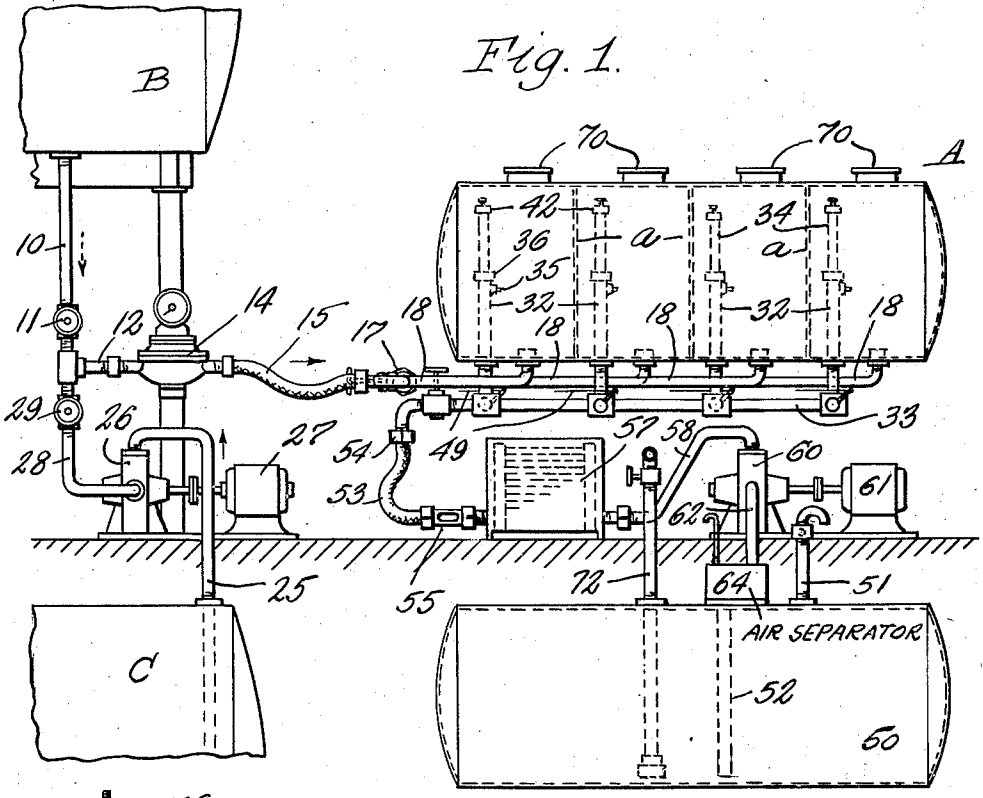
Nov. 21, 1944. J. B. HAFFNER 2,363,177

METHOD AND APPARATUS FOR FILLING PORTABLE TANKS

Filed Sept. 5, 1940

Fig. 1.



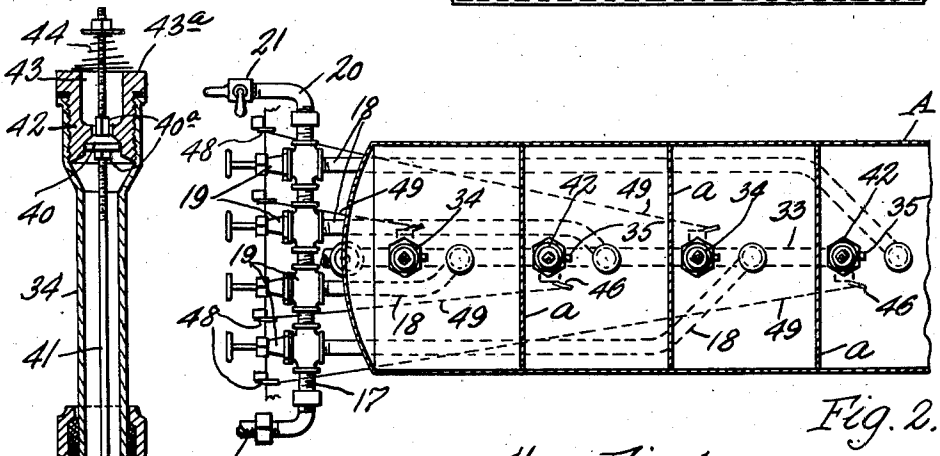


Fig. 2.

