Dec. 15, 1942. A. G. DEAN 2,305,518

RAIL CAR UNDERFRAME

Filed Sept. 14, 1940 3 Sheets-Sheet 1

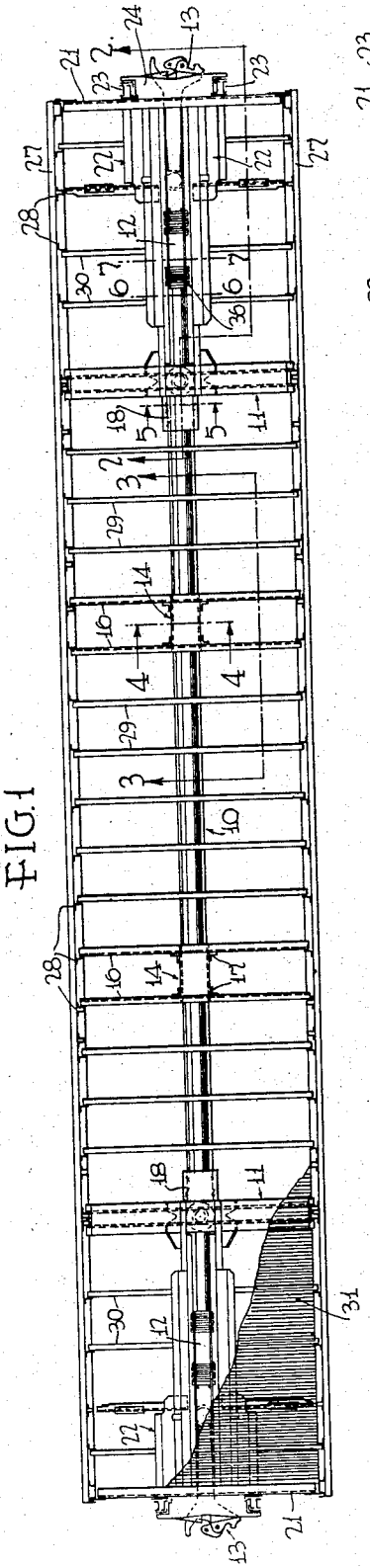


FIG. 1

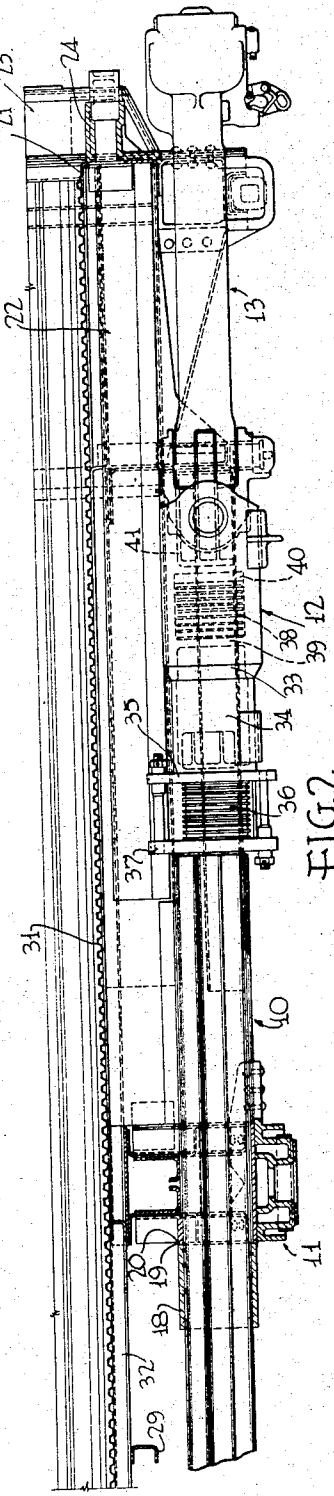


FIG. 2

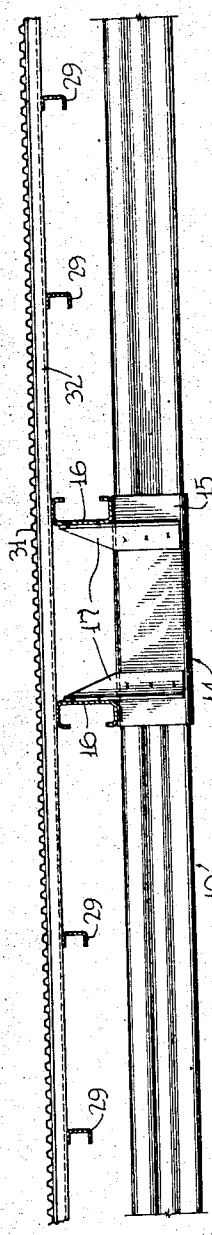


FIG. 3

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Dec. 15, 1942. A. G. DEAN 2,305,518

