Dec. 16, 1958 W. H. PETERSON 2,864,320

VEHICLE BOLSTER CONSTRUCTION

Filed July 28, 1954 2 Sheets-Sheet 1

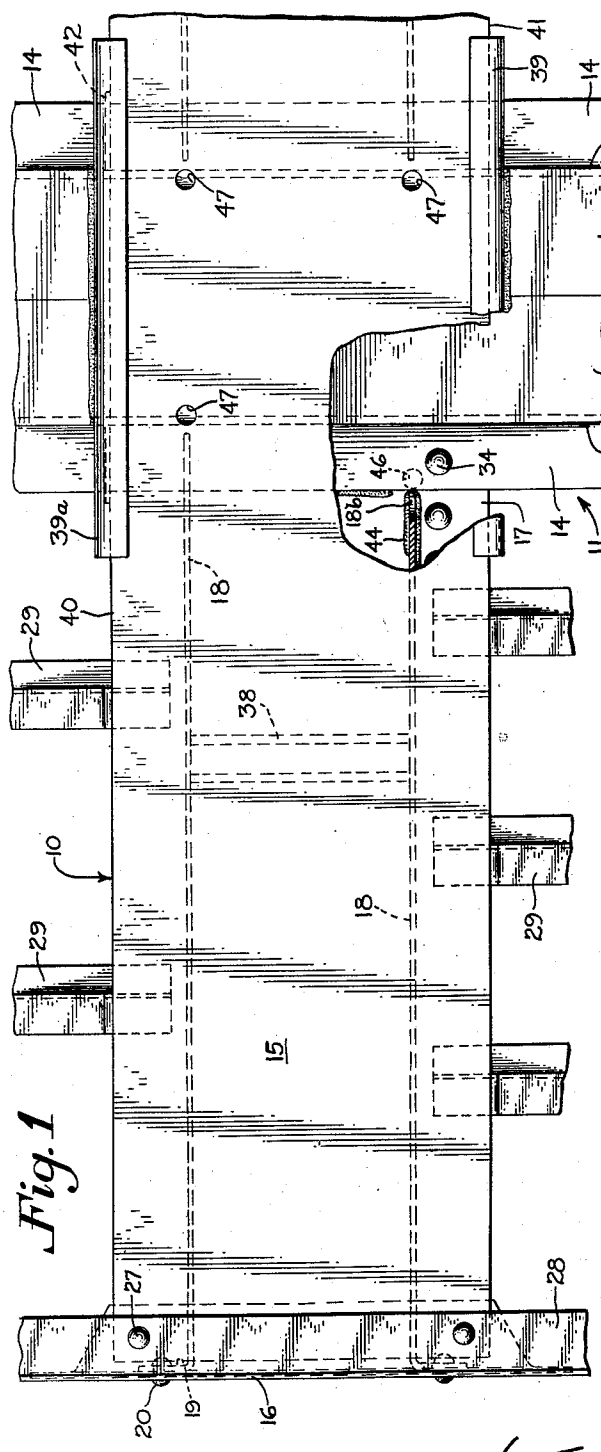


Fig. 1

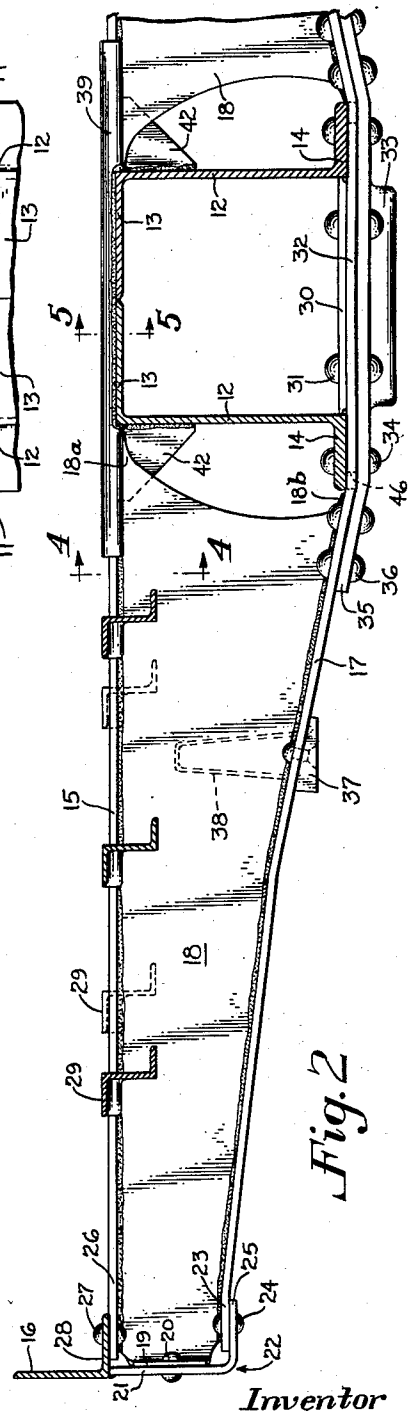


