H. R. KEITHLEY.

UNDERFRAME FOR RAILWAY CARS.

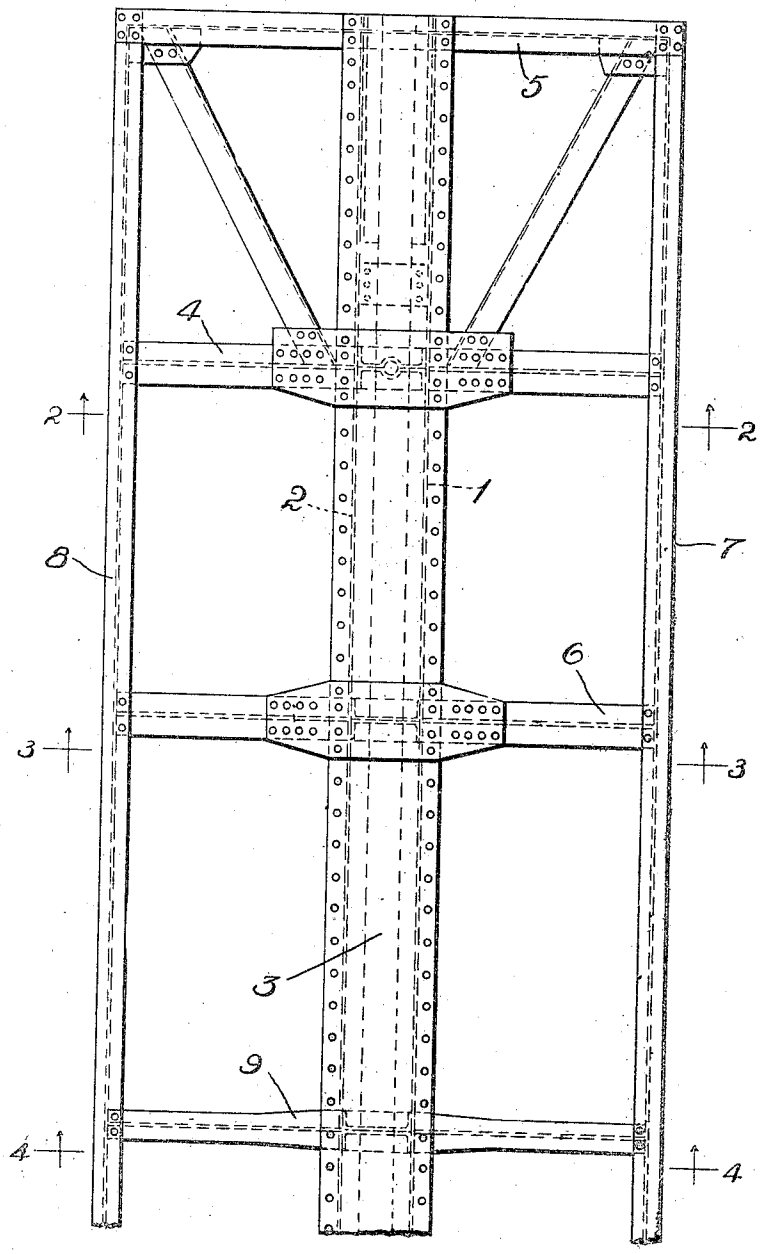
APPLICATION FILED NOV. 8, 1913.

1,104,903.

Patented July 28, 1914.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2

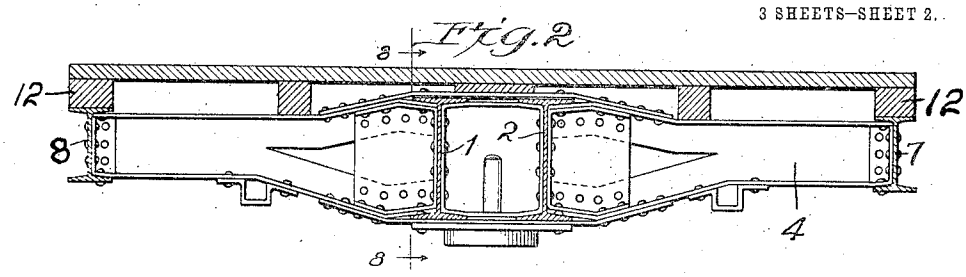


Fig. 3.