Fig. 3.

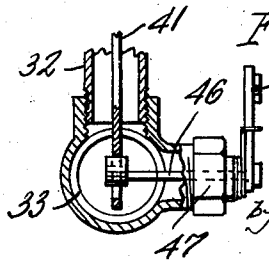


Fig. 4.

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METHOD AND APPARATUS FOR FILLING PORTABLE TANKS

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Application September 5, 1940, Serial No. 355,447

18 Claims. (Cl. 62—1)

This invention relates to improvements in methods and apparatus for filling containers, such for example as portable tanks used in connection with the transport of liquids. The invention also relates particularly to the filling of tanks of this kind with volatile liquids.

In the filling of tanks or containers, such, for example, as those of oil trucks, tank cars, barges, tankers, and the like, with gasoline or other volatile liquids, there is serious danger of explosion of the mixture of air and vapor contained in an empty container which mixture, of course, is ordinarily discharged to the atmosphere during the filling of the container. The escape of this vapor also entails loss of the volatilized liquid contained therein. In the filling of containers of this kind, it is also very desirable that the container be provided with means for filling the same accurately to a predetermined level which must be somewhat below the top of the tank to permit expansion to take place. Considerable risk is incurred by filling containers above the desired liquid level therein, since the liquid may expand due to heat.

One of the objects of this invention is to provide an apparatus and method for use in filling containers with volatile liquids, which minimizes the danger of explosions when filling the container and simultaneously avoids overloading of the container. Another object is to provide a method and apparatus by means of which the vapors or gases in the container, which are displaced by the liquid entering the container are withdrawn and by means of which any liquid in excess of the quantity desired in the container is also removed therefrom, to insure that the container will contain the correct amount of liquid.

Another object of this invention is to provide an apparatus and method by means of which suction is applied to the container to be filled during the filling of the same and for a period thereafter, said suction means having an inlet in the container at the level to which it is desired to fill the container so that excess liquid as well as gases and vapors may be withdrawn from the container.

A further object of this invention is to provide means of this kind which are capable of use in connection with tanks or containers divided into a plurality of compartments.

Another object of this invention is to provide a tank filling apparatus with means such as a condenser for recovering volatile liquid from vapors thereof withdrawn from the tank.

It is also an object of this invention to provide a simple and easily operable apparatus of this kind for filling tank trucks, tank cars and the like, and which serves to prevent overloading of the tanks and theft of liquid.

Another object is to provide the air and vapor withdrawal and overflow duct with a valve which may be closed after the tank has been filled to the desired extent to prevent further discharge of liquid from the tank.

Other objects of this invention will appear from the following description and claims.

In the accompanying drawing:

Fig. 1 is an elevation, partly diagrammatic, of an apparatus embodying this invention.

Fig. 2 is a sectional plan view of a tank or container to be filled, together with piping connections for filling the same.

Fig. 3 is a central sectional elevation of the upper portion of a suction or withdrawal pipe for a container to be filled.

Fig. 4 is a detail view of actuating means for the valve of the suction pipe shown in Fig. 3.

The construction shown in the accompanying drawing represents one embodiment of this invention, and it will be understood that it is not intended to limit the invention to the particular embodiment shown, since obviously many changes and modifications may be made in the apparatus without departing from the scope of this invention.

A represents a tank or container to be filled which may be of any suitable or desired kind, that shown being provided with a plurality of partitions *a* to divide the tank into a plurality of compartments. These partitions may, however, be omitted, if desired. This tank may be portable, and may, for example, be a part of a tank truck or tank car or may be mounted on any other type of vehicle, and my invention is also applicable to stationary tanks which may be located above or below the ground. B represents a storage tank containing liquid to be discharged to the tank A and located above the ground so that liquid may be discharged to the tank A by gravity and C represents another storage tank located below the ground and from which liquid may also be discharged to the tank A. My method and apparatus may be used in connection with either or both of the tanks B and C.

