ABSTRACT OF THE DISCLOSURE

A covered hopper railway car having a smooth arcurate side sheet on each side of the car struck from a constant radius having its center at a substantial distance outside the confines of the car, a shear plate at each end of the car which forms the discharge cover plate of the bolster structure and extends to the end sill, and an end hopper portion overhanging the shear plate. The overhanging end hopper portion includes an end hopper slope sheet having an inclined sheet portion extending over the shear plate and an upper vertical sheet portion at the end of the car, and a pair of load carrying members have upper ends secured to the end slope sheet generally at the corner junctures of the inclined sheet portion and the vertical sheet portion and extend to the shear plate.

Covered hopper cars are generally of two types; those having straight vertical sides and those having arcurate or curved sides. Hopper cars with straight vertical sides normally have vertical extending posts spaced along the side to provide strength and stiffness. Such posts require several steps in assembly to the sides of the railway car. In addition, since the posts project outwardly a few inches from the sides of the railway car, the inside width of the car is decreased a corresponding amount which results in a less than full utilization of the available space within specific clearance requirements.

In covered hopper cars having arcurate or curved sides the side posts are normally omitted, but curved sides of a substantial degree of curvature have the disadvantage of a decrease in the capacity of a hopper car at the upper and lower portions of the inwardly curved sides thereby not utilizing a maximum amount of space. Thus, a small degree of curvature in arcurate sides is highly desirable to provide a relatively light weight railway car having a relatively high volumetric capacity.

Bottom hopper outlets are arranged beneath the car for the discharge of material from the car. Such outlets are formed of a plurality of connected side slope sheets which funnel to a discharge opening. The discharge opening may be of different sizes dependent on factors such as the type of material being unloaded, the type of closure across the discharge opening, and the clearance requirements. Thus, it is evident that the slope or inclination of the hopper side slope sheets varies with different sizes of bottom outlet structures. The present invention permits the hopper side slope sheets to be positioned at a selected angle of inclination without any modification of the side sill structure being required.

It is an object of the present invention to provide a lightweight covered hopper car having arcurate sides in which a maximum utilization of space is obtained within specific clearance requirements.

An additional object of this invention is to provide a light weight covered hopper car having curved sides in which side reinforcing members are not required, the space normally filled by the side posts being utilized by the sides comprising the hopper car of this invention.

Another object of the invention is the provision of a covered hopper railway car having a bottom outlet structure in which the hopper side slope sheets may be positioned selectively at a predetermined slope or angle of inclination.

The present invention comprises a covered hopper railway car having an arcurate side sheet on each side of the car struck from a constant radius having its center substantially outside the confines of the car to provide a relatively small degree of curvature of the side sheets, and an arcurate roof over the car being struck from a constant radius having a length substantially less than the radii of the side sheets to provide a substantially greater degree of curvature in the roof than in the side sheets. The bottom hopper structure is positioned between the side sheets and includes a hopper side slope sheet secured to each side sill, and separate bracing means secures each hopper side sheet to the adjacent side sill and extends outwardly a predetermined distance for positioning the hopper sheet at a predetermined slope.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings in which one of various possible embodiments of the invention is illustrated,

FIGURE 1 is a perspective view of a covered hopper railway car illustrating the present invention;

FIGURE 2 is a side elevational view of a portion of the railway car shown in FIGURE 1;

FIGURE 3 is an end elevational view of the covered hopper railway car shown in FIGURES 1 and 2 with certain portions broken away and shown in section;

FIGURE 4 is a fragmentary sectional view illustrating the connection of the roof to the side sheets;

FIGURE 5 is an enlarged fragment of FIGURE 4;

FIGURE 6 is an enlarged sectional view of the side sill adjacent a bottom hopper outlet illustrating the connection of the adjacent hopper side slope sheet to the side sill, the broken lines indicating hopper side slope sheets at different angular relations;

FIGURE 7 is a cross-sectional view of the side sill adjacent the shear plate at each end of the car; and

FIGURE 8 is a diagrammatic illustration of the contour of the covered hopper railway body illustrating the relatively high volumetric capacity within specified clearance requirements.

Corresponding reference numerals indicate corresponding parts throughout the drawings.

