April 22, 1941. N. A. THUNSTROM 2,239,634

UNDERFRAME CONSTRUCTION

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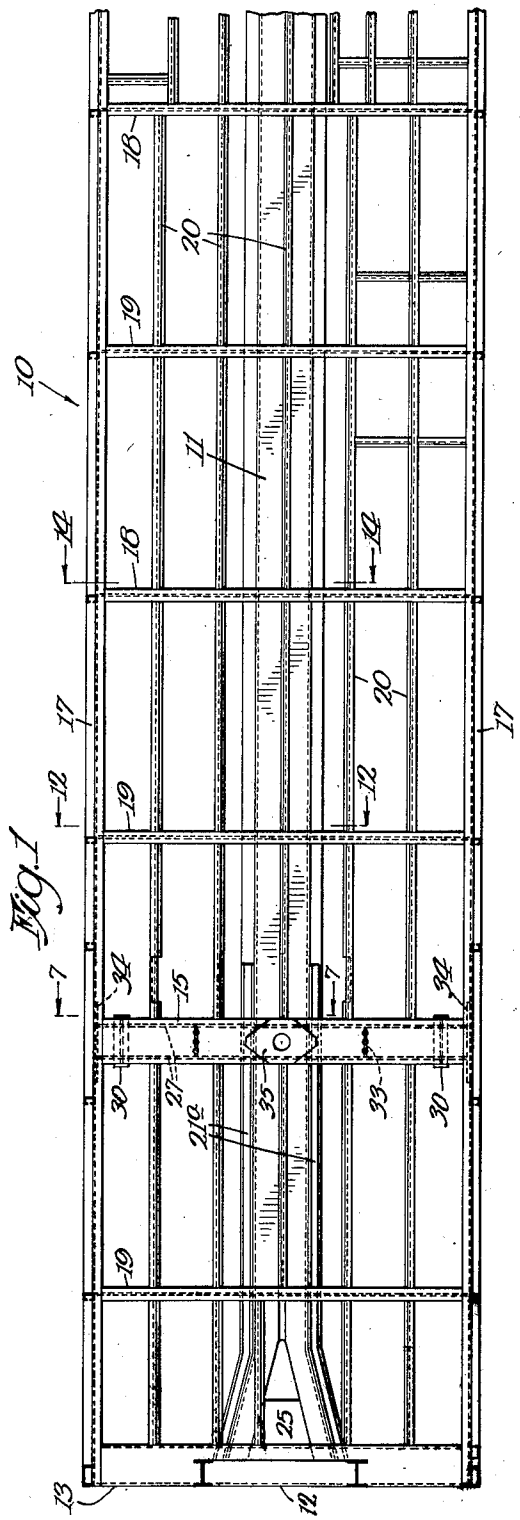


Fig. 1

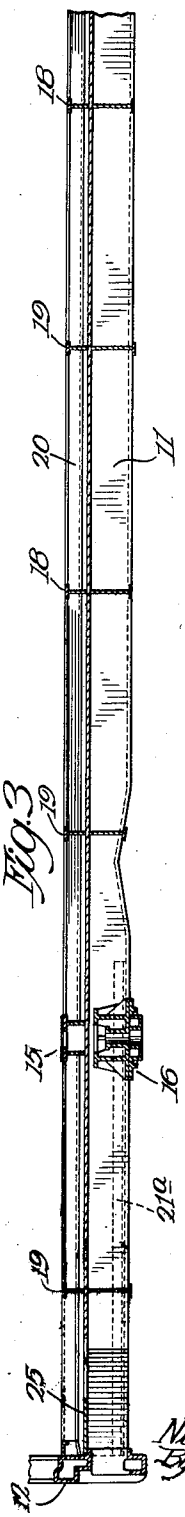


Fig. 3

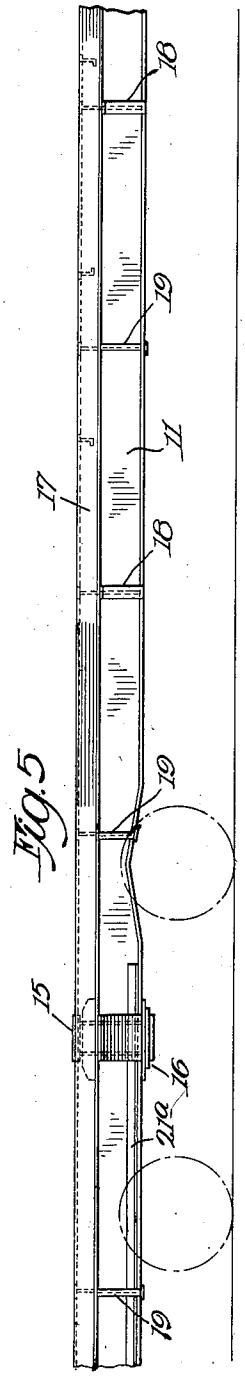


Fig. 5

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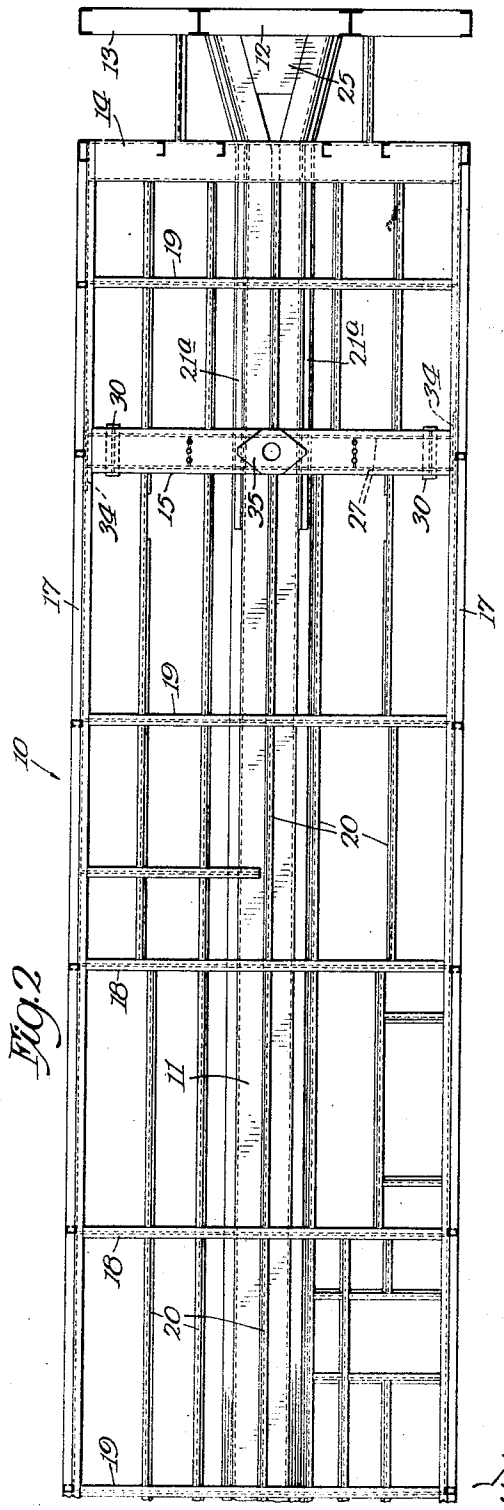