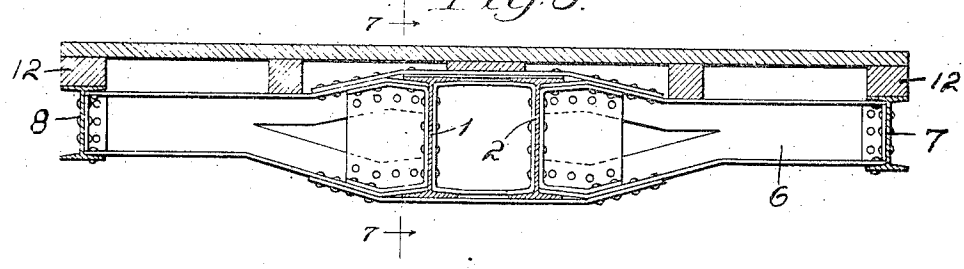


Fig. 4

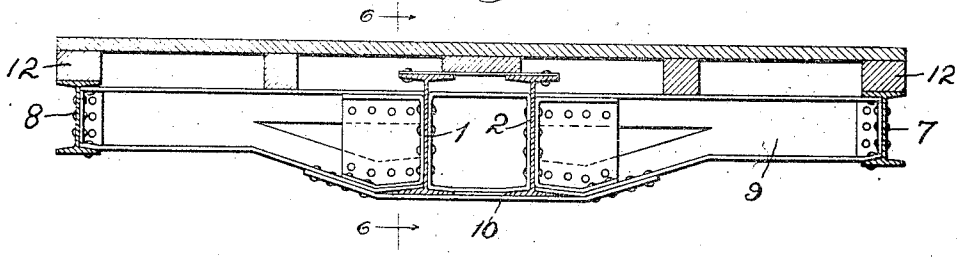
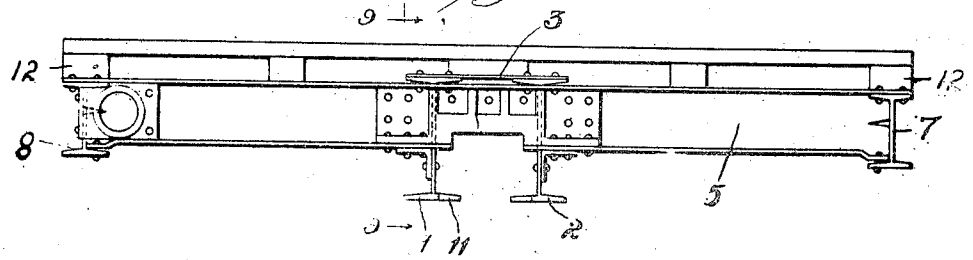


Fig. 5.



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3 SHEETS—SHEET 3.

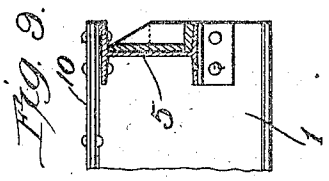


Fig. 9.

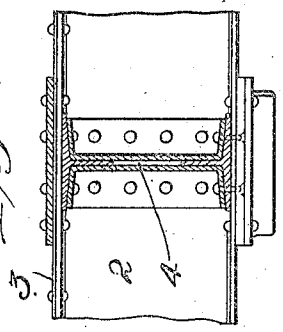


Fig. 8.

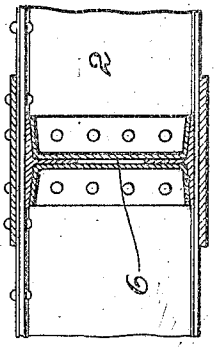


Fig. 7.

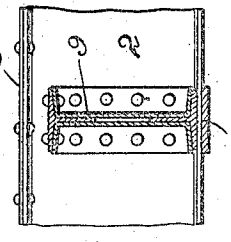


Fig. 6.

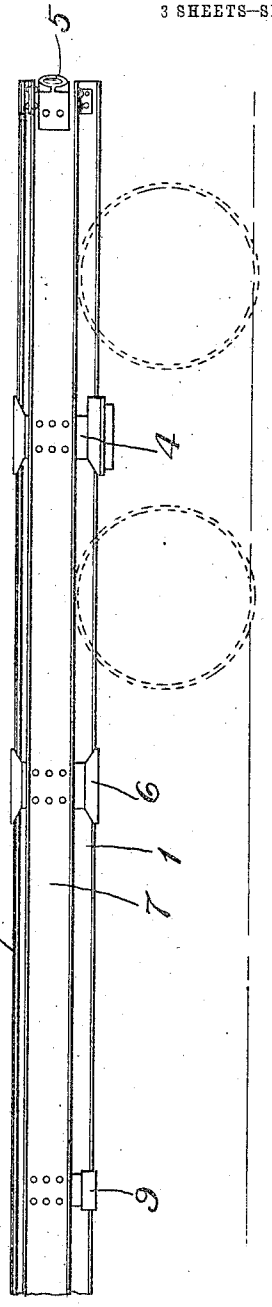


Fig. 10.

