Feb. 26, 1963 J. E. CANDLIN, JR., ETAL 3,078,814

SINGLE BEAM RAILWAY CAR

Filed June 15, 1960 3 Sheets-Sheet 1

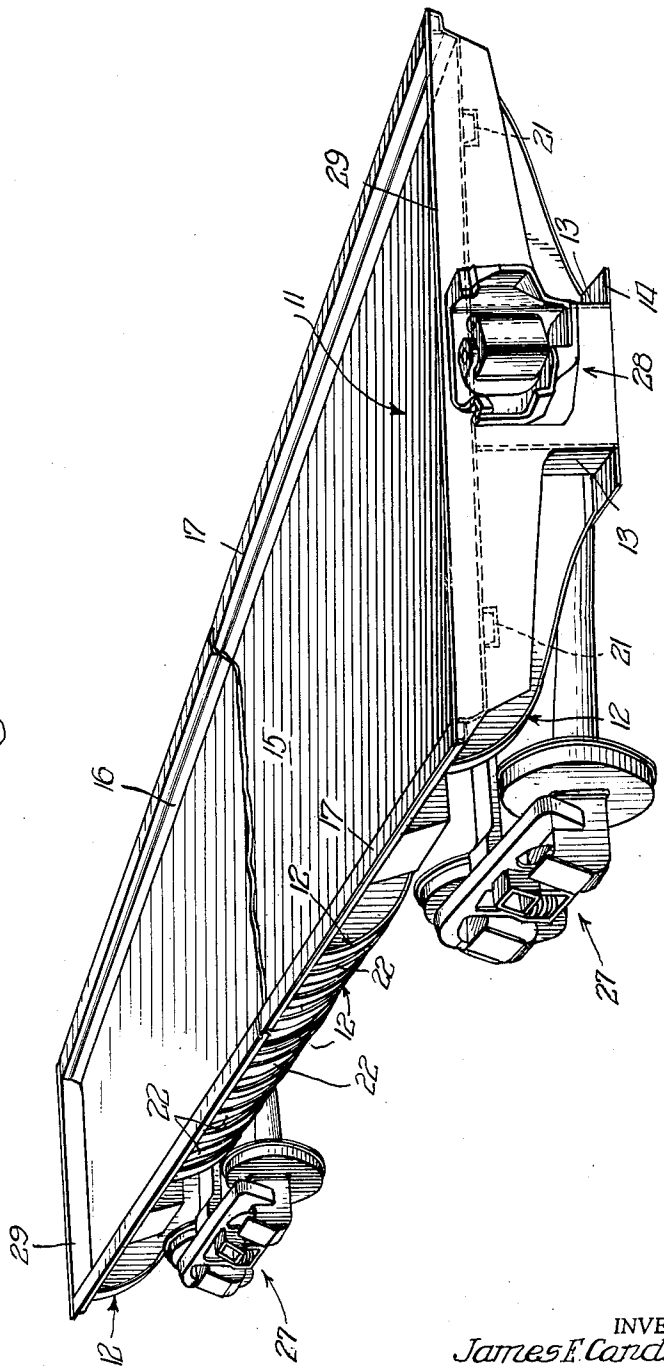


Fig. 1.

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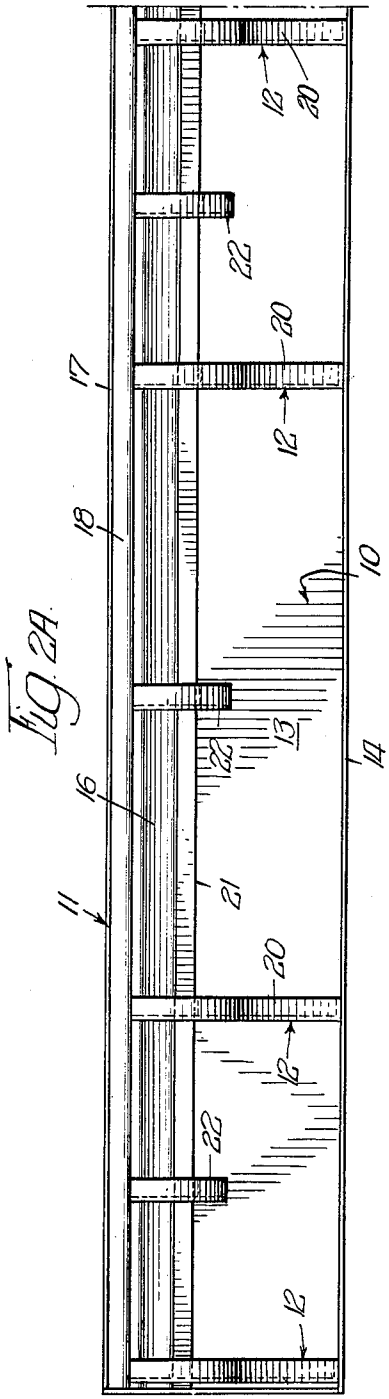