Fig. 2

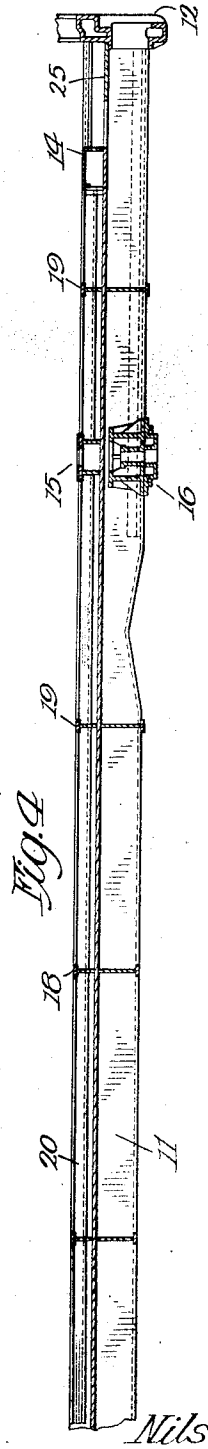


Fig. 4

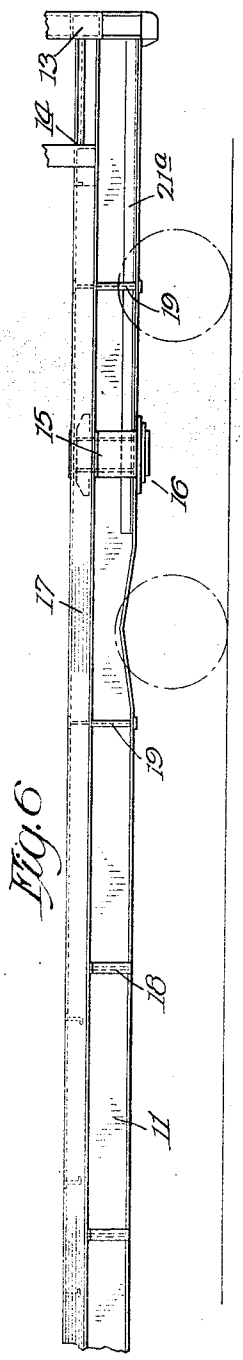


Fig. 6

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UNDERFRAME CONSTRUCTION

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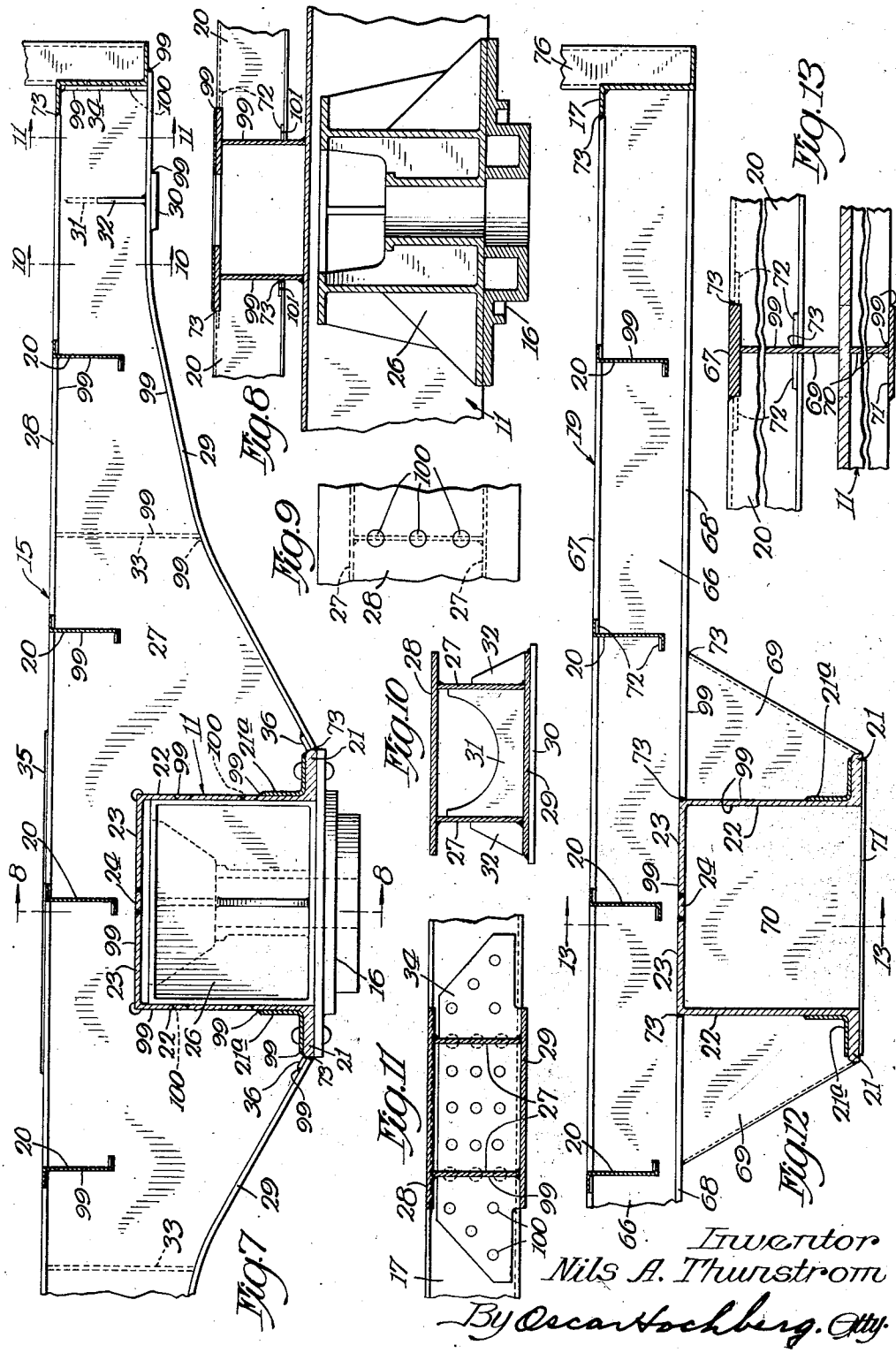


Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

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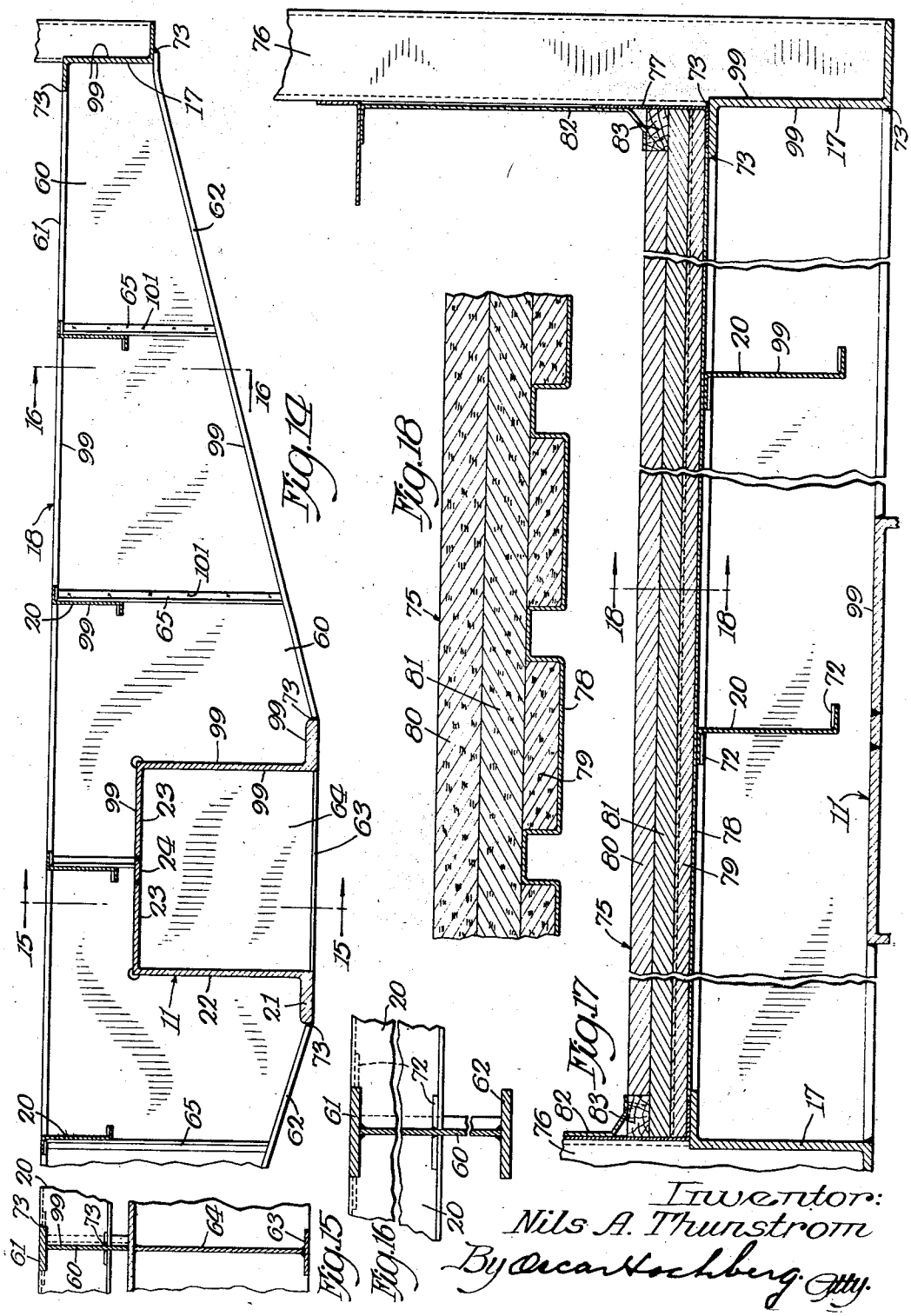


