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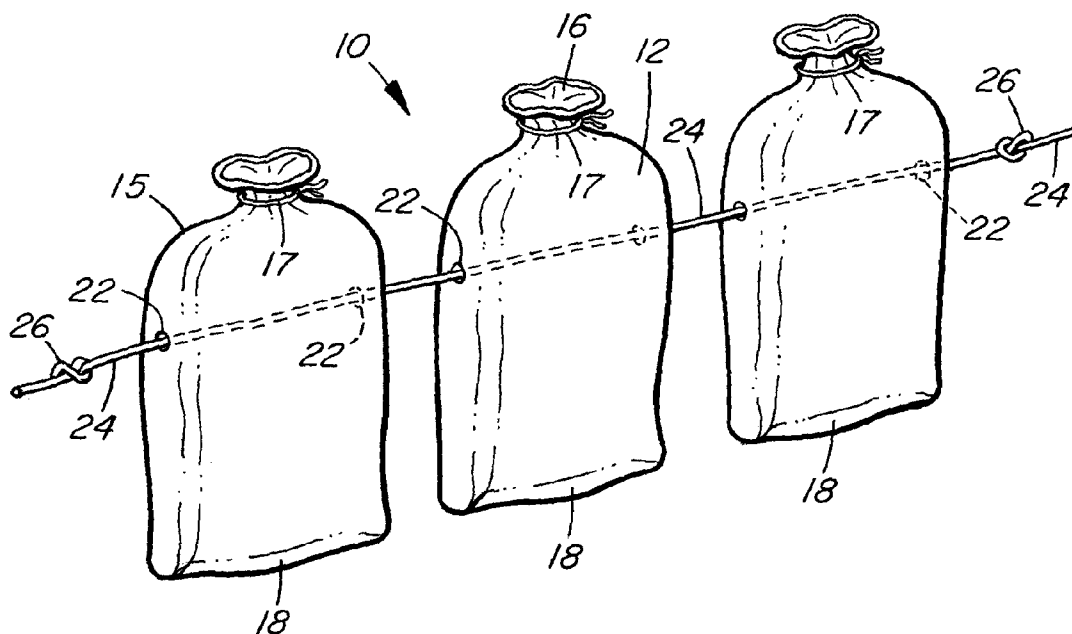
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(54) Title: CONSTRUCTIONS AND REINFORCEMENT STRUCTURES OF CONNECTED SANDBAGS



(57) Abstract: A construction element for making retaining walls and erosion control structures comprises a plurality of sandbags connected together by means of a cord. The bags have flexible walls and holes through which the cord extends. The holes can be in various positions on the bags, and various spacings of the bags on the cord can be used. The construction elements can be used to form retaining walls, structures for protecting underwater shoreline areas from erosion, and other structures in the civil engineering field.

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**CONSTRUCTIONS AND REINFORCEMENT**  
**STRUCTURES OF CONNECTED SANDBAGS**

5

Field of the Invention

The invention pertains generally to the field of erosion control and retaining walls. More specifically, it pertains to construction elements that  
10 can be used for making erosion control structures, retaining walls and similar structures.

Background of the Invention

15 Retaining wall and erosion control structures are commonly constructed using poured concrete or blocks that are affixed together with concrete. For underwater erosion control applications, permanent rock covers such as riprap are commonly used on streambanks and other shoreline areas. All such structures are costly to construct in view of the  
20 materials and labor required.

For some applications, structures made of sandbags can be used for retaining walls and erosion control purposes. Permanent structures made of sandbags have been built, using interconnecting members such as those  
25 disclosed in WO 00/61880 (Kim) published October 19, 2000, to connect the sandbags together in stable and permanent arrangements. Sandbag retaining walls and similar structures have several advantages over prior art systems in those applications where they can be used, including lower cost, ease of construction and the ability to make vegetation-covered walls  
30 from seeds in the sandbag fill material. It would desirable to extend the range of applications for which sandbag structures can be used by being able to enhance the strength and stability of such structures.

### Summary of the Invention

The invention provides construction elements that are made from a plurality of sandbags that are connected together by means of a cord that  
5 extends through holes in the sandbag walls. In one embodiment, the bags have two such holes in their walls and the cord extends through both of the holes. In another embodiment, there is a single hole in the bag wall and the cord extends through that hole and through the open mouth of the bag; when the bag is filled with fill material and the open end is sealed closed, a  
10 small opening is left to permit passage of the cord.

The invention also provides wall structures that are made of the construction elements. The elements can be laid in courses to form a retaining wall face and the free ends of the cords may be secured to the  
15 slope or fill in back of the wall face.

