Jan. 10, 1939. A. G. DEAN 2,143,547

RAIL CAR STRUCTURE

Original Filed Sept. 18, 1935 4 Sheets-Sheet 1

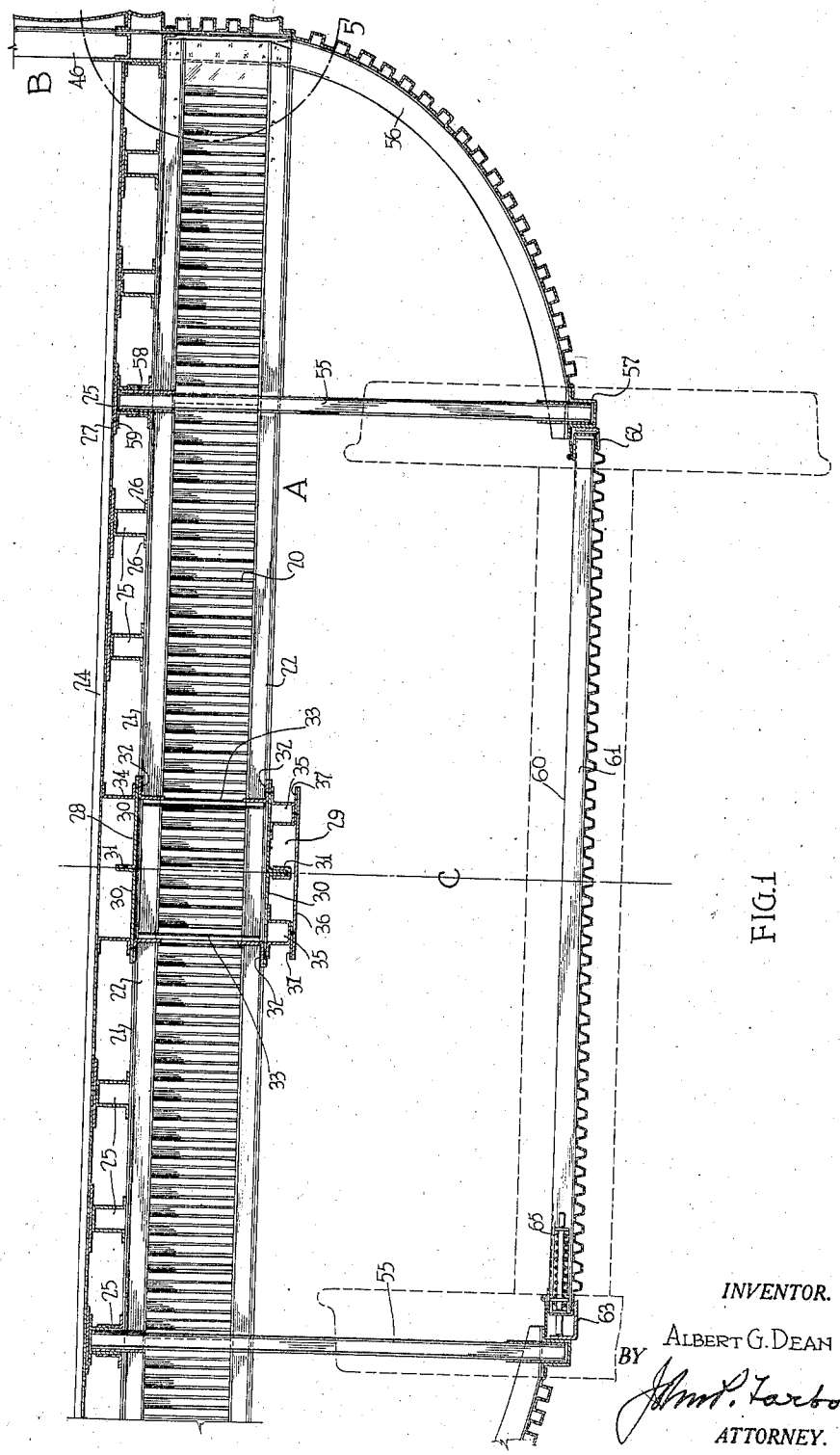


FIG.1

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RAIL CAR STRUCTURE

