

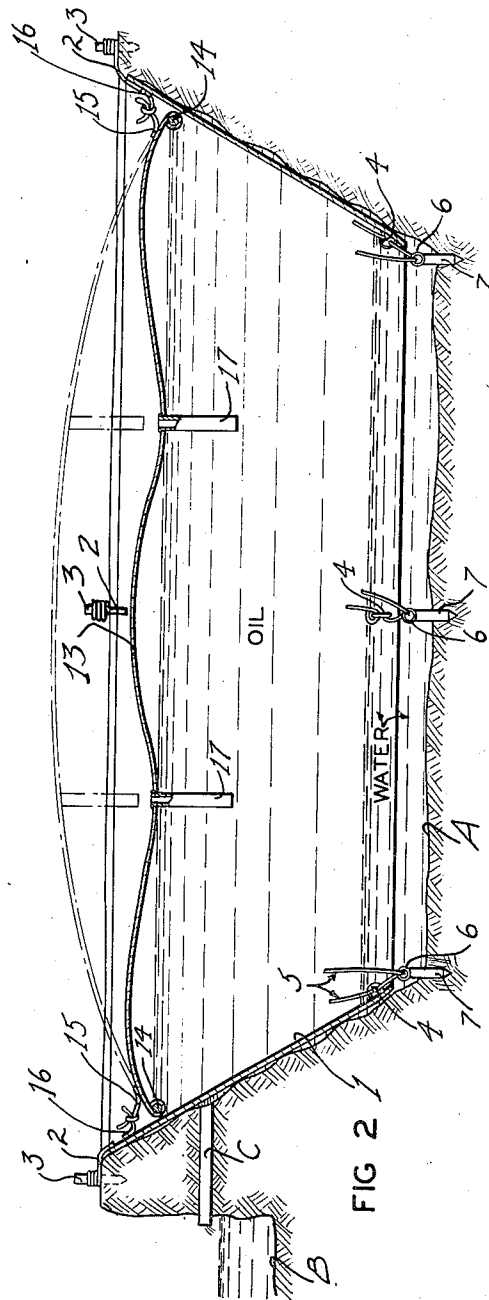
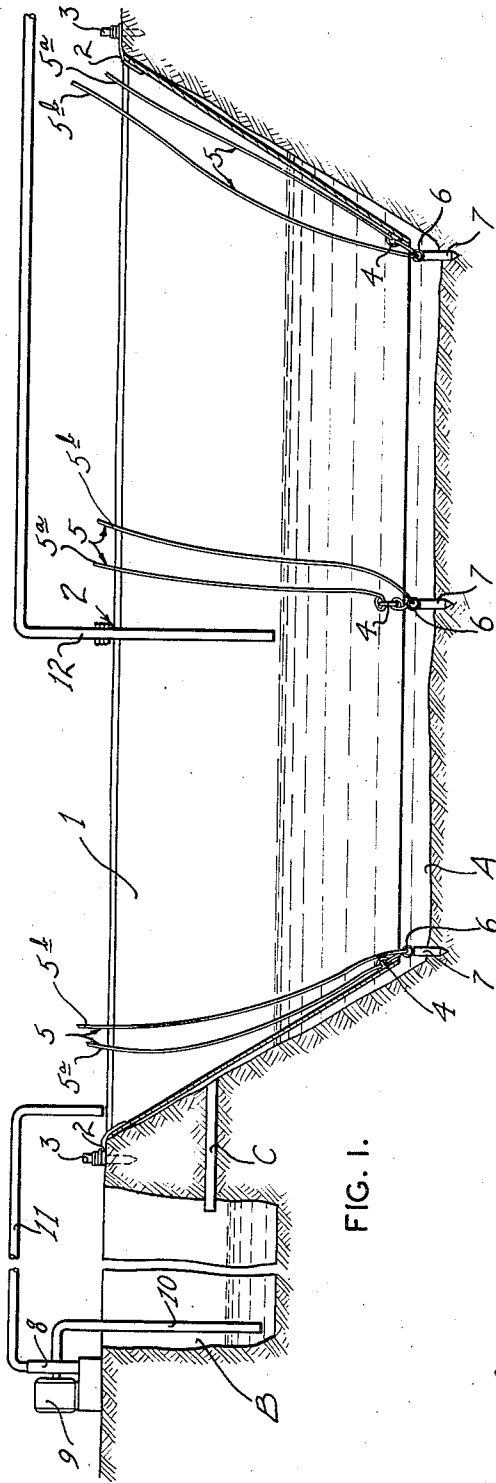
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RESERVOIR

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RESERVOIR

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This invention relates generally to reservoirs adapted for use in storing oils, gasoline, and other liquids having a lower specific gravity than water, and more specifically to the type of reservoir which includes the use of a storage pit dug in the ground, the predominant object of the invention being to greatly reduce the cost of constructing a storage reservoir of the type mentioned by employing as a part of the improved reservoir construction a receptacle for the stored liquid which is produced from relatively inexpensive flexible material instead of metal as was the case heretofore.