In another embodiment, the invention provides a structure for protecting underwater shoreline areas from erosion, comprising a plurality of the construction elements positioned on the underwater shoreline area.  
20

### Brief Description of Drawings

Figure 1 is a perspective view of one embodiment of a construction element according to the invention.  
25

Figure 2 is a side view thereof in which the sandbags are filled and closed.

Figure 3 is a perspective view of another embodiment of the construction element, in which the sandbags are filled and closed.  
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Figure 4 is a side view of another embodiment of the construction element.

Figure 5 is a schematic view of a structure for protecting underwater shoreline areas from erosion, made using the construction elements.

Figure 6 is a perspective view of a retaining wall made with the construction elements.

Figure 7 is a top plan view of one course of another embodiment of a retaining wall made with the construction elements.

#### Detailed Description of the Preferred Embodiments

Exemplary embodiments are illustrated in the referenced figures of the drawings. It is intended that the embodiments and figures disclosed herein are to be considered illustrative rather than restrictive.

In the following description and the drawings, corresponding and like parts are referred to by the same reference characters.

Figures 1 and 2 show a preferred embodiment of the construction element **10**. Bags **12** have flexible walls **14** made of geotextile or other material suitable for use as sandbags. The material of the bags should not be biodegradable, for durability of the structures made. The bags **12** have a top end **15** having a mouth or opening **16**, a closed bottom end **18** and a side portion **20**. The opening **16** is intended for permitting fill material to be put into the bag. In this specification, "fill material" means any material that is suitable for use in bags in the construction of walls, erosion control structures and similar structures, including sand, soil, gravel, dry-mix concrete and mixtures thereof, including, for some applications, fill

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material with seeds for vegetation. The term “sandbag” as used herein means a bag containing any “fill material.” For further clarity, the term is not limited to a bag in which the fill material is sand. In use, bags **12** are filled with fill material and opening **16** is then closed, for example by  
5 means of a tie **17**, or by stapling, sewing, etc.

Bags **12** have two holes **22** in the walls **14** thereof. Cord **24** extends through these holes in each of the bags and attaches the bags together to form the construction element **10**. Hole **22** preferably has a grommet (not  
10 shown) surrounding it. The cord **24** fits sufficiently snugly in hole **22** to prevent significant leakage of fill material from the hole. The cord may be made of any suitable and durable material, preferably a strong synthetic, non-degradable material. Plastics material such as nylon or high-density polyethylene are preferred.

15

The cord **24** includes knots **26** adjacent to either end. The knots have a diameter that is larger than the diameter of hole **22** and serve to retain the bags on the cord. Alternatively, clips or other kinds of retaining devices can be used on the cord in place of knots.

20

In one embodiment, the bags **12** are spaced sufficiently closely along the cord **24** that when they are filled they abut or nearly abut each other, as shown in Figure 2. Alternatively, the bags may be spaced farther apart so that they remain well-spaced from adjacent bags after they are  
25 filled, an embodiment that is useful for some applications as discussed below.

The construction elements can have the holes **22** positioned in various different locations on the bags to facilitate specific applications.  
30 Referring to Figure 3, construction element **30** comprises sandbags **32** in which the holes **22** are in or near the bottom end **18** of the bags. As a

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result, the bottom ends **18** of the bags are held close together by the cord **24** and the other ends **15** can assume spaced-apart positions. The construction element **30** is particularly suitable for use in structures to protect underwater shoreline areas from erosion. Referring to Figure 5, shoreline **34**, which may be for example the shore of a river, lake, or saltwater body, has a sloping area **36** which is partly or wholly underwater and would be subject to erosion by the action of the water. Construction elements **30** are placed on this area **36** and collectively form a structure **38** which protects the underwater shoreline area from erosion. The construction elements may be placed in random orientations and may overlie or be intermingled or entangled with each other to function in a relatively unitary manner. Optionally, they may be secured to the underwater surface **36**, for example by affixing the cords **24** to the ground by means of spikes or the like. The construction elements **30** may comprise any convenient number of sandbags **12**, for example, four, five, etc. The bags can be the same size or a mixture of different sizes. For example, a mixture of relatively larger and relatively smaller sandbags can be conducive to entanglement of the construction elements.

In another embodiment, construction element **40**, shown in Figure 4, comprises a plurality of bags **42** which have a single hole **22**, positioned at or near the bottom end **18** of the bag, for the passage of cord **24**. The cord passes through the opening **16** in the top end **15** of the bags. Once the bag is filled with fill material, opening **16** is sealed around the cord, leaving a small opening through which the cord continues to pass. The sandbags **42** are accordingly strung together end to end, to form the construction element **40**.

For convenience of illustration, the construction elements are shown in the figures having three or four bags, but it will be understood that they

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may comprise any number of bags that would be suitable for a particular application, for example two bags, five bags, ten bags, etc.

