

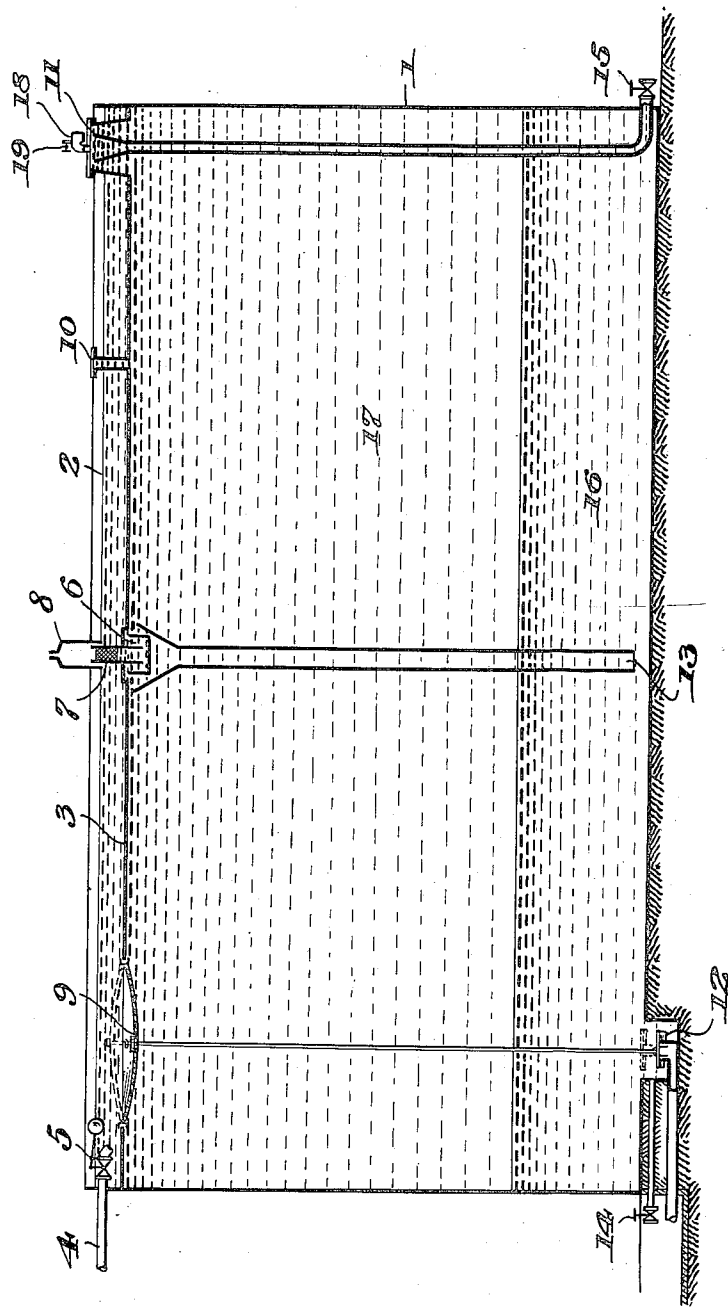
Feb. 22, 1938.

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2,108,945

STORAGE TANK FOR LIQUIDS

Filed Feb. 26, 1937



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UNITED STATES PATENT OFFICE

2,108,945

STORAGE TANK FOR LIQUIDS

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Application February 26, 1937, Serial No. 127,984

7 Claims. (Cl. 220—85)

This invention relates to a storage tank for liquids, especially for inflammable or explosive, and also for non-inflammable yet volatile liquids, of the type having arranged on the top thereof an auxiliary tank adapted for containing a pressure liquid, having a higher specific weight than, and being non-miscible with, the liquid to be stored, said auxiliary tank being connected with the interior of the storage tank proper by means of a conduit, there being provided in addition a feeding and tapping conduit for the storage liquid, reaching up into a dome on top of the tank.

It is the purpose of the invention to insure an automatically acting safe seal of the tapping conduit for the storage liquid guarding same against the penetration of pressure liquid used, such as for instance water, at the same time securely avoiding evaporation and preventing the danger of fire and explosion.

