Nov. 23, 1926.

1,608,224

M. MAURAN

MULTIUNIT TANK CAR

Filed June 24, 1924

3 Sheets-Sheet 1

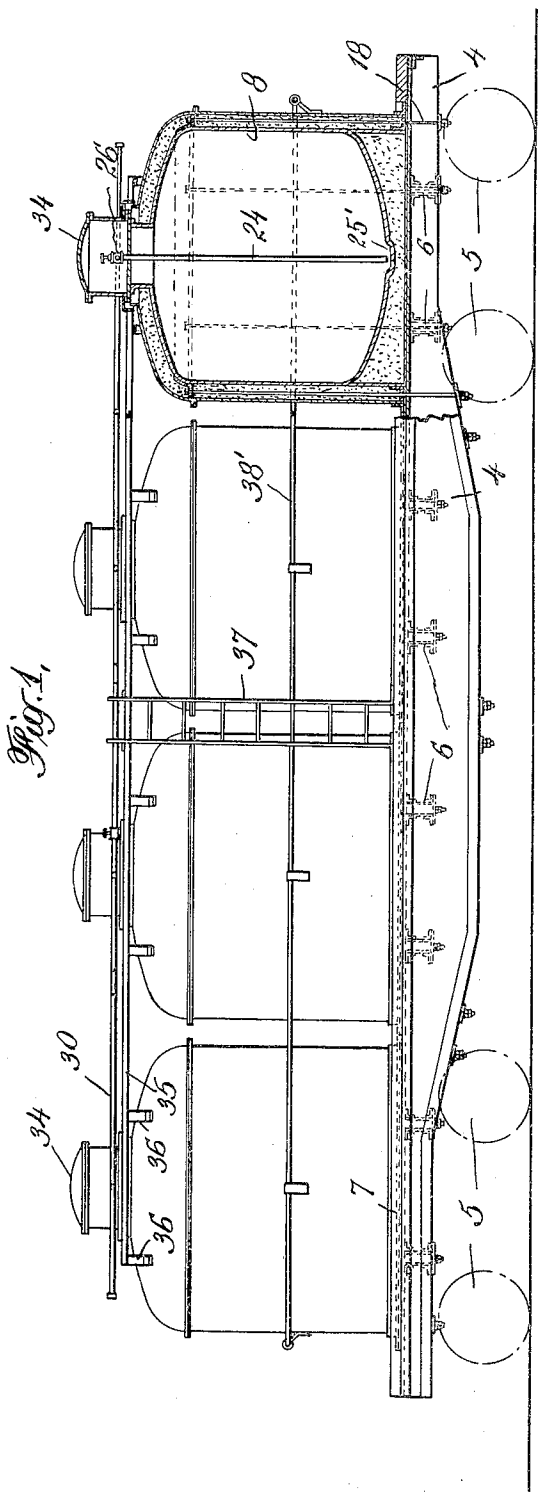


Fig. 1.