The construction elements of the invention can be used in the construction of retaining walls and similar structures. In general terms, they can be used in any application in which ordinary sandbags could be used. To such applications they bring the superior qualities of strength and stability that are imparted by virtue of the attachment of several bags together into a single unit. Figure 6 illustrates an exemplary retaining wall 50 made using construction elements 40. The wall comprises a plurality of courses 52, forming a wall face 53 supporting a slope 54. Each course 52 comprises one or more construction elements 40 comprising sandbags 42 attached together by means of cords 24. The courses 52 are laid in a generally horizontal orientation, or following the contour of the ground as required, and are laid one course atop the other, in a generally vertically sloping array as required for the particular slope being supported. In the typical application, where the length of the retaining wall 50 is much longer than the length of a single construction element, each course will comprise several construction elements 40, positioned end to end. The free ends of the cords 24 at the ends of the construction elements are preferably anchored to the slope, or to fill placed in back of the wall face, by means of spikes 56.

The wall may be further strengthened and stabilized by various means. Optionally, rods 58, made of a non-degradable material such as fiberglass, may be driven through multiple courses of sandbags. Also optionally, the construction elements may be arranged so that the sandbags in vertically-adjacent courses are in a staggered arrangement, i.e with each sandbag being positioned over two sandbags of the vertically-adjacent lower course. Also optionally, and preferably, interconnecting members are used between each course 52 in order to attach vertically- and



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horizontally-adjacent sandbags together. Such interconnecting members are described in WO 00/61880 and are commercially available under the trademark DELTALOK from Deltalok Inc. of Vancouver, British Columbia.

5

Although Figure 6 illustrates the use of construction elements **40** in a retaining wall, it will readily be seen that construction elements **10** may be used in essentially the same manner in the construction of a retaining wall. In such case, the sandbags **12** are oriented extending lengthwise  
10 from the slope, so that the outer side of the wall face is formed of the ends **18** or **15** of the sandbags, rather than their sides **12**.

Another example of a retaining wall structure made using the construction elements is shown in Figure 7. Retaining wall **60** supporting  
15 slope **54** incorporates a construction element **10** having spaced-apart sandbags **12**. Individual sandbags **62** forming the wall face **64** abut and are attached to sandbags **12**, by means of interconnecting members **66**. The interconnecting members comprise a plate having projections **67** on both sides which protrude into sandbags of vertically-adjacent courses and  
20 into horizontally-adjacent sandbags. They may be of the types described in WO 00/61880 (Kim). Other courses of the retaining wall **60** may comprise individual sandbags, or construction elements of the type shown in Figures 1 or 4, or courses constructed like the one illustrated in Figure 7, or combinations of these types of courses, as may be appropriate or  
25 convenient for a particular application.

While exemplary embodiments have been discussed above, those of skill in the art will recognize that certain modifications thereof may be made. It is therefore intended that the following appended claims are  
30 interpreted to include all such modifications, as are within their true scope.

## WHAT IS CLAIMED IS:

1. A construction element comprising:
  - 5 (a) a plurality of bags having flexible walls and a sealable opening for insertion of fill material into said bag, each of said bags having at least one hole in said wall thereof; and
  - 10 (b) a cord extending through said holes attaching said bags together.
2. A construction element according to claim 1 wherein each of said bags has two said holes in said wall thereof and said cord extends through both of said holes.
- 15 3. A construction element according to claim 1 wherein said bag wall has a side portion and opposed end portions and said hole is at or proximate to one of said end portions.
- 20 4. A construction element according to claim 1 or 2 wherein said bag has a side portion and opposed end portions and said sealable opening is in one of said end portions.
- 25 5. A construction element according to claim 4 wherein said cord extends through said sealable opening and wherein said at least one hole is in or proximate to said end portion opposite to said sealable opening.
- 30 6. A construction element according to any one of claims 1-5 wherein said cord comprises a plastics material.

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7. A construction element according to claim 6 wherein said plastics comprises nylon.
8. A construction element according to any one of claims 1-7  
5 wherein said bags are sandbags containing said fill material.
9. A wall structure comprising a plurality of construction elements according to claim 8.
- 10 10. A wall structure according to claim 9 comprising a plurality of courses, each of said courses comprising one or more of said construction elements.
11. A wall structure according to claim 10 wherein said cords of  
15 said construction elements extend from ends of said courses and are secured to a slope supported by said wall structure.
12. A wall structure according to claim 10 or 11 further  
20 comprising rods extending through said sandbags in a plurality of said courses.
13. A wall structure according to any one of claims 10-12  
25 wherein said sandbags in said courses are attached together by means of interconnecting members which attach vertically- and horizontally-adjacent sandbags together.
14. A structure for protecting underwater shoreline areas from  
30 erosion, comprising a plurality of construction elements according to claim 8 positioned on said underwater shoreline area.