Storage tanks for oil, gasoline, etc., having on top an upper auxiliary tank containing a superimposed column of water serving to impel the storage liquid outwardly, are per se known in the prior art. In such tanks the upper auxiliary tank containing the water is usually connected with the lower or storage tank proper, by means of one or a plurality of pipes establishing an open connection between both tanks. The upper end of the feeding and tapping conduit for the storage liquid extends in the known storage tank upwards into a lantern-shaped upper structure on top, the latter forming simultaneously the bottom of the upper auxiliary tank. In the known device, however, no automatically acting means are provided to prevent in any case pressure water from penetrating into the tapping conduit for the storage liquid; especially in the known case the water level, which is adjusted and kept up to a determined height, by means of a float valve and an overflow pipe, is situated above the upper end of the feeding and tapping line. With the storage tank according to the invention the auxiliary tank arranged on the top may be of such capacity as to be able to take up the whole of the quantity of pressure liquid required for the total emptying of storage liquid from the storage tank. The auxiliary tank may also be of a smaller capacity. In this case it will be necessary to provide for the required feed of pressure liquid to the auxiliary tank by means of a special conduit which is conveniently regulated by a float valve. In case of a plurality of storage tanks being used, the bottom of at least one of the auxiliary tanks placed on top of a storage tank should be higher up than the tops of all other storage

tanks connected with one another by means of pipe lines.

In all the cited arrangements as known in the prior art, the pressure exerted by the storage liquid against the top of the storage tank will vary in direct proportion to the height of the column of liquid contained in the latter. It is a further purpose of the present invention to so regulate the pressure as to keep it constant, whatever the height of this column of liquid may be, and to make instead this pressure dependent upon the height of the liquid column present on top of the storage tank, so as to prevent any extraordinary strain from being exerted upon the tank roof, inasmuch as such pressure is constantly being compensated by the weight of the pressure liquid resting on top of it.

In the annexed drawing an embodiment of the subject-matter of the invention has been illustrated by way of example.

In accordance with the drawing, the storage tank (1) is so built in a per se known manner that it may accommodate a predetermined quantity of water (2) on top of the roof thereof which is of dish-shaped (3). The liquid lever is kept constant by means of a pipe line (4) and a float valve (5) regulating the outflow from the latter.

The tank roof (3) is connected with the interior of the tank (1) by means of a liquid trap or valve acting in the way of a syphon (6), the entrance whereof is protected by a strainer (7) and may be shut off with the aid of a removable cap (8) or similar device to interrupt connection between the interior of the storage tank and the auxiliary roof tank. This may become necessary in order to temporarily relieve the pressure bearing upon the storage liquid at the time of taking measurements of contents, making inspections from time to time, etc. The roof (3) carries in addition thereto a diaphragm (9) the dimensions whereof shall be adapted to the circumstances from case to case and which is made of sheet steel or any other suitable material having sufficient strength and flexibility. Said diaphragm (9) constitutes part of the roof. Furthermore there is provided on top of the roof a measuring hatch (10) as well as a dome (11) for tapping the storage liquid in a similar manner as with the well-known prior devices.

The aforementioned diaphragm (9) is connected with a valve (12) mounted above a sump in the lower part of the tank, by means of a suitable connection, e. g. a connecting rod. The motion of the diaphragm is thereby transmitted

to the valve (12) and gives to the opening or closing of the latter.

Beneath the syphon trap (6) a vertical tube (13) is installed, being open both on its upper and lower ends, serving the purpose to guide the pressure liquid (e. g. water) passing through the syphon (6) into the storage tank, through the storage liquid partly contained therein down to the bottom and thus avoid a dispersion of the water in the shape of drops throughout the body of the storage liquid. Furthermore a drainage valve (14) for draining off pressure liquid and the usual pipe line (15) extending upwardly into the dome (11) installed on the top (3) for feeding storage liquid or tapping such storage liquid from the tank.

In the storage arrangements of this kind known in the prior art, water is always apt to enter the feeding and tapping line, as has been said before, due to the water level in the upper auxiliary tank being substantially higher than the entrance of said line.