Referring to the drawings and more particularly to FIGURES 1–3, a covered hopper railway car is indicated generally at 10. Car 10 comprises a wheel assembly 12 at each end. An end stub center sill 14 receives a draft gear and coupler structure 16. A bolster assembly generally designated 18 includes vertical webs 20 and a lower cover plate 22 secured beneath webs 20. A center plate 24 is secured to lower bolster plate 22. Forming the upper cover plate of the bolster assembly and extending over the end center sill is a shear plate 26 at each end of car 10.

Vertical posts 30 are secured to end sill 28 and upper cross member 32. Side sills generally designated 34 extend the length of car 10 and end sills 28 are secured across the ends of side sills 34 over shear plates 26. At each end of the car, an end slope sheet generally designated 41 includes an inclined sheet portion 42 and an integral upper generally vertical sheet portion 40. A stifferner plate 44 is secured to slope sheet portion 42 and shear plate 26. Intermediate hopper slope sheets 46 are secured between arcurate side sheets generally designated 48 and form hoppers 50 with partitions 52. A roof sheet 54 is secured over side sheets 48 and has hatch openings therein. Hatcher covers 56 are placed over openings 58 to permit car 10 to be loaded. Stifferners 57 comprising Z-bars are secured to slope sheets 41 and 46. As slope sheet 41 extends to the
end of car 10, a maximum utilization of space is provided. To reinforce slope sheet 41, a pair of gussets 59 extend from each end of car 10 adjacent shear plate 26 along shear plate 44 to the adjacent end slope sheet 41.

In the assembly of car 10, each side sheet 48 is first in a straight or flat relation with a side sill 34 welded thereto. To keep the upper marginal portion of sheet 48 from wrinkling when side sheet 48 is folded about partitions 52 and end sheets 40, a top chord member generally designated 60 is secured to each sheet 48 for the length of the sheet. As shown in FIGURES 4 and 5, each top chord member 60 is generally angle-shaped and has an upper leg 62 welded along seam 66 to arcuate side 48. Leg 62 extends over the upper edge of arcuate side sheet 48. Lower leg 68 has an outwardly bent marginal portion 70 extending parallel to the outer surface of sheet 48 and welded thereto along seam 72. After top chord member 60 is welded to its associated side sheet 48, the subassembly comprising top chord member 60, side sill 34 and flat side sheet 48, is folded about partitions 52 and end sheets 40. Then roof 54 is positioned over top chord member 60 and welded thereto along seams 73 and 74.

Referring to FIGURE 6, side sill 34 comprises an upper flange 76 extending parallel to the outer surface of side sheet 48 and welded along seam 78 to the adjacent side sheet 48. An outwardly bent portion 80 is integrally connected to flange 76 and extends to partition 82 which projects downwardly to a position below the lower edge of side sheet 48. An integral horizontal web portion 84 is an upwardly extending flange 86 integrally connected thereto and extending in a generally parallel relation to the outer surface of side sheet 48. Side sheet 88 is welded along seam 88 to flange 86. A hopper side slope sheet 90 on opposite sides of each bottom outlet structure 92, such as a gravity gate outlet structure, for example (see FIGURE 1), is welded along seam 94 to the adjacent side sheet 48. Weld seams 88 and 94 merge to fill the space between the lower edge of side sheet 48 and the adjacent upper edge of slope sheet 90.

To brace side slope sheet 90 at a predetermined inclination or slope, a brace generally designated 96 has a flat horizontal web portion 98 secured to the lower surface of horizontal web portion 84 and extending to the outer surface of hopper side slope sheet 90. An integrally connected downwardly bent flange 100 extends parallel to the outer surface of side slope sheet 90 and is welded along seam 102 to sheet 90. Sheet 90 slopes at an angle A of 45° to the horizontal. Hopper slope sheet 90 may be fixed at any desired slope by projecting web portion 98 inwardly a greater or lesser distance. As shown in broken lines in FIGURE 6, slope sheet 90A is positioned at an angle B of 30° with respect to the horizontal by projecting web portion 98 inwardly an increased distance. Slope sheet 90B is positioned at an angle C of 60° with respect to the horizontal by projecting web portion 98 inwardly a lesser distance. Side slope sheets 90A and 90B may be welded to flange 86 in a manner similarly to slope sheet 90. Referring to FIGURE 7, a section of side sill 34 adjacent shear plate 26 at each end of car 10 is illustrated. Shear plate 26 extends across the upper edge of flange 86A to the inner surface of vertical web portion 82 and is welded along respective seams 104 and 106 to flange 84A and web portion 82. Flange 86A is cut down from flange 86 so that the upper surface of shear plate 26 is flush with the upper edge of flange 86. A cover plate 108 is secured to shear plate 26 and flange 76 at each end of car 10 outwardly of stiffener plate 44 as shown in FIGURE 7.

