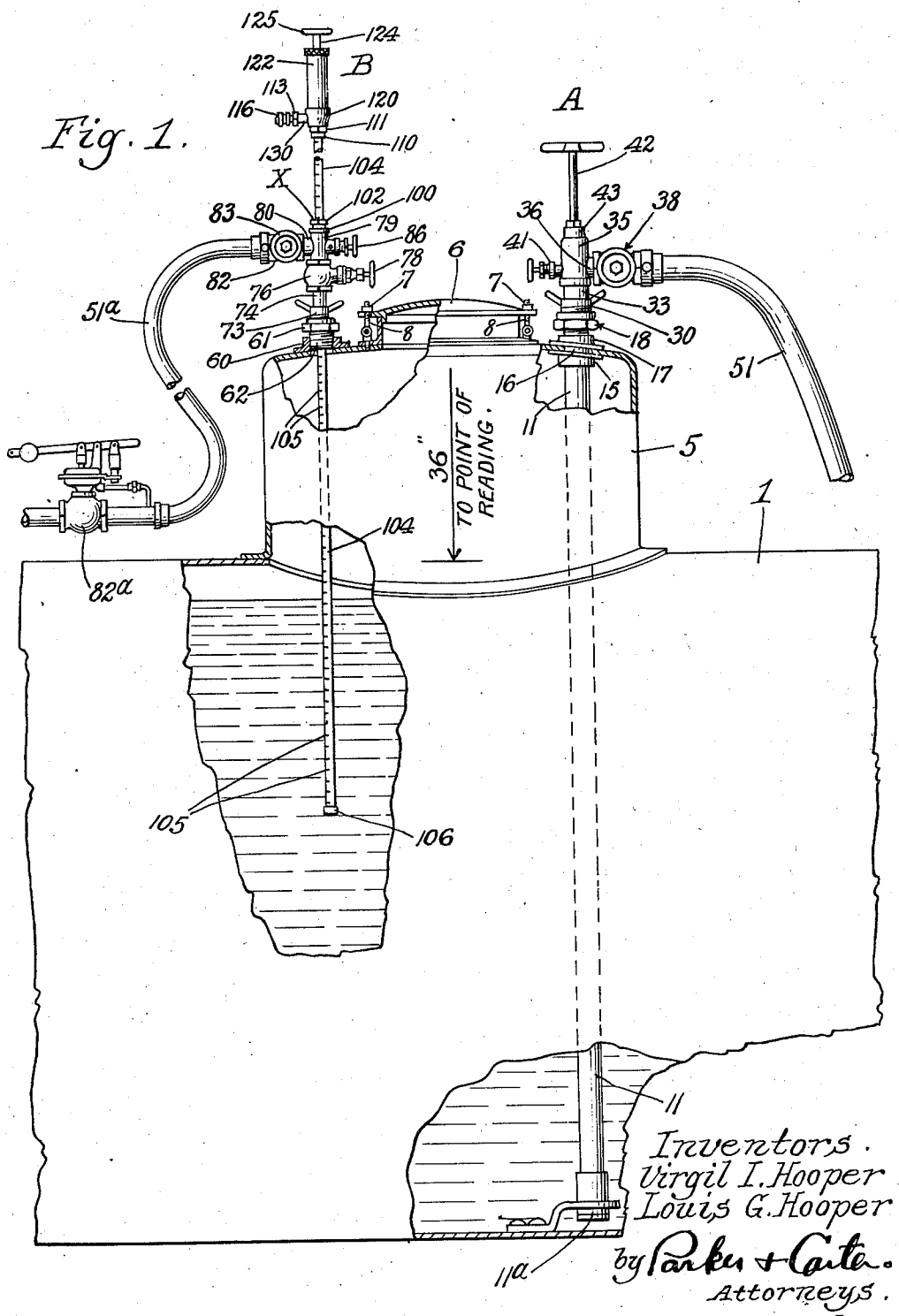
June 3, 1941. V. I. HOOPER ET AL 2,243,847

APPARATUS FOR AND METHOD OF GAUGING AND SAMPLING

Filed Jan. 9, 1939 4 Sheets-Sheet 1

Fig. 1.



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APPARATUS FOR AND METHOD OF GAUGING AND SAMPLING

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Fig. 9.

