United States Patent

[11] 3,592,008

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[45] Patented **July 13, 1971**

[54] **FLOTATION CONFINEMENT APPARATUS**
1 Claim, 12 Drawing Figs.

[52] **U.S. Cl.** **61/1,** 61/5
[51] **Int. Cl.** **E02b 15/04**
[50] **Field of Search** 61/1, 5, 69; 210/121, 242

[56] **References Cited**

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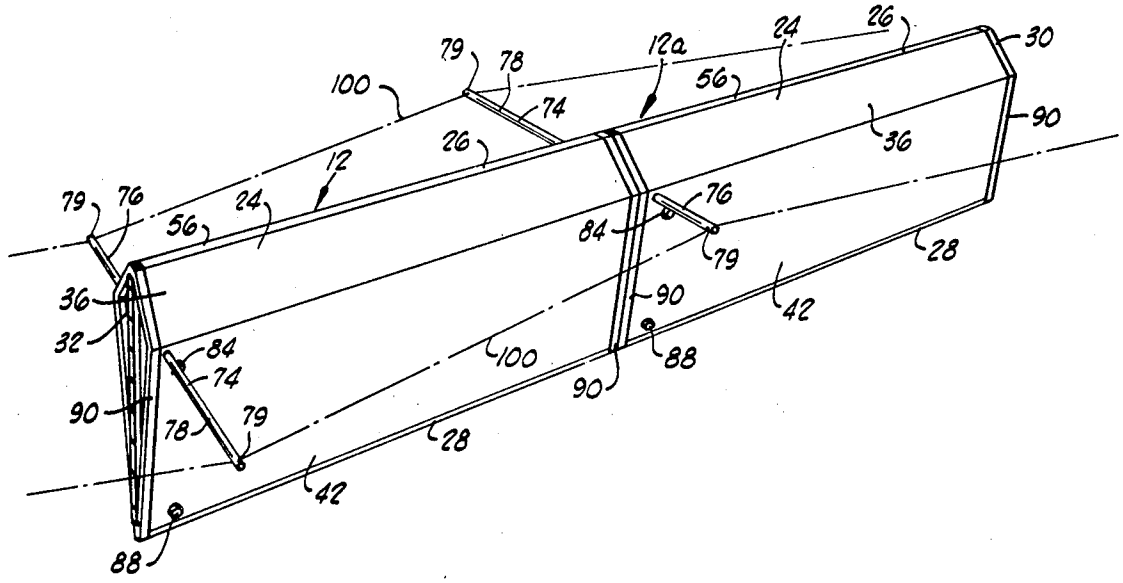
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Primary Examiner—Jacob Shapiro
Attorney—Dunlap, Laney, Hessin & Dougherty

ABSTRACT: A flotation confinement apparatus for disposition on a body of water which apparatus is particularly useful around offshore oil rigs and in cooperation with a shoreline to retain or to exclude oil or other undesirable matter until such matter can be removed or otherwise eliminated.