The tank B is provided with a discharge pipe 10 controlled by a valve 11 and connected with a pipe 12 which may, if desired, lead to a liquid meter 14. Liquid passes from the meter to a tube, for example, a hose or flexible conduit 15, which may be coupled to a pipe carried by the truck or vehicle and leading to the tank A. As shown in

Fig. 2, the duct or hose 15 is removably connected with a manifold pipe 17 on the vehicle from which a plurality of branch pipes 18 lead, one of these pipes going to each of the compartments of the tank and these branch pipes are connected and disconnected from the main or manifold pipe 17 by means of valves 19. In order to provide for the minimum splashing and consequent loss of volatile liquid due to vaporization and mixture with air contained in the tank, I preferably construct the discharge ends of the branch pipes 18 so that they terminate in the lower portion of the tank or of the compartments of the tank, as near to the bottom thereof as possible.

The other end of the manifold pipe 17 may be provided with the usual discharge pipe 20 controlled by means of a valve 21 through which liquid from any of the compartments of the tank may be discharged in the usual manner, the valves 19 also serving to control the discharge of liquid from the compartments as well as for controlling the admission of liquid thereto. The manifold 17, branch pipes 18 and valves 19 are, of course, a part of the tank A and are arranged in fixed relation thereto, the hose 15 being detachably connected thereto only during the filling of the tank A.

From the foregoing, it will be obvious that if a tank is to be filled, the flexible hose or conduit 15 is first connected thereto and one or more of the valves 19 is opened, the valve 21 being closed. Upon opening the valve 11, liquid will flow to the tank A.

If my improved method and apparatus is to be used for dispensing liquid from an underground tank, such as the tank C, it may be provided with a discharge pipe 25 connected to the inlet of a pump 26 driven by a motor 27, the discharge of the pump being connected by means of a pipe 28 to the pipe 12. A valve 29 controls the admission of liquid from the pipe 28 to the pipe 12. Consequently, when the valve 11 is closed or when no overhead tank is employed, by opening the valve 29 and starting the motor 27, liquid will be pumped through the meter to the tank A.

In order to remove fluid, which may be in the form of gas or air mixed with vapor or excess liquid, from the tank A, I provide means for withdrawing such fluid from the tank which have within the tank an intake opening which is located at the level to which it is desired to fill the tank or the compartments. Any means may be provided for removing such fluid, and in the particular construction illustrated, I have provided in each compartment a withdrawal pipe or duct, those shown in the construction illustrated extending upwardly through the bottom of the tank. Each withdrawal duct includes a fixed or stationary pipe 32 which may be welded or otherwise suitably secured to the bottom of the tank. In the construction shown, each of these pipes is connected at its lower end to a manifold or connecting pipe 33 and is also provided with an upper telescoping and adjustable tube 34, the upper end of which may receive fluid from the compartment in which it is located. The telescoping tubes 34 may be suitably secured in place relatively to the stationary tubes in any suitable or desired manner, for example, by means of a set screw 35 and the tubes 32 and 34 also have a liquid tight connection or packing 36 which prevents the entry of liquid into the tube 32 except through the upper end of the adjustable tube 34. By adjusting the upper tube 34 to the correct level, the contents of a compartment can be very accurately regulated by permitting any excess liquid above such level to be withdrawn from a tank or compartment. If the adjustability of the tube 34 relatively to the tube 32 is not desired, the tube 34 may be omitted and the tube 32 made long enough to extend to the desired level in the tank.

In some cases, it may be desirable to provide a valve or other suitable means for closing the withdrawal tube. For example, this may be desirable if the tank A is portable, since the movement of the tank may cause the liquid within the compartment to surge and splash and thus flow out through the withdrawal pipe. When a tank is divided into compartments as shown in the drawing and the several withdrawal pipes are connected to a common tube or manifold 33, it is desirable to provide such valves in the withdrawal tubes so that each compartment may be filled independently of the others. I have, consequently, shown in Fig. 3, a valve 40 mounted on a valve stem 41 arranged within the tubes 32 and 34. The upper end of the tube 34 is provided with a suitable valve body 42 in which a seat for the valve 40 is formed. Preferably the valve stem or rod 41 extends upwardly out of the open end 43 of the valve body and a spring 44 is arranged between the upper end of this rod and the valve body 42, so that the spring exerts a sufficient pressure on the rod in a direction to move the valve 40 into its closing position. The opening 43 in the valve body is sufficiently large to permit gases or liquid to pass through the same and through the valve seat and thus into the withdrawal duct when the valve is open. The horizontal top face 43*a* of the valve body thus determines the level of the liquid in a compartment, which level, as stated, may be varied by adjustment of the tube 34, in that compartment.