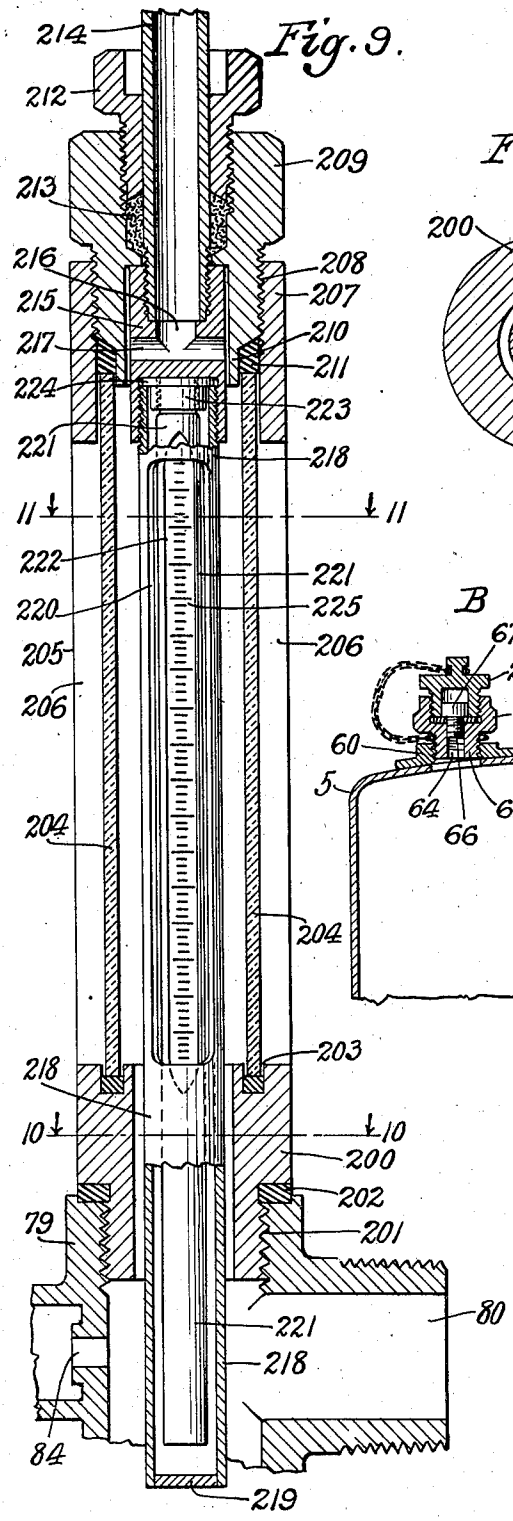


Fig. 10.

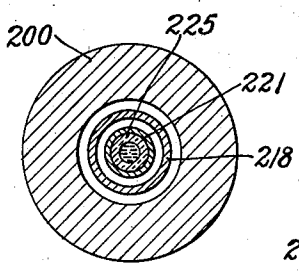


Fig. 11.

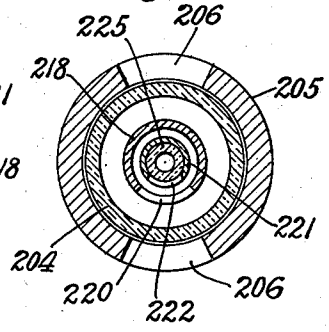
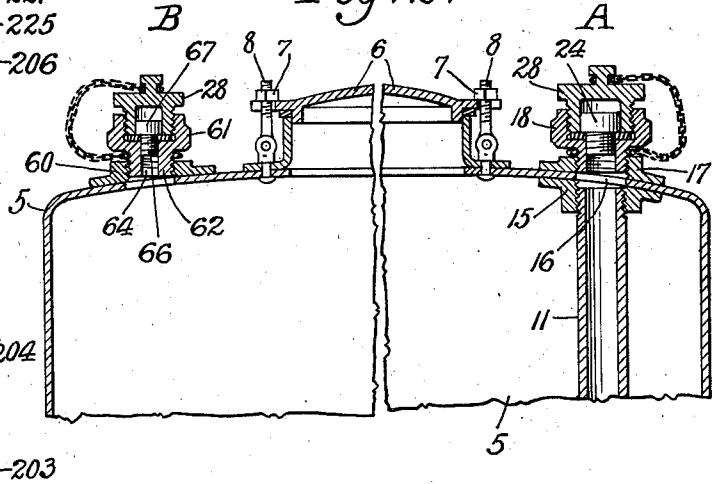


Fig. 2.



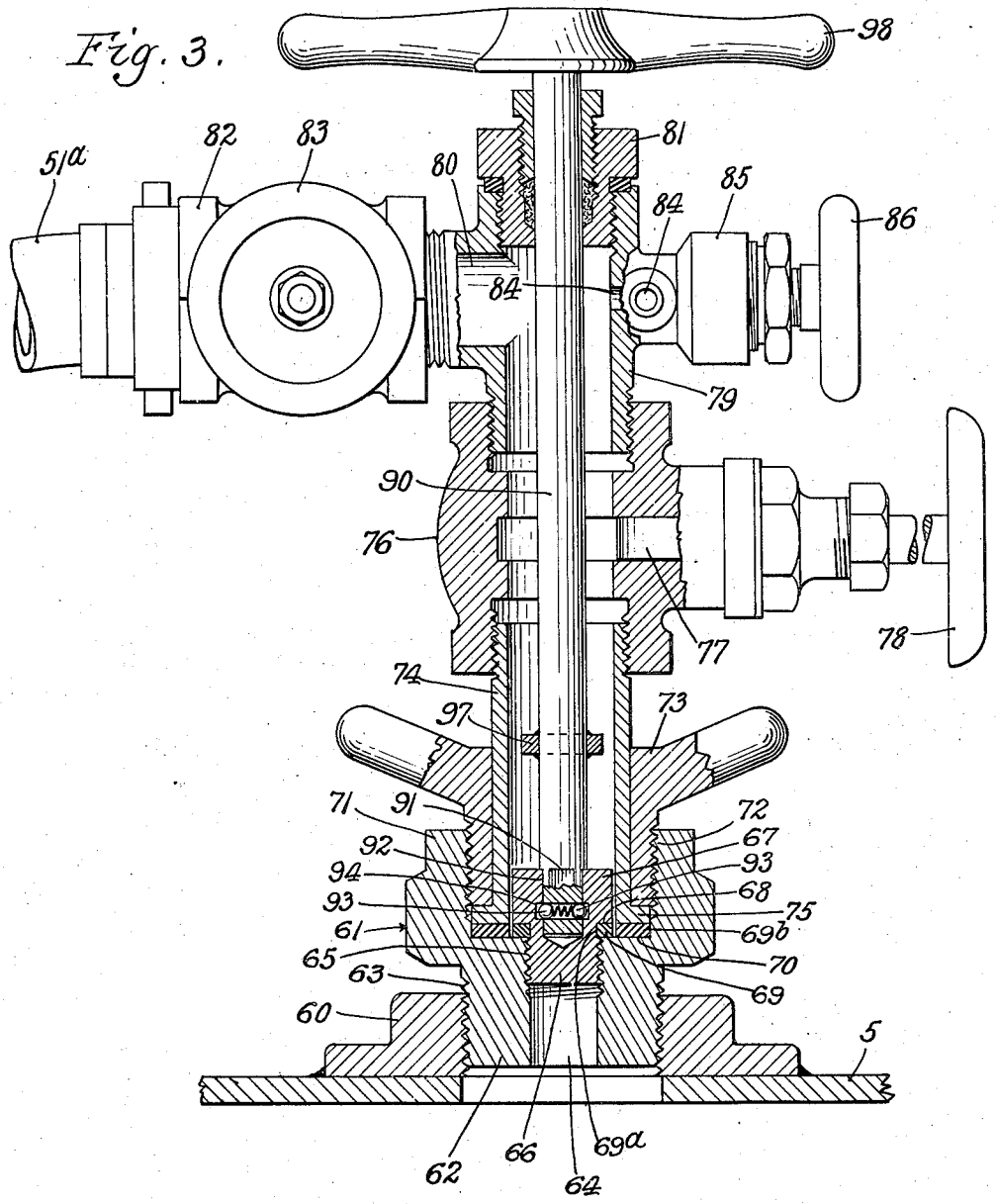
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APPARATUS FOR AND METHOD OF GAUGING AND SAMPLING

