United States Patent

[11] 3,557,714

[72] Inventors **Herman A. Aquino**
Hobart;
Walter J. Marulic, Gary; William R. Shaver, Munster, Ind.

[21] Appl. No. **739,318**
[22] Filed **June 24, 1968**
[45] Patented **Jan. 26, 1971**

[73] Assignee **Pullman Incorporated**
Chicago, Ill.
a corporation of Delaware

[54] **HOPPER CAR CONSTRUCTION**
10 Claims, 11 Drawing Figs.

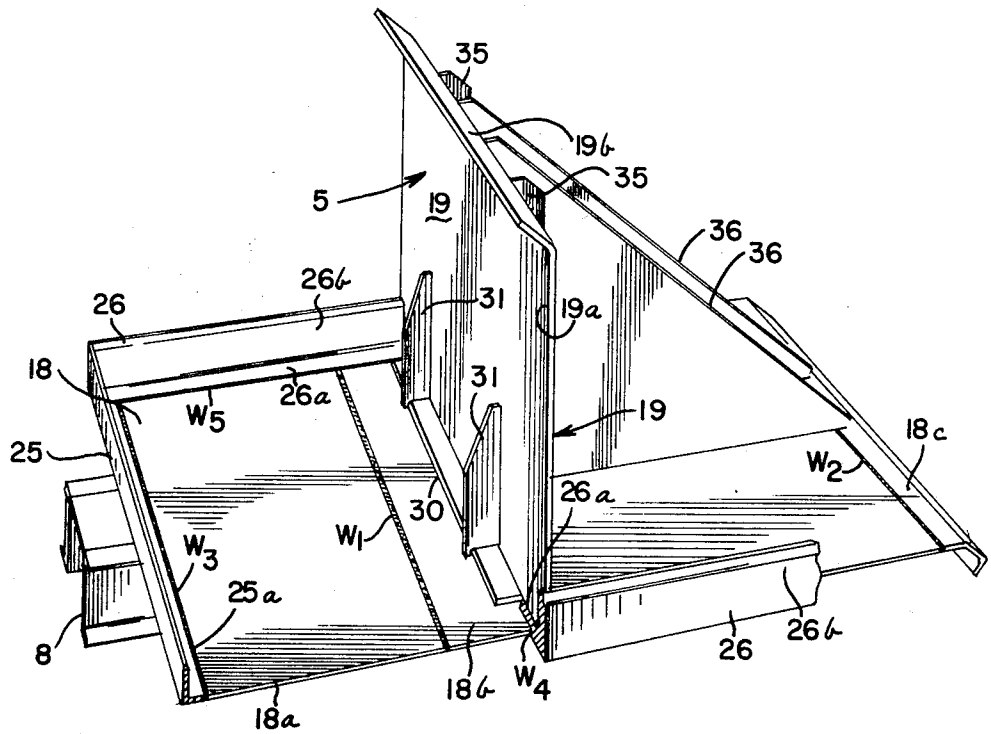
[52] **U.S. Cl.** **105/406,** 105/247
[51] **Int. Cl.** **B61d 7/00,** B61f 1/10
[50] **Field of Search** ..... 105/404, 409, 306, 413, 406, 247, 248, (Inquired)

[56] **References Cited**
UNITED STATES PATENTS

1,813,537	7/1931	Gilpin	105/406
2,140,268	12/1938	Moss	105/406
2,851,965	9/1958	Leriche	105/409
3,145,665	8/1964	Hamilton	105/377
3,240,168	3/1966	Charles et al.	105/406
3,421,453	1/1969	Allen et al.	105/406

Primary Examiner—Arthur L. LaPoint
Assistant Examiner—Richard A. Bertsch
Attorneys—Hilmond O. Vogel and Wayne Morris Russell

ABSTRACT: An aluminum hopper car having a high-pitched roof defined by sheeting mounting carlines connected between box-shaped sideplates and the coaming defining a continuous trough hatch opening, the carlines being in transverse alignment with box section side posts and reinforcing partition sheets and the bolster web, a horizontal shear plate lying in the plane of the horizontal portions of the side and end sills connecting with said bolster web and end slope sheet to define a closed torque box arrangement, said slope sheet comprising a plurality of sections of variable thicknesses to accommodate load requirements, the shear plate and slope sheets being assembled by butt welding techniques.



