# United States Patent [19]

**Hurst et al.**

[11] **3,897,807**

[45] **Aug. 5, 1975**


[54] **MANIFOLED TANK CARS FOR UNIT TRAIN SERVICE**


[75] Inventors: **Doug Hurst**, Montreal W., Canada; **Erling Mowatt-Larssen**, Warren, Ohio

[73] Assignee: **General American Transportation Corporation**, Chicago, Ill.



[22] Filed: **Oct. 5, 1973**

[21] Appl. No.: **403,828**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 186,846, Oct. 6, 1971, abandoned.

[52] **U.S. Cl.** ..... **141/98**; 137/575

[51] **Int. Cl.** ..... **B67b 3/04**

[58] **Field of Search** ..... 141/35, 346, 98, 347, 231, 141/1, 232, 21, 36, 67, 100, 105, 99, 233, 236, 237, 242, 243, 244, 385–387; 285/97, 336, 367; 222/145; 213/76; 61/10; 105/358, 360; 277/34.3; 137/263, 581, 1, 575; 214/17 A



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*Primary Examiner*—Houston S. Bell, Jr.

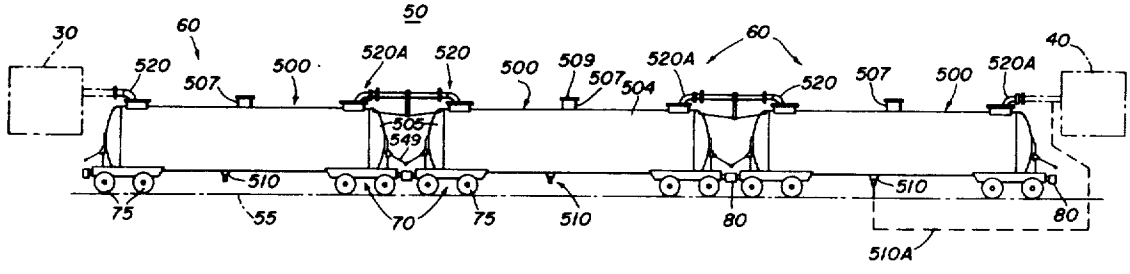
*Attorney, Agent, or Firm*—Prangley, Dithmar, Vogel, Sandler & Stotland



[57] **ABSTRACT**

A railway train includes a plurality of interconnected tank cars, each car comprising a tank provided with two lading conduits in the top thereof extending thereinto for communication with the interior thereof and each having an outer end extending above the tank and toward the adjacent end thereof, the lading conduits of adjacent cars being interconnected by flexible connecting conduits; valve assemblies may be connected in each lading conduit inside or outside the tank and are preferably all pneumatically operable from a single location, with external valves being disposed in protective housings; one lading conduit may terminate near the bottom of the tank for filling and-/or eduction unloading thereof with the other lading conduit terminating near the top of the tank for venting and filling of an adjacent tank thereof and for automatically determining the outage of the tank. Additional embodiments provide lading ports at the ends of the tank on the longitudinal axis thereof or a conduit mounted above the tank and extending the length thereof and valved to accommodate series or parallel loading of the tank cars.


