

June 30, 1925.

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SAFETY DEVICE FOR TANKS CONTAINING INFLAMMABLE LIQUIDS

Filed Dec. 10, 1921

2 Sheets-Sheet 1

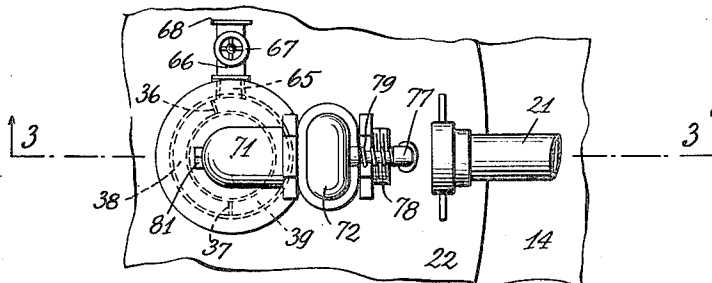
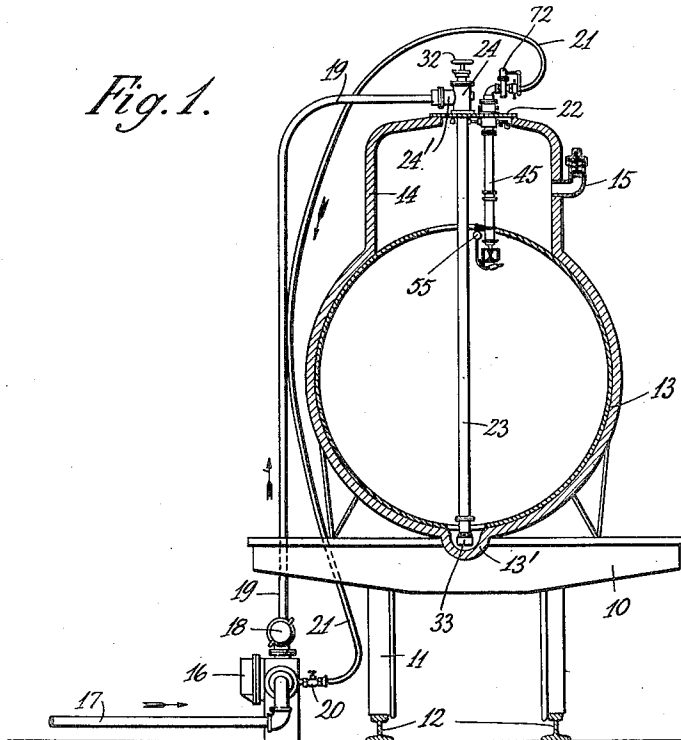


Fig. 2.

