

[54] **SAFETY DEVICE FOR THE STORAGE AND DISTRIBUTION OF LIQUIDS, PARTICULARLY HYDROCARBONS, MAKING USE OF A PRESSURIZED AUXILIARY FLUID**

[72] Inventors: **Pierre Capdevielle**, Garches; **Jean Weissmann**, Maisons, both of France

[73] Assignee: **Institut Francais du Petrole, des Carburants et Lubrifiants**, Rueil Malmaison (Huats de Seine), France

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*Primary Examiner*—Henry T. Klinksiek  
*Attorney*—Craig, Antonelli, Stewart & Hill

## [57] ABSTRACT

This invention relates to a safety device for the storage and distribution of liquids, particularly hydrocarbons with the use of a pressurized auxiliary fluid, immiscible with any fluid to be distributed and/or separated therefrom by means of a membrane.

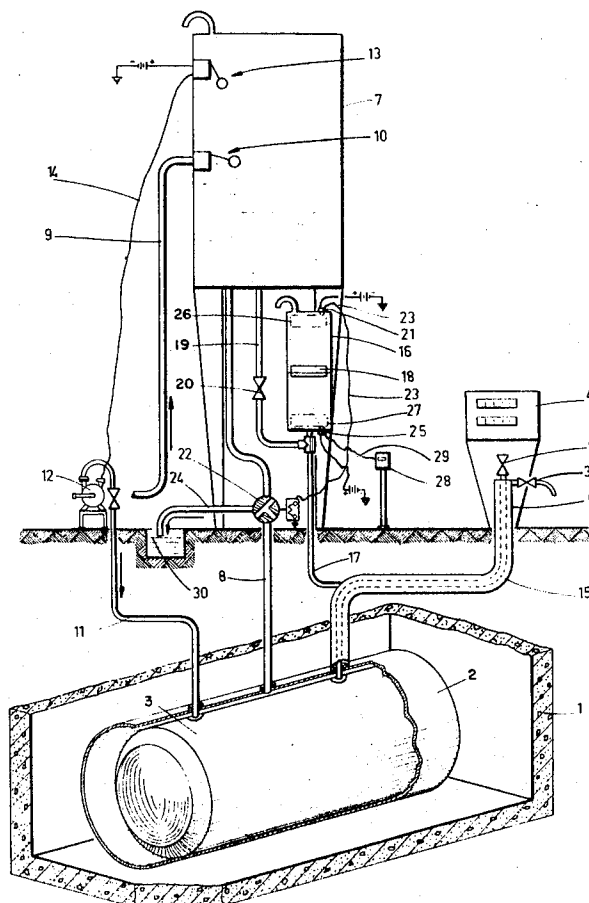
This safety device is particularly suitable for use with the storage and distribution system of the type described in the patent application entitled "New tank structure for the storage and distribution of a plurality of fluids, in particular of hydrocarbons" Ser. No. 887,679, although the use of the device according to the invention is not dependent on any particular structure of the tank for the liquid storage.