PATENTED JAN 26 1971

3,557,714

SHEET 1 OF 3

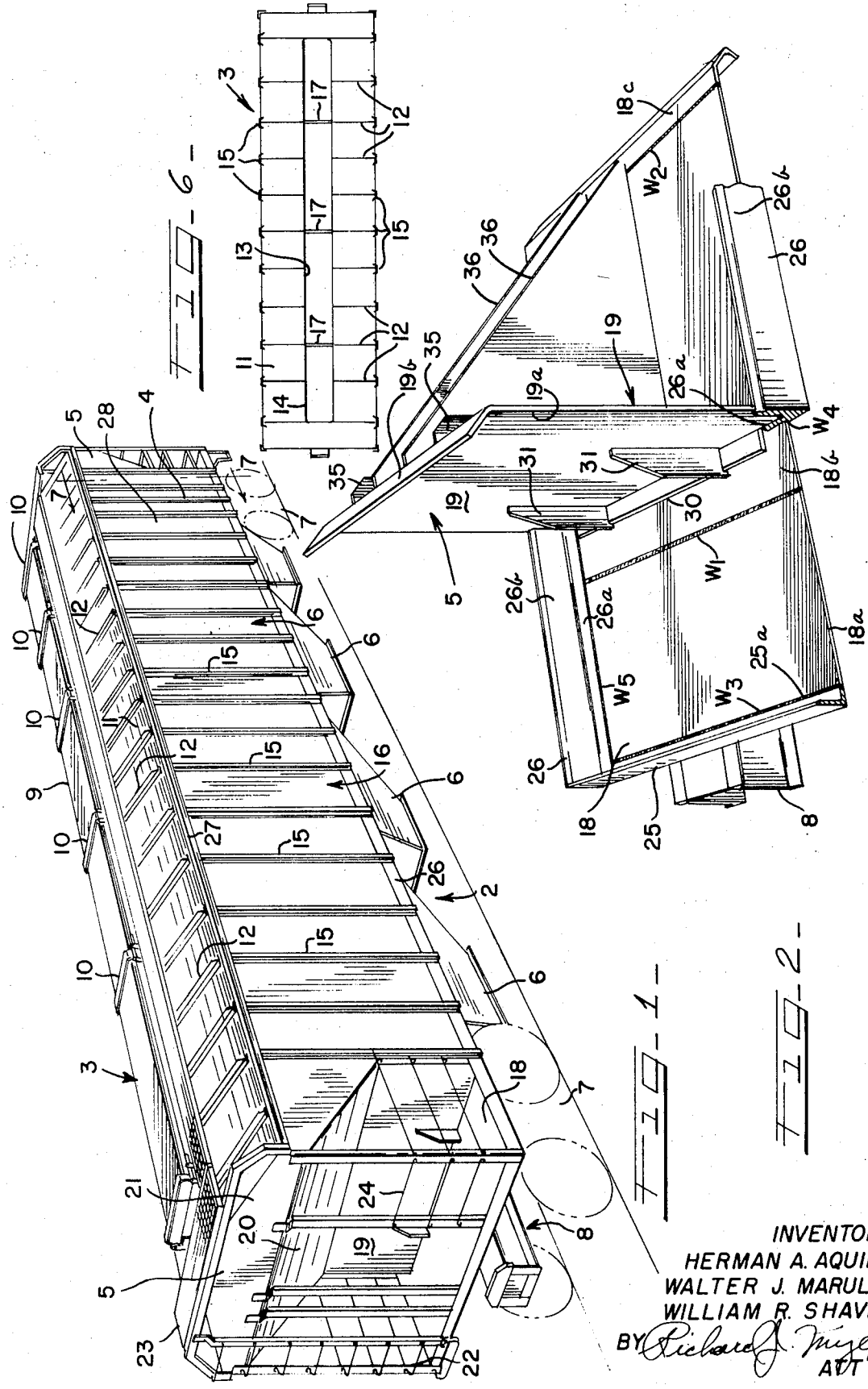


FIG. 6

FIG. 1

FIG. 2

INVENTORS
HERMAN A. AQUINO
WALTER J. MARULIC
WILLIAM R. SHAVER
BY Richard J. Myers
ATT'Y.

