United States Patent [19]

Heap et al.

[11] **3,766,862**

[45] **Oct. 23, 1973**

[54] **RAILROAD TANK CAR**

[75] Inventors: **James C. Heap**, Munster; **Fred Brown**, Hammond, both of Ind.; **Donald C. Graves**, Frankfort, Mich.

[73] Assignee: **Union Tank Car Company**, Chicago, Ill.

[22] Filed: **Oct. 21, 1971**

[21] Appl. No.: **191,272**

[52] U.S. Cl. ..... **105/358**, 105/360, 105/362, 105/419, 280/5, 296/31 P

[51] Int. Cl. **B61d 5/00**

[58] Field of Search ..... 105/358, 359, 360, 105/362; 280/5; 296/31 P; 220/9 F; 214/45

[56] **References Cited**

UNITED STATES PATENTS

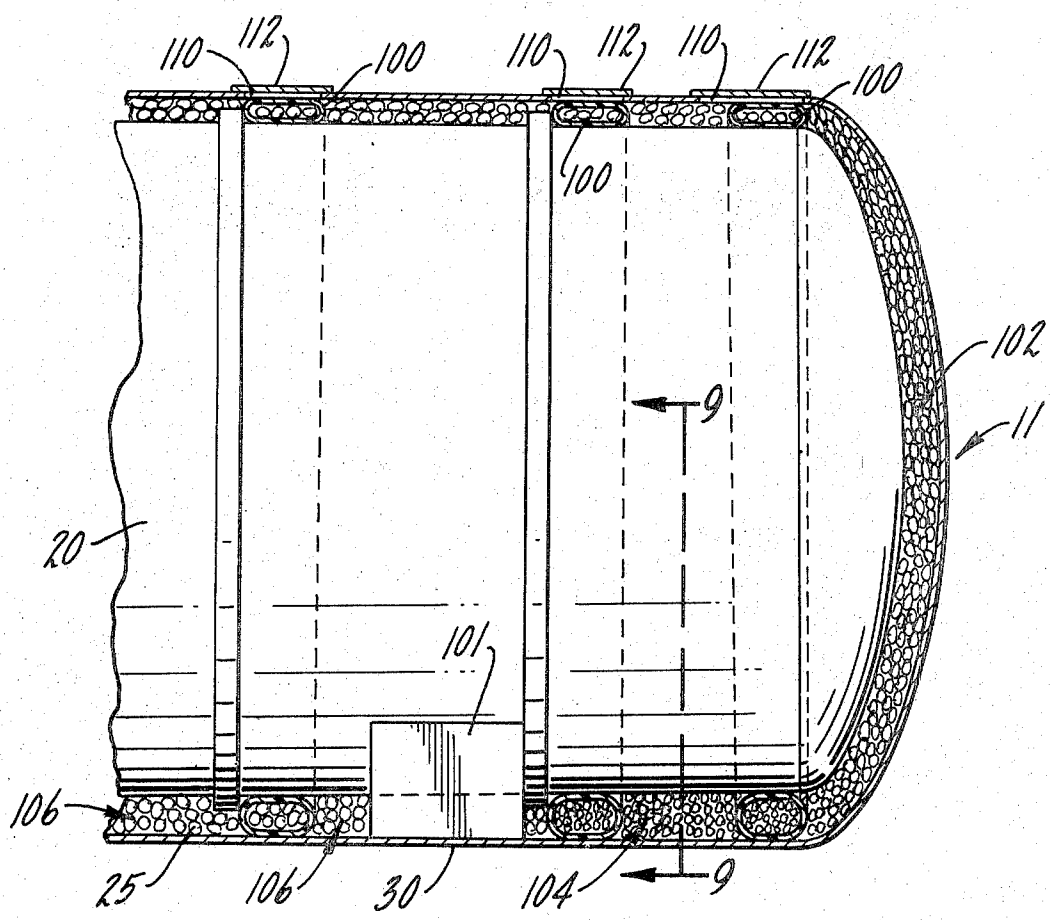
3,139,842	7/1964	Moyes et al.	105/360
3,390,644	7/1968	Kravskopf	105/358
3,450,066	6/1969	Krasprzycki	105/362
2,783,718	3/1957	Cheshire	105/419

Primary Examiner—Robert G. Sheridan
Assistant Examiner—Richard A. Bertsch
Attorney—Charles M. Kaplan

[57] **ABSTRACT**

A railroad tank car having a fully enclosed commodity confining inner tank shell which is confined within an outer "thin skinned" tank shell which forms an enclosure for and effects the confinement of an insulating layer that substantially entirely surrounds the inner tank shell. A bottom section of the outer shell is removed and a "Z" section center sill is inserted and integrally welded to the outer shell so as to effect the necessary support therefor and to achieve a stronger and lighter tank shell having sufficient buckling resistance. Reinforcing members are provided at the upper and lower flanges of the sill. The bolster assemblies includes a saddle plate which is inset and overlaps a corresponding removed portion of the lower sides of the outer shell. The density of the insulating material adjacent the bolster assemblies is increased so as to adequately support the inner shell.

25 Claims, 17 Drawing Figures



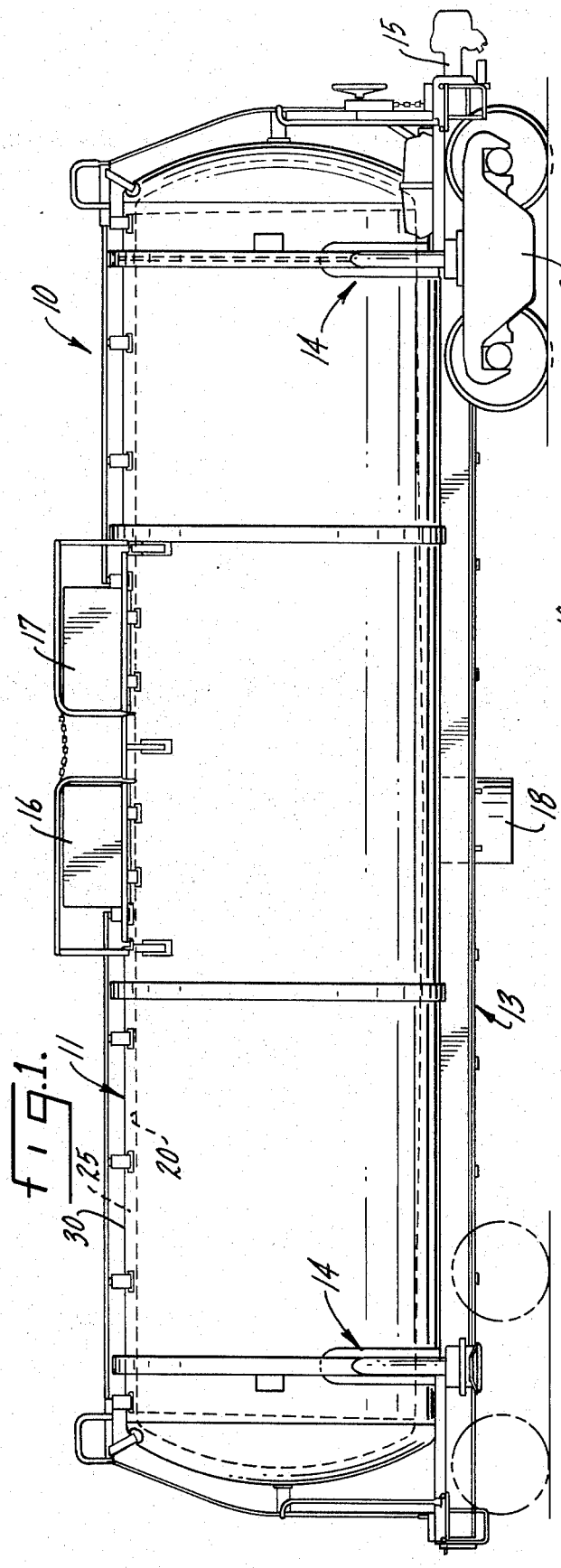


FIG. 1.