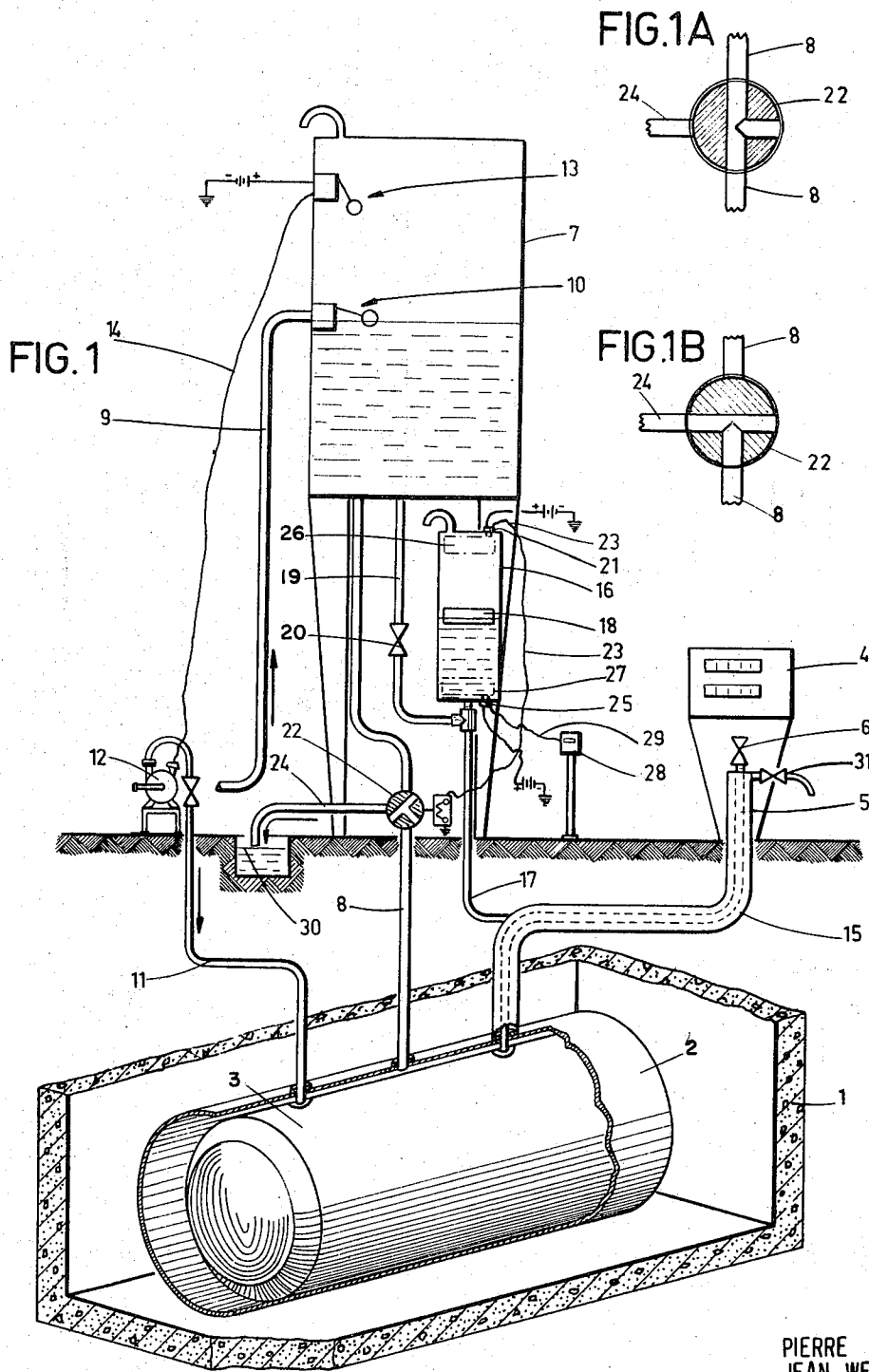
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**9 Claims, 3 Drawing Figures**

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INVENTORS  
PIERRE CAPDEVIELLE  
JEAN WEISSMANN

BY Craig, Antonelli, Stewart & Hill

ATTORNEYS

# SAFETY DEVICE FOR THE STORAGE AND DISTRIBUTION OF LIQUIDS, PARTICULARLY HYDROCARBONS, MAKING USE OF A PRESSURIZED AUXILIARY FLUID

This invention relates to a safety device for the storage and distribution of liquids, particularly hydrocarbons, with the use of a pressurized auxiliary fluid, immiscible with any fluid to be distributed and/or separated therefrom by means of a membrane.

This safety device is particularly suitable for use with the storage and distribution system of the type described in the patent application entitled "New tank structure for the storage and distribution of a plurality of fluids, in particular of hydrocarbons" Ser. No. 887.679, although the use of the device according to the invention is not dependent on any particular structure of the tank for the liquid storage.

In a distribution system of the above-mentioned type it is necessary to completely exclude any liability of uncontrolled flow of the liquid to be distributed, as a result of a breaking or sealing defect of a pipe, particularly where the distributed liquid is dangerous, volatile and/or inflammable.

It has already been proposed for this purpose to surround each duct through which flows the liquid to be distributed, with a tight enclosure defining around said duct an annular space in which the pressurized auxiliary fluid flows in a first stage before reaching the tank where it compresses the liquid to be distributed.

In these conditions a leak through the delivery duct and its enclosure will result in a stopping of the pressurized auxiliary fluid supply to the tank and consequently in a stopping of the distribution.

Such a device suffers however from a certain number of drawbacks.

First of all the stopping of the distribution is not obtained in the case of a small leak which does not result in a sufficient decrease of the pressure of the auxiliary fluid.

In addition, such a device suffers from the drawback, particularly in case of a leakage on the delivery duct, without breaking of its enclosure, of an admixture of the liquid to be delivered with the entirety of the pressurized auxiliary fluid reacting the storage tank, liable to result in the formation of emulsions which may be difficult to split up.

It is therefore an object of this invention to provide a safety device avoiding the drawbacks of the prior devices, which is simple and operated substantially without any other power source than the potential energy of a liquid column, such liquid being for example water.