Original Filed Sept. 18, 1935 4 Sheets-Sheet 2

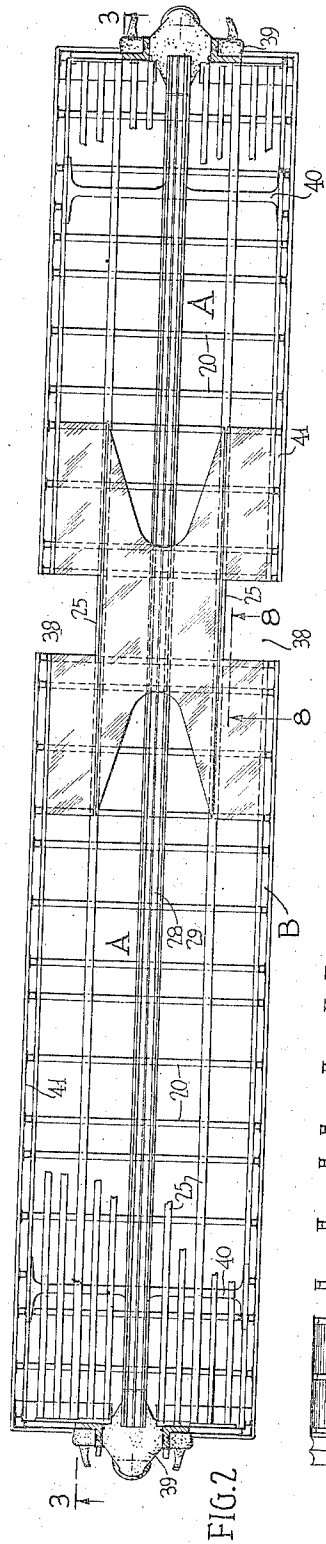


FIG.2

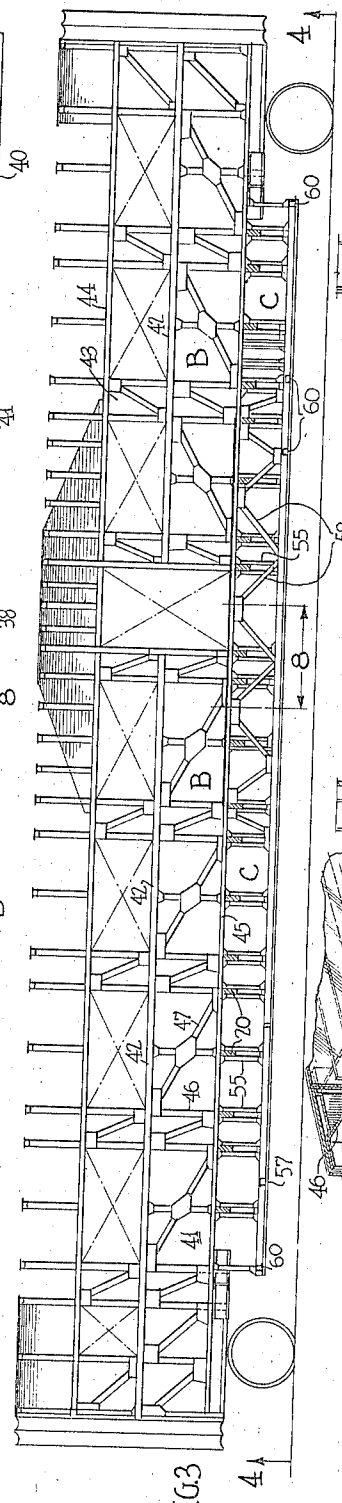


FIG.3

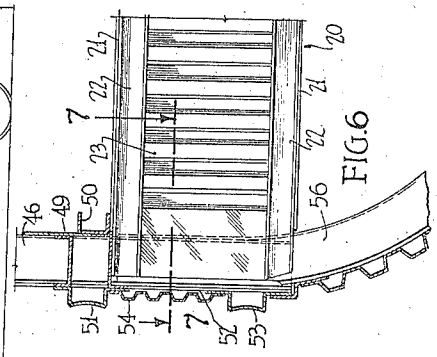


FIG.6

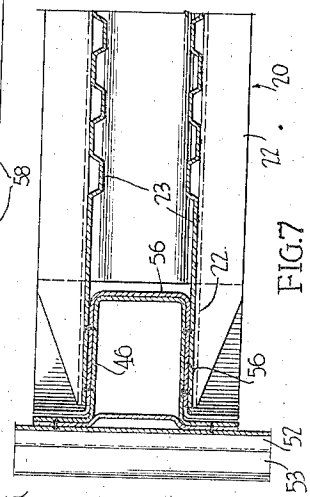


FIG.7