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UNITED STATES PATENT OFFICE.

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UNDERFRAME FOR RAILWAY-CARS.

1,104,803. Specification of Letters Patent. Patented July 28, 1914.

Application filed November 8, 1913. Serial No. 799,839.

To all whom it may concern:

Be it known that I, HERBERT R. KEITHLEY, a citizen of the United States, residing at Davenport, county of Scott, State of Iowa, have invented a certain new and useful Improvement in Underframes for Railway-Cars, and declare the following to be such a full, clear, and exact description of the same as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

In freight cars the load is distributed between the trucks and is carried to the trucks through bolsters overlying the latter and connected together by framework which, with the bolsters forms what is known as an underframe. There are at present two main types of underframes, those having four load-carrying sills extending the entire length of the car, two in the middle and two at the sides, and those in which the load is carried almost wholly upon the two center sills. In the first of these constructions it is necessary, in order to carry the heavy loads of today that all of the sills be made deep and heavy and, in fact, it is customary to make all of the sills very deep at the center. The four deep sills not only make the underframe construction heavy, but because of the great depth of the side sills, they are objectionable on account of interfering with the proper inspection of the brake equipment underneath the cars. The second type of underframe was designed with a view to lightening the underframe structure and obviating the use of deep side sills. Where the load is all carried upon two center sills, these must be made very deep and, in order to allow them to pass the bolsters and be carried out to the end sills of the car a large section of the web must be cut away, beginning from a point about six or seven feet inside of the bolster and extending to the end of the center sill. This mutilating of the center sills weakens the sills and it is difficult and at the same time an added expense to reinforce them so as to enable them to withstand the buffing and pulling stresses which are transmitted to them through the draw bars. In one form of this second type of underframe construction deep center sills have been avoided by using rolled channels connected at the top and at the bottom by cover plates riveted thereto and thus forming a large rectangular column of a depth which will permit it to pass over the truck bolsters. This latter form of underframe necessitates a large amount of riveting, because each flange of each of the sills must be riveted at numerous points to the cover plate, making the construction expensive and heavy because the bottom cover plate must be given a large section and therefore a great weight in order to compensate for the loss in tensile strength due to the rivet holes in the bottom flanges of the beams and the deterioration of the metal surrounding the holes. Where the load is carried by a center sill or sills the weight from the sides of the cars must be carried thereto through strong crossbearers which add to the weight of the underframe and, in order to save as much weight as possible, it is customary to use very light side members instead of the side sills of the other type. This virtual elimination of the side sills brings in a decided disadvantage because the portions of the load at the four corners of the car must be borne by side sills or members occupying corresponding positions. It is a distance of about five feet from the bolster to the adjacent end sill and therefore the light metal section usually employed at the sides is taxed to its full capacity when the car is loaded and, it can easily be subjected to an overload under the buffing stresses which are transmitted to it, these buffing stresses exerting a downward push upon the end sill and the adjacent portions of the rest of the underframe and therefore acting like an added weight placed upon the side members. Consequently the side members are incapable of assisting the draft sills in resisting the buffing stresses. In other words, the side members are not strong enough to hold up the end sill and thus act as supports for the outer ends of the draft sills and prevent the latter from giving way. If the side members were made heavy enough to act effectively under the weight of the load in the car and to hold up the end sill so as to assist the draft sills in resisting the downward thrust from the buffing stresses it would place in the span between the bolsters a large quantity of metal not required to carry the load in the car and would thus add so much to the weight of the underframe as to produce a loss of all the economy gained through the use of the deep center sills.

One object of my invention is to produce

an improved underframe construction in which the greater portion of the load is carried by the center sill or sills so as to avoid the use of deep side sills and thus obtain economy in weight of metal and at the same time avoid the weakening of the structure at the corners of the car.