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SHEET 1 OF 4

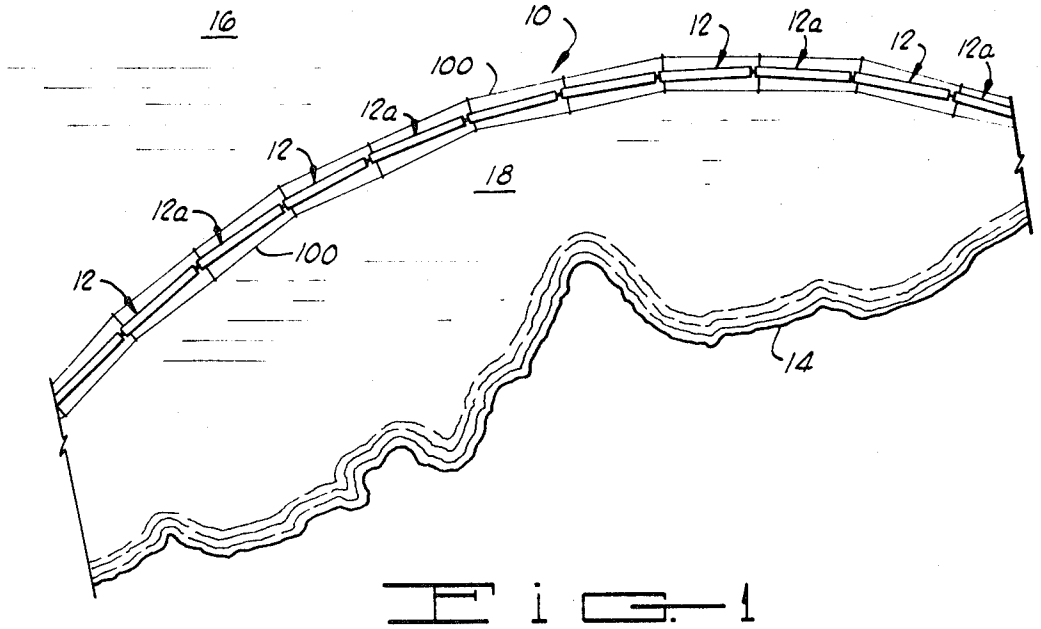


Fig. 1

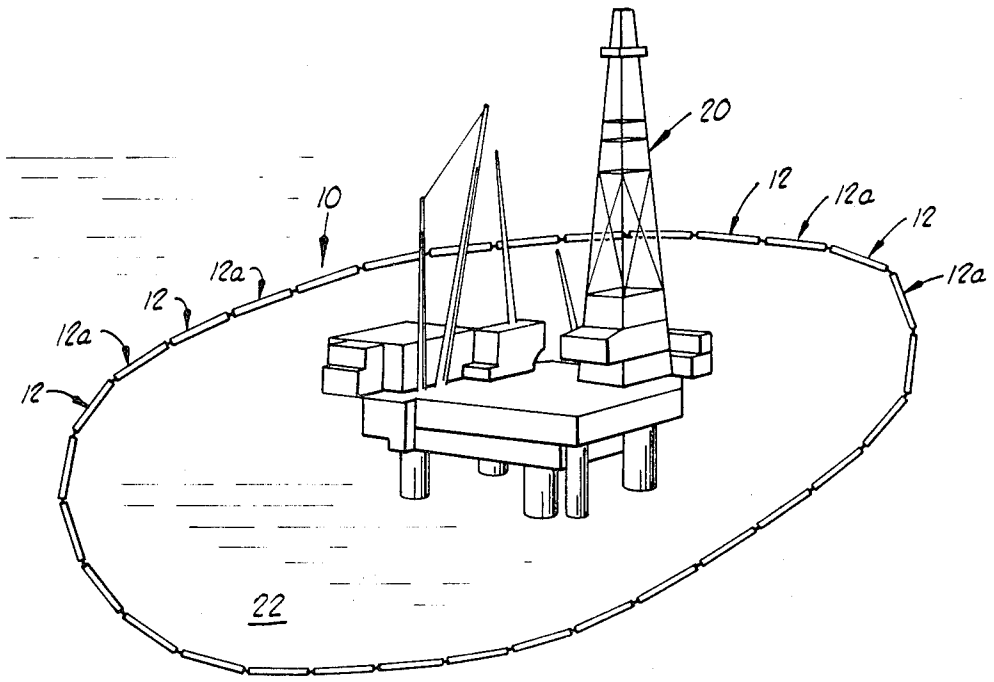


Fig. 2

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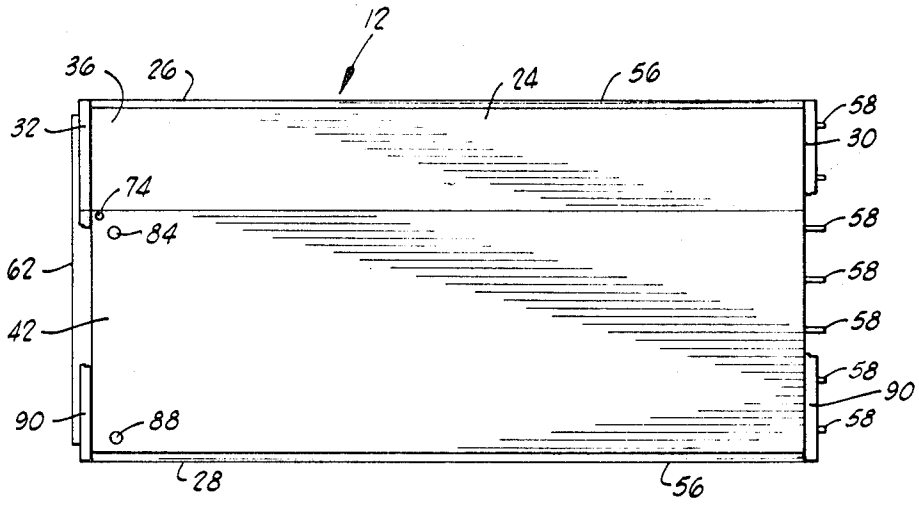


