30B** having a stiffening member **140** disposed therebetween while the board **30B** and the next adjacent board **30C** have a stiffening member indicated generally at **500**. The member **500** has the lateral flanges **501** and **502** fitting within recesses of the boards and base flanges **503** and **504** to provide added strength. The stiffening member does not have any provision for the clips and clip fasteners as described in the preceding embodiments and, thus, is a simpler shape.

One additional embodiment of the invention is shown in FIG. 9 wherein the floor boards are formed of a series of relatively narrow boards, such as **600** and **601**, which are connected by a dowel, as indicated at **602**, to make a manufactured board. The stiffening member indicated generally at **605** includes a pair of upstanding walls **606** and **607** with a pair of oppositely-extending flanges **609** and **610** providing bearing support for the composite boards. The walls **606** and **607** are provided with openings **611** and **612**, respectively, through which the dowel rod **602** extends whereby the composite boards are tied down to the stiffening member so that the stiffening member provides for hold-down as well as added strength. Additionally, this stiffening member **605** is provided with the interior opening **613** and a pair of spaced-apart flanges **614** and **615** defining therebetween a slot for access of a headed fastener **616** for connecting a clip **617** to the stiffening member **605**.

As will be evident from the foregoing embodiments of the invention, a structure has been provided which can be simply formed as an extrusion or roll-formed member from medium gauge material which can be associated with existing floor board structures with only slight modifications thereto to provide added strength to existing dimensions of floor board lumber or provide the same strength with floor boards of reduced thickness when desired additions to total cubic footage of the car are required. The stiffening member can be shaped of a height to coact with the desired thickness of floor board lumber. The stiffening members also provide maximum over-all strength by including a tie-down or hold-down function with the provision for universally adjustable clips and clip fasteners which interconnect the stiffening members to the supporting stringers of a railroad boxcar as an example to prevent upward movement of the flooring at a location remote from the actual loading.

All of the foregoing is accomplished without the use of any fasteners extending to the surface of the flooring or where objectionable snagging or damage to material within the car could occur due to working loose of various fasteners such as screws or bolts. Added strength provided by the stiffening members have added utility in requirements for updating older boxcar construction. Although the present standards require a plurality of stringers at opposite sides of the center sill, frequently old cars do not have the requisite number and must be reconstructed. With the stiffening members of this invention it is possible to provide the required strength with the lesser number of stringers and thus provide an up-to-date strength car without extensive modifications to the underframe support structure.

On occasion it is desirable to preassemble the floor boards **30** and the stiffening members before associating any attaching structure therewith. In order to accomplish this a structure is provided as shown in FIGS. 11 to 13 in which the stiffening member is basically the same as the stiffening member **140** shown in FIG. 4.

In order to attach the attaching structure to the stiffening member after assembly of the stiffening members and floor boards, a different form of clip and attaching member are provided. A clip **700** has a generally planar body with an offset section **701** to engage under the flange **41** of the stringer. A pair of upstanding tabs **702** and **703** extend upwardly from the clip body to engage within the slot **151** formed along the length of the stiffening member along the bottom thereof. These two tabs lie at opposite sides of a multi-sided bolt receiving opening **704**. With the tabs **702** and **703** providing two point contact with the stiffening member, the clip is held against rotation during assembly of the bolt thereto.

The attaching member can be a bolt or rivet and as shown herein is in the form of a bolt. The bolt has a T-shape with a narrow elongate head **705** having a width slightly less than the width of the slot **151** whereby the head can be aligned with the slot and then inserted into the chamber **152**. The bolt is then turned 90 degrees to have the length of the head overlie the flanges **149** and **150** as shown in FIG. 12. The body of the bolt has a threaded section **706** and immediately adjacent the threaded section is a multi-sided section **707** which is preferably square in cross section, engaging the similarly shaped opening **704** in the clip **700**. A cylindrical section **708** is positioned between the head **705** and the square section **707** to engage in the slot between the flanges **149** and **150** and provides a guide for the bolt. The bolt is held in assembled relation to the clip by a nut **709** threaded onto the threaded section of the bolt.

The lower end of the bolt is slotted as shown at **710** with the slot being aligned with the elongate length of the head **705** whereby the slot provides an indication when the head is positioned transversely of the slot in the stiffening member.

In use of the construction disclosed in FIGS. 11 to 13, a bolt is first associated with the stiffening member by having the head **705** aligned with the slot and then the bolt is rotated to have the head **705** lie across the flanges **149** and **150** as indicated by slot **710**. The clip **700** is then placed on the bolt with the opening **704** in the clip fitting on the square section **707** of the bolt and with the tabs **702** and **703** in the slot **151** of the stiffening member. This places the clip flange **701** under the flange **41** of the stringer and holds the clip and bolt in non-rotative relation. The nut **709** can then be threaded onto the bolt with the parts inherently held against rotation. Prior to placement of the nut on the bolt the proper orientation of the bolt can be checked by the position of the slot **710**. If a rivet is used in place of a bolt, the nut **709** would not be required.