Fig 2A

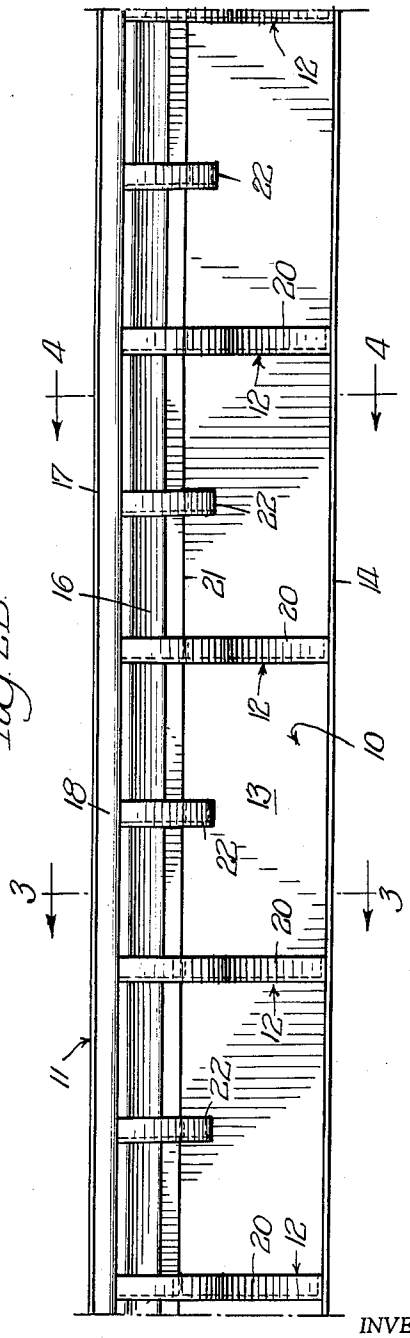


Fig 2B

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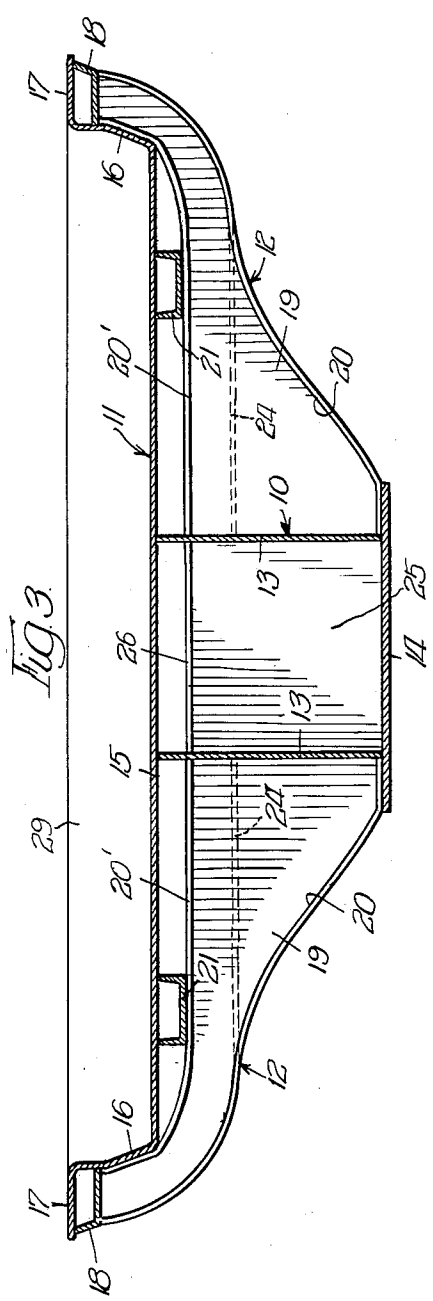