Prior to this invention reservoirs for storing oils, gasoline, and other liquids were employed which comprised simple pits dug in the ground, in which the liquid to be stored was disposed, but, due to losses of the stored liquid resulting from seepage thereof into the earthen side walls and bottoms of the pits this system of storage has not been extensively employed. In order to eliminate the seepage losses mentioned, the expedient was heretofore adopted of arranging metallic, bottomless receptacles in the pits, and locating bodies of water in the lower portions of the pits which contacted with the side walls and the bottoms of the pits and extended upwardly into the metallic receptacles to support on the surface of the water the stored liquid. In this manner the stored liquid was maintained out of direct contact with the earthen side walls and bottoms of the pits and therefore the problem of seepage losses was eliminated. However the reservoir construction just described was not entirely satisfactory for the reason that the requirement that a metallic receptacle of very large dimensions be provided rendered the cost of constructing the reservoir almost as great as would be the cost of building an above-the-ground storage tank of corresponding proportions.

The main purpose of the present invention is to provide a reservoir structure of the pit type which is relatively inexpensive when compared with reservoir structures of this type that include large metallic receptacles for receiving the stored liquid. This purpose is accomplished by employing as a part of the improved reservoir structure a bottomless receptacle for the stored liquid which is formed of inexpensive flexible material of such character that it is not affected by contact of the stored liquid, and of the water therewith. In the improved reservoir structure a body of water is located in the lower portion of the pit, and this body of water contacts with the side wall and bottom of the pit and extends upwardly into the

lower portion of the flexible receptacle. The stored liquid is disposed within the flexible receptacle wherein it is supported, because of its less specific gravity, on the surface of the water in the lower portion of said flexible receptacle, and the greater part of the flexible wall of the receptacle is maintained in a supported condition between the stored liquid and portions of the body of water within the pit.

Fig. 1 is a vertical section of the improved reservoir structure showing same as it appears when partially filled.

Fig. 2 is a view similar to Fig. 1 but illustrating the improved reservoir structure as it appears when filled.

In the drawing, wherein is shown for the purpose of illustration, merely, one embodiment of the invention, A designates a pit which is dug in the ground. Preferably, though not necessarily, the pit is circular when viewed in plan and the side wall of the pit is inclined to provide a cavity which tapers from a larger diameter at the top to a smaller diameter at the bottom. Formed in the ground at a point adjacent to the pit A is an excavation which provides an overflow sump B, and extended through the ground between the pit and the sump is a pipe C which places the pit and said sump in communication with each other for the discharge of water from the pit to the sump as will be hereinafter described.

Arranged within the pit A is a receptacle 1 which corresponds in shape to the shape of the cavity of the pit. The receptacle 1 is open at its top and bottom, said receptacle being provided by an annular sheet or wall of flexible material which is inclined to provide a cylindrical body tapered substantially in accordance with the taper of the cavity of the pit. The receptacle 1 may be formed of any material which is suitable for the intended purpose and in this connection it is essential that the material of which the receptacle 1 is formed must be flexible and of such character that it will not be affected by contact therewith of oils, gasoline, and water. The receptacle may be formed of a material having the desired characteristics, or fabric may be treated to provide the desired material.

The receptacle 1 is secured in place at its top by a plurality of suitable flexible tie elements 2 which are attached to the upper portion of the wall of the receptacle and are secured to stakes 3 driven in the ground immediately outwardly of the top of the pit. At points adjacent to the lower edge of the receptacle 1 a plurality of loop elements 4 are attached to the wall of the re-

ceptacle and extend inwardly therefrom. Tied to each of the loop elements 4 is a rope 5, one portion 5a of which extends upwardly from the loop element 4 out of the pit at the top thereof.

5 Another portion 5b of each rope 5 extends downwardly from the loop element 4 and passes through the eye 6 of a stake 7 which is driven into the ground at the bottom of the pit, said rope portion 5b extending upwardly from said stake and out of the pit at the top. By pulling on the rope portions 5b of the ropes 5 the lower portion of the receptacle 1 may be drawn downwardly with relation to the pit, and when it is desired to lift the lower portion of the receptacle with respect to the pit the rope portions 5a may be pulled, the rope portions 5b at such time sliding through the eyes 6 of the stakes 7. By proper manipulation of the various ropes 5 and by properly adjusting the tie elements 2, the lower and upper edges of the receptacle 1 may be leveled with respect to the bottom and top of the pit.