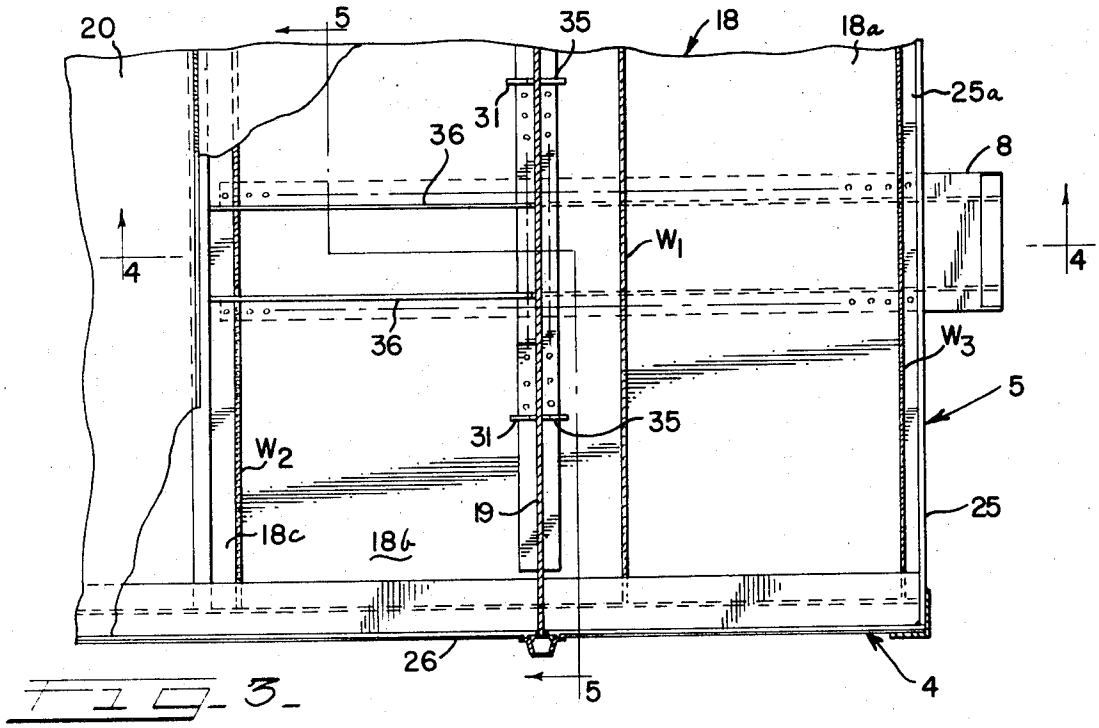


FIG. 3

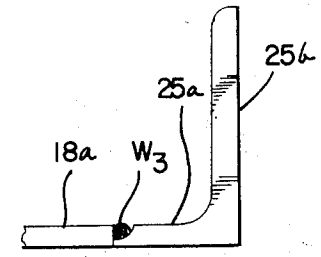


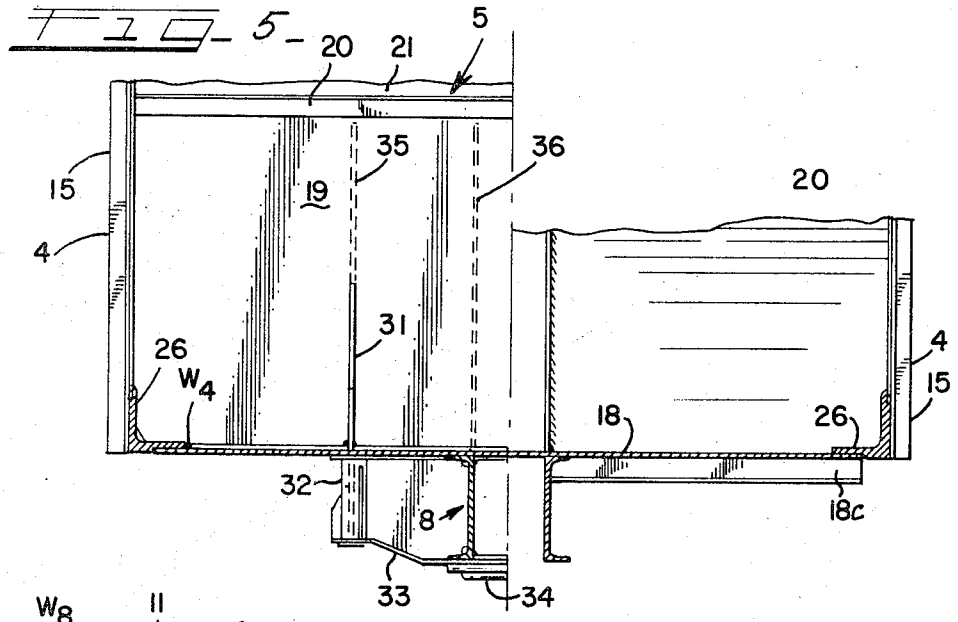
FIG. 4B

FIG. 4

FIG. 4A

INVENTORS
HERMAN A. AQUINO
WALTER J. MARULIC
WILLIAM R. SHAVER
BY Richard J. Myers
ATT'Y.

FIG. 5



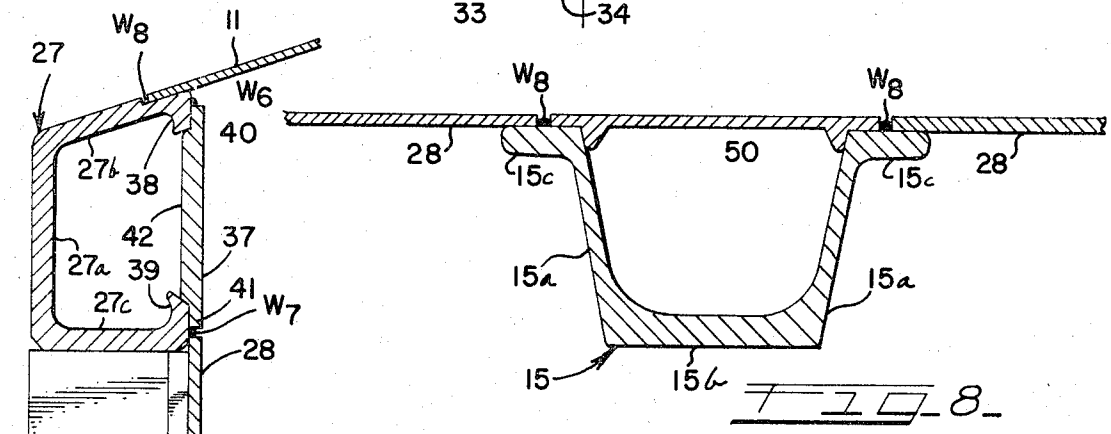


FIG. 8

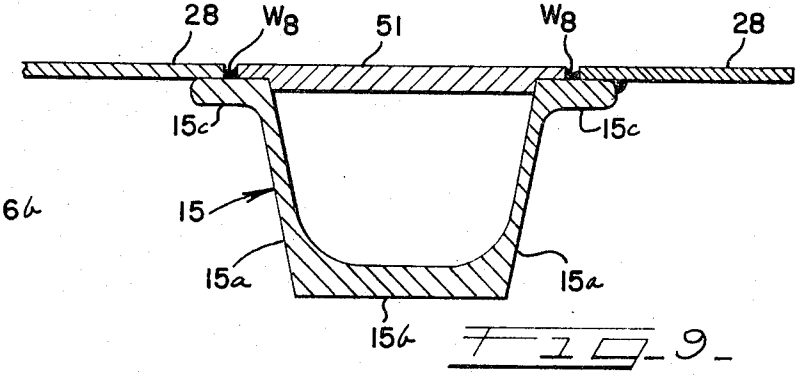


FIG. 9

FIG. 7

INVENTORS
HERMAN A. AQUINO
WALTER J. MARULIC
WILLIAM R. SHAVER
BY Richard J. Myers
ATT'Y.

HOPPER CAR CONSTRUCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention pertains to the field of art relating to hopper car construction where it is desirable to produce lightweight, high cubic capacity, high strength cars.

2. Description of the Prior Art

An aluminum hopper car construction generally is not new. In such type of construction it is always desirable to provide for the highest cubic capacity using the lightest weight and yet maintaining sufficient strength. This invention solves the problem of obtaining the maximum cubic capacity, the minimum of weight and yet providing high strength difficult to obtain in aluminum welding operations.