Fig 3

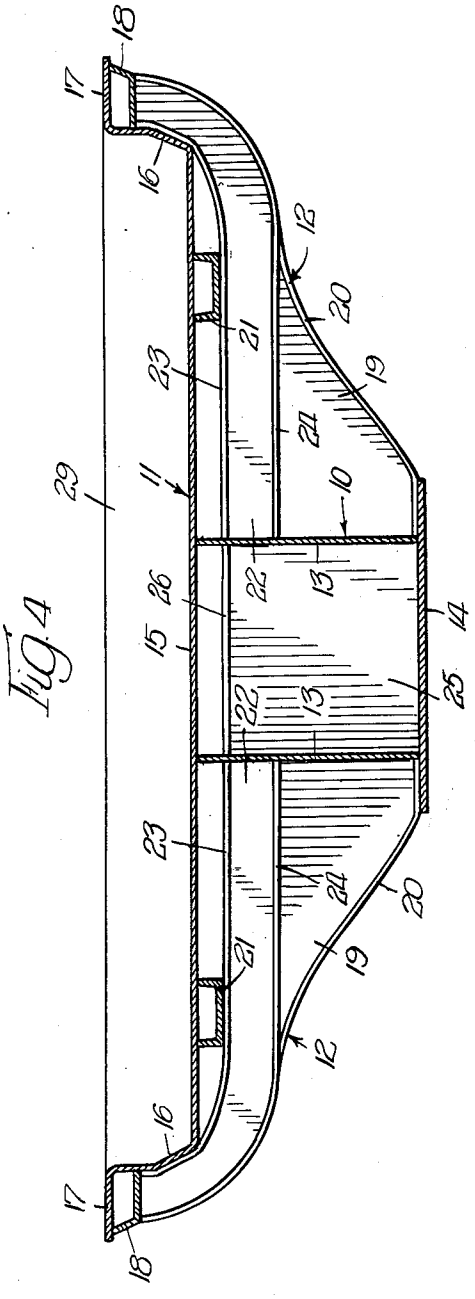


Fig 4

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SINGLE BEAM RAILWAY CAR

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6 Claims. (Cl. 105—404)

The present invention relates to a new and improved single beam railway car of generally flat bed and low side design. More specifically, the invention is directed to a new and improved railway car construction particularly adapted for lightweight and long length fabrication, the car involving the use of a box section central beam structure the top chord of which forms the entire deck or floor structure having integrally formed side sills which by reason of their design and arrangement impart to the car a low side, gondola-type configuration.

Certain railway cars, such as flat cars (including those used in piggyback operations) and low side gondolas, have been designed and fabricated in conjunction with the use of the parallel beam principle. This principle entails the use of three parallel beams the center beam carrying the couplers, wheel trucks, etc., and the outer side beams being laterally tied in with the center beam. Standard terminology identifies the center beam as the center sill and the outer side beams as the side sills. Where parallel beams are used, the stress in each is in proportion to the depth. Thus if the center sill is 30 inches deep and the side sills are 10 inches deep, the side sills will be stressed to the extent of ⅓ of the stress of the center sill. To increase car strength it is common to increase the depth of the side sills. By way of example, most flat cars for general service have side sills which are 26 inches deep so that the stress is about ⅞ of that of the center sill. The main aspect of this prior art insofar as it is of comparative interest with regard to the new and improved design principles of the present invention resides in the fact that with the parallel beam construction each beam functions basically as a separate beam insofar as load bearing properties are concerned, the individual beams being tied together so that when a load is applied to the center sill only, a portion of the load will be transmitted to the side sills and vice versa, causing each of the parallel beams to deflect substantially the same.