RAIL CAR UNDERFRAME

Filed Sept. 14, 1940 3 Sheets-Sheet 2

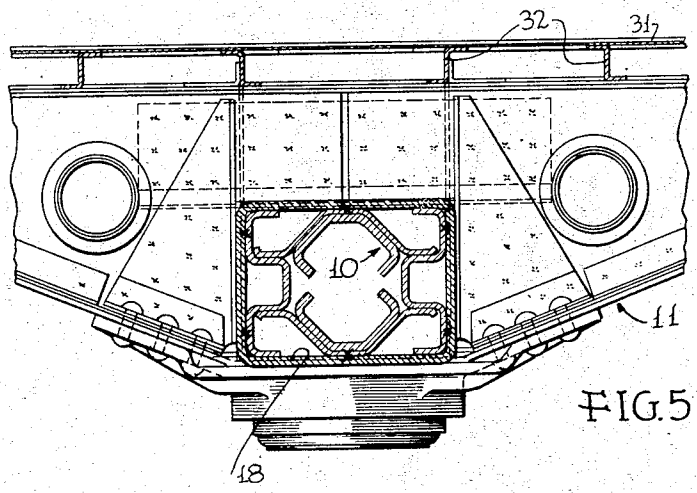


FIG. 5

FIG. 4

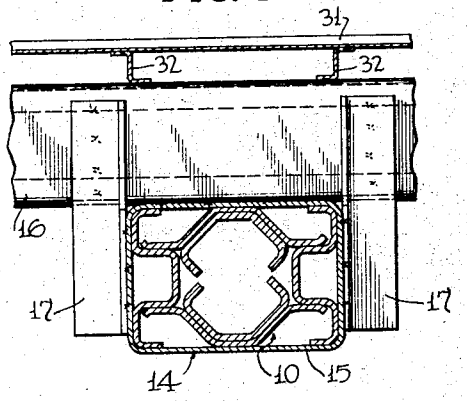


FIG. 6

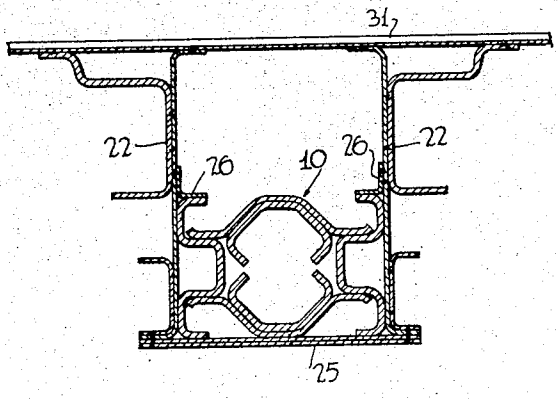
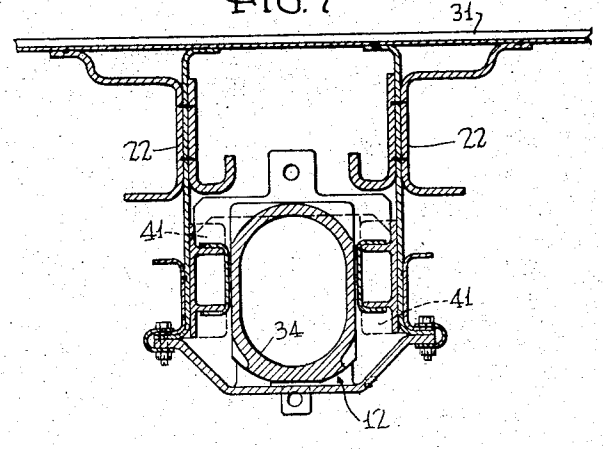


