United States Patent

[11] 3,576,108

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Continuation-in-part of application Ser. No. 829,006, May 29, 1969.

[54] **MARINE OIL BOOM**
7 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **61/1**
[51] **Int. Cl.** **E02b 15/04**
[50] **Field of Search** ..... 61/1 (F), 5; 210/(Inquired); 114/.5 (F), 43.5; 9/8.3 (E)

[56] **References Cited**
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3,146,598	9/1964	Smith	61/1F
3,221,889	12/1965	Muller	61/1F
3,321,923	5/1967	Smith et al.	61/1F
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ABSTRACT: Elongated sections of flexible buoyant tubes are connected together in end-to-end relation for extending offshore along a coastline surrounding an oil tanker or an oil well location. The wall of the tube sections is formed in accordion-pleated fashion for readily conforming to variations in the surface of the supporting water. Anchor means maintains the assembled tubes in approximate location while other means prevents longitudinal expansion of the tubes beyond the yield point of their material.

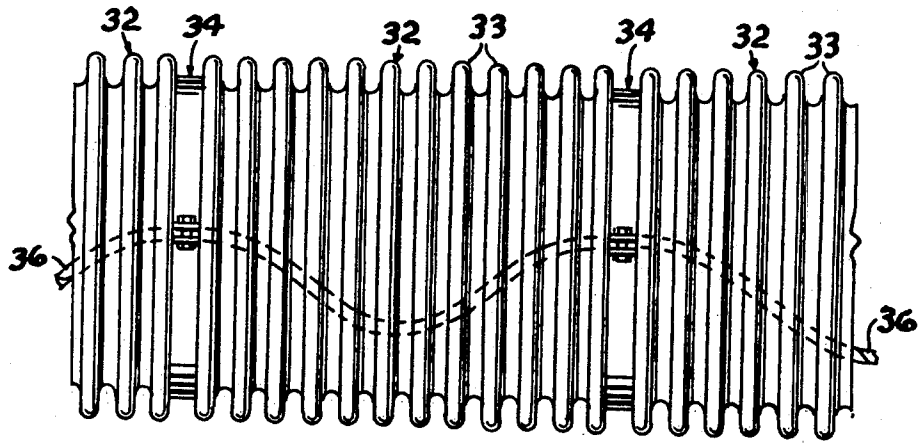
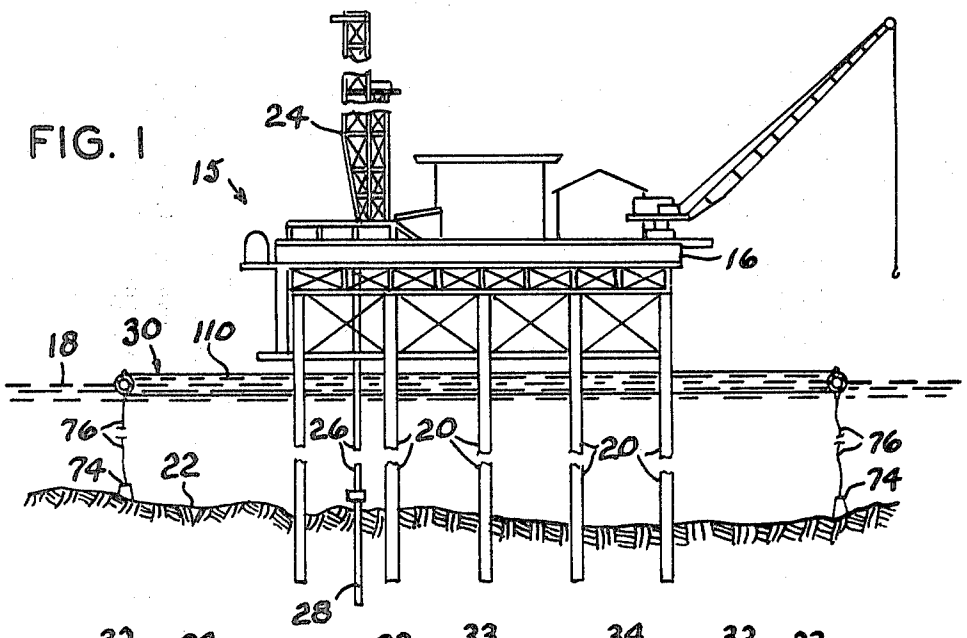