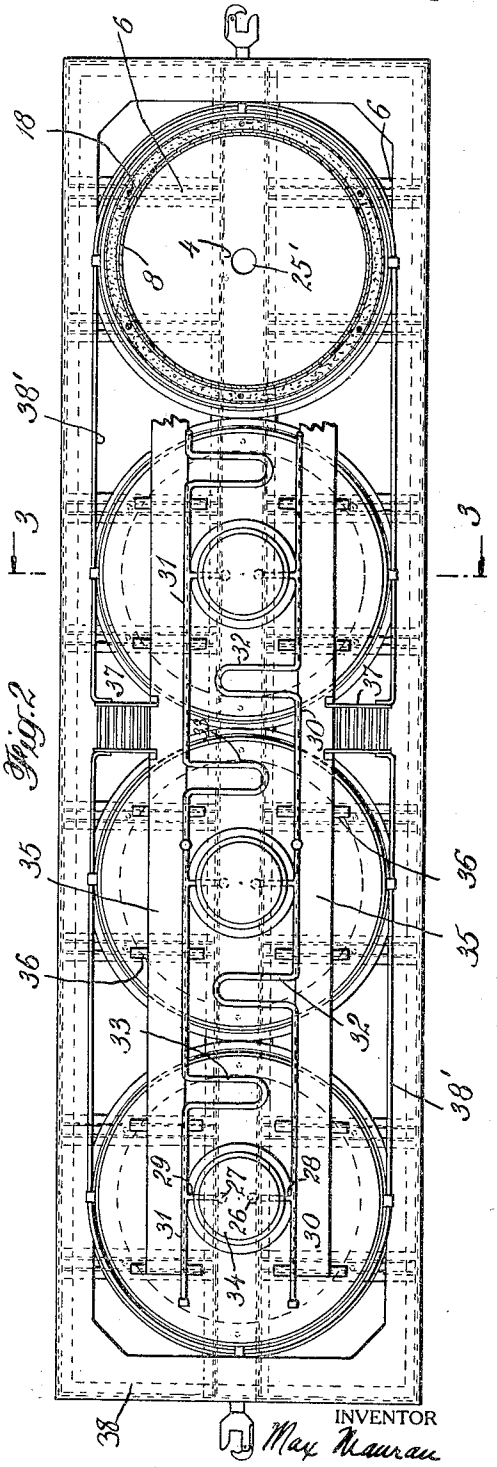


Fig. 2.

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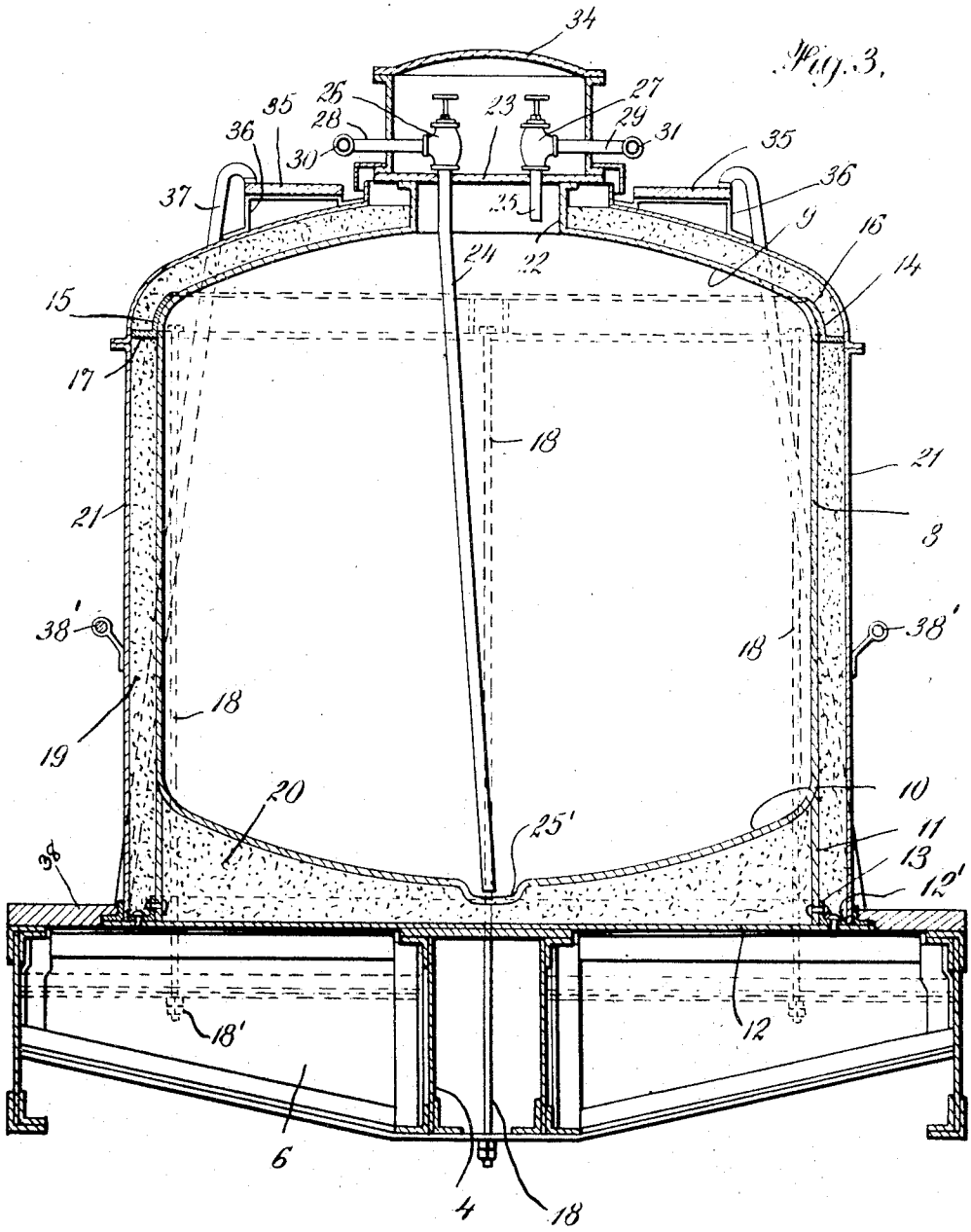
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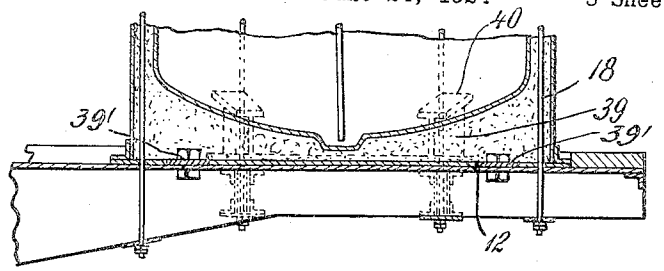