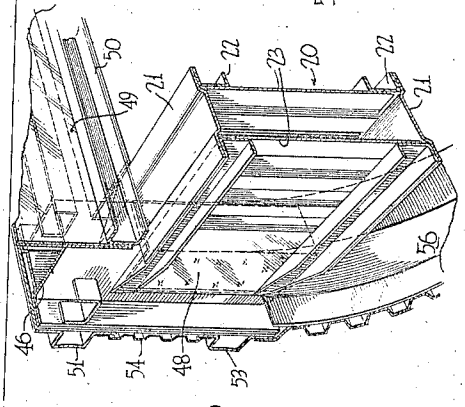


FIG.5

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RAIL CAR STRUCTURE

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FIG. 4

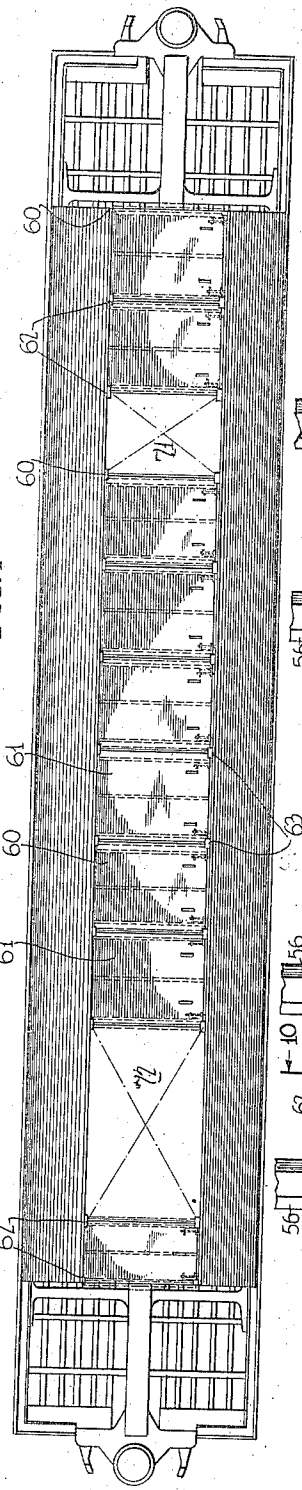
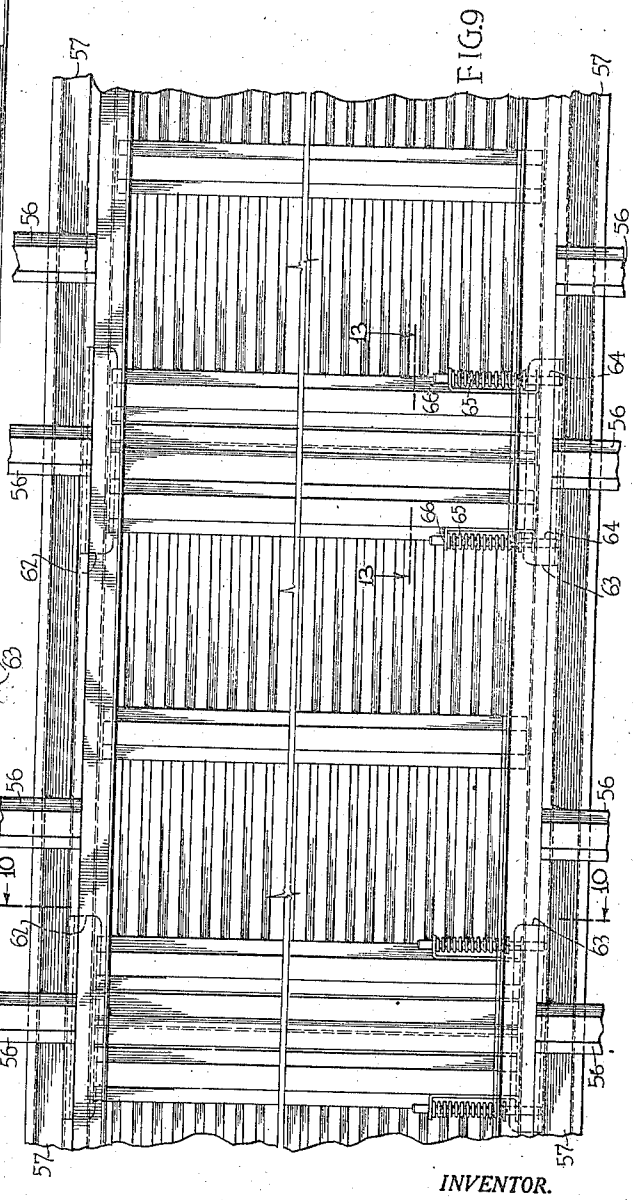