Fig. 2

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VEHICLE BOLSTER CONSTRUCTION

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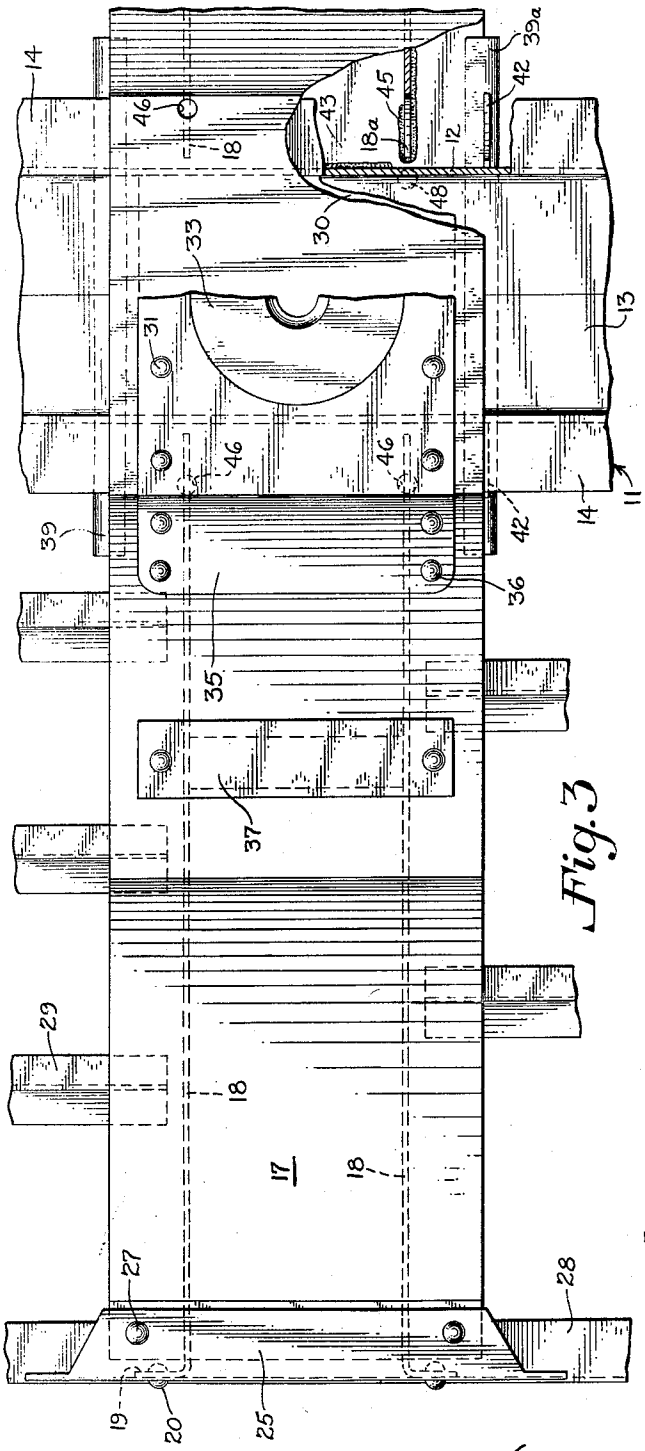