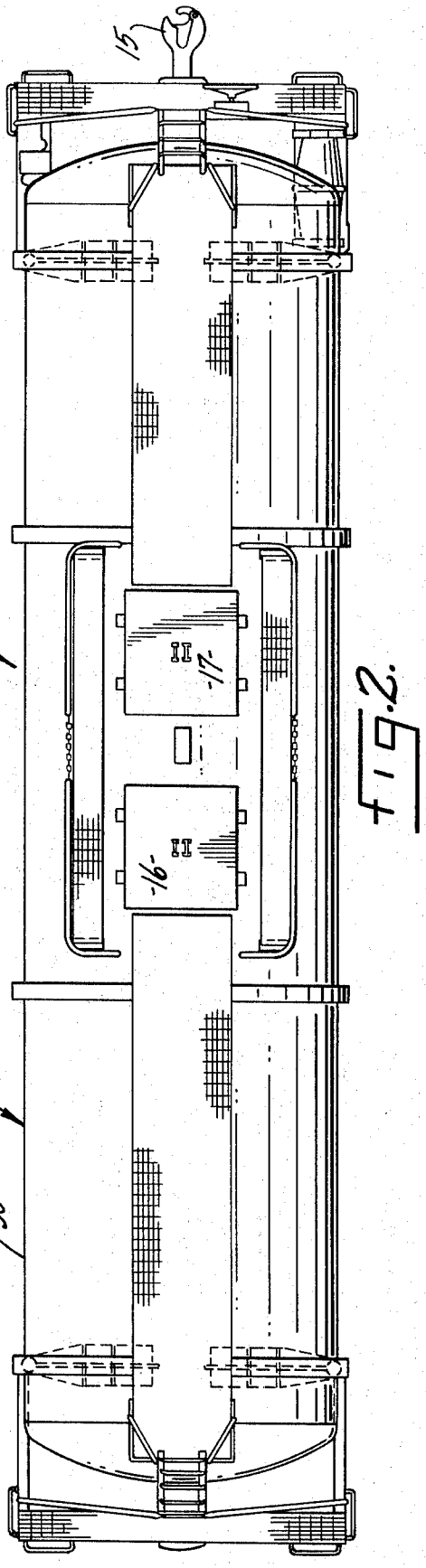


FIG. 2.

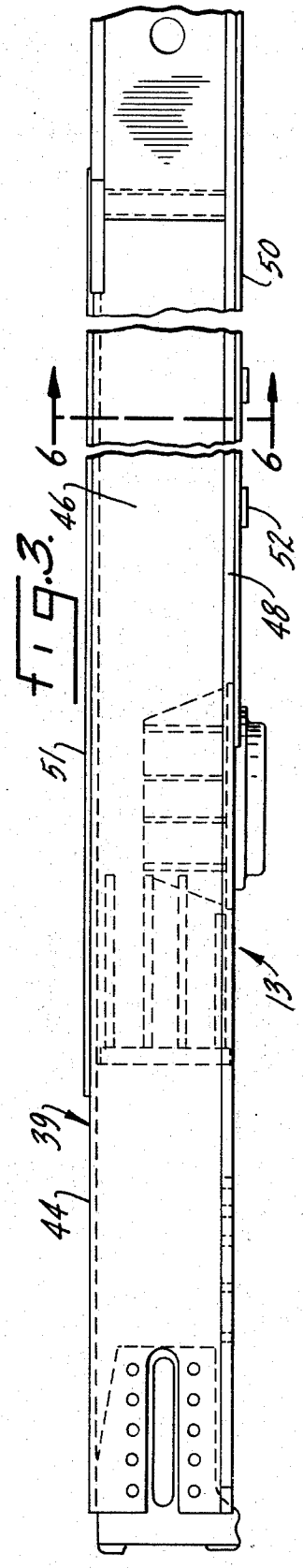


FIG. 3.

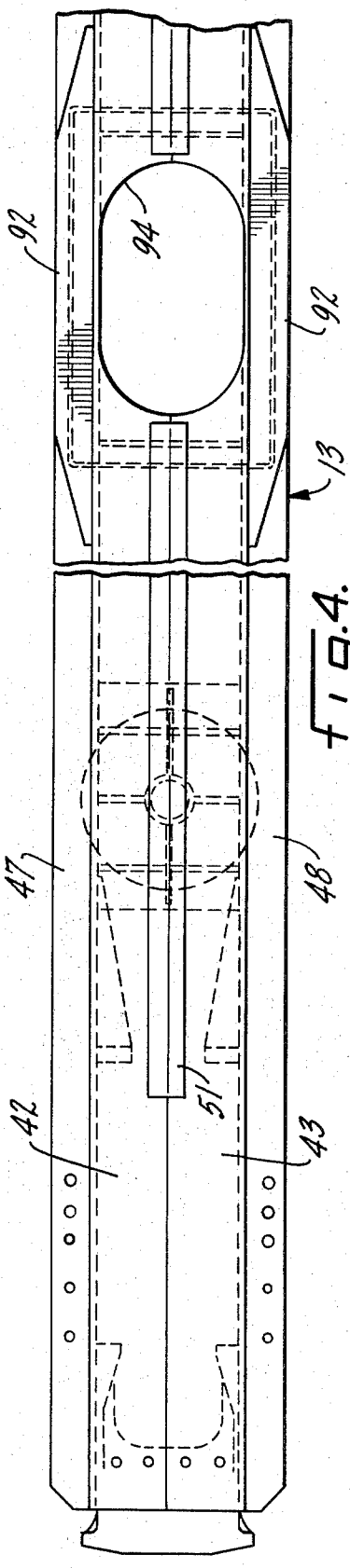


FIG. 4.