In the storage tank according to the invention, the opening of the upper end of said feeding and tapping conduit is placed higher than the level of the pressure liquid (water) contained in the auxiliary tank. Preferably there is provided in the dome of the tank roof into which the feeding and tapping conduit extends, an automatically working venting device, e. g., a valve (18) which will open the interior of the dome situated above the feeding and draining conduit towards the outer atmosphere when nearly all of the storage liquid has been drained from the tank. In addition thereto it is possible to provide an air snifter valve (19), in the highest part of the dome (11). The valve (18) is provided for the purpose of preventing the formation of a vacuum within the space above the pipe line (15) at the moment the storage tank is nearly emptied; this valve will permit entrance of air into this space when this emptied condition is reached. With the aid of the snifter valve (19) it is possible to vent any air which may have become trapped in the tank above the upper end of the pipe line (15) during the pumping in of storage liquid.

Supposing the liquid for storage to be gasoline, the device works in the following manner:

After the storage tank (1) has been completely filled with water and the dished roof (3) contains a sufficient quantity of water to cause upon arrival at the preestablished level of water the automatic closure of the float valve (5), the water pressure acting from within against the top of the tank will be compensated by the weight of the water (2) exerted from the outside against the roof.

Now, gasoline (17) is pumped through the pipe line (15) into the storage tank where by specific gravity it will remain supernatant on top of the water (16); the increase in volume of the contents of the tank will raise the pressure acting against the walls of the tank from within and due to such pressure, the diaphragm (9) which is normally in a retracted position, bulges outwardly while the pressure is not yet able to displace the water column contained in the syphon or liquid trap (6) the height whereof is predetermined accordingly.

The rise of the diaphragm (9) causes the valve (12) to lift from its seat, allowing drainage of an amount of water equivalent to the increase in pressure; the water thus yields to the incoming gasoline. When the feed is interrupted, the pressure falls off and the diaphragm (9) will return

to its primitive position, whereby the valve (12) falls back upon its seat checking the outflow of further amounts of water.

On tapping gasoline from the pipe (15) the inner pressure of the tank decreases, permitting entrance of a corresponding amount of water from the provision existing on the dished tank top (3), passing through the syphon or water trap (6) and being guided through the guiding pipe (13) located therebeneath into the interior of the tank on its way down to the bottom thereof. The water thus drained from the dished recess of the tank top (3) will be replaced by feed from the pipe line (4) and regulated by the float valve (5) connected therewith.

The same compensation of volume will take place in the case of a change of the space occupied due to differences in temperature.

By means of this device it is possible to insure a fairly constant internal pressure within the storage tank, excepting small variations. Such variations are due to the excess pressure necessary for actuating the diaphragm (9) and depending valve (12) for which a value of about 5 to 10 centimeters water column will be sufficient. This very small excess pressure is the only pressure actually bearing on the roof structure.

For the reason pointed out, a special reinforced roof structure is unnecessary; the usual thickness of plates and reinforcing structures necessary to resist the static strains present under ordinary conditions will be fully sufficient. This circumstance tends to considerably reduce the cost of construction of such storage tank.

The device consisting of a diaphragm (9) and co-acting valve (12) is in no way related to the well-known storage tanks having a flexible or "breathing" roof construction, wherein the entire roof constitutes a diaphragm being normally in a dished-in position, and apt to bulge outwardly in case of a rise in internal pressure due to evaporation of part of the storage liquid contents. Constructions of this type have been used in the past wherein the outward bulge of the diaphragm-roof will actuate a safety valve and release the gasoline vapors into the outer atmosphere, but this entails considerable loss of storage liquid and in fact is far from having the compensating effect upon the keeping of a constant pressure by means of the addition or release of pressure liquid only, as contemplated by the present invention.

Measurements of contents, periodical inspections, etc. of the storage tank may be carried out in the manner usual with similar known devices of this kind.

Having now particularly ascertained and described the nature of my present invention, and in what manner the same is to be carried into practice, I hereby declare that what I claim to be of my exclusive invention and property, is:

I claim:

1. In a storage tank for liquids, particularly for inflammable or non-inflammable liquids of a volatile nature having an auxiliary tank disposed on top of the storage tank proper for the purpose of containing a pressure liquid of greater specific gravity than and immiscible with the liquid to be stored, said auxiliary tank being connected with the interior of the storage tank by a pipe connection, an intake and discharge pipe for the stored liquid extending upwardly into a dome disposed on the top of said tank, the upper aperture of said intake and discharge pipe being placed at a higher level than the level of the

pressure liquid contained in the auxiliary tank on top of the storage tank, and yielding power-transmitting means such as a diaphragm built into the top of said tank, said yielding means effecting with the aid of adequate transmission means, such as connecting rods, the outflow of a corresponding amount of pressure liquid by opening closure devices upon exceeding a pre-established internal pressure within said storage tank.