The safety device of this invention whereby said objects can be attained when storing and distributing liquids, particularly hydrocarbons, by using a pressurized auxiliary fluid supplied to a tank containing said liquid to be distributed under pressure, comprises at least one tight enclosure around each delivery duct, containing a liquid, said enclosure being not in communication with said tank. According to a characteristic feature of the invention this enclosure is in communication with a container extending longitudinally in a direction forming an angle with the horizontal line, associated with means for sensing the liquid level in said container and means for setting a limit upper-level of

the liquid in said container, co-operating with means for interrupting the feeding of said tank with pressurized auxiliary fluid, so as to actuate said interrupting means when the liquid in said container reaches said upper limit as the consequence of a leak of the liquid to be distributed, flowing through the annular space between the delivery duct and its enclosure.

According to a preferred embodiment of the invention the stopping of the feeding of said tank with pressurized auxiliary fluid will be accompanied with the establishment of a communication between said tank and a discharge duct for said auxiliary fluid so as to produce a pressure decrease in said tank.

The means for sensing the liquid level in said elongated container may comprise a float at the surface of said liquid and means for setting an upper-limit level in said container which may consist of an electrical switch adapted to be actuated by contact with the float and placed at the upper part of said container.

The means for stopping the supply of pressurized auxiliary fluid may consist of an electrovalve, preferably of the two-way type, adapted, when actuated, to simultaneously stop the feeding of said tank with pressurized auxiliary fluid and to establish the communication with said discharge duct.

The container provided with the float may advantageously further comprise means for sensing any level decrease in said elongated container, below a lower limit, said decrease being an indication of a leak of the liquid supporting the float.

The invention will be further illustrated by a non-limitative embodiment thereof given by way of example and with reference to the accompanying drawings wherein :

FIG. 1 diagrammatically shows an overall view of the device, and

FIGS. 1 A and 1 B illustrate two different positions of the valve actuated by the safety device.

In FIG. 1, reference 1 indicates a safety pit housing a tank 2 containing an auxiliary fluid maintained under pressure and surrounding a receiver 3 which contains, for example, a hydrocarbon.

The wall of receiver 3 is at least partly formed by a membrane of deformable material, elastic or not, adapted to withstand the hydrocarbon contained therein.

This hydrocarbon is delivered under pressure from the delivery unit 4, through the delivery pipe 5 (shown in dashed line in the figure ).

The hydrocarbon contained in the receiver 3 being maintained permanently under pressure by the auxiliary fluid, is delivered by merely opening the valve 6 located at the end of pipe 5.

The auxiliary fluid, in the illustrated non limitative example, is pressurized water delivered by a water tower 7 through pipe 8, the two-way valve 22 being in its normal position shown in FIG. 1A.

The water tower is filled up through pipe 9 and the water is maintained at a constant level in the tower through any suitable means therefor, such as that diagrammatically shown at 10, comprising a float on the end of an articulated arm, or by use of an overflow pipe.

The receiver 3 is filled with hydrocarbon through pipe 11, by means of pump 12.

For a greater safety the water tower 7 is provided with a level sensor 13, which, in case where device 10 is inoperative and the water level accidentally becomes higher than a preset threshold, actuates through the electrical conductor 14 (by acting on a contactor) the stopping of pump 12 for filling the receiver 3 with hydrocarbon.

The safety device according to the invention will be now further described with reference to the embodiment illustrated in the drawings.

It comprises a tight enclosure 15 surrounding pipe 5, said enclosure filled with water having no communication with the inside of the tank 2 and being only secured to the external wall of said tank.

A vertical elongated container 16 communicates with the tight enclosure 15 through pipe 17 and is provided with a float 18 following the water level in container 16.

The tight enclosure 15 is filled with water from the water tower 7 through pipe 19 by opening valve 20 of said pipe and is brought back to atmospheric pressure by opening of valve 31.

When water overflows through valve 31 (the enclosure 15 being filled) the latter is closed and the water continuing to flow begins to fill the container 16 through pipe 19. The valve 20 is closed when the float 18 has reached in the container 16 a mean level lower than the water level in the water tower 7. The water in the tight enclosure 15 and the container 16 is then completely separated from the delivery circuit of the hydrocarbon contained in the receiver 3.

The illustrated safety device thus offers the advantage of using the same liquid, e.g., water, for feeding both the tank 2 and the container 16, while eliminating during operation periods, any communication between this tank and this container.