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15. A structure according to claim 14 wherein said sandbags comprise sandbags of different sizes.
16. An structure according to claim 14 or 15 wherein said construction elements are anchored to said underwater shoreline area by means of said cords.
17. A retaining wall structure comprising:
- 10 (a) a plurality of courses of sandbags forming a wall face supporting a mass of fill material, each of said courses comprising a plurality of sandbags;
- 15 (b) interconnecting members positioned between adjacent courses to connect sandbags of each course to said sandbags of each adjacent course; and
- 20 (c) a construction element according to claim 8 wherein said sandbags of said construction element extend from said wall face into said fill material, said extending sandbags being attached by means of an interconnecting member to one or more of said sandbags forming said wall face, said cord of said construction element being anchored to said fill material or to a slope supported by said wall face.
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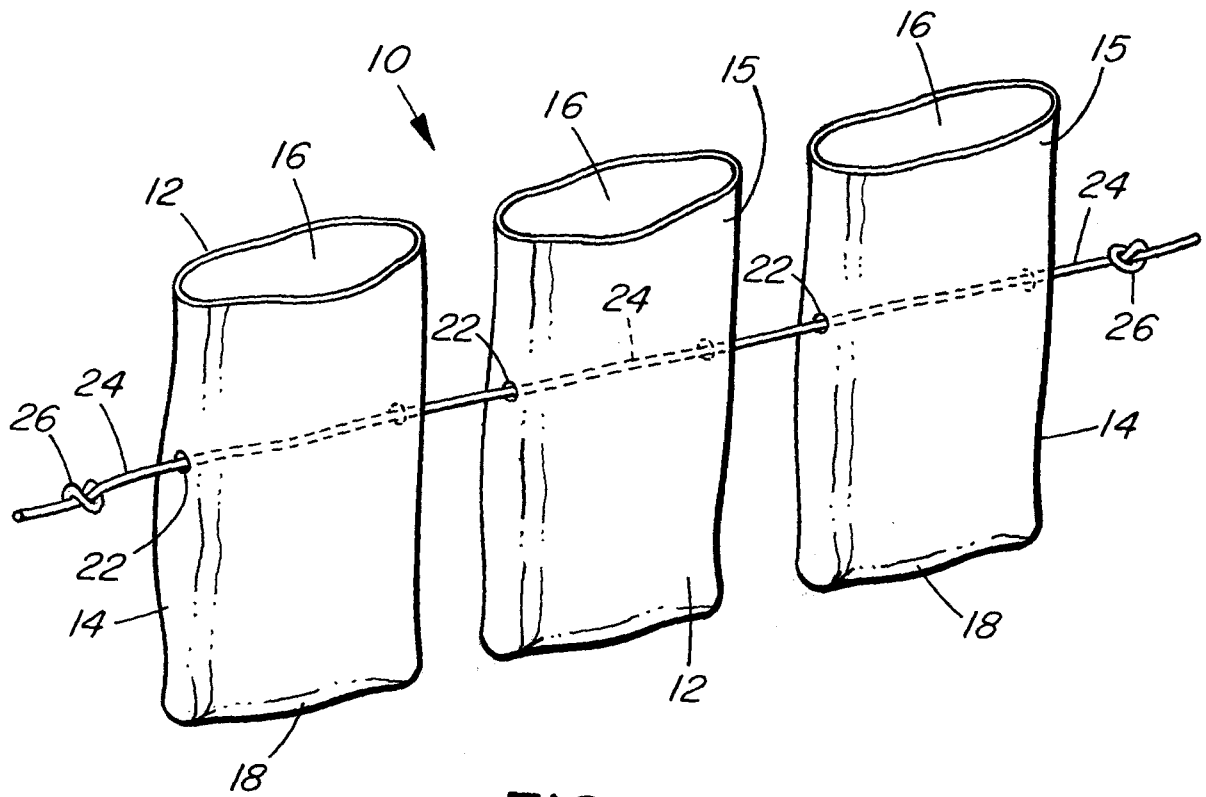