Of further interest is the fact that where a conventional railway car is designed to bear greater operational loads and stresses, it has been the general practice to merely increase the depth of the various parallel beams, particularly the side sills, thus materially adding to the overall weight of the car while increasing the general strength thereof. From this brief consideration of prior art practices, it can be readily appreciated that car design making use of the conventional parallel beam principle is confronted with several practical limitations, namely, overall car weight, length and cost.

It is an object of the present invention to provide a new and improved railway car design of general utilization in the fabrication of lightweight, adequate strength cars.

A further object is to provide a new and improved railway car of single beam construction particularly adapted for lightweight and long length application, the construction involving the utilization of a box section central beam structure the top chord of which forms the entire floor or deck portion and side sills.

Still a further object taken in conjunction with the foregoing is to provide a new and improved railway car of generally flat bed and low side design, the car being of single longitudinal beam construction particularly adapted for lightweight and long length application, the single beam construction comprising a center main beam portion

having deck or floor forming sections projecting laterally from the top portion thereof, these sections cooperatively defining an integrally formed upwardly opening and relatively wide trough-like beam portion, the construction further including unique cross bearer means which rigidify the low side portions of the bed forming sections to form a uniquely efficient unitary structure.

Another object taken in conjunction with the preceding object is to provide a unique side sill design forming an integral part of a single beam construction, each side sill being in the form of a box-like or tubular longitudinally continuous rim forming a part of a main compression chord portion of the single beam construction.

Other objects not specifically set forth will become apparent from the following detailed description of the present invention made in conjunction with the accompanying drawings wherein:

FIG. 1 is a fragmentary perspective of the combination underframe and floor portion of the new and improved railway car of the present invention, this view illustrating conventional wheel truck equipment combined with the underframe;

FIGS. 2A and 2B cooperatively illustrate a substantial portion of the railway car in side elevation;

FIG. 3 is an enlarged transverse section of a portion of the car taken generally along line 3—3 in FIG. 2B; and

FIG. 4 is a view similar to FIG. 3 taken generally along line 4—4 in FIG. 2B.

The various views of the single beam railway car construction set forth in the drawing depict the construction as comprising a main center beam portion **10** of substantial depth, a trough-like floor or deck portion **11**, and cross bearers **12**. As best shown in FIGS. 3 and 4, the main center beam portion **10** is formed from a pair of vertically directed side plates **13** extending longitudinally of the car and interconnected along the bottom edges thereof by a bottom cover plate **14**. The top edges of the center beam plates **13** are interconnected by a floor or deck plate **15** which forms a part of the deck portion **11**.

The deck portion **11** is a unitary construction integrally tied in with and forming a part of the main center beam portion **10**. The deck portion **11** includes basically the floor plate **15** having a generally flat horizontal center section which extends laterally to each side of the center beam portion **10** to a substantial extent therefrom and terminates along opposite side edges outboard of the center beam portion **10** in upstanding relatively low sides **16**. The sides **16** are, in effect, side sills and the upper edge portions thereof are in the form of box-like longitudinally continuous rims. In the actual construction illustrated, the upper edges **17** of the side plate portions **16** extend radially outwardly to, in effect, define side flanges. These flanges are reinforced by angle members **18** which are rigidly attached thereto and to the upper outer surface portion of the sides **16** to reinforce the upper edge portions of the sides **16** and define the box shaped or tubular rims.

The various elements of the single beam construction described above are illustrative of the basic principle of design constituting an important part of the present invention. The basic principle involves the use of a depending central beam structure **10** which provides the main strength characteristics of the car formed along the top thereof with a wide, upwardly exposed, deck portion **11** which with the side sills **16** defines the top compression chord of the central beam structure **10**. With this design the single beam is provided with a fully effective depth extending from the top of the side sills identified by the flange plate portions **17** to the bottom cover plate **14** of the center beam portion **10**.

Under operational stress as experienced in conventional railway car operation, the deck portion **11** and the

immediately adjacent top portion of the center beam portion 10 are in compression with the remaining lower portion of the center beam 10, including the bottom cover plate 14 thereof, being in tension. The floor plate area 15 carries shear forces resulting in the side sills, including the box-shaped rims thereof as well as the top portion of the center beam portion 10, to be placed in compression due to the integral connection of the various parts. By way of comparison, conventional parallel beam design results in each individual beam functioning as a separate beam with the top portion of each beam being in compression and the bottom portion thereof being in tension. The depth of the various beams are selected and the beams are laterally tied in to provide for uniformity in individual beam deflection and the like so that the conventional railway car will function properly. Thus in conventional car design the depth of the separate side sill beams and center sill beam are individually relied upon in retaining adequate overall strength.