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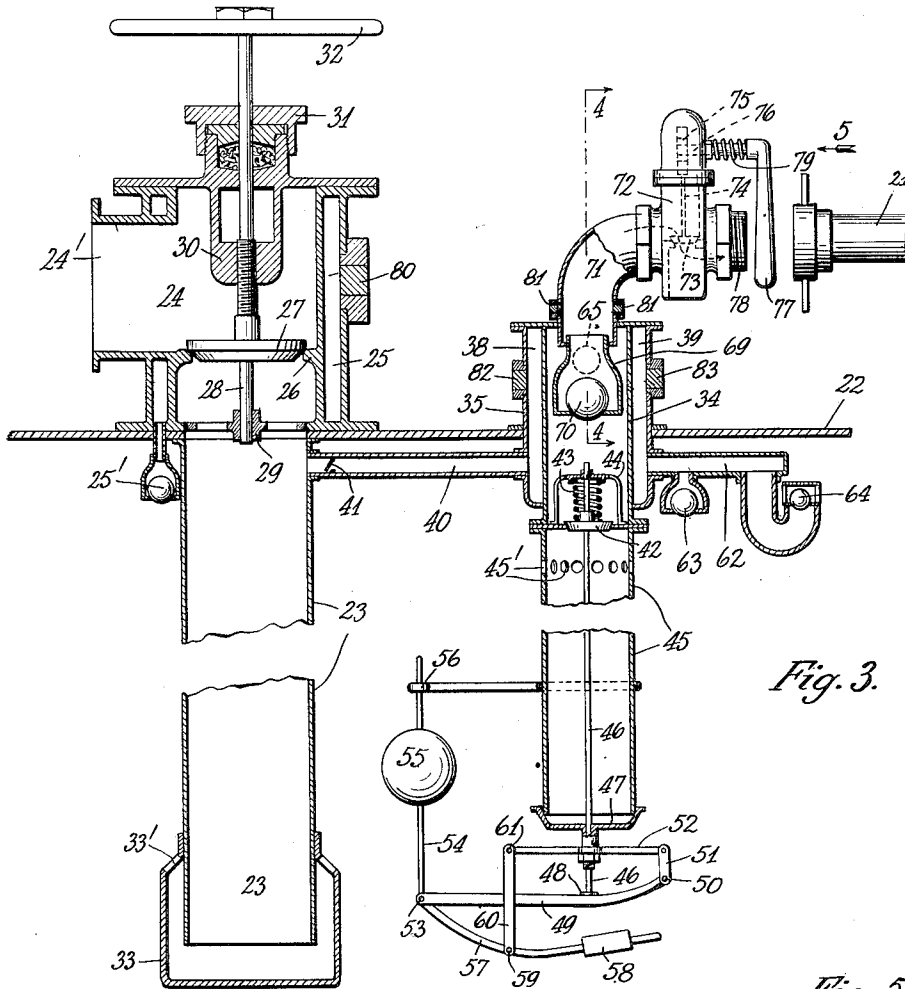


Fig. 3.

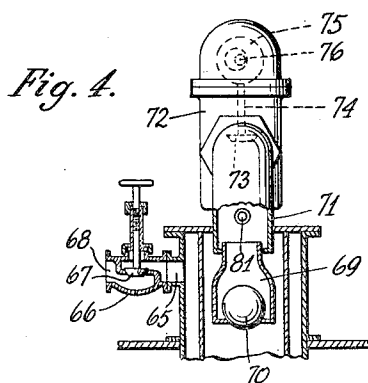


Fig. 4.

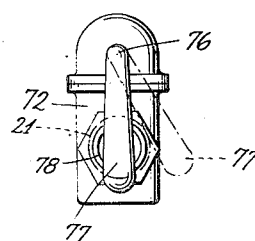


Fig. 5.

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UNITED STATES PATENT OFFICE.

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SAFETY DEVICE FOR TANKS CONTAINING INFLAMMABLE LIQUIDS.

Application filed December 10, 1921. Serial No. 521,437.

To all whom it may concern:

Be it known that we, HENRY L. MOELLER and WALTER J. WILLENBORG, both citizens of the United States, and residents of Weehawken, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Safety Devices for Tanks Containing Inflammable Liquids, of which the following is a specification.

Our invention relates to safety devices, to be used in connection with receptacles, and particularly with tank cars, containing gasoline or other volatile and inflammable liquids. The purpose of our invention is to provide a maximum degree of security against fires, both during transportation of the receptacle and while it is being filled or discharged, and also while the tank is standing or otherwise not in use.

It is also our object, in the preferred form of our invention, to adapt the safety devices to the customary form of tank cars, so that existing cars may, without trouble and material expense, be remodeled to embody our improvements.

A preferred and satisfactory example of our invention will now be described in detail with reference to the accompanying drawings, in which Fig. 1 is an end elevation of a tank car on a track, with the filling-pump connected to our improved safety device, the tank being shown in section; Fig. 2 is a partial plan view, upon an enlarged scale; Fig. 3 is a partial vertical section, upon an enlarged scale, on line 3—3 of Fig. 2; Fig. 4 is a partial vertical section, on line 4—4 of Fig. 3; and Fig. 5 is a partial end elevation, looking in the direction of the arrow 5 in Fig. 3.