FIG. 1

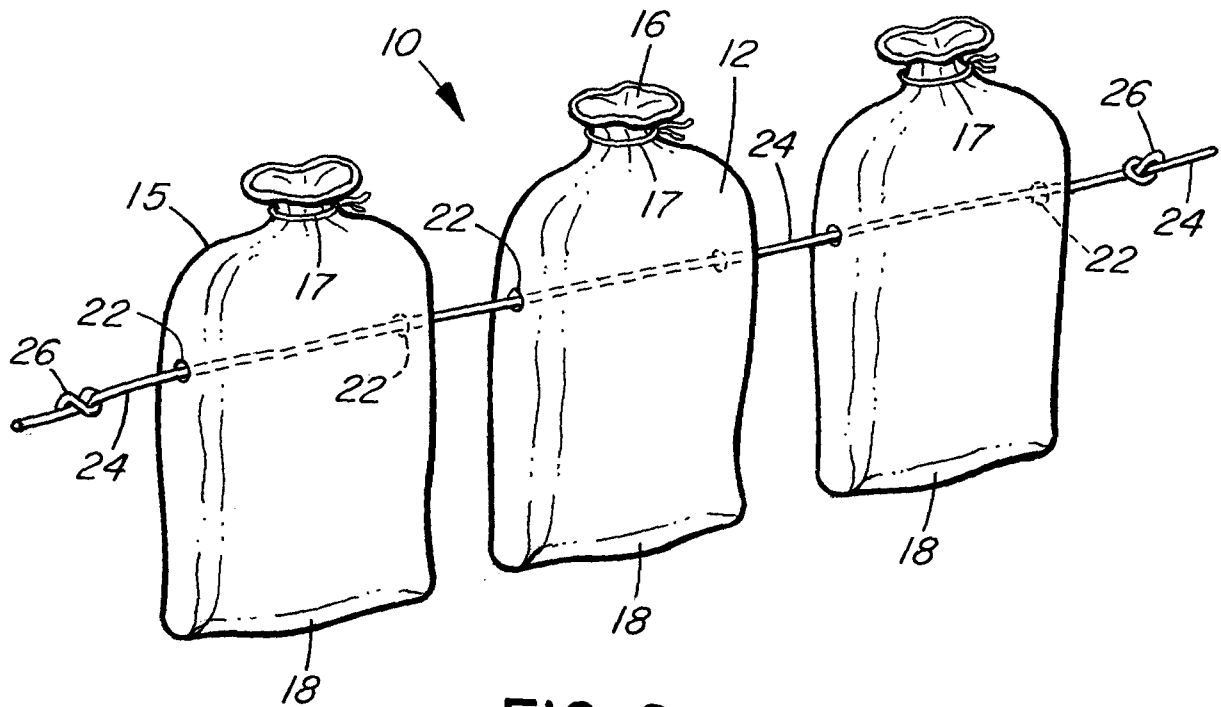


FIG. 2

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