In order to obtain the unique single beam operational aspects as described above with regard to the construction of the present invention, it is preferred that the various components of the single beam construction be formed from material having equivalent elasticity properties. Preferably the modulus of elasticity should be high (as is the case with common constructural metals) in order to obtain adequate force transference from side sill portions to center sill. The operational principle of design will function more efficiently in relatively long cars and is particularly adapted for use in cars having a low center of gravity especially where the car couplers are mounted relatively high for coupling with standard cars of conventional design. It has been found that with the design of the present invention, long cars incorporating the construction principles therein exhibit shear lag losses reduced to a virtually negligible quantity.

As previously described, it is preferred that special cross bearers 12 be added to the basic single beam construction. These cross bearers, as best shown in FIGS. 1 and 3, may be of single piece strut-like construction comprising a vertical plate 19 having opposite edge radial flanges 20 and 20' extending continuously along the inner and outer edges thereof. Each cross bearer 12 is suitably connected to the outer surface of the adjacent vertical plate 13 of the center beam portion 10 in overlapping outer edge connection with an edge portion of the bottom cover plate 14 and extending under the floor plate 15 in spaced relation thereto. Each cross bearer 12 extends upwardly along the outer surface of a side plate portion 16 in engagement therewith and into attachment with the bottom outer surface of an angle member 18 which defines the box-like rim of each side sill. The cross bearers are, in effect, wrapped around the outer surface of the laterally projecting floor sections forming a part of the deck portion 11.

The cross bearers 12 constitute external reinforcement of the sides 16, side sills or rims depending upon the terminology used, to aid in holding the same against lateral deflection in response to car operational loads. The cross bearers function to maintain the fully effective and operative position of the various sections of the top chord or deck portion 11 of the single beam construction to assure that, under operational stress, the single beam will be fully effective with regard to its original overall depth. The cross bearers 12 function much as an outrigger might be used to aid in supporting a cantilevered area. Thus the cross bearers support the side sill rims against lateral deflection to maintain the same in operative position for compression as described above and protect the same against any torsional forces that might be acting thereon.

The top edge of each cross bearer as defined by the flange 20' is spaced from the bottom surface of the floor plate 15 to receive therebetween a longitudinally continuous floor stringer 21 which is in the form of an upwardly opening channel beam. Each floor stringer 21 is located below the floor plate 15 on opposite sides of the center beam portion 10 to aid in supporting vertical loads applied to the floor plate sections. Thus, in the event that the railway car is used as a trailer car in piggyback operations, the stringers 21 are preferably located in vertical load bearing support directly below the wheels of the trailers loaded on the car. This additional strengthening is of a localized character and does not detract from the utilization of the principle of the single beam construction described above. In this regard the cross bearers 12 by reason of their relationship with the floor stringers 21 also function in a certain respect to aid in supporting localized vertical loads applied against the floor plate 15 in the bed of the car.

In order to cut down on the total number of cross bearers 12 used in a single car construction and thus cut down on the amount of material added to the car and the overall weight thereof, it has been found that the cross bearers 12 may be appreciably spaced from one another longitudinally of the car as shown in FIGS. 2A and 2B. In maintaining the number of necessary cross bearers 12 at a minimum, it may be desirable to utilize cross ties 22 shown particularly in FIG. 4. Each cross tie 22 extends laterally from a side plate 13 of the center beam portion 10 and is provided with a top edge flange 23 and a bottom edge flange 24. The cross ties 22 are spaced from the bottom surface of the overhanging section of floor plate 15 and curve upwardly around the outer surface of the side plate portion 16 in engagement therewith and in reinforcing attachment with an angle member 18 in the same manner as a cross bearer 12. Each cross tie is in supporting engagement with a floor stringer 21 at right angles thereto. The cross ties 22 function to strengthen the floor plate sections to which they are connected to withstand dead weight loads carried by the car as well as aid the cross bearers in reinforcing the rims or side sills.