FIG. 1



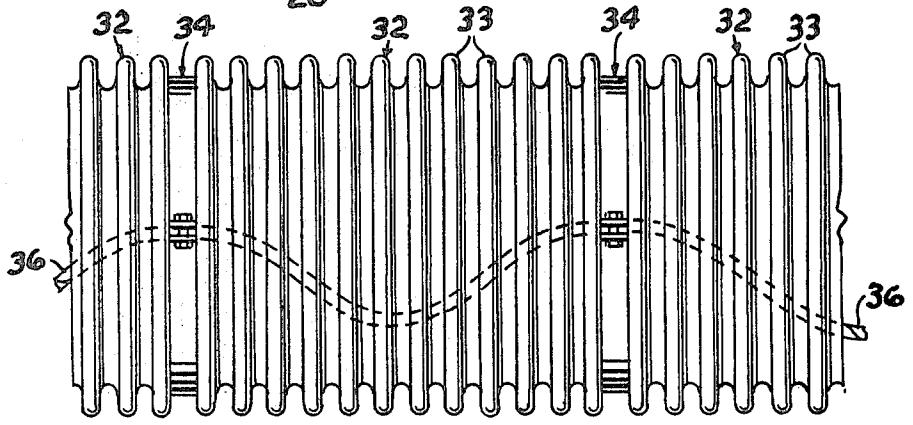


FIG. 2

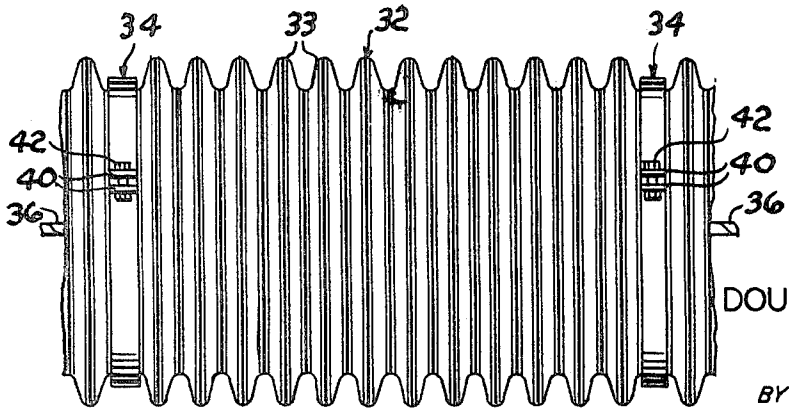


FIG. 3

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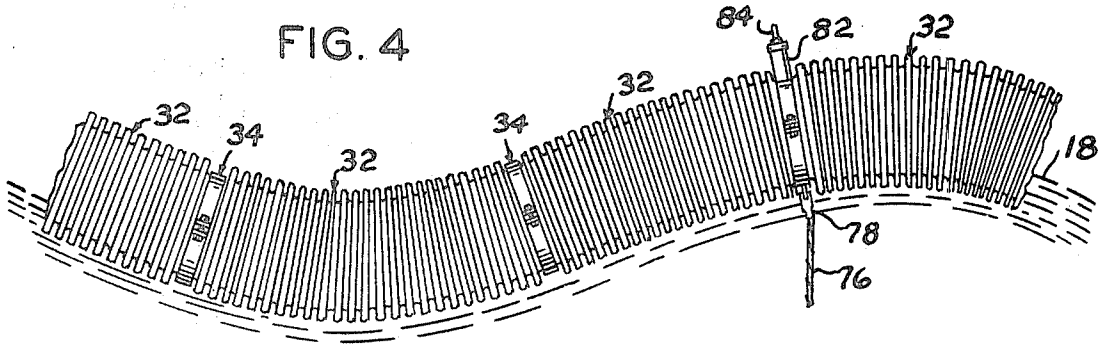
FIG. 4



