Disclosure of the invention

Embodiments of the invention propose a solution ranging from inspection to replacement of the components of a system for the storage of fluids, by optimizing ease of access to the tanks and/or to the cavity. Embodiments of invention also aim to optimize the frequency of replacement of some components of the tank on account of wear. More particularly, embodiments of the invention also aim to optimize the lifetime of sensitive components of the storage tank and consequently to limit the intervention necessary to replace said sensitive components.

According to a first aspect of the present invention, there is provided an underground storage system for the storage of fluids. The system includes a cavity formed in a piece of land, said cavity having a bottom, a holder element comprising at least one opening, at least one tank, said tank having a longitudinal axis, a lower end closed by a first closure means, and an upper end closed by a second closure means. The upper end includes a support part, said upper end being assembled to the holder element by means of the support part such that the tank is suspended inside the cavity. The storage system also includes means for access from outside the cavity comprising at least one of the following: means for access to each tank, means for access to the interior of the tanks, and means for access to the contents of the cavity, wherein the tank comprises at least two metal tubes assembled by screwing, in such a way as to form a column of tubes.

Advantageously, the means for access to each tank include a passage formed on the periphery of the holder element.

According to one embodiment, this passage surrounds the holder element. In other words, this passage is then created around the holder element.

According to one embodiment, this passage is formed on an upper surface of the holder element, for example on a flange forming the external contour of the holder element. Forming the passage on such a flange ensures that the flange has a lower surface area sufficient to allow the holder element to rest on the surface of the ground stably while offering an upper flange surface that is completely obstacle-free since it does not have any openings for the tanks.

In one embodiment, this passage may be jointly formed around and on the upper surface of the holder element.

Advantageously, the means for access to each tank comprise a corridor located on the holder element. Such a corridor advantageously makes it possible to access, from the holder element, one or more tanks that are not accessible from the passage formed on the periphery of the holder element.

Such a passage or such a corridor are surfaces free of obstacles and allow an operator to move around so as to have direct access to the tanks located along said free surfaces. Typically, by virtue of such a passage or such a corridor, the operator can access a tank directly in order to directly handle the first closure means.

The means for access to the interior of the tanks comprise a sacrificial auxiliary part interposed between the second closure means and the support part.

Advantageously, the sacrificial auxiliary part is removable. Thus, this sacrificial auxiliary part may be removed from the tank for access to the interior of the tank. Furthermore, this sacrificial auxiliary part constitutes an element that is easy to replace, for example after being screwed/unscrewed three times with the closure means during maintenance operations, allowing the support part to have a longer service life.

According to one embodiment, the means for access to the interior of the tanks comprise a plurality of sacrificial auxiliary parts interposed between the second closure means and the support part removably, each sacrificial auxiliary part making the support part last longer.

According to one embodiment, the means for access to the contents of the cavity comprise at least one suction pipe for a fluid and/or a solid and at least one injection pipe for a fluid and/or a solid. The injection pipe makes it possible to inject a fluid and/or a solid into the cavity, typically so as to surround the tank or tanks inserted in the cavity with said fluid and/or solid. Likewise, the pumping pipe makes it possible to remove said fluid and/or solid from the cavity in such a way as to allow pumping and circulation of the fluid and/or the solid present at the bottom of the cavity.

According to one embodiment, the means for access to the contents of the cavity comprise a site outside the cavity, the injection and/or suction pipes opening out in and/or being controlled from this site outside the cavity.

Advantageously, the tank comprises at least one metal tube, said metal tube having at least one end segment provided with at least one threaded portion.

Preferably, the support part includes a lower threaded portion. The metal tube or the column and the support part are assembled by screwing together a threaded portion of said or one of said metal tubes forming the column and the lower threaded portion of the support part.

Preferably, the tank is suspended inside the cavity such that an axial clearance adapted to absorb an axial thermal expansion of the tank exists between the first closure means of the tank and the bottom of the cavity.

Advantageously, the axial clearance adapted to absorb an axial thermal expansion of the tank satisfies the following inequality:

[Math 1]

$$G \geq (L^2 * \beta * \alpha) + [20 * \alpha * 80 * (1 - e^{-0.11*L})]$$

Where: G is the length of the axial clearance expressed in metres, L represents the length of a tank expressed in metres between the holder element and the lower end of the tank, β represents the geothermal gradient of the land expressed in degrees Celsius per metre, α represents the coefficient of thermal expansion of the metal from which the tank is made, expressed in metres per degree Celsius.

Preferably, the support part includes an upper threaded portion and the sacrificial auxiliary part is mounted sealingly on the support part by screwing onto said upper threaded portion.

Optionally, the first closure means and/or the second closure means is adapted to close the tank sealingly by screwing. For example, the first closure means is screwed onto an upper threaded portion of the sacrificial auxiliary part.

According to one embodiment, the storage system comprises a plurality of tanks, each tank having a longitudinal axis, a lower end and an upper end, said upper end of each tank being adapted to be assembled to the holder element by means of a respective support part such that each tank is suspended inside the cavity.

Advantageously, the cavity includes at least one watertight lining, said watertight lining being made of concrete, cement, or steel.

According to a second aspect of the present invention, there is provided an underground storage method for the storage of fluids via a

storage system as described above. The method includes at least the following steps:

- forming a cavity in a piece of land, said cavity having a bottom,
- providing a holder element comprising at least one opening adapted to receive a support part,
- providing at least one tank, said tank having a longitudinal axis, a lower end and an upper end, said upper end including the support part,
- providing a first closure means adapted to close said tank at its lower end, and a second closure means adapted to close the tank at its upper end,
- assembling said upper end to the holder element by means of the support part such that the tank is suspended inside the cavity, and
- forming means for access from outside the cavity comprising at least one of the following: means for access to each tank, means for access to the interior of the tanks, and means for access to the contents of the cavity.

Definitions

"Lower end" of the tank means the end of the tank located close to the bottom of the cavity. This "lower end" is defined as opposed to