ABSTRACT

In accordance with the present invention a through center sill is provided which in cross section comprises an enclosed tube of quadrilateral or tear drop shaped. Preferably a parallelogram, such as a square, or diamond, is used. The tube is so placed in the car as to make approximately an angle of about 30° to 60° to the horizontal.

The present invention further comprises a hopper car having such a center sill and preferably a single bolster cover plate is used between the center sill and the side sill at the ends of the car. Reinforcing members, preferably triangularly shaped, making an angle with respect to the vertical of 2° to 30° support the hopper slope sheets. With these design features the car weight and fabrication costs may be reduced.

25 Claims, 22 Drawing Figures
THROUGH SILL FOR RAILWAY CARS

BACKGROUND AND OBJECTS OF THE INVENTION

U.S. Pat. Nos. 3,339,499 and 3,490,387 illustrate hopper car constructions having stub sills and wherein the longitudinal loads are transmitted to the stub sill, to a shear plate, then outwardly to the side sills, and from the side sills into the car body. In accordance with the construction of these patents vertical turning moments are taken out by diagonal stiffeners at opposite ends of the car. The shear plate, side sills and the diagonal stiffeners add significantly to the weight of the car.

There is an AAR requirement that a 100 ton railway hopper car not exceed 263,000 pounds loaded. Most railroads and shippers are anxious to have a car in which they can load 100 tons of lading and at the same time not be concerned about the weight of specialty items, such as multi-wear wheels, center fillers and trucks (particularly side frames and truck bolster) which they may wish to order with the car.

The weight of the hopper car according to the above mentioned patents for high capacity design may vary by as much as 1000 pounds or more but usually turns out to be between 63,000 and 64,000 pounds.

It therefore would be desirable to reduce the weight of the car to 60,000 lbs. and even lower so that the user may load a 100 ton load and at the same time order the specialty items of the car which he wishes, regardless of their weight.

In application Ser. No. 439,782, filed Feb. 5, 1974, filed on even data herein, a railway hopper car is disclosed in which the weight of the car is reduced through the use of a through center sill. The shear plate and diagonal stiffeners described in the aforementioned patents may be eliminated. Also by the use of this through sill construction, it is possible to reduce the thickness of the side sheets and the side sill, and thus further reduce weight. In accordance with this construction it is possible to reduce the nominal weight of the car to below 60,000 pounds without controlling the weight of specialty items in the car.

Conventional through sill construction usually includes a hat shaped cross section and the use of hoods in the hoppers over the through sill to allow the lading to pass by the through sill and not be impeded thereby. This usually means that the hat-section flanges must be cut off from the through sill in the hopper area and reinforcements welded within the through sill in the hopper area. These operations require considerable man hours and are therefore expensive.

A bottom and top cover plate are generally required for the through sill at the end of the car. These plates require man hours to fabricate and weld in place.

Moreover, these cover plates and hoods are all weight members and it is desired to reduce as much as possible the weight of the car consistent with sound structural design.

In U.S. Pat. Nos. 1,943,294; 2,084,161; 2,519,320 and 3,048,679 it has been proposed to use a tubular center sill of circular cross section. However, the upper surface of a circular cross section has been found to be a place where some lading hangs up during unloading, and thus making a contamination problem.

U.S. Pat. Nos. 1,859,261 and 2,366,609 disclose non-circular tubes having at least five sides, making fabrication of such multi-sided tubes difficult and expensive.

Furthermore, the latter with its flat lower surface results in inefficient use of space in the hoppers because a void is created during loading under this flat surface.

It is an object of the present invention to provide an enclosed tube through sill having an apex to avoid lading entrapment and contamination of subsequent loads, which has few sides and is thus easy to fabricate, and avoids a large void occurring during loading below the center sill.

Another object of the present invention is to provide additional weight reducing features in hopper car design in addition to those described in application Ser. No. 439,782, filed Feb. 5, 1974.