Fig. 3

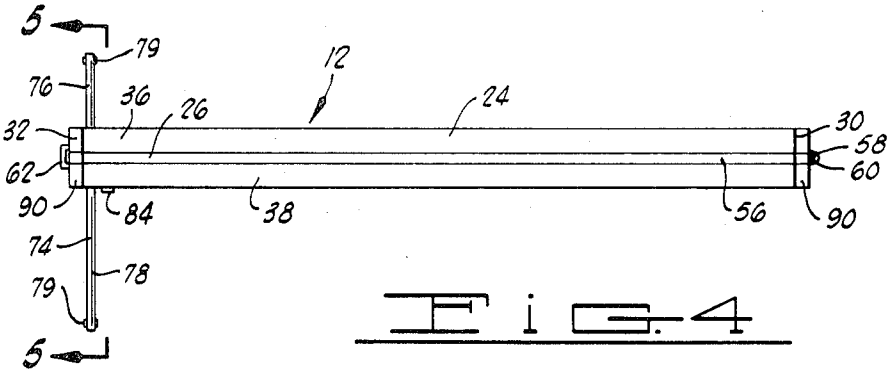


Fig. 4

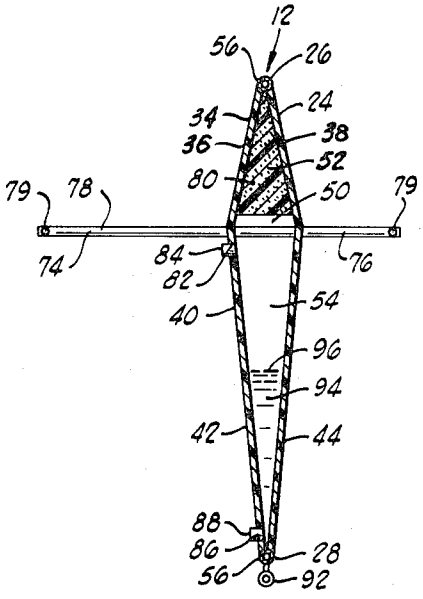


Fig. 5

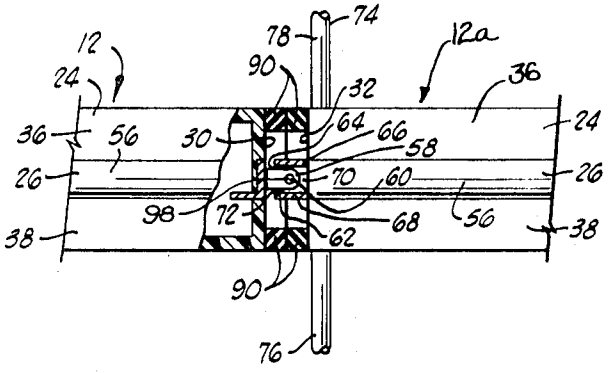


Fig. 6

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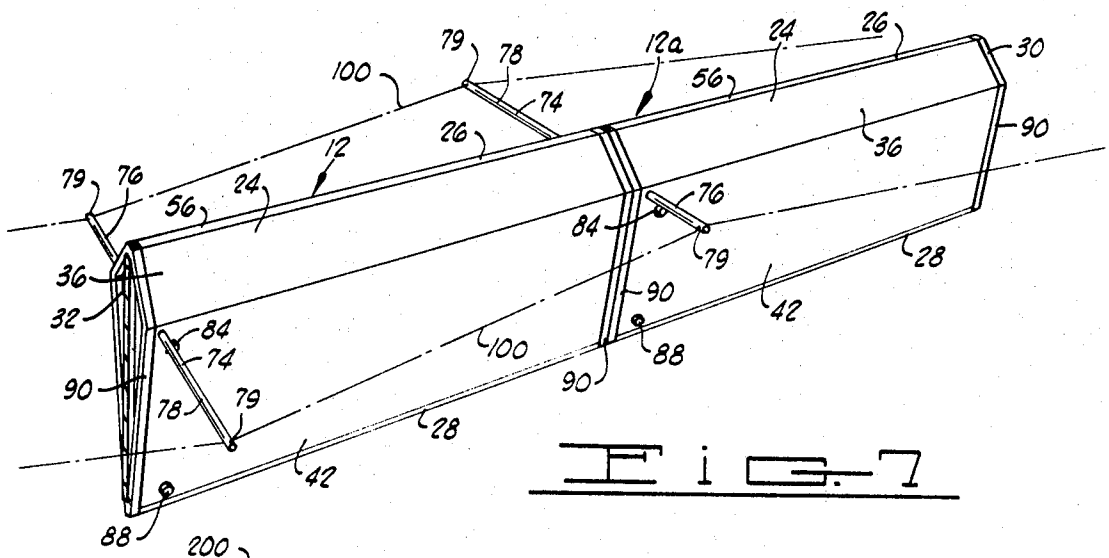