I claim:

1. A flooring structure having at least a major part of the surface thereof formed of wood or the like comprising, a series of integral boards of wood or the like extending in parallel relation, a support beam positioned beneath the flooring and extending in a direction normal to the length of said boards for supporting engagement with said boards, and means for holding the boards associated with the beam including a stiffening member positioned between and extending for substantially the entire length of a pair of boards and interlocked therewith, said stiffening member having a shape providing a central web, a pair of hold-down flanges at the upper portion of the web extending outwardly therefrom in opposite directions in back-to-back relation and overlappingly engaging one with each of a pair of adjacent boards to hold said pair of boards in association with said beam, said stiffening member having a first pair of support flanges spaced from said hold-down flanges and extending outwardly from said web and each of said first pair of support flanges supporting one of said pair of adjacent boards, said stiffening member having a second pair of support flanges spaced from said first pair of support flanges to define therewith a hollow interior, said second pair of support flanges resting upon said beam and having edges spaced from one another to provide a slot therebetween for access to the interior of said member, a clip for fastening said member to said beam, and fastening means connecting the clip to said member

including an element having a head positioned in the interior of said member and supported by said last named support flanges whereby the clip and element are adjustable along said slot and last named support flanges to the location of said beam.

2. A flooring structure as defined in claim 1 in which each flange of said first pair of support flanges supportingly engages a rib intermediate the tops and bottoms of an adjacent board.

3. A flooring structure having the exposed surface entirely of wood or the like comprising, a series of boards extending in parallel abutting relation, said boards each having a recess along an edge thereof beneath the top surface and extending for the length thereof, a series of support beams positioned beneath the flooring and extending in a direction normal to the length of said boards for supporting engagement with said boards, and means for strengthening and holding the boards associated with the beams including a stiffening member positioned between and extending for the length of a pair of boards, said stiffening member having a central web with hold-down flanges extending outwardly from said web adjacent the upper portion thereof and engaged in said recesses for interlocking said boards and stiffening member, said stiffening member having a hollow interior defined by a first pair of support flanges extending outwardly of said web below said hold-down flanges and a second pair of support flanges below said first pair of support flanges, said first pair of support flanges having adjacent boards resting thereon and said second pair of support flanges resting on said beams and being spaced apart to provide a slot therebetween for access to the interior of said member, a clip for fastening said member to one of said beams, and fastening means connecting the clip to said member including an element having a head positioned in the interior of said member and supported by said last named support flanges whereby the clip and element are adjustable along said slot and last named support flanges to the location of said beam.

4. A decking for a railroad car in which said car has a center sill with cross bearers and cross ties, and a series of stringers with flanges extending for the length of the car and supported on said cross bearers and cross ties, comprising, a series of boards extending transversely of the car in side-by-side abutting relation and supported by said stringers, said boards each having a recess along an edge thereof beneath the top surface of the board and extending for the length thereof, a plurality of stiffening members positioned one between a pair of boards, said stiffening members each having a central web with a pair of hold-down flanges extending outwardly from the web adjacent the upper end thereof and positioned in the recesses of an abutting pair of boards and above coacting surfaces on adjacent boards for hold-down of the boards, said stiffening members each having a hollow interior below said hold-down flanges and defined by a first pair of spaced apart support flanges resting on said stringers and defining a slot for access to said interior, and a second pair of support flanges extending outwardly from said web above said first pair of support flanges, said second pair of support flanges being positioned beneath coacting surfaces on adjacent boards for bearing support of said boards, a headed clip fastener positioned in said slot for adjustment along the length thereof, and a clip connected to said fastener for engagement beneath the stringer flange.

5. A flooring structure for transportation of commodities, said structure being formed primarily of lumber and having strength far in excess of the lumber and without exposed fasteners for the lumber which could work loose comprising, a series of integral lumber boards disposed adjacent to each other with adjacent boards each having a recessed portion and a rib therebeneath extending for the length thereof, a reinforcing member positioned between adjacent boards constructed to stiffen the boards and provide holddown means for the boards, each of said members having a central web with a pair of oppositely extending hold-down flanges extending outwardly therefrom adjacent the upper portion thereof and fitted over the recessed portions to overlap the boards and hold down the boards, a first pair of oppositely extending support flanges extending outwardly from said web below said hold-down flanges and positioned beneath said ribs for bearing support of the boards, and a second pair of support flanges below said first pair of support flanges and adapted to rest on an underlying support, said second pair of support flanges being spaced apart in the area of said underlying supports to provide a slot therebetween for access to the interior of said member, clip fastener means positioned in said slot for adjustment in the slot to a position adjacent the underlying support and a clip connected to said fastener means and adapted to engage the underlying support.

6. A flooring structure as defined in claim 5 wherein said recessed portions are beneath the top of the boards and open to side edges thereof whereby the hold-down flanges are beneath the surface of the boards and the boards are in abutting relation to define an all lumber top surface for the structure without any top exposure of the reinforcing member.

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2,909,054	10/1959	Phillips	189—35
2,963,751	12/1960	Mancini	52—497
3,080,021	3/1963	Muir	105—422 X
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ARTHUR L. LA POINT, *Primary Examiner.*

DRAYTON E. HOFFMAN, *Examiner.*