A further object of my invention is to produce an improved underframe construction in which the greater portion of the load will be carried by center sills extending continuously from one end of the car to the other or, at least past the bolsters, without diminution in depth above the truck bolsters.

A further object of my invention is to produce an improved underframe construction, economical in weight, embodying center sill construction upon which the greater portion of the load is carried and which shall be rigid against buffing and pulling stresses without the use of a bottom cover plate to tie the members of the sill together.

A further object of my invention is to produce an improved underframe construction embodying load-carrying center sills and side sills so connected that the side sills carry a considerable portion of the load and transfer it to the center sills at such a distance from the bolsters that the bending moment due to the transferred load will be less than an equal load uniformly distributed along the center sills or distributed or carried to the center sills through the cross beams or transoms heretofore employed in that type wherein the center sills are intended to carry all the load between the bolsters.

A further object of my invention is so to construct a car underframe as to permit the use of I-beams for all of the sills without making the structure unduly heavy.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but for a full understanding of my invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a top plan view of one-half of the underframe arranged in accordance with my invention; Fig. 2 is a section on an enlarged scale on line 2—2 of Fig. 1; Fig. 3 is a section on an enlarged scale on line 3—3 of Fig. 1; Fig. 4 is a section on an enlarged scale on line 4—4 of Fig. 1; Fig. 5 is a view on the same scales as views 2, 3 and 4 of the end sill as viewed from the top of Fig. 1; Fig. 6 is a section on an enlarged scale on line 6—6 of Fig. 4; Fig. 7 is a section on an enlarged scale on line 7—7 of Fig. 3; Fig. 8 is a section on an enlarged scale on line 8—8 of Fig. 2; Fig. 9 is a section on an enlarged scale on line 9—9 of Fig. 5; and Fig. 10 is a side view of that portion of the underframe shown in Fig. 1.

In the drawings I have illustrated only one-half of an underframe construction, since the two halves are identical.

Referring to the drawings, 1 and 2 are two center sills in the form of I-beams. The two center sills are connected together by an overlying top cover plate, 3, extending from end to end and riveted to the top flanges of the sills. Rigidly connected to the center sill are transverse body bolsters, 4, the center sills extending through the bolsters. Parallel with the bolsters, at the ends of the center sills are end sills, 5. Between the bolsters are transoms, 6. 7 and 8 are side sills in the form of I-beams extending from one end sill to another and rigidly connected to the ends of the bolsters and transoms.

In a construction of the type just described, the load may be distributed in any desired proportion between the side sills and the center sills, the transom serving to transfer more or less of the load from the sides to the center sills. With a series of cross members uniformly spaced between the bolsters the load upon the center sills will be a uniformly distributed load equal to half the total load and lying directly over the center sills and an equal load concentrated at the points where the transverse members cross the center sills. If there are enough of the cross members the effect on the center sills will be practically that of the total load uniformly distributed. Where there are two main transoms the load from the sides of the car is of course transferred to the center sills at two points removed from the bolsters a distance equal to the spacing between the centers of the bolsters and the transoms. Where the side sills are not designed to carry any considerable portion of the load the transoms must of necessity be arranged comparatively close together, that is at a considerable distance from the bolsters and therefore the bending moment due to the load transferred by the transoms to the center sill is comparatively great and may possibly necessitate the use of deeper center sills than would be required to support the whole load as a uniformly distributed load on the center sills. This condition is true with the ordinary spacing of transoms when the distance between them is approximately equal to one-third the distance between the bolsters. As the spacing between the transoms is increased the bending moment of the loads transferred thereby to the center sill decreases until it is substantially equal to the bending moment of a uniformly distributed load when the distance between the transoms equals approximately one-half the distance between

the bolsters. With such a wide distance between the transoms, however, where no load-carrying side sills are employed, it is necessary specially to design the superstructure of the car so as to make the side frames strong trusses which will carry the load between the ends of the transoms. As the distance between the transoms is increased so as to make it greater than half the distance between the bolsters, the bending moment of the loads transferred by the transoms to the center sills becomes less than the bending moment of the same load uniformly distributed and therefore it is possible to make the center sills lighter. In actual car construction the limiting factor in the approach of the transoms to the bolsters is the car wheels, it being necessary to space the transoms at least five or five and one-half feet from the bolsters in order to clear the car wheels. In the ordinary car underframe, having a span of approximately 26 feet to 30 feet between the bolsters, the placing of the transoms as near the bolsters as possible makes the span between the transoms much greater than half the distance between the bolsters and therefore reduces the bending moment due to the load transferred by the transoms to the center sills to a minimum.