Associated with the sump B is a suitable pump 8 which may be operated by an electric motor 9, or otherwise. The pump 8 has associated with it a suction pipe 10 which extends downwardly into the sump to a point slightly above the bottom of said sump. Also the pump 8 has associated therewith a discharge pipe 11 which leads from the pump to a point immediately above the pit A as shown in Fig. 1.

In the operation of introducing gasoline, or other fluid to be stored, into the reservoir, a body of water is first introduced into the pit 1 as shown in Fig. 1. In this connection it is to be noted that a portion of the body of water is located between the wall of the receptacle 1 and the side wall of the pit and another portion of the body of water is extended upwardly into the receptacle 1 through the open bottom thereof. The gasoline, or other fluid to be stored, is then introduced into the receptacle 1 through the inlet pipe 12, and owing to the fact that said gasoline or other fluid is of less specific gravity than the water in the receptacle said fluid will float on the surface of the water in the receptacle. Preferably the inlet pipe 12 is adapted for vertical movement so that the discharge end thereof may be maintained in close proximity to the surface of the fluid in the receptacle as said surface rises so as to avoid undue disturbance of the fluid in the receptacle by the incoming fluid.

As the gasoline or other fluid continues to flow into the receptacle from the inlet pipe 12 it will displace a corresponding weight of water which will pass out of the open bottom of the receptacle and move upwardly in the space between the wall of the receptacle 1 and the side wall of the pit, and eventually the surface of the water in the space between the wall of the receptacle and the side wall of the pit will reach the pipe C and be drained thereby into the sump B. In this manner the elevation of the water in the space between the wall of the receptacle 1 and the side wall of the pit is limited at all times, and the level of the stored fluid in the receptacle will be maintained by the water pressure beneath said stored fluid at a higher level than the water level maintained by the pipe C, because of the difference in specific gravities of the two fluids.

From the foregoing it is plain that the hydrostatic pressures acting against the opposite faces of the wall of the receptacle 1 are nearly balanced at all times when the improved reservoir

is in use, and therefore the light flexible wall of the receptacle is supported between these nearly balanced pressures throughout the greater part of its height. It is to be noted that if an oil or gasoline leak should appear in the portion 5 of the wall of the receptacle 1 below the elevation of the pipe C, the leaking fluid will float upwardly through the water between the wall of the receptacle 1 and the side wall of the pit and will eventually be discharged into the sump B where such oil or gasoline will float on the surface of the water therein. Also if too much oil or gasoline is pumped into the receptacle 1 so that the surface of the water is lowered below the bottom edge of the receptacle, the escaping oil or gasoline will float upwardly through the water between the wall of the receptacle and the side wall of the pit to be eventually discharged into the sump B. Thus the presence of oil or gasoline on the surface of the water in the sump is an indication to the operators of the reservoir that something is wrong in the pit. However oil or gasoline that finds its way into the sump B is not lost due to the fact that the proper amount of water is maintained in the pit by pumping water from the sump back into the pit through the use of the pump 8, and when this happens any oil or gasoline which has been discharged into the sump will be pumped back into the receptacle with the water from the sump.

The improved reservoir includes a cover 13 which is preferably formed of the same material from which the receptacle 1 is produced. The cover 13 is provided with a stiffening ring 14 which provides the cover with a stiffened marginal edge that contacts loosely with the wall of the receptacle as shown in Fig. 2. Also a plurality of tie elements 15 are secured to corresponding tie elements 16 attached to the wall of the receptacle 1 so as to maintain the cover in its proper position. The cover has attached thereto a plurality of downwardly extended pipes 17 which are open at the top of the cover, the weight of the pipes serving to depress the cover at the locations of the pipes and said pipes serving as conduits for draining into the receptacle 1 rain water which falls on the cover. The pipes 17 function also as means for permitting the escape of gas which collects beneath the cover 13, as such gas will billow the cover as suggested by dotted lines in Fig. 2, thereby moving the lower ends of the pipes 17 above the surface of the fluid in the receptacle 1 and permitting gas to escape to atmosphere through said pipes. Due to the fact that the contact between the stiffened marginal edge portion of the cover and the wall of the receptacle 1 is not tight rain water may drain into the receptacle, and gas may escape from the receptacle, at that point.

I claim:

1. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall, a receptacle formed of flexible material disposed in said pit, the flexible material of which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable of supporting itself in an upright position, said receptacle being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, and a body of water in said pit, a portion of said body of water being extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall

of said receptacle and the side wall of said pit, the surface of the water within said receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said flexible wall of the receptacle.

2. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall, a receptacle formed of flexible material disposed in said pit, the flexible material of which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable of supporting itself in an upright position, said receptacle being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said body of water being extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the surface of the water within said receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said flexible wall of the receptacle, and means for limiting the elevation of the water within the pit.

3. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall, a receptacle formed of flexible material disposed in said pit, the flexible material of which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable of supporting itself in an upright position, said receptacle being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said body of water being extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the surface of the water within said receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said flexible wall of the receptacle, and means for limiting the elevation of the water within the pit, said means comprising an overflow sump, and a conduit which places said overflow sump in communication with said pit.

4. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall, a receptacle formed of flexible material disposed in said pit, the flexible material of which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable of supporting itself in an upright position, said receptacle being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said body of water being extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the sur-

face of the water within said receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said flexible wall of the receptacle, means for limiting the elevation of the water within the pit, said means comprising an overflow sump, and a conduit which places said overflow sump in communication with said pit, and pump means for pumping fluid from said overflow sump into said pit.

5. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall, a receptacle formed of flexible material disposed in said pit, the flexible material of which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable of supporting itself in an upright position, said receptacle being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said body of water being extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the surface of the water within said receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said flexible wall of the receptacle, means for adjustably securing said receptacle to the ground at the top of the pit, and means for adjustably securing the receptacle to the ground at the bottom of the pit.

6. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall inclined to provide a tapered cavity, a receptacle formed of flexible material disposed in said pit, the flexible material of which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable of supporting itself in an upright position, said receptacle being of tapered shape and being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said body of water being extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the surface of the water within said receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said flexible wall of the receptacle, means for adjustably securing said receptacle to the ground at the top of the pit, and means for adjustably securing the receptacle to the ground at the bottom of the pit.

7. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall, a receptacle formed of flexible material disposed in said pit, the flexible material of which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable of supporting itself in an upright position, said

receptacle being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said body of water being
 5 extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the surface of the water within said receptacle being
 10 adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said flexible
 15 wall of the receptacle, a flexible cover for said receptacle, and means for securing said flexible cover in place.

8. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall, a receptacle formed of flexible material disposed
 20 in said pit, the flexible material of which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable
 25 of supporting itself in an upright position, said receptacle being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said body of water being
 30 extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the surface of the water within said receptacle being adapted
 35 to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said flexible wall of the receptacle, a flexible cover for said receptacle,
 40 stiffening means for providing said flexible cover with a stiffened marginal portion, and means for securing said flexible cover in place.

9. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall,
 45 a receptacle formed of flexible material disposed in said pit, said receptacle being open at its bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said
 50 body of water being extended into said receptacle through the open bottom thereof and a portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the surface of the water within
 55 said receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle, a flexible
 60 cover for said receptacle, means for securing said flexible cover in place, and a drainage pipe attached to said cover and extended downwardly

therefrom into the liquid within said receptacle, said drainage pipe being open through the cover so that rain water which falls on the cover may drain therefrom into said receptacle through said
 5 drainage pipe.

10. A reservoir comprising a pit formed in the ground, said pit having a bottom and a side wall, a receptacle formed of flexible material disposed in said pit, said receptacle being open at its
 10 bottom and said open bottom of said receptacle being spaced upwardly from the bottom of said pit, a body of water in said pit, a portion of said body of water being extended into said receptacle through the open bottom thereof and a
 15 portion of said body of water being located between the wall of said receptacle and the side wall of said pit, the surface of the water within said receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced
 20 hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle, a flexible cover for said receptacle, means for securing said flexible cover in place, and a drainage pipe attached to said cover and extended down-
 25 wardly therefrom into the liquid within said receptacle, said drainage pipe being open through the cover so that rain water which falls on the cover may drain therefrom into said receptacle through said drainage pipe, and said drainage
 30 pipe being movable upwardly with said cover to a point above the surface of the liquid in said receptacle to permit accumulated gas beneath said cover to escape to atmosphere through said drainage
 35 pipe.

11. A reservoir comprising a container having a bottom and a side wall, a receptacle formed of flexible material disposed in said container with a wall of the receptacle spaced from the side wall of the container, the flexible material of
 40 which said receptacle is formed being impervious to liquids, and the flexibility of said material being of such degree that the receptacle by itself is incapable of supporting itself in an upright position, there being an opening at the bottom of
 45 said receptacle which places the space within the receptacle in communication with the space between the wall of the receptacle and the side wall of the container, and a body of water in said container, a portion of said body of water being
 50 extended into said receptacle through the opening at the bottom of the receptacle and a portion of said body of water being located between the wall of said receptacle and the side wall of the container, the surface of the water within said
 55 receptacle being adapted to support thereabove a body of stored liquid of less specific gravity than the water whereby nearly balanced hydrostatic pressures will be present at opposite faces of the flexible wall of said receptacle to support said
 60 flexible wall of said receptacle.

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