Fig. 15

Fig. 16

Fig. 17

Fig. 18

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UNDERFRAME CONSTRUCTION

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Fig. 19

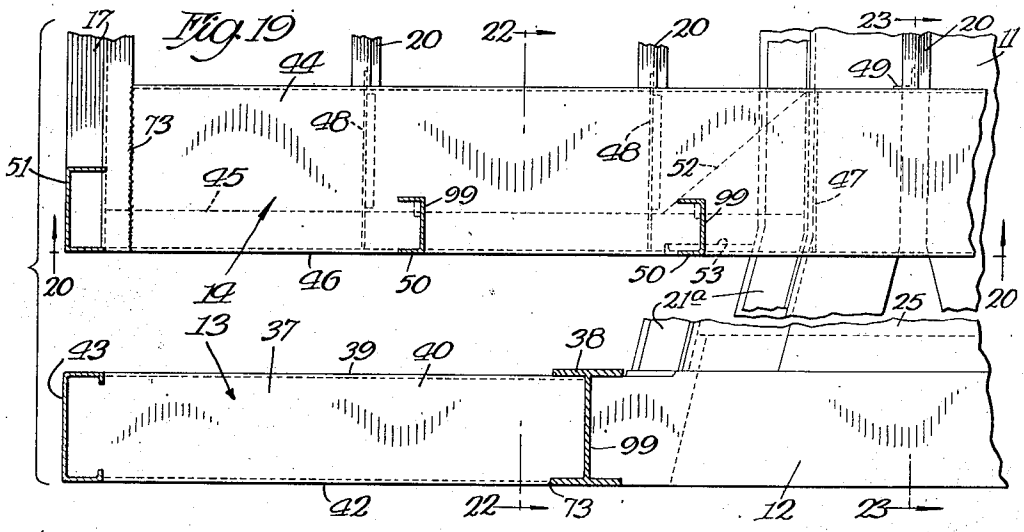


Fig. 20

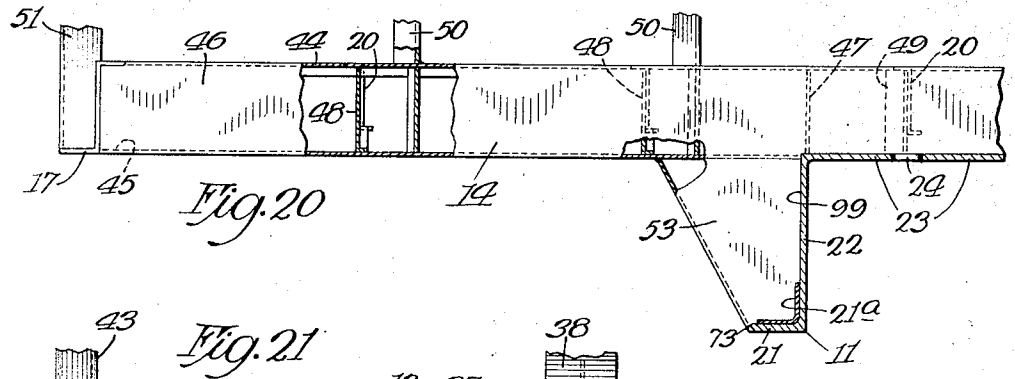


Fig. 21

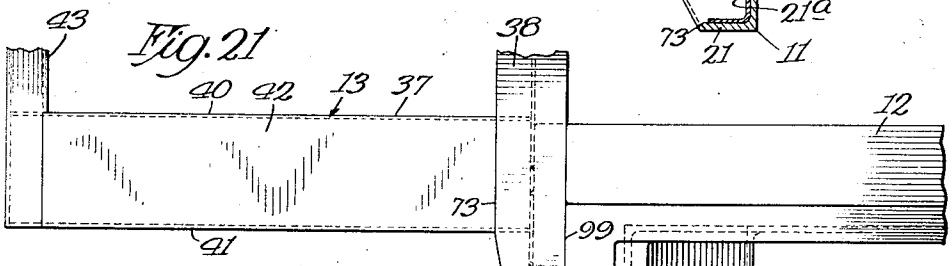
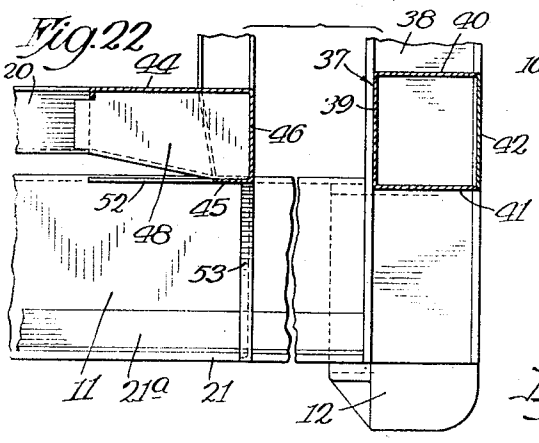
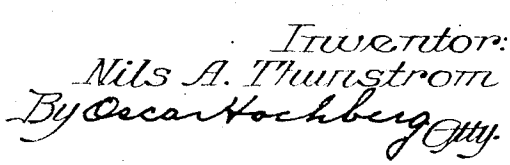


Fig. 22





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UNDERFRAME CONSTRUCTION

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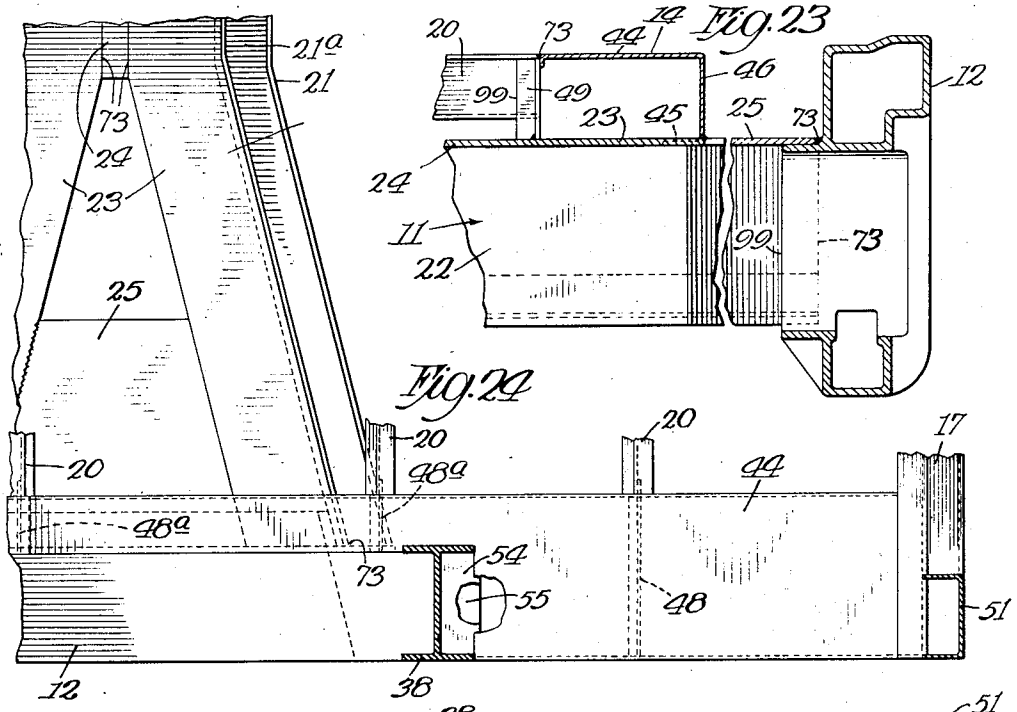