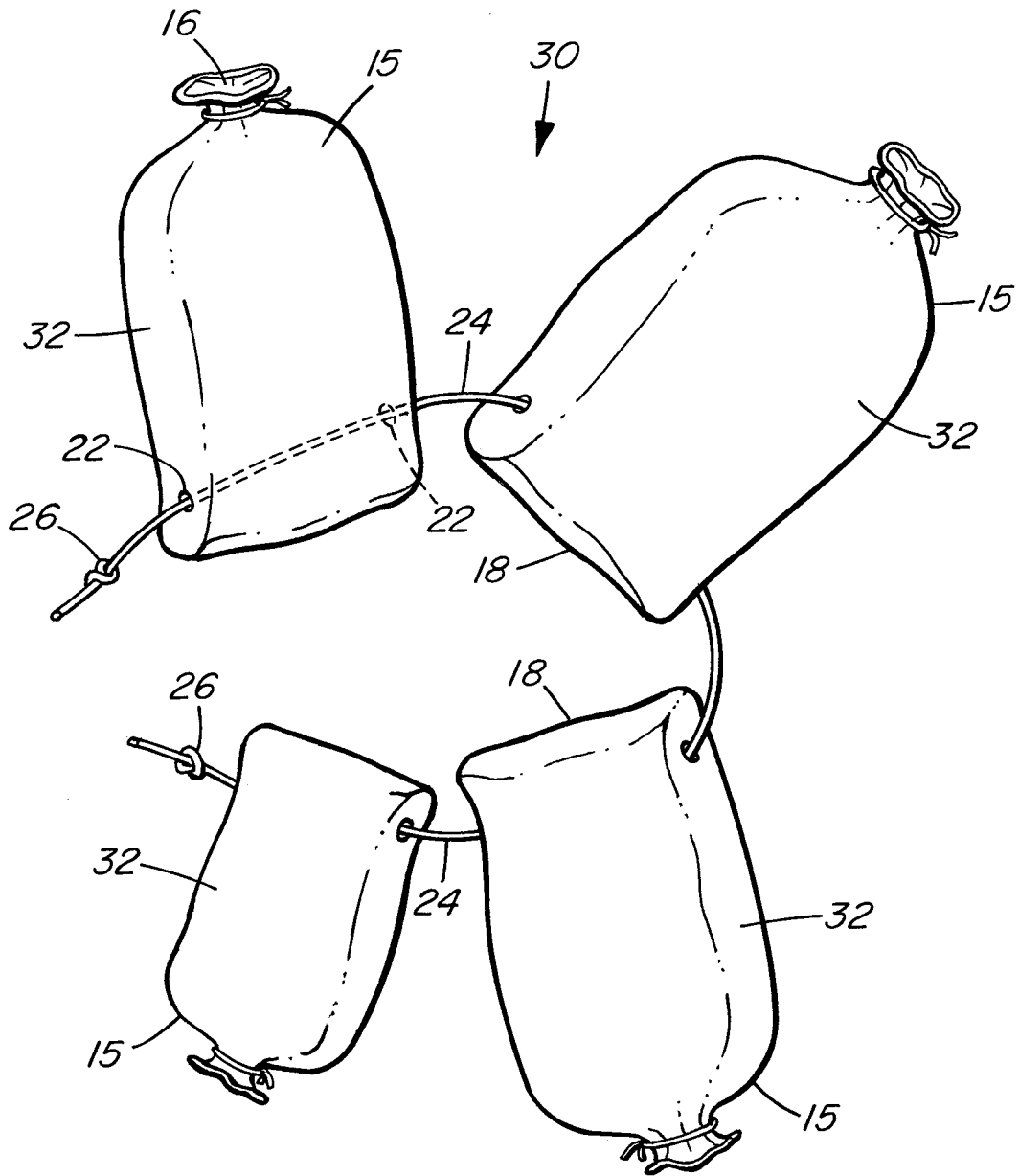
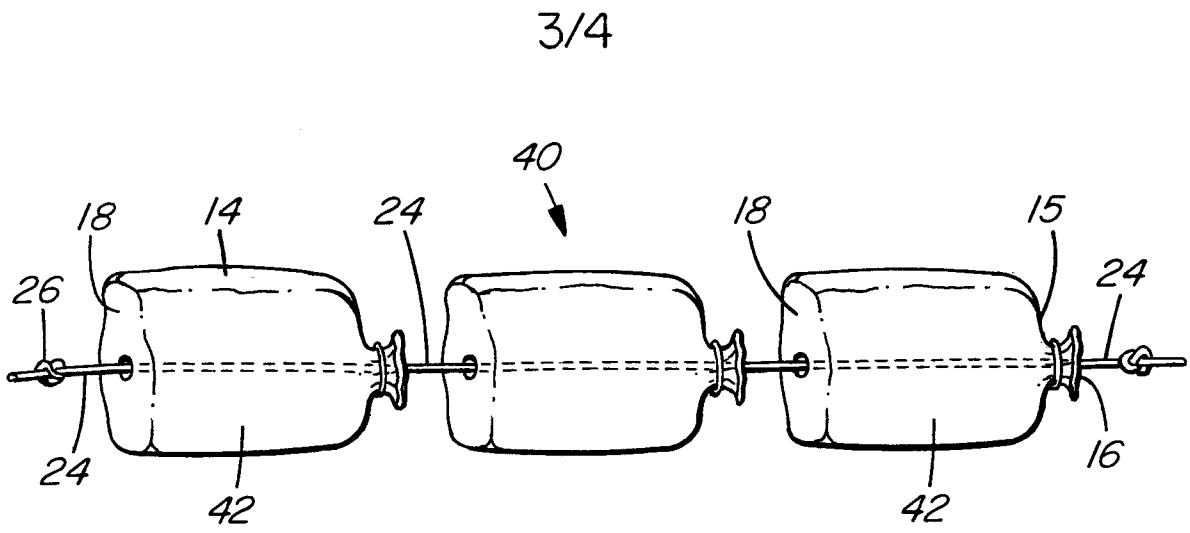
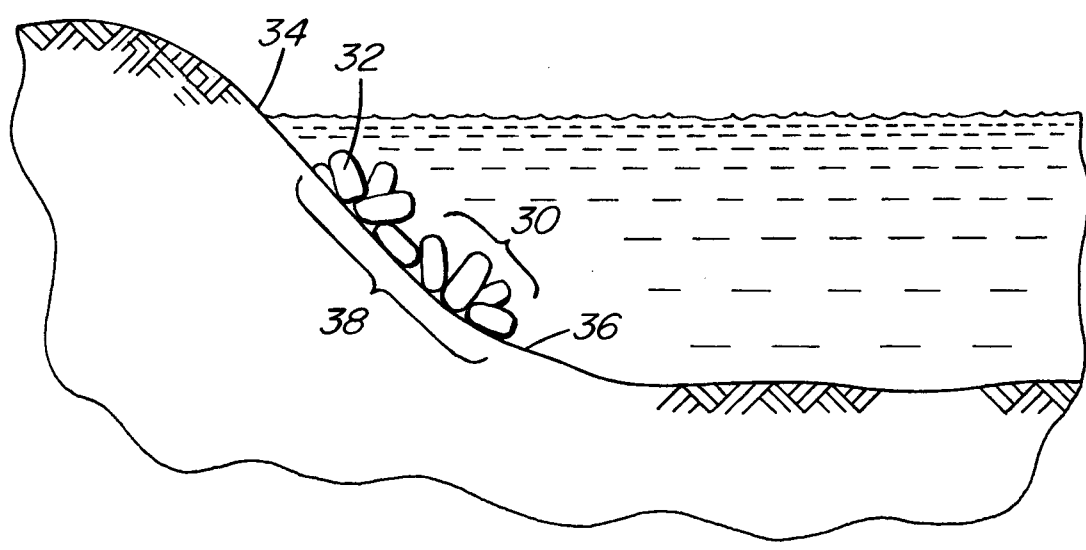