Filed Jan. 9, 1939 4 Sheets-Sheet 3

Fig. 3.



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APPARATUS FOR AND METHOD OF GAUGING AND SAMPLING

Filed Jan. 9, 1939 4 Sheets-Sheet 4

Fig. 4.

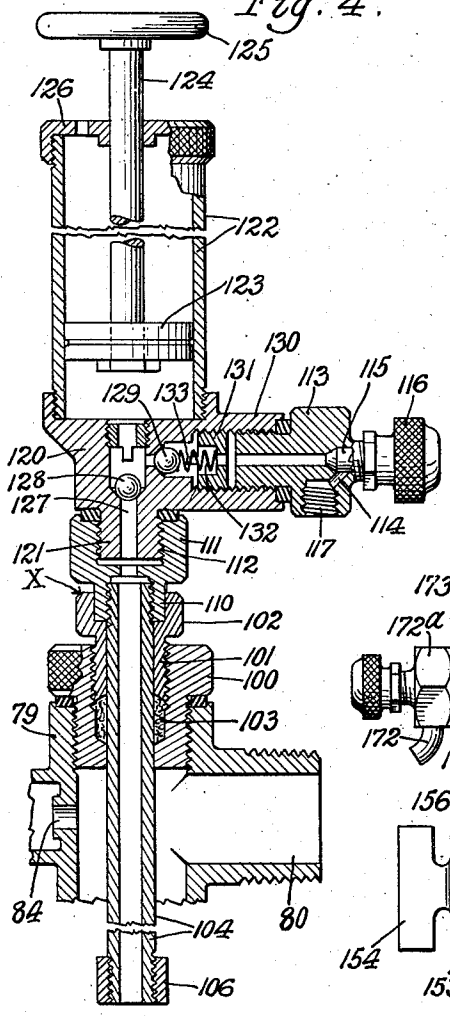


Fig. 8.

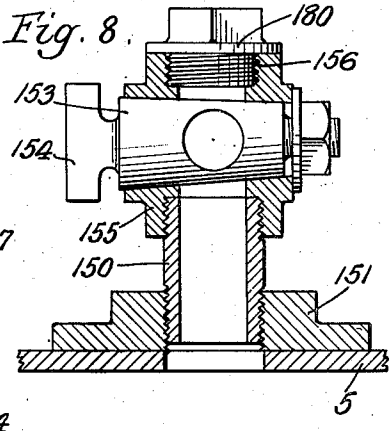


Fig. 7.

Fig. 5.

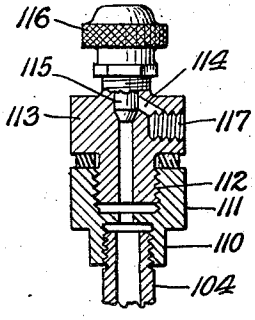
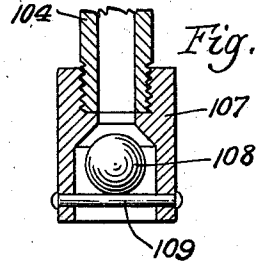


Fig. 6.



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Patented June 3, 1941 2,243,847

UNITED STATES PATENT OFFICE

2,243,847

APPARATUS FOR AND METHOD OF GAUGING AND SAMPLING

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Application January 9, 1939, Serial No. 250,056

15 Claims. (Cl. 62—1)

Our invention relates to a valve assembly for handling liquids, gases or mixed liquids and gases. One purpose is the provision of an improved valve assembly and method for gauging, testing and sampling such materials as they are loaded and unloaded, and at any time desired, and for loading and unloading them into tanks, cars and the like.

Another purpose is the provision of improved means for sampling or gauging the contents of a tank or closed space or stored body of liquid or the like.

Another purpose is the provision of an improved method and means for maintaining the interior of a tank or storage or shipping container for liquids, gases and the like closed to the atmosphere during gauging and sampling, and, in particular, during the application to a tank or removal therefrom of a removable gauging or sampling assembly.

Another purpose is the provision of improved means and methods of gauging or sampling the contents of a tank or closed space which is independent of the existence of a head of pressure within such tank or space.

Another purpose is the provision of an improved means of controlling gas pressure during loading or unloading of such materials, and during sampling, gauging or testing.

Other purposes will appear from time to time in the course of the specification and claims.

We illustrate our invention more or less diagrammatically in the accompanying drawings, wherein:

Figure 1 is a partial side elevation with parts broken away, illustrating the application of our invention to a tank car;

Figure 2 is a vertical, longitudinal section through the dome of a tank car illustrating fittings and closures in place and in closed position;

Figure 3 is a vertical section through the fittings applied to the vent of a tank car;

Figure 4 illustrates the upper portion of the vent assembly with the closure-removing means removed and with a gauging and sampling assembly substituted;

Figure 5 illustrates the gauging and sampling assembly with the gauging pump omitted;

Figure 6 is a detail;

Figure 7 is a vertical section through a variant venting assembly;

Figure 8 is a detail;

Figure 9 is a vertical section with parts in elevation illustrating a thermometer and dipper attachment for the gauge;

Figure 10 is a transverse sectional detail taken at line 10—10 of Figure 9;

Figure 11 is a transverse sectional detail taken at line 11—11 of Figure 9.