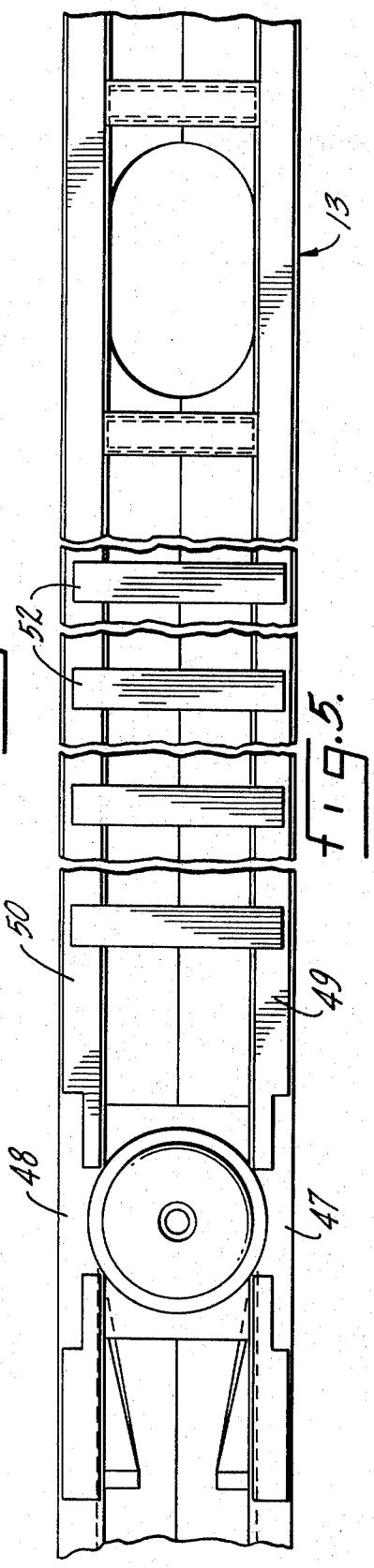


FIG. 5.

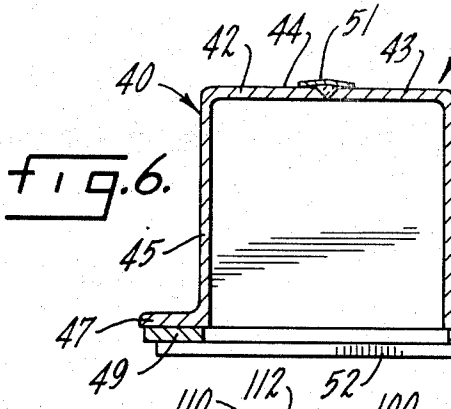


fig.6.

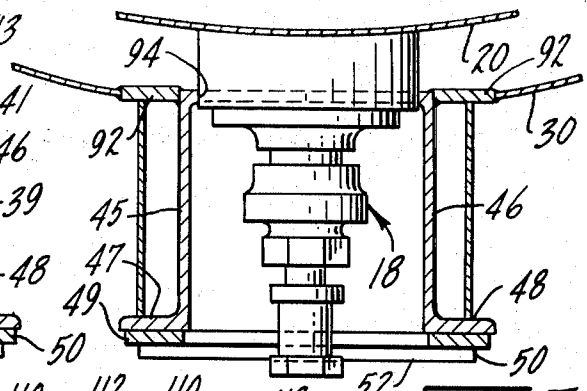


fig.7.

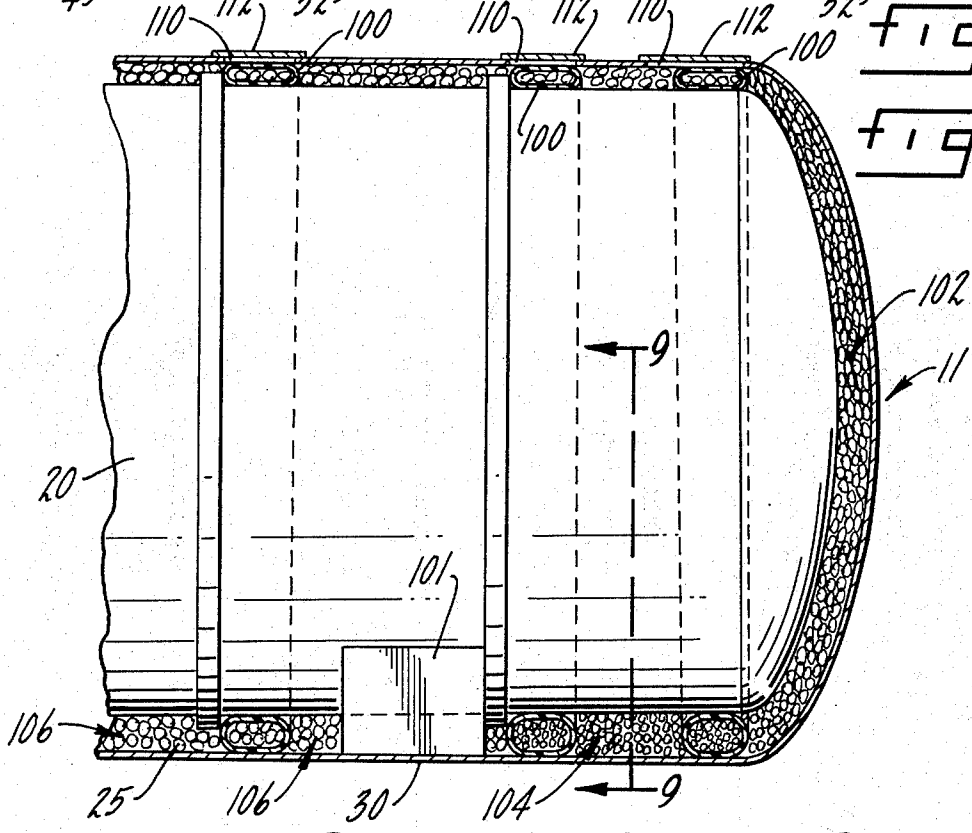


fig.8.

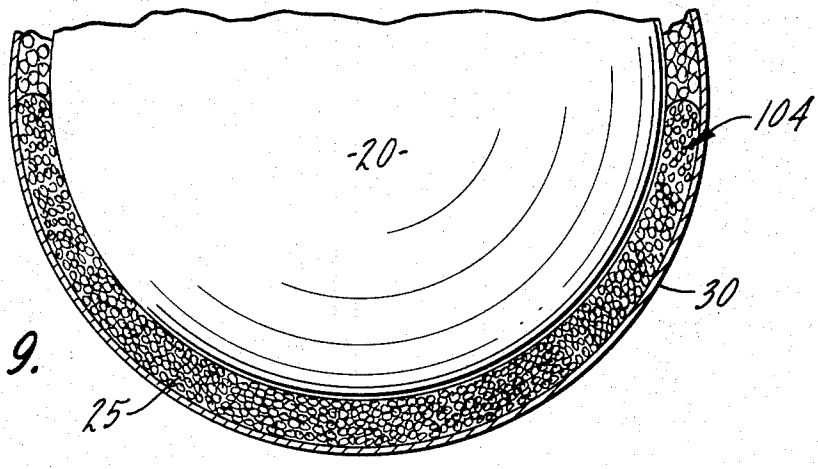


fig.9.