**48 Claims, 26 Drawing Figures**



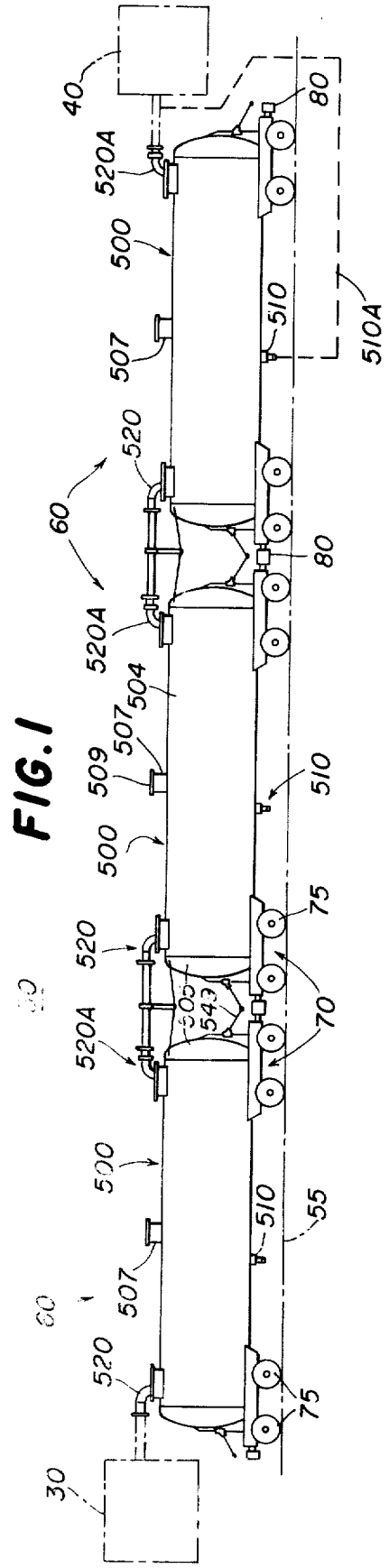



FIG. 1

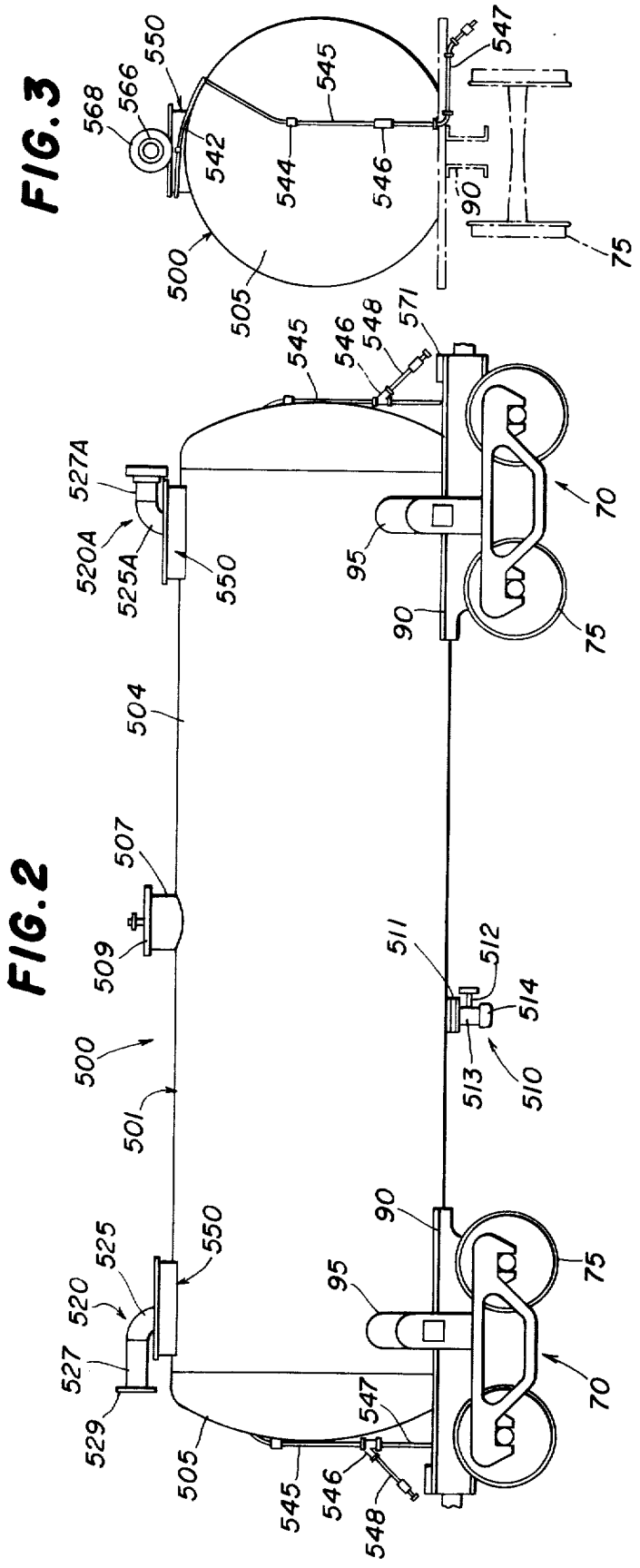



FIG. 2

FIG. 3

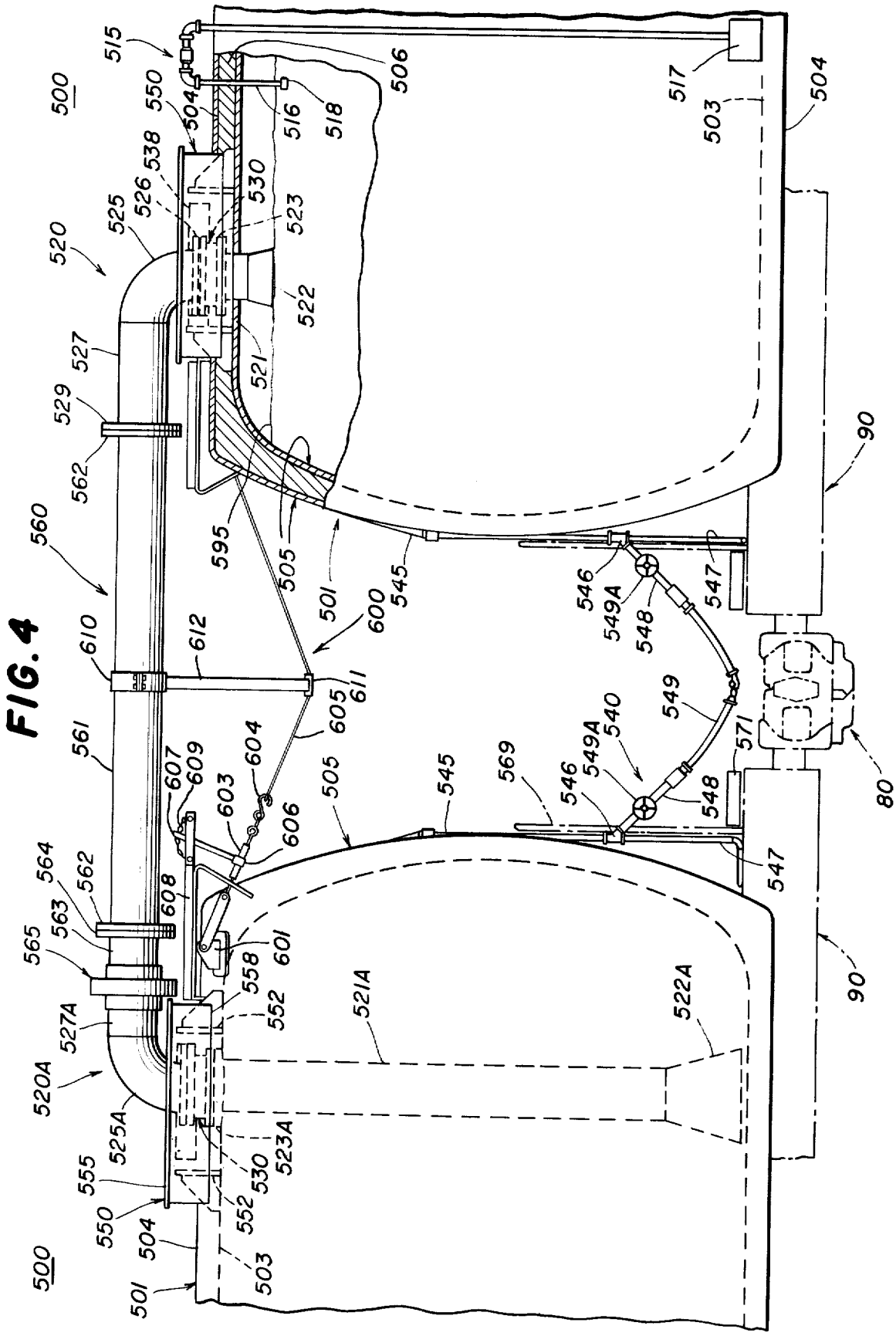

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FIG. 4

FIG. 5

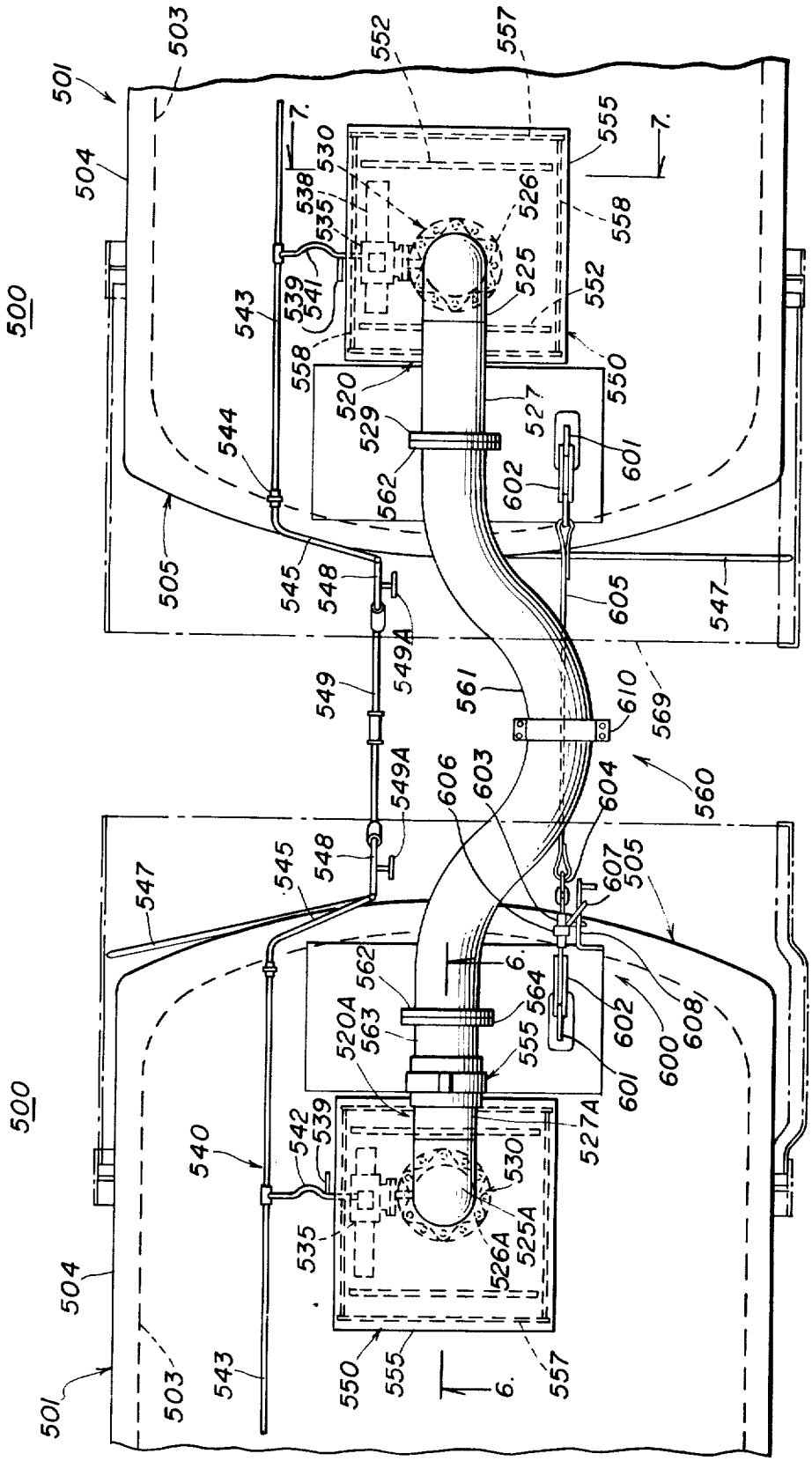

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FIG. 6

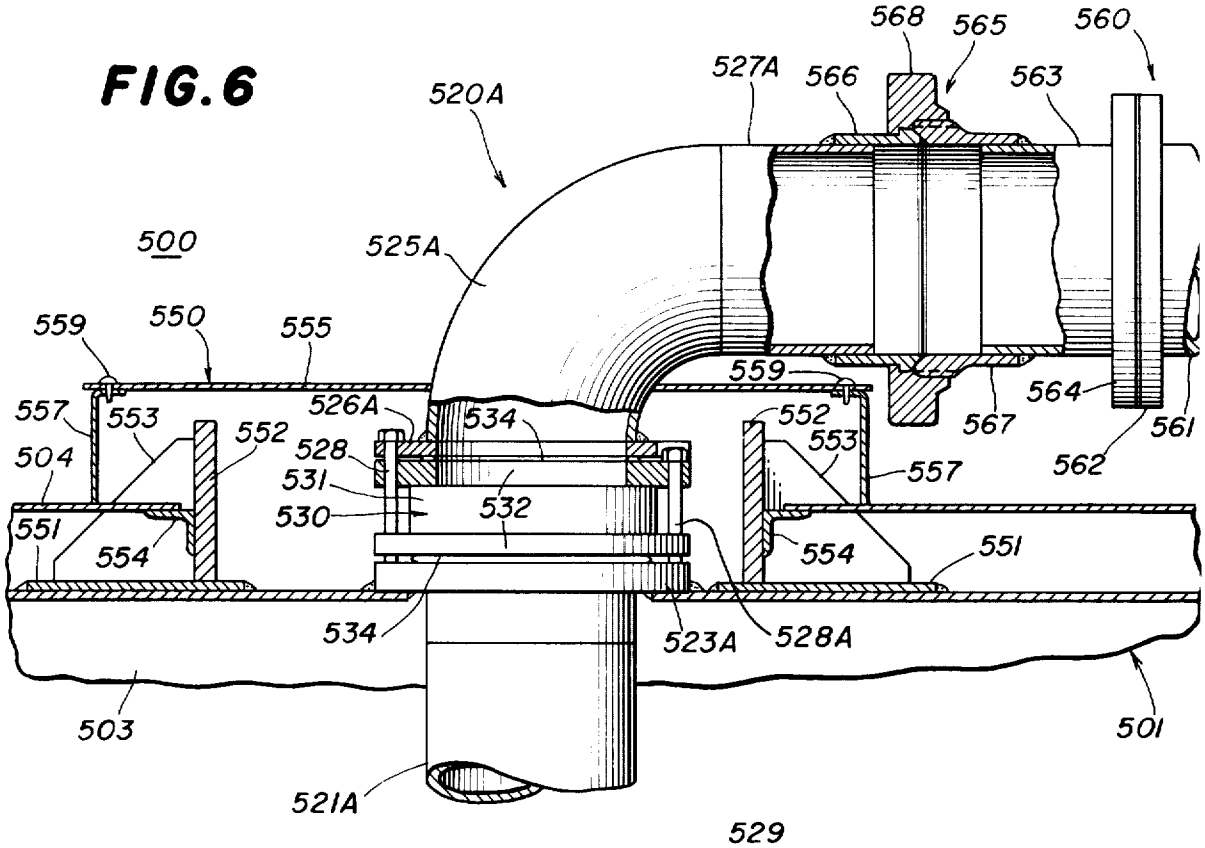

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FIG. 7

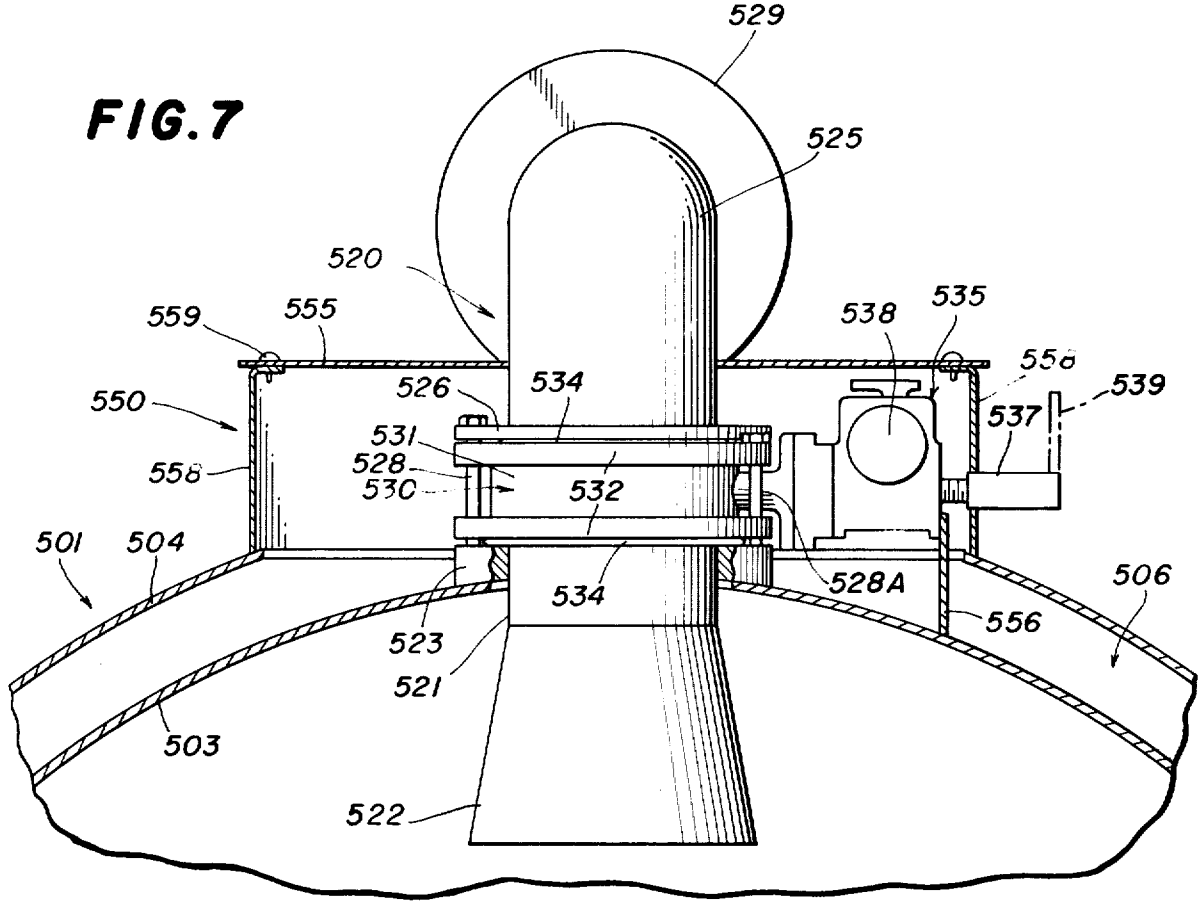

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FIG. 7A

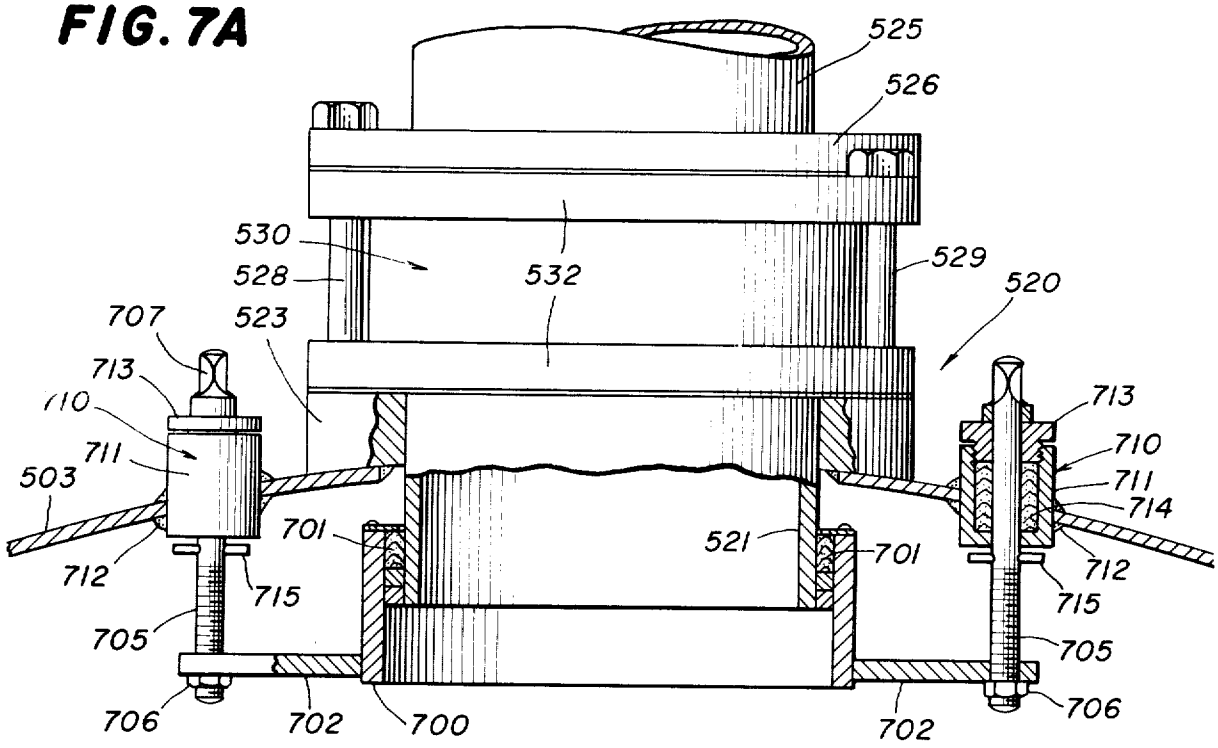

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FIG. 7B

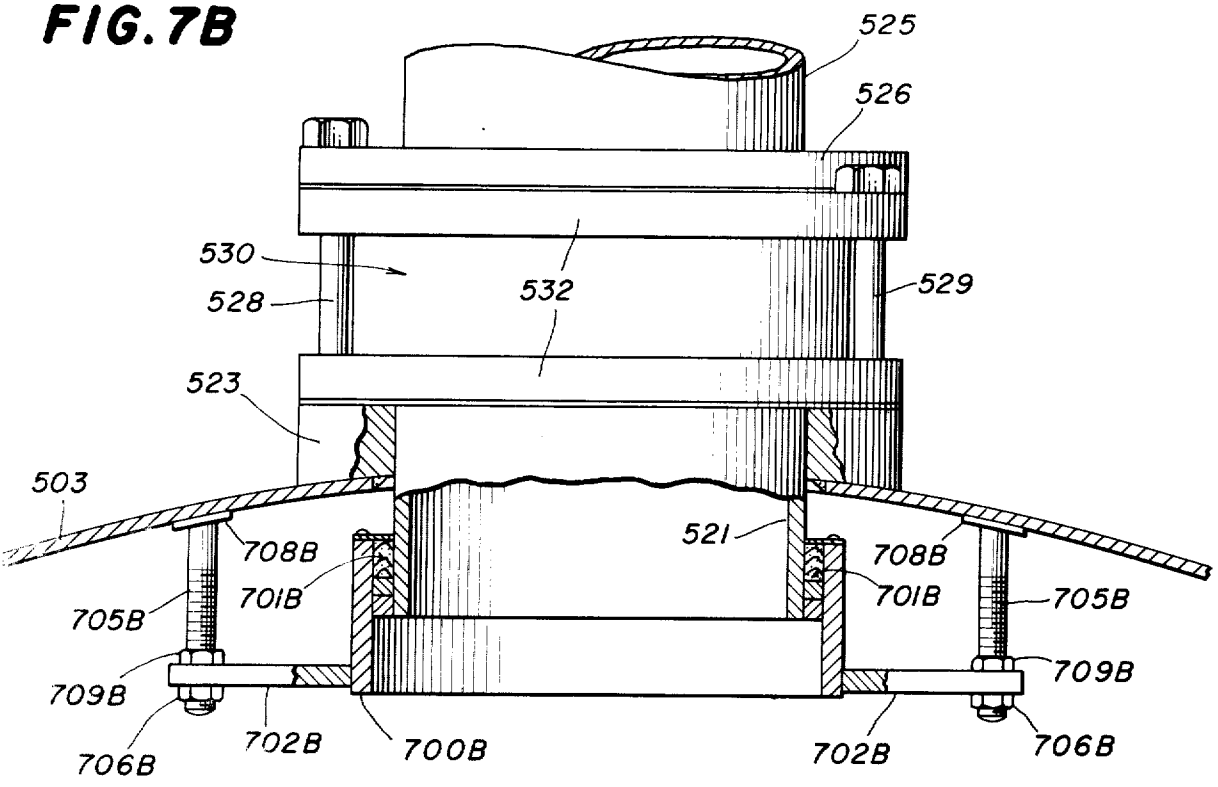

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FIG. 10

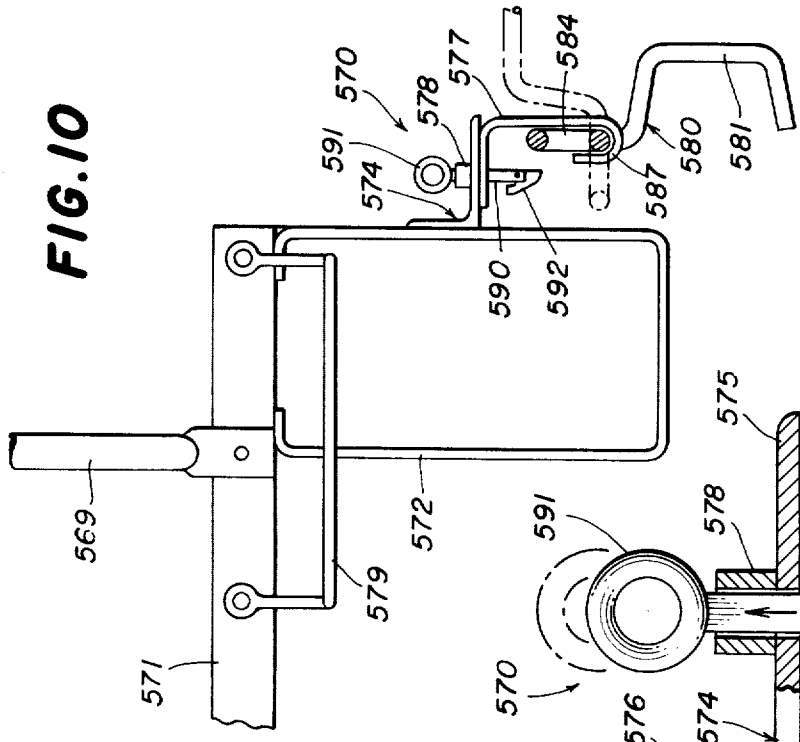



FIG. 11

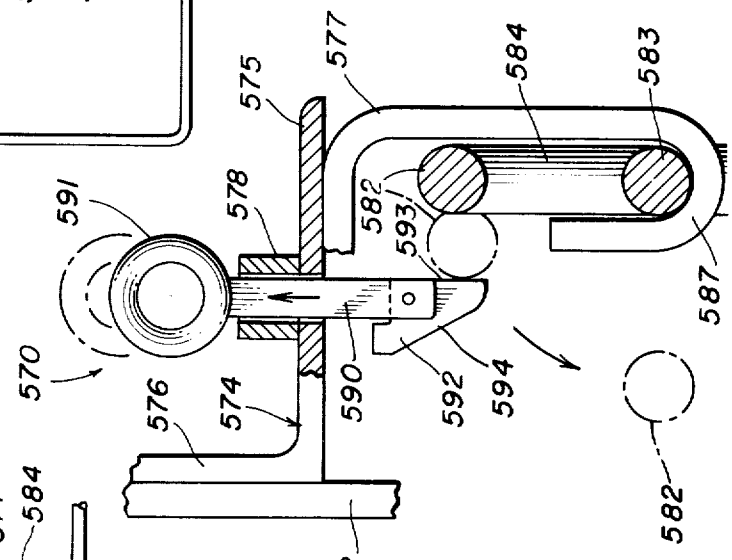



FIG. 9

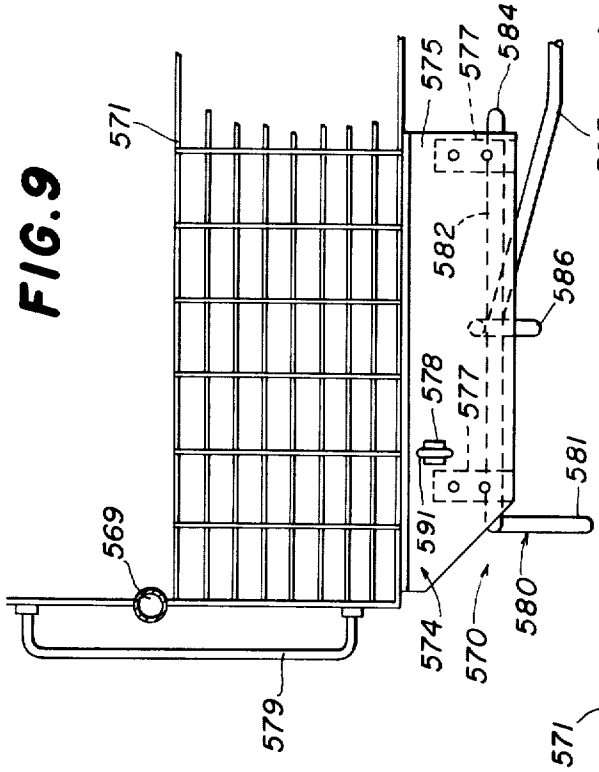



FIG. 8

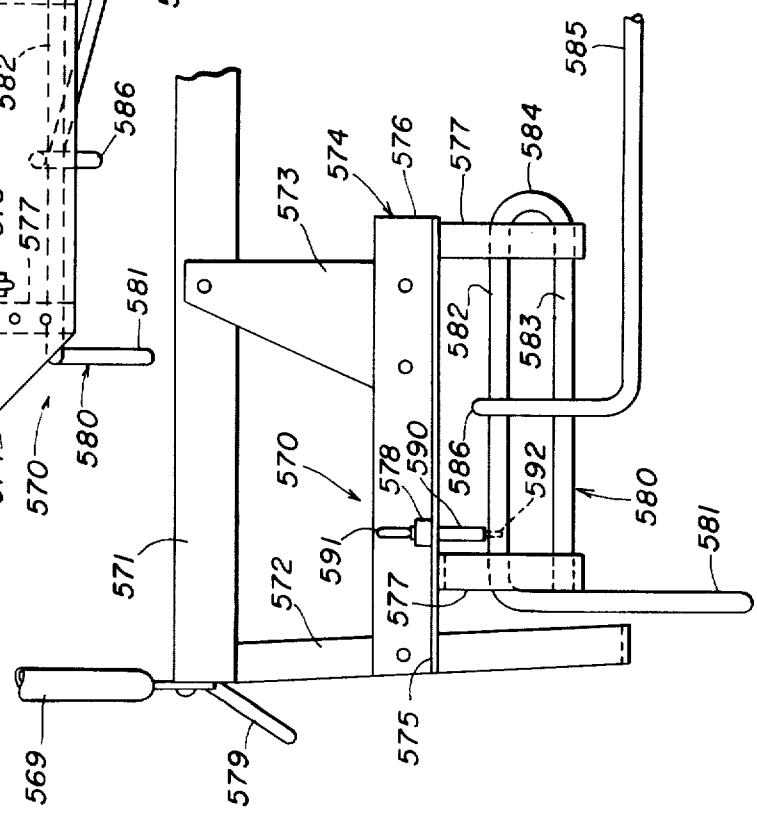


FIG. 12

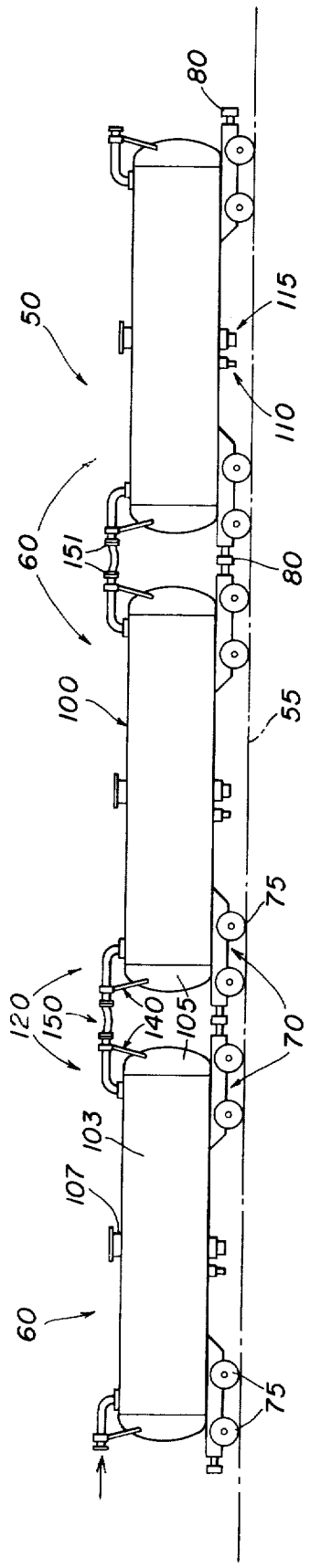



FIG. 14

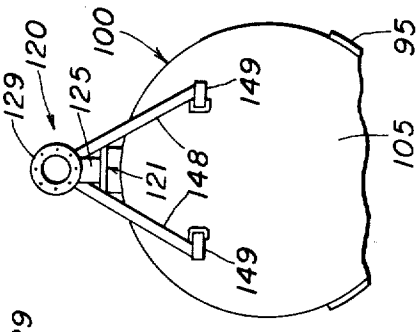



FIG. 13

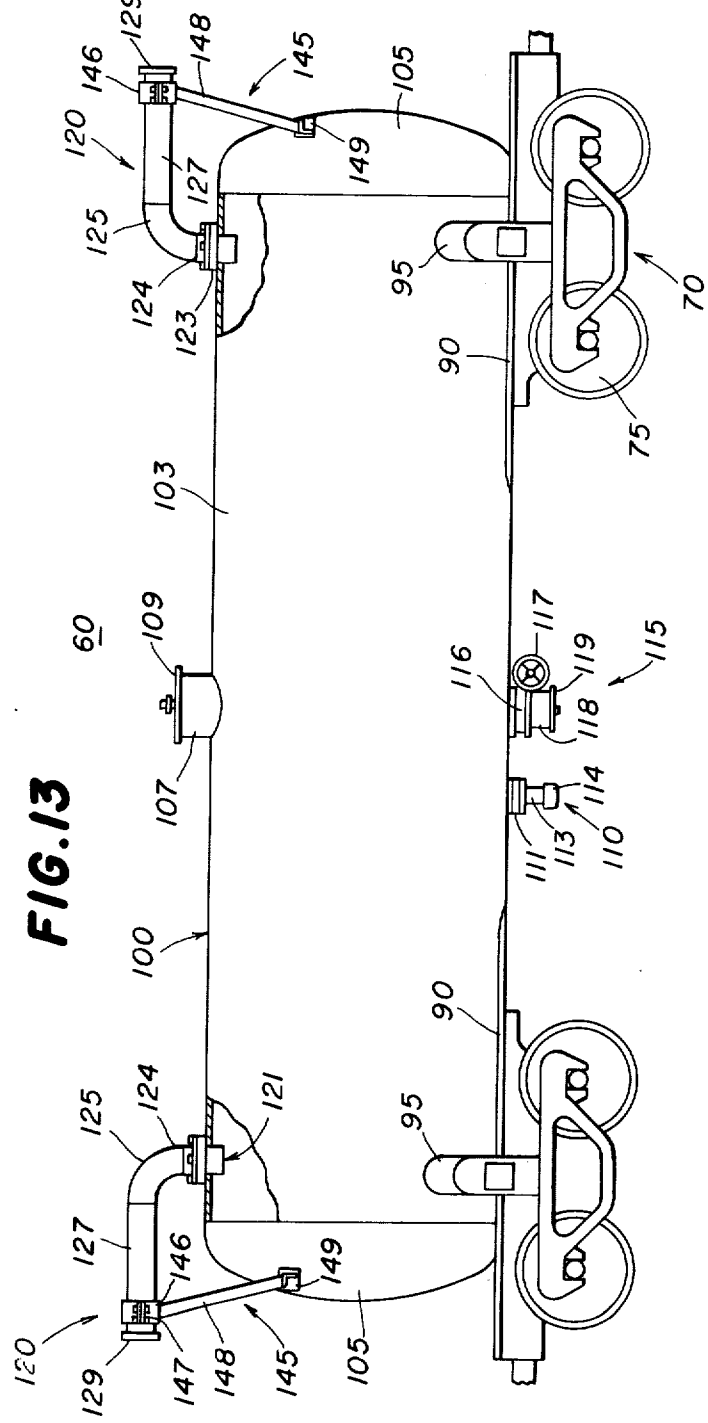


FIG. 15

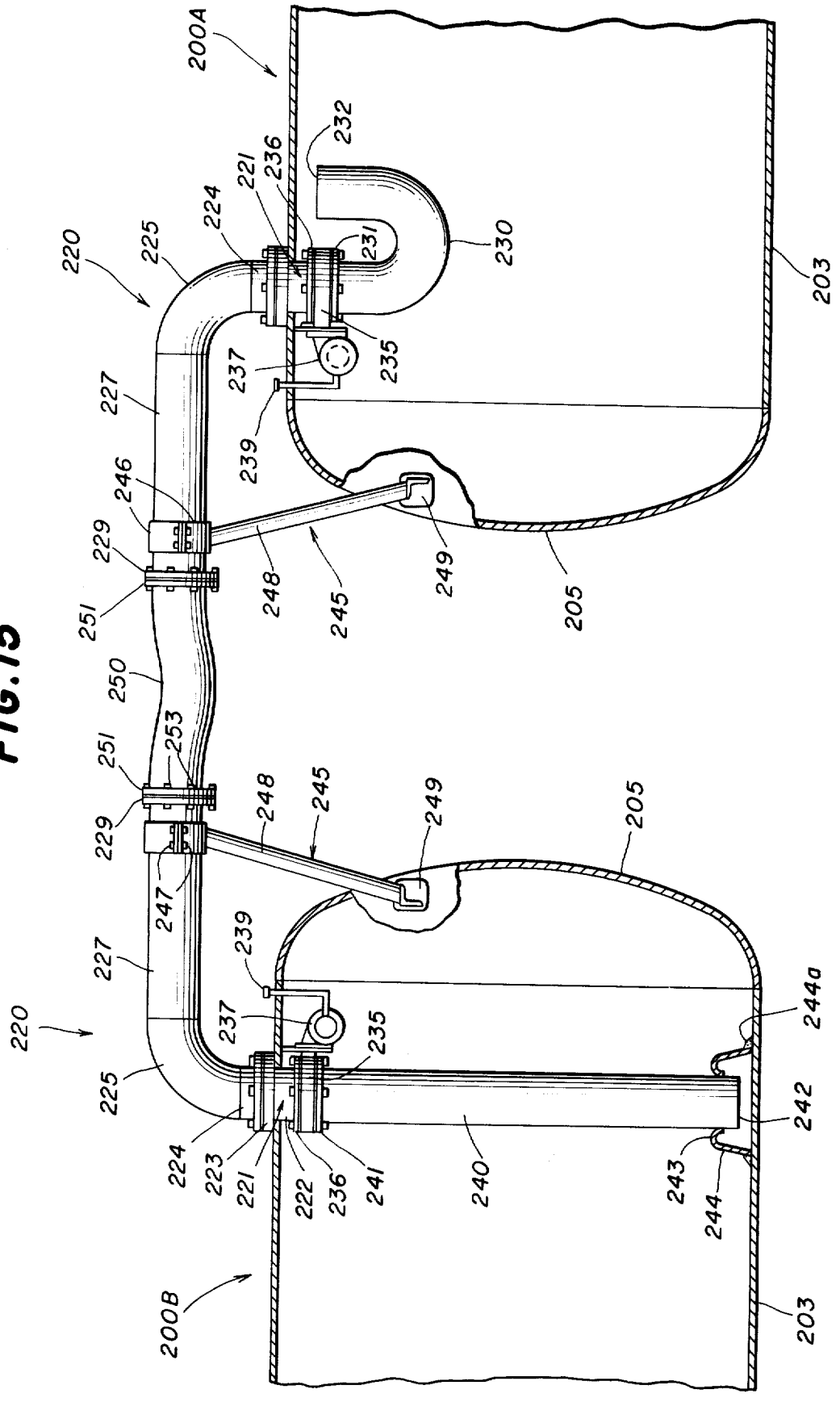

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FIG. 16

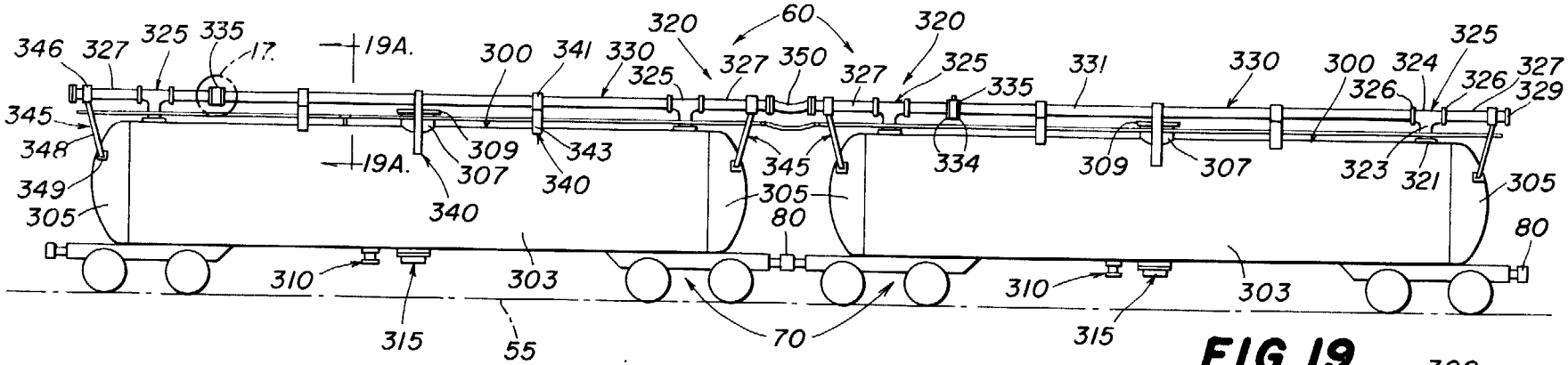



FIG. 17

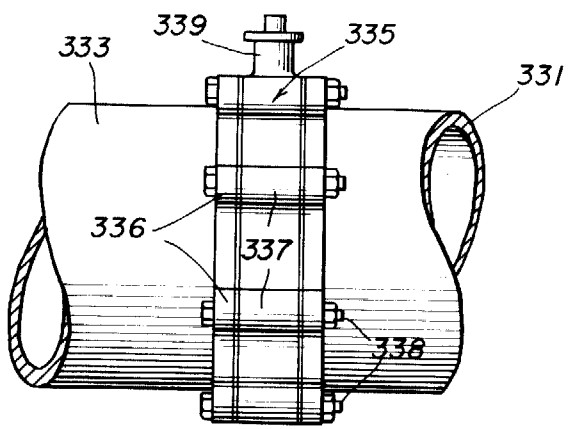



FIG. 18

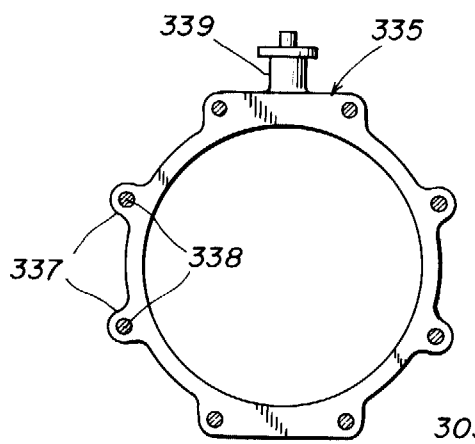



FIG. 19

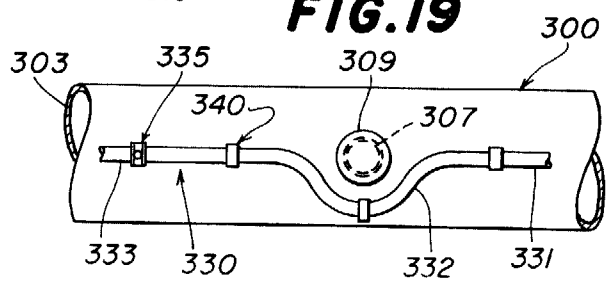
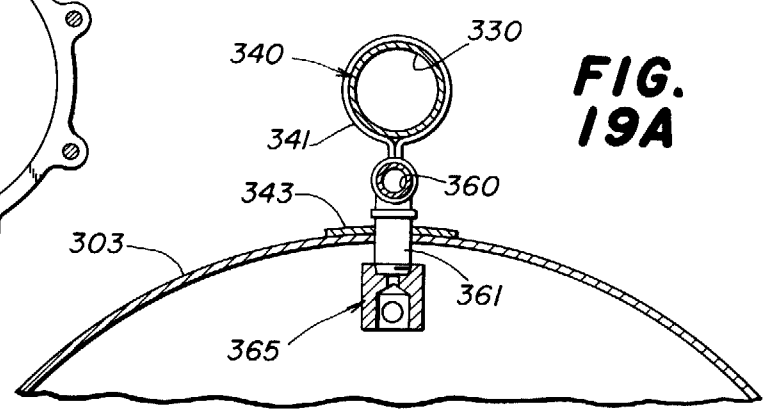



FIG. 19A



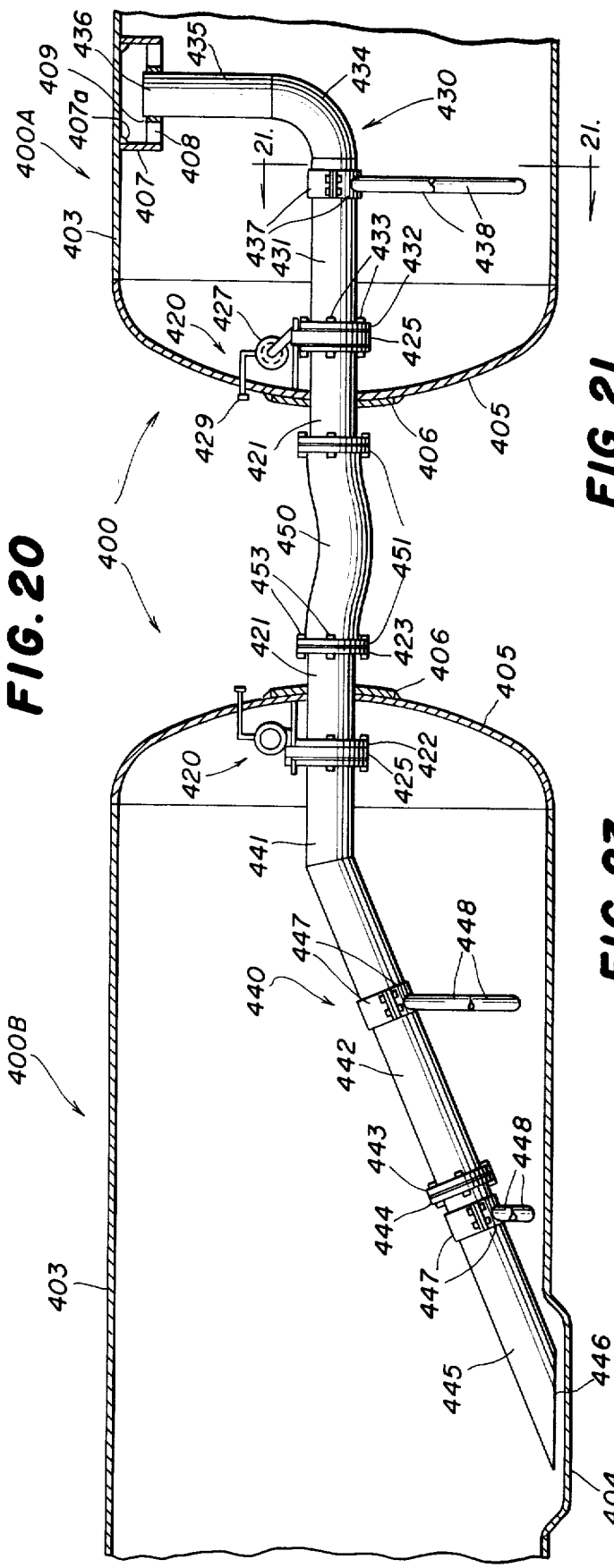



FIG. 20

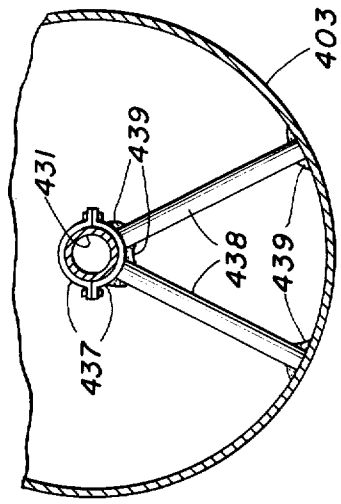



FIG. 21

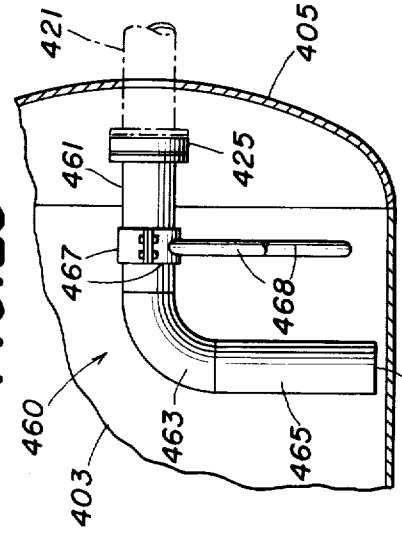



FIG. 23

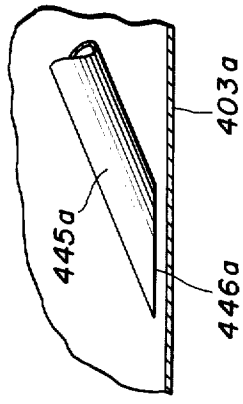



FIG. 22

# MANIFOLED TANK CARS FOR UNIT TRAIN SERVICE

## CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of our co-pending application Ser. No. 186,846, filed Oct. 6, 1971, now abandoned, and entitled MANIFOLDED TANK CARS FOR UNIT TRAIN SERVICE.

## BACKGROUND OF THE INVENTION

The present invention relates to railway tank cars and, in particular, to manifolded tank cars which may be interconnected to accommodate loading or unloading of the entire group of interconnected cars without movement thereof from a single point therealong, thereby accommodating consecutive loading, transporting and unloading of fluid ladings and facilitating the formation of unit trains.

The concept of providing fluid communication among a series of interconnected railway tank cars is disclosed in the prior art but previous systems have failed to provide an intertank connection arrangement which insured safe handling of the fluid ladings during transportation. For example, U.S. Pat. No. 1,542,116, issued to R. Welcker, discloses railway tank cars for interconnection in a manifolded arrangement to accommodate continuous emptying of the interconnected tanks from a single location, without moving or disconnecting the cars. However, Welcker's arrangement does not provide for continuous loading of the interconnected tanks from a single location, and the intertank lading connections are along the longitudinal axes of the tanks which has been found to be a disadvantageous arrangement. Furthermore, Welcker provides exposed valves for controlling the fluid lading flow, which valves must be individually manually operated.

