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UNDERGROUND STORAGE VESSEL

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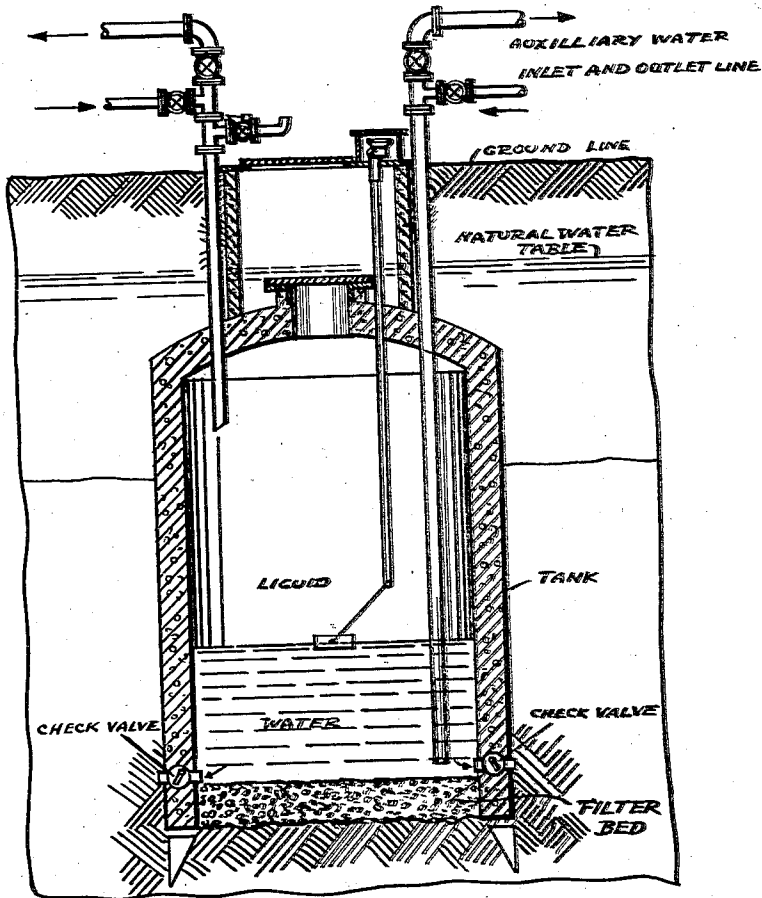
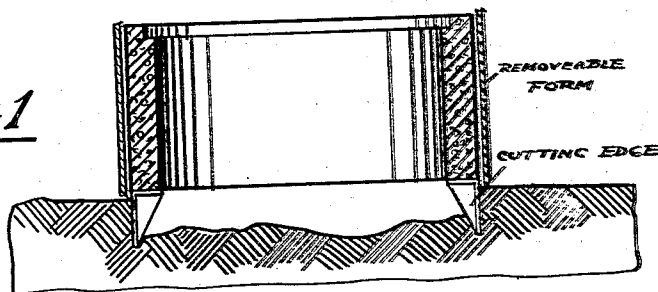


FIG.-2

FIG.-1



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UNITED STATES PATENT OFFICE

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UNDERGROUND STORAGE VESSEL

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1 Claim. (Cl. 221-67)

The present invention is concerned with an improved underground storage vessel. The invention is more particularly concerned with an underground storage vessel which is especially adapted for the storage of liquids as, for example, petroleum oils and the like. In accordance with the present invention liquids having a specific gravity less than that of water and which are relatively immiscible therewith are stored in subterranean vessels which are characterized by having a lower seal comprising ground water.

It is known in the art to store various substances in subterranean vessels, chambers, and the like, in order to maintain these substances at a relatively constant temperature and to prevent loss of the same. It has also been proposed that liquids such as motor fuels, relatively low boiling hydrocarbon constituents, lubricating oil fractions, and the like, be stored in various subterranean vessels in order to prevent loss of the same by evaporation or by pumping and the like. Furthermore, by the utilization of subterranean storage vessels considerable losses are avoided by the elimination of breathing due to expansion and contraction of vapors with the daily temperature cycle normally encountered in conventional storage vessels. It is also desirable to employ vessels of this character in order to prevent loss against bombing or artillery attacks. However, the various storage vessels proposed are relatively difficult to install or possess other objectionable characteristics.