It will further be appreciated that each of these reinforcing means is of uncomplicated design and lightweight construction. The cross ties 22 do not extend into engagement with the bottom cover plate 14. All connections may be readily obtained by any suitable means such as welding. Lateral tie-in between the main reinforcing cross bearers 12 is preferred within the center sill 10. This is accomplished as shown in FIGS. 3 and 4 by the provision of center sill separators 25 fixed between the side plates 13 and in alignment with oppositely directed cross bearers 12. The separators 25 are in the form of plates extending from the bottom cover plate 14 to the height of the flanges 20' of aligned cross bearers. The top of each separator 25 is provided with a radial flange 26.

Referring to FIG. 1, suitable wheel trucks generally designated by the numeral 27 may be connected to the single beam construction in the known manner, the endmost cross bearers 12 being adequately spaced from one another to receive the trucks 27 therebetween. The various views do not illustrate other conventional railway car equipment, such as brake systems and the like, it being understood that the single beam underframe construction disclosed constitutes as essence of the invention and all regular railway car equipment can be readily applied thereto. The center beam portion 10 has suitably housed therein at opposite ends thereof a conventional coupler 28. Where the car is used as a flat car or low side gondola, suitable end sill plates 29 may be readily attached to extend across the ends of the deck portion 11. Where the car is used as a trailer car for piggyback operation, conventional bridging plates may be pivotally mounted to the ends of the deck portion 11.

From the foregoing description of the invention, it will be recognized that the railway car consists of a single long main structural beam of which all of the steel work is an integral part. It has been found that this type of construction materially reduces the overall weight of the

car as well as the overall deflection of a long car. The raised side portions, which might be considered side sills, are an integral part of the main structural beam both from the standpoint of material connection and operational force dissipation. The reinforced rims must be located relative to the plane of the floor plate or deck of the car so as to become part of the top extreme fibre or chord to carry high compression forces. In order to maintain conventional stress levels, it is necessary that these rims either be adequately reinforced or preferably supplied with sufficient area so that they are adequately strong and bulky to resist collapse due to column instability.

Obviously certain modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. A railway car of generally flat deck single longitudinal beam design and adapted for lightweight and long length construction, said car comprising a center longitudinal beam portion having a rigidly tied-in floor plate portion adjacent the top of said center beam portion and extending continuously longitudinally of said car to define the deck of said car, said floor plate portion extending laterally to each side of said center beam portion and terminating outboard thereof in longitudinally continuous and rigidly tied-in side sills, and transverse cross bearer means attached to said side sills and said center beam portion in transverse continuity therewith to further confine said side sills as integrally functioning parts of said single longitudinal beam design, the distribution of the mass of said center beam portion, floor plate portion and side sills being such that there is a single neutral axis for the cross section of said car which is below said floor plate portion and said side sills to provide for said floor plate portion and side sills functioning in their entirety as a part of the top compression chord of said single longitudinal beam design.

2. The railway car of claim 1 wherein substantially all of the mass of said side sills projects upwardly above said floor plate portion longitudinally of said car.

3. In a railway car of generally flat deck construction,

said car including a center longitudinal beam portion having a rigidly tied-in floor plate portion adjacent the top of said center beam portion and extending continuously longitudinally of said car to define the deck of said car, said floor plate portion extending laterally to each side of said center beam portion and terminating outboard therof in longitudinally continuous and rigidly tied-in side sills, and transverse cross bearer means extending between said side sills and said center beam portion, the improvement comprising the mass of the aforesaid portions and side sills being selected and located to establish a single neutral axis for the cross section of said car, which neutral axis is located so that said floor plate portion and side sills in their entirety function as the top compression chord of a single longitudinal beam design.

4. The railway car of claim 3 wherein said side sills are each formed with a substantially greater mass above their geometric center.

5. The railway car of claim 3 wherein said side sills project upwardly above said floor plate portion longitudinally of said car.

6. The railway car of claim 3 wherein said side sills project upwardly above said floor plate portion longitudinally of said car and are formed with longitudinally continuous reinforcing means along the top portions thereof whereby the mass of said side sills above their longitudinal geometric center is substantially increased.

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