Fig. 4,

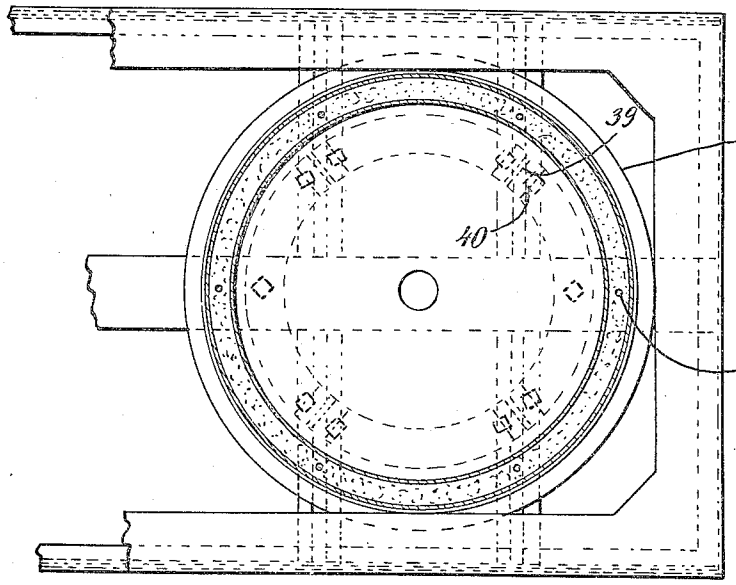


Fig. 5

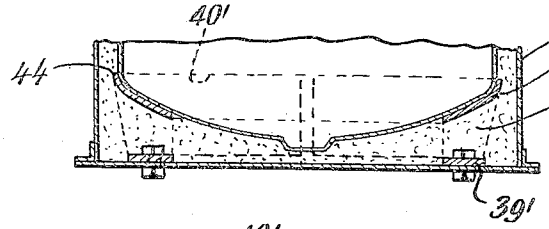


Fig. 6,

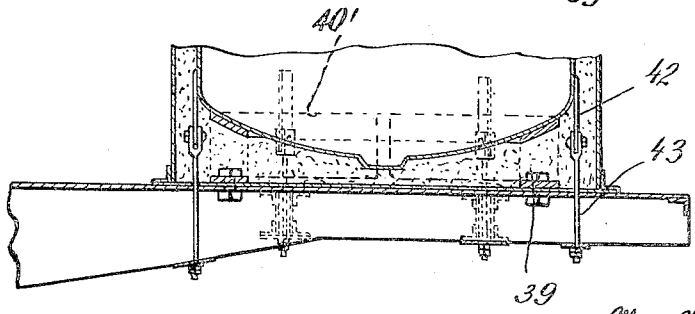


Fig. 7.