The roof construction of current cars provides for across hatch-strengthening members or so-called horse collars through the trough hatch opening, which arrangement interferes with loading operations and this invention also seeks to overcome this difficulty.

In center sill-less cars it is desirable to use a torque box construction comprised of the bolster web, shear plate and end slope sheet but difficulty arises in closing the box section by welding operation and this invention has for its purpose the overcoming of this problem. The welding of the various components of the aluminum hopper car, if done by fillet welding, results in a loss of strength at the weld and it is also this problem that the invention seeks to overcome.

SUMMARY

The invention provides a unique structural arrangement of the roof carlines being in alignment with torsion and bending force resistant side posts where the roof side sheet is attached to the carlines to provide a connecting girder between the side posts and the roof coaming to define a continuous trough hatch opening. The continuous trough hatch roof opening is thereby uninterrupted by portions of the roof and results in fast, easy and continuous loading. Aluminum or other light material construction is desirable for lightweight and yet high strength is maintained by proper butt welding techniques. Strong box section aluminum extrusion sideplates are provided between the carlines and the box section side posts to add additional strength to the car and eliminate the necessity of using horse collars at the trough hatch opening.

The invention also eliminates the construction of the through center sill, providing end stub center sills and a torque box arrangement to receive the buff and draft forces imparted to the center sills by providing for a butt-welded torque box arrangement of the bolster web, the shear plate and the end slope sheet where the shear plate is butt welded to the end sill and the slope sheet which sheet consists of a plurality of sections that are butt welded to eliminate the difficulty of attempting to weld within the torque box construction. The use of butt welding in place of fillet welding of the various aluminum components of the car provides for higher strength at the weld areas.

By the use of several sections to form the posts or the slope sheet and employing butt welding to integrate the sections, the strength of the sections may be maintained and varied to meet particular load requirements.

Other advantages and objects will become apparent from reference to the following description, appended claims and attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of our novel hopper car;

FIG. 2 is a partial perspective view of the torque box arrangement of the hopper car;

FIG. 3 is a partial plan view of the torque box arrangement;

FIG. 4 is a partial elevational view illustrating the torque box arrangement taken along line 4–4 of FIG. 3;

FIG. 4A is an enlarged view of the inner weldment of the shear plate;

FIG. 4B is an enlarged view of an outward weldment of the shear plate;

FIG. 5 is a partial end view of the car taken along line 5–5 of FIG. 3;

FIG. 6 is a plan view of the hopper car;

FIG. 7 is a partial view of the side posts taken along line 7–7 of FIG. 1;

FIG. 8 is a partial sectional view of the side post at the side sheet; and

FIG. 9 is a partial sectional view of the side post taken at the bolster.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawings and in particular with reference to FIG. 1, there is shown an aluminum hopper car 2 having deep slope hopper roof portion 3, sides 4, ends 5, lower hoppers 6 and trucks 7. The car is provided with end stub center sills 8. The roof structure 3 comprises a hatch cover 9 with battens 10 and roof sheeting 11 on which is attached transverse carlines 12.

As better seen in FIG. 6, where the hatch cover 9 is removed there is shown the trough hatch opening 13 defined by coaming 14 connecting with the carlines and the roof sheeting to form an integral deep slope roof girder arrangement. The carlines 11, extending transversely on each side of the hatch opening 13, are in transverse alignment with the car side posts 15 of the side girder structure 16 of the side 4 of the car 2. It will be noted that the trough hatch opening is continuous and no horse collars are provided that connect the carlines on opposite sides of the opening with one another but there are three partition structures 17 dividing the hopper car into the three hopper sections 6. The combination of the deep slope of the car roof from the car hatch to the side posts with attachment of the carlines by welding to the roof sheet and in transverse alignment with the box shaped side posts present a strong reinforcing roof structure.

Each end 5 of the car is defined by the fixed stub center sill 8, the shear plate 18, the bolster web 19 and the end slope sheet 20. The slope sheet 20 connects with the vertical end wall 21 and the car end is also provided with a ladder 22 leading to roof running board means 23 and with hand grabs 24. Each shear plate at the end of the car is fenced by end sills 25 and side sills 26. Each side girder 16 is comprised of box section side posts 15, box section side plate 27, the lower side sills 26 and the side sheeting 28.