Fig. 7

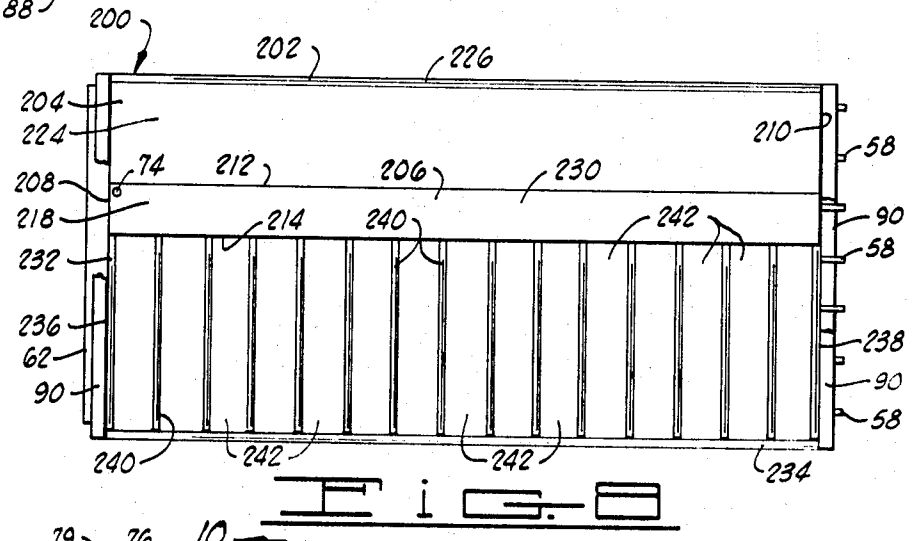


Fig. 8

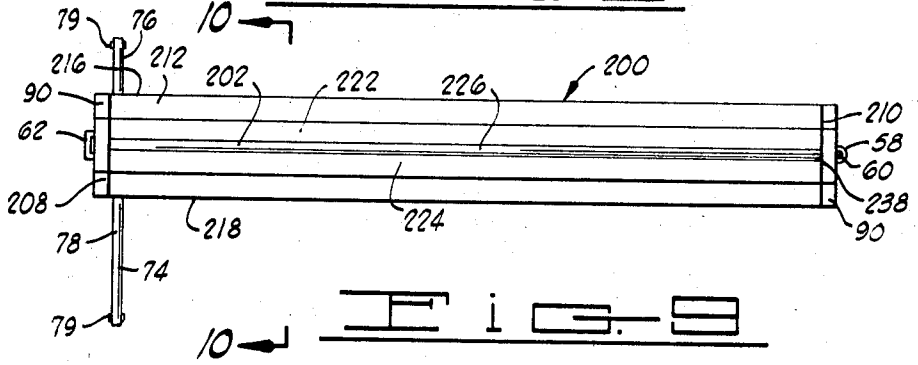


Fig. 9

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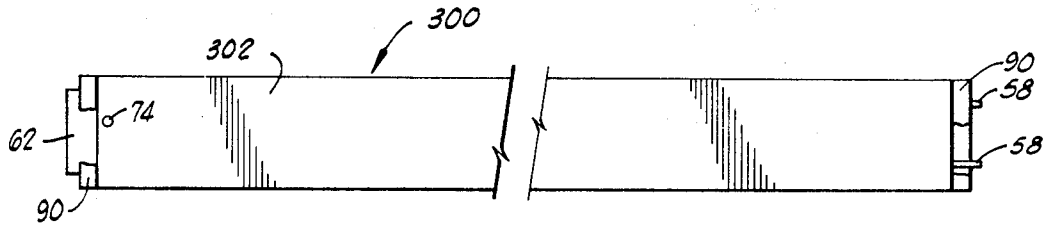


Fig. 11

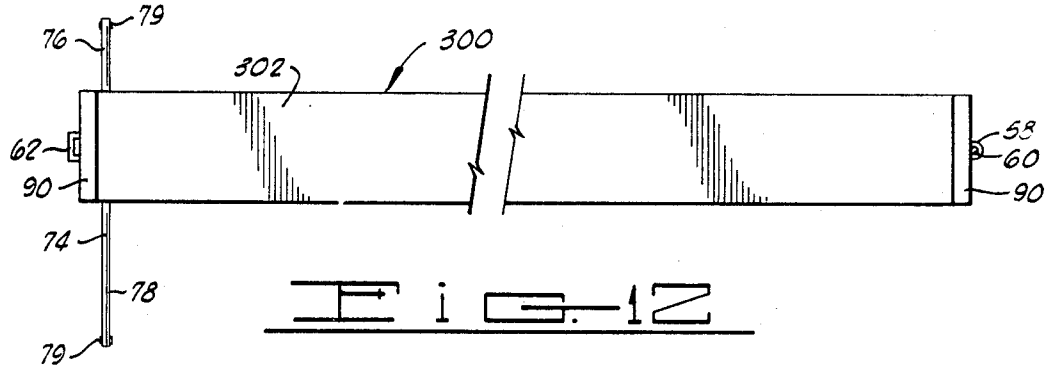


Fig. 12

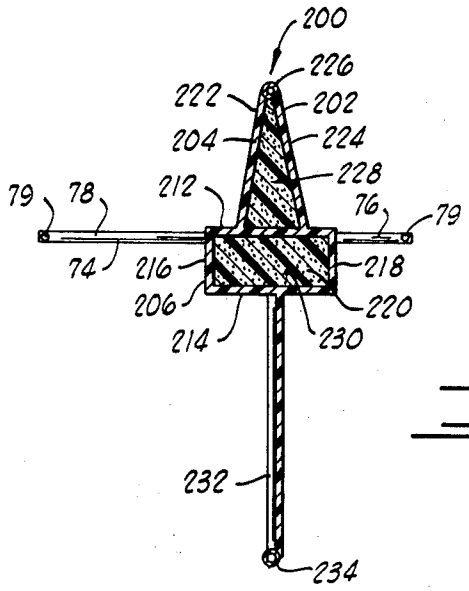


Fig. 10

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FLOTATION CONFINEMENT APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to improvements in flotation apparatus and, more particularly, but not by way of limitation, to an improved flotation confinement apparatus which is utilized to form a protective periphery to retain or keep out oil or other undesirable matter.

2. Description of the Prior Art

The problem of water pollution has been of some general concern for a number of years. This problem, however, has become extremely acute in recent years with the advent or increase in offshore drilling for oil.

An oil slick invariably results anytime an offshore rig is installed. This oil slick can result simply from seepage, or such can result from a break or other malfunction in various pipelines associated with the offshore rig.

Where the oil slick results from seepage, and usually only small quantities of oil are involved at any given time. Therefore, the problem was generally not recognized or at least no attempt was generally made to remove the oil until such time as the quantity of oil had built up, to an unmanageable amount or had already been washed on shore. At this time, it was generally too late to do anything but try to maintain the resulting damage at a minimum.

When large quantities of oil were involved, occurring via a break or other malfunction in the pipelines, the problem was easily recognized, but the solution was elusive. The basic approaches in the past directed toward eliminating a pollution of water caused by oil or other such matter have been twofold The first was to simply try to construct an offshore rig with the maximum safety features incorporated therein, at least within the economic limits. This approach, of course, does not eliminate the problem, but rather reduces or attempts to reduce the resulting damage.

