Aug. 19, 1969 J. W. SLOVER 3,461,673

LINED PIT HAVING WIND RESISTANT LINER THEREIN AND METHOD

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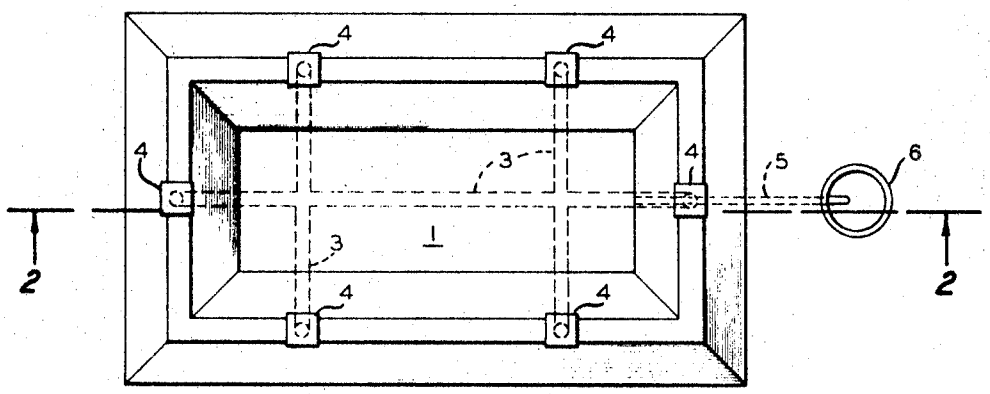

FIG. 1

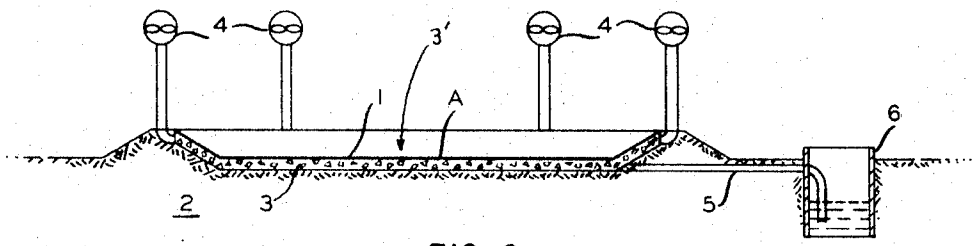

FIG. 2

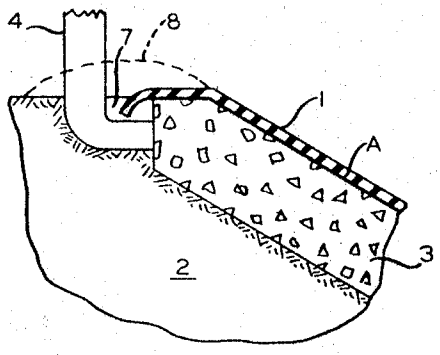

FIG. 3

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LINED PIT HAVING WIND RESISTANT LINER THEREIN AND METHOD

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ABSTRACT OF THE DISCLOSURE

A pit lined with a flexible liner, for example, rubber sheeting, is provided with means to produce suction beneath liner whenever wind is blowing tending to disarrange liner from its position in pit. In one embodiment the pit is trenched beneath the liner and the suction producing means is a chimney or vent equipped with a wind actuated suction generator. A drain to a sump is provided to test for leakage from above the liner into the trenching.

This invention relates to a lined pit or pond. Further it relates to a lined pit or pond lined with a flexible liner, disarrangement of the liner of which by wind blowing thereover is prevented. The invention further relates to detecting of leakage beneath a liner disposed in a lined pit.

According to a concept of the invention it provides a pit or pond having therein a flexible liner subject to being lifted by wind blowing thereover, especially when the pond is empty or substantially empty of liquid or other material which may be stored therein, comprising means to develop a suction beneath said liner cooperatively associated with said liner to develop a suction therebeneath at least when wind velocity is such there is a tendency for the action of the wind to disarrange the liner from its desired position in the pit. In another of its concepts the invention provides a trenching beneath a liner as here described and means cooperatively associated with said trenching to create a suction therein beneath said liner. Further, according to a concept of the invention it provides means for detecting leakage through said liner into said pit or trenching beneath the liner.