At 10 in Fig. 1 we have indicated a portion of the frame of a tank car having wheels 11 to run on the track rails 12, the tank itself being shown at 13. This tank is secured on the car in any well-known or approved manner, and is provided with the dome or expansion chamber 14 customary with many car tanks, a safety-valve 15 of usual type being indicated on the dome, said valve opening automatically when the pressure within the dome exceeds a predetermined limit.—At 16 we have indicated a (generally stationary) pump for filling the tank 13 with gasoline or other liquid, such liquid being supplied to the suction chamber of the pump by the pipe 17, while the pressure chamber of said pump has a dis-

charge connection 18 from which a delivery pipe 19, preferably a flexible hose, leads to the filling connection of the tank, as will be more fully set forth below. The suction chamber of the pump is also connected with a valved pipe or nipple 20 (the valve of which is opened or closed by a hand-wheel, as indicated), to which is attached a suction pipe 21, preferably a flexible hose, adapted for connection with a certain portion of the safety device, as will be explained below.

The dome 14 is provided at the top with an opening closed by a plate 22 which forms a support for the several parts of our improved safety device. It will be understood that this plate 22 is secured to the dome 14 with a gas-tight joint. From said plate extends downwardly a pipe 23, preferably reaching down into a depression or well 13' of the tank 13, the support or plate 22 being apertured in line with the upper end of the said pipe 23. Above said pipe is secured to the support 22 a casing 24, which may be provided with a jacket 25, and connection of said jacket with the interior of the dome 14 is controlled by a ball-valve 25' opening toward the jacket. This jacket and its valve may be omitted. The casing 24 has a passage with a valve seat 26, adapted to be engaged by a valve 27 having a stem 28 the lower end of which is guided in an apertured plate or spider 29 located at the bottom of the casing 24. The upper portion of the stem 28 extends to the outside of the casing 24, and said stem has a screw-thread in engagement with a threaded portion 30 of the casing, and a packing-box or gland 31 of any suitable construction is provided at the top. A handwheel 32 serves for turning the stem 28 and thus opening or closing the valve 27.—At the lower end of the pipe 23, we prefer to provide an arrangement to form a liquid-seal, for which purpose we may employ a cup 33 secured to said pipe rigidly and provided with openings 33' at the top. Such a liquid-seal would be of special value in connection with tanks which are exposed to violent motion, and great changes of position, for instance tanks carried on ships. With the liquid-seal, the lower end of the pipe 23 would dip into a body of liquid even if the main body of liquid contained in the tank should temporarily have its level below the openings 33'.—The casing 24 is provided with a con-

nection 24' for the passage of the liquid either into or from the tank, said connection being adapted to receive, by means of any customary or approved attachment, the upper end of the pump delivery pipe 19.

At a different point of the plate or support 22, there is arranged a vertical pipe 34, surrounded and supported by a jacket 35 suitably secured to said support 22. Approximately radial, vertical partitions 36, 37 divide said jacket into two separate compartments or chambers 38 and 39 respectively, of which the chamber 38 communicates, normally, with the upper portion of the pipe 23, by means of a by-pass or like connection 40, in which we prefer to provide a check-valve 41, opening toward the said pipe 23. The bottom of the pipe 34 has an opening normally closed by a valve 42, under the influence of a spring 43, bearing against a cage 44 located within said pipe 34. To the lower end of the pipe 34 is secured a tubular carrier 45, the interior of which communicates with the interior of the dome 14, by openings 45', so that when the valve 42 is open, the pipe 34 communicates with the interior of said dome. The valve 42 has a long stem 46 guided in the cage 44 and in the bottom 47 of the carrier 45, and bearing with its lower end against a small plate 48 on a lever 49 fulcrumed at 50, to swing about a horizontal axis, on a stationary bracket 51 secured rigidly to an arm 52 attached rigidly to the said bottom 47. The lever 49 has a pivotal connection 53, parallel to 50, with a float lever the upper arm 54 of which carries a suitable float 55, and is guided to slide at 56 in a suitable stationary support. The lower arm 57 of the float lever is preferably provided with a counterweight 58 adjustable toward and from the free end of said arm 57. The latter is also connected, by a pivot 59 parallel to 50 and to 53, with a lever 60 fulcrumed at 61 upon the arm 52.