U.S. Pat. No. 3,722,556, issued to William Jeffers et al., discloses a manifolded tank car arrangement which accommodates both loading and unloading of a string of interconnected tank cars from a single location, but Jeffers et al. provide the intertank lading connections at the bottoms of the tanks, and, in addition, they provide exposed and unprotected lading flow control valves, whereby to present a substantial safety hazard during transit of the tank car. Further, Jeffers et al. do not provide a lading conduit which during loading automatically determines the final outage of the lading in the tank, a feature which is critically necessary with certain bulk lading commodities to accommodate product expansion in transit.

## SUMMARY OF THE INVENTION

The present invention provides a railway tank car for unit train service which permits a train of such cars to be loaded or unloaded without movement thereof from a single location, and accommodates consecutive loading, transportation and unloading of liquid ladings all in safety and with improved economy of time and manpower.

It is an important object of the present invention to provide a tank car of the character described, which includes a tank having two lading conduits respectively coupled thereto adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly from adjacent to the top thereof, and conduit coupling means on each of the lading conduits for coupling at the top of the tank to an adjacent end of an



associated flexible connecting conduit to place the tank in fluid communication with the tanks of adjacent like tank cars.

In connection with the foregoing object, it is another object of this invention to provide a railway tank car of the type set forth, wherein the lading conduit serving as the output conduit during loading has the inner end thereof extending into the tank and terminating a predetermined distance below the top of the tank, thereby automatically to control the level to which the tank may be filled and thereby to determine the volume of free vapor space at the top of the tank.

It is another object of this invention to provide a railway tank car of the type set forth, wherein the inner end of the other lading conduit terminates closely adjacent to the bottom of the tank to facilitate emptying of the tank through said conduit.

Still another object of this invention is to provide a railway tank car which includes a tank having two lading conduits coupled thereto and in fluid communication therewith, two valves respectively connected in the lading conduits for controlling the flow of the liquid lading therethrough, and valve control mechanism coupled to each of the valves and actuatable from a single location automatically to operate the valves.

Yet another object of this invention is to provide a railway tank car which includes a tank having lading conduits and valves of the character described, wherein the valves are disposed externally of the tank at the top thereof, and further including guard structure mounted on the tank and cooperating therewith substantially to surround the valves for protection thereof.