FIG. 7



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Dec. 15, 1942. A. G. DEAN 2,305,518

RAIL CAR UNDERFRAME

Filed Sept. 14, 1940 3 Sheets-Sheet 3

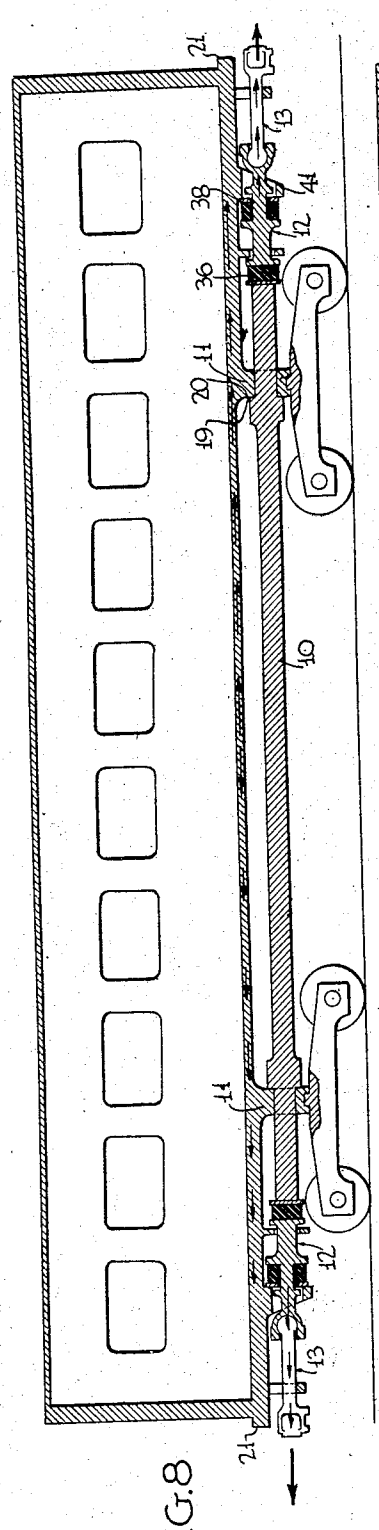


FIG. 8

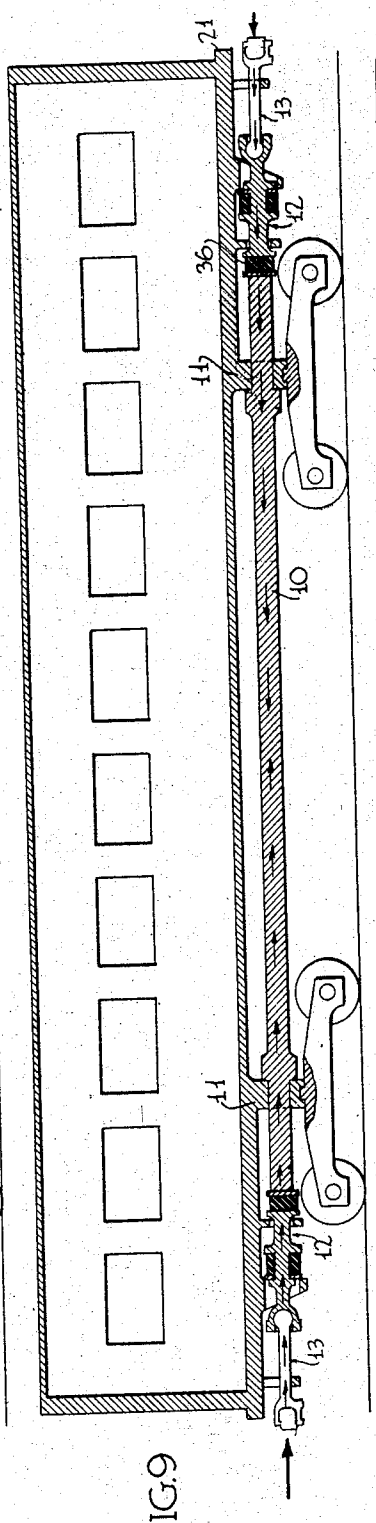


FIG. 9

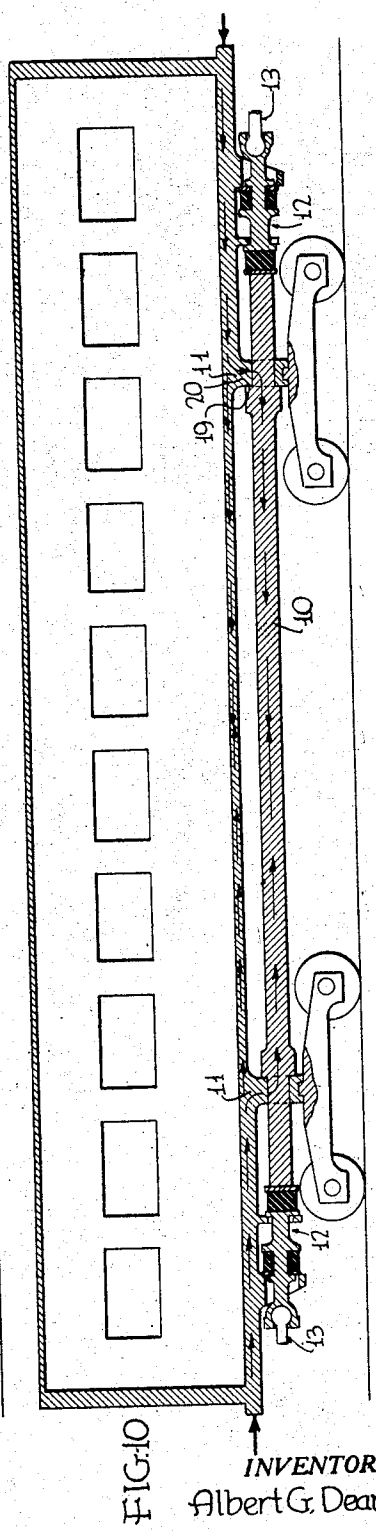


FIG. 10

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Patented Dec. 15, 1942 2,305,518

UNITED STATES PATENT OFFICE

2,305,518

RAIL CAR UNDERFRAME

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

Application September 14, 1940, Serial No. 356,741

8 Claims. (Cl. 213—8)

The invention relates to rail cars and more particularly to the underframe structure of such cars, and is variant of the underframe structure shown in my prior co-pending application Serial No. 296,026, filed September 22, 1939.

According to this earlier construction, the underframe comprises an intermediate longitudinal box-section center sill portion arranged directly in line with and adapted to directly receive the buffing loads from the couplers, and this sill is connected throughout its length and at frequent intervals to the side walls through deep transverse floor beams and bolsters, connected at their ends to the side sills of the underframe formed by the reenforced lower chords of the trussed side walls. The said intermediate portion of the center sill passes through the bolsters and projects at its ends some distance beyond the bolsters adjacent the opposite ends of the underframe. It is extended to the end sill and the vertical collision posts secured thereto by vertically deep and laterally widened sill extensions which form a pocket between them for housing the draft gear connected to the coupler. The transverse and longitudinal members of the underframe are further tied together into a unitary underframe by longitudinal stringers secured to the bolsters and floor beams and transversely corrugated floor sheeting secured to the end sills, side sills, center sill extensions and stringers.