Like parts are indicated by like symbols throughout the specification and drawings.

While we are illustrating our invention as applied in connection with a tank car, which is a practical application thereof, it will be understood that it applies equally well to other storage or shipping spaces such as tanks on steamers, fixed storage systems, underground gas storage and dispensing systems and the like. However, we find it convenient to illustrate our invention in connection with tank cars; and its application to tank cars will be understood to be a matter of illustration and not limitation.

Referring to the drawings, and first to Figure 1, 1 indicates any suitable tank herein shown as forming part of a tank car structure. 5 is a tank car dome having a removable cover plate 6, normally held in position by any suitable nuts and bolts 7, 8. It will be understood that any other suitable securing means might be employed. Referring to Figure 1, we illustrate a loading and unloading assembly generally indicated as A; and a gauging and sampling and venting assembly generally indicated as B. The assembly A does not of itself form part of the present invention and is described and claimed in a co-pending application; but it will be cursorily described herewith.

Referring to assembly A, 11 indicates an eduction pipe which may terminate closely adjacent the bottom of the tank 1, shown as screw-threaded or otherwise secured to the flange 15, which is secured to the inner surface of the top of the dome in line with the loading and unloading aperture 16. Preferably, the eduction pipe 11 is provided with any suitable excess-pressure valve, as indicated at 11a in Figure 1. The details of the valve do not of themselves form part of the present invention; but it is valuable to have such a valve so that in the event the valve assembly is prematurely removed or is broken off by accident or is put in communication with the atmosphere, the excess-pressure valve 11a will function to prevent escape of liquids from the tank 1.

Aligned above the aperture 16 is a flange member 17 in which is positioned a fitting 18, the interior of which receives any suitable removable closure member; for example, a screw-

threaded plug 24, not herein shown in detail. Removably secured to the fitting 18 is a passage member 33, which may be secured in place as by the wing nut 30. It includes an upper portion 35 having a member 43, in which is slidably and rotatably mounted the stem 42. It will be understood that this stem may be employed to move the screw-threaded closure 24 to open position. 36 is a side passage in communication with the passage member 33, 35. It may be controlled by a valve assembly 38 in communication with any suitable loading or unloading hose 51. Any suitable additional venting means 41 may be employed.

Referring to the sampling, gauging and venting assembly which forms the subject matter of the present application, 60 indicates a flange or passage member which may be secured to or may be formed integrally with the dome 5 or the dome closure plate 6. We illustrate, as secured to the member 60, a fitting generally indicated as 61. It has a lower portion 62 screw-threaded as at 63 to thread with the inner face of the member 60. The passage 64 is also inwardly screw-threaded as at 65 to receive the screw-threaded portion of a plug 66 having an enlarged upper portion 67 and a shoulder 68 shown in sealing relationship with the gasket 69 on the sealing surface 70. The gasket 69 may be received in a recess 69*a* of the plug 66, whereby it is removed upwardly with plug when the plug is moved upwardly away from the seat 70.

The member 61 has an upper portion 71, of enlarged diameter, which is inwardly screw-threaded as at 72 in order to receive the exterior screw threads of a wing nut 73, herein shown as employed to lock in position the passage member 74 with its bottom flange 75, against which the lower edge of the wing nut abuts. The portion 75 may abut against an outer gasket 69*b*, shown as seated on the surface 70. The upper portion of the passage member 74 is shown as supporting or in communication with a valve housing 76 having therein the gate valve member 77 controlled by an exterior handle 78. We illustrate the gate valve as a practical valve but any other suitable valve might be employed, the purpose being to provide means for closing the top of the passage 74 and for thus maintaining a closure for the tank as a whole when the plug 66 is removed.

79 is a passage member or elbow having a lateral passage 80 and a removable top closure or block 81. 82 indicates a valve closing the passage 80 and having an exterior handle 83 for its actuation, as shown, for example, in Figure 1. The space below the valve 82 may be further vented through the passage 84, controlled by any suitable valve structure generally indicated at 85 and having an exterior control handle 86. Preferably, the passage outlet 84 is of relatively restricted diameter.

As shown in Figure 1, we may employ a pressure relief valve 82*a* of any suitable type and, in that event, may leave the valve 82 open. The result will be that gases within the tank will be prevented from escaping along the hose 51*a* of Figure 1 unless, and until, a sufficient pressure is built up to open the valve 82 and to permit the gases to exhaust. They may be drawn off into any suitable storage zone or used for fuel or otherwise disposed of, but, preferably, are not exhausted to the atmosphere or wasted. When the pressure drops, the valve 82*a* will close and will prevent further gas flow. Thus, it is possible to maintain a predetermined gas pressure within the tank during loading or unloading. This is of particular advantage in loading as it prevents the escape of the lighter "ends" and maintains the volatility of the gasoline, when gasoline is being loaded.

It will be understood that the particular structure of valves and passages herein shown is merely illustrative and is, in a broad sense, diagrammatic. What we wish to provide is a chamber or space which may be employed to surround the closure member 66 or its equivalent, and which can be isolated from the atmosphere and closed in such fashion that when the closure 66 is moved out of closing position there will be no undesired escape of gas and no substantial reduction of pressure within the tank.