It is another object of this invention to provide a railway tank car including a tank having a main lading conduit disposed thereabove and extending longitudinally thereof substantially the entire length thereof, two branch lading conduits communicating with the main conduit and being respectively coupled to the tank at the top thereof and in communication with the interior thereof, and a valve assembly connected in the main conduit intermediate the two branch conduits and having an open condition permitting passage of fluid lading through the main conduit for connecting adjacent tank cars in parallel to accommodate simultaneous loading thereof and a closed condition preventing passage of fluid lading through the main conduit and for connecting adjacent tank cars in series to accommodate serial loading thereof.

In connection with the foregoing object, it is another object of the invention to provide a railway tank car of the type set forth, wherein a vent line is disposed above the tank and extends longitudinally thereof substantially the entire length of the tank and has a connection in fluid communication with the tank, the vent line also having a check valve in the connection to the tank closing automatically when the lading in the tank reaches the proper level during loading.

It is another object of this invention to provide a railway tank car which includes wheeled chassis structure provided with chassis coupling means movable between coupling and uncoupling conditions, a coupling control member connected to the chassis coupling means and movable from a coupling to an uncoupling configuration for effecting movement of the chassis coupling means to the uncoupled condition thereof, and lock mechanism engageable with the coupling control member in the coupling configuration thereof for

preventing movement thereof to the uncoupling configuration thereof.

Still another object of this invention is to provide a railway train comprising a plurality of tank cars according to the present invention connected in tandem relationship.

A still further object of the invention is to provide a railway train of the type set forth wherein at least the end tank cars have a loading and unloading assembly at the bottom thereof for connection to a source of lading or for connection to an outlet pipe for loading and unloading the train of tank cars serially therethrough.

Still another object of the invention is to provide a railway train of the type set forth wherein at least one of the tank cars is loaded with an inert gas under high pressure, connection of the gas under high pressure to the tank cars carrying lading serving to cause the gas to push the lading from the tank cars in the train to unload the same.

Further features of the invention pertain to the particular arrangement of the parts of the railway tank cars and railway trains whereby the above-outlined and additional operating features thereof are attained.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a railway train comprising three railway tank cars constructed in accordance with and embodying the features of a first embodiment of the present invention;

FIG. **2** is an enlarged side elevational view of one of the tank cars illustrated in FIG. **1**;

FIG. **3** is an end elevational view of the tank car of FIG. **2**, as viewed from the right-hand end thereof;

FIG. **4** is a further enlarged fragmentary side elevational view in partial vertical section of the interconnected ends of two adjacent ones of the tank cars of FIG. **1**;

FIG. **5** is a fragmentary top plan view of the interconnected tank car ends illustrated in FIG. **4**;

FIG. **6** is a still further enlarged fragmentary view in vertical section taken along the lines **6—6** in FIG. **5**, and illustrating the lading eduction conduit and valve assembly of the tank car;

FIG. **7** is a still further enlarged fragmentary view in vertical section of the lading vent conduit and valve assembly of FIG. **5**, taken along the lines **7—7** in FIG. **5**;

FIGS. **7A** and **7B** are similar to FIG. **7** and show two other embodiments of a lading vent conduit useful in the present invention;

FIG. **8** is a fragmentary end elevational view of the uncoupling rod locking assembly of the present invention, showing the uncoupling rod locked in the coupling configuration thereof;

FIG. **9** is a fragmentary top plan view of the uncoupling rod locking assembly of FIG. **8**;

FIG. **10** is a side elevational view in partial section of the uncoupling rod locking assembly of FIG. **8**, as viewed from the left-hand side thereof, and with the uncoupling configuration of the uncoupling rod illustrated in broken line;

FIG. **11** is a further enlarged fragmentary side elevational view of the uncoupling rod locking assembly as illustrated in FIG. **10**, with the unlocking position of the lock member illustrated in broken line;

FIG. **12** is a side elevational view of a railway train comprising three railway tank cars constructed in accordance with and embodying the features of a second embodiment of the present invention;

FIG. **13** is an enlarged side elevational view of one of the tank cars illustrated in FIG. **12**, with portions of the tank broken away to more clearly show the input-output conduit structure;

FIG. **14** is a fragmentary end elevational view of the tank car of FIG. **13**, as viewed from the right-hand end thereof;

FIG. **15** is a further enlarged fragmentary side elevational view in partial vertical section of the interconnected ends of two railway tank cars constructed in accordance with and embodying the features of a third embodiment of the present invention;

FIG. **16** is a side elevational view of two interconnected railway tank cars constructed in accordance with and embodying the features of a fourth embodiment of the present invention;

FIG. **17** is an enlarged fragmentary side elevational view of a valve mechanism in the lading conduit of one of the railway cars of FIG. **16**;

FIG. **18** is an end elevational view of the valve mechanism of FIG. **17**, as viewed from the right-hand end thereof;

FIG. **19** is a fragmentary top plan view of one of the tank cars shown in FIG. **16**, illustrating the bend in the lading conduit to accommodate the tank manway;

FIG. **19A** is an enlarged partial cross-sectional view as seen in the direction of the arrows along the line **19A—19A** in FIG. **16**;

FIG. **20** is an enlarged fragmentary view in vertical section of the interconnected ends of two railway tank cars constructed in accordance with and embodying the features of a fifth embodiment of the present invention;

FIG. **21** is a fragmentary view in vertical section taken along the line **21—21** in FIG. **20**, and illustrating the support structure for the lading conduit;

FIG. **22** is a fragmentary view in vertical section of a portion of a railway tank car, showing an alternative embodiment of the tank shell and lower conduit assembly of the tank car of FIG. **20**; and

FIG. **23** is a fragmentary view in vertical section showing an alternative embodiment of the lower conduit assembly illustrated in FIG. **20**.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. **1** through **7** of the drawings, there is illustrated a railway train, generally designated by the numeral **50**, comprising three railway tank cars, each generally designated by the numeral **60**. Each of the tank cars **60** includes a pair of trucks **70** respectively disposed at the opposite ends thereof and each provided with pairs of rail wheels **75** for rolling engagement with the rails of the standard railway track **55**. Each tank car **60** is further provided with a coupler **80** at each end thereof for coupling adjacent tank cars together in tandem relationship. Mounted on each of the truck assemblies **70** is a longitudinally extending center sill **90** and an arcuate saddle bolster **95** for supporting thereon one end of an associated tank, generally designated by the numeral **500**, all in a well known manner.

The tank **500** includes a tank body **501** comprising a generally cylindrical inner side wall or shell **503** with the longitudinal axis thereof disposed in use substantially horizontally, the shell **503** being surrounded by a

concentric cylindrical outer jacket **504** spaced radially a predetermined distance from the shell **503** and cooperating therewith to define an insulation space which may be filled with suitable insulation material **506.** The opposite ends of the tank body **501** are closed by generally dome shaped tank heads **505** for defining a completely enclosed liquid lading compartment. Formed in the wall of the cylindrical tank body **501** substantially midway between the ends thereof is a cylindrical manway **507** extending substantially vertically upwardly from the tank body **501** and closed at the upper end thereof by a manway cover **509.** Connected to the bottom of the tank body **501** generally midway between the ends thereof is a loading or unloading assembly, generally designated by the numeral **510,** and including a fitting **511** mounted in a complementary opening in the tank body **501** and coupled through a valve **512** to a short loading pipe **513** which extends vertically downwardly from the fitting **511** and terminates in a lower end which is closed by a cap **514.**

Mounted on the top of the tank **500** is a liquid lading level detector, generally designated by the numeral **515,** and including a pipe **516** projecting downwardly into the tank and housing a sensor, which is preferably electronic and may include a thermistor, which sensor is electrically connected to an electrical socket **517** located adjacent to the bottom of the tank, the lower end of the pipe **516** being closed by a cap **518.** When in use, suitable indicating means may be plugged into the socket **517** for indicating the readings made by the liquid level detector **515.**

The tank **500** is also provided with a lading vent conduit, generally designated by the numeral **520,** disposed adjacent to one end of the tank **500** and a lading eduction conduit, generally designated by the numeral **520A,** disposed adjacent to the other end of the tank **500.** In use during loading, the eduction conduit **520A** is the input to the tank **500** and the vent conduit **520** is the output from the tank **500,** while during unloading the vent conduit **520** is the input to the tank **500** and the eduction conduit **520A** serves as the outlet or eduction conduit for the tank **500.** Referring in particular to FIGS. **4** through **7** of the drawings, the vent conduit **520** includes a cylindrical pipe **521** extending inwardly through a complementary opening in the top of the tank body **501** having an annular mounting flange **523** at the outer end thereof for connection to the outer surface of the tank shell **503** as by welding for mounting the pipe **521** in place. Preferably, the inner end **522** of the pipe **521** is flared outwardly and downwardly to accommodate increased rate of loading of the tank **500,** and terminates a predetermined relatively short distance below the top of the tank shell **503** for a purpose to be explained more fully hereinafter.

Mounted immediately above the flange **523** is a valve, generally designated by the numeral **530,** the details of which will be described more fully below, the valve **530** having mounted immediately thereabove a tubular elbow **525** curving upwardly and outwardly toward the adjacent end of the tank **500.** The elbow **525** is provided at the lower end thereof with an annular mounting flange **526** for attachment to the mounting flange **523** with the valve **530** disposed therebetween, while the upper end of the elbow **525** is secured by suitable means, such as welding, to a horizontal cylindrical pipe section **527** which terminates between the associated valve **530** and the domed tank head **505** at the adjacent end of the tank. Referring to FIGS. **5** and **7,** it will be seen that the flange **526** has six cutouts around the periphery thereof, whereby six bolts **528** are provided that extend through openings in the flange **526** to connect the same to the flange **523,** while there are six additional bolts **528A** that interconnect the upper valve flange **532** directly to the mounting flange **523;** as a consequence, there are **12** bolts connecting the valve **530** to the mounting flange **523,** whereas there are only six bolts connecting the flange **526** to the flange **523.** Therefore, in the case of injury to the assembly due to force being applied to the elbow **525** such as in a derailment, overturn or the like, the connection between the elbow **525** and the valve **530** will be broken, whereas the additional six bolts **529** would retain the valve **530** in operative association with the mounting flange **523** and the opening to the vent pipe **521.**

The eduction conduit **520A** (see FIGS. **5** and **6**) includes an eduction pipe **521A** extending vertically downwardly into the tank **500** and provided at the upper end thereof with an annular mounting flange **523A** secured as by welding to the outer surface of the tank shell **503** for mounting the eduction pipe **521A** in place. The inner end **522A** of the eduction pipe **521A** is downwardly and outwardly flared to permit placement of the lower end thereof close to the bottom of the shell **503** so as substantially completely to unload the tank therethrough. By providing a flared lower end **522A,** it is possible to place the lower periphery thereof very close to the shell **503** and still maintain a total flow area between the lower end **522A** and the shell **503** that is essentially equal to the internal area of the eduction pipe **521A.** The outward flaring of the inner end **522A** also accommodates an increased rate of unloading and during loading minimizes foaming frothing or severe agitation of the lading. Disposed immediately above the mounting flange **523A** and concentric therewith is another of the valves **530.**

Mounted immediately above the valve **530** is an elbow **525A** identical in construction to the elbow **525,** and extending upwardly and outwardly toward the adjacent end of the tank **500.** The elbow **525A** is provided at the lower end thereof with an annular mounting flange **526A** for attachment to the mounting flange **523A** with the valve **530** disposed therebetween and is secured at the upper end thereof, as by welding, to a short horizontal pipe section **527A.** Referring to FIGS. **5** and **6,** it will be seen that the flange **526A** has six cutouts around the periphery thereof, whereby six bolts **528** are provided that extend through openings in the flange **526A** to connect the same to the flange **523A,** while there are six additional bolts **528A** that interconnect the upper valve flange **532** directly to the mounting flange **523A;** as a consequence, there are twelve bolts connecting the valve **530** to the mounting flange **523A,** whereas there are only six bolts connecting the flange **526A** to the flange **523A.** Therefore, in the case of injury to the assembly due to force being applied to the elbow **525A** such as in a wreck or the like, the connection between the elbow **525A** and the valve **530** will be broken, whereas the additional six bolts **528A** would retain the valve **530** in operative association with the mounting flange **523A** and the opening to the eduction pipe **521A.**

Disposed in concentric surrounding relationship with the horizontal pipe section **527A** and secured thereto as by welding is a cylindrical male sub **566** of a pipe

connection generally designated by the numeral **565**, the pipe connection **565** also including an internally threaded nut **568** rotatable with respect to the male sub **566** but trapped in place thereon by mating flanges in a well known manner. The nut **568** terminates at a point between the associated valve **530** and the domed tank head **505** at the adjacent end of the tank **500**.

It will be appreciated that the pipe connection **565** is of the "quick-connect" and "quick-disconnect" type. Other quick-connect pipe connections may be used in place of that illustrated at **565**. For example, the "QuikCon" connector offered by the FMC Corporation or the "C-L" coupling offered by Camlock Flange Sales Corp., or the "Flange Mate" closures offered by Continental-Emsco Co. may be used in place of the quick-connect pipe connection **565** illustrated.

The valves **530** which are respectively connected in the vent and eduction conduits **520** and **520A** are identical in construction, whereby only one of the valves **530**, associated with the eduction conduit **520A**, will be described in detail. Referring in particular to FIGS. **6** and 7 of the drawings, the valve **530** includes a cylindrical valve body **531** disposed coaxially with the eduction pipe **521A** and provided at the upper and lower ends thereof with annular mounting flanges **532** which are respectively separated from the output pipe flange **523A** and the elbow flange **526A** by suitable gaskets **534**. Preferably, flanges **523A**, **526A** and **532** are all provided with complementary openings therethrough spaced circumferentially therearound for receiving the complementary bolts **528** and **528A** securely to assemble the output pipe **521A**, the valve **530** and the elbow **525A** in a fluid-tight connection, all as has been described hereinabove.

Preferably, the valve **530** is of the type commonly known as a butterfly valve which is provided with a circular disk (not shown) disposed within the valve body **531** for movement between a closed position blocking the flow of fluid through the valve body **531** and an open condition accommodating passage of fluid therethrough. Valves of this type are disclosed in the U.S. Pat. Nos. 2,740,423 and 2,994,342 issued to C. K. Stillwagon and in the U.S. Pat. No. 3,241,806 issued to A. H. Snell, Jr. The valve **530** includes a rotatable stem **537** projecting laterally from the valve body **531** and connected to the circular disk therein for effecting rotational movement thereof between the open and closed positions thereof. Mounted on the stem **537** is a valve position indicator **539** visible from the exterior of the car to show the position of the valve and also useful as a handle for manual actuation of the valve **530**.

Preferably, the valve **530** is also automatically operable and to that end includes a valve actuator mechanism, generally designated by the numeral **535**, which includes a piston disposed within a cylinder **538** and threadedly engageable with the valve stem **537** so that reciprocating movement of the piston will effect a corresponding rotational movement of the valve stem **537**. A bias spring within the cylinder **538** resiliently urges the piston and the valve stem **537** to a closed condition, whereby the valve **530** is normally closed. The valve actuator **535** may be electrically or pneumatically operated, but in the preferred embodiment of the invention it is illustrated as being pneumatically operated, whereby the actuator **535** includes an air hose coupling for coupling the actuator **535** to an air actuation system, generally designated by the numeral **540**. The valve position indicator **539** can be used as a manual override of the automatic system described. The valves **530** are preferably both disposed on the same side of the tank **500**, but it will be appreciated that other arrangements could be used.

The air actuation system **540** includes a network of air conduits, including a main conduit **543** extending longitudinally along one side of the tank **500** adjacent to the top thereof and externally thereof, the main line **543** being connected by a short branch line **541** to the valve actuator **535** of the input conduit **520** and being connected by a branch line **542** to the valve actuator **535** of the output conduit **520A**. At the opposite ends of the tank **500**, the main line **543** is connected respectively to two tank head lines **545** which extend outwardly over the adjacent head ends **505** of the tank and are in turn respectively connected to Y-couplers **546**. Each of the Y-couplers **546** is in turn connected by a chassis line **547** to the pneumatic system of the tank car and by a line **548** to an inter-tank connecting line **549** which is in turn connected to the air actuation system **540** of the next adjacent tank car, each of the lines **548** having a release valve **549A** therein. Thus, it will be understood that compressed air may be fed to the air actuation system **540** of all of the interconnected tanks **500** in a train of the tank cars **60** simultaneously by operation of the central pneumatic system of the train from a single location.

Each of the valves **530** is disposed in a protective housing or guard structure, generally designated by the numeral **550**, the protective housings **550** each being identical in construction, whereby only one of these housings will be described in detail. Referring in particular to FIGS. **5** through **7** of the drawings, the protective housing **550** includes a pair of arcuate weld pads **551** respectively disposed forwardly and rearwardly of the associated valve **530** and extending transversely of the tank shell **503** and fixedly secured to the outer surface thereof as by welding.

Respectively mounted on the weld pads **551** are two guard plates **552** which are constructed substantially as mirror images of each other, each of the guard plates **552** preferably being constructed of steel plates which is substantially thicker than the tank shell **503** and is fixedly secured to the associated weld pad **551** as by welding. Each of the guard plates **552** is generally rectangular in shape but has an arcuate bottom edge complementary to the weld pad **551**, the guard plates **552** extending vertically upwardly from the tank shell **503** and transversely thereof and at opposite ends of the valve **530** closely adjacent thereto and substantially parallel to each other. Each of the guard plates **552** is further connected to the associated weld plate **551** by a gusset plate **553** disposed approximately midway between the opposite side edges of the guard plate **552** and extending therefrom away from the valve **530**. Fixedly secured to the outer surfaces of each of the guard plates **552** is at an angle iron **554** which serves to connect the guard plate **552** to the adjacent edge of the tank jacket **504**, which jacket is cut away to accommodate the valve **530**. The guard plates **552** protect the valves **530** from physical damage, such as for example in a "roll-over" of the tank car **500**.

In order to provide protection from the weather for the valves **530**, a pair of parallel housing end walls **557** respectively are disposed outwardly of the guard plates **552** and parallel thereto, and a pair of side walls **558**

respectively are disposed substantially perpendicular to the end walls **557** and extending therebetween. The end walls **557** and side walls **558** are all provided with inturned flanges at the upper ends thereof to receive a rectangular cover plate **555** held in place by screws **559** and provided with a complementary opening therethrough for accommodating the elbow **525** (or **525A**), the cover plate **555** cooperating with the end walls **557** and the side walls **558** and the tank shell **503** and jacket **504** substantially to surround the associated valve **530** to provide a weather protective enclosure therefor. The plates **552** prevent damage to the valve **530** in the event of an accidental derailment and overturning of the tank car or inadvertent contact with objects along the track.

The vent conduit **520** of one tank **500** is connected to the eduction conduit **520A** of an adjacent tank **500** by means of a flexible connecting conduit, generally designated by the numeral **560.** The conduit **560** includes a flexible tubular hose **561** provided at the opposite ends thereof with annular coupling flanges **562,** at least one of which is complementary to the connecting flange **529** on the vent conduit **520** for coupling thereto by means of bolts in the usual manner. It will be understood that other "flexible" connections may be used in place of the conduit **560,** other conduit interconnecting means being acceptable so long as they accommodate all of the relative movements between two coupled tank cars in train action.