My invention is based on the theory that with the use of transoms as illustrated, any increase in the distance between the transoms over half the distance between the bolsters produces such a distribution of the load on the center sills that the latter may be made lighter than in any construction heretofore employed in which the center sills carry the greater portion of the total load; the preferred arrangement being that in which the transoms are placed as close to the bolsters as the conditions will permit, thus giving a maximum span between the transoms.

As I have heretofore explained, it is necessary, even where it is attempted to place all of the load on the center sills, to have side sill members extending from the bolsters to the end sills of the car and the practice heretofore has been to use very light side members continuing over the bolsters from one end of the car to the other. By arranging the transoms as I have heretofore explained, actual load-carrying side sills may be used to advantage, making it unnecessary to have a specially trussed superstructure to take portions of the load which may be borne wholly by the underframe. In other words, the long span between the transoms permits a comparatively heavy side sill to be used efficiently and this side sill, continuing out to the end sills of the car, provides effective load-supporting members between the bolsters and the end sills, leaving them strong enough to hold up the end sill under the combined loads due to the load in the car and the downward thrust resulting from the buffing stresses. Consequently with my improved arrangement it is possible to use center sills shallow enough to permit them to pass over the truck bolsters and shallower load-carrying side sills which will give a much stronger construction from the bolsters to the ends of the car than has heretofore been possible with deep center sills, and at the same time securing the same economy of metal over the construction in which there are four deep load-carrying sills as has heretofore been obtained by using deep center sills to carry all the load.

It will of course be understood that with my novel arrangement of transoms the advantage of lighter center sills is obtained even though instead of side sills, as shown, a specially trussed superstructure is employed. The transoms are of course rigidly connected to the center sills so as to act as strong cantalivers supported by the center sills and extending to the side sills. Between the transoms there may be arranged cross-bearers as indicated at 9. While these cross-bearers may have any suitable construction, they may be so designed that they will serve as beams supported at their ends by the side sills and supporting the center sills midway between their ends, the effect being that they will transfer an overload from the center sills to the side sills or, in other words, equalize the loads between the four sills so that each will bear that portion of the load which it is intended to carry. A convenient way of constructing the cross-bearers is that best illustrated in Fig. 4 of the drawings; the cross-bearer comprising two side members connected to the webs of the center sills and connected together by means of a member 10 passing beneath the bottom flanges at the center sill, there being no corresponding member across the top. Consequently the member 10 serves as a tension member instead of as a compression member as would be the case with a cantaliver cross-bearer.

My construction permits the center sills to be extended continuously from one end sill to the other; but it will of course be understood that the center sills may terminate between the bolsters and the end sills, suitable draft sills being connected to the center sills and bridging the gaps between them and the end sills. Where the center sills are continued to the end sills the top flanges and the cover plate may be left instact while the inside flanges at the bottom may be sheared off at some distance in front of the bolster, as indicated at 11, so as to allow the draft rigging to be inserted from beneath.

Figs. 2, 5 and 10 illustrate how my invention overcomes the objection to deep side

sills heretofore noted. With my construction the side sills may be made so shallow that even though they are disposed low enough to permit the floor stringers 12 to be placed directly over them, the bottom surfaces of the sills do not come below the highest points on the wheel treads; thus allowing the apparatus beneath the car to be readily inspected.

While I have illustrated and described with particularity only a single preferred form of my invention, I do not desire to be limited to the exact structural details thus illustrated and described, but intend to cover all forms and arrangements which fall within the terms employed in the definitions of my invention constituting the appended claims.

I claim:

1. In a car underframe, bolsters, a center sill extending between said bolsters, cantalivers extending laterally from the center sill at a distance from the bolsters considerably less than one-fourth of the span between the bolsters, and means for supporting directly upon the said cantalivers that portion of the load above the sides of the frame in the space between the cantalivers.

2. In a car underframe, bolsters, a center sill extending between said bolsters, cantalivers extending laterally from the center sill at a distance from the bolsters less than one-fourth of the span between the bolsters, and load-carrying side sills supported by the cantalivers and each having a single span in the space between the cantalivers.