Fig. 24

Fig. 23

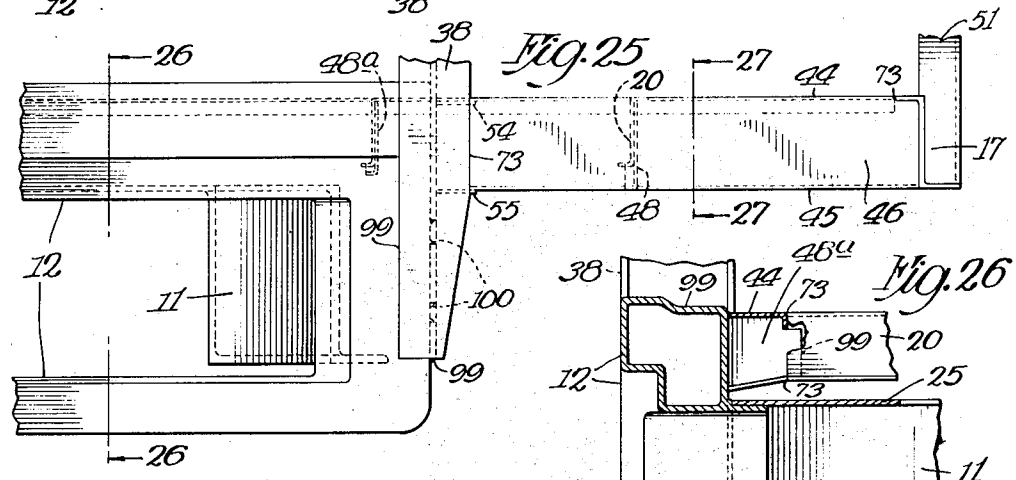


Fig. 25

Fig. 26

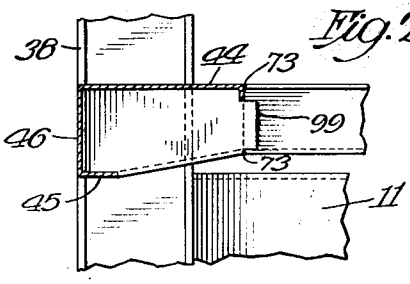


Fig. 27

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Patented Apr. 22, 1941 2,239,634

UNITED STATES PATENT OFFICE

2,239,634

UNDERFRAME CONSTRUCTION

Nils A. Thunstrom, Chicago, Ill., assignor to Pullman-Standard Car Manufacturing Company, Chicago, Ill., a corporation of Delaware

Application October 13, 1938, Serial No. 234,742

20 Claims. (Cl. 105—414)

This invention relates to railway cars and has particular reference to underframe construction therefor.

The principal object of the invention is a construction in which underframe vibrations transmitted to the floor and superstructure are reduced to a minimum and, more specifically, an underframe structure having transverse members flexing sufficiently to prevent transmission of underframe vibrations to the floor.

An important feature of the invention is the provision of an underframe construction particularly adapted for fabrication by welding and including longitudinals and transverse members providing a flush surface for application of a floor.

Another object of the invention is the provision of an underframe having a center sill detached from direct connection with the floor except through flexible transverse webs.

A further object of the invention is the provision of an underframe structure wherein the center sill, in effect, is carried by cross-bearers at spaced intervals and which are so dimensioned as to have greater stiffness acting as beams between side sills than the center sill has acting between cross-bearers, whereby center sill vibrations are rendered of reduced amplitude and increased frequency.

A still further object of the invention is the provision of an underframe comprising longitudinal center and side sills and stringers with transverse members in which the longitudinal stringers are of such dimension as to make feasible the use of a lesser number of transverse members and greater spacing of such fewer members.

The foregoing and other objects are accomplished by the mechanism illustrated in the accompanying drawings, in which—

Fig. 1 is a plan view of approximately one-half of an underframe constructed in accordance with this invention;

Fig. 2 is a plan view of the remaining complemental portion of the underframe;

Fig. 3 is a central, longitudinal, sectional view through the center sill of the portion of the underframe illustrated in Fig. 1;

Fig. 4 is a similar view of the portion of the underframe illustrated in Fig. 2;

Fig. 5 is a side elevational view of a portion of the underframe illustrated in Fig. 1;

Fig. 6 is a similar view of the portion of the underframe illustrated in Fig. 2;

Fig. 7 is a cross-sectional view taken on the line 7—7 of Fig. 1 and illustrating the bolster construction;

Fig. 8 is a longitudinal, fragmentary, sectional view taken on the line 8—8 of Fig. 7 and illustrating the bolster in cross section where it traverses the center sill and also showing the bolster center filler;

Fig. 9 is a fragmentary plan view of a portion of the bolster illustrating the method of welding a bracing member in the bolster;

Fig. 10 is a cross-sectional view through the bolster taken on the line 10—10 of Fig. 7 and illustrating the side bearing construction;

Fig. 11 is a cross-sectional view through the bolster taken on the line 11—11 of Fig. 7 and illustrating the connection to the side sill;

Fig. 12 is a cross-sectional view through the underframe taken on the line 12—12 of Fig. 1 and illustrating a crosstie member;

Fig. 13 is an enlarged, fragmentary, sectional view through the crosstie and center sill taken on the line 13—13 of Fig. 12;

Fig. 14 is a cross-sectional view through the underframe taken on the line 14—14 of Fig. 1 and illustrating a cross-bearer member;

Fig. 15 is a sectional view through the cross-bearer and center sill taken on the line 15—15 of Fig. 14;

Fig. 16 is a sectional view through the cross-bearer taken on the line 16—16 of Fig. 14;

Fig. 17 is a cross-sectional view through the underframe illustrating the floor construction and showing the application of side framing members;

Fig. 18 is an enlarged, fragmentary, detail, sectional view through the flooring taken on the line 18—18 of Fig. 17;

Fig. 19 is an enlarged plan view of the body and buffer end sill construction illustrated in Fig. 2;

Fig. 20 is an end elevational view of the body end sill;

Fig. 21 is an end elevational view of the buffer end sill;

Fig. 22 is a sectional view taken on the line 22—22 of Fig. 19 through the body and buffer end sills;

Fig. 23 is a central, longitudinal, sectional view taken on the line 23—23 of Fig. 19 through the body end sill over the center sill and through the coupler carrier casting;

Fig. 24 is an enlarged plan view of the combination body and buffer end sill at the opposite end of the underframe illustrated in Fig. 1;

Fig. 25 is an end elevational view of the body and buffer end sill illustrated in Fig. 24;

Fig. 26 is a sectional view through the coupler carrier casting and body end sill taken on the line 26—26 of Fig. 25; and

Fig. 27 is a sectional view taken on the line 27—27 of Fig. 25 through the body end sill.

Ordinarily, in the construction of railway cars, the underframe is so designed as to act substantially as a rigid unitary structure in which forces applied to the center sill are distributed to the respective side frames in the most direct manner by means of stiff cross members connected to the center and side sills and wherein the floor is supported on or directly connected with the center sill and, of course, the cross members—whereby objectionable center sill vibrations are transmitted to the floor and superstructure. In the present invention, it is intended that the center sill shall have a certain amount of longitudinal freedom with respect to the floor and superstructure within a range permitted by the flexibility of the webs of the cross members which form the sole means of connection with the center sill, whereby the sill has no direct rigid connection with the floor, and transmission of center sill vibrations thereto is minimized.