FIG. 9



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RAIL CAR STRUCTURE

Original Filed Sept. 18, 1935 4 Sheets-Sheet 4

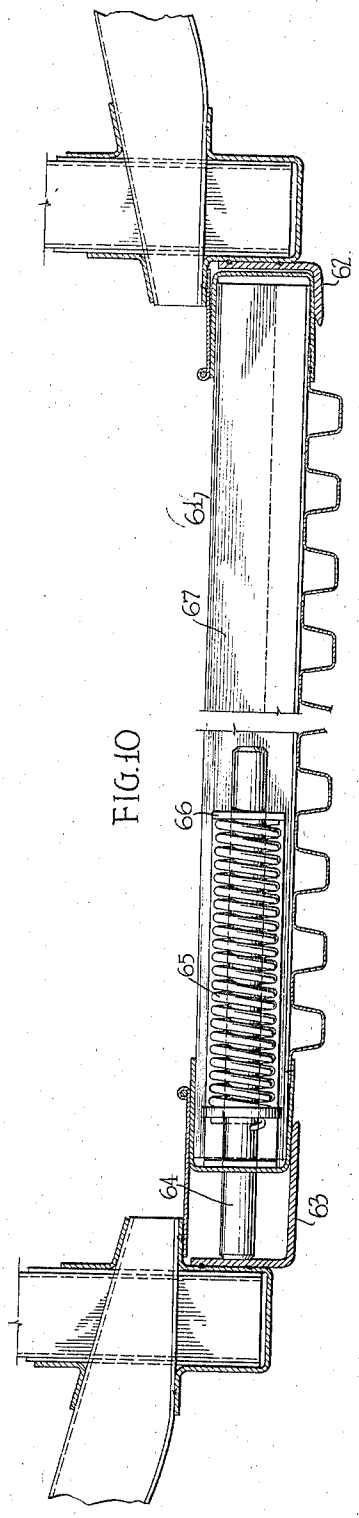


FIG. 10

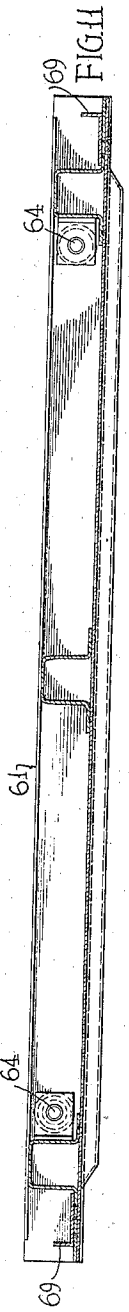


FIG. 11

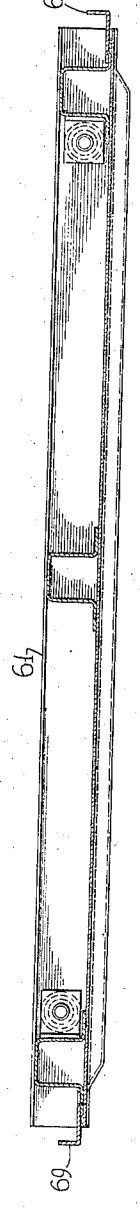


FIG. 12

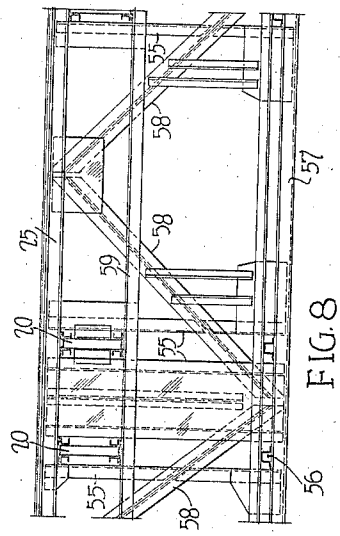


FIG. 8

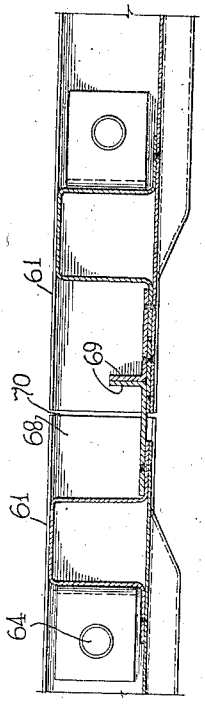


FIG. 13

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Patented Jan. 10, 1939

2,143,547

UNITED STATES PATENT OFFICE

2,143,547

RAIL CAR STRUCTURE

Albert G. Dean, Narberth, Pa., assignor to Edward G. Budd Manufacturing Company, Philadelphia, Pa., a corporation of Pennsylvania

Application September 18, 1935, Serial No. 41,031
Renewed November 8, 1937

15 Claims. (Cl. 105—397)

This invention has to do with rail car construction of the light weight order such as is now being very commonly used by the railroads in connection with the light weight streamline high speed Diesel powered economically operated articulated trains. These trains are being constructed today either of alloy steel or aluminum and considerable numbers are being constructed of high tensile stainless steel which is pre-cold worked to give extremely high strength values. Such structures have given rise to many new problems connected with the attaining maximum strength with minimum weight, the obtaining of light weight power and auxiliary equipment and the light weight support from and housing within the streamline form of the structure of the equipment. This invention has particularly to do with the solution of the problem of disposition, support and housing of the auxiliary equipment.

In rail car construction heretofore two orders of development affecting the auxiliary equipment have been predominant. According to one the transverse or longitudinal frameworks or both of them, which respectively afford principal transverse strength and principal longitudinal strength to the car, have been freely extended in diverse ways below the floor level irrespective of the problem of providing space for auxiliary equipment below the floor level and the auxiliary equipment has been fitted as best one might to the spaces between these diverse dominant features of the strength affording framework, in many cases having to be modified in order to fit the space. The dominant extended strength affording frameworks are covered by streamlining sheathing. According to the other order of development the strength affording main body framework structures were not extended dominantly below the floor level to such extents as materially to interfere with the accommodation of auxiliary equipment, and thereafter an under cover or streamline sheathing is laid over the installed equipment. In some cases this is a mere dust cover and not a streamline. Various admixtures of these orders of development have of course occurred.