It is the object of this invention to provide an improved subterranean storage vessel which is relatively easy to install and from which the stored material may be readily introduced or withdrawn. The invention essentially comprises utilizing a storage vessel or chamber which is characterized by having a lower seal comprising water which is open to the ground water.

The process of my invention may be readily understood by reference to the drawing illustrating embodiments of the same. Figure 1 illustrates a preferred method for installing the vessel while Figure 2 illustrates the vessel in place. Referring specifically to Figure 1, it is assumed for the purpose of description that the vessel is installed by employment of the Caisson method. The first step in the construction and installation of the vessel is to place the cutting edge in the ground. This cutting edge in horizontal cross section follows the form of the outside shape of the shell of the vessel to be installed. The cutting edge may be built of structural steel or may be cast so that a portion of it will extend

into the shell of the vessel in order to obtain a bond with the tank. Concentric sections of removable forms are placed over the cutting edge so that an annular space is formed. Reinforcing steel is placed in this annular space and concrete is poured therein. After the concrete has set the forms are removed and earth is excavated from the area within the concrete shell, thus permitting the shell to drop gradually so that the forms previously used can be set on top of the concrete ring previously formed. The operation is repeated until the required height of shell has been constructed and the bottom of the shell reaches the desired level. The roof may be constructed before or after the shell reaches the desired level. As described, the Caisson method is based on the use of reinforced concrete for the shell but other suitable materials such as steel or cast iron may be used. The vertical portion of the shell may be any practical horizontal cross section but a circular cross section is preferable.

Referring specifically to Figure 2, a cross section of the installed tank is illustrated. The vessel is open and sealed at the lower part by water which communicates directly into the natural earth water. The vessel is shown in the form of a bell, a part of which is below the natural underground water level. The vessel is also preferably of sufficient length so that an adequate depth is attained and so that the bottom thereof may be filled with a suitable filtering material such as sand, gravel, or similar substances which may be used for the purpose of preventing silt from reaching the interior of the vessel. The vessel is also provided with an adequate level gauge equipment as well as suitable inlet and outlet lines and the like.

It is to be understood that the invention may be widely varied. The invention essentially comprises utilizing an underground storage vessel which is adapted for storing fluids having a specific gravity of less than about one and which are substantially immiscible with water, which vessel is characterized by being sealed at the lower portion with water which communicates with the natural ground water. The vessel is also disposed so that at least a portion of the vessel is below the natural underground water level.

Although the vessel may be adapted for the storage of any liquids or gases of the character described, it is particularly suitable for the storage of petroleum oils, especially relatively low boiling petroleum oils which have relatively high

vapor pressures and which are very susceptible to loss by evaporation and by fire.

By utilizing storage vessels as described, it is possible to store liquids and gases and take advantage of the natural water pressure which is exerted at the bottom of the vessel or which is exerted through the filter bed provided a filter bed be employed in the operation of the vessel. The vessel upon construction is vented to the atmosphere which allows water to flow through the filter bed into the tank and to rise in the tank to the level of the exterior natural water level. The liquid which is to be stored is pumped into the tank displacing the water through the filter bed or through the auxiliary water outlet line, the latter being used if displacement through the filter bed is not rapid enough. After the liquid displaces the water to such an extent that the water level in the tank is still above the filter bed, all valves in the liquid and water lines are closed and the liquid is thus stored until needed. For withdrawing the liquid the valve in the outlet line is opened and the external water pressure forces the liquid through the outlet line. If the

discharge rate is insufficient to meet requirements, water is forced into the tank through the auxiliary water line.

What I claim as new and wish to protect by Letters Patent is:

In an underground storage tank adapted to be placed below the natural water level comprising a cylindrical vessel having its lower end sealed with filtering material for the entrance of ground water, valve means located immediately above said filtering material adapted to prevent the flow of water therethrough into said vessel, said valve means being so constructed that water is free to pass therethrough from the tank, means for introducing into said vessel under pressure, fluid material to be stored therein, means for balancing the pressure of said fluid against the natural water pressure exerted through the bottom of said vessel and means for releasing the pressure on the fluid stored in said vessel whereby advantage is taken of the natural water pressure in releasing said fluid from said vessel.

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