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Patented Nov. 23, 1926. 1,608,224

UNITED STATES PATENT OFFICE.

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MULTIUNIT TANK CAR.

Application filed June 24, 1924. Serial No. 722,041.

This invention relates to improvements in multiple unit tank cars for the transportation of liquefied gases.

In the transportation of liquefied gases such as liquefied chlorine, liquefied sulphur dioxide, etc., it has been necessary heretofore to ship the liquefied gases in relatively small containers, of one ton capacity or less, especially designed and constructed for withstanding the high pressures of the liquefied gases contained therein. The shipment of the liquefied gases in this way involves an excessive cost for the containers and for freight charges in their transportation since the containers must be returned empty. The amount of the liquefied gases which can be transported in such a container, moreover, is limited, for only about fifteen one-ton containers can be directly secured on a car of usual size, so that the load is only fifteen tons of liquefied gas, or one-half the normal load of a tank car.

Tank cars which have a single large tank are unsatisfactory for transporting liquefied gases. It is difficult to prevent injury or weakening of the tanks, especially by corrosion when corrosive gases are transported and where it is necessary to insulate the tanks to prevent them from overheating during transportation. Also the transportation of such gases in a car having a single tank presents a potential risk of a major order in case of accident to the car.

Since tank cars employed for the purpose of transporting liquefied gases are ordinarily so constructed as to be adapted simply for this one purpose, it is desirable that the car be used to its utmost capacity since the tanks must be returned empty and consequently one stage of the journey is unprofitable.

The present invention, therefore, is directed to the provision of a multi-tank car which permits the transportation of liquefied gases in large containers, these containers being of such a size as to make possible the transportation of greater quantities of the liquefied material than has been heretofore possible. Also the car constructed according to the present invention permits of the shipment of the material with equal safety although the tanks are of greater size than heretofore used, and this car affords numerous further advantages by reason of the facility with which the material may be withdrawn from the tanks either in the liquid or gaseous form.

The car of the present invention involves the use of a relatively small number of tanks, each of which contains a considerable quantity of the liquefied gases. These tanks are constructed so as to withstand safely the pressures involved and are firmly and securely mounted on the car so as to form a substantially integral part thereof, being capable, however, of removal therefrom should occasion arise.

In transporting such materials confined under heavy pressure in tanks, especially when the liquid is of a highly noxious and destructive character, it is important not only to insure that the tanks are held securely in place but they should be so designed as to prevent the end thrust or water hammer effect which is of great importance and may result in damage in the case of a long car, by reason of the tendency of the liquid to pile up at one end or the other whenever the motion of the car is suddenly started or stopped. The multi-tank car of the present invention is constructed to minimize this effect and to prevent injury to the tanks while the car is in transit, due to strains to which the mooring of the tanks is subjected.

According to the present invention the car structure is especially strengthened at those points where the greatest strains are placed and the tanks are designed so that a quantity of the gases having a weight at least equal to the minimum car load tonnage may be transported. By this construction, therefore, the capacity of the car is utilized to the best advantage and it follows that the transporting of the gases is much less expensive than was previously the case since the car is fully loaded in one stage of the journey. Furthermore, the individual tanks are so designed that their contents may be removed either in the gaseous or liquid form and the connections are such that the several tanks may be emptied simultaneously, or else the contents may be withdrawn from one tank at a time. Various other advantages incidental to the construction now to be described will be apparent from the following more detailed construction.

In that construction of the car which is now considered preferable the car frame, which is of a length sufficient to support

four tanks, each large enough to hold seven and one-half tons of liquid chlorine, is provided with a central box girder which runs lengthwise. The tanks, which are substantially cylindrical with rounded ends, are mounted vertically on the car over cross beams which extend from either side of the box girder. Each tank rests over a pair of cross beams which extend from one edge of the car to the other, and the bottom of the tank is supported above the floor level of the car at some distance so that insulating material may be placed between the bottom of the tank and the floor of the car.