As best seen in FIGS. 3—5, the shear plate 18 comprises an outer end flat portion 18*a* attached to an intermediate flat shear plate portion 18*b* by a butt weldment W_1, and an inner downwardly turned generally U-shaped shear plate portion or reinforcement member 18*c* attached to the intermediate portion 18*b* by a butt weldment W_2. The outer end shear plate portion 18*a* is attached to the horizontal flange 25*a* of the end sill 25 by butt weldment W_3 and the end sill 25 also has a vertical flange 25*b*. The weldments W_2 and W_3 for holding the shear plate sections together is illustrated in FIGS. 4A and 4B. The weldment W_1 is similar to weldments W_2 and W_3. These butt weldments W_1, W_2, and W_3 are formed by scalloping out a part of one of the shear plate portions or adjacent member and butting it next to the adjacent shear plate portion and laying the weld bead therein. This type of weldment for welding together the aluminum shear plate portions provides for greater strength than the fillet type of weldment where one shear plate portion would be overlapped on the other shear plate portion and thus we have a stronger shear plate arrangement. The shear plate is similarly welded to the side plate 26 by weldment W_4 (See FIG. 7) by placing the horizontal flange 26*a* FIG. of the side still, which also has a vertical flange 26*b*, in abutting relation with the shear plate 18 and laying the weld bead in between to insure maximum strength at the weldment. It is, therefore, seen that the shear plate 18 lies in the same horizontal plane as the horizontal flanges 26*a* of the side sill 26 and the horizontal flange 25*a* of the end sill 25 to thereby

apply shear forces from the shear plate directly to the side and end sills. It will be noted that the side sill horizontal flange 26*a* on the bottom, seen in FIG. 7, is actually notched out to receive the butt-welded bead between it and the shear plate 18 and the bottom of the side sill is actually grooved or notched out deeper to present a shoulder 26 or to act as a positioning stop for alignment of the shear plate therewith.

The bolster web 19 is an upright member that is positioned transversely of the car and at each end thereof over its respective shear plate portion 18*b* and spaced inwardly of the end thereof. The bolster web or beam comprises an upright portion 19*a* and an upper outwardly turned sloped end portion 19*b*. The bolster web extends laterally and is attached to the horizontal and vertical flanges of the side sill 26. The lower bolster web portion 19*a* is mounted on the shear plate reinforcement member 30 which in turn is welded to each sideplate by butt weldment W_5 as seen in FIGS. 2 and 7 with the butt weldment W_5 extending back to a juncture with the weldment W_3 on top of the shear plate portions 18*a* and 18*b*. Side bearing brace reinforcements 31 are mounted against the upright bolster web portion 19*a* and over the shear plate reinforcement plate directly over the lateral ends of the side bearing structure 32 (see FIG. 5) which are connected by web 33 with the center plate structure 34 attached to the stub center sill 8. On the opposite or inner side of the bolster web portion 19*a* are mounted thereagainst laterally spaced-apart internal side bearing brace reinforcements 35 in longitudinal alignment with the short outer side brace reinforcement members 31. The inner side bearing brace reinforcement members 35 extend upwardly to the bolster web flange 19*b* which is attached to the end slope sheet 20. Each end construction is also provided with two laterally spaced end slope sheet reinforcement members 36 which are triangular in shape and bear against the bolster web, shear plate and end slope sheet for reinforcement of the torque box arrangement formed thereby. The end slope sheet reinforcement members 36 extend longitudinally of the car and at each end thereof and over the outer lateral upright portions of the respective center stub sill.

The end slope sheet member 20 comprises an upper slope sheet part 20*a*, an intermediate or torque box portion 20*b* and a lower portion 20*c* extending into the area of the hopper end portion of the end hopper 5. The adjacent ends of the slope sheet portion 20*c* and 20*b* are welded by butt welding W_9 to the inner shear plate or reinforcement portion 18*c* on the intermediate part thereof and the adjacent end of the slope sheet portions 20*a* and 20*b* are butt welded by weldment W_9 to the upper bolster web portion or flange 19*b*. By this type of welding of the three sections of the slope sheet to the bolster and the shear plate, it is not necessary to do any internal welding inside of the torque box which is normally a very difficult task.