THE DRAWINGS

FIG. 1 is a side elevational view of the hopper car according to the present invention;

FIG. 2 is an end view along the lines 2—2 in FIG. 1;

FIG. 2A is a sectional view along the lines 2A—2A in FIG. 1;

FIG. 2B is a detail view of the side sill-hopper outlet connection;

FIG. 3 is a side elevational view of the end portion of the center sill of the present invention;

FIG. 4 is a bottom view of the end portion of the center sill of the present invention;

FIG. 5 is an end view of the center sill according to the present invention;

FIG. 5A is a detailed view of an alternative center sill transition section according to the present invention;

FIG. 6 is an end view of the hopper car according to the present invention;

FIG. 7 is a side elevational view of the end portion of the hopper car according to the present invention;

FIG. 8 is a view along the lines 8—8 in FIG. 7;

FIG. 9 is a view along the lines 9—9 in FIG. 8;

FIG. 10 is a sectional view of a rounded square cross section center sill according to the present invention;

FIG. 11 is a sectional view of a diamond cross section center sill according to the present invention;

FIG. 12 is a sectional view of a rounded diamond cross section center sill according to the present invention;

FIG. 13 is a sectional view of a "tear drop" shaped cross section center sill according to the present invention;

FIGS. 14 and 15 are views similar to FIGS. 2 and 2A illustrating the present invention as applied to an open top hopper car;

FIG. 16 is a view of a single enclosed tube center sill according to the present invention;

FIG. 17 is a view along the lines 17—17 in FIG. 16;

FIG. 18 is a view along the lines 18—18 in FIG. 16;

FIG. 19 is a view along the lines 19—19 in FIG. 16.

SUMMARY OF THE INVENTION

In accordance with the present invention a through center sill is provided which in cross section comprises an enclosed tube of quadrilateral or tear drop shaped. Preferably a parallelogram, such as a square, diamond, rounded square, or rounded diamond is used. The tube is so placed in the car as to make approximately an angle of about 30° to 60° to the vertical.

The present invention further comprises a hopper car having such a center sill and preferably a single bolster cover plate is used between the center sill and the side
sill at the ends of the car. Reinforcing members, preferably triangularly shaped, making an angle with respect to the vertical of 2° to 30° support the hopper slope sheets. With these design features the car weight and fabrication costs may be reduced.

DESCRIPTION OF PREFERRED EMBODIMENTS

In accordance with the present invention a railway hopper car is indicated in the drawings generally at 10. The car comprises side sills 11 extending longitudinally along opposite sides of the car having sides 12 welded thereto, preferably curved as shown. The sides 12 in turn are welded to top chords 14. A curved roof portion 16 joins the top chords 14 in the embodiment shown in FIGS. 2 and 2A.

The car is provided with a plurality of hoppers 20, 22 and 24. Of course, more or less hoppers could be provided, if desired. The hopper is provided with appropriate outlets 26 of known construction. The lower hopper portions 21, 23 and 25 of the hoppers are welded to side sills 11. If desired, reinforcing plates 27 may be used for this connection, for example, having an angle shape as shown in FIG. 2A. Conventional trucks 28 having wheels 29 support the car at opposite ends thereof.

In accordance with the embodiment of the present invention a tubular center sill indicated generally at 30 extends between the ends of the car and passes through the hoppers 20, 22 and 24. Center sill 30 is in the form of a closed tube 32, having an upper apex 33 inserted into the car so as to make an angle of about 30° to about 60° with respect to the horizontal (FIG. 4). The tube should be easy to fabricate. Furthermore, the lower surface of the tube should not result in a large void area during loading as would, for example, a flat lower surface. Thus, cross-sectional shapes which satisfy these requirements are quadrilateral and derivatives of circular which provide an upper apex, particularly the tear drop shape shown in FIG. 14. The preferred quadrilateral shape is a parallelogram. Most preferably the parallelograms are square (FIG. 9), diamond shaped (FIG. 12), rounded square (FIG. 10), or rounded diamond (FIG. 13). The tube thus comprises an upper apex 33 extending into the hopper which acts to shed lading and allow it to move smoothly and easily around the center sill during loading and unloading. Space in the hopper is saved which previously would be lost due to the hood. The enclosed tube also comprises a lower apex 35 which tends to avoid a void space which a flat section below the upper apex would tend to cause. While the tear drop shape has a lower apex as shown in FIG. 14, the parallelogram shapes are more effective in this regard than is the tear drop. Thus space loss is minimized due to the through sill design.