In the particular form of mechanism herein shown, we provide the screw-threaded plug 66 and means for unscrewing it while the vent assembly above described is in position and is isolated from the atmosphere and from the rest of the system. We may employ, for example, the stem 90, which is slidable and rotatable in the block or end member 81 and has a squared end 91, which penetrates the corresponding aperture 92 in the plug 66. As a practical means for permitting upward removal of the plug 66 when it is unscrewed, we provide the spring-loaded balls 93, which penetrate a recess 94 within the plug 66, whereby, when the stem 90 is withdrawn to upward position after the plug is unscrewed, the plug 66 will also be upwardly withdrawn. The abutment 97 limits the upward movement of the stem in relation to the block 81 but permits it to be drawn sufficiently upwardly to permit the bottom of the plug 66 to clear the valve 77, whereby, after the plug is released and upwardly withdrawn, the operator can actuate the handle 78 and close the gate valve and, thus, close the interior of the tank.

Assuming that the operator has released the plug 66 and has withdrawn it to upward position and has closed the valve 77, he can then remove the block 81, for example, by unscrewing it, and can then upwardly remove the stem 90 with its handle 98 and attached plug 66. He can then insert the gauging and sampling assembly shown in detail in Figures 4 and 5. He may screw the block or plug 100 into the place previously occupied by the block or plug 81. Upwardly extending from the plug 100 is the fitting 101, which has an upward flange 102, which may serve as a gauge-reading point as indicated at X. The calibration can be used by the operator in connection with the indication shown in Figure 1 of the height from the top of the tank 1 to the reading point X. The details of the calibration and mode of reading are not of themselves part of the present invention. The member 101 serves, also, to exert compression against the packing member 103.

Longitudinally slidable in this block structure is the gauge tube generally indicated as 104, which may be provided with any suitable calibrations 105 in inches or other units. Any suitable enlargement 106 at the bottom of the tube 104 limits its upward withdrawal through the plug 100. If desired, the member 100 may be removed and any suitable excess-flow valve may be applied, as shown in Figure 6. It may include a valve housing 107, a ball 108 and a pin 109 to prevent the downward escape of the ball. It will be understood that when excess gas pressure flows, it will be effective to lock the ball 108

against the bottom of the passage 104 or against the upper end or taper of the aperture of the member 107.

Secured to the top of the gauge tube 104 is a fitting 110, having an upper enlargement 111, interiorly screw-threaded as at 112. In Figure 5, we illustrate as screw-threaded into it a vent-plug assembly 113, which includes an outlet passage or vent 114 and a valve 115 to control it, having an exterior control handle 116. The vent 114 extends into the interiorly screw-threaded aperture 117. If desired, gas or liquid may be allowed to flow through this aperture to the atmosphere, or it may be gathered in any suitable sampling bottle or bomb not herein shown.

The above assembly is satisfactory for use in systems or in handling materials where pressure exists, or is maintained in the tank. Where pressure is not maintained or does not exist within the tank, for example, where gauging liquids which do not cause or are not accompanied by gas pressures; we may apply a pump assembly to the gauging and sampling tube 104. In that case, the assembly 113 is removed and a pump body 120 is applied. It is shown as including a screw-threaded portion 121 in screw-threaded relationship with the threads 112 of the member 111. 122 indicates any suitable pump cylinder in which is contained a pump piston 123, which may be reciprocated as by the stem 124, controlled by the exterior handle 125, passing through the cylinder end 126.

When the piston 123 is upwardly withdrawn, liquid will pass upwardly through the passage 127 and about the valve 128. On the down stroke, the ball valve 128 is locked in closing position by pressure, and the fluid is driven by the compression of the pump against and around the spring-loaded ball valve 129. 130 is an inwardly screw-threaded sleeve in the inner end of which we show a loading disc 131, which holds the spring 132 against the ball 129. The projection or abutment 133 limits the outward escape of the ball against the spring in response to the thrust of the pump. Then, if desired, the assembly 113, shown in Figure 5 and earlier described, is screw-threaded into the member 130, as shown in Figure 4.

Referring to Figures 7 and 8, we illustrate a variant form of structure. A nipple 150 extends upwardly from the dome 5 and may be screw-threaded into a flange 151. 152 is any suitable valve housing having a valve 153, therein shown as controlled by the exterior handle 154. Whereas we have illustrated a turn cock, it will be understood that any other suitable valve type may be employed. The valve housing has an upper aperture surrounded by a flange 155, inwardly screw-threaded as at 156 to receive the passage member 170 having a side passage 171, a vent passage 172 controlled by a valve 172a and an upward extension 173, herein shown as extending above said side passage member and vent. The side passage member 171 may be controlled by any suitable valve 174 in a housing 175, whereby the interior of the passage member 170 may be put in communication with any suitable hose or conduit 176.

Mounted in the upper end of the member 173 is a packing gland comprising a screw-threaded nut or block 177, in which is screw-threaded the member 178, which surrounds the packing 179. Through it may pass the gauge tube 104 with its exterior calibrations 105.

Referring to Figure 8, it will be understood that the nipple 150, when the passage member 170 is removed, may be closed by having the valve 153 turned to closed position. The valve 153 thus remains on the car or tank and is not, of itself, part of the removable assembly. An additional closure may be employed in the shape of the screw-threaded plug 180, which is received in the threads 156 of the valve housing 155.

In Figures 9, 10 and 11, there is shown a modified construction of the slip tube, in which a thermometer and a "dipper" are provided. It is frequently very important to determine the contents of a tank or of a container. This is particularly true in connection with the shipping of volatile liquids in tank cars and tank trucks where the amount of liquid may vary greatly, depending upon the temperature. If the liquid is shipped and measured in relatively cool conditions, later upon an increase of temperature evaporation may continue to occur, and the amount of liquid may appear to be changed. For this reason and for many others, it is highly desirable to be able to take the temperature of the liquid readily. It is, also, frequently desirable to be able to sample the liquid. Where pressure is present, the liquid may rise through the gauge tube, when free to do so; or where there is no pressure, it may be drawn up by the pump mechanism shown. It is, also, sometimes desirable to dip a certain quantity of the liquid bodily out; and where a thermometer is used, it is particularly desirable to bring up a certain quantity of the liquid and to hold that quantity about the thermometer so that the thermometer will continue in the same temperature. If the thermometer is merely dipped into the liquid and then pulled out to a point where it can be read, it may cool off substantially. Bringing up the thermometer surrounded by a body of liquid dipped from the material within the tank avoids cooling or heating of the thermometer, and tends to hold it at the same temperature which it reached while in the body of the tank. These purposes are accomplished by the construction of Figures 9, 10 and 11. The thermometer and "dipper" construction of those figures might be applied to the gauge tube as shown in Figures 1 and 4, or it might be applied to the gauge tube without the pump assembly. It might, thus, be applied to a gauge tube which has merely the top fittings as in the form shown in Figure 5.