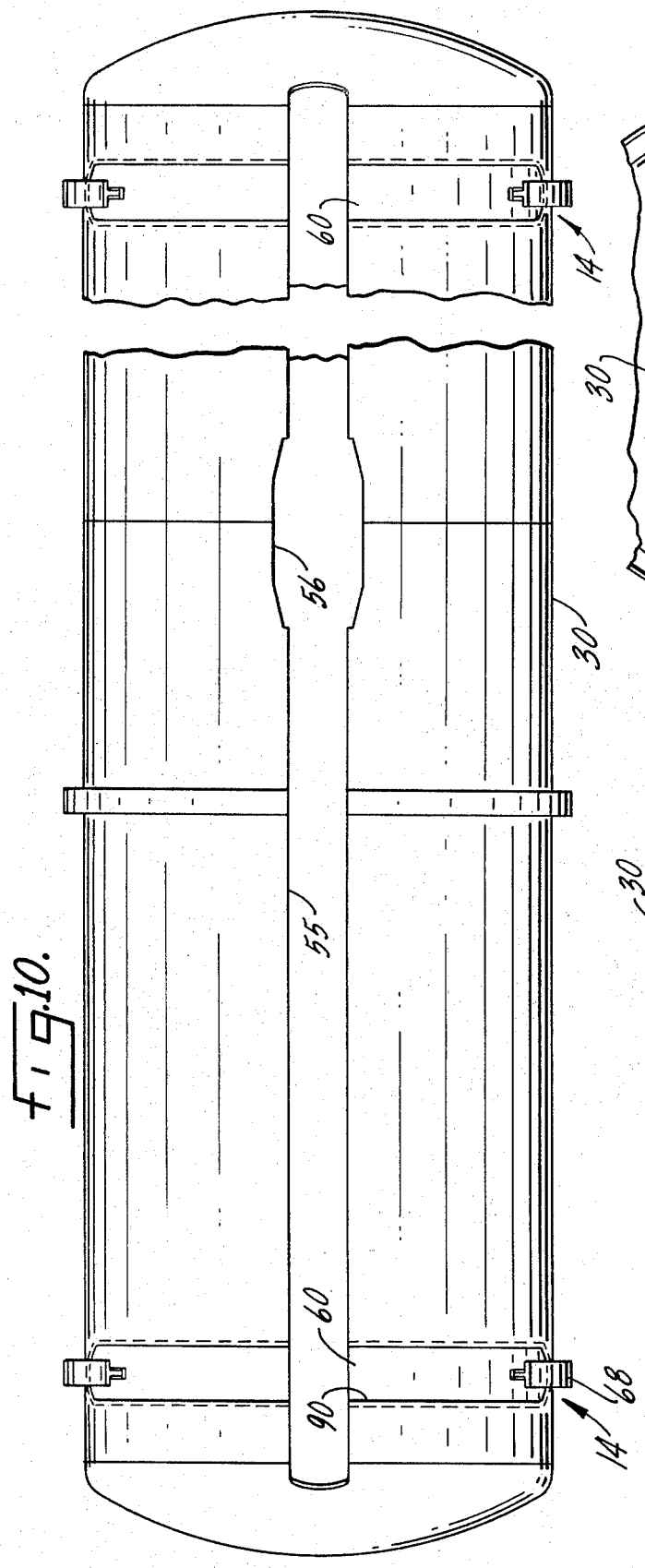


FIG. 10.

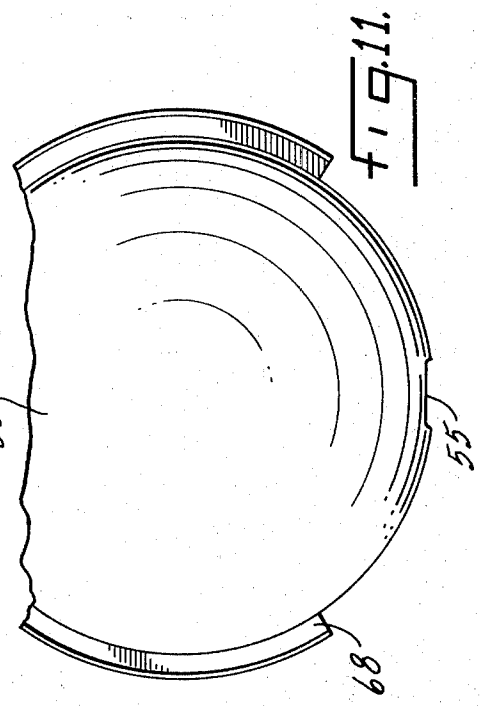


FIG. 11.

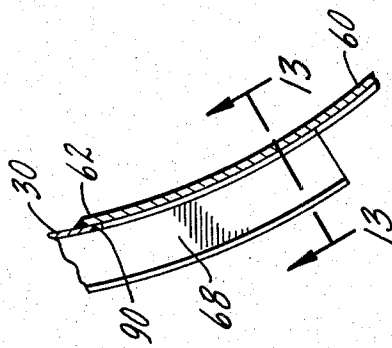


FIG. 12.

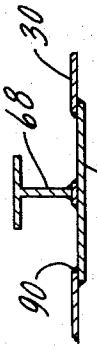


FIG. 13.

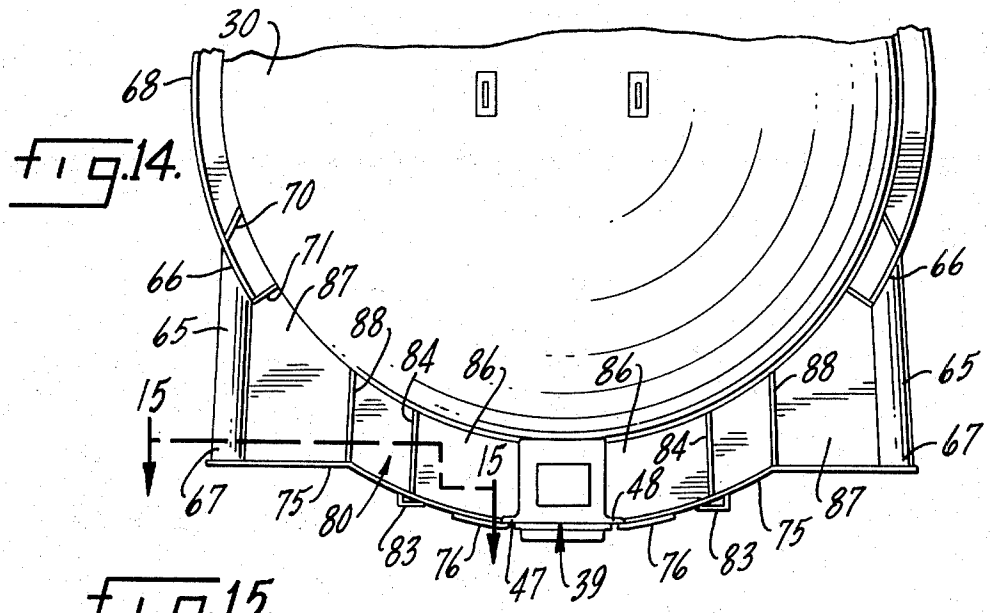
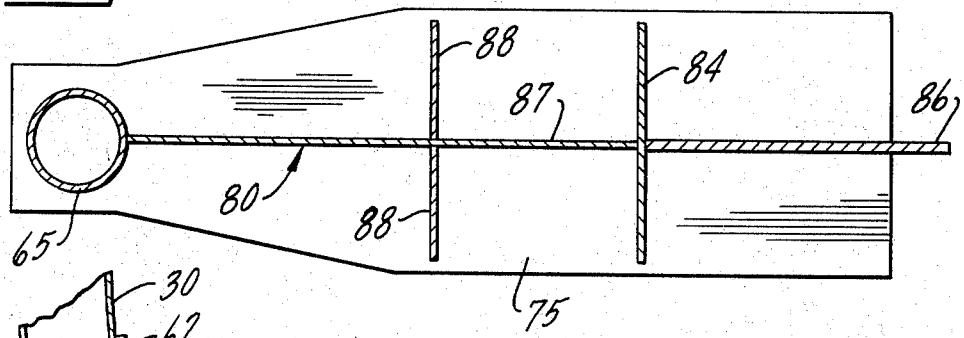


fig.14.

fig.15.