The valve rod or stem 41 is connected to any suitable means for actuating the same to open or close the valve. In the construction shown by way of example, the lower end of each rod is connected to a crank member 46 which is journalled in a suitable packing gland 47 in the main pipe 33, and which has a cam within the pipe which engages in an eye in the lower end of the valve rod or stem 41 and a spring controlled arm arranged on the exterior of the pipe. By swinging the arm of the crank member 46, the valve may be positively moved into its seating position and held there. Any suitable means may be provided for actuating the crank member 46. For example, at the rear end of the tank truck or vehicle a lever 48 may be provided for each compartment, the lever being connected with a flexible cable 49, the other end of which is secured to the arm of the crank member 46 so that by swinging the lever 48, the crank member 46 may be actuated either to turn the cam thereon into a position in which it will positively hold the valve 40 in closed position or to turn the cam in the eye of the rod into a position to release the valve so that it may move into open position.

Valves of other suitable constructions may be employed as well as other means for actuating the same, and the actuating means may be omitted entirely since a spring seated valve which opens when suction is applied to the withdrawal pipe is sufficient to prevent any substantial loss of liquid during transit. The valve actuating mechanism is, however, desirable for positively preventing loss of liquid, and when the withdrawal pipe is not subjected to suction, but discharges excess liquid by gravity, the valve actuating means are

so constructed as to hold the valve open during filling of the tank A.

When the valve **40** is used with an adjustable tube section **34**, I arrange the valve **40** so that it too may be adjusted for corresponding movement with the section **34**. This may be done by threading the upper portion of the stem **41** and adjustably securing the valve **40** thereon by means of nuts **40a**, see Fig. 3. Any other way of providing variation in the position of the valve **40** on its stem **41** may be employed.

Fluid passing from the tank A down through the withdrawal pipes may be discharged in any suitable or desired manner to a receiver or a tank **50**, that shown being arranged below the ground and having a vent pipe **51** and an inlet pipe **52** through which the fluid from the tank A is discharged into the receiver **50**. The pipe **52** preferably extends almost to the bottom of the receiver **50** and may be connected with the withdrawal pipe **33** in any suitable or desired manner. For example, the pipe **33** may be removably connected with a hose or tube **53** by means of a quickly detachable coupling **54**. The other end of the flexible conduit **53** is preferably connected with a tube **55** containing a sight glass so that it can be readily determined when liquid is discharged from the tank A.

In the construction shown, I have also provided a condenser **57** to which the tube **55** connects for the purpose of condensing vapor discharged from the tank A. This condenser may be of any desired form and a suitable cooling liquid may be circulated through the condenser, by means not shown, to effect condensation of vapors entering the condenser through the pipe **55**. In the construction shown, the condenser is connected by means of a pipe or conduit **58** with a suction pump **60** driven by means of an electric motor **61** or other suitable power means. The discharge from the suction pump **60** is connected with a pipe or conduit **62**, and if desired, this pipe may connect with an air separator **64** of any suitable or well known construction not herein shown in detail, by means of which air or uncondensed gas or vapor is separated from the fluid withdrawn from the tank A and discharged from the system, for example, to the atmosphere, the liquid passing from the air separator into the pipe **52** leading to the receiver **50**.

The mechanism for removing fluid from the tank A is preferably operated as follows:

The operator releases or opens the withdrawal valve **40** of a compartment and preferably keeps the other withdrawal valves closed. He also opens the inlet valve **19** for the same compartment. Then as liquid is discharged into the tank A, the motor **61** is also started to operate the suction pump **60** which draws fluid from the pipe **33** through the condenser past the sight glass in the tube **55**. This fluid then passes through the air separator by means of which air and gases, as well as uncondensed vapors are discharged from the system, the liquid flowing from the air separator into the receiver **50**. By means of the condenser, a large part of the vapor of the volatile liquid is condensed into liquid form, so that the danger of explosion of air or gas discharged from the air separator **64** is greatly reduced. If a meter **14** is employed, any desired quantity of liquid may be supplied to any compartment. It sometimes happens that before filling, a compartment may not have been entirely drained, and consequently, even with an accurate meter, excess liquid may be supplied to such compartment. When this happens, such excess liquid will overflow into the withdrawal pipe **34**, and when this is noted in the sight glass, further supply of liquid to the compartment is immediately interrupted by the attendant. The suction pump **60** is continued in operation for a time interval after the supply of liquid to the tank A has been interrupted until the sight glass shows that no more liquid is being withdrawn from the tank A, so as to ensure the removal of excess liquid from the compartment. When this has been done, the valve **40** for such compartment is again closed and another compartment may be filled in the same manner.

In the event that no meter is used, the adjustable pipe **34** may be set to a level at which the corresponding compartment contains a known quantity of liquid, and in such case, liquid is supplied to a compartment until the sight glass shows that liquid is passing out of the compartment to the receiver **50**, whereupon further supply of liquid to the tank A is interrupted and all excess liquid is withdrawn from this tank.

Most portable tanks are provided in the upper portions thereof with manholes closed by means of covers **70**. Heretofore it has been customary to fill such tanks by opening the manholes and discharging the liquid by means of a hose through the manholes, the air and vapor from the interior of the tank also discharging outwardly through the manhole. This vapor is not only dangerous because of its highly explosive nature, but is also in many cases injurious to the health of employees inhaling the same. When a tank of this kind is filled by means of my improved apparatus and method, the manhole covers **70** are not removed from the tank during the filling of the same and no explosive gases are discharged into the air in the neighborhood of the tank A. The receiver **50** may be located at a considerable distance from the other parts of the apparatus and from the tank A.

The pump **60** may, of course, be eliminated in some cases in which it is possible to permit liquid discharged from the tank A to flow by gravity to the receiver **50**. The condenser **57** may also be eliminated, if it is found that it is not economical or necessary to use a condenser with the particular liquid which is being handled.

72 represents a suction or outlet pipe, by means of which liquid may be withdrawn from the receiver **50** by any suitable means (not shown).

By means of my apparatus, danger of explosion is reduced to a minimum and overloading of the tank A or any of its compartments is avoided. Overloading of the tank is dangerous for the reason that as the tank is transported on a truck or car and the contents thereof become heated, expansion of the liquid in the tank may cause damage to the tank. In spite of this danger, unscrupulous employees sometimes overload the tanks of trucks, particularly in cases where no meters are used, and sell the excess liquid without paying their employers therefor. By means of my improved apparatus, the overloading of tanks or compartments therein is avoided, since by means of the sight glass, overloading of a truck can be readily detected without climbing up on the truck and inspecting the liquid level therein.

My improved construction also adds to the safety of employees operating tank trucks or the like, in that it is not necessary for an employee to climb up on a tank for filling the same through a manhole, where he is also in danger of inhaling gases or vapors discharged through the man-

hole. My improved apparatus is also of simplified construction in that the inlet pipe for the liquid which terminates in the bottom of the tank to avoid splashing, also serves as a discharge pipe for the liquid.

I claim as my invention:

1. An apparatus for filling a tank with a volatile liquid, which includes means for supplying liquid to the tank, suction creating means adapted to be connected with said tank during the filling thereof and including a duct terminating in an inlet arranged at a predetermined level in said tank to determine the quantity to be filled into said tank, whereby air and vapor are withdrawn from the tank through said duct during filling thereof and liquid is withdrawn if the tank is filled above said level.

2. An apparatus for filling a portable tank divided into a plurality of compartments, with a volatile liquid, while the upper portion of the tank is closed, which includes means for withdrawing fluid from each compartment, said means including an inlet located at a predetermined level in and below the top of each compartment, and means for supplying liquid to each compartment, said withdrawing means discharging air and vapor from said compartments while the same are being filled and withdrawing excess liquid from said compartments when the same are overfilled, and a common receptacle into which air, vapor, and liquid from said compartments is discharged from said withdrawing means.