Fig. 3

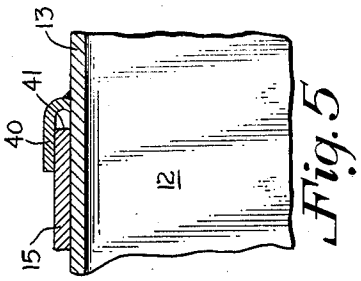


Fig. 5

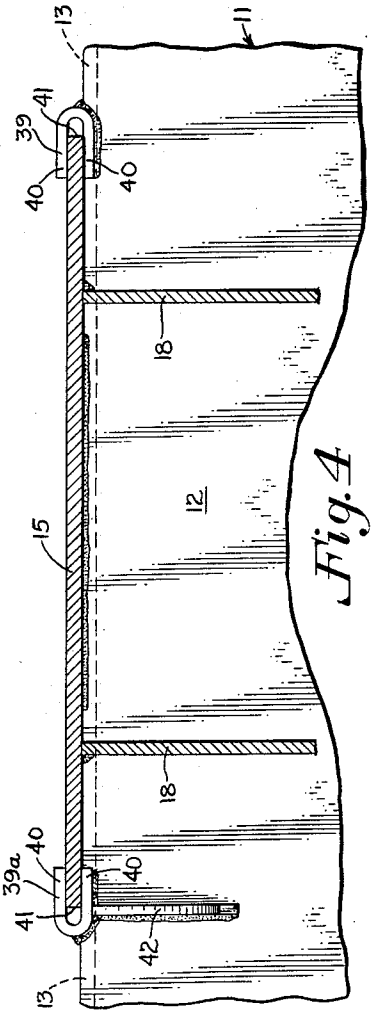


Fig. 4

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VEHICLE BOLSTER CONSTRUCTION

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Application July 28, 1954, Serial No. 446,360

19 Claims. (Cl. 105—228)

This invention relates to railway cars and more particularly to an improved welded body bolster construction.

With the advent of the welded body bolster construction, certain areas of high stress concentration, due mainly to particularly located weldments, have been found to exist in the bolster structure. In the main, these areas are located at the transverse weld connection between the top cover plate and the center sill and at the welded juncture between the bolster web plates and the center sill. The former weld connection is disadvantageous in two respects. First, at each end of the weld a high stress concentration exists which, under the type of repeated horizontal loading this structure receives, usually gives rise to a crack leading to failure of the structure; and second, on the tension side of the cover plate, which could be either side depending on which end of the car the horizontal forces are applied, the weld tends to prevent plastic deformation of the cover plate metal along the edge. The latter welded juncture between the bolster web plates and the center sill has the disadvantage of creating a high stress concentration area; also, with respect to resisting horizontal bending, the juncture offers practically no aid to the cover plates as the web plates are substantially in the plane of the vertical neutral axis of the bolster. By the introduction of novel and improved structural features, the present invention not only eliminates the aforementioned disadvantages but also strengthens the bolster construction at these highly stressed points.

Thus, it is the principal object of this invention to provide a railway car body bolster of the welded type having improved strength, durability and efficiency.

Another object of this invention is to create a welded body bolster relatively free of high stress concentrations which contribute to early structural failure.

A further object of this invention is to provide means for preventing buckling of the top bolster cover plate due to horizontal loads imposed thereon.

And yet another object of this invention is to provide stress raiser-free means in place of the transverse center sill-top bolster cover plate weld, the weld causing undesirable high stress concentrations.

A still further object of this invention is to provide means structurally connecting the center sill to the top cover plate while permitting the edges of the cover plate adjacent the center sill to flow in a plastic manner when under horizontal loading.

And still another object of this invention is to provide means for increasing the capacity for plastic flow at the toe of a weld securing a web plate at right angles to a cover plate.

These and other objects will be apparent to those skilled in the art from the following description, accompanied by illustrations, in which:

Fig. 1 is a fragmentary plan view of a railway car body bolster embodying the present invention, a portion of the top cover plate and the upper part of a web plate being broken away;

Fig. 2 is a fragmentary side elevational view of the body bolster depicted in Fig. 1;

Fig. 3 is a fragmentary bottom view of the body bolster depicted in Fig. 1, a portion of the bottom cover plate being broken away;

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 2; and

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 2.