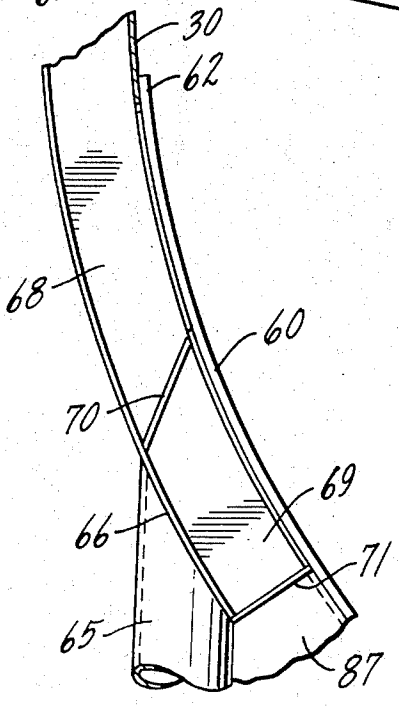


fig.17.

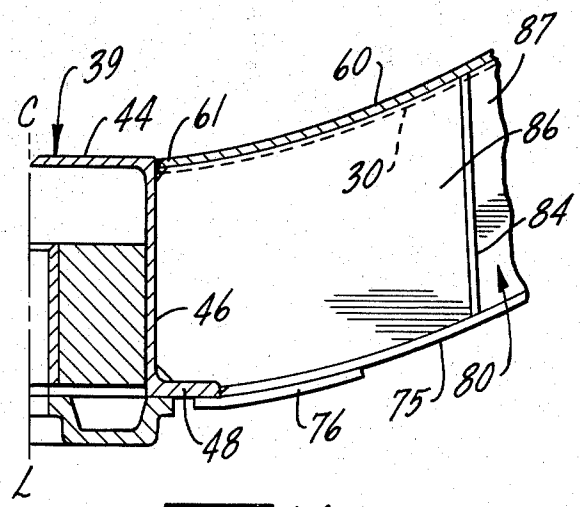


fig.16.

RAILROAD TANK CAR

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to railroad tank cars generally of the insulated type. More particularly, the invention is directed toward an improved insulated tank car having an outer tank shell fabricated from thin reinforced plates.

Insulated railroad tank cars of this particular type have heretofore included an outer tank shell fabricated of approximately 7/16 inch plate steel in order to insure the structural stability of the outer tank shell against dynamic and impact loads applied to the tank. This has resulted in a tank car which is necessarily relatively heavy and consequently suffers weight penalties. It is also not competitive from a weight and cost standpoint with non-insulated tank cars. This, in combination with an always present desire to reduce material cost, has resulted in the development of the present invention.

It is a prime object of the present invention to provide an improved tank car that more effectively compensates for dynamic and impact loads applied to the tank shell with a minimum of stress concentrations.

It is another object to provide an insulated tank car fabricated of a thin outer shell which is stiffened against buckling along its entire length without adding substantial weight thereto.

A further object is to provide a structurally stable insulated tank car fabricated of a thin outer shell that is light in weight and economical to manufacture.

To facilitate a clear understanding of the "thin skin" type tank car of the present invention, the following description will deal with a tank car of the insulated type. This description of the improved tank car construction is not intended to limit the applicability of the invention to other forms of tank cars. One skilled in the art will appreciate that a number of the inventive features of a thin shelled tank car embodying the present invention could also be used in conventional non-insulated tank cars.

With the foregoing and other objects in view the invention is herein shown as embodied in an insulated railroad tank car that is designed to effect the handling and transportation of commodities which are to be maintained in the tank car under other than ambient temperature conditions. The tank car includes an elongated and fully enclosed commodity confining inner tank shell which is confined within an outer "thin skinned" tank shell which forms an enclosure for and effects the confinement of an insulating layer that substantially entirely surrounds the inner tank shell. A bottom section of the outer shell is removed and a "Z" section center sill is integrally welded to the outer shell so as to effect the necessary support therefor and to achieve a stronger and lighter tank shell having sufficient buckling resistance. In order to reduce center sill stresses added reinforcement is provided to the upper and lower flanges of the sill. A unique pair of body bolster assemblies are provided at each end of the tank car to support the tank shell above the wheel trucks. The bolster assemblies include a saddle plate which is inset and overlaps a corresponding removed portion of the lower sides of the outer shell. The saddle plate and shell are welded together with double fillet welds in a manner which insures a continuous loading path. In order to adequately support plus stiffen the inner shell, the density of the insulating material at the bolster assemblies has been increased.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, both as to its organization and method of operation, taken with further objects and advantages thereof, will be understood by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevational view of a railroad tank car constructed in accordance with this invention;

FIG. 2 is a top plan view of the railroad tank car illustrated in FIG. 1;

FIG. 3 is a side elevational view of the center sill assembly embodying features of the present invention;

FIG. 4 is a top plan view of the center sill assembly in FIG. 3;

FIG. 5 is a bottom plan view of the center sill assembly in FIG. 3;

FIG. 6 is a sectional view taken along line 6—6 in FIG. 3;

FIG. 7 is a sectional view of the center sill assembly similar to FIG. 6 taken at the discharge assembly;

FIG. 8 is a fragmentary cross sectional view of one end of the commodity confining container of the railraod tank car in FIG. 1 with various parts removed to more clearly illustrate the insulating material at various locations;

FIG. 9 is a sectional view taken along line 9—9 in FIG. 8;

FIG. 10 is a bottom plan view of the commodity confining container of the railroad tank car in FIG. 1 illustrating the cutouts therein for receipt of the bolster assembly and the center sill assembly;

FIG. 11 is an end elevation of the commodity confining container of FIG. 10;

FIG. 12 is a sectional view illustrating the assembly of the saddle plate to the outer shell;

FIG. 13 is a sectional view taken along line 13—13 in FIG. 12;

FIG. 14 is an end elevational view of the bolster assembly embodying features of the present invention;

FIG. 15 is a sectional view taken along line 15—15 of FIG. 14;

FIG. 16 is an enlarged end elevational view of a portion of the bolster assembly adjacent the center sill assembly; and

FIG. 17 is an enlarged end elevational view of the portion of the bolster assembly connected to the stiffening ring.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2, the railway tank car 10 there illustrated, and embodying the features of the present invention, is of the heat-insulated type generally of a conventional construction and arrangement. More particularly, the railway tank car 10 comprises an elongated container 11 supported on its oppositely disposed ends by substantially identical wheel trucks 12 of generally conventional construction. Center sill structure 13, secured to the container 11 and extending the entire length thereof, carries two saddle-shaped bolster assemblies 14 adjacent its ends which in turn are respectively carried by wheel trucks 12 disposed therebelow in a conventional manner. Center sill structure 13 is connected to the respective wheel trucks 12 by a center pin, not shown, so as to accommodate articulation

of wheel trucks 12 with respect to container 11. The ends of center sill structure 13 are hollow and are adapted to receive conventional draft gears and couplers 15, in a conventional manner.