The chamber 39 of the jacket 35 communicates with an extension 62 the communication of which with the interior of the dome 14 is controlled by a ball-valve 63 opening automatically outward from said dome, and by another ball-valve 64 opening automatically toward said dome, according as there is preponderance of pressure on one side or the other.—The chamber 39 also has a lateral connection 65 leading to a valve casing 66, which has a passage controlled by a valve 67, and also has an opening 68 which normally connects with the outside air, as in Fig. 4, but which may receive the end of a hose or other connection to charge the tank 13 with inert gas, as referred to below.

At the upper portion of the pipe 34 is located a valve-casing 69 containing an out-

wardly-opening ball-valve 70, and said casing communicates with an elbow-pipe 71 leading to a valve-casing 72, the passage of which is controlled by a valve 73. We have indicated a construction of well-known type in which the valve 73 is moved toward or from its seat by its stem 74 and eccentric-mechanism 75 acting on the upper end of said stem and operated by a rocking spindle 76. One feature of our invention consists in providing said spindle 76 with a rigid handle 77 so arranged that when the valve is closed said handle will project across the outlet 78 of the valve-casing 72, as shown in full lines in Fig. 5. The effect of this arrangement is that the outlet 78 cannot be connected with a pipe, such as the suction 21, without opening the valve 73, and, as indicated by dotted lines in Fig. 5, such pipe, while connected with said outlet, will by itself hold the handle 77 in the position in which the valve 73 is open. We also prefer to provide means, for instance a coiled spring 79 (Fig. 3), tending to close the valve 73, and to keep the handle 77, when the valve 73 is open, against the pipe 21, the spring operating to close the valve as soon as the pipe 21 is detached.

For purposes explained below, plugs containing fusible material are provided at various points of the apparatus. Thus a fuse 80 has been indicated on the jacket 25, and if this jacket were omitted, such fuse would be omitted also. One or more fuses 81 would be placed on the elbow 71, and fuses 82 and 83 on the jacket 35, to admit the outside air to the chambers 38 and 39 respectively, in case the fuse 82 or 83 should melt. All of these fuses are preferably on the outside of the apparatus, and therefore in contact with the outside air, as shown.

The preferred way of using the form of our invention illustrated by the drawings is as follows: Before the tank 13 is supplied with liquid, it is preferably charged with inert gas (generally a mixture containing carbon dioxide and a large proportion of nitrogen). For this purpose, a suitable hose or pipe communicating with the gas tank or other source of inert gas, is connected with the nipple or opening 68 of the valve-casing 66, the valve 67 being opened by hand, the valves 27, 42, and 73 being closed. The inert gas will then pass into the chamber 39 and from the latter into the interior of the dome 14 and of the tank 13, through the extension 62 and through the opening controlled by the ball-valve 64, the latter opening automatically. The charge of inert gas forms a non-explosive mixture with the air originally contained in the tank. The tank may then be filled with gasoline or other liquid, and this is the preferred way of filling; but we desire it to be understood that the preliminary charging of the tank

with inert gas may be dispensed with if desired.