At the ends of the car a conventional hat section type center sill 36 may be utilized having the usual horizontally extending flanges 38 (FIGS. 3 and 4). Mounted within the center sill 36 is a conventional center filler and draft gear housing indicated in the drawings at 40. The center filler is of conventional construction and may be either fabricated or cast. However, inboard of the center filler 40 there preferably is provided a transition section 42. Section 42 may, for example, be cast integral with the member 40 or may be welded thereon. Enclosed tube 32 preferably is dimensioned so as to fit over the inboard end portion 44 of transition section 42. Preferably transition section 42 is provided with a collar 46 to facilitate joining of transition section 42 and tube 32. The tube 32 is then welded to transition section 42 as indicated at 48.

An alternative transition arrangement is shown in FIG. 5A. Enclosed tube 32 and end section 36 are each welded to a plate 50. Thus, in the embodiment shown in FIG. 5A, plate 50 becomes the equivalent of transition of member 42 in the embodiment shown in FIGS. 3-5. End center sill 36 may have the flanges 38 removed prior to welding to plate 50, in which case plate 50 may be of thinner gage material.

Another alternative is that the entire center sill 130 including a center portion 132 and end portions 134 and 136 comprise a single enclosed tube as shown in FIGS. 16-19. The bottom portions 140 and 142 of the tube may be cut out at the end portions to install the draft gear coupling equipment and center filler. Then an assembly 150, for example, a casting, may be inserted into the cutout portions, including a center filler 152, center plate 156, and a center pin 154. The assembly may also include rear draft gear lugs 158.

A second assembly indicated at 160 is also inserted which may comprise resilient draft gear 164, stopping blocks 166 and coupler yokes 168. Then a draft gear carrier 162, comprising foreshortened bottom portions 170 and 172 are fastened or welded in place of cutout portions 140 and 142. Thus, in this embodiment, there would be no identifiable transition section.

In the end portion of the car a lower bolster cover plate 60 is welded up to the end center sill section 36. Plate 60 extends over to and is welded to side sills 11 as indicated at 62. Also welded to the center sill 32 is an end sill 70 (FIG. 8). The end sill is welded to the extensions 71 of the side sill 11 and end sill gussets 73 may be provided therebetween. Gussets 73 reinforce the end sill so the latter can withstand impacts such as occur, for example, with coupler by-passing and collisions with forklift trucks and other vehicles.

A center plate 64 is preferably affixed to flanges 38 and plate 60 with appropriate fasteners, for example, by means of rivets 65. Side bearings 84 are integrally affixed, preferably by welding to bottom cover plate 60. If desired, shims 82 may also be provided between the cover plate and side bearings 84.

Car end reinforcement is indicated generally at 88. A vertically extending bolster web 92 is welded to the bolster plate 60 and to reinforcing plate 90 and/or rear slope sheet 91. Side bearing supports 80 are welded to vertical web 92 and to bolster plate 60 above side bearings 84. A bolster top cover plate 90 extends across the end slope sheet 91 and is welded thereto and to bolster web 92. End slope sheet reinforcement may be provided by a plate or beam, for example, an angle 96 extending transversely across the end slope sheets.

Reinforcement means indicated generally at 100 is provided between the slope sheets of the car and center sill 32. Preferably this reinforcement means comprises triangular members 101 having sides 102 extending along the slope sheets and base portions 104 which are welded to the sill 32 as shown at 105 (FIG. 2A). As shown in FIGS. 2, 2A, and 6, triangles 101 are inclined with respect to the vertical to form an angle β (FIG. 9) from 2° to 30°, preferably 5° to 15°. Preferably plates 106 are welded to the slope sheets and triangular legs 102 welded to plates 106 to provide more effective slope sheet reinforcement. If desired, triangles 101 may
be cut off as indicated at 107 (FIG. 1) near the jointure of legs 102 to facilitate welding the triangles in place to the hopper slope sheets and/or plates 106.

In accordance with this arrangement a large portion, at least above about 60% and preferably more than about 70% of the squeeze load is carried by the through center sill. Impact loads are received by the center sill and are distributed to the car body through reinforcing means 100.