Further, the top central portion of container 11 carries a manway cover assembly 16 enclosed by an insulated housing, a top unloading assembly 17 likewise enclosed by an insulated housing, as well as other conventional tank car accessories and hardware. A bottom discharge assembly 18, enclosed by an insulated housing, is associated with the bottom central portion of container 11 and will hereinafter be discussed in further detail.

Container 11 essentially comprises an inner commodity confining shell 20, an intermediate layer of insulating material 25, and an outer shell 30 substantially completely enclosing inner shell 20 and insulating material 25. Inner shell 20 is preferrably constructed from approximately 3/16 inch thick steel plates as has been the practice heretofore. However, outer shell 30 is likewise constructed of 3/16 inch thick steel plates in accordance with the present invention instead of the heretofore practice of forming the outer shell of 7/16 inch thick steel plates. The structural details which follow below form the heart of the present invention as it is due to these improvements that the "thin skinned" tank car 10 is able to withstand the dynamic and impact loads applied thereto.

Referring to FIGS. 1 and 3–6, the center sill structure 13 is shown as extending the entire length of container 11. Center sill structure 13 comprises a channel shaped member 39 formed by welding together a pair of Z-sections 40 and 41 at their top flanges 42 and 43 respectively, as best seen in FIG. 6. Member 39 includes a horizontal top surface 44, a pair of vertical leg portions 45 and 46 depending from the longitudinal edges of surface 44, and a pair of substantially horizontal bottom flanges 47 and 48. Channel member 39 is reinforced by reinforcing plates 49 and 50, associated with bottom flanges 47 and 48, and by reinforcing plate 51 associated with top surface 44. As best seen in FIGS. 5 and 6, plates 49 and 50 are respectively secured to the bottom surfaces of flanges 47 and 48 and extend between the portions of flanges 47 and 48 between the wheel trucks 12. Plates 49 and 50 are effective to eliminate the shear lag for the thin sections, lessen the eccentric loading throughout the center sill structure 13, reduce the deflection and end slope, and make the center sill structure 13 elastically stable per the theory of elastic stability. To further improve the stresses, end slope, deflection, and elastic stability of center sill structure 13 a bent reinforcing plate 51 is secured to the upper surface of surface 44, preferably above the weld connecting top flanges 42 and 43. Plate 51 likewise extends at least between trucks 12 and is slightly bent since it is undesirable to grind the weld joining flanges 42 and 43 flush with top surface 44. A V-shape is shown; however, a U shape could also be used. Plate 51 could also be secured to the bottom surface of surface 44. Battens 52 are additionally provided as shown in FIGS. 5 and 6.

Referring to FIG. 10, a section of the bottom of the outer shell 30 is removed or cutout, as indicated at 55, for receipt of center sill assembly 13. Removed section 55 is substantially rectangular in shape with the exception of an enlarged central portion 56 for receipt of bottom unloading assembly 18. Center sill assembly 13 is positioned within and dimensioned relative to section 55 such that the longitudinal edges of outer shell 30 formed by section 55 contact legs 45 and 46 a short distance below the edges of top surface 44, as best seen in FIG. 16. The longitudinal edges of outer shell 30 formed by section 55 are preferrably secured to the corresponding legs 45 and 46 by fillet welds on both sides of the shell thickness.

A continuous center sill assembly 13 is utilized since it and a portion of the outer shell 30 must transmit the imposed longitudinal impact and dynamic forces, and its flanges 47 and 48 are reinforced to avoid overstressing the sill. Sill assembly 13 is inserted into removed section 55 of shell 30 for ease of fabrication and to develop strength from the lower adjacent shell by double fillet welds.

Bolster assembly 14 has been modified to conform with the above described center sill structure and to reduce the magnitude of the local shell stresses adjacent to the saddle. To this end bolster assembly 14 includes a saddle plate 60 which is inset and overlaps outer shell 30 adjacent a removed portion of the lower sides of the outer shell.

Referring to FIGS. 10–17, each bolster assembly 14 includes a pair of mirror image bolster sections, each having a bolster saddle plate 60 contoured to the radius of curvature of outer shell 30. Each bolster section of each body bolster assembly 14 is identical in construction. Accordingly, only one body bolster section is herein described in detail. Saddle plate 60 extends from a lower end 61 adjacent the vertical center line CL of the outer shell 30, upwardly along the side of the shell to an upper end 62 immediately below the widest portion of the shell. Extending downwardly from a point adjacent the upper end 62 of saddle plate 60, and inclined slightly outwardly, is a bolster pipe 65. As best seen in FIGS. 10–13, a stiffening ring 68, having a T-shape cross section as seen in FIG. 13, encircles and is secured to shell 30. Ring 68 extends from the upper end 66 of pipe 65 around the top of shell 30 to the upper end of the pipe 65 of the adjacent bolster section. The upper end 66 of pipe 65 is rigidly secured to the lower end 69 of ring 68 which is preferably provided with a pair of stiffening webs 70 and 71, as seen in FIG. 17. Pipe 65 extends downwardly from ring 68 to a bolster base plate 75 which spans the distance between the corresponding flange 47 or 48 on channel member 39 and the lower end 67 of pipe 65, as seen in FIG. 14.

Each base plate 75 is connected to the corresponding flange 47 or 48 by a tie plate 76, welded to the lower surface of each, as seen in FIG. 16. At the outer end of plate 75, its upper surface supports and is welded to the lower end 67 of pipe 65.

The area between the corresponding leg 47 or 48 of the channel member 39, the bolster pipe 65, and the bolster saddle plate 60, as well as the base plate 75 in each bolster section is occupied by a plate web 80. Web 80 is welded to the corresponding leg 47 or 48, pipe 65 saddle plate 60 and base plate 75, along its edges.

Welded to the lower surface of base plates 75 are body side bearing supports 83. The supports 83 are conventionally spaced from the truck side bearings (not shown) on wheel trucks 12. A side bearing stiffener plate 84 passes through web 80 and is secured along the side to web 80, along the lower edges to plate 75, and along the upper edges to plate 60, as seen in

FIGS. 14 and 15. Plate 84 is positioned above and over supports 83 because it is in this area that the greatest shear stresses are developed.

Web 80 is preferably fabricated in two parts 86 and 87, as seen in FIG. 14, which are separated by the side bearing plate 84. A pair of web stiffener plates 88 which are also used and secured along their lower edges to plate 75, along their upper edges to plate 60, and at their vertical center line to web part 87, one on each side. These pair of web stiffener plates 88 stiffen the saddle plate 60. Web part 87 utilizes a thinner material thickness than web part 86 to reduce weight with no additional fabrication cost. Web parts 86 and 87 center planes lie in the same plane as seen in FIG. 15.