FIG. 3



**FIG. 4**



**FIG. 5**

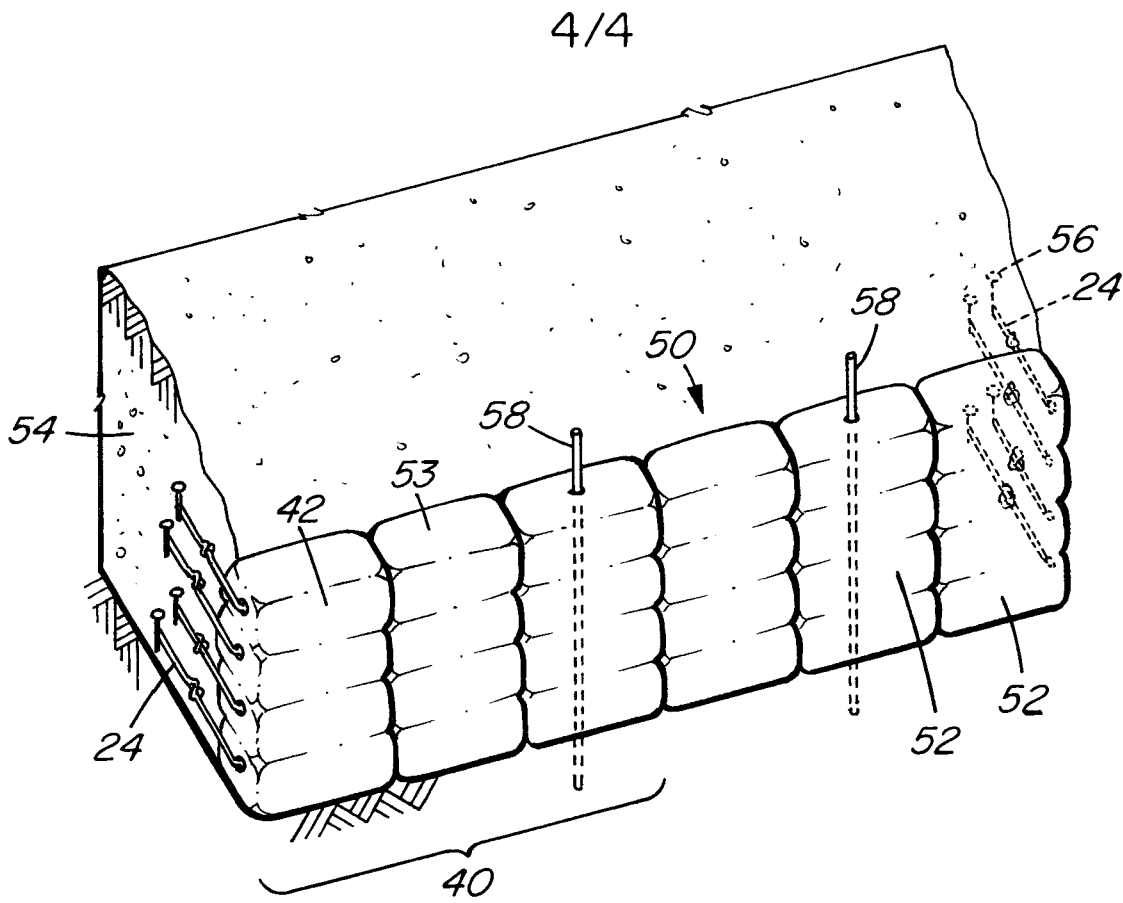


FIG. 6

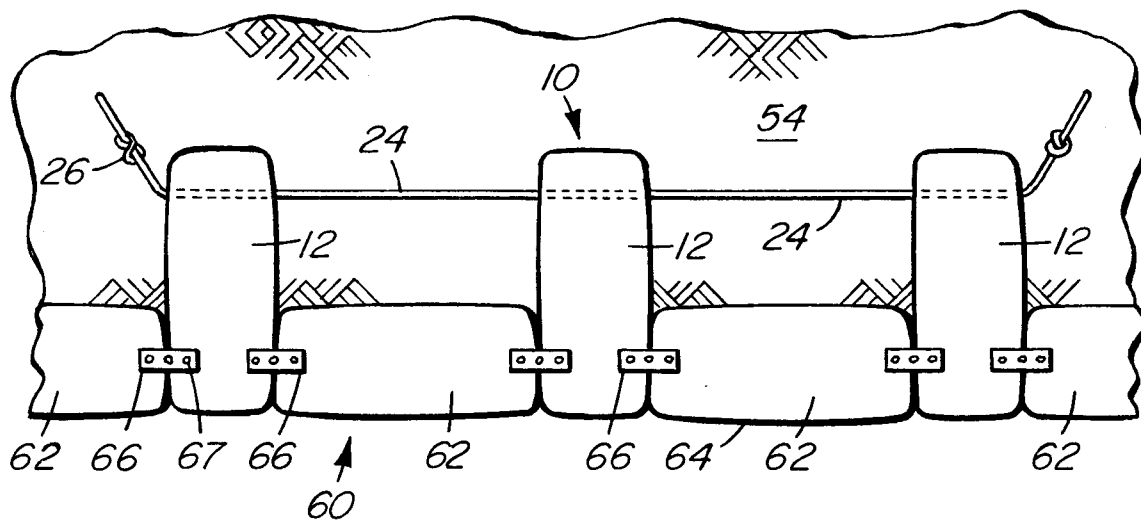


FIG. 7



<p>A. CLASSIFICATION OF SUBJECT MATTER  <b>IPC: E02B 3/04</b> (2006.01) , <b>E02D 29/02</b> (2006.01)          According to International Patent Classification (IPC) or to both national classification and IPC</p>																										
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols)          IPC(2006.01): E02B, E02D <span style="float: right;">CPC: 61/51</span>          USPC: 383/32, 33, 37, 38, 78, 80, 84; D09/703, 705</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)          Espacenet, Canadian Patents Database, Delphion (all databases), USPTO, Internet (Keywords: sandbag(s), cord, cable)</p>																										
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>JP 2005-068832 A (OMORI) 17 March 2005 (17-03-2005) *Abstract; drawings; paragraphs [0033, 0044, 0062]*</td> <td>1-4, 6-12, 14-16</td> </tr> <tr> <td>Y</td> <td></td> <td>13, 17</td> </tr> <tr> <td>X</td> <td>JP 2000-080637 A (MATSUOKA et al.) 21 March 2000 (21-03-2000) *Abstract; drawings*</td> <td>1-4, 6-10</td> </tr> <tr> <td>Y</td> <td>CA 2,426,836 A1 (KIM) 25 October 2004 (25-10-2004) *whole document*</td> <td>13, 17</td> </tr> <tr> <td>A</td> <td>CA 1,204,295 A (SCALES et al.) 13 May 1986 (13-05-1986) *whole document*</td> <td></td> </tr> <tr> <td>A</td> <td>US 6,224,258 B1 (DODSON) 01 May 2001 (01-05-2001) *whole document*</td> <td></td> </tr> <tr> <td>A, P</td> <td>JP 2005-256295 A (SHIBATA) 