United States Patent

Dial

[15] **3,667,641**

[45] **June 6, 1972**

[54] RESERVOIR COVER ARRANGEMENT

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[21] Appl. No.: **15,439**

[52] **U.S. Cl.** ..... **220/26 S**

[51] **Int. Cl.** **B65d 87/18**

[58] **Field of Search** ..... 220/26 S, 26 R, 26 D, 85 B; 4/172.12

[56] **References Cited**

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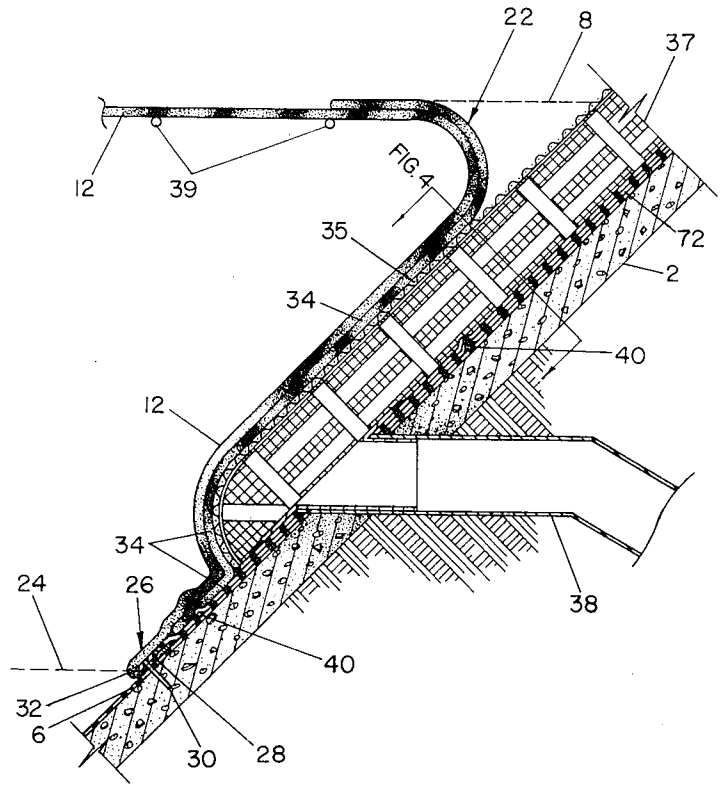
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[57] **ABSTRACT**

A reservoir is provided with a flexible, floating, cover secured to the sides of the reservoir along a line located between the anticipated upper and lower levels which water or other liquid in the reservoir may assume whereby the cover will remain in contact with the surface of the liquid as its level fluctuates up and down. A drain extending through the wall of the reservoir is arranged to draw off any rain or melted snow accumulating on the upper surface of the cover.

4 Claims, 7 Drawing Figures



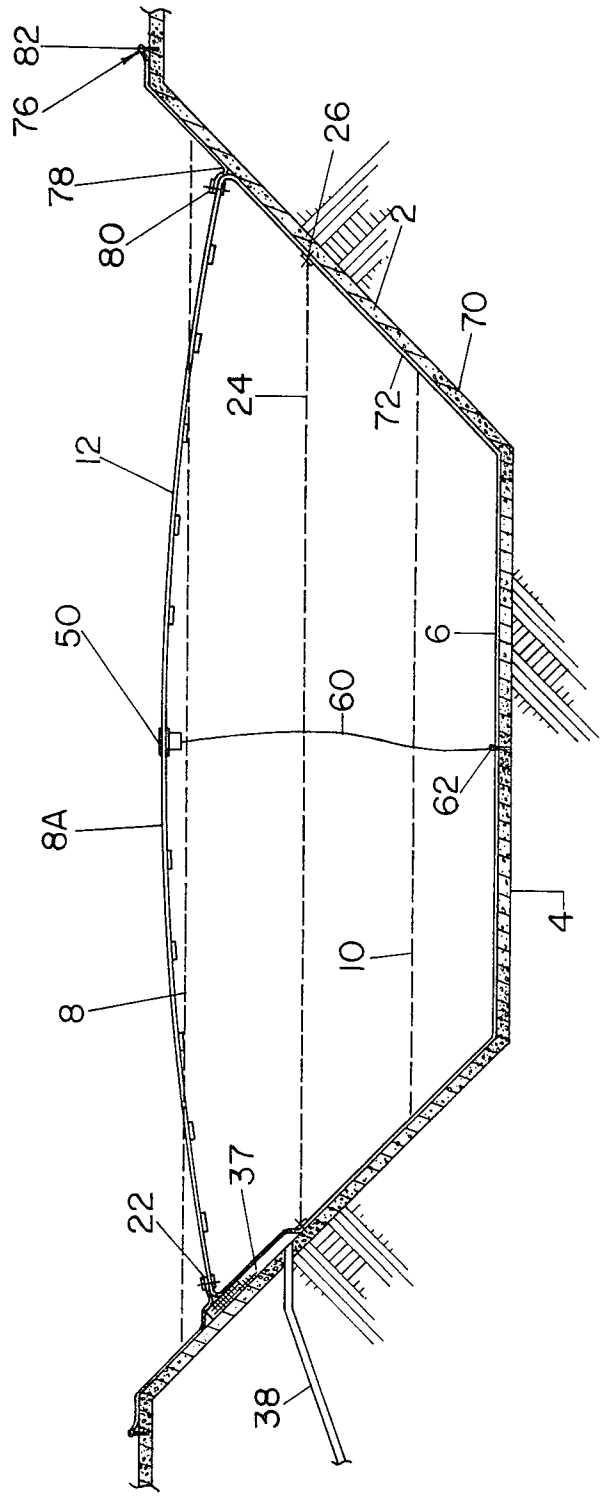


FIG. 1

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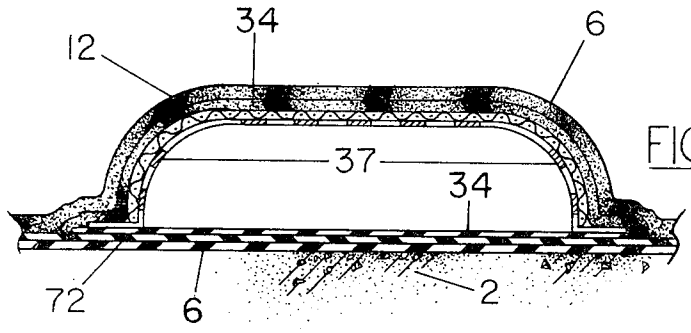


FIG. 4

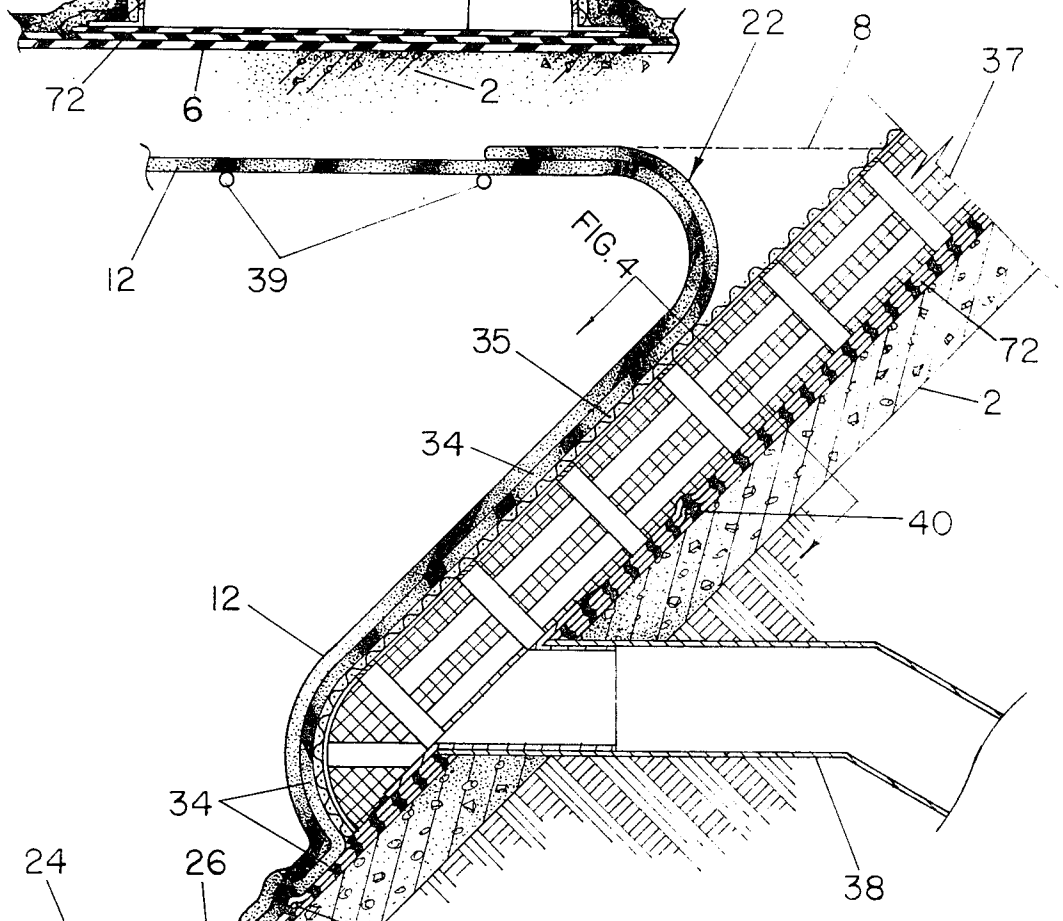


FIG. 2

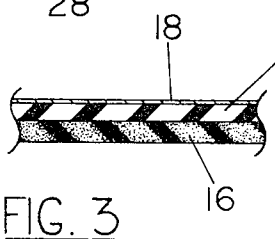


FIG. 3

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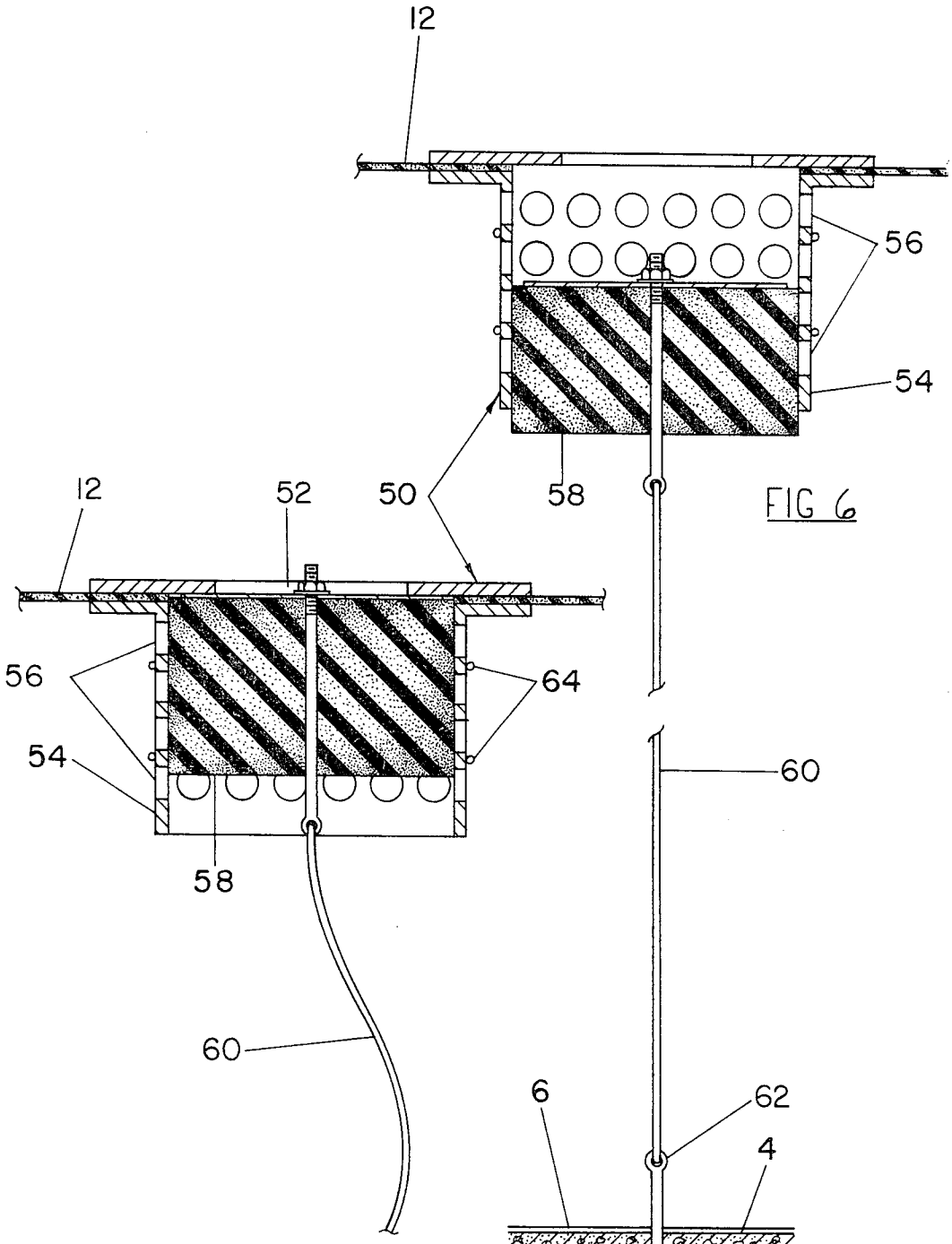


FIG 6

FIG 5

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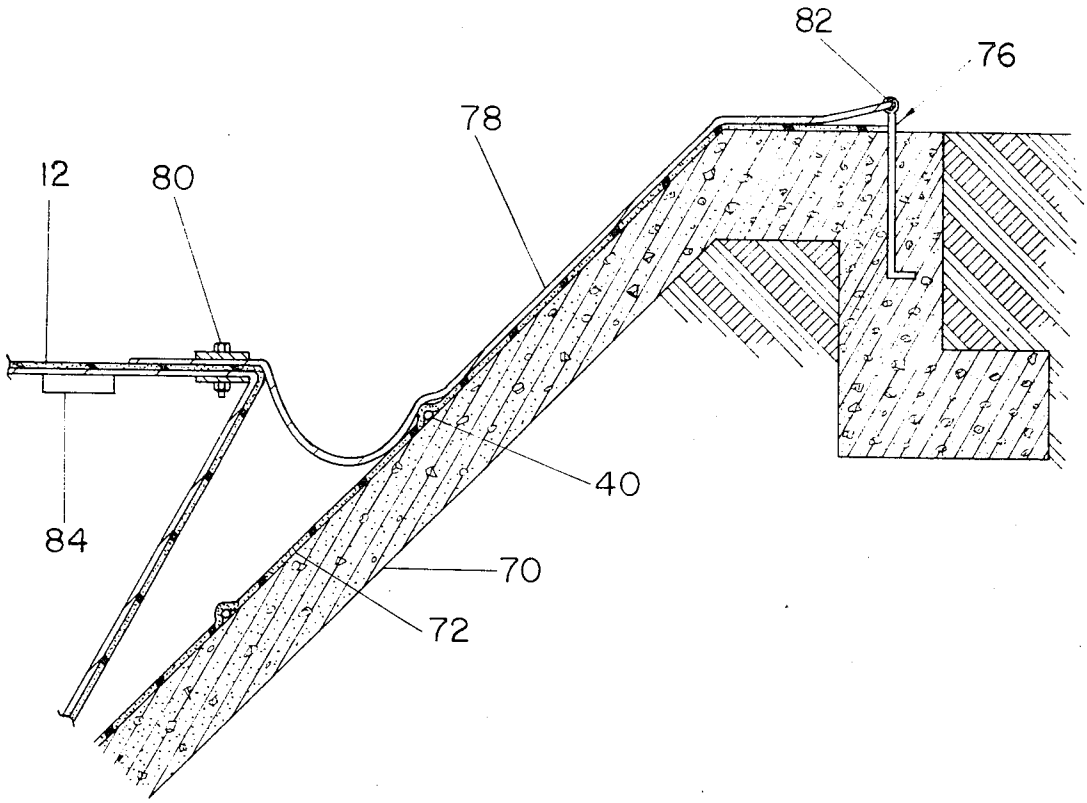


FIG. 7

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RESERVOIR COVER ARRANGEMENT

FIELD OF INVENTION

It is highly desirable to provide liquid reservoirs with covers for preventing dirt, and foreign matter from coming into contact with the liquid or to prevent accumulations of algae to form and contaminate the liquid. This is particularly true with respect to reservoirs for drinking water since such water is generally purified before it is pumped into the reservoir and any subsequent contamination thereof will not be removed before the water is drawn off for supply to consumers.

The level of the liquid maintained in a reservoir may fluctuate considerably from time to time as liquid is drawn off or supplied to the reservoir with the result that any cover material floating on the upper surface of the water must be provided with marginal portions or other areas which are sufficiently loose to permit the cover to rise and fall with the liquid. Thus, as disclosed in the patent to Dial et al., U.S. Pat. No. 3,313,443, for example, the reservoir cover may be of substantially greater area than the surface of the water in order that loose folds and wrinkles of the cover material may be presented within the cover and about the edges or in various areas thereof to allow the cover to move up and down. These folds and wrinkles serve also to form channels into which rain water may drain and from which it can be drawn off through suitably located drain lines to a sump or the like to be pumped off to a sewer or other drainage means.

However, the location of the folds formed in the loose portions of the cover and the positioning of drain lines to remove the water therefrom sometimes presents difficulties. Moreover, in cold weather the water may freeze and remain in the various folds, depressions or sump placing a severe strain on the material of which the cover is formed. Furthermore, the loose portion of the cover adjacent the sides of the reservoir may become frozen in contact with the sides of the reservoir with the result that it is not free to move upward and downward with the water as its level rises and falls.

In accordance with the present invention these and other objections and problems presented in the construction and use of flexible reservoir covers are overcome and constructions are provided wherein the marginal edges of the cover are secured to the sides of the reservoir or its lining at a level between the anticipated maximum and minimum levels at which the surface of the water or other liquid may be located during normal use of the reservoir. The area of the cover member employed then need be only slightly greater than that of the reservoir and the drainage of rain water and melted snow off the cover is greatly simplified. Moreover, the drainage can take place continually or whenever required without resorting to the use of extensive drain lines and pumping means. The installation further may be provided with heating means located about the sides of the reservoir to prevent freezing of the cover thereto and for melting snow and ice which might otherwise place a strain on the cover or prevent the cover from moving upward and downward freely as the level of the liquid in the reservoir fluctuates.

THE DRAWINGS

FIG. 1 is a diagrammatic vertical sectional view through a typical form of reservoir embodying the present invention;

FIG. 2 is an enlarged view of the marginal portion of the reservoir and cover illustrated in FIG. 1;

FIG. 3 is a sectional view of a typical form of material which may be used in forming the reservoir cover;

FIG. 4 is a sectional view of the construction illustrated in FIG. 2 taken on the line 4—4 thereof;

FIGS. 5 and 6 are vertical sectional views of an overflow construction which may be employed in the present invention with the elements shown in their inactive and active positions respectively, and

FIG. 7 is a view similar to FIG. 2, illustrating an alternative embodiment of the present invention.

PREFERRED EMBODIMENT OF THE INVENTION

In that embodiment of the invention chosen for purposes of illustration in FIGS. 1 to 6 of the drawings, the reservoir is provided with side walls 2 which as shown are inclined and may be formed of earth, concrete, metal or any other suitable material. Further, although the side walls are illustrated as being inclined, they may be arranged vertically or otherwise formed as desired. The bottom 4 of the reservoir will ordinarily be flat as shown and the inner surface of the reservoir may be lined with suitable water impervious material In some instances, the liner 6 may be formed of flexible sheet material such as rubber coated fabric, multi-ply butyl rubber, nylon, polyvinyl chloride or the like.

The water or other liquid may be supplied to and withdrawn from the reservoir by any suitable or conventional means (not shown) and normally will be maintained at a level between predetermined upper and lower limits represented by the dotted lines 8 and 10 respectively of FIG. 1. Such normal level extremes will, of course, be determined by the anticipated supply and removal of the liquid for which the reservoir is provided and may differ in every installation.

The cover 12 of the present invention is formed of flexible sheet material which is impervious to water and will not be attacked by or deteriorate in the presence of the liquid in the reservoir. When used as a cover for a reservoir containing water, the cover may be formed of butyl rubber-coated fabric, nylon, polyvinyl chloride or any of various other flexible and water impervious sheet materials. On the other hand, if the reservoir contains oil, hydrocarbons or other liquid, the composition of the sheet material should be selected from or coated with a material which is impervious to water and at the same time will not be attacked by the liquid in the reservoir. In any case the cover 12 may be secured to the liner 6 of the reservoir so as to provide a liquid tight seal whereby the liquid in the reservoir will be wholly enclosed within an impervious envelope.

The cover further is preferably capable of floating on the surface of the liquid and for this purpose, as shown in FIG. 2, may consist of a layer of butyl coated fabric 14 having a layer of closed cell foamed material 16 applied to or sprayed upon one surface of the sheet 14. The upper surface of the sheet material forming the cover further may be provided with a layer or film of reflective material 18, such as aluminum paint or foil which will serve to reduce the absorption of heat from the sun on long standing of the liquid.

In accordance with the present invention, the marginal portion 22 of the cover 12 is secured to the side walls 2 of the reservoir along a line 24 extending about the reservoir at a level between the normal upper and lower liquid levels 8 and 10 which the liquid may reach during ordinary use of the reservoir. For this purpose, anchoring means 26 are mounted on or embedded in the side walls 2 of the reservoir. Thus, as shown in FIG. 2, a long or continuous strip of material 28, such as anodized aluminum, may be secured to the side walls 2 of the reservoir by bolts 30 in a manner to secure the edge 32 of the marginal portion 22 of the cover in sealing contact with the liner 6 on the inner surface of the side walls. The inner surface of the side wall 2 above the line 24 and anchoring means 26 is preferably provided with a chafing strip or protective layer 34 for preventing wear or abrasion of the marginal portion of the cover material when the cover extends upward from the anchoring means 26 toward the upper liquid level line 8.

The cover 12 for the reservoir should have an area which is greater than the area of the reservoir bounded by the line 24 where the anchoring means for the cover are located. The excess in area of the cover should be sufficient to provide a marginal portion 22 which is of such width as to permit the cover 12 to flex upward or downward from the line 24 to the limit line 8 or 10 representing the normal upper and lower levels of the liquid in the reservoir. The width of the marginal portion

22 required can be readily determined in each installation and will of course depend upon the difference in elevation of the maximum and minimum levels of the liquid in the reservoir. The line 24 along which the anchoring means 26 is located should accordingly be at or about the means level between the upper and lower levels 8 and 10.

In actual practice the marginal portion 22 of the cover 12 will assume a somewhat rounded form as it extends upwardly from the anchoring means 26 to the upper level line 8 as shown in FIG. 2, by reason of the outwardly directed fluid pressure exerted by the liquid against the inner surface of the cover. As a result, the cover will be subjected to lateral tension tending to stretch the cover outwardly toward the edges thereof whereby wrinkles and cavities in the surface of the cover will be reduced facilitating the flow of rain and the water from melting snow off the cover toward the marginal edges thereof. The need for multiple and extended drain lines to remove such water from cavities in the upper surface of the cover will therefore be reduced or they may be eliminated altogether. The water flowing to the edges of the cover is drained away from the cover through a drain 38 which extends outward through the side wall 2 of the reservoir and communicates at its inner end with the space between the cover 12 and the protective layer of material 34. As a result, the accumulation and retention of liquid and the formation of ice on the exterior of the cover is avoided and strains on the material of which the cover is formed are reduced. If desired a screen 35 may be located between the marginal portion 22 of the cover and the side wall of the reservoir in the area adjacent the drain 38 and extending up to the level of the line 8 as shown in FIG. 2 and 3. In this way a drainage space 37 is provided between the cover and the drain pipe 38 for free flow of water to the drain at all times.

Further, as shown in FIG. 2, it is possible to locate heating elements 40 such as electrical resistance elements or steam or hot water lines beneath the protective layer of material 34 or in other heat exchanging relation with the area between the marginal portion of the cover and the adjacent side of the reservoir to melt any accumulations of ice and snow between the cover and the protective layer 34. The snow and ice thus melted will flow directly and continuously to the drain 38 whereby strains, abrasion and any tendency to tear the cover will be greatly reduced and its useful life increased. In some instances heating elements 39 also may be attached to the cover itself to aid in melting ice or snow accumulations on the cover.

In order further to protect the cover from rupture or injury in the event the level of the liquid in the reservoir should for any reason rise above the normal upper level 8, the cover may be provided with a relief or overflow means indicated generally at 50 in FIG. 1 and shown in more detail in FIGS. 5 and 6. As there shown, the cover 12 is provided with an overflow outlet opening 52 which may be located in the center of the cover and provided with a downwardly extending tubular casing 54 secured to the cover 12 about the opening 52. Ports 56 are formed in the casing 54 and are normally closed as shown in FIG. 5 by means of a float 58 or other closure means formed of closed cell sponge material or the like. The float 58 is connected by a cord or wire 60 to an anchoring means 62 on the bottom 4 of the reservoir. The length of the cord 60 is such that the ports 56 communicating with the relief opening 52 will be closed and sealed as long as the elevation of the central portion of the cover 12 does not rise above the normal upper level line 8. However, if additional liquid is supplied to the reservoir so that the cover 12 is raised and bowed upwardly at the center above the upper level line 8 as represented by the line 8a in FIG. 1, the cord 60 will prevent the closure means 58 from rising further with the cover and as a result the closure member and casing 54 will assume the positions indicated in FIG. 6. Excess liquid will then flow through the ports 56 and relief opening 52 onto the exterior of the cover where it will run across the rounded upper surfaces 8a to the edges of the cover so as to be drained away through drains 38. In this way, excessive and unusual strains which might otherwise be applied to the cover are prevented whereas the closure means 58 will return to its normal port closing position when the level of the liquid is lowered and the cover returns to the normal upper level 8 within the reservoir. Heating elements 64 may be applied to the casing 54 if desired to melt any ice accumulating thereon.

As shown in FIG. 7, the side walls 70 of the reservoir may be formed of concrete, earth or other material and need not have a rubber or other plastic liner 6 but may instead be coated with bituminous or other sealant material 72. The cover 12 may then be secured to the side wall by suitable anchoring means permanently embedded in or otherwise fixedly secured to the side wall 70. Further, as shown in FIG. 7, the cover 12 may be provided with supporting means such as the sling straps 78 which are attached to the cover at various points by attaching means 80. The outer ends of the straps 78 are anchored to eye bolts or other means 82 secured to the side wall of the reservoir at points above the normal upper level line 8. The straps 78 may extend all of the way across the reservoir from one side to the other and are of such length as to support the cover at or about the normal level 10 of the liquid in the reservoir. For this purpose the length of the slings or straps 78 between the points of attachment 80 to the cover and the eye bolts 82 should be such that the straps will be relatively loose, as shown in FIG. 7, at all times when the cover 74 is at any elevation above the lower liquid level line 10.

With this construction, it is possible to drain the reservoir completely while holding the cover at an elevation above the bottom of the reservoir a distance sufficient to enable workmen to enter the reservoir through suitable openings in the cover, to clean or repair the reservoir lining or to perform any other needed duties.

Further, as shown in FIGS. 1 and 7, the cover 12 may be provided with suitable floats or buoyant means 84 which are attached to the cover on the lower side thereof to float upon the liquid and aid in supporting the cover in a normal generally horizontal position in contact with the liquid and to reduce or eliminate any tendency for the formation of depressions or pockets within the central area of the cover 12.

When using any of the various possible forms of the present invention, the cover material employed is protected from damage or injury during use and the life of the cover is greatly increased. At the same time, the cost of providing reservoirs with protective covers which prevent airborn dirt and foreign matter from contaminating the liquid is greatly reduced.

I claim:

1. A reservoir having a side wall and adapted to receive and hold a variable amount of liquid therein with the surface of the liquid normally being located between upper and lower limit levels, a cover for said reservoir in the form of a flexible sheet of material normally contacting the surface of said liquid throughout the major area of said surface, the marginal edges of said sheet material being secured to the side wall of said reservoir along a line located between said upper and lower limit levels of the liquid; and

a drain line passing through said side wall of the reservoir and communicating with the space between the interior of said side wall and the exterior of the cover at a point located adjacent but above the line at which said cover is secured to the side wall.

2. A reservoir having a side wall and adapted to receive and hold a variable amount of liquid therein with the surface of the liquid normally being located between upper and lower limit levels, a cover for said reservoir in a form of a flexible sheet of material normally contacting the surface of said liquid throughout the major area of said surface, the marginal edges of said sheet material being secured to the side wall of said reservoir along a line located between said upper and lower limit levels of the liquid; and

heating means located between the side wall of the reservoir and said cover member in the area between the line at which the cover member is secured to said side wall and the normal upper limit level of the liquid in the reservoir.

3. A reservoir having a side wall and adapted to receive and hold a variable amount of liquid therein with the surface of the liquid normally being located between upper and lower levels, a cover for said reservoir in the form of a flexible sheet of material normally contacting the surface of said liquid throughout the major area of said surface, the marginal edges of said sheet material being secured to the side wall of said reservoir along a line located between said upper and lower limit levels of the liquid; and

a liner extending throughout the side wall and bottom of the reservoir and the marginal edges of said cover being in liquid sealing contact with said liner.

4. A reservoir as defined in claim 3, wherein; both said cover and said liner are formed of a water impervious flexible sheet material.

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