2. In a storage tank for liquids, particularly for inflammable or non-inflammable liquids of a volatile nature having an auxiliary tank disposed on top of the storage tank proper for the purpose of containing a pressure liquid of greater specific gravity than and immiscible with the liquid to be stored, said auxiliary tank being connected with the interior of the storage tank by a pipe connection, said connection between the auxiliary and storage tanks including a liquid valve or trap acting in the way of a syphon, an intake and discharge pipe for the stored liquid extending upwardly into a dome disposed on top of said tank, the upper aperture of said intake and discharge pipe being placed at a higher level than the level of the pressure liquid contained in the auxiliary tank on top of the storage tank, and yielding power-transmitting means such as a diaphragm built into the top of said tank, said yielding means effecting with the aid of adequate transmission means, such as connecting rods, the outflow of a corresponding amount of pressure liquid by opening closure devices upon exceeding a preestablished internal pressure within said storage tank.

3. In a storage tank for liquids, particularly for inflammable or non-inflammable liquids of a volatile nature having an auxiliary tank disposed on top of the storage tank proper for the purpose of containing a pressure liquid of greater specific gravity than and immiscible with the liquid to be stored, said auxiliary tank being connected with the interior of the storage tank by a pipe connection, said connection between the auxiliary and storage tanks including a liquid valve or trap acting in the way of a syphon, a pipe open at both the upper and lower ends arranged directly beneath said liquid valve or trap and leading downwardly to the bottom of the storage tank for guiding the pressure liquid entering from above through said liquid valve or trap, an intake and discharge pipe for the stored liquid extending upwardly into a dome disposed on the top of said tank, the upper aperture of said intake and discharge pipe being placed at a higher level than the level of the pressure liquid contained in the auxiliary tank on top of the storage tank, and yielding power-transmitting means such as a diaphragm built into the top of said tank, said yielding means effecting with the aid of adequate transmission means, such as connecting rods, the outflow of a corresponding amount of pressure liquid by opening closure devices upon exceeding a preestablished internal pressure within said storage tank.

4. In a storage tank for liquids, particularly for inflammable or non-inflammable liquids of a volatile nature having an auxiliary tank disposed on top of the storage tank proper for the purpose of containing a pressure liquid of a greater specific gravity than and immiscible with the liquid to be stored, said auxiliary tank being connected with the interior of the storage tank by a pipe connection, said connection between the auxiliary and storage tanks including a liquid valve

or trap acting in the way of a syphon, a pipe open at both the upper and lower ends arranged directly beneath said liquid valve or trap and leading downwardly to the bottom of the storage tank for guiding the pressure liquid entering from above through said liquid valve or trap, an intake and discharge pipe for the stored liquid extending upwardly into a dome disposed on the top of said tank, the upper aperture of said intake and discharge pipe being placed at a higher level than the level of the pressure liquid contained in the auxiliary tank on top of the storage tank, and yielding power-transmitting means such as a diaphragm built into the top of said tank, said yielding means effecting with the aid of adequate transmission means, such as connecting rods, the outflow of a corresponding amount of pressure liquid by opening closure devices upon exceeding a preestablished internal pressure within said storage tank, said yielding means being so arranged as to react first upon an excess pressure being reached which is not of sufficiently high a degree to exert a lift upon the water column enclosed within the aforementioned liquid valve or trap.