Any use of a rubber or rubber-like membrane or liner covering the floor and sides of a pit or pond approximately 700 x 1200 feet and constituting a reservoir in excess of two million barrels, it has been found due to the somewhat irregular surface of the dirt portion of the pond that it contains air beneath the rubber-like membrane or liner, especially where the membrane or liner is supported by peaks of the dirt formation. High winds cause the membrane to press against the dirt and to displace air therebeneath driving it to other points in the pond at which the membrane is thus lifted from the dirt setting up a wave action tossing the membrane about and causing damage thereto. A falling barometer creates substantially the same type of problem. Further high winds are often accompanied by low barometric pressure and the effects here described become sufficiently violent to lift 100 pound blocks of concrete disposed upon the liner. Waves as high as three feet have been observed to occur.

It has now occurred to me that removal of the air from beneath a liner as here described and in any event creatiny a suction beneath such a liner, particularly at a time when the wind velocity is such that it may tend to lift or disarrange the liner, will prevent such disarrangement to the wave or other action.

It is an object of this invention to provide a lined pit or pond. It is a further object of this invention to provide

a lined pit or pond having laid therein a flexible liner. It is a further object of this invention to provide a pond having a flexible liner therein resistant to disarrangement by wind blowing thereover especially when said pond or pit is substantially or almost completely empty. Still further, it is an object of the invention to provide means and combination with a lined pond to create a suction beneath the liner thereof. Still further it is an object of the invention to provide means for detecting leakage from above a liner in a pond or pit to the earth below said liner.

Other aspects, concepts and objects of the invention are apparent from a study of this disclosure, drawing and the appended claims.

According to the invention there is provided a lined open pit or pond formed in the surface of the ground and therefore subject to the influence of wind blowing thereover, said pit or pond having laid therein a flexible liner and means cooperatively connected to at least one place beneath said liner to develop a suction beneath said liner at least when wind velocity is such that there is a tendency on the part of the wind to disarrange the liner from its desired position in the pond.

In one form or embodiment of the invention, there is created an open communication between a place beneath the liner and a suction generating means such that the suction is generated at least whenever there is a tendency on the part of the wind to disarrange said liner from its desired position in the pond. The suction generating means is ordinarily rendered to be operative responsive to a wind velocity and may indeed be operated by the wind velocity. Other means for operating the suction creating means such as by way of an electric motor or otherwise can be used within the scope of the invention.

In a now preferred form of the invention, the surface of the earth beneath the liner is trenched with a network of trenches and this network of trenches is operatively connected with a suction producing a means such as a chimney or stack which can be and preferably is equipped with a wind operated exhaust fan. Thus, as the wind velocity increases, the operation of the exhaust fan becomes more efficient and any tendency on the part of the liner to lift responsive to wind action is overcome.

The trenching or other place beneath the liner at which suction is applied to the underside of the liner can be equipped with means for receiving any leakage draining thereinto and said leakage conducted to a place, as to a sump, at which it can be noticed.

FIGURE 1 is a plan view of a lined pond or pit according to the invention. FIGURE 2 is a vertical section along line 2—2 of FIGURE 1. FIGURE 3 is an enlarged view of a portion of the left hand end of FIGURE 2.

Referring now to the drawings. Liner **1** is disposed on the ground **2** in a pit **3'** with trough **3**. At least one point A, beneath the liner, is connected to at least one suction generator device **4**. Six such devices are shown in FIGURE 1. In operation, whenever the wind is blowing generators **4** which are wind responsive will rotate creating a suction beneath liner **1** in pit **3'**. Any leakage into the trough **3** passes by drain line **5** into sump **6**, in which it can be detected.

In FIGURE 3 the trough **3** is shown to be composed, at least in part, of stones. This has the advantage of assuring the open communication of points A with the generators **4**. The liner **1** is anchored along its periphery by being extended into a channel **7** and there covered by a mound of earth **8**.

It will be evident to those skilled in the art in possession of this disclosure having studied the same that other means can be provided for creating the suction, as herein indicated. There can be provided a sump pump responsive to leakage level to pump leaked liquid to a place where it may be viewed more conveniently or to sound

an alarm signal or back into the pond above the liner, periodically.

EXAMPLE.—LINER INSTALLATION AND PIT OPERATION

Pit size (top)

	Feet
Length	1200
Width	700
Depth	20

Trough size [1]	Feet
Width	1½
Depth	1

[1] Troughs can be spaced 10 ft. to 50 ft. or more apart and also placed in the sloping sides. Spacing depends upon size of pond, sheeting, and wind velocity expected in an area. The troughs are preferably filled with ¾ inch to 1½ inch round (screened) stone. The slope 1:3 on slanting edge is less than the angle of repose of the stone used.

Spaced 50 ft. apart.

Differential pressure created across line—2 in. H_2O.

Rubber sheet liner (total) [2]

Length	ft.	1225
Width	ft.	725
Thickness	in.	3/32

NOTE.—After the pit is excavated and leveled (inner side slope 1:3, outer sides slope 1.2), the troughs, vent units, drain line, and sump are constructed. The liner is laid in sections (of about 122 ft. by 150 ft.) and (rubber) cemented at lapped edges. Normally the first application is at the upper edge of the pit, the outer edge being held by earth.[2] The vent units allow removal of air beneath the section to allow firm fit of liner section on the surface of the pit. Additional sections of the liner are installed to complete the lining of the pit. Then the pit is ready for liquid fill.

[2] Liner is anchored at edge of pit by burying edge or piling earth on edge of liner.

Any leakage which occurs can be noted in the water sealed sump.

It is within the scope of the invention to provide for a force additional to that of the wind to operate the suction generating means. It is also within the scope of the invention to employ the suction generating means to raise into a convenient position, as into a sight glass, leaked liquid so that it may be viewed or otherwise disposed of.

Further, other than rubber flexible liners can be employed, such as synthetic resin films, e.g., polyethylene film. Also, mats, felts, fabrics, and the like, saturated, for example, with an asphaltic or bituminous material, can be used as the flexible liner. The fibers used to produce the mats, felts, fabrics, etc., can be synthetic and/or natural fibers. Of course, laminates of these materials can be used.

Reasonable variation and modification are possible within the scope of the foregoing disclosure, the drawing and the appended claims to the invention, the essence of which is that there has been provided a lined pit having suction means operatively connected below the liner at least to create a suction therebeneath whenever the wind velocity is such that disarrangement or displacement of the liner within the pit is tending to occur; that a method for arranging a liner in a pit to resist displacement or disarrangement due to wind velocity has been provided and, further, that means for detecting leakage beneath the liner in a pit, substantially as described, has also been provided.

I claim:

1. A lined open pit or pond formed in the surface of the ground and therefore subject to the influence of wind blowing thereover comprising an impervious, pliant sheet liner laid in said pit, an open air flow communication between a section of ambient air encompassed between said liner and said ground and a suction generating means in open air communication with ambient atmospheric conditions and with said section of ambient air such that a suction is generated at least whenever there is a tendency on the part of the wind to disarrange said liner from its position in the pit.

2. A pit according to claim 1 wherein said section encompasses at least one trench below the liner.

3. A pit according to claim 1 wherein the suction generating means is operative responsive to the wind velocity.

4. A pit according to claim 1 wherein the pit beneath the liner is provided with several of said sections to which suction is applied to create a sucking action on the bottom side of the liner and each of said sections is in suction generating connection with said suction generating means.

5. A pit according to claim 4 wherein the section comprises a network of trenches established in the earth below the liner and said suction generating means is in suction generating connection with said network.

6. A pit according to claim 5 wherein the trenches are provided with at least one drain and means are provided to detect leakage of said liner.

7. A pit according to claim 1 wherein the suction generating means is an upstanding vent extending into the atmosphere.

8. A pit according to claim 7 wherein said vent is a chimney.

9. A pit according to claim 7 wherein said vent is equipped with a rotating ventilator.

10. A method of lining a pit with a liner which will not be lifted therefrom when wind blows over said liner in said pit which comprises providing a suction producing zone in the bottom of said pit, laying said liner into said pit and over said zone, rendering said zone responsive to wind velocity to create a suction therein when the wind is blowing so that the liner tends to be lifted or disarranged from its position in the pit.

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U.S. Cl. X.R.

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