With this arrangement the total weight of liquefied gases which may be transported in these tanks is much greater than can be carried by using small containers supported on the car. The large tanks are individually mounted in place, and are so designed that they may be easily kept clean, which is a matter of considerable importance when liquid of a corrosive nature is being shipped. Furthermore, the tanks are so supported that the strains to which the car is subjected are not transmitted to the tank itself and thus pitching and rolling of the car are not likely to cause injury to the tanks which would permit the contents to escape. The securing devices employed are wholly exterior to the tank, and there are no rods, rivets, or other devices passing through the tank shell. Also, the tanks may be thoroughly insulated so as to conform to Government requirements, and thus if the car is subjected to the heat of a fire, for example, there will be a considerable time factor involved before the temperature of the contents of the tank rises to a point which will create a dangerous pressure, due to expansion of the contents.

While the tanks are designed primarily for the shipment of gases, such as liquefied chlorine, which is transported at a pressure from 75 to 100 pounds per square inch, they may also be used for other liquefied gases, such as liquid sulphur dioxide. Also, these tanks are advantageously employed in the transportation of gasoline and particularly of casing head gas which contains large quantities of light and readily volatile constituents and which is maintained under a substantial pressure during transportation. By the arrangement of the tanks as will presently be described, the contents may be withdrawn either in liquid or gaseous form, and consequently the car is delayed only a short time for loading or unloading.

The accompanying drawings illustrate that construction of the multi-tank car of the present invention which is now considered preferable, and in these drawings,

Fig. 1 represents a side elevation of the car with one tank shown in section,

Fig. 2 is a top plan view of the car shown in Fig. 1, also showing one tank in section,

Fig. 3 is a transverse vertical cross-section through one of the tanks on the line 3—3 of Fig. 2,

Fig. 4 is a partial vertical section through one of the tanks showing a different type of tank mounting,

Fig. 5 is a horizontal section of one of the tanks, showing the type of mounting employed in Fig. 4,

Fig. 6 is a partial vertical section of a tank, showing a different type of mounting, and

Fig. 7 is another partial sectional view of a tank, showing a different type of anchoring means.

In these drawings, the car is shown as having a central box girder 4 extending throughout the length of the car and built up of plates and angle members in any suitable or convenient manner. This box girder is of greater depth in the middle than at the ends where it rests on trucks, not illustrated but the position of which is shown by the diagrammatic representation of the wheels 5. The car here illustrated is designed to carry four vertical tanks placed side by side in the direction of its length, and to support these tanks there is a plurality of cross beams 6. Each beam is made up of two parts secured to either face of the box girder, and extending at right angles to the latter. In order to distribute the weight of the tanks evenly there is a pair of cross beams under each tank and these beams are arranged so that they will be symmetrically placed with respect to the axis of the tank.

Each tank, which is of substantially cylindrical form having rounded ends, consists of a cylindrical side wall 8, having a rounded upper end 9 and a rounded lower end 10. This tank may be made in any suitable or convenient manner, preferably by welding so that it may be considered to be of one continuous piece of metal. In the tank mounting illustrated in Figs. 1 and 3, the tank is carried on a supporting ring 11, which is a cylindrical piece of metal upon the upper end of which the tank rests. The cylindrical supporting ring may, if desired, consist of a continuation of the cylindrical side wall of the tank; that is, the lower head 10 of the tank may be placed a short distance within the end of this cylindrical side wall and then be welded in place to complete the tank. Thus the extension of the side wall beyond the lower head will serve as the supporting ring. This ring may be secured to the side wall of the tank by welding, if desired, and it extends beyond the end of the tank so as to form substantially a continuation of the side wall. This supporting ring 11 rests at its lower end upon a metal plate

12 which is riveted or otherwise secured to the cross beams, and a flanged ring 12′ is riveted to the plate 12 so that its upstanding flange 13 encircles the lower end of the supporting ring 11 and may be riveted or otherwise secured thereto. That portion of the ring 12′ which bears against the face of the plate 12 may also be riveted or otherwise secured in place.