Referring particularly to the drawings, a railway car body bolster unit 10 is shown in conjunction with a center sill unit 11, the latter unit being comprised of two Z-shaped beams 12 contacting at their upper flanges 13, their lower flanges 14 extending outwardly toward the sides of the car (Fig. 2). The bolster unit 10 includes a top cover plate 15 extending from one side sill 16 to the other side sill (not shown), a bottom cover plate 17, similar to the top cover plate and also extending between the side sills, and two pairs of longitudinally spaced, vertically disposed web plates 18, each pair extending transversely in a plane normal to the center sill axis from one side of the center sill to the adjacent side sill (Fig. 1). Each web plate 18 is welded along its top edge to the top cover plate 15 and along the bottom edge to the bottom cover plate 17 and is located inwardly from an adjacent free edge of both cover plates approximately one quarter the width of either cover plate (Figs. 1 and 3).

The outer end 19 of each web plate 18 is flanged at right angles to the main portion of the plate 18. The ends 19 of a pair of web plates are secured, as by rivets 20, to the vertical portion 21 of an L-shaped connecting plate 22, the plates 18 being turned so that the ends 19 face away from each other. The outer horizontally disposed end 23 of the bottom cover plate 17 is secured, as by rivets 24, to the horizontal portion 25 of the connecting plate 22, and the upper edge of the connecting plate vertical portion 21 is welded along the bottom of the side sill 16. The outer edge 26 of the top cover plate 15 is secured by rivets 27 to the horizontal leg 28 of the side sill 16 (Fig. 2).

Z-shaped floor stringers 29 are welded to the bottom surface of the top cover plate 15 on each side of the center sill 11 and extend away from the plate 15 in both directions (Fig. 1). A rectangular base plate 30 extends between the center sill beams 12 and is secured by rivets 31 to the horizontal center portion 32 of the bottom cover plate 17 and to the body center plate 33 (Fig. 2). The lower flanges 14 of the center sill are secured by rivets 34 to the portion 32 and plate 33, and the bottom cover plate portion closely adjacent the flanges 14 is secured to the angularly disposed end flanges 35 of the body center plate 33, as by rivets 36 (Fig. 1). A body side bearing 37 formed of a suitably shaped plate is secured to the bottom cover plate 17 at an intermediate portion thereof and is placed below a U-shaped bearing brace 38 which is secured to and extends between each web plate 18 (Fig. 1).

A U-shaped gusset clamp 39 is welded to the top of the center sill 11 on each side of the top cover plate 15 in such a manner that the horizontally disposed legs 40 of the clamp 39 loosely enclose the adjacent free transverse inboard edge of the plate 15 (Fig. 4). A similar clamp 39*a* is provided for the outboard edge. The transversely extending length of each gusset clamp 39 is approximately twice the width of the top of the center sill 11. It is to be noted that the lower leg 40 of the guesset clamp 39 is cut out in order to accommodate the center sill 11 from which the clamp receives the main support (Figs. 2 and 5). Additional support for each outer end of the outboard or struck-end gusset clamp 39*a*, where the most compressive forces are found, is afforded by a

gusset plate **42** welded between each side of the center sill and each outer end of the clamp **39***a* (Fig. 1).

It has been found that when horizontal impact loads were imposed on the center sill structure, causing tension or compression forces along each top cover plate edge, the usual transverse connection between the cover plate **15** and the center sill **11**, such as a weld, prevented the desired plastic flow of the critically affected edge metal. In addition thereto, the ends of the welded connection set up stress raisers or highly concentrated stress points which had a tendency to start early brittle fracture. By eliminating the undesirable welded connection and substituting the gusset clamp in which the cover plate edges can move, the stress raising points are eliminated and the adjacent edges **40** and **41** are permitted to flow in a plastic manner whereby the energy absorption capacity for the entire bolster is raised. Another important function of the gusset clamp is the prevention of premature buckling of the top cover plate from the horizontal impact bending by means of the horizontally disposed legs **40** of the clamps **39** and **39***a* offering resistance to vertical movement of the plate **15**.

Another critical weld connection which has been eliminated by the present improved bolster construction is the usual welded connection between the web plates **18** and the center sill. It has been found that this connection also has a high stress concentration contributing to early brittle fracture. Therefore, by eliminating the connection between the web plates and the center sill, the undesirable weld also has been eliminated. Instead of the usual right angular web end contacting the center sill, the inner end has a concave surface or arcuate cutout therein extending the entire height of the web plate and facing the center sill, whereby only the upper and lower corners, **18***a* and **18***b* respectively, of the web are adjacent the center sill (Fig. 2). The loss of vertical shear strength due to the elimination of the web material adjacent the center sill is replaced by the extended end flanges **35** of the bdy center plate **33**.