22 September 2005 (22-09-2005) *Abstract; drawings*</td> <td></td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	JP 2005-068832 A (OMORI) 17 March 2005 (17-03-2005) *Abstract; drawings; paragraphs [0033, 0044, 0062]*	1-4, 6-12, 14-16	Y		13, 17	X	JP 2000-080637 A (MATSUOKA et al.) 21 March 2000 (21-03-2000) *Abstract; drawings*	1-4, 6-10	Y	CA 2,426,836 A1 (KIM) 25 October 2004 (25-10-2004) *whole document*	13, 17	A	CA 1,204,295 A (SCALES et al.) 13 May 1986 (13-05-1986) *whole document*		A	US 6,224,258 B1 (DODSON) 01 May 2001 (01-05-2001) *whole document*		A, P	JP 2005-256295 A (SHIBATA) 22 September 2005 (22-09-2005) *Abstract; drawings*	
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<p>Date of the actual completion of the international search</p> <p>08 June 2006 (08-06-2006)</p>		<p>Date of mailing of the international search report</p> <p>31 July 2006 (31-07-2006)</p>																								
<p>Name and mailing address of the ISA/CA</p> <p>Canadian Intellectual Property Office          Place du Portage I, C114 - 1st Floor, Box PCT          50 Victoria Street          Gatineau, Quebec K1A 0C9          Facsimile No.: 001(819)953-2476</p>		<p>Authorized officer</p> <p><b>Scott Jurgens (819) 953-0617</b></p>																								

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/CA2006/000398

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
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JP2000080637	21-03-2000	NONE	
CA2426836	25-10-2004	NONE	
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