My invention gives rise to a new order of development, a development in which space for the auxiliary equipment, light weight yet strong mounting therefor, and streamline housing are put on a parity of consideration with general streamlining and covering on the one hand, and main strength affording frameworks for the car on the other. I attain this object by providing below the floor level of the car a longitudinally extending hold for the auxiliary equipment, affording longitudinally extending space free of obstruction by strength affording frameworks, and arrange for accessibility to this hold through a longitudinally extending series of hatchways in the bottom of the hold rather than through the floor which is it top. This hold I suspend from the strength affording framework of the car by members generally free from strength affording function in connection with the main body. Thus the equipment is freely accessible throughout the length of the car. Thus the hold may be given any desired configuration for streamlining without reference to the strength affording framework of the car, yet it is of itself a permanent structure quite so permanent as the bottom of a ship. Thus neither need the equipment be modified or handicapped in function in order to locate it for there is abundant open space. Thus damage to strength affording frameworks incident to attachment of equipment or erroneous alteration to accommodate equipment is avoided. And thus the under side of the flooring per se of the car and the framework of the hold provide ready accessible anchoring and securing means for the equipment without the necessity of resort directly to the strength affording framework of the car. In brief, through this separate hold of free space for the auxiliary equipment, the thoroughness and efficiency of its accommodation in these light weight structures becomes coordinate with the thoroughness and efficiency of the provision of strength affording functions in the main body framework, instead of subordinate.

In the accompanying drawings I show that form of my invention now best known to me but very obviously there must be others.

Of the drawings—

Figure 1 is an almost whole transverse cross section of the lower part of the rail car body.

Figure 2 is a floor plan of the strength affording framework of the car.

Figure 3 is a vertical elevation of the framework of one side of the car looking at it from the inside of the car by means of a section taken on line 3—3 of Fig. 2. This clearly shows the framework of the hold for auxiliary equipment below the floor level.

Figure 4 is a view of the bottom of the car showing the bottom of the hold and its hatchways. One is looking upward substantially in the direction of the arrows 4—4 applied to Fig. 3.

Figure 5 is an enlarged perspective of one of

the suspension points of the hold, that shown in the circle 5 of Fig. 1.

Figure 6 is a side elevation of this joint of Fig. 5.

Figure 7 is a transverse cross section on line 7—7 of Fig. 6.

Figure 8 is an enlarged elevation of that portion of the hold suspension system lying between the lines marked 8 in Fig. 3 in the vicinity of the stair well of the side doors therein shown. The location of the view of Fig. 8 is also indicated in Fig. 2 by the arrows 8—8.

Figure 9 is an enlarged plan view from the inside of certain of the hatchways and hatch doors.

Figure 10 is a transverse cross section of one of these hatchways and its door taken on line 10—10 of Fig. 9.

Figure 11 is a longitudinal section of a hatch door.

Figure 12 is a similar section of an adjacent hatch door.

Figure 13 is an enlarged section of adjoining ends of the doors of Figs. 11 and 12, such section being taken substantially on line 13—13 of Fig. 9.

The main body strength affording frameworks of the car are designated respectively, the transverse framework A and the longitudinal framework B, while the hold for auxiliary equipment which I provide is designated generally C. In this connection reference may be had particularly to Figs. 1 and 3.

The transversely extending framework of the car, A, is embodied principally in relatively shallow transversely extending floor beams 20 of which there are provided a great number as clearly appears in Figs. 2 and 3. These beams 20, as can be seen most clearly in Figs. 5, 6 and 7, are of box cross section. Their caps or chords are comprised of through running strips 21 reinforced by channels 22. Their webs are comprised of vertically corrugated sheet stock 23. The whole is electrically spot welded together in the regions where the several parts 21—22—23 overlap each other. Such beams from six to twelve inches deep and from one to three inches thick provide an extremely great transverse strength. By reason of their construction, however, and a uniform cross section from end to end, they are relatively shallow as respects the general depth of the bottom portion of the car as shown in Fig. 1 and do not project a great distance below the level of the flooring 24.

The floor 24 is supported from these floor beams 20 by means of a transverse series of longitudinally extending floor stringers 25 of inverted channel form. These stringers are integrally continuous from one end of the car to the other. They are spot welded by their flanges 26 down upon the caps 21 of the beams 20. They are spot welded to their tops in turn through running strips 27 to which again in turn the flooring 24 is spot welded. The flooring 24 is formed of transversely corrugated metal sheet. The transverse strength affording structure comprised of beams 20 is longitudinally spaced apart and longitudinally bound together not only by these floor stringers 25 but also by the central draft and bumper structure 28—29. This structure comprises two upper and two lower wide through-running relatively heavy gauged strips 30 whose main bodies are spot welded down upon the caps 21 of the beams and spot welded to each other through the outturned lapped flanges 31 of their adjacent edges. To their juxtaposed margins are welded angle strips 32 the ends of which abut the chord members 22 of the beams 20. The inwardly disposed free branches of the angle cross sections of members 32 are vertically joined together by a thin gauged corrugated sheathing 33. Through-running channel members 34 laid on their sides support the flooring 24 from the upper members 30. These channels are welded by one branch to the outer margins of the members 30 in the same region as are the angles 32 and by the other branch are welded to the flooring 24. Flanged channels 35 are welded by their flanges to the lower members 30, the outermost flange being welded in the same region as the angles 32. A through-running plate 36 bridges these through-running channels and is welded thereto through the intermediary of the flange strips 37 which are welded to the bottoms of the channels 35 before these channels are welded down upon the members 30.