The underframe construction of this invention comprises a longitudinal center sill and side sills with transverse connecting members including end sills at the body ends of the frame, bolsters at center plate locations, cross-bearers at predetermined locations in accordance with the type of car, framing, etc., etc., but not exceeding a maximum spacing of approximately twelve to fourteen feet apart, and crossties intermediate the cross-bearers. It is to be understood, of course, that the particular arrangement and location of the various members, as described, might vary in accordance with the type of car involved—as, for instance, room cars, coaches, etc. Floor stringers extend between cross-bearers, crossties, bolsters and end sills in spaced relation transversely of the underframe consistent with the type of flooring used, location of seats, etc., etc., and are of a depth sufficient to reduce, substantially, the number of cross members required to carry the floor load, but none of the stringers is connected to the center sill, wherefore the full flexibility of the webs of the cross members is available for dampening vibrations of the sill. All of the underframe members, aside from the center sill, provide a substantially flush surface for supporting the floor.

The center sill might be termed the "backbone" of an underframe, and one of its primary functions is that of a column transmitting and resisting draft and buffing forces imposed at opposite ends of the sill through suitable draft and buffing gears and also transmitting braking forces, etc., to and from the trucks by means of the usual center plate arrangement, and also is subjected to twisting forces resulting from relative and opposed transverse rocking motions between the body and trucks and other forces imposed thereon due to its load-carrying relationship. All of thus-imposed stresses and deflections give rise to center sill vibrations, some of which are harmonic because of the nature of the actuating forces and which, if not eliminated, give rise to floor vibrations of sufficient frequency and amplitude to be objectionably noticeable. By detaching the center sill from contact or direct connection with the floor except through the webs of the cross members, a great many center sill vibrations are dampened or eliminated through the flexibility of such webs before they become apparent as floor vibrations, and this produces a floor construction in which the possibilities for the development of objectionable vibrations are reduced to a minimum.

As shown in the drawings, the center sill is carried in the webs of the bolsters and cross-bearers and is not connected to the horizontal top flanges of such members but only to the bottom flanges which are offset due to the greater depth of the bolsters and cross-bearers at the center sill, thus permitting restrained longitudinal movement of the center sill as a result of the eccentricity set up in the application of a load from the center sill to the offset bottom flanges, as well as the flexibility of the webs, and whereby the center sill is semi-floating to the extent of the flexibility of the webs and the movement permitted by the offset bottom flanges. The crossties in the underframe are connected to the center sill only by their respective bottom flanges, whereby the full flexibility of the webs is available for permitting longitudinal movement of the center sill. The longitudinal floor stringers do not connect to the center sill at any point and, where a center stringer is necessary, sufficient space is provided between the bottom of the stringer and the top of the center sill to give each member freedom of deflection independently of the other.

In the drawings, 10 represents an underframe having a center sill 11 of inverted, flanged channel configuration extending the full length thereof and rigidly secured, at opposite ends, to coupler carrier end sill castings 12 forming the central portion of the respective buffer end sills 13. The center sill extends in a straight line for the major portion of its length and flares outwardly adjacent the respective ends thereof to the buffer end sills for accommodation of coupler mechanism (not shown). Bolsters 15 traverse the center sill at the points where the underframe is supported on trucks (not shown) by means of the usual center plates 16, and extend between and are secured to the opposite side sills 17, as are the buffer sills 13 and body end sill 14. The particular plan of car for which the underframe illustrated was designed is equipped with only one vestibule end, and, therefore, only one body end sill 14 is illustrated; but in a car equipped with vestibules at opposite ends, the underframe will be substantially symmetrical about a line midway of the length thereof.

Cross-bearers 18 also traverse the center sill at spaced intervals (varying with the type of car) intermediate the bolsters and extend continuously between side sills. Crossties 19 extend across the center sill between side sills intermediate the cross-bearers and between the respective bolsters and body end sill at one end and the buffer end sill at the opposite end. Longitudinally-extending floor stringers 20, paralleling the center and side sills, are continuous between the various cross members 13, 14, 15, 18 and 19 and are secured thereto and serve to support the floor. It is to be noted that the entire underframe is completely assembled by welding, for which the design is particularly suited and which permits full realization of the principles of the invention and by means of which overlapping plate areas, which are necessary to other forms of connections, are avoided, since practically all joints in the present construction are made by direct edgewise connection. All connections between the various members are secured by welding, whereby

the underframe, when completed, is practically integrated as a unit; and throughout the drawings all fillet welds are indicated by the numeral 99, plug welds by 100, spot-welds by 101 and butt welds by 73.

The inverted, flanged, channel-shaped center sill 11 is comprised of a pair of rolled Z members 22 having outwardly-extending, thickened lower flanges 21, which may be augmented in the draft sill area from behind the respective bolsters 15 to the buffer end sills 13 by pressed angle members 21a secured thereto by welding, and upper flanges 23 directed inwardly with their edges connected by a filler plate 24 secured therebetween by welding and extending throughout the straight portion of the sill. At the flared end portions, a plate 25, to the contour of the flare, connects the upper flanges and is also secured by welding. A bolster center filler casting 26 is disposed between the side walls of the sill 11 at the respective bolster positions and is secured by plug welds 100, and serves to reinforce the center sill at the bolster positions and to back up the center plates 16 which are secured to the filler castings and to the lower flanges 21 of the center sill and receive king pins (not shown) locking the car body to supporting trucks.

As shown in Fig. 7, the bolsters 15 are each composed of a plurality of spaced webs 27, continuous across the center sill between the side sills 17, having a top cover plate 28, continuous between side sills, and bottom cover plates 29 extending between the center sill lower flanges 21 and the respective side sills and all integrated by welding. Side bearing plates 30 are welded to the bottom cover plates 29 and reinforced by gusset plates 31 and 32 disposed between the webs 27 and outwardly thereof, respectively, and welded thereto and to the bottom cover plate. Cross webs 33 are disposed between the bolster webs 27 and are attached thereto and to the top and bottom cover plates by welding. It is to be noted that the welded connections to the top cover plate 28 are by means of plug-welds 100 where holes are provided in the top plate directly over the webs 33 and filled in with weld metal to form a connection with the webs 33. End closure plates 34 are provided which are secured to the ends of webs 27 also by plug-welds together with fillet welds 99 and to the webs of the respective side sills 17 by this same method and to the bottom cover plate 29 by fillet welding. The bottom cover plates of the bolster extend beyond the plane of the respective end closure plates beneath the lower flange of the side sills to be secured thereto by fillet welds. The side sills 17 each comprise a rolled Z member with the web, to which the end closure plate 34 is plug-welded, disposed vertically with the horizontal upper and lower flanges extending inwardly and outwardly respectively. The top cover plate 28 extends continuously between the inwardly extending upper flanges of the side sills and is secured thereto by welding. A flat diamond-shaped plate 35 reinforces the top cover plate 28 about the king pin opening and is secured in place by fillet welding about the edges. The bottom cover plates 29, where they are welded to the center sill lower flanges 21, are afforded thickened edge portions for more secure attachment by means of plate members 36 extending across the width thereof and connected thereto by welding.

The buffer end sill 13, at the vestibule end of the underframe, as best shown in Figs. 19 and 21, is comprised of the coupler-carrying end sill casting 12 and box-section wing members 37—all forming an integral part of the vestibule end framing of the car and integrated by welding. The casting 12 is disposed between vertically extending I-beam end posts 38 in interlocking relation with the flanges thereof and welded thereto. The wing members 37 are each composed of a channel-shaped pressing with the web 39 disposed vertically and horizontal upper and lower flanges 40 and 41 extending rearwardly and connected by a closure plate 42 welded to both. The wing members 37 extend between the respective end posts 38 and channel-shaped, vertically disposed vestibule corner posts 43 and interlocked with the flanges of each and secured by welding. The upper and lower flanges 40 and 41 extend between the respective webs of the end posts 38 and corner posts 43, while the web 39 and closure plate 42 merely extend between the respective flanges of such members and at the front afford a flush construction for the application of sheathing. The channel corner posts 43 provide end closure means for the wings 37.