5. In a storage tank for liquids, particularly for inflammable or non-inflammable liquids of a volatile nature having an auxiliary tank disposed on the top of the storage tank proper for the purpose of containing a pressure liquid of greater specific gravity than and immiscible with the liquid to be stored, said auxiliary tank being connected with the interior of the storage tank by a pipe connection, said connection between the auxiliary and storage tanks including a liquid valve or trap acting in the way of a syphon, a pipe open at both the upper and lower ends arranged directly beneath said liquid valve or trap and leading downwardly to the bottom of the storage tank for guiding the pressure liquid entering from above through said liquid valve or trap, an intake and discharge pipe for the stored liquid extending upwardly into a dome disposed on the top of said tank, the upper aperture of said intake and discharge pipe being placed at a higher level than the level of the pressure liquid contained in the auxiliary tank on top of the storage tank, and yielding power-transmitting means such as a diaphragm built into the top of said tank, said yielding means effecting with the aid of adequate transmission means, such as connecting rods, the outflow of a corresponding amount of pressure liquid by opening closure devices upon exceeding a preestablished internal pressure within said storage tank, said yielding means being so arranged as to react first upon an excess pressure being reached which is not of sufficiently high a degree to exert a lift upon the water column enclosed within the aforementioned liquid valve or trap, a vent provided upon the dome of said storage tank top to open the inner space above the intake and discharge pipe towards the outer atmosphere, at the moment nearly all of the storage liquid has been drained from the tank.

6. In a storage tank for liquids, particularly for inflammable or non-inflammable liquids of a volatile nature having an auxiliary tank disposed on the top of the storage tank proper for the purpose of containing a pressure liquid of greater specific gravity than and immiscible with the liquid to be stored, said auxiliary tank being connected with the interior of the storage tank by a pipe connection, said connection between the auxiliary and storage tanks including a liquid valve or trap acting in the way of a syphon, a pipe open at both

the upper and lower ends arranged directly beneath said liquid valve or trap and leading downwardly to the bottom of the storage tank for guiding the pressure liquid entering from above through said liquid valve or trap, an intake and discharge pipe for the stored liquid extending upwardly into a dome disposed on the top of said tank, the upper aperture of said intake and discharge pipe being placed at a higher level than the level of the pressure liquid contained in the auxiliary tank on top of the storage tank, yielding power-transmitting means such as a diaphragm built into the top of said tank, said yielding means effecting with the aid of adequate transmission means, such as connecting rods, the outflow of a corresponding amount of pressure liquid by opening closure devices upon exceeding a preestablished internal pressure within said storage tank, said yielding means being so arranged as to react first upon an excess pressure being reached which is not of sufficiently high degree to exert a lift upon the water column enclosed within the aforementioned liquid valve or trap, a vent provided upon the dome of said storage tank top to open the inner space above the intake and discharge pipe towards the outer atmosphere, at the moment nearly all of the storage liquid has been drained from the tank, said closure devices to be opened by said power-transmitting yielding means, being built into a sump placed at a lower level than the bottom of the storage tank, and a discharge pipe leading from said sump outwardly for disposal of the pressure liquid discharged.

7. In a storage tank for liquids, particularly of inflammable or non-inflammable liquids of a volatile nature having an auxiliary tank disposed on the top of the storage tank proper for the purpose of containing a pressure liquid of greater specific gravity than and immiscible with the liquid to be stored, said auxiliary tank being connected with the interior of the storage tank by a pipe connec-

tion, said connection between the auxiliary and storage tanks including a liquid valve or trap acting in the way of a syphon, said liquid valve or trap being provided with a removable cap for the purpose of interrupting at will the connection between the storage tank and the upper auxiliary tank disposed on top of the latter, a pipe open at both the upper and lower ends arranged directly beneath said liquid valve or trap and leading downwardly to the bottom of the storage tank for guiding the pressure liquid entering from above through said liquid valve or trap, an intake and discharge pipe for the stored liquid extending upwardly into a dome disposed on the top of said tank, the upper aperture of said intake and discharge pipe being placed at a higher level than the level of the pressure liquid contained in the auxiliary tank on top of the storage tank, yielding power-transmitting means such as a diaphragm built into the top of said tank, said yielding means effecting with the aid of adequate transmission means, such as connecting rods, the outflow of a corresponding amount of pressure liquid by opening closure devices upon exceeding a preestablished internal pressure within said storage tank, said yielding means being so arranged as to release first upon an excess pressure being reached which is not of sufficiently high degree to exert a lift upon the water column enclosed within the aforementioned liquid valve or trap, a vent provided upon the dome of said storage tank top to open the inner space above the intake and discharge pipe towards the outer atmosphere, at the moment nearly all of the storage liquid has been drained from the tank, said closure devices to be opened by said power-transmitting yielding means, being built into a sump placed at a lower level than the bottom of the storage tank, and a discharge pipe leading from said sump outwardly for disposal of the pressure liquid discharged.

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