To fill liquid into the tank, the gas-supply connection is detached, the valve 67 being left open, the upper ends of the hose 19 and 21 are attached to the connections 24' and 78 respectively. As has been explained above, it will be understood that in order to attach the hose 21 to the connection or outlet 78, the handle 77 controlling the valve 73 must be swung aside to the position indicated in Fig. 5 by dotted lines, this bringing the valve 73 to the open position; in fact, the mere placing of the hose 21 in attached position will automatically swing the handle 77 to the position in which it holds the valve 73 open. The pump 16 is then started to force gasoline or other liquid into the tank 13 through the delivery pipe 19, connection 24' of the casing 24, the passage of said casing, and the pipe 23. The check-valve 41 will close automatically against the passage of liquid from the pipe 23 to the chamber 38 by way of the connection 40. The valve of the pipe or nipple 20 is also opened at the time of starting the pump, or soon thereafter. Of course, the valve 27 is opened before starting the pump.—As the liquid rises in the tank, the gas (or air), or part of it, is expelled correspondingly, the internal pressure opening the ball-valve 63 to allow gas (or air) to pass into the connection or extension 62, the chamber 39, connection 65, valve-casing 66, and into the outside air, since the valve 67 is open. As the level of the liquid rises, it will finally reach the float 55. The latter will be lifted by the liquid, the resistance of the spring 43 being overcome at a certain point, and thus the valve 43 will be opened. The moment this happens, the gas (or air) from the dome 14, which latter communicates with the inside of the carrier 45 by the openings 45', will pass from said dome and carrier into the pipe 34, lifting the ball-valve 70, so as to open an outlet through the casing 69, elbow-pipe 71, valve-casing 72, its outlet 78 and hose 21 to the suction chamber of the pump 16. The gas or air thus admitted to said suction chamber will stop the flow of gasoline or other liquid through the supply pipe 17, and thus, while the pump may continue to run, it will not supply any more liquid to the tank 13 after the liquid therein has reached the predetermined level. This level may be varied, within certain limits, by adjusting the counterweight 58 toward or from the free end of the arm 57. The tank 13 having thus been filled, the valves 27 and 67 are closed, and the upper ends of the pipes 19 and 21 are disconnected, the valve 73 in the casing 72 being closed automatically by the spring 79 as soon as the pipe or hose 21 is withdrawn. The valve in the pump connection 20 is also closed.

In many cases, the presence of gasoline vapors in the tank will be sufficient to supply the pressure required to discharge the liquid from the tank when the valve 27 is opened. If, however, it is considered desirable to increase the pressure, this can be done readily, either by closing the valve 67 before the tank is completely filled with liquid, so that during the latter part of the filling operation, the gas or air will be unable to escape, and will thus increase the pressure in the tank; or, after the tank has been filled with liquid, and the valve 27 closed, a further amount of inert gas may be forced into the tank through the opening 68, the valve 64 opening automatically as such gas is being forced in.

Should a fire occur while the liquid is being pumped into the tank, the melting of the fuse 81 will admit the outside air to the elbow-pipe 71 and stop the liquid-feeding action of the pump, in substantially the same manner as described above in connection with the action of the float 55.

To draw off liquid from the tank, the valve 27 is opened, the outlet 24' being connected by a hose or otherwise to deliver liquid to the desired point. The pressure within the tank will generally be sufficient to expel the liquid as soon as the valve 27 is opened, or at least to start the flow of the liquid. In most cases, the point of discharge from such hose will be materially below the bottom of the tank, so that once the flow of liquid is started, it will continue by siphon action, even if the pressure within the tank should be insufficient, by itself, to cause continued flow. While the liquid is being withdrawn from the tank, all the valves remain closed, except the valves 27 and 67. In some cases, the liquid will be withdrawn from the tank by the action of a pump having its suction port connected (for instance, by a hose) with the outlet connection 24'.

Should a fire occur during the discharge of liquid from the tank, the melting of the fuse 82 will admit the outside air to the chamber 38 and through the connection 40, to the upper portion of the pipe 23, the valve 41 opening to allow such air to reach the pipe 23. If the liquid is being withdrawn by siphon action, this admission of air will break the siphon; if a pump is being used to withdraw the liquid through the pipe 23, the air thus admitted will reach the suction port of the pump. In either event, the flow of liquid will be stopped, and the danger of fire avoided or at least greatly reduced.