The supporting ring serves to distribute the weight of the tank and to transmit the weight to the central girder and cross beams, and the tank is then held in place by means of a ring 14 having a substantially cylindrical portion 15 which lies in contact with the side wall of the tank near the place where the side and end walls merge. The ring also has an inwardly curved portion which overlies the upper end of the end wall 9 and has a lateral flange extending outwardly from the side wall at its lower end. This lateral flange has a number of bolt holes formed through it, in which are inserted stay bolts 18, here shown as six in number, equidistantly distributed around the tank, with their heads resting against the flange and their threaded ends 18′ extending through the cross beams and central girder. These stay bolts are then held in place by suitable nuts or lock nuts, and in the illustrated construction two stay bolts pass through the central girder on either side of the tank and two stay bolts pass through each cross beam. By reason of the overlying portion 16 of the ring 14 the bolts may be drawn up so as to hold the tank firmly in position, and the weight of the tank and its contents is evenly distributed by reason of the symmetrical placing of the tank with respect to the girder and beams. In the drawings the stay bolts have been illustrated as lying substantially parallel to the side wall of the tank, but if desired the bolts may be placed so as to lie at an angle to the central axis of the tank, in which case the lower ends of the bolts would pass through the beams and girder at some distance from the place where the lower edge of the tank-supporting ring rests on the plate. If desired the stay bolts may also be placed at an angle to the vertical.

Each tank is preferably insulated by means of a covering 19, made of any desired material, such as magnesia compounds, and this body of insulation extends over the upper ends of the tank and down its side, while a further quantity of the material 20 is introduced on the plate 12 so as to lie between this plate and the lower end of the tank before the latter is placed in position. A metal sheathing 21 of suitable form or construction encloses the insulation about the tank, thus serving to protect that portion of the insulation which would otherwise be exposed. At the upper end the tank has the usual man-hole 22, with its cover 23, and extending through this cover are outlet pipes 24 and 25. The outlet pipe 25 extends only a short distance into the tank, while the outlet pipe 24 passes downwardly and has its intake lying in a depression 25′ which is formed in the lower end of the tank. By the use of these outlets the contents may be withdrawn either in the gaseous or liquid form, and by making the lower end wall of the tank with this depression 25′, it is possible to discharge the contents of the tank completely, even in the event that the car is resting on a track which is somewhat inclined. The outlet pipes have valves 26 and 27 respectively, which are, in turn, connected to outlet branches 28 and 29, leading to mains 30 and 31. The latter extend throughout the series of tanks and are provided with expansion beams 32 and 33, which lie between each pair of tanks. These mains have suitable couplings so that they may be connected with pipes through which the contents from a single tank or from all the tanks simultaneously may be withdrawn when the car reaches its destination. The valves and the ordinary safety devices, which are not shown, are enclosed within a housing 34 placed on the top of each tank, and running boards 35 mounted on the upper end of the casing 21, on suitable brackets, provide a convenient access for the workman in loading and unloading operations. Also ladders 37 leading to these running boards are provided between the two middle tanks. Extending along the length of the car on the ends of the cross beams on either side, are running boards 38, these running boards, as shown in Fig. 2, extending across the end of the car. Also a hand rail 38′ is secured to either side of the tanks, so as to provide for the safety of the trainmen.

In Fig. 4 there is illustrated a different form of tank mounting, in which there are used vertical standards 39 which may be cast integrally with a base ring 39′, which is in turn secured to the cross beams and if desired to the central box girder by bolts or rivets. If desired, however, each standard may have a foot at its lower end which rests on the ring 39′ and is secured thereto by being riveted or bolted in place. A plate 12 is employed, as before, to close the space between the lower end of the tank and the level of the car floor. At the upper end each standard has an inclined plate member 40 the contour of which conforms to the surface of the lower end of the tank. The inclination of the faces of these plate causes the tank to rest upon them with a slight wedging action, so that the tank is supported in a cradle in which it is held in position by means of stay bolts 18, as before. In other respects the construction of the tank

and the mounting is similar to that illustrated in Fig. 3.

In Fig. 5 the tank is shown as supported on four such standards, each of which is placed over a part of a cross beam. Additional standards, however, may be placed on the box girder to assist in supporting the tank if required.