3. In a car underframe, bolsters, a center sill extending between the bolsters, load-carrying side sills extending between the bolsters and means for transferring the load carried by the middle portions of the side sills to the center sill at points removed from the bolsters less than one-fourth of the distance between the bolsters.

4. In a car underframe, body bolsters, a center sill extending between the bolsters, load-carrying side sills extending between the bolsters and beyond the same to the end of the frame, and means for transferring the load carried at the middle of the side sills to the center sill at points located at a distance from the bolsters less than one-fourth of the span between the bolsters.

5. In a car underframe, bolsters, a center sill extending between the bolsters, load-carrying side sills extending between the bolsters and beyond the same to the ends of the frame, and cantalivers extending laterally from the center sill to the side sills at a distance from the bolsters less than one-fourth the distance between the bolsters, the side sills each having a single span in the space between the said cantalivers.

6. In a car underframe, bolsters, enter sills extending between the bolsters and beyond the same, the center sills being shallow enough to pass through the space between the truck bolster and the bottom of the car, load-carrying side sills extending between the bolsters and cantalivers extending laterally from the center sills to the side sills at a distance from the bolsters less than one-fourth the distance between the bolsters, the side sills each having a single span in the space between the said cantalivers.

7. In a car underframe, bolsters, a center sill containing two parallel I-beams extending through the bolsters, shallower load-carrying side sills extending between the bolsters and also formed of I-beams, and cantalivers extending from the center sill to the side sills at a distance from the bolsters less than one-fourth of the distance between the bolsters.

8. In a car underframe, bolsters, a center sill comprising two parallel I-beams and a cover plate riveted to the top flanges of the I-beams, said center sill extending through the bolsters, shallower load-carrying side sills extending between the bolsters and each having the form of an I-beam, and cantalivers extending laterally from the center sill to the side sills at a distance from the bolsters less than one-fourth the distance between the bolsters.

9. In a car underframe, bolsters, a center sill extending between the bolsters and beyond the latter to the end of the frame, said center sills comprising two I-beams of uniform depth throughout and a cover plate riveted to the upper flanges of the I-beams, shallower load-carrying side sills extending between the bolsters and beyond the same to the ends of the frame, said side sills being in the form of I-beams, and end sills connecting corresponding ends of the center sill and side sills together.

10. In a car underframe, bolsters, a center sill extending between said bolsters, cantalivers extending laterally from the center sill at a distance from the bolsters less than one-fourth of the span between the bolsters, and load-carrying side sills in the form of I-beams supported by the cantalivers and each having a single span in the space between the cantalivers.

11. In a car underframe, bolsters, a center sill containing two parallel I-beams extending between said bolsters, cantalivers extending laterally from the center sill at a distance from the bolsters less than one-fourth of the span between the bolsters, and load-carrying side sills supported by the cantalivers and each having a single span in the space between the cantalivers.

12. In a car underframe bolsters, a center sill extending between the bolsters, cantalivers extending laterally from the center sill at a distance from the bolsters great

enough to afford a safe clearance for the car wheels, and load-carrying side sills supported by the cantalivers and each having a single span in the space between the cantalivers.

13. In a car underframe, bolsters, a center sill extending between the bolsters, cantalivers extending laterally from the center sill at a distance from the bolsters approximating the distance between the bolsters and the ends of the frame, and load-carrying side sills supported by the cantalivers and each having a single span in the space between the cantalivers.

14. In a car underframe, bolsters, a center sill extending between the bolsters, end sills, load-carrying side sills extending from one sill to the other and supported by the bolsters, and cantalivers extending laterally from the center sill to the side sills at a distance from the bolsters approximating the distance between the end sills and the bolsters, each side sill having a single span extending from one cantaliver to the other.

15. In a car underframe, bolsters, a center sill extending between the bolsters, cantalivers extending laterally from the center sill at a distance from the bolsters less than one-fourth of the span between the bolsters, load-carrying side sills supported by the cantalivers, and cross beams supported at their ends by the side sills at points between the cantalivers and adapted to transfer an overload from the center sills to the side sills.

16. In a car underframe, bolsters, end sills, a center sill comprising two parallel I-beams extending through the bolsters to the end sills, each of said I-beams having its lower inner flange cut away for a portion of the distance between each end sill and the corresponding bolster.

In testimony whereof, I sign this specification in the presence of two witnesses.

HERBERT R. KEITHLEY.

Witnesses:

WM. F. FREUDENREICH.

RUTH E. ZETTERWALL.