The second approach was to try to discover methods of cleaning up the oil in the shortest possible time. The solutions found in this area are generally too costly to be used on a daily basis to combat the seepage, and these have not been found to be adequate or fast enough to clean up large quantities of oil during what may be referred to as a major disaster.

It is apparent that both of the approaches taken in the past tended only to reduce the damaging effects, and neither provided a continuing type of antiwater pollution or oil loss control.

SUMMARY OF THE INVENTION

The present invention contemplates a flotation confinement apparatus designed to provide a protective periphery to retain or keep out undesirable debris or matter, such as oil. The flotation confinement apparatus comprises a plurality of flotation sections. Each flotation section is adapted such that a portion thereof will extend above the waterline when the flotation section is floated in water. Means are provided to interconnectingly secure the various flotations together such that they form a protective periphery.

Therefore, it is an object of the present invention to provide apparatus for retaining a relatively large volume of oil on a body of water.

A further object of the invention is to provide flotation confinement apparatus which can be used around an offshore oil rig to retain the oil seepage within a given protective periphery.

Another object of the invention is to provide flotation confinement apparatus which can be used in cooperation with the shoreline to retain or keep out undesirable matter such as oil.

One other object of the invention is to provide flotation confinement apparatus in a segmental form which can be quickly and easily assembled or repaired in the field for emergency use.

One further object of the invention is to provide flotation confinement apparatus where the vertical height of the apparatus above the water is adjustable to retain a certain level of oil slick or other such debris within a given protective periphery.

One additional object of the invention is to provide flotation confinement apparatus which can be economically manufactured and will have a long service life.

Other objects and advantages of the invention will be evident from the following detailed description when read in conjunction with the accompanying drawings which illustrate the preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a pictorial representation of a flotation confinement apparatus providing a protective periphery about a shoreline;

FIG. 2 is a pictorial representation of a flotation confinement apparatus providing a protective periphery around an offshore oil rig;

FIG. 3 is a side elevational view of a flotation section;

FIG. 4 is a top elevational view of the flotation section of FIG. 3;

FIG. 5 is a cross-sectional view of the flotation section of FIG. 3, taken substantially along the lines 5–5 of FIG. 4;

FIG. 6 is a partial sectional, partial elevational view of the interconnecting means of the flotation section of FIG. 3;

FIG. 7 is an elevational view of two of the flotation sections of FIG. 3 joined in an assembled position;

FIG. 8 is a side elevational view of a modified flotation section;

FIG. 9 is a top elevational view of the modified flotation section of FIG. 8;

FIG. 10 is a cross-sectional view of the modified flotation section of FIG. 8 taken substantially along the lines 10–10 of FIG. 9;

FIG. 11 is a side elevational view of another modified flotation section; and

FIG. 12 is a top elevational view of the modified flotation section of FIG. 11.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in detail, and to FIGS. 1 and 2 in particular, shown therein and designated by general reference character 10 is a flotation confinement apparatus constructed in accordance with the present invention.

The flotation confinement apparatus 10, in one form, is used to form a protective periphery to either retain debris or matter such as oil within a protective periphery, or to keep it out, depending upon the particular application involved. The flotation confinement apparatus 10 basically comprises a plurality of flotation sections 12 which are joined together to form the protective periphery.

As shown in FIG. 1, a plurality of the flotation sections 12 have been joined to form an encompassing protective periphery about an area of a shoreline 14. When the flotation sections 12 are joined and used in cooperation with a shoreline in this manner, the shoreline 14 is protected from any matter or debris which may be present in the body of water 16, outside of the protective periphery.

It is also apparent that when used in this manner, the flotation confinement apparatus 10 could retain debris within the body of water 18, or in other words within the protective periphery formed by the flotation confinement apparatus 10.

As shown in FIG. 2, the flotation sections 12 have been joined to form a protective periphery around an offshore oil rig designated by the general reference 20. When the flotation sections 12 are joined in this manner, the flotation confinement apparatus 10 will form a protective periphery around the offshore oil rig 20, and retain any seepage of oil within the body of water 22, or in other words within the protective periphery formed by the flotation confinement apparatus 10.

One embodiment of the flotation section **12** is shown in FIGS. **3**, **4**, and **5**, and this basically comprises a rectangular shaped shell **24** having an elongated diamond-shaped cross section, an upper and a lower side **26** and **28**, respectively, and opposite ends **30** and **32**.

The shell **24**, as shown more clearly in FIG. **5**, has an upper triangular-shaped section **34** having sides **36** and **38** thereon, and a lower triangular-shaped section **40** having sides **42** and **44** thereon. The upper and lower triangular-shaped sections **34** and **40** are separated by a plate **50**, which in cross section forms a common base for the upper and lower triangular-shaped sections **34** and **40**.

One end of the side **36** of the upper triangular section **34** is joined to one end of the side **38**, thereby forming the upper side **26** of the shell **24**. The ends of the sides **36** and **38**, opposite the ends which are joined, are each secured to one side of the plate **50**, thereby forming a hollow upper chamber **52** in the upper triangular section **34**. One end of the side **42** of the lower triangular section **40** is joined to one end of the side **44**, thereby forming the lower side **28** of the shell **24**. The ends of the sides **42** and **44** opposite the ends which are joined, are each secured to one side of the plate **50**, thereby forming a hollow lower chamber **54** in the lower triangular section **40**.