Body end sill 14, as shown in Figs. 19 and 20, is continuous betwen side sills 17 and comprises a generally channel-shaped pressing having a horizontally arranged, relatively deep upper flange 44 terminating in a depending edge and a narrower bottom flange 45 connected by the vertical web 46. The top flange 44 extends between and is welded to the upper, inwardly extending flanges of the side sills 17, while the vertical web 46 extends between and is welded to the webs of the side sills, and the lower flange 45 extends only between the respectively opposite sides of the center sill 11 and the side sills and is welded thereto. Vertical web plates 47 are disposed in the body end sill in alignment with the respective vertical webs 22 of the center sill and are welded to the center sill and the top flange 44 of the end sill and the vertical web 46 thereof. Vertical webs 48, paralleling the webs 47 and having flanged lower edges, are welded within the sill 14 to the web and upper and lower flanges and extend rearwardly thereof in position to provide attaching means for the longitudinal floor stringers 20 welded thereto. Angle member 49, welded to the center sill and to the depending rear edge of the top flange 44, affords a welding connection for the floor stringer directly over the center sill. Vertical channel-shaped end framing posts 50 are welded to the upper flange 44 of the end sill and are disposed directly over reinforcing members similar to the members 48 and welded within the end sill. The forward flanges of the posts 50 are disposed flush with the surface of the vertical web 46 as are the body corner posts 51 welded to the side sills. Horizontal gussets 52 are welded between the edge of lower flange 45 and the center sill 11 in line with the top sill flanges 23 upon opposite sides thereof, and flanged, vertically disposed gussets 53 are arranged at opposite sides of the center sill and welded to the bottom flange 45 of the end sill and to the webs 22 of the center sill and lower flanges 21 thereof, and both sets of gussets serve substantially to reinforce the connection between the center sill and end sill.

The combination buffer and body end sill construction 13 at the non-vestibule or dummy end of the underframe, as shown in Figs. 24 and 25, is substantially like that of the body end sill 14, but is adapted to have the coupler-carrying end sill casting 12 and buffer end posts 38 incorporated therewith, and, therefore, only the changes

resulting from this difference will be described. The top flange 44 is cut out to fit around in back of the casting 12 and posts 38 and welded along such cut edge to the back surfaces of the casting and posts, and a filler plate 54 is fitted to the web of each post 38 on the outer side between the flanges and welded thereto and to the top flange 44 of the end sill. The bottom flanges 45 are each provided with a similar filler plate 55 fitted to the web of the buffer post and front flange and secured in assembled relation by welding. Flanged web members 48a, disposed over the flared end portion of the center sill in end sill 13, are secured by welding to the back surface of the casting 12 and the top flange 44 of the end sill and, like the webs 48, provide welding connections for the longitudinal floor stringers 20.

The cross-bearers 18, as best shown in Fig. 14, comprise relatively deep vertical web members 60 having top and bottom flange plates 61 and 62, respectively, fillet-welded thereto. The webs 60 extend continuously between the webs of the side sills 17, to which they are fillet-welded, and are cut out to closely receive the center sill 11— to the top, sides, and flanges of which they are welded edgewise in order that the full flexibility thereof may be available for the absorption of vibration. The top flange 61 of the respective cross-bearers is continuous between the inwardly extending top flanges of the side sills 17 and is butt-welded to such flanges. Bottom flanges 62 extend from the center sill lower flanges 21 outwardly beneath the lower flange of the respective side sills and are welded at opposite ends to both. Tie plates 63 extend between the webs of the center sill to which they are butt-welded in the plane of bottom flanges 62. Web plates 64 are disposed within the center sill transversely thereof in alignment with webs 60 and provide virtual continuations of such webs through the center sill area and are fillet-welded to the center sill webs and top and bottom connecting plates. Angle stiffeners 65, spot-welded to webs 60, are provided to which the longitudinal floor stringers 20 may be welded.

The crossbearer and bolster members both comprise relatively deep webs formed with openings the margins of which directly engage and are welded to the webs of the center sill member and may be assembled therewith by vertically sliding the members together.

Crossties 19, as shown in Fig. 12, extend continuously across the top of the center sill between the side sills 17 and comprise each a web plate 66 with top and bottom flange plates 67 and 68, respectively—all integrated by welding. The webs 66 and top plates 67 extend continuously between and are welded to the webs and upper flanges of the side sills 17 respectively, but the bottom plates 68 extend between and are welded to the respective sides of the center sill and the webs of the side sills as shown in Fig. 12. The bottom plates 68 form means of connection between the crossties and the center sill, to which they are welded, as are the webs 66; and flanged, vertical gusset plates 69 welded to the bottom plates 68 and to the center sill webs 22 and bottom flanges 21 in alignment with webs 66 serve materially to reinforce the crossties insofar as vertically applied loads are concerned. The crossties are not provided with any form of special connections for attachment of the floor stringers—such members being welded directly to the webs and flanges of the crossties. Transversely arranged web plates 70 are disposed within the center sill in alignment with the webs 66 of the crossties and are welded in place, and, for all practical purposes, provide continuous webs including the crosstie webs 66, gussets 69 and the plates 70. Bottom flange plates 71 extend across the bottom of the center sill and are welded to the plates 70 and center sill bottom flanges 21.

The longitudinal floor stringers 20 comprise pressed Z members having their webs vertical and which are relatively deep compared to such members as ordinarily and heretofore used, whereby the number of cross-bearers and/or crossties necessary to carry the floor load may be substantially reduced, due to the greater load carrying capacity of such relatively deep longitudinals, and the cross-bearers and/or crossties in the underframe spaced greater distances apart with respect to each other. At the bolsters 15 and crossties 19 the vertical webs of the longitudinals 20 are welded directly to the webs of such cross members, and at the dummy end sill 13 and body end sill 14 and at the cross-bearers 18 are welded to the members 48, 48a and 65. The lower horizontal flanges of the longitudinals in all cases are welded directly to the webs of the various cross members, and the upper flanges, likewise, in every case, are welded directly to the top flanges of the various cross members. The upper and lower flanges of the members 20, where they are welded directly to the cross member webs and flanges, are thickened by the use of plates 72, attached by welding, to provide a more secure welding connection. The upper flanges of the longitudinals 20 are disposed flush with the top surfaces of all of the cross members 13, 14, 15, 18 and 19. The floor stringers 20 do not connect to the center sill at any point, and, where a center stringer over the center sill, as shown, is necessary, sufficient space is provided between the bottom of the stringer and the top of the center sill to permit freedom of deflection of each member independently of the other.

The side sills 17, as before stated, comprise rolled Z members with vertical webs and having inwardly extending upper flanges and lower flanges extending outwardly and extending on each side of the underframe from the body end sill 14 to the dummy end sill 13. The upper flanges and webs of the side sills nest over the opposite ends of all of the cross members 13, 14, 15, 18 and 19 which are all welded to the side sills edgewise as at 73, and the top plate members of all of such cross members are disposed flush with the top surface of the side sill upper flanges, whereby the underframe, as a whole, presents a perfectly flush upper surface for the application of floor 75 which extends between coves 77 at the side frames, to which they are secured, and the posts 76 of which are shown secured to the outer face of the side sill web and lower flange by welding. The floor 75 comprises corrugated plates 78 with the corrugations extending transversely of and secured to the underframe and having corkboard 79 cemented in the corrugations with a layer of corkboard 81 cemented thereon and a surface layer of cork tile 80 cemented on the layer of cork board 81. The floor 75 is lapped at the respective side edges by side wall finish plates 82 secured, by screws, to wood furring strips 83 embedded in the floor. It will be seen that since the floor is supported on and directly secured to the underframe, center sill

vibrations, unless absorbed, will be transmitted directly to the floor 75 and superstructure 76.