At the upper part of container 16 is placed an electrical contactor, adapted to be actuated by the float 18 when the latter is raising up with the water level in container 16 up to a position indicated at 26, as a result of an accidental overpressure in the tight enclosure 15 due to a hydrocarbon leak flowing from pipe 5 surrounded by said enclosure.

This contact then controls, through the electrical conductor 23 the actuation of electrovalve 22 to the position shown in Figure 1 B.

The admission in tank 2 of pressurized water from the water tower 7, through pipe 8 is then immediately interrupted and the pressure in tank 2 simultaneously reduced for safety reasons, by establishing the communication between said tank and the waste pipe 24 (FIGS. 1 and 1 B) whereby a portion of the pressurized auxiliary fluid contained in tank 2 may be discharged to the cistern 30.

The safety device according to the invention thus eliminates any danger which might result from a leakage in pipe 5, by providing a water pressure decrease in tank 2 when such a leakage occurs.

The level in container 16 must of course be so adjusted as to avoid that at any moment the water pressure inside the enclosure 15 may be sufficient for allowing penetration of said water in duct 5, thereby resulting in the admixture of the water with the hydrocarbons, in the case of perforation of pipe 5.

Said safety device offers with respect to those of the prior art, the further advantage according to which the hydrocarbon which might have escaped from pipe 5, can not be admixed but with the very small liquid amount contained in the tight enclosure 15 since said enclosure has no communication with the internal space of tank 2.

There is accordingly no liability of a mixture of the stored liquid, in the present case the hydrocarbon, with the auxiliary fluid contained in the tank 2 and this is an essential advantage with respect to the safety devices of the prior art.

The safety device according to the invention would be still applicable in the case where the stored liquid (e.g hydrocarbon) and the pressurized auxiliary fluid (water from the water tower 7), instead of being separated by the membrane from receiver 3, would be in contact with each other in the tank 2, since the absence of communication between the enclosure 15 and tank 2 prevents any possible accidental backflow to tank 2 of the fluid contained in pipe 5 and thus prevents that inside enclosure 15, an emulsion which could have been formed, following a leakage of pipe 5, might penetrate into tank 2 and be admixed to the liquid to be distributed, making therefore necessary to completely empty the tank in the case of occurrence of a leakage in pipe 5.

There can be advantageously provided another electrical contact 25 at the lower part of container 16 so as to detect a decrease of the liquid level in said container, due to a leak of the safety liquid contained in the enclosure 15, said detection being achieved by means of the signalling device 28 when the float 16 reaches the position shown at 27 in FIG. 1, thereby actuating the contactor 25 which is connected to the device 28 through the conductor 29.

What we claim as this invention is :

1. A safety device for the storage and distribution of liquids, especially hydrocarbons, by use of a pressurized auxiliary fluid that is not dangerous, which comprises a tank means containing a liquid to be distributed, conduit means for supplying said pressurized auxiliary fluid to said tank means wherein pressure is applied to the liquid to be distributed, at least one delivery conduit means connected to said tank means for delivering the liquid to be distributed, enclosure means containing a non-dangerous liquid surrounding each of said delivery conduit means, said enclosure means communicating with a container means, a liquid level limiting means operatively associated with said container means for determining an upper level limit therein and operatively associated with means for interrupting the supply of pressurized auxiliary fluid to said tank means whereby a leak of the liquid to be distributed from said delivery conduit means into said enclosure means forces the liquid in said enclosure means into said container means to the upper level limit, said level limiting means then actuating said interrupting means so that the delivery of the liquid to be distributed is stopped.

2. A device according to claim 1, wherein said liquid level limiting means includes means for sensing the liquid level in said container means.

3. A device according to claim 2, wherein said means for sensing the liquid level in said container means

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comprises a float in the surface of the liquid therein and said liquid level limiting means comprises an electrical switch adapted to be actuated by said float, said switch being located in the upper portion of said container means.

4. A device according to claim 2, wherein said container means comprises an elongated container extending in a direction forming an angle to a horizontal line.

5. A device according to claim 2, wherein said interrupting means is operatively associated with a valve means for establishing communication between said tank means and an exhaust pipe for said auxiliary fluid, said valve means being actuated in synchronism with said interrupting means.

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6. A device according to claim 5, wherein said interrupting means and said valve means include a two-way electrovalve.

7. A device according to claim 1, further comprising means for indicating a decrease of the liquid level in said container means below a lower limit.

8. A device according to claim 1, wherein the liquid in said container means and in said enclosure means is water and the liquid to be distributed is hydrocarbon.

9. A device according to claim 1, wherein a membrane is provided in said tank means to separate the auxiliary fluid from said liquid to be distributed.

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