The end **30** of the shell **24** is secured to one end of the sides **36** and **38** of the upper triangular section **34**, to one end of the sides **42** and **44** of the lower triangular section **40** and to one end of the plate **50**, thereby enclosing one end of the upper and lower chambers **52** and **54**. The end **32** of the shell **24** is secured to one end of the sides **36** and **38** of the upper triangular-shaped section **34**, to one end of the sides **42** and **44** of the lower triangular-shaped section **40**, and to one end of the plate **50**, opposite the ends which secured to the end **30** of the shell **24**, thereby enclosing one end of the upper and lower chambers **52** and **54**. It is apparent from the foregoing that the plate **50** isolates the upper chamber from the lower chamber, for reasons which will be described in detail below.

Since the ends **30** and **32** of the shell **24**, the sides **36** and **38** of the upper triangular-shaped section **34**, and the sides **42** and **44** of the lower triangular-shaped section **40** will be either immersed in water, or exposed to the water, the sides and ends mentioned above should be constructed of a material suitable for this particular type of application. In a preferred form, the sides and ends of the shell **24** are constructed of a laminated fiberglass material which affords desirable strength, resilience and lightweight qualities. It should be noted too, that in one form, the sides of the shell **24** could be of a one-piece construction for purposes of economy and manufacture.

A metal frame **56**, which may be constructed of pipe, is secured to the shell **24** and extends around the outer periphery thereof. The metal frame **56** provides the basic structural strength, both lateral and longitudinal support, to the flotation section **12**.

Shown more clearly in FIGS. **3** and **4**, a plurality of tongues **58** are secured to the portion of the metal frame **56** adjacent the end **30** of the flotation section **12**. The tongues **58** extend perpendicular to the end **30**, and each tongue **58** has an aperture **60** which extends therethrough. The purpose of the tongues **58** will be described in more detail below.

A C-shaped bracket **62** having an end **64** and flange portions **66** and **68**, which extend perpendicular to the end **64**, is secured on the end **32** of the shell **24**. In particular, the ends of the flanges **66** and **68**, opposite the ends which are secured to the end **64** thereof, are each secured to the end **32** of the shell **24**; and each flange **66** and **68** is formed to have a sufficient length so that a gap **70** will exist between the end **64** of the bracket **62** and the end **32** of the shell **24**.

As shown more clearly in FIG. **6**, a plurality of slots **72** are provided through the end **64** of the bracket **62**, thereby communicating with the gap **70** between the bracket **62** and the shell **24**. The slots **72** are sized and positioned to receive the tongues **58** in a manner and for a purpose to be described below.

A guide arm **74** extends through the shell **24**, adjacent the plate **50** and the end **32** thereof, and is adjustably secured therein. As shown more clearly in FIG. **4**, and in the preferred form, the guide arm **74** extends a greater distance from the shell **24** on one side thereof than on the opposite side thereof, thereby resulting in what may be referred to as a short arm **76** extending from one side of the shell **24** and a long arm **78** extending from the opposite side of the shell **24**. A guide hook **79** is secured on each end of the guide arm **74**, for reasons which will be made more apparent below.

In a preferred form, the guide arm **74** is adjustable so that the the long arm **78** and the short arm **76** may be alternately extended from the opposite sides of the flotation section **12**. However, if the guide arm **74** is not adjustable in this manner, but rather is secured in place in the flotation section **12**, it is necessary to provide a flotation section **12*a*** to be used in cooperation with the flotation section **12** in forming the flotation confinement apparatus **10**.

The flotation section **12*a*** is constructed identically to the flotation section **12** except the short arm **76** of the long arm **78** will extend from the opposite side of the shell **24** with respect to the short arm **76** of the flotation section **12**, and the long arm **78** will extend from the opposite side of the flotation section **12*a*** with respect to the long arm **68** of the flotation section **12**. Notwithstanding the particular construction of the guide arm **74**, the flotation section **12*a*** referred to hereinafter will be a flotation section wherein the guide arm **74** extends from the shell **24** in a manner as described above.

The upper hollow chamber **52**, in a preferred form, is filled with a flotation material **80**. It has been found that a polyurethane foam plastic provides an excellent flotation material to be used in this portion of the shell **24**.

A fill port **82**, having a plug **84** removably disposed therein, is provided in the side **42** of the lower triangular section **40**, and it is disposed adjacent the connection of the side **42** with the plate **50**. A drain port **86**, having a plug **88** removably disposed therein, is provided in the lower portion of the side **42** generally adjacent the side **28** of the shell **24**. The purpose of the fill port **82** is to permit the filling of the lower chamber **54** with ballast, preferably water, and the drain port **86** is provided to drain the ballast from the lower chamber **54**, as will be described in greater detail below.

In the preferred form, a neoprene seal **90** is bonded to each end **30** and **32** of the shell **24**. The neoprene seal is sized to sealingly engage the adjoining flotation section, and yet it will permit a certain amount of transverse movement between the two flotation sections, as will be described in greater detail below.

A plurality of eyebolts **92** are secured on the lower side **28** of the shell **24**, and these are provided to accommodate an anchor or additional weights which may be required during the operation of the flotation confinement apparatus **10**, as will be described below.