It is well known that, due to the elasticity of the metal of which it is fabricated, the center sill of this arrangement will shorten slightly under the heavy buffing forces to which it is subject, and such foreshortening, in view of its strong connection to the rest of the underframe, will tend to foreshorten the entire width of the underframe and to deflect the side wall trusses connected to the sides of the underframe, unless the parts entering into the structure are fabricated with sufficient strength to counteract this foreshortening. Such foreshortening of the side sills of the underframe, for example, has the disadvantage that it causes undue deflection of the trussed side walls of the body, and this affects the interior appointments of the car. In the application above referred to, undue deflection is avoided by strengthening the underframe to take care of it. Strength in the underframe is, of course, advantageous in case of collision where the shock is transmitted to the entire underframe directly from the end sill and, in such case, it is desirable that the center sill work in conjunction with the rest of the underframe in taking the collision load. However, in taking normal buffing loads through the coupler, it is not necessary, if the center sill has sufficient columnar strength, to have the rest of the underframe work with it in taking these loads and it will be obvious that, if the rest of the underframe is not secured to the center sill to work with it, the foreshortening of the sill under these normal loads will not cause deflection of the rest of the underframe and body side walls.

It is, therefore, an object of my invention to overcome the defects of the rigidly connected center sill, and thus make it possible to lighten the overall weight of the underframe by so constructing the underframe that the center sill under buff loads transmitted to it through the couplers acts by itself to absorb those loads independently of the rest of the underframe and connected car body, but where, in case of collision with the end sill or end posts, the collision load is transmitted by the center sill and the rest of the underframe working together to resist it.

To achieve this object, I make the portion of the center sill, extending directly in line with the draft gear mechanism associated with the couplers at opposite ends of the car, a strong columnar structure unconnected to the rest of the underframe, or alternatively connected at one end only, except for spaced slidingly fitted guides provided to prevent buckling of the sill. The ends of this sill portion extend beyond and are guided in the bolsters and terminate between the bolsters and the end sills where they provide the inner faces of the draft gear pockets. At opposite sides of the said sill portion ends, I provide strong columnar sill extensions, extending between the bolsters and the end sill which provide the sides of the draft gear housing pockets. The ends of the underframe, between and including the end sill and the bolster, are rigid structures rigidly tied into the side walls and act to take the relatively light draft forces as compared with the buffing forces through the car body independently of the columnar center sill portion extending between the draft gear pockets at the opposite ends of the underframe.

To enable the said portion of the center sill to work with the rest of the underframe in case of collision load against the end sill or the collision posts at the end of the car, I provide said sill portion with strong rigid shoulders which normally abut coacting faces on the rigid end underframe structures so that collision forces on said structures are transmitted through them to said center sill portion as well as to the rest of the underframe. However, under normal buff

forces from the couplers, this sill portion is free to foreshorten without imposing deflection strains on the rest of the underframe or the car body as a whole. One important advantage of this arrangement is the possibility of still further lightening the underframe construction and of the body as a whole, since it is no longer subject to frequent deflection forces due to the buffing loads acting on the center sill. Fatigue strains in the rest of the body structure due to the buffing forces are also avoided.

Other and further objects and advantages and the manner in which they are attained will become clear from the following detailed description when read in connection with the appended drawings in which—

Fig. 1 is a plan view of a car underframe, with parts broken away, showing the invention applied thereto;

Figs. 2, 3, 4, 5, 6 and 7 are enlarged fragmentary sectional views, the sections taken, respectively, on the correspondingly numbered section lines of Fig. 1 and looking in the direction of the arrows at the ends of the section lines;

Figs. 8, 9 and 10 are similar diagrammatic central longitudinal sectional views through a car body equipped with the invention showing, by means of arrows, the path through which the forces mainly act, Fig. 8 indicating the draft forces, Fig. 9 the buff forces, and Fig. 10 the collision forces.

In the embodiment of the invention shown in Figs. 1 to 7, inclusive, the underframe is built up almost wholly of formed strips of high strength steel, such as high-tensile stainless steel, and in most respects follows the structure disclosed in my application above identified. It will be understood, however, that the invention is applicable to other types of underframe construction, the form selected being merely illustrative.

The underframe may comprise a main center sill portion **10** extending the greater portion of the length of the car and through guiding openings in the bolsters **11** adjacent its ends. This sill portion terminates some distance beyond the bolsters adjacent each end of the car, and these ends are substantially directly in line with the draft gear, indicated generally at **12**, and connected coupler **13** at each end of the car.