Connected to the end flange **562** at the other end of the hose **561** by bolts is the coupling flange **564** of a coupler extension pipe **563.** Disposed on concentric surrounding relationship with the coupler extension pipe **563** and secured thereto as by welding is a female sub **567** of the pipe connection **565,** adapted for mating with the male sub **566** on the eduction conduit **520A** of an adjacent tank **500,** the female sub **567** being externally threaded for threaded engagement with the nut **568** securely to join the male and female subs **566** and **567** in a fluid-tight joint thereby to place the adjacent tanks **500** in fluid communication with each other. It will be appreciated that the pipe connection **565** affords a quick and simple means for connecting and disconnecting the flexible conduit **560** to a tank **500.** Preferably, the flexible connecting conduit **560** will be more or less permanently connected to the coupling flange **529** of the vent conduit **520** of the tank car **60,** with the opposite end of the conduit **560** carrying the female sub **567** being free for connection to the eduction conduit **520A** of an adjacent car by means of a pipe connection **565.** The flexible connecting conduit **560** is of such a length as to afford considerable slack when coupled to an adjacent tank car in use.

In order to permit complete emptying of the flexible connecting conduits **560** subsequent to loading of the tank car train **50** and prior to transport thereof, there has been provided a conduit support **600** between each pair of railway tank cars **60,** the support **600** being best illustrated in FIGS. **1, 4** and **5** of the drawings. As illustrated, the adjacent ends of the tanks **500** have mounted adjacent to the upper sides thereof and displaced slightly from the centerline thereof (see FIG. **5**) a lug **601** carrying a set of pivotal links **602.** One of the set of links **602** has threadingly connected thereto a threaded sleeve **603** carrying at the outer end thereof a hook **604.** Connected between the hook **604** and the other set of links **602** is a wire rope **605.** Disposed about the midpoint of the flexible connecting conduit **560** is a clamp **610** from which extends a strut **612** connected to a sleeve **611** slidably receiving the wire rope **605** therethrough. The tension in the wire rope **605** can be adjusted by means of a ratchet **606** drivingly engaging the threaded sleeve **603,** the ratchet **606** carrying a handle **607** that a user can grasp to operate the ratchet **606** so as to turn the threaded sleeve **603** to tighten the wire rope **605** as required. There further is provided a bracket **608** on the tank **500** adjacent to the handle **607** and a cooperating chain **609** to hold the handle **607** in the adjusted position.

The conduit support **600** can be adjusted by means of the ratchet **606** so as to hold the clamp **610** and the associated center of the flexible connecting conduit **560** at an elevation slightly above that of the associated pipes **527** and **563** so as to permit complete drainage of the conduit **560** at the completion of a loading operation and prior to transport of the tank **500,** all as will be explained more fully hereinafter.

Referring to FIG. **7A** of the drawings, there is shown a modified form of adjustable vent conduit in place of the fixed inner end **522** of the pipe **521,** whereby to provide for adjustability of the outage of the associated tank car. As illustrated, a movable pipe section **700** is provided around the lower end of the vent pipe **521,** a suitable packing **701** being provided therebetween to afford a fluid-tight seal. Extending outwardly from the pipe section **700** is a pair of arms **702,** the outer ends of which are apertured to receive therethrough the lower ends of adjusting bolts **705.** The lower end of the adjusting bolt carries a nut **706** and the upper end of the adjusting bolt extends through the tank shell **503** and terminates in an outer end **707** which is shaped to receive a tool for turning the bolt **705.** At the place where the bolt **705** passes through the shell **503,** a packing gland **710** is provided including a housing **711** welded to the shell **503** as at **712.** A nut **713** closes the upper end of the packing gland **710** to maintain the packing **714** in position. Finally, there is provided a pin **715** which limits the distance that the movable pipe section **700** can be moved upwardly, thereby to set the minimum outage that can be accomplished by adjustment of the vent conduit.

It will be appreciated that the outage provided by the vent **520** using the adjustable pipe section **700** can be adjusted from outside of the tank car **500** by threading the bolts upwardly and downwardly, thus to position the pipe section **700** higher or lower with respect to the top of the tank shell **503.** The higher the position of the pipe section **700,** the less the outage, the minimum outage permitted by the system being determined by the position of the pins **715.** Increased outage can be obtained by threading the bolts **705** to move the pipe section **700** downwardly.

Referring to FIG. **7B** of the drawings, there is shown yet another form of the adjustable vent, this form requiring access to the interior of the tank in order to adjust the position of the movable pipe section and therefore the outage. Where appropriate like reference numerals have been applied as in FIG. **7A** but with the addition of the suffix "B". The bolts **705B** instead of passing through the shell **503** terminate in pads **708B** welded to the interior of the shell **503.** An additional nut **709B** is provided on each bolt **705B** and engages the upper surface of the associated arm **702B,** whereby positively to position the arm **702B.** It will be appreciated therefore, that the outage provided by the struc-

ture of FIG. 7B can also be adjusted to provide more or less outage as required.

Referring now also to FIGS. 8 through 11 of the drawings, there is illustrated an uncoupling rod locking mechanism, generally designated by the numeral 570, for preventing inadvertent or accidental uncoupling of two adjacent tank cars 60, the tanks 500 of which are in fluid communication with each other through the flexible connecting conduit 560. Each end of the tank car 560 is provided with a service ramp or catwalk 571 disposed horizontally adjacent to the bottom of a tank 500, the catwalk 571 having secured thereto a hand rail 569 and a side rail 579 and one or more vertically aligned steps 572 to facilitate mounting of the catwalk by a trainmen. As is best illustrated in FIGS. 8 and 10 of the drawings, the step 572 is preferably a metal band bent into a substantially rectangular configuration and secured to the underside of the catwalk 571 along the side thereof.

Fixedly secured to the endmost side of the step 572 is one end of an elongated angle iron 574 extending substantially perpendicular to the step 572 along the adjacent end of the tank car transversely thereof. The angle iron 574 is an upstanding attachment flange 576 and a horizontal flange 575, one end of the attachment being fixedly secured to the step 572 by a suitable fastener, and the other end thereof being secured to a mounting plate or bracket 573 suspended from the catwalk 571. Fixedly secured to the underside of the horizontal flange 575 at longitudinally spaced apart points thereon and depending therefrom are two support brackets 577 provided with generally U-shaped lower ends 587 for receiving therein an uncoupling rod, generally designated by the numeral 580. Formed in the horizontal flange 575 between the support brackets 577 is an opening surrounded by a tubular sleeve 578 having an opening of square cross section therein and secured to the upper surface of the horizontal flange 575.

The uncoupling rod 580 is an elongated integral rod having a handle portion 581 extending downwardly below the support brackets 577, the remainder of the uncoupling rod 580 defining an elongated U-shaped member extending substantially perpendicularly to the handle 581 and including a pair of elongated leg portions 582 and 583 interconnected at the ends thereof remote from said handle 581 by a bight portion 584.

In use, the connecting rod 580 is disposed with the leg portion 583 thereof resting in the U-shaped lower ends 587 of the support brackets 577, these U-shaped ends 587 serving as bearings to facilitate rotational movement of the uncoupling rod 580 about the longitudinal axis of the leg portion 583. Encircling the leg portions 582 and 583 of the uncoupling rod 580 and fixedly secured thereto is a loop portion 586 at one end of a connecting rod 585, the other end of which is connected to the coupler 80 at the adjacent end of the tank car 60. In use, the coupler rod 581 is manually movable by means of the handle portion 581 between a coupling configuration illustrated in solid lines in FIGS. 8 through 11, and an uncoupling configuration, illustrated in broken lines in FIGS. 10 and 11, movement of said uncoupling rod 580 from the coupling to the uncoupling configuration thereof effecting movement of the coupler 80 to an uncoupling condition by means of the connecting rod 585 for uncoupling the adjacent tank car 60.

It is important to insure that the uncoupling rod 580 is not inadvertently or accidentally moved to the uncoupling configuration thereof when two adjacent tank cars are in fluid communication with each other because this might result in a rupture of the inter-tank connection through the flexible connecting conduit 560, since neither the conduit 560 nor the conduits 520 nor the conduits 520 or 520A are designed to handle the buff and draft forces of a railway train in transit. Accordingly, there is provided a locking pin, which extends vertically through the sleeve 578 and the adjacent opening in the horizontal flange 575, the pin 590 being of square cross section and provided at the upper end thereof with a handle 591 and being secured at the lower end thereof to a locking tab 592 having a bearing surface 593 thereon. When the locking pin 590 is disposed in the lowered position thereof, illustrated in solid lines in FIGS. 8 through 11, the bearing surface 593 is positioned for engagement with the upper leg portion 582 of the uncoupling rod 580 to prevent movement thereof from the coupling configuration to the uncoupling configuration. In order to uncouple the adjacent tank car 60, it is necessary only to manually raise the locking pin 590 to the unlocking position illustrated in broken lines in FIG. 11, thereby moving the locking tab 592 out of the path of the upper leg portion 582 to permit movement of the uncoupling rod 580 between the coupling and uncoupling configurations thereof. Upon release of the handle 581, the locking tab 592 will rotate when the upper leg 582 contacts the sloping surface 594 pivoting the locking tab 592 out of the way, temporarily to allow the leg 582 to return to its neutral position, whereby the locking tab 592 will then return to its locking position.

In operation, a plurality of the tank cars 60 are coupled together, as illustrated in FIG. 1, with the vent conduit 520 of one car coupled to the eduction conduit 520A of the adjacent car by means of the flexible connecting conduits 560 in the manner described above, thereby to place the tanks 500 of the cars in fluid communication with one another to form a continuous lading vessel. While three of such interconnected railway cars have been illustrated in FIG. 1, it will, of course, be appreciated that the railway train 50 may comprise any desired number of such railway tank cars 60. When it is desired to fill the tanks 500 of the train 50 with fluid lading, the input end of the train 50 is moved into position adjacent to an associated source 40 of liquid lading, which is preferably provided with a sub 567 for connection to the sub 566 at the free end of the connecting conduit 560 attached to the eduction conduit 520A at the adjacent end of the train. The vent conduit 520 at the other end of the train may be vented to atmosphere or may be coupled to a scrubber 30 or other suitable anti-pollution device. The valves 530 on all of the tanks 500 are then simultaneously opened by application of pressurized air to the actuators 535, which can be accomplished from a single remote location, as was described above.

The fluid lading, which is normally a liquid lading, is introduced into the first tank 500 at the right-hand end of the train 550, as illustrated in FIG. 1. When the tank 500 is filled to a predetermined level, the pressure of the vapor therein above the liquid lading will build up and push the liquid lading upwardly through the vent conduit 520 at the other end of the tank and thence through the flexible connecting conduit 560 and into

the next adjacent tank **500** through the eduction conduit **520A** thereof. When the next tank is filled to a predetermined level, the liquid lading will flow therefrom to the next succeeding tank and this process will be continued until all of the tanks **500** in the train **550** have been filled to the predetermined level with liquid lading. It will be noted that the entire train of tank car **60** can be filled from a single location without moving any of the tank cars **60** or disconnecting them from one another.

It is a significant feature of the present invention that the level to which the tank **500** will be filled with liquid lading is predetermined by the distance which the inner end **522** of the vent pipe **521** extends below the top of the tank shell **503.** This level is preferably set so that there will be provided a free vapor space or "outage" above the liquid lading at the top of the tank **500,** which vapor space is required in the case of expandable liquid ladings, including flammable liquid ladings. It will be appreciated that when the level **595** of the surface of the liquid lading within the tank **500** reaches the bottom of the vent pipe **522,** ti will close the opening therein and prevent further escape of vapors therethrough, after which the remaining vapors at the top of the tank **500** will be compressed as filling of the tank **500** continues. The pressure build-up will continue until it is sufficient to force liquid lading through the vent pipe **522** to the next adjacent tank **500.** It will, therefore, be understood that by judiciously selecting the length of the vent pipe **522,** the maximum level of liquid lading within the tank and, therefore, the minimum volume of freeboard or outage at the top of the tank will be determined. When the tank car farthest from the source **40** of liquid lading has reached the desired depth of fill, the liquid lading level detector **515** therein is actuated and can be connected to control the pump forcing lading into the tank cars to turn off the pump and thus stop fill at the desired level in the final tank car to be filled. It will be appreciated that the detectors **515** can be used to monitor the progress of filling along a string of the tanks **500.**

After the train **50** of tank cars **60,** and specifically the tanks **500** thereof, have been loaded, it is desirable prior to transport of the train **50** to empty all lading from the flexible connecting conduits **560** between adjacent tanks **500** and also from the other conduits **520** and **520A** connected between the conduit **560** and the adjacent valves **530.** It will be appreciated that this is desirable so that there will be no lading in the conduits outside of the tanks **500,** i.e., outwardly beyond the valves **530,** during transport of the train **50,** all for safety reasons. If the lading is flammable or otherwise dangerous, it is desirable to have no lading in these conduits in the event of an accidental rupture of any of the conduits or an accidental separation of the cars **50** and the associated tanks **500** during transport.

In order to remove from the conduits **520, 520A** and **560** all liquid lading at the end of a loading operation, in accordance with a first preferred method, a source of high pressure gas is connected to the input end of the train of tank cars, and specifically to the eduction conduit **520A** that was connected to the source **40** of liquid lading. The gas pressure will force the liquid lading from the right-handmost conduit **520A** and in so doing will push a corresponding quantity of lading upwardly through the vent conduit **520** in the right-handmost car and through the flexible connection **560** and into the adjacent car, the middle car as illustrated in FIG. **1.** As soon as the level of liquid in the right-hand-most car falls below the lower end of its vent conduit **520,** the air under pressure will force all of the liquid upwardly and out of the vent conduit **520,** the associated flexible conduit **560** and that portion of the connected eduction conduit **520A** above the liquid level in the adjacent middle tank car. This process will be repeated down the entire string of tank cars until the conduit **520** and the flexible conduit **560** and the portion of the eduction conduit **520A** above the liquid level in the left-handmost car have been emptied, thus to empty all of the conduits **520, 520A** and **560** throughout the entire length of the train **50** in seriatim. It will be appreciated that the liquid level in the last tank car loaded prior to the emptying of the conduits must be such that the last tank car loaded can accept all of the lading from the conduits along the entire length of the train **50.**

In a second preferred method of emptying the conduits **520, 520A** and **560** along a train of tank cars **60,** the eduction conduit **520A** that was connected to the supply **40** of liquid lading is closed and the vent conduit **520** that was connected to the scrubber **30** is connected to a source of subatmospheric pressure or vacuum. As a result there will be a pressure differential between the right-handmost eduction conduit **520A** in FIG. **1** and the left-handmost vent conduit **520** just as was the case in the first preferred method described above. As a consequence, there will be a seriatum emptying of the conduits **520, 520A** and **560** progressively from the right in FIG. **1** through to the left-hand end of the train **50** in FIG. **1.** After the pressure in the tanks has fallen to atmospheric pressure, the eduction conduit **520A** that was connected to the supply **40** of liquid lading will be vented to atmosphere. It will be seen that in this method also the level of liquid lading in the left-handmost car, i.e., the car last loaded, must be low enough so that the car can accept all of the lading from the conduits **520, 520A** and **560.**

After the train **50** has been completely filled with liquid lading and the conduits **520, 520A** and **560** emptied as described above, the valves **530** are closed by shutting off the supply of compressed air thereto, the valves then automatically returning to their normally closed conditions under the urging of the bias springs. As explained above, all of the valves **530** may be simultaneously closed from a common remote location, there being one of such locations at each tank car. The fact that the valves **530** are closed can be verified by visually inspecting the positions of the indicators **539,** the indicators **539** being in a horizontal position when the valves **530** are closed and being in a vertical position when the valves **530** are open. The train **50** may then be transported to an unloading station in the usual manner. It is significant feature of the present invention that the conduits **520** and **520A** and the flexible connecting conduit **560** are so constructed and arranged as to accommodate all of the various types of movement which a train normally undergoes in transit thereby to facilitate a safe and unencumbered transportation of the train of tank cars **60.**

More particularly, in the first preferred embodiment of the invention the outer ends of the conduits **520** and **520A** are respectively set back behind the domed heads **505** of the tank i.e., each of these conduits terminate at points between the associated protective housing **550** and the head **505** at the adjacent end of the

tank. This set-back position of the ends of the conduits **520** and **520A** permits the flexible connecting conduit **560** to be of a length sufficient to provide a considerable amount of slack between adjacent tanks when the tanks are on a straight portion of track. This slack length in the connecting conduit **560** insures that there will be no undue stresses placed on the flexible conduit **560** or the conduits **520** and **520A** as the train undergoes various track conditions such as sharp curves, inclines, banked curves, uneven rails and the like.

Using conventional trucks and a standard overhang as illustrated in FIGS. **1** to **5**, it will be appreciated that the necessary slack length in the flexible connecting conduit **560** might not be provided if the conduits **520** and **520A** extend outwardly beyond adjacent ends of the tank **500** because the connecting conduit **560**, while being flexible, is of sufficient stiffness to prevent its being bent into a tight curve, whereby the amount of slack which can be provided in the connecting conduit **560** increases with the length thereof. In this regard, the positioning of the conduits **520** and **520A** at the tops of the tanks **500** permits a length of flexible connecting conduit **560** which would not be permitted in the conduits **520** and **520A** were located on the heads **505** of the tank **500**.

It will also be observed that the location of the conduits **520** and **520A** at the top of the tank **500** minimizes the possibility of lading spillage in the event of an accidental derailment of the train **50** or accidental disconnection of adjacent cars **60**. It will also be noted that the possibility of accidental damage to the valves **530** is minimized by the protective guard plates **552** associated with each of the valves **530**. More particularly, each of the guard plates **522** is of sufficient thickness and strength as to prevent damage of the valve **530** except in the case of their being subjected to the most severe forces which would be sufficient to destroy the integrity of the tank **500** itself. The protective guard plates **552** are so designed that even in the event of the tank **500** rolling over, the valves **530** would be protected.

After the train **50** has reached its destination, the tanks **500** thereof may be unloaded by connecting the eduction conduit **520A** at one end of the train to an associated liquid lading reservoir or other storage facility **40** by suitable connecting means. At this point, the valves **530** of the tanks **500** would all be simultaneously automatically opened by applying compressed air to the valve actuators **535** thereof, which actuation may be accomplished from a common remote location as described above. The tank at the opposite end of the train is pressurized with an appropriate gas as through the vent conduit **520** thereof, whereby the liquid lading therein will be forced upwardly through the eduction pipe **521A** and the flexible connecting conduit **560** to the next adjacent tank **500** at the same time the liquid lading will be forced from the tank at the other end of the train into the storage facility, thus to unload serially the entire train of tank cars. This unloading will continue until the first pressurized tank **500** is empty, after which each succeeding tank **500** will in turn be emptied until the entire train has been unloaded. After unloading, the source of gas pressure is withdrawn from the tanks and the pressurized air to the valve actuators **535** is shut off, whereupon the valves **530** all automatically return to their closed conditions. Thus, it will be appreciated that the entire train **50** can be unloaded in a single operation at a single location without movement of the train or disconnection of any of the cars thereof.

Referring again to FIG. **1**, there is illustrated an alternative method of filling and emptying the train of tank cars utilizing the loading and unloading assembly **510** at the bottom of the individual tank cars. More specifically, during the loading operation, a connection can be made through a pipe **510A** from the source **40** of liquid lading to the assembly **510** of the adjacent tank car **500**. Likewise, when unloading the train **50**, the source of gas under pressure can be applied through the conduit **520** or the assembly **510** and the line **510A** connected to a suitable receptacle for the lading, thus to unload the train serially.