Operation of FIGS. 1 through 7

In a preferred form of using the flotation sections **12** and **12*a*** to form a protective periphery, the lower chamber **54** is initially filled through port **82** with a ballast **94**, such as water, to a level **96**. The level **96**, or in other words the volume of ballast **94** which is put in the lower chamber **54**, will depend on the requirements of the particular application. It is apparent, that the greater the volume of ballast **94** which is put in the lower chamber **54**, the lower the shell **24** will ride in the water, or in other words, the closer the topside **26** of the shell **24** will be to the waterline. In this manner the volume of debris combined within the protective periphery is adjustable and controllable.

A plurality of flotation sections **12** and **12*a*** are loaded on a barge or similar water vehicle and transported to the particular area of water where the flotation confinement apparatus is to be used. A flotation section **12** is lowered into the water in a position where a portion of the shell **24** generally adjacent the

upper side **26** thereof extends above the waterline. A flotation section **12***a* is lowered into the water in the same manner, and it is positioned such that the end **32** of the flotation section **12***a* is generally adjacent the end **30** of the flotation section **12**.

The flotation sections **12** and **12***a* are moved into an interlocking and adjoining relationship. The tongues **58** will be inserted through the slots **72**, the gap **70** being sized sufficiently large to accommodate the tongues **58** such that they will not contact the end **32** of the flotation section **12***a*.

An elongated eyebolt **98** is inserted downwardly through the gap **70**, between the bracket **62** and the shell **24**, and through each aperture **60** of each tongue **58**. The eyebolt **98** will therefore join the flotation sections **12** and **12***a* in an interlocking type relationship.

The neoprene seal **90** bonded on the end **30** of the flotation section **12**, and the seal **90** bonded on the end **32** of the flotation section **12***a*, are each sized to extend a sufficient distance from the respective shell **24** so that the seals **90** will sealingly contact when the flotation sections **12** and **12***a* are interlocked. It should be noted that the seals **90** are also sufficiently sized to permit some transverse movement between the flotation sections **12** and **12***a*.

The flotation sections **12** and **12***a* are alternately interlocked and positioned to form the protective periphery, such as illustrated in FIGS. **1** and **2**. The particular number of flotation sections **12** and **12***a* used to form a given protective periphery will, of course, depend on the particular application and the size of the area to be enclosed.

Either during the time the flotation sections **12** and **12***a* are being disposed in the water, or after the protective periphery has been formed, a pair of guide cables **100** are extended between each of the flotation sections **12** and **12***a*. One of the guide cables **100** is extended around the inner portion of the protective periphery, and the other cable **100** is extended around the outer portion of the protective periphery. Each cable **100** is secured to each flotation section **12** and **12***a* through the guide hooks **79** on the guide arm **74**.

Since the flotation sections **12** and **12***a* are alternately joined, it is apparent that each cable **100** will be secured through the guide hook **79** of the long arm **78** of one of the flotation section **12** or **12***a* and, alternately, through the guide hook **79** of the short arm **76** of one of the flotation sections **12** or **12***a*, as shown more clearly in FIG. **7**.

When the flotation sections have been secured to form the protective periphery, and the cables **100** have been secured as described above, it is apparent that by pulling either cable **100**, an individual can control and alter the shape and position of the protective periphery.

It is apparent too from the foregoing that the flotation sections **12** and **12***a* are such that they can be easily transported to a particular work location, and quickly assembled to form the protective periphery. The flotation sections **12** and **12***a* may therefore be used in emergency situations to prevent the resulting costly damage. For example, if a break were to occur in a pipeline located offshore thereby depositing large quantities of oil in the water, a protective periphery could quickly be formed around the oil to contain same until such time as it could be removed or otherwise eliminated. It is apparent that it may also be desirable in such a situation to provide the protective periphery about a certain shoreline to protect the shore from damage.

In one presently constructed form, the flotation sections are about 20 feet in length and ten feet in overall height. These dimensions will vary with requirements.

The flotation sections **12** and **12***a* are also of such a structure that they may be used on a permanent antiwater pollution basis. For example, a protective periphery could be formed around an offshore oil rig, as shown in FIG. **2**, thereby retaining the oil slick, which invariably builds up, until such time as it can be pumped out or otherwise eliminated. The height which the upper side **26** of each shell **24** extends above the waterline will determine the volume of oil which can be retained within the protective periphery.

When the flotation confinement apparatus **10** is used in cooperation with a shoreline, it may be desirable to attach an anchor or other such additional weight through the eyebolt **92** of some of the flotation sections **12** and **12***a* to provide additional stability to the protective periphery. It is apparent that the location of the guide cables **100** provides the main stabilizing factor.

It should also be noted, that when using the flotation confinement apparatus **10** to form the protective periphery about an offshore oil rig, it may be desirable to secure at least four cables between the rig and the protective periphery to provide an additional stabilizing compensator.

Embodiment of FIGS. 8, 9 and 10

A modified flotation section **200** is shown in FIGS. **8**, **9** and **10**, and this basically comprises a shell **202** having an upper portion **204** and a lower portion **206** and opposite ends **208** and **210**.

The lower portion **206** has a rectangular shaped cross section, upper and lower sides **212** and **214**, respectively, and opposite sides **216** and **218**. The sides **212**, **214**, **216** and **218** define a lower chamber **220** in the lower portion **206**.

The upper portion **204** has sides **222** and **224**, and is basically triangular-shaped in one cross section thereof, as shown more clearly in FIG. **10**. One end of the side **222** is joined to one end of the side **224**, thereby forming what may be referred to as the upper side **226** of the shell **202**.