It has been found that another highly concentrated stress point due to welding exists at the toe of the weld **44** at the lower web plate corner **18***b* (Fig. 1) and at the toe of the weld **45** at the upper web plate corner **18***a* (Fig. 3). These particular points exhibit a tendency to cause early brittle fracture under the horizontal loading of the bolster. An ingenious and novel method of alleviating the concentrated stress problem at these points comprises providing a small round hole **46** in the bottom cover plate **17** in alignment with and closely adjacent the corner **18***b* and another small round hole **47** in the top cover plate **15** in alignment with and closely adjacent the upper corner **18***a* of each web plate. The diameter of the holes **46** and **47** should be approximately twice the thickness of a web plate **18** and there should be sufficient space between each hole and the adjacent web plate corner for the usual sized fillet weld **44** or **45** to run therebetween without the toe of the weld running into the hole. It is imperative that the edges of the holes be machined or flame cut in order to be notch free, thereby preventing the beginning of a crack. By providing these holes, improved ductile performance is achieved at these points, thus alleviating the tendency to start brittle fracture thereat and increasing the total energy absorption capacity of the body bolster.

What is claimed is:

1. In a railway car underframe, the combination of a center sill unit, a body bolster unit having a top cover plate, the edges of the cover plate adjacent the center sill being free, and clamp means secured to said center sill adjacent each edge of said cover plate, said clamp means overlying said edges for resisting vertical movement of said cover plate.

2. In a vehicular underframe, the combination of a center sill unit, a body bolster unit having a top cover plate, the transverse edges of the cover plate adjacent

the center sill being free, and U-shaped clamping means secured to said center sill and loosely engaging the transverse edges of said cover plate thereby allowing horizontal movement of said plate but preventing vertical movement thereof.

3. In a railway car underframe, the combination of a center sill unit, a body bolster unit comprising a top cover plate, a bottom cover plate similar to the top cover plate, and at least one vertically disposed web plate extending from each side of the center sill unit in a plane normal thereto, each web plate being welded at the top and bottom to said cover plates and having an arcuate surface at an inner end whereby only the upper and lower corners of the plate are closely adjacent the center sill, and means secured to the center sill overlying the free edges of the top cover plate for structurally connecting the top cover plate to the center sill and resisting vertical movement of said cover plate relative to the center sill.

4. In a vehicular underframe, the combination of a center sill unit, a body bolster unit comprising a top cover plate, a bottom cover plate, and a pair of vertically disposed, longitudinally spaced web plates on each side of the center sill, each web plate secured to and extending between the cover plates and having a concave surface extending the entire height of the web plate at the web plate end adjacent the center sill, and means secured to said center sill overlying the free edges of said top cover plate thereby resisting vertical movement of the top cover plate relative to the center sill and allowing horizontal movement only of said top cover plate.

5. In a vehicular underframe as defined in claim 4 wherein the web plates extend at right angles to the center sill and wherein the upper and lower inner corners of each web plate are closely adjacent the center sill.

6. In a vehicular underframe as defined in claim 4 wherein the web plates are welded to the cover plates and wherein at least one cover plate has a small round smooth-edged opening the diameter of which is approximately twice the thickness of a web plate in alignment therewith and closely adjacent an inner welded corner thereof.

7. In a vehicular underframe, the combination of a center sill unit, a body bolster unit comprising a top cover plate having free edges adjacent the center sill, a bottom cover plate, and a pair of vertically disposed, longitudinally spaced web plates on each side of the center sill, each web plate secured to and extending between the cover plates and having a concave surface therein extending the entire height of the web plate at the web plate end adjacent the center sill, and means secured to said center sill loosely engaging the free edges of said top cover plate thereby permitting only horizontal movement thereof.

8. In a vehicular underframe as defined in claim 7, wherein the web plates extend at right angles to the center sill and the upper and lower inner corners of each web plate are closely adjacent the center sill.