In yet another method of unloading the train **50** of tank cars **500** one of the tank cars **500**, and preferably a tank car at one of the ends of the train **50** is filled with an inert gas such as nitrogen which is pressurized to a high pressure such as 250 p.s.i. When the train reaches the point for unloading, the inert gas is connected to the vent connection **520** of the adjacent railway car carrying lading and the inert gas pressure utilized to force the lading out of the tank cars in the manner described hereinabove.

Referring now to FIGS. **12** through **14** of the drawings, there is illustrated a railway train, generally designated by the numeral **50**, comprising three railway tank cars, each generally designated by the numeral **60**. Each of the tank cars **60** includes a pair of trucks **70** respectively disposed at the opposite ends thereof and each provided with pairs of rail wheels **75** for rolling engagement with the rails of a standard railway track **55**. Each tank car **60** is further provided with a coupler **80** at each end thereof for coupling adjacent tank cars together in tandem relationship. Mounted on each of the truck assemblies **70** is a longitudinally extending center sill **90** and an arcuate saddle bolster **95** for supporting thereon one end of an associated tank, generally designated by the numeral **100**, constructed in accordance with a second embodiment of the invention.

The tank **100** includes a generally cylindrical side wall **103** with the longitudinal axis thereof disposed in use substantially horizontally and having the opposite ends thereof respectively closed by generally dome-shaped tank heads **105** for defining a completely enclosed liquid lading compartment. Formed in the top of the cylindrical side wall **103** substantially midway between the ends thereof is a cylindrical manway **107** extending substantially vertically upwardly from the tank side wall **103** and closed at the upper end thereof by a manway cover **109**. Connected to the bottom of the tank side wall **103** generally midway between the ends thereof is a loading assembly, generally designated by the numeral **110**, and including a fitting **111** mounted in a complementary opening in the bottom of the side wall **103** and coupled to a short loading pipe **113** which extends vertically downwardly from the fitting **111** and terminates in a lower end which is closed by a cap **114**.

Mounted on the bottom of the tank side wall **103** adjacent to the loading assembly **110** is an unloading assembly, generally designated by the numeral **115**, and including a valve assembly **116** mounted in a complementary opening in the side wall **103** and provided with a pair of control wheels **117** (one shown) respectively extending laterally outwardly toward the opposite sides of the tank **100**. Coupled to the valve assembly **116** and extending vertically downwardly therefrom is a short

unloading pipe **118** terminating in a lower end which is closed by a cap **119.**

The tank **100** is also provided with two identically constructed input-output conduits, each generally designated by the numeral **120,** respectively disposed adjacent to the opposite ends of the tank **100.** The input-output conduits **120** are arranged as mirror images of each other, wherefor only one of the conduits **120** will be described in detail. Referring, in particular, to FIGS. **13** and **14** of the drawings, the input-output conduit **120** includes an adapter fitting **121** having a reduced diameter lower portion **122** received in a complementary opening or port in the top of the tank side wall **103** adjacent to one end thereof, and an enlarged diameter flange **123** disposed above the tank side wall **103** in contact therewith and in surrounding relationship with the associated port. The flange **123** is coupled by suitable bolts to a complementary flange on a short vertically extending pipe section **124,** the upper end of which is in turn connected to an elbow **125,** which is in turn connected to a horizontally extending conduit section **127** disposed substantially parallel to the longitudinal axis of the tank **100.** The outer end of the horizontal section **127** preferably extends a slight distance outwardly beyond the adjacent end of the tank **100** and terminates in an annular attachment flange **129.**

The input-output conduits **120** are respectively supported by two identically constructed supports, each generally designated by the numeral **145.** Each support **145** includes a pair of half-rings **146** clamped about the outer end of the adjacent horizontal section **127** by suitable means such as bolts, and connected, as by welding, to the upper ends of a pair of downwardly and outwardly diverging struts **148.** Each of the struts **148** preferably comprises an angle iron coupled at the lower end thereof to a foot pad **149** which is secured to the outer surface of the adjacent tank head **105** as by welding.

The attachment flange **129** of each or the horizontal sections **127** of the input-output conduits **120** is constructed and arranged complementary to corresponding flanges **151** at the opposite ends of a flexible connecting conduit **150,** whereby each of the flanges **129** may be connected, as by nuts and bolts, to the corresponding flange **151** of the flexible conduit **150** for providing a flexible coupling between the input-output conduits **120** of adjacent tank cars **60.** In this manner, a unit train may be formed with the tanks **100** and the input-output conduits **120** of the interconnected manifolded cars **60** cooperating with the flexible connecting conduits **150** to form a continuous lading vessel extending the entire length of the train. The flexible conduits **150** are of such a length as to accommodate the normal maneuvers of a railway train without danger of rupturing the connection formed by the flexible conduits **150.**

In operation, a plurality of tank cars **60** are coupled together as illustrated in FIG. **12,** with the adjacent input-output conduits of adjoining cars coupled together by flexible connecting conduits **150** in the manner described above. While three of such interconnected railway cars **60** have been illustrated in FIG. **12,** it will of course be appreciated that the railway train **50** may comprise any desired number of such railway tank cars **60.** When it is desired to fill the tanks **100** of the train **50** with liquid lading, one end of the train **50** is moved into position adjacent to an associated source of liquid lading (not shown), whereupon the free input-output conduit **120** at that end of the train is coupled by suitable means to the source of liquid lading. Preferably, the input-output conduit **120** at the other end of the train is left open and vented to atmosphere.

Referring to FIG. **12,** if the left-hand end of the train **50** is coupled to the source of liquid lading, the lading is introduced into the first tank car **60** in the direction of the arrow until the tank **100** of that car is filled. When the tank **100** is full, pressure will build up therein and move the liquid lading upwardly through the input-output conduit **120** at the other end of the tank, through the flexible connecting conduit **150** and into the next adjacent tank **100,** which will in turn be filled before the liquid lading flows in a similar manner the next succeeding tank. This process continues until the entire train **50,** or any desired portion thereof, is filled. During the filling operation, the air pressure in the tanks **100** is relieved through the input-output conduits **120** to the next adjacent tank and is finally vented to atmosphere through the end conduit **120** at the other end of the train. Alternatively, each tank **100** may be individually equipped with a suitable air vent, in lieu of venting the air through the manifold tank system.

For unloading the tanks **100,** the tank cars **60** are positioned, one at a time, over a suitable pit or hopper or other reservoir (not shown) disposed beneath and between the tracks **55.** The unloading valve **116** is then opened by operation of the valve control wheel **117** to discharge the contents of the tank **10** into the reservoir. Preferably, each tank **100** is equipped with a vacuum relief valve (not shown) of sufficient capacity to handle air flow into the tank at peak flow during unloading.

An alternative method of unloading the tanks **100** is to connect the unloading valves **116** of the tanks **100** individually to a manifold connected to a pump which will pump the lading to a terminal.

Further, in addition to the loading of the tanks **100** through the input-output conduits **120** as described above, the tanks **100** may alternatively be loaded through the loading assembly **110** at the bottom thereof, thereby affording a great deal of flexibility in loading of the railway tank cars **60.** It will be appreciated that this novel arrangement permits an entire train of tank cars **60** to be filled from a single point, thereby obviating the expensive and timeconsuming jockeying of the tank cars one at a time into loading position adjacent to the associated source of liquid lading.

An alternative method of loading the tanks **100** is to connect the loading assembly **110** of the tanks **100** individually to a manifold connected to a pump which will pump the lading from a source thereof into the tanks **100.**

As an important feature of the present invention, it will be noted that the input-output conduits **120** are disposed in elevated positions above the tanks **100,** whereby in the event of any accidental rupture of the connection between adjacent cars provided by the flexible connecting conduits **150,** for example, as a result of derailment or accidental uncoupling of the cars **60,** the possibility of spillage of the liquid lading is minimized. This may be of paramount importance if the lading is a commodity such as bunker "C", sewer sludge, etc., which are considered to be highly pollutant.

Referring now to FIG. **15** of the drawings, there is illustrated a second tank embodiment, generally designated by the numeral **200,** for use on the tank cars **60.** FIG. **15** illustrates portions of two adjoining tank car

tanks, respectively designated 200A and 200B, the left-hand end of tank 200A being shown coupled to the righthand end of tank 200B. The tanks 200A and 200B are identically constructed, whereby a single description will be given for both. The tank 200 includes a cylindrical side wall 203 having the longitudinal axis thereof disposed in use substantially horizontally and having the opposite ends thereof respectively closed by generally dome-shaped tank heads 205. The tank 200 is mounted on truck and bolster structure identical to that illustrated in FIG. 2 and preferably includes bottom loading and unloading assemblies 110 and 115 identical to those illustrated in FIG. 2.

The tank 200 is also provided with two input-output conduits, each generally designated by the numeral 220, and respectively disposed adjacent to the opposite ends of the tank 200. The input-output conduits 220 are constructed and arranged as mirror images of each other, wherefor only one of the conduits 220 will be described in detail. The input-output conduit 220 includes an adapter fitting 221 having a reduced diameter lower portion 222 received in a complementary opening or port in the top of the tank side wall 203 adjacent to one end thereof and an enlarged diameter flange 223 disposed above the tank side wall 203 in contact therewith and in surrounding relationship with the associated port. The flange 223 is coupled by suitable bolts to a complementary flange on a short vertically extending pipe section 224, the upper end of which is in turn connected to horizontally extending pipe section 227 disposed substantially parallel to the longitudinal axis of the tank 200. The outer end of the horizontal section 227 preferably extends a slight distance outwardly beyond the adjacent end of the tank 200 and terminates in an annular attachment flange 229.

One end of the tank 200 (the left-hand end of tank 200A), is provided with a generally U-shaped elbow or trap conduit section 230 disposed within the tank 200 with the bight portion of the elbow 230 disposed downwardly, the elbow 230 being provided at one end thereof with an annular attachment flange 231, the other end 232 of the elbow 230 being open and spaced a slight distance below the top of the tank side wall 203. The attachment flange 231 of the elbow 230 is secured by suitable means to a control valve 235 which is in turn connected by an attachment flange 236 to the inner end of the reduced diameter portion 222 of the adapter fitting 221. The control valve 235 is provided with actuator mechanism 237 which is also disposed within the tank 200 and is coupled by an air control pipe 239 to the atmosphere.

The other end of the tank 200 (the right-hand end of tank 200B), is provided with an elongated vertically extending pipe or conduit section 240 having an annular attachment flange 241 at the upper end thereof, the lower end 242 of the pipe 240 being open and spaced a slight distance above the bottom of the tank side wall 203. The attachment flange 241 is connected by suitable means to another control valve 235, which is in turn connected by another attachment flange 236 to the reduced diameter portion 222 of the adjacent adapter fitting 221. The lower end 242 of the pipe 240 extends through a centering ring 243 which is supported a slight distance above the bottom of the tank side wall 203 by means of support legs 244 which are secured to the inner surface of the tank side wall 203 by suitable means such as weldments 244*a*. The centering ring 243 preferably has an inner diameter only slightly greater than the outer diameter of the pipe 240 so as to fixedly position the pipe 240 and maintain it substantially in vertical alignment within the tank 200.

The input-output conduits 220 typically are respectively supported by two identically constructed supports, each generally designated by the numeral 245. Each support 245 includes a pair of half-rings 246 clamped about the outer end of the adjacent horizontal conduit section 227 by suitable means such as bolts, and connected, as by welding, to the upper ends of a pair of downwardly and outwardly diverging struts 248. Each of the struts 248 preferably comprises an angle iron coupled at the lower end thereof to a foot pad 249 which is secured to the outer surface of the adjacent tank head 205 as by welding.

The attachment flange 229 of each of the horizontal sections 227 of the input-output conduits 220 is constructed and arranged complementary to corresponding flanges 251 at the opposite ends of a flexible connecting conduit 250, whereby each of the flanges 229 may be connected as by bolts 253 to the corresponding flange 251 of a flexible conduit 250 for providing a flexible coupling between the input-output conduits 220 of adjacent tank cars 60, all as was described above with respect to tanks 100.

Accordingly, it will be understood that a plurality of tank cars bearing the tanks 200 may be coupled together in exactly the same manner as was described above with respect to the tanks 100 in FIG. 12. Similarly, the loading of liquid lading into the tanks 200 will be substantially as was described with respect to FIG. 12. However, in the embodiment of FIG. 15, the tanks 200 will normally be arranged so that the input-output conduit 220 which is coupled to the vertically extending pipe 240 will be coupled to the source of liquid lading.

Thus, referring to FIG. 15, the right-hand end of tank 200A (not shown), may be coupled to the source of liquid lading, after which the valves 235 will be operated to the open conditions thereof for filling of the tanks 200 comprising the unit train. When the tank 200A is filled, the pressure build-up therein will cause the liquid lading to flow through the elbow 230 and the valve 235 and through the input-output conduits 220 and flexible connecting conduit 250 and thence through the valve 235 in the tank 200B and the vertically extending pipe 240 to the bottom of the tank 200B. In like manner, when the tank 200B is filled, the liquid lading will then flow from the left-hand end thereof to the next adjoining tank 200 and so on.

It will be appreciated that the upper end 232 of the elbow 230 serves to control the outage in the tank 200 in the same manner as does the vent conduit 520 described above with respect to the first embodiment of the invention.

When the entire train 50 or any desired portion thereof is filled, and the liquid lading has settled within the tanks 200, the valves 235 will be closed to prevent escape of liquid lading through the input-output conduits 220 while the train 50 is in transit. Thus, it will be appreciated that the valves 235 provide additional protection against accidental rupture of the inter-car connections provided by the flexible connecting conduits 250. Of course, as described above, the elevated positions of the input-output conduits 220 will minimize the

possibility of any liquid lading spillage, even in the event of a malfunction of one of the valves **235** or in the event it is inadvertently left open. It will be appreciated that the confinement of the valves **235** within the tanks **200** serves to protect the valves **235** and their actuator structures **237** from damage, thereby prolonging the valve life and further protecting against accidental lading spillage.

The tanks **200** may also be loaded through bottom loading assemblies **110** and may be unloaded through the unloading assemblies **115**, as was described in detail with respect to FIG. **12** above. In addition, the tanks **200** may be emptied by connecting the input-output conduit **220** at one end of the train to a suitable source of pressurized air and thereby pressurizing the associated end tank and blowing the liquid lading out through the other end of the train in a closed system. Thus, for example, the left-hand end of the tank **200B** (not shown) may be connected to a source of pressurized air, whereupon the liquid lading will be forced upwardly through the pipe **240** and into the tank **200A** until the tank **200B** is empty and, in like manner, the tank **200A** and each succeeding tank will be emptied in succession.

Referring now to FIGS. **16** through **19A** of the drawings, there is illustrated a third tank embodiment, generally designated by the numeral **300**, for use on the railway tank cars **60** of the present invention. Each of the tanks **300** comprises a substantially cylindrical side wall **303** having the longitudinal axis thereof disposed in use substantially horizontally and closed at the opposite ends thereof by a pair of generally dome-shaped heads **305**. The tank side wall **303** is provided at the top thereof substantially midway between the ends thereof with a cylindrical manway **307** extending vertically upwardly from the tank side wall **303** and terminating in an open end which is covered by a manway cover **309**. Coupled to the tank side wall **303** at the bottom thereof and substantially midway between the ends thereof, are a bottom loading assembly **310** and a bottom unloading assembly **315**, preferably being respectively constructed identically to the loading and unloading assemblies **110** and **115** described above in connection with FIG. **12**.

The tank **300** is also provided with a pair of input-output conduits, each generally designated by the numeral **320**, and respectively disposed adjacent the opposite ends of the tank **300**. The input-output conduits **320** are identically constructed and are arranged as mirror images of each other, whereby only one of these conduits **320** will be described in detail. The input-output conduit **320** includes an adapter fitting **321** which is constructed and arranged identically to the adapter fittings **121**. The adapter fitting **321** is coupled to the lower end of the vertically extending leg **323** of a tee section **325**, the vertical leg **323** communicating at the upper end thereof with a horizontally extending portion **324** which is provided at the opposite ends thereof with annular attachment flanges **326**. The horizontal portion **324** of the tee **325** is disposed with the longitudinal axis thereof substantially parallel to the longitudinal axis of the tank **300**, the outboard one of the attachment flanges **326** being coupled by suitable means to a corresponding flange at one end of a horizontally extending pipe section **327**, the other end of the pipe section **327** terminating at a point a slight distance beyond the adjacent end of the tank **300** in an annular attachment flange **329**.

Connected between the inboard ends of the horizontal portions **324** of the two tee sections **325** of the tank **300** is bypass pipe section, generally designated by the numeral **330**, which is disposed a predetermined distance above the top of the tank **300** substantially in horizontal alignment with the horizontally extending portions of the input-output conduits **320**. The bypass section **330** includes a relatively long pipe section **331** coupled at one end thereof to the inboard end of one of the tee sections **325**, the other end of the pipe section **331** being coupled to a control valve **335** at a point adjacent to the tee section **325** at the other end of the tank **300**. The pipe section **331** includes a laterally displaced arcuate portion **332** which circumvents the manway **309** so as to prevent interference with the operation of the manway **309** (see FIG. **19**). The bypass pipe section **330** further includes a relatively short pipe section **333** coupled at one end thereof to the valve **335** and coupled at the other end thereof to the inboard end of the horizontal portion **324** of the other tee **325** at the other end of the tank **300**.

Referring to FIGS. **17** and **18** of the drawings, the valve **335** is provided with openings **337** spaced about the periphery thereof and arranged for alignment with corresponding openings **336** on complementary attachment flanges at the adjacent ends of the pipe sections **331** and **333**, the aligned openings **336** and **337** receiving bolts **338** therethrough for securely clamping the valve **335** in circuit between the pipe sections **331** and **333**. The valve **335** includes a control stem **339** for operating the valve **335** between the open and closed conditions thereof.

The bypass pipe section **330** is supported a predetermined distance above the top of the tank **300** by means of a plurality of longitudinally spaced-apart supports **340**, each of the supports **340** including a ring **341** receiving the adjacent portion of the bypass pipe section **330** therethrough and connected by suitable means to a support leg **343**, the lower end of which is secured as by welding to the outer surface of the tank side wall **303**. Similarly, the input-output conduits **320** are supported by means of supports **345** which are identical in construction and function to the supports **145** described above in connection with FIG. **12**.

The attachment flange **329** of each of the horizontal sections **327** of the input-output conduits **320** is constructed and arranged complementary to corresponding flanges **351** at the opposite ends of a flexible connecting conduit **350**, whereby each of the flanges **329** may be connected as by bolts **353** to the corresponding flange **351** of a flexible conduit **350** for providing a flexible coupling between the input-output conduits **320** of adjacent tank cars **60**, all as was described above with respect to tank **100**.