The ends of the sides **222** and **224** opposite the ends which are joined together are each secured to the upper side **212** of the lower portion **206**, in a manner which centrally locates the upper portion **204** on the upper side **212**. The sides **222** and **224** of the upper portion **204** in cooperation with the upper side **212** of the lower portion **206** define an upper chamber **228** in the upper portion **206**. The upper chamber **228** is of course isolated from the lower chamber **220** by the upper side **212** therebetween.

The end **208** of the shell **202** is secured to one end of the sides **222** and **224** of the upper portion **204**, and to one end of the sides **212**, **214**, **216** and **218** of the lower portion **206**, thereby enclosing one end of the upper and lower chambers **228** and **220**, respectively. The end **210** of the shell **202** is secured to one end of the sides **222** and **224** of the upper portion **204**, and to one end of the sides **212**, **214**, **216** and **218** of the lower portion **206** opposite the ends secured to the end **208**, thereby enclosing one end of the upper and lower chambers **228** and **220**, respectively.

The lower chamber **220** is filled with a filler **230** which, in a preferred form, may be of a polyurethane-type material to provide the proper flotation for the flotation section **200**.

A bracket-shaped metal frame **232** having a lower side **234** and opposite ends **236** and **238**, extends downwardly from the lower portion **206** of the shell **202**. An upper portion of the end **236** is secured to the end **208** of the shell **202**, and an upper portion of the end **238** is secured to the end **210**.

A plurality of spaced support members **240** are secured between the lower side **234** of the metal frame **232** and the lower side **214** of the lower portion **208** of the shell **202**. A plurality of panels **242** are then secured between each of the support members **240**.

The remaining portions of the shell **200**, such as the C-shaped bracket, the tongues and the guide arm are identical in construction and operation to the components of the shell **24**, FIGS. **3**, **4** and **5**, which have corresponding reference numerals.

A flotation section **200***a* bears the same relationship to the flotation section **200**, as the flotation section **12***a* and the flotation section **12**. A pair of cables provides the stability and control between flotation sections **200** and **200***a* in the same manner as described before with respect to the cables **100**.

Operation of FIGS. 8, 9 and 10

The flotation sections **200** and **200***a* will operate substantially the same as the flotation sections **12** and **12***a* previously described.

The flotation sections 200 and 200*a* are alternately joined in a manner exactly like that described with respect to the flotation sections 12 and 12*a*, to form a protective periphery to retain or keep out debris. In operation the metal frame 232 will of course be immersed in the water, and the upper edge 226 of the shell 202 will extend above the waterline.

Embodiment of FIGS. 11 and 12

A modified flotation section 300 is shown in FIGS. 11 and 12, and this basically comprises a shell 302 having a rectangular shaped cross section. The opposite end sides of the shell 302 form a chamber therebetween and within the shell 302. In this particular embodiment of the invention the chamber may be filled with a flotation material in a manner as described with respect to the flotation sections 12 and 200 described before.

The remaining portions of the shell 300 are identical in construction and operation to the components of the shell 24 having the corresponding reference numerals.

A flotation section 300*a* bears the same relationship to the flotation section 300 as does the flotation section 12*a* to the flotation section 12. A pair of cables will also provide the stability and control between the flotation sections 300 and 300*a* in a manner as described before with respect to the cables 100.

Operation of FIGS. 11 and 12

It is apparent from the foregoing that the flotation section 300 will operate in a manner substantially the same as the flotation sections 12 and 200, and they may be alternately interconnected to form a protective periphery in a manner exactly as described before. Due to the shape and compact size of the flotation section 300, this embodiment may be more suitable to use in the emergency type situation.

It is apparent from the foregoing that the flotation confinement apparatus of the present invention controls one of the major problems of recent years; that is, preventing the pollution of the natural water resources, the shorelines, and the resulting depletion of water wildlife, which results from the presence of foreign matter such as oil in the water.

The flotation confinement apparatus can be used effectively not only in emergency situations, but in a manner providing a continuing-type control.

Changes may be made in the construction and arrangement of the parts or elements of the various embodiments as disclosed herein without departing from the spirit and scope of the invention.

What I claim is:

1. A flotation confinement apparatus consisting of a plurality of shell members connected serially to envelope a body of oil-bearing water, each of said shell members comprising:

first elongated float means defining an upper chamber;

flotation material of high buoyancy characteristic disposed within said upper chamber;

second elongated float means defining a lower chamber, said second float means being rigidly secured below said first elongated float means;

ballast means of predetermined amount contained within said lower chamber;

cable guide arm means secured transversely across said first elongated float means at one end of each of said shell members, each alternate arm means as between alternating shell members being laterally displaced in an opposite off set position relative to the shell member alignment;

connecting means disposed on each end of said first and second elongated float means for pivotal, sealing interconnection to adjacent shell members serially connected therewith, said connecting means including first latch means which includes a bracket having one or more apertures disposed therethrough connected to one end of each of said shell members, and second latch means including one or more tongue means connected to the opposite ends of each of said shell members, such that said shell members are interconnected by joinder of each second latch means to a first latch means by locked insertion of respective tongue means within a respective bracket means; and,

first and second cables led along opposite sides of said flotation confinement apparatus as movably retained by opposite ends of said guide arm means as secured across each shell member.