Should the valve casing 72 leak, or be broken off accidentally, air or gas will escape from the tank through the valve 42, pipe 34, and valve 70, until the pressure within the tank is substantially equal to atmospheric pressure. The said valves however will

close automatically to prevent the entrance of air into the tank if there should be suction or some other force tending to bring the interior pressure below atmospheric pressure. The provision of the valve 70 is for additional safety, since it might happen that the valve casing 72 would leak or be wrenched off at a time when the amount of liquid in the tank is sufficient to lift the float 55 and open the valve 42; in this event, but for the provision of the valve 70, air from the outside would be admitted to the interior of the tank, through the open valve 42, with the possibility of resulting danger. Should the fuse 80 melt, a communication will be opened from the jacket 25 to the outside air, and the valve 25' would open to allow excess pressure to escape from the tank through such jacket; the valve 25' would however close should there be any tendency of the outside air to pass into the jacket and from it into the dome 14.

Similarly, the melting of the fuse 83 would allow excess pressure to be relieved through the ball-valve 63, the extension 62, the chamber 39, and the opening cleared by the melting of said fuse 83.

If through failure of the spring 79, the lodging of some obstruction, or any other cause, the valve 73 should fail to close, the valve 70 will perform the same function as has been described above with reference to the case in which such function is caused by the breaking or looseness of some part at the upper portion of the elbow-pipe 71.

We claim as our joint invention:

1. A liquid-receptacle provided at its upper portion with a valved pipe for filling and discharging the tank, another pipe adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, a valve normally closing the communication between the upper portion of the receptacle and said second pipe, a float adapted to be engaged by the liquid in the receptacle and operatively connected with said valve to open the same when the liquid rises to a certain level, a jacket surrounding said second pipe and divided into two chambers, one of said chambers being in communication with the upper portion of said first-named pipe, the other chamber having two openings leading into the receptacle, an inwardly-opening automatic valve controlling one of the said openings, and an outwardly-opening automatic valve controlling the other opening, the said second chamber further having a valved connection normally leading to the outside air, and a fuse for admitting the outside air to the first-named chamber when such fuse melts.

2. A liquid-receptacle provided at its upper portion with a valved pipe for filling and discharging the tank, another pipe adapted for connection with the suction port

of a pump used for conveying liquid into the receptacle, a valve normally closing the communication between the upper portion of the receptacle and said second pipe, a float adapted to be engaged by the liquid in the receptacle and operatively connected with said valve to open the same when the liquid rises to a certain level, a chamber connected with the first-named pipe, a fuse for admitting the outside air to such chamber when such fuse melts, another chamber having two openings leading into the receptacle, an inwardly-opening automatic valve controlling one of said openings, and an outwardly-opening automatic valve controlling the other opening, said chamber further having a valved connection normally leading to the outside air.

3. A liquid-receptacle provided at its upper portion with a valved pipe through which the liquid is adapted to pass into and from the receptacle, a structure forming a chamber, a connection leading from said chamber to the upper portion of said pipe and communicating with said pipe at a point located between the receptacle and the valve which controls said pipe, and a fuse for admitting the outside air to said chamber upon the melting of said fuse.

4. A liquid-receptacle provided with a valved pipe through which the liquid is adapted to pass into and from the receptacle, another pipe having a normally closed, float-controlled connection with the interior of the receptacle at the upper portion thereof, and also having an outlet adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, and a valve controlling said outlet.

5. A liquid-receptacle provided with a valved pipe through which the liquid is adapted to pass into and from the receptacle, another pipe having a normally closed, float-controlled connection with the interior of the receptacle at the upper portion thereof, and also having an outlet adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, and a valve controlling said outlet, said valve having a member connected therewith operatively and extending across the outlet to prevent connection of said outlet with a hose or the like unless the valve is thrown open.