There also is provided along the top of the tank **300** a vent line **360** mounted on the supports **340** and connected through a T-connection **361** to the interior of the tank shell **303**. On the lower end of the connection **361** is a check valve **365** which is float operated and serves to close the inlet to the connection **361** when the fluid level within the tank **300** reaches the predetermined level, whereby to provide a controlled outage for the tank car **300**. More specifically, the tank car **300** is vented through the open check valve **365**, the T-connection **361** and the vent line **360** while the tank car

is being filled with lading, and when the level of the lading reaches that desired for the required outage, the float controlled check valve **365** will close and thus prevent further filling through the T-connection **361** and the vent line **360.**

In operation, the train comprising the tank cars of the type illustrated in FIG. **16** is coupled to an associated source of liquid lading in the same manner as was described above with respect to FIG. **12.** However, the bypass sections **330** and the valves **335** connected therein permit either serial or parallel loading of the tanks **300** in the train. In particular, if the valves **335** are all closed, thereby preventing passage of liquid lading through the bypass sections **330,** the tanks **300** will all be connected in series and may be serially filled in exactly the same manner as was described with respect to the tanks **100** of FIG. **12.** However, when the valves **335** are open to permit passage of liquid lading through the bypass pipe sections **330,** the tanks **300** will all be connected in parallel, and it will be understood that liquid lading may flow in a direct path from one bypass pipe section **330** to another and thereby permit the substantially simultaneous loading of the tanks **300.** Such parallel filling of the tanks **300** is facilitated by the vent line **360** which permits vapors in the tanks to exit through the check valve **365** and the connection **361** until the desired lading level is obtained at which time the check valve **365** is closed. It will also be appreciated that by the provision of valves in the tee sections **325,** the tanks **300** can be isolated from the pipe section **330,** whereby individual tanks can be selectively bypassed in the loading operation.

The unloading of the tanks **300** through the bottom unloading assemblies **315** will be exactly as described with respect to the tanks **100,** and it will also be appreciated that the tanks **300** may alternatively be loaded through the bottom loading assemblies **310,** also in the same manner as was described with respect to the tanks **100** in FIG. **12.**

Since the input-output conduits **320** and the bypass sections **330** are all disposed in elevated positions above the tanks **300,** it will be appreciated that the possibility of lading spillage in the event of accidental rupture of the inter-car connections will be minimized, as was explained above.

Referring now to FIGS. **20** and **21** of the drawings, there is illustrated a fourth tank embodiment, generally designated by the numeral **400,** for use on the tank cars **60** of the present invention. FIG. **20** is similar to FIG. **15** in that it discloses only the interconnected end portions of two adjacent tanks **400A** and **400B,** but since these tanks are identically constructed, only a single detailed description will be given. The tank **400** includes a cylindrical side wall **403,** the longitudinal axis thereof being disposed in use substantially horizontally, and closed at the opposite ends thereof by generally dome-shaped tank heads **405.** Formed in the bottom of the tank side wall **403** intermediate the ends thereof is a shallow depression **404** defining a tank sump. Each of the tank heads **405** is preferably provided with a centrally disposed reinforcing plate **406** on the outer surface thereof for a purpose to be described below. Mounted on the inner surface of the tank side wall **403** adjacent to one end thereof (the left-hand end of tank **400A**), is a generally cylindrical baffle plate **407** secured to the side wall **403** as by weldments **407***a* and extending substantially vertically downwardly therefrom. Connecting to the baffle plate **407** adjacent to the lower end thereof and extending radially inwardly therefrom are a plurality of support arms **408** connected at the inner ends thereof to a cylindrical support ring **409** for a purpose to be described below.

The tank **400** is provided at each end thereof with an input-output conduit assembly, generally designated by the numeral **420,** the input-output assemblies **420** being identically constructed and arranged as mirror images of each other, whereby only one will be described in detail. The input-output assembly **420** includes a relatively short horizontally extending conduit **421** disposed coaxially with the cylindrical side wall **403** and extending through complementary openings in the adjacent tank head **405** and the reinforcing plate **406.** The conduit **421** is provided at the inner end thereof with an annular attachment flange **422** and at the other end thereof with an annular attachment flange **423.** Coupled to the inner attachment flange **422** by suitable means is a control valve **425** which is provided with an actuator assembly **427,** the control valve **425** and the actuator assembly **427** being completely enclosed within the tank **400,** with the actuator assembly **427** communicating with the atmosphere by means of an air control pipe **429.**

Disposed within the tank car **400** at the end thereof adjacent to the baffle plate **407** is an upper conduit assembly, generally designated by the numeral **430,** the assembly **430** including a short horizontally extending pipe or conduit section **431** coupled by means of an attachment flange **432** and bolts **433** to the adjacent control valve **425,** and arranged substantially in longitudinal alignment with the adjacent conduit **421.** The other end of the horizontal conduit section **431** is connected to one end of an upwardly turned elbow **434,** the other end of which is in turn connected to the lower end of a vertically extending conduit section **435,** the upper end **436** of which extends through the support ring **409** and terminates a slight distance below the top of the tank side wall **403.** Preferably, the support ring **409** has an inner diameter only slightly greater than the outer diameter of the vertical conduit section **435** for fixedly positioning the conduit section **435** within the tank **400.** Preferably, the horizontal conduit section **431** is provided with a pair of half rings **437** clamped thereabout, the rings **437** being connected to the upper ends of a pair of downwardly diverging support legs **438,** the lower ends of which are secured as by weldments **439** (see FIG. **21**) to the inner surface of the tank side wall **403** for supporting the assembly **430.**

Disposed within the tank **400** at the other end thereof is a lower conduit assembly, generally designated by the numeral **440,** and including a short horizontal pipe or conduit section **441** connected at one end thereof by means of a suitable attachment flange to the adjacent control valve **425.** The other end of the conduit section **441** is connected to the upper end of a downwardly inclined conduit section **442,** the lower end of which is connected by an attachment flange **443** to a complementary attachment flange **444** on a lower downwardly inclined conduit section **445.** The conduit sections **442** and **445** are disposed in longitudinal alignment with each other, the conduit section **445** terminating in a lower end **446** which is disposed in the sump **404,** a slight distance above the bottom thereof, the lower end **446** being truncated so as to be disposed in use substantially parallel to the bottom surface of the sump **404.**

Preferably, each of the conduit sections **442** and **445** is provided with a pair of half rings **447** clamped thereabout, the half rings **447** being connected to the upper ends of a pair of downwardly diverging support legs **448**, the lower ends of which are connected as by welding to the inner surface of the tank side wall **403** for supporting the assembly **440**.

In use, the outer attachment flanges **423** of the input-output conduits **421** of adjoining tanks **400** are each connected by bolts **453** to complementary attachment flanges **451** at the opposite ends of a flexible connecting conduit **450**, constructed and functioning identically to the flexible connecting conduit **150** described above in connection with FIGS. **12** through **14**.

In use, the tanks **400** on adjoining tank cars **60** are coupled together to form a unit train **50**, one end of which train is coupled to a source of liquid lading for loading the train **50** in the same manner as was described with respect to the tanks **200** of FIG. **15**. Furthermore, it will be understood that by pressurizing one end of the train **50**, the tanks **400** may be unloaded by blowing the liquid lading out of the other end of the train, as was also explained with respect to FIG. **15**. In this type of unloading operation, for example, the left-hand end of tank **400B** would be coupled to the source of pressurized air, whereupon the liquid lading would be forced upwardly through the lower conduit assembly **440** and the input-output assemblies **420** and connecting conduit **450** and then upwardly through the upper conduit assembly **430** of the adjacent car **400A** until the tank **400B** is completely empty, and so on until all the cars in the train have been emptied.

It will be understood that after the tanks **400** have been loaded, the valves **425** will normally be closed so as to prevent spillage of liquid lading in the event of accidental rupture of the inter-car connections while the car is in transit. Further, it will be appreciated that the completely enclosed position of the valves **425** and their actuator mechanisms **427** within the tank **400** serves to prolong the valve life by protecting them from damage, thereby further protecting against accidental lading spillage.

Referring to FIG. **22** of the drawings, there is illustrated an alternative form **403*a*** of the tank side wall illustrated in FIG. **20**, the side wall **403*a*** being essentially identical to the side wall **403**, with the exception that the side wall **403*a*** is not provided with the sump **404**. Accordingly, the side wall **403*a*** has disposed therein a lower conduit assembly which is substantially identical to the assembly **440**, and is provided with a lower downwardly inclined conduit section **445*a***, identical to the section **445** in FIG. **20** but of a shorter length, the section **445*a*** terminating in a truncated lower end **446*a*** spaced a slight distance above the bottom of the tank side wall **403*a***.

Referring to FIG. **23** of the drawings, there is disclosed an alternative embodiment of a lower conduit assembly, generally designated by the numeral **460**, for use in the tank **400**. The assembly **460** includes a short horizontally extending pipe or conduit section **461** connected at one end thereof by an associated attachment flange to the adjacent control valve **425**, the other end of the conduit section **461** being connected to the upper end of a downwardly turned elbow **463**, the lower end of which is in turn connected to the upper end of a vertically extending conduit section **465**, the lower end **466** of which is spaced a slight distance above the bottom of the tank side wall **403**. Preferably, the horizontal conduit section **461** is provided with a pair of half-rings **467** clamped thereabout, the half-rings **467** being connected to the upper ends of a pair of downwardly diverging support legs **468**, the lower ends of which are connected as by welding to the inner surface of the tank side wall **403** for supporting the assembly **460**. In operation, the embodiments of FIGS. **22** and **23** are identical to the embodiment of FIGS. **20** and **21**.

While the uncoupling rod locking assembly **570** and the pneumatically operated valves **530** which can be simultaneously operated from a single remote location have been specifically described in connection with the embodiment of FIG. **1**, it will be understood that these features may be utilized in any of the other tank embodiments disclosed herein. In addition, while the valves **530** are automatically operable, they are preferably also provided with auxiliary manual operating means.

From the foregoing, it will be seen that there has been provided a novel railway tank car adapted to be interconnected with associated like tank cars from forming therewith a continuous lading vessel which can be consecutively loaded in a single loading operation from one end of the associated series of cars, transported, and unloaded in a single unloading operation from the other end of the associated series of cars.

More particularly, there has been provided a railway tank car provided with input and output conduits disposed above the tank and adapted for coupling to adjacent like tank cars by means of a flexible connecting conduit, the elevated position of the conduits minimizing the change of lading spillage in the event of accidental rupture of the inter-car connections, and the distance that the inner end of the input conduit extends below the top of the tank determining the free vapor space at the top thereof.

In addition, there has been provided a railway tank car wherein each of the input and output conduits is provided with a valve, the valves being simultaneously automatically operable from a single remote location.

Further, there has been provided a railway tank car wherein each of the input and output conduit valves is disposed at the top of the tank externally thereof and is surrounded by a protective housing.

There has also been provided an alternative embodiment of the tank car wherein the valves in the input and output conduits are completely disposed within the tank body so as to protect the valves from damage and further insure against accidental lading spillage.

There has also been provided a novel uncoupling rod locking assembly to prevent accidental or inadvertent uncoupling of adjacent tank cars while they are in fluid communication with each other.

There has also been provided alternative embodiments of the tank cars provided with a lading input assembly disposed within the tank and coupled to the inner end of the input-output conduit at one end of the car and an output assembly disposed within the tank and connected to the inner end of the input-output assembly at the other end of the car. There has also been provided alternative versions of these input and output assemblies.

Finally, there has been provided yet another embodiment of the tank car of the present invention which ac-

commodates either serial or parallel loading of an interconnected string of associated like tank cars.

While there have been described what are at present considered to be the preferred embodiments 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 as fall within the true spirit and scope of the invention.

What is claimed is:

1. A railway tank car adapted for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, and conduit coupling means on each of said lading conduits for coupling at the top of said tank to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars while safely accommodating the relative motions between the adjacent tank cars in transit, whereby said tank may be connected to associated like tanks in a series through which fluid lading may flow to accommodate consecutive loading thereof while the position of said lading conduits adjacent to the top of said tank safely accommodates the relative motions between the adjacent tank cars in transit.

2. The railway tank car set forth in claim 1, wherein the outer ends of said lading conduits respectively terminate inboard of the ends of said tank.

3. A railway tank car adapted for interconnection in fluid communication with associated tank cars by flexible connecting conduits for accommodating consecutive loading, transporting and unloading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, at least one lading conduit coupled to said tank adjacent to one end thereof in fluid communication therewith and extending outwardly therefrom adjacent to the top thereof, conduit coupling means on said lading conduit for coupling at the top of said tank to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tank of an adjacent tank car while safely accommodating the relative motions between the adjacent tank cars in transit, and a loading and unloading assembly mounted on the bottom of said tank for connection to a source of lading for loading said tank and for connection to an outlet pipe for unloading said tank, whereby said tank may be connected to an associated tank as the end tank in a series through which fluid lading may flow to accommodate consecutive loading, transporting and unloading thereof while the position of said lading conduits adjacent to the top of said tanks safely accommodates the relative motions between the adjacent tank cars in transit.

4. A railway tank car for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading of expandable liquid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, a lading input conduit and a lading output conduit respectively coupled to said tank adjacent to the opposite ends thereof and being in fluid communication therewith, each of said lading conduits having an outer end extending outwardly from said tank adjacent to the top thereof, the inner end of said output conduit terminating a predetermined distance below the top of said tank, filling of said tank to a level above the inner end of said lading output conduit causing compression of gas trapped above said liquid lading to a pressure at which occurs outflow of liquid lading through said output conduit at the same rate of inflow of liquid lading through said input conduit thereby to provide in said tank above the liquid lading a free vapor space, and conduit coupling means on each of said lading conduits for coupling to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series through which expandable liquid lading may flow to accommodate consecutive loading to a predetermined level while automatically providing a free vapor space at the top of said tank above the liquid lading.

5. The railway tank car set forth in claim 4, wherein the inner end of said lading output conduit is flared to permit an increased rate of loading of said tank.

6. A railway tank car for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading, transporting and unloading of expandable liquid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, a lading vent conduit and a lading eduction conduit respectively coupled to said tank adjacent to the opposite ends thereof and being in fluid communication therewith, each of said lading conduits having an outer end extending outwardly from said tank adjacent to the top thereof, the inner end of said vent conduit terminating a predetermined distance below the top of said tank, filling of said tank to a level above the inner end of said vent conduit causing compression of gas trapped above said liquid lading to a pressure at which occurs outflow of liquid lading through said vent conduit at the same rate as the inflow of liquid lading through said eduction conduit thereby to provide in said tank above the liquid lading a free vapor space, the inner end of said eduction conduit terminating closely adjacent to the bottom of said tank to facilitate emptying of said tank through said eduction conduit, and conduit coupling means on each of said lading conduits for coupling to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series through which expandable liquid lading may flow to accommodate consecutive loading to a predetermined level, transporting thereof while automatically providing a free vapor space at the top of said tank above the liquid lading, and substantially complete unloading thereof through said eduction conduit.

7. The railway tank car set forth in claim 6, wherein the inner end of said lading eduction conduit is flared to permit maximum unloading of said tank through said eduction conduit.

8. A railway tank car for interconnection in fluid communication with associated tank cars by flexible connecting conduits for accommodating consecutive loading of expandable ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated cars, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof and being in fluid communication therewith, each of said lading conduits having an outer end extending outwardly from said tank adjacent to the top thereof and an inner end in communication with the interior of said tank, the inner end of one of said conduits extending into said tank and being adjustable toward and away from the top of said tank so as to terminate an adjustable predetermined distance below the top of said tank, filling of said tank to a level above the inner end of said one lading conduit causing compression of gas trapped above said liquid lading to a pressure at which occurs outflow of liquid lading through said output conduit at the same rate of inflow of liquid lading through said input conduit thereby to provide in said tank above the liquid lading a free vapor space, and conduit coupling means on each of said lading conduits for coupling to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent tank cars, whereby said tank may be connected by associated flexible connecting conduits to associated tanks in a series through which expandable liquid lading may flow to accommodate consecutive loading to a predetermined adjustable level while automatically providing an adjustable free vapor space at the top of said tank above the liquid lading.

9. The railway tank car set forth in claim 8, wherein the position of the inner end of said one lading conduit can be adjusted from the exterior of said tank.

10. The railway tank car set forth in claim 8, wherein the position of the inner end of said one lading conduit is adjustable from the interior of said tank.

11. A railway tank car for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive unloading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, a lading input conduit and a lading output conduit respectively coupled to said tank adjacent to the opposite ends thereof and being in fluid communication therewith, each of said lading conduits having an outer end extending outwardly from said tank adjacent to the top thereof and an inner end extending into said tank, the inner end of said output conduit terminating closely adjacent to the bottom of said tank to facilitate emptying of said tank through said output conduit, and conduit coupling means on each of said lading conduits for coupling to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series through which fluid lading may flow to accommodate consecutive unloading thereof while the position of said lading conduits adjacent to the top of said tank safely accommodates the relative motions of the tank cars in transit.

12. The railway tank car set forth in claim 11, and further including support means mounted on the inside of said tank adjacent to the bottom thereof and connected to said output conduit adjacent to the inner end thereof for effecting a rigid mounting thereof in said tank.

13. A railway tank car train for accommodating consecutive loading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, and conduit coupling means at the outer end of each of said lading conduits; and a plurality of flexible connecting conduits respectively extending between adjacent coupled ones of said tank cars and coupled to said conduit coupling means thereon at the tops of said tanks, said flexible connecting conduits interconnecting said lading conduits to place said adjacent ones of said tanks in fluid communication with each other while safely accommodating the relative motions between said tank cars in transit, whereby said flexible connecting conduits cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate consecutive loading thereof while the position of said lading conduits adjacent to the tops of said tanks permits said flexible connecting conduits safely to accommodate the relative motions between adjacent ones of said tank cars in transit.

14. The railway tank car train set forth in claim 13, wherein the inner end of one of said lading conduits of each of said tanks terminates closely adjacent to the bottom of said tank to facilitate emptying of said tanks therethrough.

15. A railway tank car train for accommodating consecutive loading, transporting and unloading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, at least one lading conduit respectively coupled to the tanks of the end tank cars of said train and in fluid communication with the respective tank and each extending outwardly therefrom adjacent to the top thereof, two lading conduits respectively coupled to the tanks of the intermediate tank cars of said train adjacent to the opposite ends thereof and in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, and conduit coupling means at the outer end of each of said lading conduits; a plurality of flexible connecting conduits respectively extending between adjacent coupled ones of said tank cars and coupled to said conduit coupling means thereon at the tops of said tanks, said fexible connecting conduits interconnecting said lading conduits to place said adjacent ones of said tanks in fluid communication with each other while safely accommodating the relative motions between said tank cars in transit, and

a loading and unloading assembly mounted on the bottom of the tank of an end tank car of said train for connection to a source of lading for loading said train and for connection to an outlet pipe for unloading said train, whereby said flexible connecting conduits cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate consecutive loading, transporting and unloading thereof while the position of said lading conduits adjacent to the tops of said tanks permits said flexible connecting conduits safely to accommodate the relative motions between adjacent ones of said tank cars in transit.

**16.** A railway tank car train for accommodating consecutive loading, transporting and unloading of expandable liquid ladings, said train comprising a plurality of railway tank cars connecting in tandem relationship; each of said tank cars comprising a wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, a lading vent conduit and a lading eduction conduit respectively coupled to each of said tanks adjacent to the opposite ends thereof and being in fluid communication therewith, each of said lading conduits having an outer end extending outwardly from said tank adjacent to the top thereof, the inner end of said vent conduit terminating a predetermined distance below the top of said tank, filling of said tank to a level above the inner end of said vent conduit causing compression of gas trapped above said liquid lading to a pressure at which occurs outflow of liquid lading through said vent conduit at substantially the same rate as the inflow of liquid lading through said eduction conduit thereby to provide in said tank above the liquid lading a free vapor space, the inner end of said eduction conduit terminating closely adjacent to the bottom of said tank to facilitate emptying of said tank through said eduction conduit, and conduit coupling means at the outer end of each of said lading conduits; a plurality of flexible connecting conduits respectively extending between adjacent coupled ones of said tank cars and coupled to said conduit coupling means thereon at the tops of said tanks, said flexible connecting conduits interconnecting said lading conduits to place the adjacent ones of said tanks in fluid communication with each other while safely accommodating the relative motions between the tank cars in transit, whereby said flexible connecting conduits cooperate with said tanks to form a continuous lading vessel through which expandable liquid lading may flow to accommodate consecutive loading to a predetermined level, transporting thereof while automatically providing a free vapor space at the top of each tank above the expandable liquid lading, and substantially complete unloading thereof through said eduction conduits, the position of said lading conduits adjacent to the tops of said tanks permitting said flexible connecting conduits safely to accommodate the relative motions between adjacent ones of said tank cars in transit.