Referring to FIG. 10, a removed or cutout portion 90 from the lower sides of the outer shell 30 is provided adjacent the wheel trucks 12 for receipt of bolster assembly 14. Removed portion 90 is dimensioned slightly less than saddle plate 60 which is in turn inset and overlaps the edges of shell 30, formed by removed portion 90, as best seen in FIG. 13. Referring to FIG. 16, the inner longitudinal edge of saddle plate 60 is welded to the corresponding leg 45 or 46, preferably on both sides of the plate thickness, immediately above shell 30 and adjacent the intersection between surface 44 with the corresponding leg 45 or 46.

The inset bolster assembly 14 hereinabove described in conjunction with center sill assembly 13 is effective to reduce the magnitude of the local stress adjacent saddle plate 60 and to transfer the saddle load concentrically into the top surface 44 of center sill assembly 13. To this end the saddle plate 60 is positioned inside outer shell 30 so that its inner edge butts into the edge of upper surface 44, thus maintaining the continuity of this structural member for bolster chord loads. Removed portion 90 of outer shell 30 is effective to reduce weight and to permit double fillet welding of the saddle plate 60 to shell 30 which causes the shell shear load to be transferred into the bolster assembly 14. This is particularly important if the outer shell is fabricated from relatively thin plates.

Referring to FIGS. 4 and 7 reinforcement plates 92 are provided for reinforcing center sill 13 at the discharge assembly cutout 94. Plates 92 are shaped to fill the vacant area of central portion 56 remaining after the insertion of center sill 13 in section 55, see FIG. 10. As best seen in FIG. 7, plates 92 are secured at their outer edges to shell 30 by double fillet welds and at their inner edges to the corresponding leg portions 45 and 46 by double fillet welds. This method of reinforcing center sill 13 at sill cutout 94 maintains the sectional properties of center sill 13 about the horizontal neutral axis and increases the sectional properties about the vertical neutral axis.

The method of insulating container 11 and the density of the insulating material at specific locations are unique to the present invention. Prior to assembling outer shell 30 in enclosing relationship with inner shell 20, the inner shell 20 is encircled in spaced relationship with a plurality of inflatable tubes or bags 100 of polyethylene plastic or the like, as seen in FIGS. 8 and 9. Once the outer shell is assembled, the tubes 100 are adapted to be inflated to compartmentalize the annular space between inner shell 20 and outer shell 30. To seat the inner shell 20 in prescribed spaced relationship with the outer shell 30 and define the insulation receiving annular space therebetween, pre-cast cradles 101 of foamed cellular plastic or the like are positioned to support inner shell 20 within outer shell 30. Cradles 101 are preferably formed of a foaming plastic material having a density of approximately 4.4 lbs./cu.ft..

Tubes 100 are spaced so that the volume of each compartment is precisely that which can be charged at maximum charging rate, with a required charge of the reactants, in a period of time equal to or less than the "cream time". Tubes 100 which straddle bolster assembly 14 are spaced to define a compartment adjacent bolster assembly 14, which receive insulating material of a different density than the remainder of the container 11.

Referring to FIGS. 8 and 9, tubes 100 divide each end of container 11 into an end or head compartment 102, a bolster compartment 104 which is adjacent the bolster assembly 14, and a plurality of main body compartments 106. Since container 11 is constructed of an inner and outer shell both of which are formed of relatively thin plates, the insulating material 25 contained therebetween must contribute to the structural stability of container 11. To this end it has been necessary to increase the density of the insulating material 25 at various high stress areas so as to attain the desired structural stability.

Tubes 100 are inflated by charging them with a quantity of foaming reactants so as to inflate the tubes 100 and thereby result in the definition of compartments 102, 104, and 106. The foaming reactants are supplied to tubes 100 and compartments 102, 104, and 106 through apertures 110 in outer shell 30 which are closed off by plates 112 after the completion of the foaming operation. The liquid foaming reactants are added to the compartments 102, 104, and 106 in a quantity to substantially fill these volumes and thereby complete the foaming operation of insulated container 11.

For the aforedescribed reasons the compartments 102, 104 and 106 and the tubes 100 which define these compartments are filled with different liquid foaming reactants so as to provide additional strength at various high stress areas. The preferred embodiment of the present invention calls for filling the end compartments 102 with an insulating foam having a density of 5.3 lbs./cu.ft. and filling the main body compartments 106 with an insulating foam having a density of 4.4 lbs./cu.ft.. The bags 100 which define compartment 104, and compartment 104 itself are filled in two stages. The bottom halves, which are adjacent bolster assemblies 14, are filled with a foam having a density of 16 lbs./cu.ft. and then the upper halves are filled with a foam having a density of 4.4 lbs./cu.ft., as best seen in FIG. 9.

The foamed cellular plastic material is preferably a reaction product of organic polyisocyanate and a polyester or polyether. One example of such reactants is methy glucoside polyether resin and polyisocyanate. It should be understood, however, that numerous other reactants might be used to obtain similar products.

A test car was constructed in accordance with the present invention and tested in accordance with AAR specifications. Static loads of 846,000 pounds were applied to the rear draft lugs of the test car with eccentric of ± one-half inch to the center line of the draft and held in place for several minutes without damage to the car, with the inner container removed . This test car without the inner container and with the hand brake

set, was filled full of water so that its gross weight was 197,300 pounds and struck by a second car having a gross weight of 260,000 pounds at speeds up to 14.8 mph, which resulted in a coupler force of 1,560,000 pounds, without damage to the car. This test car, without the inner container, was filled with water and hydraulic jacks were placed under the coupler shank, 9 ½ inches outboard of the striker face. A force of 51,000 pounds was exerted by the jacks on the coupler shank in an upward direction and held for a minimum of 60 seconds, without damage to the car. After these initial tests, a head on the test car was removed, the inner container inserted, the outer head replaced, the foam operations performed, and the dynamic tests repeated.

In view of the foregoing, it is apparent that there has been provided a railroad tank car that is of improved construction and arrangement.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications that fall within the true spirit and scope of the invention.

What is claimed is:

1. In a railroad tank car for use in transporting a commodity at other than ambient temperature, having an elongated tank designed for support near its ends over conventional wheel trucks; the combination comprising:

a. an inner commodity confining shell;
b. an outer shell surrounding said inner shell;
c. insulating material located between said inner and outer shells; and
d. center sill means for supporting said inner and outer shells above said wheel trucks;
e. said center sill means including a pair of Z-sections secured together at their top flanges to form a channel shaped member having a substantially horizontal top surface, a pair of substantially vertical leg portions depending from the longitudinal edges of said top surface, and a pair of substantially horizontal bottom flanges extending outward respectively from the lower edges of said leg portions;
f. said center sill means being received within a removed bottom section of said outer shell; such that the longitudinal edges of said outer shell, formed by the removal of said bottom section, are secured to said leg portions of said center sill means immediately below said top surface.

2. The invention of claim **1** wherein said longitudinal edges of said outer shell are secured to said leg portions by fillet welds on both sides of said outer shell thickness.