3. A method of filling a tank with a predetermined quantity of a volatile liquid, which includes connecting the tank with an inlet conduit for the liquid and with a discharge conduit terminating at a predetermined level within the tank, applying suction to said discharge conduit and supplying liquid to the tank through said inlet conduit, stopping the supply of liquid to said tank after the level of liquid in said tank rises above said predetermined level, and continuing the application of suction to said discharge pipe until the discharge of liquid therefrom stops.

4. A method of filling a substantially closed tank with a volatile liquid, which includes admitting liquid to the lower portion of the tank, withdrawing fluid in gaseous form from the upper portion of said tank at a predetermined level below the top thereof, chilling the gaseous fluid withdrawn from said tank to condense vapor of said fluid, withdrawing from said tank any liquid above said predetermined level to prevent overloading of said tank, and collecting said last mentioned liquid and the condensate.

5. A method of filling a substantially closed tank with a volatile liquid, which includes admitting liquid to the lower portion of the tank, withdrawing fluid in gaseous form from the upper portion of said tank at a predetermined level below the top thereof, chilling the gaseous fluid withdrawn from said tank, condensing vapor contained in said fluid, removing uncondensed gas from the condensate, withdrawing from the tank any liquid above said predetermined level to prevent overloading of said tank, and collecting said last mentioned liquid and said condensate.

6. The combination with a portable substantially closed tank, a liquid inlet pipe leading to the interior of said tank, a withdrawal pipe extending into said tank and terminating at a predetermined level below the top thereof for withdrawing gas and vapor from said tank during the filling of the same and for withdrawing liquid from said tank if the liquid rises above said level, and valve means mounted in fixed relation to said portable tank for opening and closing said withdrawal pipe.

7. The combination with a portable substantially closed tank, divided into a plurality of compartments, a valve controlled inlet pipe leading to the lower portion of each compartment, a common pipe connected with each of said first mentioned pipes, a withdrawal pipe for each compartment, each of said withdrawal pipes terminating within its compartment at a predetermined distance below the top thereof for discharging air and vapor from said compartments during the filling of the same and for discharging liquid when the liquid level in a compartment is above the terminus of the withdrawal pipe in such compartment, a passage connecting with each of said withdrawal pipes, and a valve connected with each withdrawal pipe for opening and closing the same, whereby any compartment of said tank may be filled or emptied independently of other compartments.

8. The combination with a portable substantially closed tank, a liquid inlet pipe leading to the interior of said tank, a withdrawal pipe extending into said tank and terminating at a predetermined level therein for withdrawing gas and vapor from said tank during the filling of the same and for withdrawing liquid from said tank if the liquid rises above said level, and means for adjusting said withdrawal pipe to vary the level of the inlet opening thereof, and means for collecting vapor and liquid discharged from said withdrawal pipe.

9. A substantially closed portable tank having means for admitting liquid thereto, a withdrawal pipe extending into said tank for withdrawing gaseous fluid therefrom during the filling of the tank and for withdrawing liquid in said tank when the same rises above a predetermined level, said withdrawal pipe having its inlet opening located at said level, said withdrawal pipe including a pair of telescopically arranged conduits for varying the length of said pipe to position the inlet opening thereof at different levels in said tank, a valve for closing said withdrawal pipe and located in the upper portion thereof, a valve stem for actuating said valve, and means for varying the position of said valve on said stem in accordance with adjustments of said telescopic conduits.

10. Apparatus for use in connection with the filling of portable tanks with volatile liquids, including stationary means for releasably connecting said tank with a supply of said liquid for filling the tank, a stationary fluid withdrawal pipe adapted to be connected with said tank when the same is being filled and disconnected therefrom after said tank was been filled, stationary means associated with said fluid withdrawal pipe for withdrawing gaseous fluid from said tank during the filling thereof and for withdrawing excess liquid from said tank if the tank is filled beyond the predetermined level, and means connected with said fluid withdrawal pipe for collecting liquid withdrawn from said tank.

11. Apparatus for use in connection with the filling of portable tanks with volatile liquids, including stationary means for releasably connecting said tank with a supply of said liquid for filling the tank when the same is being filled and disconnected therefrom after said tank has been filled, a stationary fluid withdrawal pipe adapted to be connected with and disconnected from said portable tank, stationary means associated with said fluid withdrawal pipe for withdrawing gase-

ous fluid from said tank during the filling thereof and for withdrawing excess liquid from said tank if the tank is filled beyond the predetermined level, and stationary means for applying suction to said fluid withdrawal pipe to effect withdrawal of fluid from said tank.