The center sill is principally utilized as a bottom chord for the side sheets. The side sheets and top chords support the car vertically along the length of the car, with this vertical load being transmitted from the sides to the truck through the vertical bolster web 92 and bolster cover plate 60.

The enclosed tube center sill of the present invention may also be used in an open top hopper as shown in FIGS. 16 and 17. Reinforcing means 100, preferably triangular shaped members 101 are provided between the hoppers. The car end reinforcing means 88 is preferably as described above in connection with the covered hopper car.

It will be apparent that the enclosed tube type center sill avoids the need for removing the flanges from the usual hat section used for a through sill. Furthermore, it avoids providing reinforcement in the inside of the hat section. The upper apex greatly reduces or avoids lading entrapment and the curved lower surface reduces the void space below the center sill formed during loading.

Furthermore, if it is desired to reduce weight, a single bolster cover plate may be used rather than two which were normally utilized in previous constructions. The inclined triangles provide low weight slope sheet support. It is thus apparent that the constructions of the present invention result in lower man hours of fabrication time and thus less cost and may be used to obtain less car weight.

What is claimed is:
1. A center sill comprising:
in cross section an enclosed quadrilateral tube adapted to be placed in a railway hopper car; said quadrilateral having an apex adapted to extend upwardly into a railway car hopper making an angle of about 30° to 60° to the horizontal and a lower apex adapted to extend downwardly into a railway hopper car; said center sill further comprising opposite end portions which are adapted to receive the railway car draft gear, and transition sections comprising a portion of a railway car center filler joining each of said end portions to said quadrilateral tube.
2. A center sill according to claim 1 wherein said quadrilateral tube is a parallelogram.
3. A center sill according to claim 2 wherein said parallelogram comprises a square.
4. A center sill according to claim 3 wherein said square tube has rounded corners.
5. A center sill according to claim 3 wherein said parallelogram comprises a diamond.
6. A center sill according to claim 5 wherein said diamond has rounded corners.
7. A center sill according to claim 1 wherein said lower apex makes an angle of 30° to 60° with the horizontal.
8. A center sill comprising:
a center portion comprising in cross section an enclosed tube having an upper apex, said upper apex making an angle of 30° to 60° to the horizontal; at opposite ends thereof, said tube integrally affixed to end portions adapted to house draft gear and coupling equipment; and a transition section comprising a portion of a railway car center filler joining each of said end portions with said center portion.
9. A center sill according to claim 8 wherein said enclosed tube is a quadrilateral in cross section.
10. A center sill according to claim 8 wherein said quadrilateral is a parallelogram.
11. A center sill according to claim 10 wherein said end section comprises a hat shaped cross section.
12. A center sill according to claim 10 wherein said parallelogram comprises a square.
13. A center sill according to claim 12 wherein said square tube has rounded corners.
14. A center sill according to claim 10 wherein said parallelogram comprises a diamond.
15. A center sill according to claim 14 wherein said diamond has rounded corners.
16. A center sill according to claim 8 wherein said transition section comprises a plate welded to said end section and said tube.
17. A center sill according to claim 16 wherein said end sections are hat shaped in cross section.
18. A center sill according to claim 8 in which said transition section and said center filler comprises an integral member.
19. A center sill according to claim 18 wherein said end portion, said transition section and said center filler comprise an integral member.
20. A center sill comprising:
a center portion comprising in cross section an enclosed tear drop tube having an upper apex, said upper apex making an angle of 30° to 60° to the horizontal; at opposite ends thereof said tube integrally affixed to end portions adapted to house draft gear and coupling equipment; and a transition section joining each of said end portions with said center portion.
21. A center sill according to claim 20 wherein said transition section comprises a portion of a center filler.
22. A center sill according to claim 20 wherein said transition section comprises a plate welded to each of said end sections and said tube.
23. A center sill according to claim 22 wherein said end sections are hat shaped in cross section.
24. A center sill comprising:
in cross section a tear drop tube adapted to be placed in a railway hopper car; said tear drop having an apex adapted to extend upwardly into a railway car hopper, and a lower apex adapted to extend downwardly into a railway hopper car.
25. A center sill according to claim 24 wherein said center sill comprises opposite end portions which are adapted to receive railway car draft gear.

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