If the thermometer assembly of Figure 9 is to be used, it will ordinarily be applied complete, as shown in that figure. The inspection housing there shown comprises an end member 200, threaded as at 201, and carrying, if desired, a washer 202. The member 200 may be grooved, as at 203, to receive one end of a transparent shell 204, which may be of glass, plastic material or any other desired material. The member 200 is preferably integral with the body 205 of the inspection housing, which is split or cut as at 206, 206 so that its contents may be observed. At its upper end, the inspection housing is provided with the member 207, interiorly threaded as at 208, and, in part, surrounding the upper end of the transparent tube 204. A housing bushing 209 is seated in the threading 208. The bushing is provided with a downwardly-depending sectional portion 210. Packing 211 is seated between the portion 210 and the portion 207, and the upper end of the transparent member 204 is received and spaced between these parts. At its

upper end, the bushing 209 is interiorly threaded to receive a packing nut 212, which adjustably holds packing 213 in place. A hollow gauge-tube section 214 is provided, and it may be identical with, or substantially the same as, the tube 104. At its lower end, it is exteriorly threaded and receives a thermometer armor cap 215, which is provided with a longitudinal hollow or passage 216 communicating with a lateral passage 217. A tube 218 is threadedly engaged in the cap just mentioned, and at its bottom is closed as at 219. It may be cut away to provide slots 220. Within the tube 218 is positioned a thermometer tube 221, which may be cut away as at 222. The tube 221 provides an armor and reenforcement for the thermometer 225. As shown, the tube 221 is provided with an enlargement 223 at its upper end, which has a shoulder 224, which shoulder rests upon the upper end of the tube 218. By this means, the thermometer is sustained and positioned within suitable reenforcing and protecting means.

As shown in Figure 9, when the thermometer assembly is to be used, the inspection housing for the thermometer assembly may conveniently be positioned by being substituted for the plug 100, as shown in Figures 1 and 4. When the plug is removed, the threaded portion 201 of the inspection housing is seated in the threaded open end of the member 79, and it, thus, provides a housing extending above the member 79. Because of the transparent wall member 204 and the openings or slots 206, the contents of the housing may be observed. When the slip-tube gauge is pushed down, the numerals or other markings on the gauge can be seen through this transparent housing. After the gauge has been slipped down so that the thermometer has been affected by the temperature of the contents of the tank, the gauge is raised and the thermometer is brought into position so that it can be seen through the openings 206, and the temperature is thus read.

While, ordinarily, where "sampling" is desired the material of the sample will either be forced out by pressure within the container or withdrawn by the pump assembly shown in Figures 1 and 4, it may be desirable to use as a sample the material brought up in the dipper portion of the thermometer arrangement of Figure 9. One way to improve this is to close the valve below the thermometer assembly after the latter has been raised to the position of Figure 9, and, then, to unscrew the member 200, and tip over the assembly so that the liquid flows out of the dipper portion. In general, therefore, it is within the contemplation of our invention to use the dipper portion of the thermometer device as a sampling means. Whether this is done or not, an important use of the dipper portion is, of course, to bring up the thermometer, in part, at least, by the liquid in which it has been immersed so as to guard against heating of the thermometer after it leaves the liquid, and to insure as far as possible that the thermometer remains at the same temperature which it reached while immersed in the liquid; and, therefore, when withdrawn to the observation position gives an accurate reading of the temperature of the main body of liquid within the container.

The thermometer and inspection assembly may be used as indicated or may be used otherwise; and this phase of our invention is not limited to the particular association shown with the other mechanisms illustrated, and the thermometer and inspection assembly might be used in practically any association in which it is desirable to test the temperature of the contents of a tank, and to read that temperature while the tank and associated parts all remain closed to the exterior.

It will be realized that where in the specification and claims we use the term "passage fitting" or "passage fitting associated with the tank," we wish these terms to be interpreted with sufficient breadth to include the formation of a passage integral with the tank or integral with the dome cover or cover plate, it being a matter of choice as to whether or not such a fitting or its equivalent be made removable or be separately formed and thereafter applied permanently to the tank, or if it be formed as part of the tank, dome or cover.

Where in the specification and claims we describe the plug or closure as screw-threaded, it will be understood that we wish such term to be interpreted with sufficient breadth to cover any locking arrangement whereby the plug or closure is locked or unlocked in response to rotation thereof. For example, it will be understood that where we employ an externally screw-threaded wing nut 73 in connection with an internally screw-threaded fitting 61, the relation of the parts may be reversed and the wing nut and the housing 74 may engage the exterior rather than the interior of the fitting flange.

It will be realized that whereas we have described and illustrated a practical and operative method and device, nevertheless, many changes may be made in the size, shape, number and disposition of parts and in the steps of the method disclosed without departing from the spirit of our invention. We, therefore, wish our description and drawings to be taken as, in a broad sense, illustrative or diagrammatic, rather than as limiting us to our precise showing.