Curved side sheets 48 and curved roof 54 result in a simplicity in design and manufacture as well as a lighter weight car. Side slope sheets 48 are of a small degree of curvature and have not been found to provide adequate structure stability without the use of side posts. Referring to FIGURE 8, the limits of the area in which the outer contour of the car must fit according to existing standards defined by A.A.R. (Association of American Railroads) clearance diagrams is indicated by outer broken line F. An inner broken line is found to be optimum for arcuate sides 48. The letter P indicates the point from which radius R is struck. While a greater radius would result in a greater volume for the car, it would be probably necessary to provide vertical reinforcing for the sides in order to have sufficient structural stability. A smaller radius would decrease the volume of car 10 undesirably. Roof 54 is arcuate and is struck from a radius R1 having a length of around ninety (90) inches. While some volumetric capacity is lost in the upper corners of the car from the curved roof and curved sides, this volume is not utilized to any degree for most prevalent or granular loadings. As shown in FIGURE 6, for example, if the lading has an angle of repose of thirty (30) degrees, the volume above line L extending from the edge of a center hatch opening would not be utilized by the lading. However, the increased volume obtained from utilizing the space occupied by side posts is fully utilized. As an example, a covered hopper car having a lading of 54 feet 4 inches wide, a width of 10 feet 4 inches, and a height measured from the rails of 14 feet 8 inches has a capacity of 4500 cubic feet. This volume is slightly larger than that obtained with a car of similar dimensions employing flat sides with side posts.

A covered hopper railway car having curved sides and a curved roof is easily fabricated. The fabrication is first commenced by forming a plurality of subassemblies. Each side sheet 48 is formed into a subassembly by the welding of a top chord member 60 and a side sill 34 thereto with the side sheet remaining in a flat and smooth relation. Next, an end sill assembly for each end of the car is formed including shear plate 26, bolster structure 18, and a wheel assembly 12. The partitions and end slope sheets are also subassemblies and are placed in position. The two side sheet subassemblies are positioned on the end sills and the side sheets are folded by suitable jigs (not shown) about the partitions and end slope sheets for securing by welding. The roof is then placed over the top chord members and welded in position. Thus, a simplified fabrication of car 10 is effected by employing arcuate side sheets and an arcuate roof.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results obtained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A covered hopper railway car having a cross-sectional area with AAR clearance limits comprising, a separate stub center sill structure adjacent each end of the car, an arcuate side sheet on each side of the car struck from a constant radius having its center at a substantial distance outside the confines of the car and being without any separate external vertical reinforcing members, the outer surface of each sheet at its maximum lateral extent being substantially at the AAR clearance limit with the sheets being spaced from each other a distance at said lateral maximum extent of around ten and one-half feet, a side sill secured along the outer surface of the lower marginal portion of each side sheet, a top chord member secured along the upper marginal portion of each side sheet and extending in a direction longitudinally of the car, each top chord member having a generally laterally
extending upper portion, a roof secured between the upper portions of the top chord members, an end sill at each end of the car extending transversely of the car between the side sills and over the adjacent stub center sill structure, a plurality of hoppers spaced at intervals along the length of the car, a bottom hopper outlet structure for each hopper positioned centrally of the width of the car between the stub center sill structures, a bolster assembly at each end of the car secured to the adjacent stub center sill structure and including a generally horizontally extending shear plate over the subjacent center sill structure extending between the side sills, an end hopper slope sheet for each end hopper including an inclined sheet portion and an upper vertical sheet portion, said inclined sheet portion extending from its associated bottom outlet structure upwardly adjacent and inwardly of the inner end of the adjacent stub center sill structure to a position over the shear plate to provide each end hopper with a hopper portion overhanging the shear plate, said vertically extending sheet portion being at the end of the car generally in vertical alignment with the associated end sill and extending upwardly to the roof, and external load carrying means at each end of the car extending from the associated end sill structure in the area of the corner junctures of the inclined sheet portion with the vertical sheet portion and secured between the associated end slope sheet and shear plate for transmitting loads therebetween.