**17.** The railway tank car train set forth in claim **16,** wherein the inner ends of said lading vent conduits and said lading eduction conduits are flared to permit an increased rate of loading and unloading of said tank car train.

**18.** A railway tank car for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading and transporting of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, conduit coupling means on each of said lading conduits for coupling to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, two valves respectively connected in said two lading conduits for controlling the flow of fluid lading therethrough, and automatic valve control mechanism coupled to each of said valves and actuatable from a single location to accommodate simultaneous operation of said valves, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series through which fluid lading may flow to accommodate consecutive loading and transporting thereof and with the valves of all cars in the series being controllable automatically from a single location.

**19.** The railway tank car set forth in claim **18,** wherein said valve control mechanism is pneumatically operated.

**20.** The railway tank car set forth in claim **18,** wherein each of said valves is movable between a closed condition and an open condition, each of said valves further including bias means resiliently urging said valve toward the closed condition thereof, said automatic valve control mechanism being operable for moving said valves to the open conditions thereof against the urging of said bias means, whereby said valves will remain in the closed conditions thereof until said automatic valve control mechanism is actuated.

**21.** The railway tank car set forth in claim **18,** and further comprising strong means connecting said valves to said tank, and wherein the connection between said valves and the portion of said lading conduits in said tank is substantially mechanically stronger than the connection between said valves and the outer portions of said conduit coupling means, whereby the connection between said conduit coupling means and said valves will break before the connection between said valves and said lading conduits thus to insure that the valves remain connected to said lading conduits in the event of damage to said railway tank car.

**22.** The railway tank car set forth in claim **18,** and further including a valve position indicator for each of said valves mounted exteriorly thereof and visible from the exterior of said tank car and movable between a first position corresponding to the open condition of the associated valve and a second position corresponding to the closed condition of the associated valve.

**23.** A railway tank car train which can be loaded and unloaded from a single location for accommodating consecutive loading and transporting of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chasis coupling means for coupling said cars together, a tank mounted on said chassis structure, and two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, conduit coupling means at the

outer end of each of said lading conduits, and two valves respectively connected in said two lading conduits for controlling the flow of liquid lading therethrough; automatic valve control mechanism coupled to each of said valves on each said tank car and actuatable from a single location to accommodate essentially simultaneous operation of said valves; and a plurality of flexible connecting conduits respectively extending between adjacent coupled ones of said tank cars and interconnecting the outer ends of said lading conduits to place said adjacent ones of said tank cars in fluid communication with each other; whereby said flexible connecting conduits cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate consecutive loading and transporting thereof and with the valves of all of said tanks being controllable automatically from a common location.

**24.** The railway tank car train set forth in claim **23**, wherein a plurality of common locations is provided along said train for controlling automatically the valves of all of said tanks.

**25.** A railway tank car for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading, transporting and unloading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, a main lading conduit disposed above said tank and extending longitudinally thereof substantially the entire length thereof, two branch lading conduits communicating with said main conduit and being respectively coupled to said tank adjacent to the opposite ends thereof and being in fluid communication therewith, a valve assembly connected in said main conduit intermediate said two branch conduits, said valve assembly having an open condition permitting passage of fluid lading through said main conduit for connecting adjacent tank cars in parallel and accommodating parallel loading thereof, said valve assembly having a closed condition preventing passage of fluid lading through said main conduit for connecting adjacent tank cars in series and accommodating serial loading thereof, and conduit coupling means at each of the opposite ends of said main lading conduit for coupling to one end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series to form a continuous lading vessel accommodating serial or parallel loading thereof depending upon the condition of said valve assembly.

**26.** A railway tank car train which can be loaded and unloaded from a single location for accommodating consecutive loading, transporting and unloading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, and a main lading conduit disposed above said tank and extending longitudinally thereof substantially the entire length thereof, two branch lading conduits communicating with said main conduit and being respectively coupled to said tank adjacent to the opposite ends thereof and being in fluid communication therewith, conduit coupling means at each end of said main lading conduit, and a valve assembly connected in said main conduit intermediate said two branch conduits, said valve assembly having an open condition permitting passage of fluid lading through said main conduit for connecting adjacent tank cars in parallel and accommodating simultaneous loading thereof, said valve assembly having a closed condition preventing passage of fluid lading through said main conduit for connecting adjacent tank cars is series and accommodating serial loading thereof; and a plurality of flexible connecting conduits respectively extending between adjacent coupled ones of said tank cars and interconnecting the ends of said main lading conduits to place said adjacent ones of said tank cars in fluid communication with each other; whereby said flexible connecting conduits cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate serial or parallel loading thereof depending upon the condition of said valve assembly.

**27.** A railway tank car for interconnection in fluid communication with associated like tank cars by flexible connection conduits for accommodating consecutive loading, transporting and unloading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means movable between a coupling condition for coupling to the chassis of associated like cars and an uncoupling condition, a coupling control member mounted on said chassis and connected to said chassis coupling means and movable from a coupling configuration to an uncoupling configuration for effecting movement of said chassis coupling means from the coupled condition thereof to the uncoupled condition thereof, lock mechanism engageable with said coupling control member in the coupling configuration thereof for preventing movement thereof to the uncoupling configuration thereof, a tank mounted on said chassis structure, two lading conduits coupled to said tank and being in fluid communication therewith, conduit coupling means on each of said lading conduits for coupling to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series through which fluid lading may flow to accommodate consecutive loading, transporting and unloading thereof while accidental uncoupling of adjacent cars in the series is prevented.

**28.** The railway tank car set forth in claim **27**, wherein said lock mechanism includes a pin movable between a locking position for engagement with said coupling control member in the coupling configuration thereof to prevent movement thereof to the uncoupling configuration thereof and an unlocking position accommodating movement of said coupling control member between the coupling and uncoupling configurations thereof.

**29.** A railway tank car train for accommodating consecutive loading, transporting and unloading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means movable between a coupling condition for coupling to the chassis of adjacent cars and an uncoupling condition, a coupling control

member mounted on said chassis and connected to said chassis coupling means and movable from a coupling configuration to an uncoupling configuration for effecting movement of said chassis coupling means from the coupled condition thereof to the uncoupled condition thereof, lock mechanism engageable with said coupling control member in the coupling configuration thereof for preventing movement thereof to the uncoupling configuration thereof, a tank mounted on said chassis structure, two lading conduits coupled to said tank and being in fluid communication therewith, and conduit coupling means at the outer end of each of said lading conduits; and a plurality of flexible connecting conduits respectively extending between adjacent coupled ones of said tank cars and coupled to said conduit coupling means thereon interconnecting said lading conduits to place said adjacent ones of said tank cars in fluid communication with each other; whereby said flexible connecting conduits cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate consecutive loading, transporting and unloading thereof while accidental uncoupling of adjacent cars is prevented.

**30.** A railway tank car for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading and transporting of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, two lading conduits coupled to said tank in fluid communication therewith and extending outwardly therefrom adjacent to the top thereof, two valves mounted on said tank externally thereof and respectively connected in said two lading conduits for controlling the flow of liquid lading through said lading conduits, and conduit coupling means respectively connected to each of said valves by a breakaway connection for coupling to one end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series through which fluid lading may flow to accommodate consecutive loading and transporting thereof while said external valves are protected against damage in transit.

**31.** The railway tank car set forth in claim **30**, wherein said two valves have a low profile, thereby further to protect said valves against damage in transit.

**32.** The railway tank car set forth in claim **30**, and further comprising two discrete housings respectively surrounding said two valves.

**33.** The railway tank car set forth in claim **32**, wherein each of said housings includes a pair of upstanding heavy duty guard plates rigidly mounted on said tank externally thereof, said guard plates being respectively disposed closely adjacent to the opposite ends of the associated valve and extending transversely of said tank substantially parallel to each other, and a box-like rigid outer covering cooperating with said tank and said guard plates substantially to surround the associated valve.

**34.** A railway tank car for interconnection to fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading and transporting of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, conduit coupling means on each of said lading conduits for coupling to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, two valves respectively connected in said two lading conduits for controlling the flow of fluid lading therethrough, and automatic valve control mechanism coupled to each of said valves and actuatable from a single location to accommodate simultaneous operation of said valves, said valves and said valve control mechanism being fail-safe in operation whereby upon failure or deactivation of said valve control mechanism said valves move to the closed positions thereof, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series through which fluid lading may flow to accommodate consecutive loading and transporting thereof and with the valves of all cars in the series being controllable automatically from a single location.

**35.** A railway tank car adapted for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, a flexible hose for at least one of said lading conduits, and conduit coupling means on each of said lading conduits for coupling at the top of said tank to the adjacent end of said flexible hose to place said tank in fluid communication with the tanks of adjacent like tank cars, said flexible hose safely accommodating the relative motions between the adjacent tank cars in transit while maintaining a fluidtight connection therefor, whereby said tank may be connected to associated like tanks in a series through which fluid lading may flow to accommodate consecutive loading thereof while the position of said lading conduits adjacent to the top of said tank safely accommodates the relative motions between the adjacent tank cars in transit.

**36.** A railway tank car adapted for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, a flexible hose for at least one of said lading conduits, conduit coupling means on each of said lading conduits for coupling at the top of said tank to the adjacent end of a flexible hose to place said tank in fluid communication with tanks of adjacent like tank cars, and a support for said

flexible hose mounted on the adjacent end of said tank car for maintaining said flexible hose at an elevation higher than that of the associated conduit coupling means so as to cause drainage of all the lading from said flexible hose through the associated conduit coupling means and into said tank, said flexible hose safely accommodating the relative motions between the adjacent tank cars in transit while maintaining a fluid-tight connection therefor, whereby said tank may be connected to associated like tanks in a series through which fluid lading may flow to accommodate consecutive loading thereof while the position of said lading conduits adjacent to the top of said tank safely accommodates the relative motions between the adjacent tank cars in transit.

**37.** A railway tank car train for accommodating consecutive loading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, and conduit coupling means at the outer end of each of said lading conduits; and a plurality of flexible hoses respectively extending between adjacent coupled ones of said tank cars and coupled to said conduit coupling means thereon at the tops of said tanks to place said tanks in fluid communication with the tanks of adjacent tank cars, said flexible hoses safely accommodating the relative motions between the adjacent tank cars in transit while maintaining a fluid-tight connection therefor, whereby said flexible hoses cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate consecutive loading thereof while the position of said lading conduits adjacent to the tops of said tanks permits said flexible hoses safely to accommodate the relative motions between adjacent ones of said tank cars in transit.

**38.** A railway tank car train for accommodating consecutive loading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, and conduit coupling means at the outer end of each of said lading conduits; and a plurality of flexible hoses respectively extending between adjacent coupled ones of said tank cars and coupled to said conduit coupling means thereon at the tops of said tanks to place said tanks in fluid communication with the tanks of adjacent tank cars, and supports for said flexible hoses respectively mounted on the adjacent ends of said tank cars for maintaining said flexible hoses at an elevation higher than that of the associated conduit coupling means so as to cause drainage of all the lading from said flexible hoses through the associated coupling means and into the associated tanks, said flexible hoses safely accommodating the relative motions between the adjacent tank cars in transit while maintaining a fluid-tight connection therefor, whereby said flexible hoses cooperate with said tanks to form a continuous lading vessel through which lading may flow to accommodate consecutive loading thereof while the position of said lading conduits adjacent to the tops of said tanks permits said flexible hoses safely to accommodate the relative motions between adjacent ones of said tank cars in transit.

**39.** A railway tank car adapted for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, two lading conduits respectively coupled to said tank adjacent to the opposite ends thereof in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, conduit coupling means on each of said lading conduits for coupling at the top of said tank to an adjacent end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars while safely accommodating the relative motions between the adjacent tank cars in transit, and a fluid level detecting means mounted on said tank adjacent to the top thereof and extending downwardly thereinto for sensing the fluid lading when it reaches the desired level in said tank, whereby said tank may be connected to associated like tanks in a series through which fluid lading may flow to accommodate consecutive loading thereof while the position of said lading conduits adjacent to the top of said tank safely accommodates the relative motions between the adjacent tank cars in transit.

**40.** The railway tank car set forth in claim **39**, wherein said fluid level detecting means is electrically operated and is connectable to the pumping system for filling said tank car to interrupt operation thereof when the fluid lading reaches the desired level in said tank.

**41.** A railway tank car train for accommodating consecutive loading, transporting and unloading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, at least one lading conduit respectively coupled to the tanks of the end tank cars of said train and in fluid communication with the respective tank and each extending outwardly therefrom adjacent to the top thereof, two lading conduits respectively coupled to the tanks of the intermediate tank cars of said train adjacent to the opposite ends thereof and in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, and conduit coupling means at the outer end of each of said lading conduits; a plurality of flexible hoses respectively extending between adjacent coupled ones of said tank cars and coupled to said conduit coupling means thereon at the tops of said tanks, said flexible hoses interconnecting said lading conduits to place said adjacent ones of said tanks in fluid communication with each other, supports for said flexible hoses mounted on adjacent ends of said tank cars for maintaining said flexible hoses at an elevation higher than that of an associated conduit coupling means, and means for connecting the lading conduit through which said train of cars is filled to a source of

pressure higher than that to which is connected the lading conduit at the other ends of said train of cars, so that the pressure differential will force the fluid lading from said flexible hoses from the input ends to the other ends thereof, whereby said flexible hoses cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate consecutive loading, transporting and unloading thereof while the position of said lading conduits adjacent to the tops of said tanks and the supports for said flexible hoses permits said flexible hoses safely to accommodate the relative motions between adjacent ones of said tank cars in transit.

**42.** The railway tank car train set forth in claim **41**, wherein subsequent to loading thereof the lading conduit at the inlet ends of said train is adapted to be connected to a source of pressure above atmospheric pressure and the lading conduit at the other end of said train is adapted to be connected to atmospheric pressure.

**43.** The railway tank car train set forth in claim **41**, wherein subsequent to loading thereof the lading conduit at the inlet end of said train is adapted to be connected to atmospheric pressure and the lading conduit at the other end of said train is adapted to be connected to a source of pressure below atmospheric pressure.

**44.** A railway tank car for interconnection in fluid communication with associated like tank cars by flexible connecting conduits for accommodating consecutive loading, transporting and unloading of fluid ladings, said tank car comprising a wheeled chassis structure provided with chassis coupling means for coupling to the chassis of associated like cars, a tank mounted on said chassis structure, a main lading conduit disposed above said tank and extending longitudinally thereof substantially the entire length thereof, two branch lading conduits communicating with said main conduit and being respectively coupled to said tank adjacent to the opposite ends thereof and being in fluid communication therewith, a valve assembly connected in said main conduit intermediate said two branch conduits, said valve assembly having an open condition permitting passage of fluid lading through said main conduit for connecting adjacent tank cars in parallel and accommodating parallel loading thereof, said valve assembly having a closed condition preventing passage of fluid lading through said main conduit for connecting adjacent tank cars in series and accommodating serial loading thereof, conduit coupling means at each of the opposite ends of said main lading conduit for coupling to one end of an associated flexible connecting conduit to place said tank in fluid communication with the tanks of adjacent like tank cars, a vent line disposed above said tank and extending longitudinally thereof substantially the entire length thereof and having a connection in fluid communication with said tank, connecting means connecting said vent line to vent lines on adjacent cars to provide a continuous vent line for venting said tank during loading and unloading thereof, whereby said tank may be connected by associated flexible connecting conduits to associated like tanks in a series to form a continuous lading vessel accommodating serial or parallel loading thereof depending upon the condition of said valve assembly.

**45.** The railway tank car set forth in claim **44**, and further comprising a check valve within said tank in the connection to said vent line in fluid communication with said tank, said check valve closing automatically when the lading in the tank reaches the proper level during loading.

**46.** A railway tank car train which can be loaded and unloaded from a single location for accommodating consecutive loading, transporting and unloading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, and a main lading conduit disposed above said tank and extending longitudinally thereof substantially the entire length thereof, two branch lading conduits communicating with said main conduit and being respectively coupled to said tank adjacent to the opposite ends thereof and being in fluid communication therewith, conduit coupling means at each end of said main lading conduit, and a valve assembly connected in said main conduit intermediate said two branch conduits, said valve assembly having an open condition permitting passage of fluid lading through said main conduit for connecting adjacent tank cars in parallel and accommodating simultaneous loading thereof, said valve assembly having a closed condition preventing passage of fluid lading through said main conduit for connecting adjacent tank cars in series and accommodating serial loading thereof; and a plurality of flexible connecting conduits respectively extending between adjacent coupled ones of said tank cars and interconnecting the ends of said main lading conduits to place said adjacent ones of said tank cars in fluid communication with each other; a vent line disposed above said tank and extending longitudinally thereof substantially the entire length thereof and having a connection in fluid communication with said tank, a plurality of flexible connections respectively extending between said vent lines to place said vent lines in fluid communication with each other to provide a continuous vent line through which said tanks can be vented during loading and unloading of said tanks; whereby said flexible connecting conduits cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate serial or parallel loading thereof depending upon the condition of said valve assembly.

**47.** The railway tank car train set forth in claim **46** and further comprising a check valve within each tank in the connection to said vent line in fluid communication with said tank, said check valve closing automatically when the lading in the tank reaches the proper level during loading.

**48.** A railway tank car train for accommodating consecutive loading, transporting and unloading of fluid ladings, said train comprising a plurality of railway tank cars connected in tandem relationship; each of said tank cars including wheeled chassis structure provided with chassis coupling means for coupling said cars together, a tank mounted on said chassis structure, at least one lading conduit respectively coupled to the tanks of the end tank cars of said train and in fluid communication with the respective tank and each extending outwardly therefrom adjacent to the top thereof, two lading conduits respectively coupled to the tanks of the intermediate tank cars of said train adjacent to the opposite ends thereof and in fluid communication therewith and each extending outwardly therefrom adjacent to the top thereof, and conduit coupling means

at the outer end of each of said lading conduits; a plurality of flexible hoses respectively extending between adjacent coupled ones of said tank cars and coupled to said conduit coupling means thereon at the tops of said tanks, said flexible hoses interconnecting said lading conduits to place said adjacent ones of said tanks in fluid communication with each other, fluid level detecting means mounted on the tank of the end tank car of said train opposite from the end tank car through which fluid lading is to be loaded, said fluid level detecting means being mounted adjacent to the top of the associated tank and extending downwardly thereinto for sensing the fluid lading when it reaches the desired level in the associated tank, said fluid level detecting means being adjusted to accommodate the flow into the associated tank of the fluid lading from all of the flexible hoses in said train, whereby said flexible hoses cooperate with said tanks to form a continuous lading vessel through which fluid lading may flow to accommodate consecutive loading, transporting and unloading thereof while the position of said lading conduits adjacent to the tops of said tanks and the supports for said flexible hoses permits said flexible hoses safely to accommodate the relative motions between adjacent ones of said tank cars in transit.

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