In Fig. 6 there is shown a somewhat similar tank mounting, but in this case the standards 39 are formed with an upper surface 40 which curves upwardly around the line of mergence of the side and end walls, this outer, upper end 44 of each of the surfaces 40 serving to resist any lateral movement of the lower end of the tank. The standards 39, as shown in this figure, as before, are either bolted or riveted to a ring 39′ which is in turn secured to the cross beams and these standards are connected at their upper ends by a ring 40′ so that the lower end of the tank is engaged by the ring throughout its circumference. If desired, the standards may be cast integrally with the rings and in either case the tank is supported on a ring which is in turn supported by a plurality of upright standards 39 placed at different points about the base ring.

In Fig. 7 there is shown another construction for the tank mounting, in which standards such as are shown in Figs. 4 and 6 may be employed. However, with this type of tank, the stay bolts are not used, but, on the contrary, the tank has welded to its side wall near the lower end, brackets or lugs 42, each of which extends down beyond the end of the tank and is secured in the forked end of an angle bolt 43 which may be secured to the central girder and cross beams in any appropriate manner. Each of the tanks shown in Figs. 4, 6 and 7, is preferably encased in a layer of insulation which is, in turn, protected by a sheathing of metal 21, as shown in Fig. 3.

It will be seen that the multi-tank car of the present invention is of simple construction, but, nevertheless, of great strength, and the tanks are held securely in position and prevented from movement which might cause injury. Also, in each case, the tank is held in place on the car in such a way that there are no rivets or bolts extending through the tank shell so that the strains to which the tank is subjected during transportation cannot result in injury which would in turn cause a leakage of the contents. The securing means in each case are wholly exterior to the tank and may easily be applied and removed in the event that it is desirable, for some reason or other to remove the tank from the car. It is to be understood, of course, that ordinarily the tanks will be kept in place and the contents introduced through the mains. The car provides for the transportation of large quantities of liquefied material and the tonnage capacity of the car is used to the best advantage since the tanks, though small in number, are sufficiently large in size so that the total weight of material transported corresponds closely to the usual carload tonnage.

When the car has reached its destination the tanks may be quickly unloaded, either singly or simultaneously, and the contents of each tank may be removed either in the gaseous or liquid form, as may be desired. Since the car permits of the transportation of so great a tonnage of material, transportation costs are considerably reduced. It will be understood that tank cars of this character, after the contents is unloaded, are returned empty to the shipping point so that at best there is a loss in transportation efficiency, but in the present instance this loss is kept to a minimum, because of the greater quantity of material which may be handled in the outward journey. Since the tanks are securely held in place by means of the supporting ring or the cradle, as the case may be, and also by the upper ring and stay bolts, the strains arising in transit are, to a large extent, rendered harmless, and even should a stay bolt break or the rivets securing the supporting ring to the car frame be sheared off, no injury would result to the tank since none of these parts passes through the tank shell. In tank cars which consist of a single large tank, the tank is ordinarily secured in place by means of rivets or bolts which pass through the shell of the tank, and injury to a single rivet is likely to result in leakage which would be dangerous, especially where highly noxious or corrosive materials are being transported, but in the present tank construction such danger is obviated. The tanks may be made of a construction sufficiently strong to contain liquefied gases under high internal pressure and even though violent agitation occurs during transit there is no likelihood of leakage losses. Should it be necessary to remove a single tank for any purpose, this can easily be done without damage to the container proper.

The present car has been shown as being built with a frame made up of a box girder and cross beams on which the tanks rest directly, but there is interposed between the bottom of each tank and the car frame a plate which assists in distributing the weight of the tank evenly and which also serves the purpose of holding in place the insulation which protects the lower end of the tank. If desired, however, it is possible to cover the entire framework of the car with a platform or floor, in which event the use of the individual plates beneath the tanks would be rendered unnecessary.

I claim:

1. In a car of the type described, the combination of a body, a plurality of upright containers mounted at different points along the body, means on the body for supporting the tanks in upright position with their lower ends above the level of the body, the said supporting means engaging each tank near the edge of the lower end of the latter to leave a space between the central part of the head and the body, and a mass of insulating material occupying this space.

2. In a car of the type described, the combination of a body, a plurality of upright containers, mountings at different points along the car body for supporting the containers with their lower ends spaced above the level of the body, the said mountings engaging the lower ends of the containers near the edge of these ends, and means for securing the upper end of each container to the body.