2. A covered hopper railway car as set forth in claim 1 wherein said shear plate forms the upper cover plate of the bolster assembly and extends to the adjacent end sill.

3. A covered hopper railway car having a cross-sectional area within AAR clearance limits comprising, a stub center sill structure adjacent each end of the car, a smooth arcuate side sheet on each side of the car struck from a constant radius of generally around one hundred seventy inches and being without any external vertical reinforcing members, the outer surface of each sheet at its maximum lateral extent being substantially at the AAR clearance limit with the sheets being spaced from each other a distance at said lateral maximum extent of around ten and one-half feet, a separate side sill secured along the lower exterior marginal portion of each side sheet, a top chord member secured along the upper exterior marginal portion of each side sheet and extending in a direction longitudinally of the car, each top chord member having an upper outwardly extending portion secured adjacent the upper edge of the adjacent side sheet and a lower portion secured to the outer surface of the associated side sheet, said side sills and said top chord members projecting outwardly from the adjacent contiguous surfaces of the associated side sheets with the outer surfaces of the side sill and top chord member on each side of the car being in a generally vertical alignment and positioned slightly inwardly of the maximum lateral extent of the adjacent side sheet, a roof secured to the upper portions of the top chord members, an end sill at each end of the car extending between the side sills transversely of the car over the adjacent stub center sill structure, a plurality of hoppers spaced at intervals along the length of the car, a bottom hopper outlet structure for each hopper positioned centrally of the width of the car between the stub center sill structures, a bolster assembly at each end of the car secured to the adjacent stub center sill structure and including a generally horizontal shear plate over the subjacent center sill structure extending between and secured to the side sills, an end hopper slope sheet for each end hopper including an inclined sheet portion and an upper vertical sheet portion at the end of the car, said inclined sheet portion extending upwardly from its associated bottom outlet structure closely adjacent and inwardly of the inner end of the adjacent stub center sill structure to a position over the subjacent shear plate to provide each end hopper with a hopper portion overhanging the shear plate, said vertically extending sheet portion being at the end of the car generally in vertical alignment with the associated end sill and extending upwardly to the roof, and a pair of load carrying members at each end of the car having upper ends secured to the adjacent end slope sheet in the area of the corner junctures of the inclined sheet portion with the vertical sheet portion and extending in converging relation from said upper ends to the associated shear plate for transmitting loads therebetween.

4. A covered hopper railway car having a cross-sectional area within AAR clearance limits comprising, an end stub center sill structure adjacent each end of the car, an arcuate side sheet on each side of the car struck from a constant radius of generally around one hundred seventy inches and being without any external vertical reinforcing members, the outer surface of each sheet at its maximum lateral extent extending substantially to the AAR clearance limit, a separate side sill secured along the lower marginal portion of each side sheet, a roof secured between the side sheets, an end sill at each end of the car extending transversely of the car between the side sills, a plurality of hoppers spaced at intervals along the length of the car, a bolster assembly at each end of the car secured to the adjacent stub center sill structure and including a generally horizontal shear plate over the subjacent center sill structure extending between and secured to the side sills, an end hopper slope sheet for each end hopper including an inclined sheet portion and an upper vertical sheet portion, said inclined sheet portion extending upwardly from a position adjacent the inner end of the adjacent stub center sill structure to a position over the shear plate to provide each hopper with a hopper portion overhanging the shear plate, said vertically extending sheet portion being generally at the end of the car and extending upwardly to the roof, and external load carrying members at each end of the car extending from the associated end sill structure in the area of the corner junctures of the inclined sheet portion with the vertical sheet portion and extending to the shear plate for transmitting loads therebetween.