As seen in FIG. 7, the sideplate 27 which runs longitudinally on each sidewall of the car comprises an outer vertical flange portion 27*a*, a top upwardly inwardly extending top portion 27*b*, and a lower or bottom flange portion 27*c* closed by the sideplate closure member 37 of the side plate arrangement. The sideplate portion 27*b* has an inner downwardly turned flange 38 and the bottom sideplate portion 27*c* has an inner upwardly turned flange portion 39 against which seats the side plate closure member 37 having ends 40 and 41 and intermediate portion 42. The intermediate portion 42 is thicker than the portions 40 and 41 to set into and between the ends of the flanges 38 and 39 and fillet weld W_6 attaches portion 40 to portion 38 and butt weld W_7 attaches portion 41 and 39 together with the side sheet 28. The butt type weldment W_7 is needed to transfer strength between the sideplate closure and the side sheet. Similarly, the roof sheet is butt welded by weldment W_8 to the sideplate top portion 27*b* for the good strength transference between the sideplate and the roof sheet, an advantage of butt weld as previously discussed. The side posts, side sheet and side sill are joined to one another as, for instance, at 43 in FIG. 7.

The construction of the box side posts 15 at its attachment to the side sheet 28 and at the bolsters or bolster webs and at the three partition sheets 17 is best seen in FIGS. 8 and 9 respectively. The side post 15 is of similar construction whether attached to the side sheets or at the bolsters and partition sheets with the exception that a heavier closure plate is used at the bolster webs and at the partition sheets. The side post 15 is provided with a pair of lateral flanges 15*a* tapering outwardly toward one another and an outer longitudinally extending flange 15*b* to form an integral type side post construction but the sideplate closure 50 at the side sheets is of thin construction and has locating ears extending inwardly and between each of the lateral side post flanges 15*a* whereas the sideplate closure 51 at the bolsters and partitions is thicker along its full longitudinal length to provide offset shoulders abutting against the inner sides of the side posts' lateral portions 15*a*. However, both closure plates 50 and 51 are held to the hoppers and to the side sheets by butt welds W_8 by having the closures and side sheets adjacent one another and the inner end flanges 15*c* lying thereagainst and welded therewith.

Thus our invention provides for a novel lightweight high cubic capacity aluminum hopper car having a high pitched roof of sheeting and sheet mounted carlines in line with box section side posts attached to sideplates to permit an open type hatch of maximum strength. Further, the car is provided with aluminum constructed end torque box arrangements such that the end slope sheet of each torque box is made into sections that are butt welded with one another and with the shear plate and bolster web to provide a high strength aluminum torque box for receiving coupler forces. Further, the box-type construction of the sideplates and side posts accepts bending as well as torsion forces to strengthen the roof construction. The box-type construction of the sideplates and side posts is also designed for butt welding to the side sheets to provide maximum strength characteristics from the sheeting to the plate construction as is the case with the torque box so that the roof and the side constructions act as girders taking the loading from the aluminum torque box construction.

We claim:

1. An aluminum hopper car comprising:

a roof girder having an elongated annular trough hatch coaming defining a continuous hatch opening extending longitudinally of the car and roof sheeting surrounding the coaming and a plurality of longitudinally spaced laterally extending roof reinforcing carlines on each side of the longitudinally extending coaming such that a carline on one side of the coaming is in transverse alignment with a carline on the other side of the coaming;

a pair of laterally spaced upright longitudinally extending side girders connecting with the longitudinally extending roof girder and each girder comprising upright longitudinally extending side sheeting and box section post means being upright and in longitudinally spaced relation along the side of the car, each box section post means being in lateral alignment with a pair of laterally aligned carlines on either side of the coaming, and a pair of laterally spaced longitudinally extending sideplates connecting the carlines and roof sheeting with the side sheeting and side posts and a pair of longitudinally extending laterally spaced side sills, each side sill connecting with the lower portions of the side post means and a respective side sheet;

longitudinally spaced transversely extending partition means defining hopper spaces connecting with a pair of laterally spaced transversely aligned post means and with each of the laterally spaced side sheeting and with each of the laterally spaced sideplates and side sills; and

end car construction means at each end of the car connecting with the side girders and the roof construction and comprising a center sill portion, horizontal shear plate means mounted on the center sill portion and connecting with each of the side sills and an end sill means connecting with each of the side sills and with the shear plate

means, and upright bolster web extending transversely and spaced inwardly of said end sill means and mounted on the shear plate means intermediate the shear plate means ends, and end hopper slope sheet means sloping upwardly and outwardly of the end of the car and connecting with the shear plate and the bolster web intermediate the ends of the slope sheet means to define a closed triangularly shaped torsion box arrangement for receiving coupler forces imparted to the center sill portion for transmission of the loads from the side sills and into the side girders and roof girder.