12. Apparatus for use in connection with the filling of portable tanks with volatile liquids, including stationary means for releasably connecting said tank with a supply of said liquid for filling the tank, a stationary fluid withdrawal pipe adapted to be connected with said tank when the same is being filled and disconnected therefrom after said tank has been filled, stationary means associated with said fluid withdrawal pipe for withdrawing gaseous fluid from said tank during the filling thereof and for withdrawing excess liquid from said tank if the tank is filled beyond the predetermined level, and a sight glass in said stationary withdrawal pipe to enable an operator to determine whether gas or liquid is being withdrawn from said tank.

13. Apparatus for use in connection with the filling of tanks mounted on vehicles with volatile liquids, said apparatus being located in a relatively fixed position and being adapted to be connected with said tanks during filling of the same and including means for connecting said tank with a supply of said liquid for filling the tank, a fluid withdrawal pipe adapted to be connected with said tank when the same is being filled and disconnected therefrom after said tank has been filled, means associated with said fluid withdrawal pipe for withdrawing gaseous fluid from said tank during the filling thereof and for withdrawing excess liquid from said tank if the tank is filled beyond the predetermined level, a condenser in said withdrawal pipe for condensing vapor withdrawn from said tank, and means for collecting the condensate from said condenser and the excess liquid withdrawn from said tank.

14. Apparatus for use in connection with the filling of tanks mounted on vehicles with volatile liquids, said apparatus being located in a relatively fixed position and being adapted to be connected with said tanks during filling of the same and including means for connecting said tank with a supply of said liquid for filling the tank, a fluid withdrawal pipe adapted to be connected with said tank when the same is being filled and disconnected therefrom after said tank has been filled, means associated with said fluid withdrawal pipe for withdrawing gaseous fluid from said tank during the filling thereof and for withdrawing excess liquid from said tank if the tank is filled beyond the predetermined level, an air separator in said withdrawal pipe for separating gaseous fluid from liquid, and means for collecting liquid withdrawn from said tank.

15. The combination with a portable substantially closed tank mounted on a vehicle, a pipe mounted on said vehicle and extending into said tank and terminating in the bottom thereof and through which liquid may be admitted to or discharged from said tank, a valve on said vehicle controlling said pipe, a withdrawal pipe also mounted on said vehicle and extending into said tank and terminating near the upper portion thereof but below the top of the tank and through which fluid in gaseous form is withdrawn while the tank is being filled and through which excess liquid is withdrawn if the level of the liquid in the tank exceeds that desired, and stationary means adapted to be detachably connected with said withdrawal pipe for removing fluid therefrom.

16. An apparatus for filling a tank with a volatile liquid from a supply of said liquid while the upper portion of the tank is closed, which includes means for supplying liquid to the tank, and a combined vapor discharge and excess liquid discharge duct operable simultaneously with said supply means for withdrawing vapor from the tank and having its receiving opening located within said tank at a predetermined level below the top thereof to determine the quantity of liquid to be filled into said tank and to withdraw liquid in excess of said quantity, whereby vapor and air are withdrawn from said tank during the initial filling thereof and any liquid in excess of the quantity desired in the tank is also withdrawn through said duct, and means for collecting vapor and liquid discharged from said duct.

17. An apparatus for filling a portable tank divided into a plurality of compartments, with a volatile liquid while the upper portion of the tank is closed, which includes a combined gas withdrawal and overflow duct for each compartment, each duct having an inlet located at a predetermined level in each compartment below the top thereof to determine the quantity of liquid to be filled into each compartment, and means for supplying liquid to each compartment, said ducts discharging air and vapor from said compartments while the same are being filled and withdrawing excess liquid from said compartments when the same are filled above said level.

18. Means for filling a portable tank with a volatile liquid, including a valve controlled duct terminating in the bottom of said tank for both inlet and discharge of liquid, and a combined gas and vapor discharge and overflow duct terminating at the upper portion of said tank below the top thereof at a level to determine the quantity of liquid to be filled into said tank, and means for closing said discharge and overflow duct while said tank is in transit.

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