Each end of the sill thus forms the inner end of a draft gear pocket and is adapted to directly receive the forces in buff transmitted from the couplers **13** to the associated draft gears **12**.

From Figs. 4, 5, and 6, it will be seen that this sill portion **10** comprises a compact column built up of a plurality of formed sheet metal strips secured together as by spot welding to form a generally rectangular box-section structure having free edge flanges.

This sill portion is entirely free to contract and foreshorten under the buffing forces transmitted to its ends, since it is not connected to the bolsters through which it passes nor to any other parts of the underframe to transmit any of these buffing forces to the underframe. Alternatively, it may however be rigidly connected to the bolster and/or columnar structures **22, 22** at one end thereof. Such connection at but one end would not interfere with the free contraction or foreshortening of the sill throughout substantially its entire length. The sill portion **10** is stabilized against bending under buffing load by the guided connection with the bolsters, and additionally by a pair of spaced guides, designated generally by numeral **14** between the bolsters.

The guides **14** may consist of a sleeve **15** slidably receiving the sill portion **10** and strongly secured to two spaced vertically-deep transverse floor beams **16** through its top and side walls. The top may be directly welded to the bottom of the floor beams, while the side walls of the sleeve **15** may be secured by angles **17** overlapping and welded through their respective arms to the floor beams and sleeve.

The sill portion **10** so mounted to have longitudinal sliding movement with respect to the bolster and the guides **14** would, without further provision, be inoperative to transmit collision loads directly transmitted to the end of the underframe independent of the couplers. To enable this sill portion to act with the rest of the underframe and car body to take collision loads, I provide the sill portion **10** with an enlargement, designated **18**, directly abutting the inward face of each bolster, such enlargement, in the form shown, consisting of a sleeve strongly welded or otherwise secured to the sill. These sleeves provide shoulders, indicated at **19**, each shoulder directly abutting the corresponding shoulder **20** surrounding the opening in the bolster through which the sill extends. From this it will be seen that any collision forces transmitted to the bolsters are also transmitted through the abutting shoulders **19** and **20** to the sill portion **10** extending between the bolsters.

The end portion of the underframe, including the bolster **11** and the end sill **21**, is reenforced to take collision by a spaced pair of strong columnar built-up structures **22**, see Figure 7, which are of vertically-deep section and increase in width transversely from the bolster to the end sill, to both of which they are strongly secured. The laterally outer widened portions of these columnar structures are in line with the vertical collision posts **23** of the end wall, and the space between these posts is further reenforced by a buffer casting **24** secured to the posts and sill.

These columnar structures **22, 22** form the sides of a draft gear pocket and receive between them the draft gear **12** and coupler **13** as well as the extreme end of the center sill proper **10**. As shown in Fig. 6, in the region of the end of the sill **10**, the columnar structures **22, 22** are joined at the bottom by a double-thickness plate **25** which guides the bottom of the sill, while the upper portion of the sill is guided by angles **26** secured to the vertical portions of members **22**.

Of course, the underframe so far described is strongly reenforced at the sides by the strong columnar side sills **27** which may also form the bottom chords of the side wall trusses, the vertical members of which are indicated at **28**. Other and shallower floor beams **29** may connect the side walls between the bolsters and the floor beams **16** supporting the guides **15**, and between the spaced guides **15** themselves. Similarly, the end portion of the underframe between the bolster and the end sill may be additionally transversely reenforced by the floor beams **30**. Finally, the entire underframe may be stiffened and strengthened by the transversely corrugated floor sheeting **31**, indicated in Fig. 1, this sheeting being secured directly to the end sills, to the columnar structures **22, 22**, and indirectly through longitudinal stringers **32** to the bolster and the transverse floor beams **16, 29** and **30**.

Since the ends of the underframe are thus strongly reenforced and tied into the side sills

and side walls of the body, the draft forces acting through the coupler can very well be taken by the body without utilizing the center sill 10, since the draft forces are comparatively light as compared with the forces in buff.