The use and operation of this invention are as follows:

An important purpose of our invention is to avoid the enormous losses which take place in the current handling of volatile liquids such as gasolines, casing-head gasolenes and the like, which are prevailingly shipped in insulated containers. In handling highly volatile liquids, it is exceedingly disadvantageous and wasteful to permit such liquids or the gases therein or associated therewith to exhaust to the atmosphere, whether during loading, unloading, gauging, sampling or testing. Our invention enables an operator to load volatile liquids to a tank and to unload, gauge, sample or test them without at any time permitting the storage or shipping zone or such liquids to be in direct communication with or to exhaust to the atmosphere. Our invention is applicable not merely to shipping volatile liquids from point to point, but for fixed or buried storage systems from which liquids or gases are thereafter dispensed or used. It may be used in connection with buried butane or propane systems used for house heating, cooking or the like.

A practical advantage of our loading assembly is that it can be applied to and used in connection with existing equipment, such as tanks, tank trucks and tank cars, without any substantial modification of the present structures and without the necessity of applying new and expensive equipment to tanks, tank cars and the like. A further advantage is that our removable valve and gauge assembly or assemblies can be kept at

loading or unloading points, and may be carried to or removed from fixed tanks, whereby a given assembly or group of assemblies may be employed in connection with a large number of different cars, tanks or the like. We can readily adapt existing cars or tanks to our invention by applying to them the preferably removable and semi-fixed fitting 81, 72 with the closure plug 66 and the outer cover 28. Thus, only inexpensive elements are applied to or are moved with or are installed on the tank cars or tanks while the more expensive and delicate valve assemblies such as are shown at A in Figure 1 may be applied to the tank or car at the time of loading or unloading and may be removed when the loading or unloading operation is completed, and may be stored and serviced at the loading or unloading point. Thus, they are at all times in the hands of competent operators and are not subjected to the hazards of travel or to the abuse which they would receive at the hands of employees who have no direct responsibility for them. It will be clear that a large number of cars can be handled by the employment of a small number of loading, unloading, gauging, sampling or testing assemblies or units.

In handling volatile liquids and, particularly, inflammable liquids, the prevention of any substantial exhaustion to the atmosphere results in an enormous saving of the substances handled. It, also, greatly increases safety, since it prevents the exhaustion to the atmosphere of the large quantities of inflammable gases which are released in current practice. A further advantage is the great saving in time.

As an example of the problem faced during the loading and transit of casing-head gasoline, a considerable portion of the gasoline is driven into vapor so that when the tank car arrives at its destination a very substantial pressure has been built up in the tank. Prevailingly, in the present practice, the closure cap is removed and the gaseous contents under pressure are simply wasted to the atmosphere. This venting has to be permitted since, otherwise, it would be dangerous for the operator to remove the dome cover 6, and it is carried out even where the tank is opened merely for gauging or testing, and not specifically for emptying. Some cars are even provided with a safety cover which prevents their removal until this pressure is vented off. This venting may require several hours, which involves a substantial loss of time. The presence of the vapor in the atmosphere is a hazard since a spark from a passing locomotive may ignite the vapor. As a matter of fact, many lives have been lost from this cause.

Also, the wastage of material is great. In hot weather, cases are known where as much as 3,000 gallons of gasoline have been wasted from a ten-thousand gallon load. The wastage is seldom less than 300 gallons per load, even in cold weather. This involves not merely a money loss to the shipper but a waste of a limited natural resource; and under present practice with present methods and apparatus, it occurs whenever a full tank is opened for any purpose, whether it be to unload, to gauge, to test, to sample or for any other purpose.

Whereas this invention is particularly applicable to and valuable with the handling of volatile and inflammable liquids, it lends itself to the economical handling of a wide variety of liquids, both where pressure is present and where pressure is absent. Lubricating oils, for example, may be efficiently handled through our removable valve assembly. A partial list of substances which can advantageously be handled for loading, shipping, gauging, testing, sampling and unloading includes gasoline, propane, butane, crude oil, lubricating oil, alcohols, volatile solvents, acids, malodorants, poison gases, chlorine gas and liquefied gases in general.

We claim:

1. The method of gauging the contents of a tank, which includes removably positioning a housing adjacent an opening in said tank while said opening is closed by a closure, temporarily fixing said housing in relation to said tank and in sealed relation to said opening, removing said closure through said housing and thereby putting the interior of said tank thereafter into communication with the interior of said housing, and thereafter gauging or sampling the contents of said tank through said housing while maintaining said housing closed to the atmosphere.

2. A method of loading a tank with a liquid, which includes the following steps: applying removable valve assemblies to the inlet and vent apertures of a tank while said inlet and vent apertures are closed, thereafter putting the interiors of the valve assemblies in communication with the interior of the tank; inserting a gauge passage member through the vent aperture and its associated valve assembly, while maintaining the interior of the tank closed to the atmosphere; delivering a liquid to the interior of the tank through the inlet aperture and its associated valve assembly, while maintaining the interior of the valve assembly and the tank closed to the atmosphere; terminating the liquid delivery when the gauge passage with its bottom set at the desired top level of the liquid passes liquid; removing the gauge passage, while keeping the interior of the tank closed to the atmosphere; closing the inlet and vent apertures, while maintaining the interior of the valve assemblies closed to the atmosphere; and thereafter removing the valve assemblies.

3. A method of loading a tank with a liquid, which includes the following steps: applying removable valve assemblies to the inlet and vent apertures of a tank, while said inlet and vent apertures are closed; thereafter putting the interiors of the valve assemblies in communication with the interior of the tank; inserting a gauge passage member through the vent aperture and its associated valve assembly, while maintaining the interior of the tank closed to the atmosphere; delivering a liquid to the interior of the tank through the inlet aperture and its associated valve assemby, while maintaining the interior of the valve assembly and the tank closed to the atmosphere; terminating the liquid delivery when the gauge passage with its bottom set at the desired top level of the liquid passes liquid; removing the gauge passage while keeping the interior of the tank closed to the atmosphere; closing the inlet and vent apertures while maintaining the interior of the valve assemblies closed to the atmosphere; venting said valve assemblies; and thereafter removing the valve assemblies.