6. A liquid-receptacle provided with a valved pipe through which the liquid is adapted to pass into and from the receptacle, another pipe having a normally closed, float-controlled connection with the interior of the receptacle at the upper portion thereof, and also having an outlet adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, a valve controlling said outlet, said valve having a member connected therewith operatively and extending across the outlet to

prevent connection of said outlet with a hose or the like unless the valve is thrown open, and a spring tending to close said valve and to throw said member across the said outlet.

7. A liquid-receptacle provided with a valved pipe through which liquid is adapted to pass into and from the receptacle, another pipe having a connection with the upper portion of the receptacle, which connection is normally closed but opened automatically when the liquid rises to a predetermined level, said pipe also having an outlet adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, and a valve controlling said outlet.

8. A liquid-receptacle provided with a valved pipe through which liquid is adapted to pass into and from the receptacle, another pipe having a connection with the upper portion of the receptacle, which connection is normally closed but opened automatically when the liquid rises to a predetermined level, said pipe also having an outlet adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, and a valve controlling said outlet, said valve having a member connected therewith operatively and extending across the outlet to prevent connection of said outlet with a hose or the like unless the valve is thrown open.

9. A liquid-receptacle provided with a valved pipe through which liquid is adapted to pass into and from the receptacle, another pipe having a connection with the upper portion of the receptacle, which connection is normally closed but opened automatically when the liquid rises to a predetermined level, said pipe also having an outlet adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, a valve controlling said outlet, said valve having a member connected therewith operatively and extending across the outlet to prevent connection of said outlet with a hose or the like unless the valve is thrown open, and a spring tending to close said valve and to throw said member across the said outlet.

10. A liquid-receptacle provided with a valved pipe through which the liquid is adapted to pass into and from the receptacle, another pipe having a normally closed, float-controlled connection with the interior of the receptacle at the upper portion thereof, and also having an outlet adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, a valve controlling said outlet, and a fuse for admitting the outside air to said second-named pipe upon the melting of such fuse.

11. A liquid-receptacle provided with a valved pipe through which the liquid is adapted to pass into and from the receptacle,

a chamber connected with the upper portion of said pipe, a fuse for admitting the outside air to said chamber when said fuse melts, and a check-valve controlling the communication of said chamber with said pipe and opening toward the pipe.

12. A liquid-receptacle provided with a valved pipe through which liquid is adapted to pass into and from the receptacle, and a fuse the melting of which will admit the outside air to said pipe at a point located between the receptacle and the valve which controls said pipe.

13. A liquid-receptacle provided with a valved pipe through which the liquid is adapted to pass into and from the receptacle, a fuse exposed to the outside air, a connection from said fuse to a point of the upper portion of said pipe located between the receptacle and the valve which controls said pipe, and a check-valve controlling said connection and opening toward said pipe.

14. A liquid-receptacle provided with a valved pipe through which the liquid is adapted to pass into and from the receptacle, another pipe having a normally-closed, float-controlled connection with the interior of the receptacle at the upper portion thereof, and also having an outlet adapted for connection with the suction port of a pump used for conveying liquid into the receptacle, a valve controlling said outlet, and a check-valve interposed between said outlet valve and said float-controlled connection and opening toward said outlet valve.

15. A liquid-receptacle having means for the admission and withdrawal of the liquid, and also having a chamber with two openings leading into the receptacle, an inwardly-opening automatic valve controlling one of said openings, an outwardly-opening automatic valve controlling the other opening, said chamber being further provided with a valved connection adapted for the introduction of gas into the receptacle, and a fuse exposed to the outside air and adapted to connect said chamber with the outside air upon the melting of the fuse.

16. A liquid-receptacle having means for the admission and withdrawal of the liquid, and also having a chamber with two openings leading into the receptacle, an inwardly-opening automatic valve controlling one of said openings, and an outwardly-opening automatic valve controlling the other opening, said chamber being further provided with a valved connection adapted for the introduction of gas into the receptacle through said chamber and the opening controlled by the inwardly-opening valve.

In testimony whereof we have signed this specification.

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