According to the form of the invention shown, the forces in buff are transmitted from the coupler 13 to a yoke 33 guided in the draft gear pocket and having an inwardly extending portion 34 directly engaging the outer abutment 35 of a buff spring nest 36, the inner face of this spring nest engaging the abutment 37 directly engaging the end of the sill.

In draft, the draft spring nest 38 is compressed between the transverse wall 39 on the yoke 33 and abutment 40 which brings up against a pair of draft lugs, as 41, one secured to each of the columnar structures 22 forming the sides of the draft gear pocket.

The operation will be clearly apparent by reference to the diagrammatic showing in Figs. 8, 9 and 10, wherein corresponding parts are given corresponding reference characters. From the showing in Fig. 8, it will be obvious that, when couplers 13 are subjected to draft forces, as indicated by the arrows, the forces will be transmitted through the draft spring nest 38 and draft lugs 41 to the reenforced underframe structure between and including the bolster 11 and the end sill 21, and through this reenforced end underframe structure, as well as through the longitudinal stringers and the transversely corrugated flooring between the bolsters and, by reason of the connection of the underframe to the side walls, through the side walls also. The arrows of Fig. 8 indicate generally the path of the main portion of the draft forces. It will be seen that sill portion 10 is entirely idle, while the couplers are subject to draft forces.

Refer now to Fig. 9 where the couplers 13 are shown to be subjected to buff forces. It will be seen that these forces are directly transmitted through the couplers to the yokes and through the yokes and buff spring nests 36 to the ends of the sill portion 10. Since the sill portion 10 is free to contract or foreshorten under the load, none of the forces in buff are transmitted to the rest of the underframe or body structure, so that under these heavy buffing forces the body structure is relatively free from fatigue strains and from deflection such as might harm the interior appointments of the body. Since these normal buff loads are taken wholly through the center sill portion 10, the rest of the underframe, especially that portion of it between the bolsters, can be very considerably lightened by the use of shallow floor beams 29, shown in Figs. 1 and 3, and otherwise.

Referring now to Fig. 10, where collision forces are shown applied directly to the ends of the car underframe, it will be seen that here such forces are carried, not only by the portions of the underframe carrying the draft loads, but also by the center sill portion 10 by reason of its shouldered engagement 19, 20 with the inner faces of the bolsters. It will be understood, of course, that the hollow bolsters 11 are reenforced between their side walls around the openings therein to transmit these loads from the bolsters to the sill 10 through the shouldered connection. Thus, the center sill adds its effect in resisting collision to the rest of the body structure, while free to contract and foreshorten in buff without placing any strain upon the rest of the structure. The spaced guides along its length prevent its bending under the buff and collision loads.

While I have herein shown and described a specific embodiment of the invention, it will be understood that changes and modifications may be made without departing from the spirit of the invention, and such changes and modifications are intended to be included within the scope of the appended claims.

What is claimed is:

1. A rail car underframe comprising spaced bolsters adjacent the ends of the body, a center sill member extending between and through openings in said bolsters and having its ends beyond the bolsters in line with the draft gear to directly receive forces in buff, said sill being free to foreshorten under forces in buff without affecting the rest of the underframe, but having normally direct shouldered engagement with the inward faces of the bolsters, whereby collision forces transmitted to the ends of the underframe are taken by said sill member as well as the remainder of the underframe.

2. A rail car underframe comprising end sills, bolsters spaced from said end sills, longitudinally extending members including side sills connecting the ends of said end sills and bolsters, center sill end extensions spaced apart to provide a draft gear pocket between interconnecting the bolsters and end sills at each end of the underframe, and a center sill member extending between the bolster and guidingly supported thereby with its ends in line with the draft gear pockets, and arranged to directly receive the forces in buff, said sill member being free to foreshorten under forces in buff without affecting the rest of the underframe, but having normally direct shouldered engagement with the inward faces of the bolsters, whereby it assists in taking collision forces transmitted to the ends of the underframe.