The through-running character of this member 28—29 can be clearly seen in Fig. 2. However, this member does not afford substantial longitudinal strength. It is prevented from doing so by the employment of such thin gauged stock for the side walls 33 as to preclude this stock from giving adequate web strength to the structure 28—29, such web strength as to make it behave as a beam. Moreover, the interruption of the connections 33 at their transverse beam 20 destroys their continuity entirely. Nevertheless, the various angle channel and box cross sections afforded by the structure 28—29 have a very high compressive strength to resist bumping strains and needless to say, the tensile strength of the through-running structure under draft strains is very great. These draft and bumping strains are shared by the structure 28—29, with the floor stringers 25, up to and including that floor stringer 25 on each side of the center which immediately adjoins the stair well 38. See Fig. 2. These strains are transmitted directly to members 25, 28 and 29 from the draft connections 39—39 at the opposite ends of the car. While these members do not substantially enter into the longitudinal load supporting structure of the car, they do tie together and transmit loads to the transverse load supporting structure comprised of the beams 20.

The longitudinal strength affording structures B is comprised principally of the side trusses 41 which lie substantially in the planes of the opposite side walls of the car and the principal portion of which lies below the belt line 42. The structure above the belt line comprising the trussing 43 between the windows, top rail 44, and the roof of the car and the sheathing (not shown) enters subordinately into longitudinal load supporting relation. Outstandingly, however, the lower trusses 41 comprised of the bottom sill members 45, the belt line members 42, the vertically extending posts 46, and the diagonals 47 constitute this principal longitudinal strength affording framework. The detailed construction is generally well understood and inasmuch as it does not enter into this invention except as subsequently described, it need not be repeated here.

This longitudinally extending load supporting structure is joined to the transversely extending load supporting structure comprised of beams 20 by the joints shown in Figs. 5, 6 and 7 and appearing in Fig. 1 within the circle designated 5. The posts 46 are of outwardly flanged channel cross section. The caps 21 of the transverse beams 20 are interrupted short of their ends. The angles 22 and the webs 23 however are not

interrupted. Instead they are both extended to outwardly lap the side walls of channels 46 at the lower ends of the carlines and are in this overlapped region generally spot welded throughout the overlapped region to these side walls. Through-running gusset members 49 welded on the inside of the car fast to the channel bottom, through-running marginal floor stringers 50 of channel section welded to the gussets 49 by the channel bottoms, and also by one side wall to the caps 21 of the floor beams 20, augment the very great strength of this nested, lapped and welded joint. Both the members 49 and 50 become with the moulding channel 51 and other parts in this region, such for example, as gusset 52, lower moulding 53 and corrugated paneling 54 a part of the through-running construction of the lower chord 45 of the truss 41. Thus is substantially entire provision made on the one hand by the organization of transverse beams 20 for the transverse load supporting and strength affording structure of the car and on the other, by the through-running side trusses 41 for the longitudinal load carrying and strength affording structure of the main body.

Now substantially entirely independent of these transverse and longitudinal strength affording structures designated in the first instance A and B, I construct the hold C. I but substantially suspend the hold structure from these two strength affording structures of the main body. Suspension is by means of vertical stays 55 and 56. Stays 55 are of longitudinally presenting channel cross section and connected at their upper ends by welding of their side walls interiorly of the channel cross section of certain of the floor stringers 25 and at their lower ends similarly with the obverted channel cross section of the through-running hatchway sill 57 of the hold framework. The stringers 25 to which the suspension stays 55 are connected are not of the conventional channel section of the remaining stringers 25 but instead are given a channel form by constituting them of angles 58—59 welded by one branch together and by the remaining branches respectively by one to the caps 21 of the beams 20 and by the other to the floor plates 27. There are two longitudinal series of stays 55 so connected, each of which extends longitudinally of the car from truck to truck as clearly appears in Fig. 3. The stays themselves in each series are arranged in pairs, one on each side of each beam 20. Appropriate gussets may be used as desired as indicated in Fig. 3, the better to effect and the greater to strengthen the end connections. The stays 56 on the other hand are connected by their upper ends to the longitudinally extending strength affording structure B the connection being through the same joint by which transverse structure A is connected with longitudinal structure B as shown in Fig. 5. Stays 56 are of channel section presenting outwardly and bottom and side walls of the channel are nested over the outside of the channel walls of the posts 46 and between these walls and the overlapped parts 48 of the beams 20 as clearly appears in Figs. 6 and 7. They may be welded together by one and the same welding operation. The side walls of stays 56 are flanged, the side walls of the hatchway sill 57 are flanged, and the lower ends of the stays are connected to the sills 57 by welding together the flanges as clearly appears in Fig. 1. There are as many stays 56 substantially as there are posts in that portion of the structure B which is flanked by the hold C. Thus we have two longitudinal series of stays 56. The stays of the series 56 are bowed outwardly, the more effectively to resist external damage and to afford more efficient streamline form. They enter into an approximately triangular bracing relation to the stays 55 and constitute the framework of the hold comprised of them together with the hatchway sills 57 a structure transversely very rigid and strong. Yet it does not partake of any of the load of the main car frameworks A and B nor does it partake of their characteristics except that in the region of the step well 38 as shown in Figs. 3 and 8, I use stringers 25 and hatchway sills 57 to help bridge the stair well gap. This I do by interrupting the continuity of the stays 55 in this region and providing diagonals 58 to form a trussing between stringer 25 and sill 57. In such side door cars this may constitute a part of a torsion beam structure the details of which need not enter here. The stays 55 which are interrupted are joined to the side walls of the bottom to bottom channels of which the diagonals 58 are comprised as clearly appears in Fig. 8. Angle strips 59 tie them all to the bottoms of beams 20.