3. In a car of the type described, the combination of a body having cross beams arranged in pairs throughout its length, a plurality of upright containers of substantially cylindrical contour mounted on the body in spaced relation above the level of the body, each container being disposed over a pair of cross beams, and means for securing both ends of each container to the body.

4. In a car of the type described, the combination of a body comprising a longitudinal girder and cross beams arranged in pairs throughout its length, a plurality of upright containers mounted on the body, each container being disposed over a pair of cross beams, and held against lateral movement at its lower end, and means for securing the upper ends of the containers to the girder and cross beams.

5. In a car of the type described, the combination of a body, a plurality of upright containers of substantially cylindrical contour mounted on the body, supports for the individual containers distributed along the body, each support serving to hold the container with its lower end in spaced relation to the body and also to prevent lateral movement of the lower end of the container, and means secured to each container for holding the latter on its support.

6. In a car of the type described, the combination of a body, a plurality of upright containers of substantially cylindrical contour mounted on the body, each container consisting of a side wall and a pair of heads, supports for the individual containers distributed along the body, the lower head of each container resting on one of the supports in spaced relation to the body, and the latter serving to hold the container against lateral movement, and means secured to the upper end of each container and to the body for holding the container on its support.

7. In a car of the type described, the combination of a body comprising a central girder and cross beams, a plurality of upright containers mounted on the body, a cradle for each container including a standard secured to each cross beam on either side of the girder, and means for securing the upper end of each container to the body to hold the container in its cradle.

8. In a car of the type described, the combination of a body comprising a central girder and cross beams, a plurality of upright containers mounted on the body, a cradle for each container against which the lower end of the container rests, in spaced relation to the body, each cradle including pairs of standards, each cross beam having a standard secured to it at either side of the central girder, and means secured to the container and to the body for holding each container in its cradle.

9. In a car of the type described, the combination of a body, a plurality of upright containers mounted on the body, a cradle for each container secured to the body to support the container above a pair of cross beams, and a clamping ring mounted near the upper end of each container and secured to the body, this clamping ring having a portion overlying the upper end of the container.

10. In a car of the type described, the combination of a body comprising a central girder and cross beams, a plurality of upright containers mounted on the body, a cradle for each container secured to the body and supporting the container above the body, a clamping ring mounted at the upper end of each container, and stay bolts secured to the ring and to the girder and cross beams.

11. In a car of the type described, the combination of a body, a plurality of upright containers mounted on the body, each container having a domed lower end, a plurality of cradles secured to the body, one for each container, each cradle comprising a plurality of standards having inclined upper surfaces upon which the lower end of the container rests, the container being supported in spaced relation to the body, and means for securing the upper end of each container to the body.

12. In a car of the type described, the combination of a body comprising a girder and cross beams arranged in pairs throughout its length, a plurality of upright containers mounted on the body, a cradle for supporting each container above a pair of cross beams in spaced relation to the body, a clamping ring partially overlying the upper end of each container, and means for securing the ring to the cross beams over which the container is supported.

13. In a car of the type described, the combination of a body comprising a girder and

cross beams arranged in pairs throughout its length, a floor plate covering a part of each pair of cross beams, a cradle mounted on each pair of cross beams and extending above the plate, an upright container mounted on each cradle, means secured to the upper end of each container and to the body to hold the container on its cradle, and a layer of insulation substantially enclosing the container, a portion of this insulation lying between the plate and the lower end of the container.

14. In a car of the type described, the combination of a substantially cylindrical upright container, a cradle on which the lower end of the container rests, this cradle being formed to prevent lateral movement of the lower end of the container, and a clamping ring encircling the container and having a portion overlying the upper end thereof, this ring having a plurality of stay bolts for holding the container on its cradle.

15. In a car of the type described, the combination of a body, a plurality of upright containers, mountings at different points along the body for supporting the containers with their lower ends spaced above the level of the body, a layer of insulation substantially enclosing each container and its mounting, and means for holding the containers in place in their mountings.

In testimony whereof I affix my signature.

MAX MAURAN.