3. In a rail car underframe, draft gear pockets adjacent the ends thereof, bolsters inwardly of said pockets and having openings therein in line with said pockets, a center sill member extending between the bolsters, guided in said bolster openings, and having its ends form the inner ends of said pockets, the center sill member having normally direct shouldered engagement with the inward faces of said bolsters, but being otherwise free to permit relative longitudinal movement between it and the rest of the underframe under buffing forces transmitted to its ends.

4. In a rail car underframe, end portions stiffened and strengthened to take compression and tension loads and including a bolster at their inner ends, a center sill member slidably supported by said bolsters and terminating beyond the bolsters, draft gear mechanism arranged adjacent the ends of the underframe in line with the center sill portion, whereby to transmit forces in buff to said center sill member only independent of the rest of the underframe, the sill member having normally direct shouldered engagement with the inward faces of said bolsters, whereby it aids in taking collision forces transmitted to the ends of the underframe.

5. An underframe for rail cars comprising end sills, bolsters inwardly spaced from the end sills, center sill end extensions comprising spaced longitudinal members interconnecting each said bolsters and the adjacent end sill and forming the side walls of draft gear pockets, draft gear including a draft yoke and cushioning means disposed in each of said pockets, a rectilinear center

sill member directly in line with said pockets, extending at its ends between said spaced end extensions and forming the inner ends of the respective pockets, the rectilinear center sill member being free of positive connection to the rest of the underframe, at least, from one end thereof for substantially its entire length and adapted to take the forces in buff from the draft gear directly against its ends, whereby it is free to foreshorten under the action of the forces in buff without transmitting such forces into the rest of the car structure, and means whereby all the forces in draft are transmitted from the draft gear to the longitudinal members forming the side walls of the draft gear pockets and from them through the rest of the underframe independently of said rectilinear center sill member.

6. An underframe for rail cars having inwardly extending draft gear pockets at its opposite ends, draft gear disposed and guided in each of said pockets, a rectilinear center sill member in line with said pockets, having its ends form, respectively, the inner end walls of said pockets and arranged to receive directly on its ends forces in buff transmitted to the draft gear in the respective pockets, longitudinally spaced transverse members of the underframe supporting and guiding said center sill member, the said center sill member providing the sole main generally centrally arranged longitudinally extending strength member of the underframe in the region between the endmost of said transverse members supporting and guiding it and being free of positive connection to the rest of the underframe, at least, from one end thereof for substantially its entire length, whereby it is free to foreshorten under the action of forces in buff without transmitting such forces through it into the rest of the car body.

7. An underframe for rail cars comprising bolsters adjacent the ends thereof, end sills, draft gear pockets the sides of which are formed by spaced longitudinal members connecting each bolster with the adjacent end sill, draft gear disposed and guided in each of said pockets and means for transmitting the forces in draft from said gear to the longitudinal members forming the sides of the pockets, a rectilinear center sill member supported and guided by openings in the bolsters and by guiding means carried on transverse members arranged between the bolsters, said center sill member forming the sole main generally centrally arranged longitudinally extending strength member of the underframe in the region between the bolsters and being arranged directly in line with the draft gear in said pockets and adapted to take the forces in buff from the draft gear directly against the ends thereof, the center sill member being free of positive connection to the rest of the underframe throughout substantially the entire length thereof whereby it is free to foreshorten under the forces in buff transmitted to it through said draft gear without transmitting such forces into the rest of the car structure.

8. A rail car underframe comprising spaced transverse members including end sills and bolsters, draft gear pockets adjacent the ends of the underframe having their sides formed by spaced longitudinal members interconnecting the bolsters, respectively, with their adjacent end sills, draft gear disposed and guided in each of said pockets and means for transmitting forces in draft from said gear to the longitudinal members forming the sides of the pockets, a rectilinear center sill member forming the sole main generally centrally arranged longitudinally extending strength member of the underframe in the region between the draft gear pockets and being supported and guided by certain of said spaced transverse members arranged inwardly of the end sills, the ends of said center sill member being directly engaged by said draft gear in said pockets and the said sill member being free of positive connection to the rest of the underframe throughout substantially its entire length whereby it is free to foreshorten under buff forces transmitted to its opposite ends through said draft gear without transmitting such forces into the rest of the underframe.

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