5. A covered hopper railway car having a cross-sectional area within AAR clearance limits comprising, an end stub center sill structure adjacent each end of the car, a smooth arcuate side sheet on each side of the car struck from a constant radius having its center at a substantial distance outside the confines of the car and being without any separate external vertical reinforcing members, the outer surface of each sheet at its maximum lateral extent being substantially at the AAR clearance limit, a separate side sill secured along the lower marginal portion of each side sheet, a roof secured between the side sheets, an end sill at each end of the car extending transversely of the car over the adjacent stub center sill structure, a plurality of hoppers spaced at intervals along the length of the car, a bolster assembly at each end of the car secured to the adjacent stub center sill structure and including a generally horizontal shear plate over the subjacent center sill structure extending between and secured to the side sills, an end hopper slope sheet for each hopper including an inclined sheet portion and an upper vertical sheet portion, said inclined sheet portion extending upwardly to a position over the subjacent shear plate to provide each end hopper with a hopper portion overhanging the shear plate, said vertically extending sheet portion being generally at the end of the car and extending upwardly to the roof, and external load carrying members at each end of the car having upper ends secured to the adjacent end slope sheet generally in the area of the corner junctures of the inclined sheet portion with the vertical sheet portion and extending to the shear plate for transmitting loads therebetween.

6. A covered hopper railway car comprising, a separate stub center sill structure adjacent each end of the
car, an arcuate side sheet on each side of the car struck from a constant radius having its center at a substantial distance outside the confines of the car and being without any external vertical reinforcing members, a side sill secured along the outer surface of the lower marginal portion of each side sheet, a top chord member secured along the upper marginal portion of each side sheet and extending in a direction longitudinally of the car, each top chord member having a generally literally extending portion of the roof secured between the upper portions of the top chord members, an end sill at each end of the car extending between the side sills transversely of the car over the adjacent stub center sill structure, a plurality of hoppers spaced at intervals along the length of the car, a bottom hopper outlet structure for each hopper positioned centrally of the width of the car between the stub center sill structures, a bolster assembly at each end of the car secured to the adjacent stub center sill structure and including a generally horizontally extending sheet plate over the adjacent center sill structure, extending between and secured to the side sills, an end hopper slope for each end hopper including an inclined sheet portion and an upper vertical sheet portion, said inclined sheet portion extending upwardly from its associated bottom outlet structure to a position over the subjacent sheet plate to provide each end hopper with a hopper portion overhanging the sheet plate, said upper vertical sheet portion being at the end of the car generally in vertical alignment with the associated end sill and extending upwardly to the roof, and external load carrying means at each end of the car extending between and secured to the side sills, shear plate for transmitting loads therebetween. In a covered hopper railway car having a separate stub center sill structure adjacent each end of the car, a smooth arcuate side sheet on each side of the car struck from a constant radius of generally around one hundred seventy inches and being without any separate external vertical reinforcing members, the outer surface of each sheet at its maximum lateral extent being substantially at the AAR clearance limit with the sheets being spaced from each other a distance at said lateral maximum extent of around ten and one-half feet, a side sill secured along the outer surface of the lower marginal portion of each side sheet, a top chord member secured along the upper marginal portion of each side sheet and extending in a direction longitudinally of the car, each top chord member having a generally literally extending portion of the roof secured between the upper portions of the top chord members, an end sill at each end of the car extending transversely of the car between the side sills and over the adjacent stub center sill structure, a plurality of hoppers spaced at intervals along the length of the car, a bottom hopper outlet structure for each hopper positioned centrally of the width of the car between the stub center sill structures, the improvement comprising a bolster assembly at each end of the car secured to the adjacent stub center sill structure and including a generally horizontally extending sheet plate over the subjacent center sill structure extending between and secured to the side sills, shear plate forming the top cover plate of the bolster assembly and extending to the adjacent end sill, an end hopper slope for each end hopper including an inclined sheet portion and an upper vertical sheet portion, said inclined sheet portion extending from its associated bottom outlet structure upwardly adjacent and inwardly of the inner end of the adjacent stub center sill structure to a position over the subjacent sheet plate to provide each end hopper with a hopper portion overhanging the sheet plate, said upper vertical sheet portion being at the end of the car generally in vertical alignment with the associated end sill and extending upwardly to the roof, and a pair of external load carrying members at each end of the car having upper ends secured to the adjacent end sill sheet generally in the area of the corner junctions of the inclined sheet portion with the vertical sheet portion and extending in converging relation from said upper ends to the associated sheet plate for transmitting loads between the sheet plate and end slope sheet.

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ARTHUR L. LA POINT, Primary Examiner.
H. BELTRAN, Assistant Examiner.