2. The invention according to claim 1, each sideplate means being of box-shaped construction to receive torsion and bending forces as a result of the coupler forces and comprising an outwardly facing U-shaped member and an inner closure plate connecting with the ends of said U-shaped member to define said boxlike construction and said roof sheeting being butt welded to the upper end of the U-shaped member, and a butt weldment lying in a space defined by the side sheet portion, the side closure plate and the lower end of the U-shaped member for attaching the U-shaped member, the closure plate and the end of the side sheet together in an integral unit whereby forces may be directly transferred through the side sheets and closure plate.

3. The invention according to claim 1, each side post being defined by a U-shaped member and a closure plate, the closure plate being located at the bolster web and at the partition sheets being of greater thickness between the ends of the U-shaped member and extending into the U-shaped member, the U-shaped member, the side portions and the closure plate being butt welded together at each leg of the U-shaped member.

4. The invention according to claim 1, each side post being defined by a U-shaped member and a closure plate, the closure plate at the connection with the side sheeting portions being provided with a pair of inwardly directed, spaced-apart ears resting against the inside parts of the ends of the U-shaped member, the side sheeting being a plurality of sheet portions attached to opposite ends of the U-shaped member, said side sheet portions, each closure plate and each U-shaped member being butt welded together at each leg of the U-shaped member.

5. The invention according to claim 1:

said side and end sills being generally L-shaped angle beams;

said shear plate means comprising three longitudinally aligned welded together plate parts, the outer end shear plate part generally lying in the same plane of the lower horizontal flange of the angle beam end sill and generally in the same plane of each of the horizontal flanges of the angle beam side sill and being attached to the end sill and the side sill by butt welding and to the intermediate shear plate portion for transferring the buff and draft coupler forces in a horizontal plane from the outer end shear plate portion to the end sill, the side sills and the intermediate shear plate portion providing for maximum force transfer efficiency;

the intermediate shear plate portion being attached to the lower horizontal flange of each of the side sills by butt welding and being attached to the underside of the upright bolster web with transmission of the buff and coupler forces in a horizontal plane to the side sill producing a bending moment on the bolster web; and

the inner end shear plate portion being attached to the intermediate shear plate portion by butt welding and having an inner downwardly directed flange being welded with the end slope sheet means.

6. The invention according to claim 1:

said side and end sills being generally L-shaped angle beams; and

said shear plate means generally lying in the same plane of the lower horizontal flange of the angle beam of the end sill and generally in the same plane of each of the horizontal flanges of the side sill angle beam and being attached to the end sill and the side sill by butt welding for transferring the buff and draft coupler forces in a horizontal plane from the shear plate means to the end sill and side sills.

7. The invention according to claim 1:

said side sills being generally L-shaped angle beams; and

said shear plate means comprising three longitudinally aligned welded together plate parts, the intermediate shear plate portion being attached to the lower horizontal flange of each of the side sill angle beams by butt welding and being attached to the underside of the upright bolster web with the transmission of buff and coupler forces in a horizontal plane to the side sill and producing a bending moment on the bolster web, the inner end shear plate portion being attached to the intermediate shear plate portion by butt welding and having an inwardly downwardly directed flange being welded with the end slope sheet means.

8. The invention according to claim 1:

said end sill being a generally L-shaped angle beam; and

said shear plate means generally lying in the same plane of the lower horizontal flange of the angle beam end sill and being attached to the end sill by butt welding.

9. The invention according to claim 1:

said end hopper slope sheet means defining with a partition sheet an end hopper and comprising an upper, intermediate and lower slope sheet portion; and

the upper and intermediate slope sheet portions being butt welded to one another and to an upturned end of the bolster web, and the intermediate and lower slope sheet portions being butt welded to one another and to the downturned end of the shear plate means.

10. The invention according to claim 1, said shear plate comprising a plurality of butt welded sections the innermost of which is butt welded to the plates of the end slope sheet and the outer of which is butt welded to the end sill, each of the shear plate portions being butt welded to the side sills of the side girder.