The hatchways may be constituted by the longitudinally extending through-running hatchway sill members alone or by them in combination with certain transverse members which may be provided, as for example, as suggested at the points 60 in Fig. 4. But I prefer not to use these transverse members 60. The hatchways are closed by a longitudinal series of transversely applied hatch doors or covers 61. These doors are supported by their opposite side margins in longitudinally extending channels 62 and 63 of differential depth, the channel 63 being deeper than the channel 62. The width of the door is less than the distance between the bottom of the deeper channel 63 and the mouth of the shallow channel 62. Thereby the door may be entered and removed by first moving the side in the deeper channel 63 to the bottom of the channel and then moving the opposite side upwardly and into the mouth of the shallow channel 62. The doors so applied are retained in place by laterally extending spring plungers 64 permanently urged laterally outwardly against the bottom of channel 63 by means of an engaging spring 65 also re-actively engaged within the confining clip or brackets 66 welded to the side of frame members 67 of the door.

Doors 61 are alternately provided with different widths of abutting end margins 68 and alternately with different lengths of overlapping end flanges 69 as clearly appears in the alternate doors illustrated in Figs. 11 and 12 in longitudinal section of two adjacent doors and Fig. 13 a longitudinal section of two such adjacent doors as overlap. A short margin 68 is provided with a long overlapping flange 69 whereas the long margin 68 is provided with a short flange 69 the short flange terminating inwardly of the edge of the margin whereby the edge of the margin may be overlapped by the long flange 69 and the flanges 69 may abut. Through this abutting of the flanges 69 the edges 70 of the margins are prevented from following each other and yet the long overlapped flange 69 effectually seals the joint between them.

The manner in which the structure described attains the advantages I have outlined to be my aim is believed to be so fully apparent as not to necessitate additional recital of the advantages

themselves. Suffice it to say that they are each and all attained through the employment of this hold as suspended from the main strength affording framework. It is emphasized that through this system of suspension by longitudinal series of stays themselves substantially free from load carrying function, the auxiliary equipment cannot interfere with the main load carrying structures of the car on the one hand nor can the main load carrying structures interfere with the auxiliary equipment. The space encompassed by the longitudinal series of stays is free of obstructing frameworks of any kind from truck to truck of the car, from end to end of the hold. Through the elimination of cross connections such as 60 except at the extremities of the hold, when the hatch doors are removed, one may stand in a work pit over which the car is run and walk standing from end to end of the hold thereby reaching freely to each and all elements of the auxiliary equipment.

The spaces 71 and 72 in Fig. 4 are reserved for panels or hatch covers of especial order, such for example, as screens for air conditioning equipment. Cross members 60 may or may not be used at such special points but are preferably not so used.

The circumstantial terminology which is utilized in the foregoing description and the annexed claims is an outgrowth of my present best efforts to describe the form of my invention which I have illustrated, the best embodiment now known to me. The generic spirit of my invention should give the interpretation of the annexed claims rather than the immediate import of this terminology, for there is no doubt but what my invention is susceptible of much modification without departing from its generic spirit.

What I claim is:—

1. A rail car construction comprising a main body strength framework including a transverse strength system including transversely extending floor beams interconnected by longitudinal floor stringers, and a longitudinally extending strength framework, together with a hold for auxiliary equipment suspended below the floor beams by means of transversely triangulated longitudinally extending series of suspension stays the outer of which is connected at its upper ends with the lower ends of the carlines and the inner of which is connected at its upper ends with the floor stringers, the triangulated series of stays on opposite sides of the body being widely spaced apart and forming between them a downwardly open space to receive auxiliary equipment.

2. A rail car construction comprising a main body framework including relatively shallow transversely extending floor beams affording principal transverse strength to the car, a longitudinally extending framework connected with the beams embodying vertically extending posts and affording principal longitudinal strength for the car, and a hold structure for auxiliary equipment beneath the floor beams, which hold structure is suspended from the said strength affording frameworks by suspension stays, the upper ends of said stays, said posts and the outer ends of said transverse floor beams being nested and secured together.

3. A rail car structure according to claim 2 in which the posts and the suspension stays are of outwardly presenting channel cross section nested together as channels and the floor beam embodies two vertical extending side wall members which respectively exteriorly flank the side walls of the aforesaid channel cross sections.

4. A rail car construction having a floor structure including transverse floor beams and longitudinally extending angular cross section floor stringers secured to said beams, together with a hold for auxiliary equipment suspended below the floor structure, said suspension being in part by vertical members welded at their upper ends to vertical branches of the stringers, the suspension members being in laterally spaced relation thereby leaving an unobstructed downwardly open space between them for the reception of auxiliary equipment.