3. The invention of claim **1** wherein a longitudinally extending reinforcement plate is secured to said top surface substantially equadistant from said longitudinal edges of said top surface.

4. The invention of claim **3** wherein said reinforcement plate being slightly bent to clear a weld securing together the top flanges of said Z-sections.

5. The invention of claim **1** wherein a pair of longitudinally extending reinforcement plates are secured repsectively to the undersurfaces of said bottom flanges of said center sill means.

6. The invention of claim **5** wherein a plurality of spaced apart battens extend between said reinforcement plates.

7. The invention of claim **1** wherein said outer shell is formed of metallic plates having a thickness in the range of three-sixteenths inch to five-sixteenths inch.

8. The invention of claim **1** wherein said insulating material is formed of a foaming plastic material.

9. The invention of claim **8** wherein the annular area located between said inner and outer shells is encircled in spaced relationship with a plurality of inflatable bag means so as to compartmentalize said annular area.

10. The invention of claim **9** wherein at least a portion of the compartments located adjacent the bolster assembly being filled with higher density foaming material than the other compartments.

11. The invention of claim **10** wherein the foaming material in the main body compartments having a density of approximately 4 lbs./cu.ft., the foaming material in the end compartments having a density of approximately 5 lbs./cu.ft., and the foaming material in at least the bottom portion of said compartments adjacent the bolster assembly having a density of approximately 16 lbs./cu.ft..

12. In a railroad tank car having an elongated tank shell, for confining a commodity, supported near its ends over conventional wheel trucks; the combination including:

a. a removed longitudinally extending section formed in a bottom portion of said tank shell;
b. center sill means for supporting said tank shell above said wheel trucks;
c. said center sill means including a pair of Z-sections secured together at their top flanges to form a channel shaped member having a substantially horizontal top surface, a pair of substantially vertical leg portions depending from the longitudinal edges of said top surface and a pair of substantially horizontal bottom flanges extending outward respectively from the lower edges of said leg portions;
d. said center sill means being received within said removed bottom section of said tank shell; and
e. bolster assembly means for supporting the weight of the tank from the wheel trucks;
f. said bolster assembly means including an arcuate saddle means which is inset and overlaps a removed portion of the lower sides of said tank shell.

13. The invention of claim **12** wherein the longitudinal edges of said shell, formed by the removal of said bottom section, are secured to said leg portions of said center sill means immediately below said top surface by fillet welds on both sides of said tank shell thickness.

14. The invention of claim **12** wherein:

a. the longitudinal edges of said shell, formed by the removal of said bottom section, are secured to a portion of said leg portions of said center sill means below said top surface of said center sill means; and
b. said saddle means is secured to said leg portions of said center sill immediately above said longitudinal edges of said shell so as to eliminate a discontinuous bolster top chord loading path.

15. In a railroad tank car for use in transporting a commodity at other than ambient temperature, having an elongated tank designed for support near its ends over conventional wheel trucks; the combination comprising:

a. an inner commodity confining shell;
b. an outer shell surrounding said inner shell;
c. insulating material located between said inner and outer shells; and

d. bolster assembly means for supporting the weight of the tank from the wheel trucks;

e. said bolster assembly means including an arcuate saddle means which is inset and overlaps said outer shell adjacent a removed portion of the lower sides of said outer shell.

16. The invention of claim **15** wherein the outer periphery of said saddle means is welded to the inner surface of said outer shell and the edges of said outer shell formed by said removed portion are welded to the bottom surface of said saddle means.

17. The invention of claim **15** wherein longitudinally extending center sill means is received within a removed bottom section of said outer shell.

18. The invention of claim **7** wherein the longitudinal edges of said outer shell, formed by the removal of said bottom section, are secured to a substantially vertical portion of said center sill means spaced below the top surface thereof and said saddle means is secured to said vertical portion of said center sill means immediately above said longitudinal edges of said outer shell so as to eliminate a discontinuous bolster top chord loading path.

19. The invention of claim **18** wherein said outer shell is formed of metallic plates having a thickness in the range of 3/16 inch to 5/16 inch.

20. In a thin skin insulated railroad tank car for handling and transporting materials under other than ambient temperature conditions and wherein the tank car includes an elongated and enclosed commodity confining inner tank shell, an outer tank shell formed of metallic plates in the range of three-sixteenths inch to five-sixteenths inch thickness which forms an enclosure for and effects the confinement of insulating material that substantially entirely surrounds and supports said inner tank shell, and center sill means and bolster assembly means for supporting said inner and outer shells above a pair of wheel trucks; an improved structure wherein:

a. said center sill means includes a pair of Z-sections secured together at their top flanges to form a channel shaped member having a substantially horizontal top surface, a pair of substantially vertical leg portions depending from the longitudinal edges of said top surface, and a pair of substantially horizontal bottom flanges extending outward respectively from the lower edges of said side surfaces;

b. said center sill means being received within a removed bottom section of said outer shell; and

c. the longitudinal edges of said outer shell, formed by the removal of said bottom section, are secured to said leg portions of said center sill means spaced a short distance below said top surface.

21. The invention of claim **20** wherein:

a. said bolster assembly means includes an arcuate saddle means which is inset and overlaps a removed portion of the lower sides of said outer shell; and

b. the outer periphery of said saddle means is secured to the inner surface of said outer shell and the edges of said outer shell formed by said removed portion are secured to the bottom surface of said saddle means.

22. The invention of claim **21** wherein said saddle means is secured to said leg portions of said center sill means immediately above said longitudinal edges of said outer shell so as to eliminate a discontinuous bolster top chord loading path.

23. In a thin skin insulated railroad tank car for handling and transporting material under other than ambient temperature conditions and wherein the tank car includes an elongated and enclosed commodity confining inner tank shell, an outer tank shell formed of metallic plates in the range of three-sixteenths inch to five-sixteenths inch thickness which forms an enclosure for and effects the confinement of insulating material that substantially entirely surrounds and supports said inner tank shell, and center sill means and bolster assembly means for supporting said inner and outer shells above a pair of wheel trucks; an improved structure wherein:

a. the annular area located between said inner and outer shells is encircled in spaced relationship with a plurality of inflatable bag means so as to compartmentalize said annular area; and

b. at least the bottom portion of the compartments located adjacent said bolster assemblies being filled with a higher density insulating material than the other compartments.

24. The invention of claim **23** wherein said insulating material is formed of a foaming plastic material.

25. The invention of claim **24** wherein the foaming material in the main body compartments having a density of approximately 4 lbs./cu.ft., the foaming material in the end compartments having a density of approximately 5 lbs./cu.ft., and the foaming material in at least the bottom portion of said compartments adjacent said bolster assemblies having a density of approximately 16 lbs./cu.ft.

* * * * *

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,766,862 Dated October 23, 1973

Inventor(s) James C. Heap, Fred Brown, and Donald C. Graves

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In column 2, lines 25 and 26, the word "railraod" should be --railroad--.

In column 7, lines 63 and 64, the word "repsectively" should be --respectively--.

In column 9, line 15, "claim 7" should be --claim 17--.

Signed and sealed this 23rd day of April 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents