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MacQueen et al.

(54) **METHOD OF SECURING ELONGATED OBJECTS TO A FLOATING COVER**

(76) Inventors: **Jason Jeffery Robert MacQueen**, Edmonton (CA); **James Andrew Mills**, Edmonton (CA)

Correspondence Address:
CHRISTENSEN, O'CONNOR, JOHNSON, KINDNESS, PLLC
1420 FIFTH AVENUE, SUITE 2800
SEATTLE, WA 98101-2347 (US)

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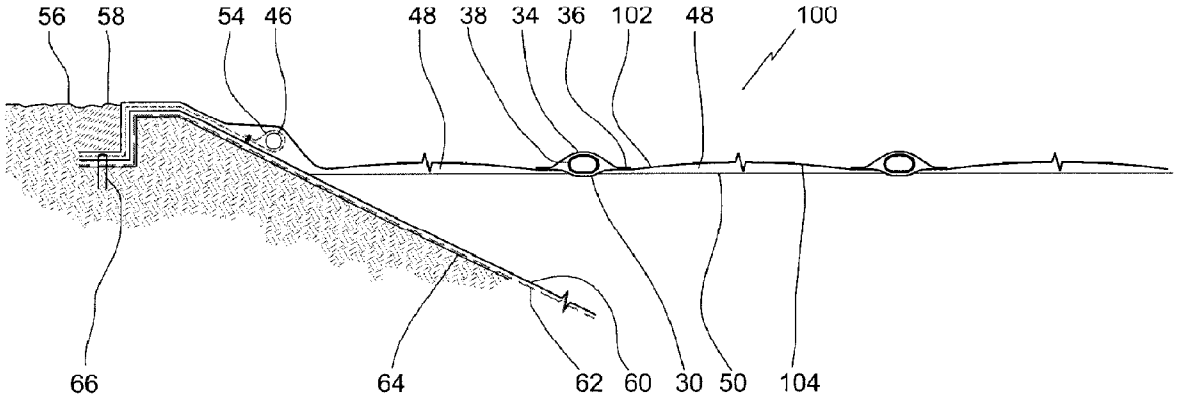
(57) **ABSTRACT**

A method of securing elongated objects, such as weights or floats to a floating cover. A first step involves providing a sheet form substrate. A second step involves forming elongated retention pockets on the substrate. A third step involves inserting elongated objects into the elongated retention pockets. This method allows thinner lower cost substrates to be used, while still facilitating secure attachment of weights or floats.



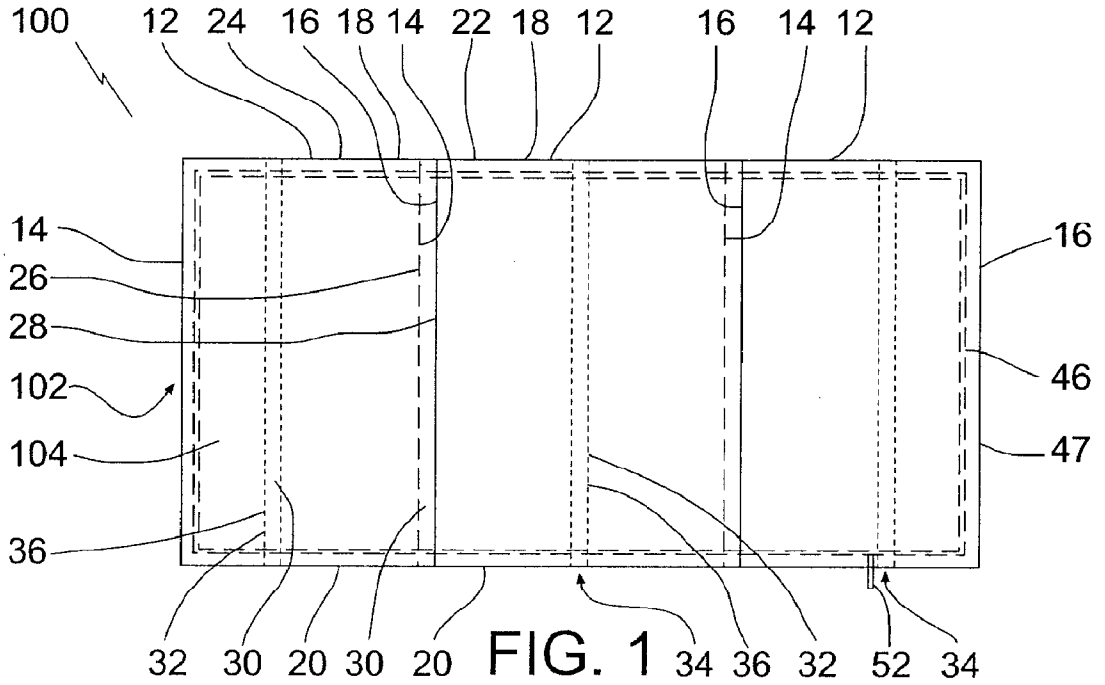


FIG. 1

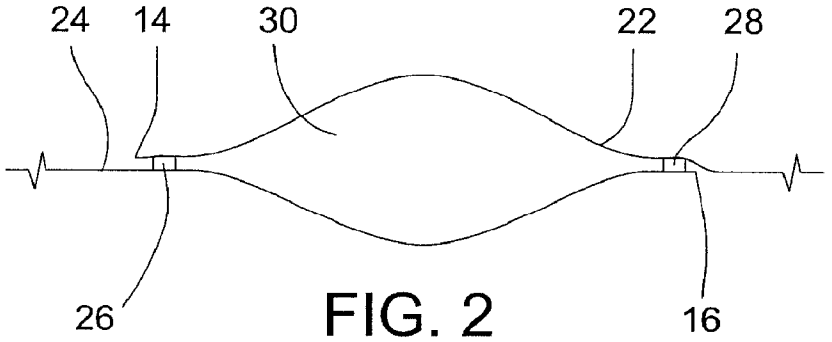


FIG. 2

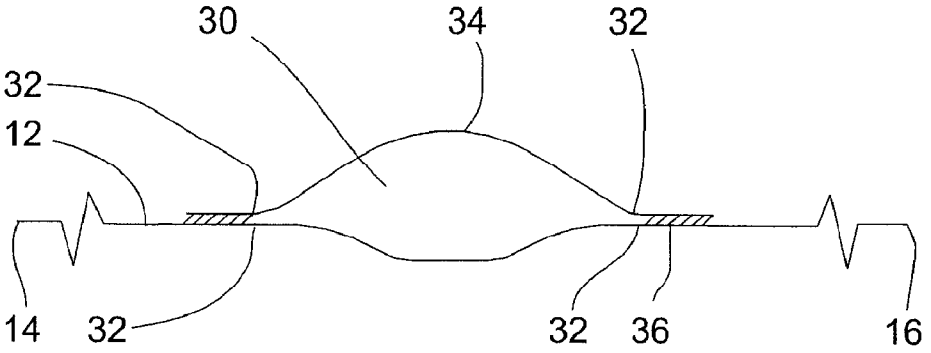


FIG. 3

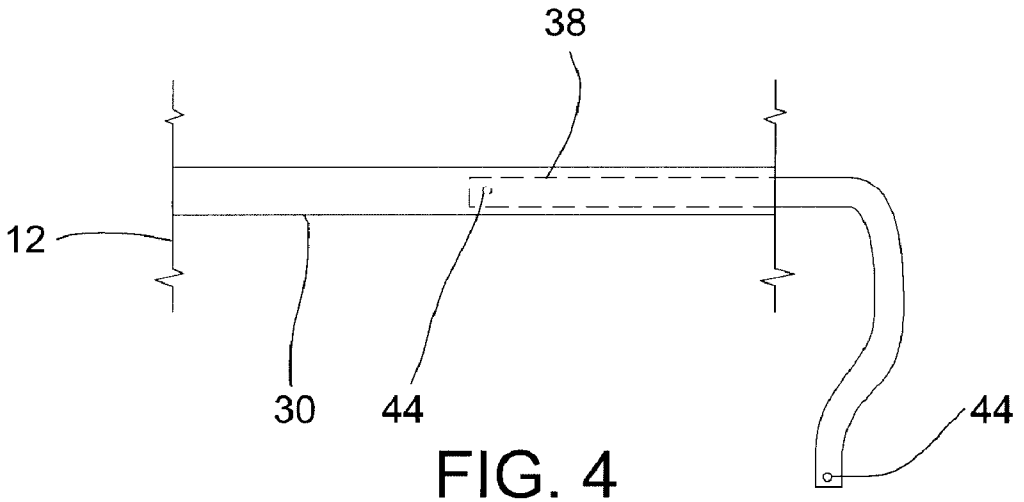


FIG. 4

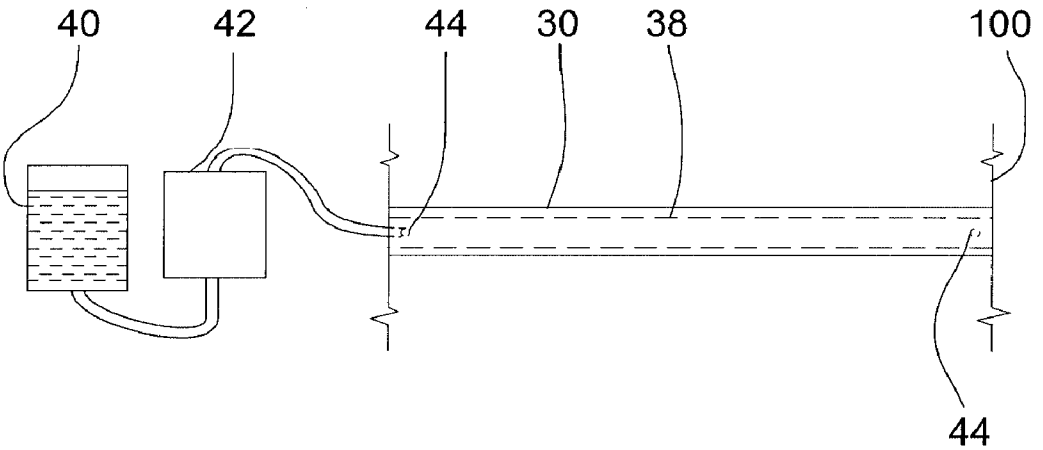


FIG. 5

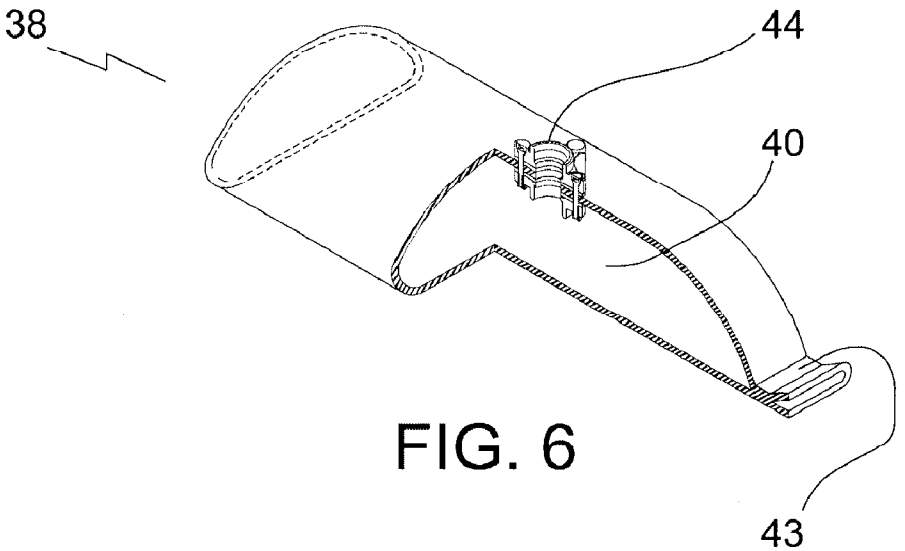


FIG. 6

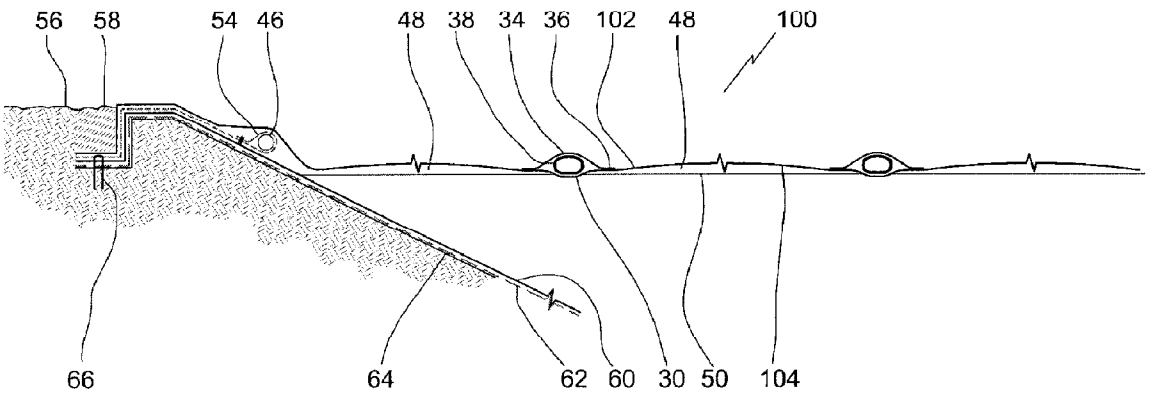


FIG. 7

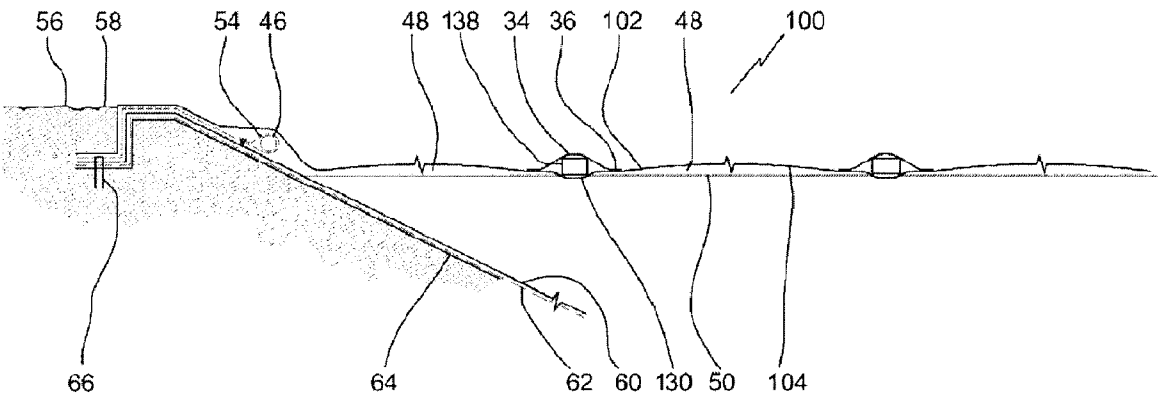


FIG. 8

METHOD OF SECURING ELONGATED OBJECTS TO A FLOATING COVER

FIELD

[0001] The present invention relates to a method of securing elongated objects, such as weights or floats to a floating cover, and a floating cover resulting from the method.

BACKGROUND

[0002] Floating covers have floats attached to provide needed buoyancy and weights attached to control slack and to protect against wind uplift. A gas collection cover is a particular type of floating cover. There is an increasing tendency to cover lagoons that release gas to atmosphere with gas collection covers. For example, sewage lagoons release methane gas to atmosphere. Sometimes gas collection covers are installed for environmental reasons. Sometimes gas collection covers are installed for commercial reasons, to capture and utilize the methane gas.

[0003] As gas collects under the gas collection cover, the gas tends to lift the gas collection covers off the surface of the pond or lagoon. Once lifted, the gas collection cover becomes vulnerable to wind damage, as it flaps over the surface of the pond or lagoon. Weights are, therefore, attached at spaced intervals to the gas collection cover in order to keep the gas collection cover in tension so it does not flap. The attaching of weights is presently a time consuming and labour intensive process. Previous gas collection covers have used polyethylene tubes filled with ballast as weights. These weight tubes were secured to the gas collection cover using straps that were bonded onto an upper surface of the gas collection cover.

SUMMARY

[0004] According to one aspect there is provided a method of securing elongated objects, such as floats or weights, to a floating cover. A first step involves providing a sheet form substrate. A second step involves forming elongated retention pockets on the substrate. A third step involves inserting elongated objects into the elongated retention pockets. This method provides an advantage of allowing thinner lower cost substrates to be used, while still facilitating secure attachment of weights or floats.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] These and other features will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

[0006] FIG. **1** is a bottom plan view of a floating cover formed in accordance with the teachings of the present method.

[0007] FIG. **2** is a side elevation view of the floating cover of FIG. **1**, showing elongated retention pockets where two substrates forming the floating cover are joined.

[0008] FIG. **3** is a side elevation view of the floating cover of FIG. **1**, showing elongated retention pockets formed by bonding a strip of material to the substrate of the floating cover.

[0009] FIG. **4** is a top plan view, partially in section, of the floating cover of FIG. **1**, showing the manner of insertion of weight tubes into the elongated retention pockets.

[0010] FIG. **5** is a top plan view, partially in section, of the floating cover of FIG. **1**, showing the manner of filling weight tubes with liquid ballast while the weight tubes are positioned in situ within the elongated retention pockets of the floating cover.

[0011] FIG. **6** is a detailed cut away perspective view, partially in section, showing one end of a weight tube from FIG. **4**.

[0012] FIG. **7** is a detailed side elevation view in section of the floating cover of FIG. **1**.

[0013] FIG. **8** is a side elevation view of a floating cover with tubular floats positioned in the elongated retention pockets.

DETAILED DESCRIPTION

[0014] A method of securing elongated objects to a floating cover will now be described with reference to FIG. **1** through **8**.

[0015] Referring to FIG. **1**, in broad terms the method involves three steps. A first step involves providing a sheet form substrate **12**. Where substrate **12** is to be used as a gas collection cover, substrate **12** is gas impervious. A second step involves forming elongated retention pockets **30** on substrate **12**. A third step involves inserting an elongated object, such as weight tubes **38** or, as will hereinafter be described floats into elongated retention pockets **30**. There are various ways in which the elongated retention pockets may be formed, two of which will hereinafter be described.

[0016] Referring to FIG. **1**, a first step in the method involves providing more than one substrate **12**. Each substrate **12** has a leading edge **14**, a trailing edge **16** and opposed side edges **18** and **20**, respectively.

[0017] Referring to FIG. **1**, one approach to the second step of forming the elongated retention pockets **30** involves bonding leading edge **14** of a trailing substrate **22** to trailing edge **16** of a leading substrate **24**. Referring to FIG. **2**, leading edge **14** of trailing substrate **22** and trailing edge **16** of leading substrate **24** are placed in overlapping relation and two parallel spaced bonded seams **26** and **28** are used to secure trailing substrate **22** and leading substrate **24** together to form one of elongated retention pockets **30**. Referring to FIG. **1**, parallel spaced bonded seams **26** and **28** extend between opposed side edges **18** and **20** of respective trailing substrate **22** and leading substrate **24**. This bonding step of attaching leading edge **14** of trailing substrate **22** to trailing edge **16** of leading substrate **24** is repeated, by joining in end to end relation a plurality of substrates **12** until a floating cover, generally indicated by reference numeral **100**, of a desired length with a desired number of elongated retention pockets **30** has been formed. The bonding process can be performed with various bonding technologies. In field testing, beneficial results have been obtained through the use of a heat bonding process. During field testing, floating cover **100**, was created along the shoreline of a lagoon by bonding a plurality of substrates **12** together. It will be appreciated that this work could have been performed at a remote fabrication facility and a completed floating cover **100** transported to the lagoon. It is believed that factory fabrication speeds installation and reduces field handling.

[0018] Referring to FIG. **3**, another approach to the second step of forming the elongated retention pockets **30** involves bonding a strip of material **34** to substrate **12**. Referring to FIG. **1**, strip of material **34** extends between opposed side edges **18** and **20** of substrate **12**. Referring to FIG. **3**, opposed

edges **32** of strip of material **34** are bonded to substrate **12** with two parallel spaced bonded seams **36**. Referring to FIG. **1**, seams **36** also extend between the opposed side edges **18** and **20** to form one of elongated retention pockets **30** between bonded seams **36**.

[0019] For some installations, having elongated retention pockets **30** positioned where substrates **12** have been joined will be insufficient. This may be the case where substrates **12** come in long lengths, thereby requiring fewer joints. In such cases, one, or both approaches may be used to ensure there are enough elongated retention pockets to accommodate sufficient floats to provide floatation and sufficient weights to keep floating cover **100** in place when gas starts to accumulate under floating cover **100**.

[0020] Referring to FIG. **4**, a further step involves inserting weight tubes **38** into elongated retention pockets **30**. Although weight tubes **38** may be pre-filled with ballast when inserted, for ease of handling it is preferred that weight tubes **38** be empty. Referring to FIG. **5**, weight tubes **38** are shown as having been inserted into elongated retention pockets **30** empty.

[0021] A further step is illustrated of pumping ballast **40** with pump **42** into each of weight tubes **38**, while weight tubes **38** are positioned in situ within elongated retention pockets **30** of floating cover **100**. Weight tubes **38** are provided with fill ports **44** at each end. When filling takes place from one end, the one of fill ports **44** at the other end serves as a vent for the release of air. FIG. **6**, details a cut-away view of one end of weight tube **38**. Both ends of weight tube **38** are the same. Each weight tube **38** is closed at either ends. Depending upon the kind of material used, ends of weight tubes **38** may be closed with end seals **43**. In the illustrated example, seals **43** were formed through heat sealing. Fill ports **44** are plugged after weight tube **38** is filled with ballast **40**.

[0022] In the prior art, weights tubes were positioned onto gas collection covers with straps as it was deployed. With the present method, floating cover **100** can be fully deployed before the weight tubes are filled with ballast. This simplifies the deployment process. Once deployed, the filling with liquid ballast is relatively rapid. A further advantage of this teaching is that the weight tubes can be drained of ballast to simplify future cover replacement.

[0023] The liquid ballast **40** is selected based upon application requirements. For many applications water can be used. Water has neutral buoyancy when the cover is floating on water, but provides the required weight when accumulated gas physically lifts the cover from surface of the lagoon. In applications where greater weight is required, a slurry of sand and water, grout, or any other cementatious mixture can be used. Where freezing is of concern, liquid ballast can be selected based upon its ability to withstand freezing at anticipated temperatures.

Floating Cover

[0024] Referring to FIG. **1** floating cover **100**, fabricated in accordance with the teachings of the method, consists of a substrate **12** having an upper surface **102**, a lower surface **104**, and opposed side edges **18** and **20**. Floating cover **100** may be made from geomembrane materials. Continuous open ended elongated retention pockets **30** extend between opposed side edges **18** and **20**. As described above, elongated retention pockets **30** are formed either by bonding strips of material **34** to gas impervious substrate **12** or by placing parallel side edge to side edge bonded seams **26** and **28** where one substrate **12** which is a leading substrate **24** is overlapped with a trailing substrate **22**.

[0025] Referring to FIG. **1**, floating cover **100** may contain a perforated pipe **46** contained within a perimeter **47** of floating cover **100**. Referring to FIG. **7**, perforated pipe **46** collects gas that is contained by floating cover **100**. Gas may naturally collect in a gas space **48** between floating cover **100** and a body of water **50**. Gas from gas space **48** then enters into perforated pipe **46**. Referring to FIG. **1**, gas travelling through perforated pipe **48** exits floating cover **100** through a non-perforated pipe **52**. Non-perforated pipe **52** may carry any gas collected by floating cover **100** away to be processed. This has the advantage of allowing any gas that builds up in gas space **48** to be removed or collected, as well as reducing the gas pressure that may otherwise build up in gas space **48**. Referring to FIG. **7**, perforated pipe **48** may be wrapped in a geotextile sleeve **54**, in order to protect perforated pipe **48**. Floating cover **100** may be secured to a shore **56** of body of water **50**. This may be accomplished by securing floating cover **100** in a trench **58**. Floating cover **100** may be buried within trench **58**. Other anchorage methods may be appropriate depending on site conditions.

[0026] Referring to FIG. **7**, a liner **60** and an underlay **62** may be present on a bottom **64** of body of water **50**. Liner **60** and underlay **62** may prevent the loss of water from body of water **50** to the surroundings. Liner **60** may be made from a geomembrane material, and underlay **62** may be made from geotextile materials. Both liner **60** and underlay **62** may be secured to shore **56** by burying liner **60** and underlay **62** within trench **58**. Additionally, a staple **66** may be used to ensure that geotextile sleeve **54** holding perforated pipe **48** used for gas collection does not move during the installation process.

[0027] Advantages:

[0028] There are several advantages to using elongated retention pockets **30** over the prior art. Elongated retention pockets **30** are able to retain weight tubes **38** using lighter weight and less expensive materials to construct substrates **12**. This is due to the fact that the weight of containing weight tubes **38** within pockets **30** is dispersed throughout the entire length of each elongated retention pocket **30**. Traditional methods in the prior art would involve using straps which would require stronger materials to construct a gas collection cover with. In addition, elongated retention pockets **30** may be constructed within a factory. This is advantageous because it makes construction more consistent (using higher quality factory construction equipment) and installation in the field easier (no need to assemble cover **100** on site). Floating cover **100** may also be rolled up and transported to the field for easy installation and transportation. Furthermore, by containing weight tubes **38** entirely within elongated retention pockets **30**, weight tubes **38** are protected from harmful UV exposure. This allows weight tubes **38** to be made from less expensive materials.

[0029] Variations:

[0030] In working with other types of floating covers, it has been determined that there is sometimes a need to secure floats to the floating covers. A variation of the present invention is to place floats into the pockets instead of or in addition to weight tubes. Referring to FIG. **8**, there is illustrated a floating cover generally indicated by reference numeral **100**. Floating cover **100** has pockets **130**, formed as has previously been described. Instead of weight tubes, elongated floats **138**

(also referred to as float) have been inserted into pockets **130**. The purpose of this illustration is to demonstrate how the present method and apparatus can be used when flotation is of concern instead of or as well as the addition of weight. In many situations, there may be a mixture of tubular floats **138** and weight tubes **38** (not shown).

[0031] In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

[0032] It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiments without departing from scope of the Claims.

What is claimed is:

1. A method of securing elongated objects to a floating cover, comprising:

providing at least one sheet form substrate;

forming elongated retention pockets on the substrate; and

inserting elongated objects into the elongated retention pockets.

2. The method of claim **1**, the elongated objects being at least one of elongated weights or elongated floats.

3. The method of claim **1**, the elongated weights being hollow weight tubes.

4. The method of claim **1**, including a step of forming the elongated retention pockets by bonding a leading edge of a trailing substrate to a trailing edge of a leading substrate in overlapping relation with two parallel spaced bonded seams which extend toward opposed side edges of the respective leading substrate and the trailing substrate to form one of the elongated retention pockets between the bonded seams

5. The method of claim **1**, including a step of forming the elongated retention pockets by bonding a strip of material in overlapping relation to the substrate with two parallel spaced bonded seams to form one of the elongated retention pockets between the bonded seams.

6. The method of claim **3**, including a step of inserting the weight tubes into the elongated retention pockets before the weight tubes are filled with ballast and involving a further step of pumping ballast into each of the weight tubes in situ.

7. A method of securing elongated objects to a floating cover used for gas collection, comprising:

(a) providing more than one gas impervious substrate having a leading edge, a trailing edge and opposed side edges;

(b) forming elongated retention pockets on each substrate by bonding a strip of material which extends between the opposed side edges in overlapping relation to the substrate with two parallel spaced bonded seams which extend between the opposed side edges to form one of the elongated retention pockets between the bonded seams;

(c) bonding the leading edge of a trailing substrate to the trailing edge of a leading substrate until a floating cover of a desired length has been formed;

(d) inserting at least one of elongated weights or elongated floats into the elongated retention pockets.

8. The method of claim **7**, involving inserting empty weight tubes into the elongated retention pockets during step (d); and

(e) pumping ballast into each of the weight tubes in situ.

9. A method of securing elongated objects to a floating cover used for gas collection, comprising:

(a) providing more than one gas impervious substrate having a leading edge, a trailing edge and opposed side edges;

(b) bonding the leading edge of a trailing substrate to the trailing edge of a leading substrate in overlapping relation with two parallel spaced bonded seams which extend between the opposed side edges of the respective leading substrate and trailing substrate to form elongated retention pockets between the bonded seams;

(c) repeating step (b) until a floating cover of a desired length with a desired number of the elongated retention pockets has been formed;

(d) inserting at least one of elongated weights or elongated floats into the elongated retention pockets.

10. The method of claim **9**, involving inserting empty weight tubes into the elongated retention pockets during step (d); and

(e) pumping ballast into each of the weight tubes in situ.

11. A floating cover, comprising:

a substrate having opposed side edges with continuous open ended elongated retention pockets extending between the opposed side edges.

12. The floating cover of claim **11**, wherein a leading edge of a trailing substrate is bonded to a trailing edge of a leading substrate in overlapping relation with two parallel spaced bonded seams which extend between the opposed side edges of the respective leading substrate and trailing substrate to form one of the elongated retention pockets between the bonded seams.

13. The floating cover of claim **11**, wherein strips of material extend between the opposed side edges of the substrate in overlapping relation, each strip of material being bonded to the substrate with two parallel spaced bonded seams which extend between the opposed side edges to form one of the elongated retention pockets between the bonded seams.

* * * * *