The center sill 11, in effect, is carried by the cross-bearers 18, which are so dimensioned as to have greater stiffness acting as beams between the side sills than the center sill has acting between cross-bearers—the cross-bearers thus forming nodal points of the center sill with the result of reducing the amplitude and increasing the frequency of eventual center sill vibrations. The crossties 19, relatively lacking stiffness considered as beams between side sills, unload their portion of the floor load to the center sill and side sills, whereby a concentrated load is applied approximately at the middle of the center sill span between crossbearers, which also has a tendency of favorably changing the nature of the center sill vibrations.

From the foregoing it will be seen that there has been provided an underframe particularly designed for fabrication by welding and which eliminates or minimizes the transmission of center sill vibrations to the car floor.

What is claimed is:

1. A welded underframe construction including a longitudinally extending inverted flanged channel-shaped center sill flanked by Z-shaped side sills having inwardly and outwardly extending upper and lower flanges respectively with the side sill lower flange substantially in the same horizontal plane with the top of the center sill, bolster members traversing the center sill and connecting the side sills comprising each a plurality of web plates embracing the center sill and welded edgewise thereto and to the side sills with top and bottom cover plates welded to the web plates and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill flanges outwardly and welded beneath the side sill lower flanges and having internal cross webs welded to the web plates and top and bottom cover plates, bolster center filler members secured in the center sill, crossbearers traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill flanges outwardly and welded beneath the side sill lower flanges, web plates welded edgewise within the center sill in alignment with said cross-bearer web plates, bottom plates extending beneath and welded to said center sill web plates, crosstie members extending across the center sill and connecting the side sills comprising each a web plate extending between and welded edgewise to the side sills with upper and lower flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly-directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sill webs, said lower flange plate being welded to the center sill and having gusset plates welded thereto and to the center sill sides, web plates welded within the center sill in alignment with said gussets and crosstie web plates, bottom plates extending beneath and welded to said center sill web plates and connecting the center sill flanges, floor stringers paralleling and detached from said center and side sills extending between and welded to all of the various cross members flush with the upper surfaces of such members and of the side sills, and end sill members traversing the center sill and connecting the side sills comprising channel members having their flanges oppositely disposed with web plates welded therebetween and extending therebeyond for attachment of said floor stringers.

2. A welded underframe construction including a longitudinally extending inverted flanged channel-shaped center sill flanked by Z-shaped side sills having inwardly and outwardly extending upper and lower flanges respectively with the side sill lower flange substantially in the same horizontal plane with the top of the center sill, bolster members traversing the center sill and connecting the side sills comprising each a plurality of web plates embracing the center sill and welded edgewise thereto and to the side sills with top and bottom cover plates welded to the web plates and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill flanges outwardly and welded beneath the side sill lower flanges and having internal cross webs welded to the web plates and top and bottom cover plates, cross-bearers traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill flanges outwardly and welded beneath the side sill lower flanges, bottom plates extending beneath and welded to said center sill, crosstie members extending across the center sill and connecting the side sills comprising each a web plate extending between and welded edgewise to the side sills with upper and lower flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sill webs, said lower flange plate being welded to the center sill, web plates welded within the center sill in alignment with said crosstie web plates, bottom plates extending beneath and welded to said center sill web plates and connecting the center sill flanges, floor stringers paralleling and detached from said center and side sills extending between and welded to all of the various cross members flush with the upper surfaces of such members and of the side sills, and end sill members traversing the center sill and connecting the side sills comprising channel members adapted to receive and have said floor stringers welded thereto.

3. A welded underframe construction including a longitudinally extending inverted flanged channel-shaped center sill flanked by Z-shaped side sills having inwardly and outwardly extending upper and lower flanges respectively with the side sill lower flange substantially in the same horizontal plane with the top of the center sill, bolster members traversing the center sill and connecting the side sills comprising each a plurality of web plates embracing the center sill and welded edgewise thereto and to the side sills with top and bottom cover plates welded to the web plates and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill flanges outwardly and welded beneath the side sill lower flanges and having in-

ternal cross webs welded to the web plates and top and bottom cover plates, cross-bearers traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill flanges outwardly and welded beneath the side sill lower flanges, crosstie members extending across the center sill and connecting the side sills comprising each a web plate extending between and welded edgewise to the side sills with upper and lower flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sill webs, said lower flange plate being welded to the center sill, floor stringers paralleling and detached from said center and side sills extending between and welded to all of the various cross members flush with the upper surfaces of such members and of the side sills, and end sill members traversing the center sill and connecting the side sills comprising channel members adapted to receive and have said floor stringers welded thereto.

4. A welded underframe construction including a longitudinally extending inverted flanged channel-shaped center sill flanked by Z-shaped side sills having inwardly and outwardly extending upper and lower flanges respectively with the side sill lower flange substantially in the same horizontal plane with the top of the center sill, bolster members traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom cover plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill flanges outwardly and welded beneath the side sill lower flanges, cross-bearers traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill flanges outwardly and welded beneath the side sill lower flanges, crosstie members extending across the center sill and connecting the side sills comprising each a web plate extending between and welded edgewise to the side sills with upper and lower flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sill webs, said lower flange plate being welded to the center sill, floor stringers paralleling said center and side sills extending between and welded to all of the various cross members flush with the upper surfaces of such members and of the side sills, and end sill members traversing the center sill and connecting the side sills adapted to receive and have said floor stringers welded thereto.

5. A welded underframe construction including a longitudinally extending inverted flanged channel-shaped center sill flanked by Z-shaped side sills having inwardly and outwardly extending upper and lower flanges respectively with the side sill lower flange substantially in the same horizontal plan with the top of the center sill, bolster members traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom cover plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly-directed side sill upper flanges and from the center sill flanges outwardly and welded edgewise to the side sills, cross-bearers traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sills, crosstie members extending across the center sill and connecting the side sills comprising each a web plate extending between and welded edgewise to the side sills with upper and lower flange plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sill webs, said lower flange plate being welded to the center sill, floor stringers paralleling said center and side sills extending between and welded to all of the various cross members flush with the upper surfaces of such members and of the side sills, and end sill members traversing the center sill and connecting the side sills adapted to receive and have said floor stringers welded thereto.

6. A welded underframe construction including a longitudinally extending center sill flanked by Z-shaped side sills having inwardly and outwardly extending upper and lower flanges respectively with the side sill lower flange substantially in the same horizontal plane with the top of the center sill, bolster members traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom cover plates welded to the web plate and extending respectively continuously between and welded edgewise to the inwardly-directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sills, cross-bearers traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom flanges extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sills, crosstie members extending across the center sill and connecting the side sills comprising each a web plate extending between and welded edgewise to the side sills with upper and lower flanges extending respectively continuously between and welded edgewise to the inwardly directed side sill upper flanges and from the center sill outwardly and welded edgewise to the side sill webs, said lower flange being welded to the center sill, floor stringers paralleling said center and side sills extending between and welded to all of the various cross members flush with the upper surfaces of such members and of the side

sills, and end sill members traversing the center sill and connecting the side sills adapted to receive and have said floor stringers welded thereto.

7. A welded underframe construction including a longitudinally extending center sill flanked by side sills, bolster members traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom cover plates welded to the web plate and extending respectively continuously between and welded edgewise to the side sills and from the center sill outwardly and welded edgewise to the side sills, cross-bearers traversing the center sill and connecting the side sills comprising each a web plate embracing the center sill and welded edgewise thereto and to the side sills with top and bottom flanges extending respectively continuously between and welded edgewise to the side sills and from the center sill outwardly and welded edgewise to the side sills, crosstie members extending across the center sill and connecting the side sills comprising each a web plate extending between and welded edgewise to the side sills with upper and lower flanges extending respectively continuously between and welded edgewise to the side sills, said lower flange being welded to the center sill, floor stringers paralleling said center and side sills extending between and welded to all of the various cross members flush with the upper surfaces of such members and of the side sills, and end sill members traversing the center sill and connecting the side sills adapted to receive and have said floor stringers welded thereto.