9. In a vehicular underframe as defined in claim 7, wherein the web plates are welded to the cover plates and at least one cover plate has a small round smooth-edged opening the diameter of which is approximately twice the thickness of a web plate in alignment with a web plate and closely adjacent an inner welded corner thereof.

10. In a vehicular underframe, the combination of a center sill unit, a body bolster unit comprising a top cover plate having free edges adjacent the center sill, a bottom cover plate, and a pair of vertically disposed, longitudinally spaced web plates on each side of the center sill, each web plate secured to and extending between the cover plates and having a concave surface therein at the web plate end adjacent the center sill, and

U-shaped clamping means secured to said center sill and loosely engaging a transverse edge of said top cover plate thereby allowing only horizontal movement primarily of a transverse nature of said plate.

11. In a vehicular underframe as defined in claim 10, wherein the web plates extend at right angles to the center sill and the upper and lower inner corners of each web plate are closely adjacent the center sill.

12. In a vehicular underframe as defined in claim 10, wherein the web plates are welded to the cover plates and wherein at least one cover plate has a small round smooth-edged opening the diameter of which is approximately twice the thickness of a web plate in alignment with a web plate and closely adjacent an inner welded corner thereof.

13. In a railway car underframe, the combination of a center sill unit, a body bolster unit comprising a top cover plate having free edges adjacent the center sill, a bottom cover plate, and a pair of vertically disposed, longitudinally spaced web plates on each side of the center sill, each web plate welded to and extending between the cover plates and having a concave surface at the web plate end adjacent the center sill, which extends substantially the entire height of the web plate, said cover plates each having a small round smooth-edged opening the diameter of which is approximately twice the thickness of a web plate in alignment with each web plate and closely adjacent an inner welded corner thereof, and means secured to said center sill and loosely engaging said top cover plate free edges for permitting only horizontal movement thereof.

14. In a railway car underframe as defined in claim 13, wherein the web plates extend at right angles to the center sill and the upper and lower corners of each web plate are closely adjacent the center sill.

15. In a railway car underframe as defined in claim 13, wherein the securing means comprises a U-shaped clamp welded on top of the center sill adjacent each transverse edge of the top cover plate, each clamp having parallel legs extending over and under the adjacent cover plate edge and having a length approximately twice the width of the center sill.

16. In a vehicular underframe, the combination of a center sill unit, a top cover plate, a bottom cover plate spaced from and similar to said top cover plate, and vertically disposed, transversely spaced web plates at each end of the cover plates, said center sill unit being disposed between the web plates, each web plate secured to and extending between the cover plates and having a concave surface extending the entire height of the web plate at the inner end thereof, and means secured to the center sill overlying the free edges of the top cover plate for structurally connecting the top cover plate to the center sill and resisting vertical movement of said cover plate relative to the center sill.

17. In a railway car underframe, the combination of a center sill unit, a top cover plate, a bottom cover plate, and transversely spaced web plates whereby a transversely central opening is left between the cover plates, each web plate being welded at right angles to both cover plates, said center sill unit being disposed adjacent the web plates, and at least one cover plate having a small round smooth-edged opening the diameter of which is approximately twice the thickness of a web plate in alignment with a web plate and closely adjacent an inner welded corner thereof for partially eliminating a tendency to begin brittle fracture thereat, and means secured to the center sill overlying the free edges of the top cover plate for structurally connecting the top cover plate to the center sill and resisting vertical movement of said cover plate relative to the center sill.

18. In a vehicular underframe, the combination of a center sill unit, a top cover plate, a bottom cover plate spaced from and extending in a plane substantially parallel to said top cover plate, and a pair of vertically disposed web plates at each end of the cover plates, said web plates being spaced transversely from each other and welded between said cover plates, each web plate having a substantially concave surface at an inner end thereof, said center sill unit being disposed between the pairs of web plates, each of said cover plates having a small round smooth-edged opening the diameter of which is approximately twice the thickness of a web plate in alignment with each web plate and closely adjacent an inner welded corner thereof, and means secured to the center sill overlying the free edges of the top cover plate for structurally connecting the top cover plate to the center sill and resisting vertical movement of said cover plate relative to the center sill.

19. In a vehicular underframe as defined in claim 18 wherein the web plates extend in a plane normal to the longitudinal axis of the vehicle.

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