5. A railway car comprising a main body strength framework including transverse floor beams and a main longitudinal framing characterized by the provision of a sheathed in hold for auxiliary equipment beneath the floor beams, means to support said hold from said beams, hatchways in the bottom of the hold and means to suspend the hold from the main body framework of the car including spaced longitudinally extending series of suspension stays individually transversely braced, said stays encompassing longitudinal hold space throughout the length and breadth of main body strength framework and providing between the stays a downwardly open space substantially free of obstructing framework.

6. A railway car comprising a transverse floor structure and a main longitudinal framing, a longitudinally extending sheathed in hold for auxiliary equipment beneath the floor structure, hatchways in the bottom of the hold, means to support said hold from said floor structure including two transversely spaced longitudinally extending series of vertical suspension stays anchored to the floor structure and projecting downwardly, longitudinally continuous hatchway sills connected with the lower ends of the stays, and a longitudinally extending series of hatch covers supported from said sills.

7. A rail car construction comprising a transversely extending floor structure and main longitudinally extending framing together providing the principal transverse and longitudinal strength structure of the car, and a sheathed in hold for auxiliary equipment located below the floor structure extending throughout the width of the car and as a structure suspended from the main body structure, said hold being provided with longitudinally extending hatchway sills suspended from said floor structure by transversely spaced longitudinal series of stays, stair well structures interrupting the longitudinal strength affording framework of the car, and diagonals between the floor structure and the hatchway sills in the vicinity of the stair wells, there converting the suspension stay series into truss girders spanning the stair well.

8. A rail car construction comprising a floor structure and main longitudinally extending framing together providing the principal transverse and longitudinal strength structure of the car, and a sheathed in hold for auxiliary equipment located below the floor structure extending throughout the width of the car and as a structure suspended from the main body structure, said hold being provided with longitudinally extending hatchway sills suspended from said floor structure by spaced longitudinal series of stays, stair well structure interrupting the longitudinal strength affording framework of the car, and diagonals between the floor stringers and the hatchway sills in the vicinity of the stair wells

converting the suspension stays series into truss girders spanning the stair well region, together with means in this region tying the stays to the floor structure independently of the stringers.

9. A railway car comprising a main body strength framework including transverse floor beams and a main longitudinal framing characterized by the provision of a sheathed in hold for auxiliary equipment beneath the floor beams, means to support said hold from said floor beams, hatchways in the bottom of the hold, the hatchways being provided on their opposite sides with juxtaposed channel cross section seats for hatch doors which seats are of differential depth and hatch doors less in width than the distance from the bottom of the deeper channel to the mouth of the shallow channel, entered in said channels and retained therein by spring pressure exerted between the bottom of the deep channel and the adjacent side of the hatch door.

10. A railway car comprising a main body strength framework including transverse floor beams and a main longitudinal framing characterized by the provision of a sheathed in hold for auxiliary equipment beneath the floor beams, means to support said hold from said floor beams, hatchways in the bottom of the hold, said hatchways being provided on their opposite sides with juxtaposed channel cross section seats for hatch doors which seats are of differential depth, and hatch doors less in width than the distance from the bottom of the deeper channel to the mouth of the shallow channel, entered in said channels and retained therein by spring pressure exerted between the bottom of the deep channel and the adjacent side of the hatch door, the lower side walls of the channels being discontinuous between one longitudinal end of the door and another whereby to prevent extended freezing of the door to the channels.

11. A rail car body including a floor structure, an underframe hold construction including downwardly and inwardly extending stays extending from the sides of the floor structure to a position inward and below the underframe and a plurality of transversely spaced vertical stays secured to the floor construction and to the inward ends of the first mentioned stays, and vertically supporting said stays, the laterally spaced vertical stays forming a hatchway therebetween, sheathing on said first mentioned stays and closure means secured to the bottom of said hatchway and supported by said vertical stays.

12. A rail car body including a floor construction, an underframe hold construction including downwardly and inwardly extending stays extending from the sides of the floor construction to a position inward and below thereof, a plurality of vertical, transversely spaced stays secured to the floor construction and to the inward end of the stays and supporting said stays, sheathing on said first mentioned stays, longitudinally extending hatchway sill means joining the terminal portions of said inwardly extending stays and vertical stays, said means forming a substantially continuous opening throughout the length of the car body.

13. A railway car comprising an underframe, a sheathed in hold below said underframe, said hold being suspended by two transversely spaced longitudinally extending series of vertically disposed suspension stays, which series encompass between them longitudinally extending hold openings substantially free of strength framework obstruction throughout its length, and means to close said opening.

14. A rail car construction comprising a main strength framework including main longitudinal side frames having vertical posts of angular cross section and transverse floor beams interconnecting the posts of the opposite side frames, a hold for auxiliary equipment beneath the floor beams, said hold having lateral walls comprising downwardly and inwardly curved stays of angular cross section secured to the bottoms of said posts, said lateral walls terminating at the bottom in widely spaced relation thereby leaving an unobstructed downwardly open space between them for the reception of auxiliary equipment and outer sheathing applied to said stays and secured thereto.

15. A rail car construction according to claim 14 in which the outer sheathing is continuous and longitudinally corrugated.

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