8. An underframe construction including longitudinally extending center and side sills, bolsters traversing the center sill and connecting the side sills and comprising members having webs, cross-bearers traversing the center sill and connecting the side sills and comprising members having webs, and crossties extending across the center sill and connecting the side sills and comprising members having webs, said crossties being relatively shallow and disposed above said center sill and said cross-bearers and bolsters being relatively deep and all of said webs being adapted to flex in response to longitudinal displacement of the center sill.

9. A railway car having a floor, an underframe in said car for supporting the floor including a center sill out of contact with the floor, and cross members on said center sill forming the support for the floor and having web portions flexing therebetween in response to longitudinal vibratory movements of the center sill whereby displacement of said sill in relation to the floor may be had independently thereof.

10. An underframe structure including center and side sills, cross-bearers traversing the center sill and connecting the side sills and of such depth as to have greater stiffness between side sills than the center sill has between cross-bearers thereby to provide nodal points of the center sill, and crosstie members connecting the side sills carried by the center sill.

11. An underframe construction comprising side sills connected by cross members having vertical webs certain of which are relatively deep with respect to others and adapted to flex and a center sill carried by said relatively deep members for relative longitudinal vibratory movements of the center sill whereby displacement of said sill in relation to the side sills may be had independently thereof.

12. A railway car having a floor, an underframe supporting the floor comprising side sills connected by cross members having vertical webs certain of which are relatively deep with respect to others and adapted to flex and a center sill carried by said relatively deep web members out of contact with said floor and movable with respect thereto in response to longitudinal vibratory movements of the sill whereby displacement of the sill with respect to the floor may be had independently thereof.

13. A railway car having a floor, an underframe supporting the floor comprising side sills connected by cross members having vertical webs certain of which are relatively deep with respect to others and adapted to flex and a center sill carried by said relatively deep web members out of contact with said floor and movable with respect thereto in response to longitudinal vibratory movements of the sill whereby displacement of the sill with respect to the floor may be had independently thereof, and members paralleling the center and side sills connecting said cross members independently of said center sill.

14. An underframe construction including longitudinally disposed side sills having transverse connecting members including end sills, bolsters, crossbearers and crossties, and longitudinal stringers extending between and secured to all of said transverse members, a floor supported on the underframe, said stringers being of a depth substantially to support said floor thereby to reduce the number of said transverse members necessary to carry the floor, and a center sill embraced by certain of said cross members and secured to all of such members and having relative movement with respect to said floor by the flexibility of said members.

15. An underframe construction including longitudinally disposed side sills having transverse connecting members including end sills, bolsters, cross-bearers and crossties, a floor supported on the underframe, and a center sill embraced by certain of said cross members and secured to all of such members and having relative movement with respect to said floor by the flexibility of said members.

16. An underframe construction including longitudinal center and side sill members comprising webs having flat vertical side surfaces, the webs comprising the center sill member having outer flat vertical side surfaces defining the maximum width of at least the upper and intermediate parts of the center sill member and facing the named surfaces of the side sill members, in combination with transverse members including bolsters and cross-bearers each comprising a web having an opening therein substantially equal in width to said maximum width, the margins of said openings being engaged directly with the center sill member and being adapted to be assembled therewith by vertically sliding the center sill member and the webs of the transverse members together, the webs of said transverse members extending continuously between said side sill members and being welded to the named surfaces thereof and having the margins of the openings therein welded to the center sill member.

17. An underframe construction including longitudinal center and side sill members comprising webs having flat vertical side surfaces, the webs comprising the center sill member having outer flat vertical side surfaces defining the maximum width of at least the upper and interme-

diate parts of the center sill member and facing the named surfaces of the side sill members, in combination with transverse members including bolsters and cross-bearers each comprising a relatively deep web having an opening therein substantially equal in width to said maximum width, the margins of said openings being engaged directly with the center sill member and being adapted to be assembled therewith by vertically sliding the center sill member and the webs of the transverse members together, and said transverse members including also crossties having relatively shallow webs, the webs of all of said transverse members extending continuously between said side sill members and being welded to the named surfaces thereof and the margins of the openings in the transverse members being welded to the center sill members.

18. A welded underframe construction including side sills, a center sill comprising laterally spaced vertical web plates the outer surfaces of which define the maximum width of at least the upper and intermediate parts of the center sill, bolster members comprising a plurality of web plates each having an opening therein substantially equal in width to said maximum width, the margins of said openings being engaged directly with the center sill web plates and being adapted to be assembled therewith by vertically sliding the center sill and the web plates of the bolster members together, said bolster web plates extending continuously between the side sills, welds connecting the bolster web plates with the named parts of the center sill and with the side sills, top and bottom cover plates welded to the bolster web plates and extending respectively continuously between and welded to the side sills and from the center sill outwardly and welded to the side sills, cross-bearers connecting the side sills comprising each a web plate having an opening therein substantially equal in width to said named width, the margins of said openings being engaged directly with the center sill web plates and being adapted to be assembled therewith by vertically sliding the center sill and the web plates of the cross-bearers together, welds connecting the cross-bearer web plates with the named parts of the center sill and with the side sills, top and bottom flanges formed on the cross-bearer web plates extending respectively continuously between and welded to the side sills and from the center sill outwardly and welded to the side sills, crosstie members extending across and secured to the center sill and connecting the side sills, floor stringers paralleling said center and side sills extending between and welded to all of the various members, and end sill members traversing the center sill and connecting the side sills adapted to have said floor stringers welded thereto.

19. A welded underframe construction including side sills, a center sill comprising laterally spaced vertical web plates the outer surfaces of which define the maximum width of at least the upper and intermediate parts of the center sill, bolster members comprising a plurality of web plates each having an opening therein substantially equal in width to said maximum width, the margins of said openings being engaged directly with the center sill web plates and being adapted to be assembled therewith by vertically sliding the center sill and the web plates of the bolster members together, said bolster web plates extending continuously between the side sills, welds connecting the bolster web plates with the named parts of the center sill and with the side sills, cross-bearers connecting the side sills comprising each a web plate having an opening therein substantially equal in width to said named width, the margins of said opening being engaged directly with the center sill web plates and being adapted to be assembled therewith by vertically sliding the center sill and the web plates of the cross-bearers together, welds connecting the cross-bearer web plates with the named parts of the center sill and with the side sills, top and bottom flanges formed on the cross-bearer web plates and welded to the side sills, crosstie members extending across and secured to the center sill and connecting the side sills, floor stringers paralleling said center and side sills extending between and welded to all of said cross members, and end sill members traversing the center sill and connecting the side sills adapted to have said floor stringers welded thereto.

20. A welded underframe construction including side sills, a center sill comprising laterally spaced vertical web plates the outer surfaces of which define the maximum width of at least the upper and intermediate parts of the center sill, bolster members comprising a plurality of web plates each having an opening therein substantially equal in width to said maximum width, the margins of said openings being engaged directly with the center sill web plates and being adapted to be assembled therewith by vertically sliding the center sill and the web plates of the bolster members together, said bolster web plates extending continuously between the side sills, welds connecting the bolster web plates with the named parts of the center sill and with the side sills, top and bottom cover plates welded to the bolster web plates, cross-bearers connecting the side sills comprising each a web plate having an opening therein substantially equal in width to said named width, the margins of said opening being engaged directly with the center sill web plates and being adapted to be assembled therewith by vertically sliding the center sill and the web plates of the cross-bearers together, welds connecting the cross-bearer web plates with the named parts of the center sill and with the side sills, top and bottom flanges formed on the cross-bearer web plates, crosstie members extending across and secured to the center sill and connecting the side sills, and end sill members traversing the center sill and connecting the side sills.

NILS A. THUNSTROM.

CERTIFICATE OF CORRECTION.

Patent No. 2,239,634. April 22, 1941.

NILS A. THUNSTROM.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, second column, line 4, claim 5, for the word "plan" read --plane--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of June, A. D. 1941.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)