4. In a removable valve assembly for tanks and the like, a passage member and means for removably sealing it in relation to an aperture of a tank while such aperture is closed, removable means extending through said passage member for opening and closing said tank aperture while such passage member is in place, including an exterior actuating means, an additional passage

member in communication with said first mentioned passage member adapted for fluid flow, valve means therefor, and means for gauging or sampling the contents of said tank, operable through said passage member and tank aperture.

5. In a removable valve assembly for tanks and the like, a passage member and means for removably sealing it in relation to a tank opening, including a fitting associated with said opening and adapted selectively to receive said passage member or to receive a closure, additional valve means for said tank opening, externally extending means removably positioned within said passage member for actuating said valve means when said passage member is in position, an additional passage member in communication with said first passage member and adapted for the flow of fluids and valve means therefor, and gauging and sampling means mounted on said passage member and adapted for insertion through said passage member and tank opening into said tank.

6. In a testing apparatus, a thermometer, a partially open hollow member surrounding said thermometer, a dipper-like portion formed within said hollow member, said thermometer being located partially within said dipper-like portion, a hollow casing adapted to be secured to a container member, a transparent wall portion for said casing, and a carrier for said thermometer extending into and adapted to be moved through said casing.

7. In a testing apparatus, a thermometer, a partially open hollow member surrounding said thermometer, a dipper-like portion formed within said hollow member, said thermometer being located partially within said dipper-like portion, a hollow casing adapted to be secured to a container member, a transparent wall portion for said casing, a carrier for said thermometer extending into and adapted to be moved through said casing, sealing means on the outer end of said casing about said carrier member preventing the escape of material from said casing, and contacting said carrier member to permit its reciprocation and rotation with respect to said casing, said carrier member being hollow.

8. In a testing apparatus for testing the temperature of tanks and the like, a thermometer, a reenforcing enclosure member surrounding and in contact with said thermometer, said enclosure member partially cut away to reveal said thermometer, a second enclosure member for the thermometer surrounding it and the first enclosure member, said second enclosure member being partially cut away to reveal the thermometer and comprising, also, a dipper portion surrounding a part of said thermometer, and a carrier member for said thermometer and for said enclosures, the thermometer and enclosures being removably secured to said carrier member.

9. The method of gauging the contents of a tank and testing its temperature, which includes removably positioning a housing adjacent an opening in said tank while said opening is closed by a closure, temporarily fixing said housing in relation to said tank and in sealed relation to said opening, removing said closure through said housing and putting the interior of said tank thereafter into communication with the interior of said housing, and thereafter gauging the contents of said tank and testing its temperature through said housing while maintaining said housing closed to the atmosphere.

10. The method of gauging and testing the contents of a tank containing liquid and which is provided with a hollow housing having a transparent wall and means for cutting off the interior of the housing from the interior of the tank, which includes the following steps: inserting a gauging member in said housing, opening said housing to the interior of said tank, passing said gauging member through said housing and into said tank and into contact with the liquid therein, moving a thermometer into said liquid by said gauging member, leaving said thermometer in said liquid until it is brought to the same temperature as the liquid, thereafter withdrawing the thermometer and a body of liquid surrounding it from the tank into the housing to a point visible through said transparent wall portion.

11. The method of testing the temperature of the contents of a tank or the like, which includes the steps of passing a thermometer into the contents of the tank while retaining the tank closed to the air, withdrawing the thermometer and a body of the contents of the tank in which the thermometer is immersed to a point outside the confines of the tank and there observing the thermometer reading while still maintaining the entire thermometer and the body of material about it separate from the outside air.

12. The method of gauging and testing the temperature of the contents of a tank or the like, which is provided with a hollow housing, having a transparent wall portion and valve means for cutting off the interior of the housing from the tank, which includes the following steps: inserting a gauging member through said housing and thereby closing the outer end of said housing to the air, opening said valve, moving said gauging member into the tank and into the contents of the tank, moving it into said housing and reading the temperature while the gauging member is retained within the housing and surrounded by some of the liquid from the tank.

13. The method of gauging and testing the temperature of the contents of a tank or the like, which is provided with a hollow housing, having a transparent wall portion and valve means for cutting off the interior of the housing from the tank, which includes the following steps: inserting a gauging member and thermometer through said housing, opening said valve, moving said gauging member and thermometer into the tank and into the contents of the tank, retaining the gauging member and thermometer in the contents of the tank until that portion which is submerged in the contents is brought to the same temperature as the contents of said tank, thereafter raising the thermometer with a body of the contents of the tank retained about it, moving it into said housing and reading the temperature while the gauging member is retained within the housing and surrounded by some of the liquid from the tank, and subject to the pressure and temperature conditions prevailing within the tank.

14. The method of gauging and testing the temperature of the contents of a tank or the like, which is provided with a hollow housing, having a transparent wall portion and valve means for cutting off the interior of the housing from the tank, which includes the following steps: inserting a gauging member and thermometer through said housing and thereby closing the outer end of said housing to the air, opening said valve, moving said gauging member and

thermometer into the tank and into the contents of the tank, retaining the thermometer in the contents of the tank until that portion which is submerged in the contents is brought to the same temperature as the contents of said tank, thereafter raising the thermometer with the body of the contents of the tank retained about it, moving it into said housing and reading the temperature while the gauging member is retained within the housing and surrounded by some of the liquid from the tank.

15. In a removable valve assembly for tanks and the like, a passage member and means for removably sealing it in relation to a tank opening, including a fitting associated with said opening and adapted selectively to receive said passage member or to receive a closure, additional valve means for said tank opening, externally extending means removably positioned within said passage member for actuating said valve means when said passage member is in position, an additional passage member in communication with said first passage member and adapted for the flow of fluids and valve means therefor, and a gauging and sampling tube mounted on said passage member with one end of said tube adapted for insertion through said passage member and tank opening into said tank and the other end of said tube extending exteriorly of said passage member, and a pump means mounted on said exterior end of said tube in operative communication with the interior of the tube.

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