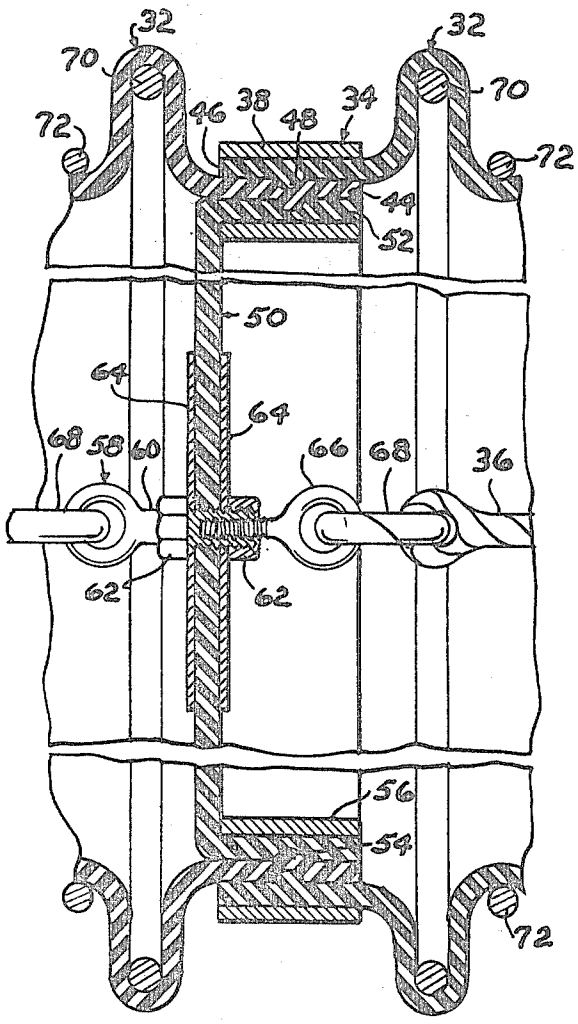


FIG. 5

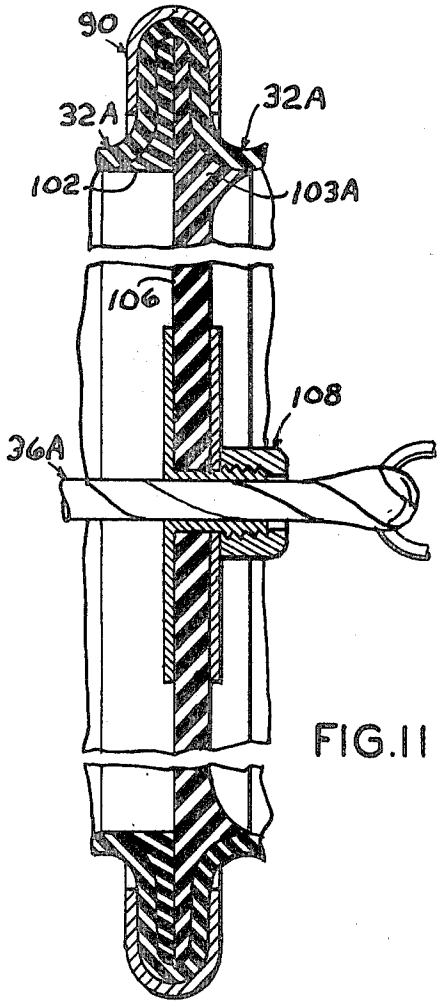


FIG. 11

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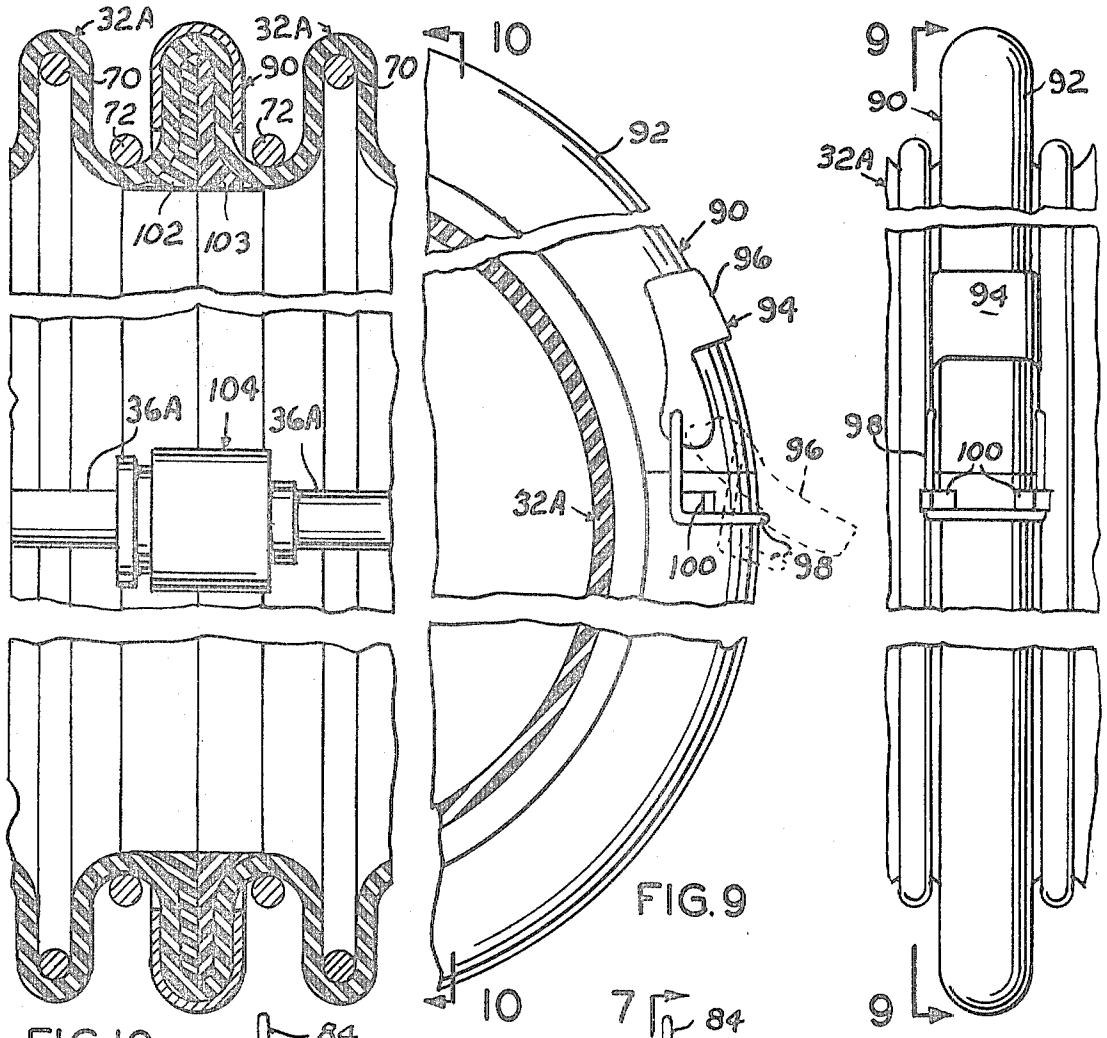

FIG. 10

FIG. 9

FIG. 8

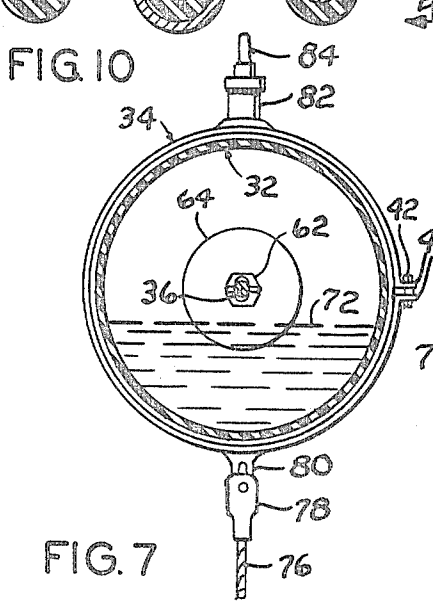

FIG. 7

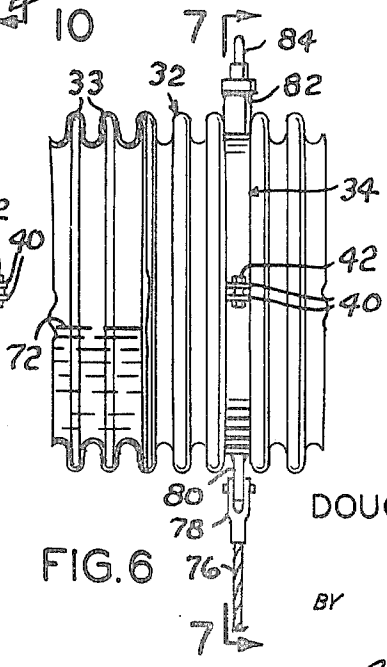

FIG. 6

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MARINE OIL BOOM

CROSS REFERENCE TO RELATED APPLICATION

The present invention is a continuation-in-part of an application filed by me in the U.S. Patent Office May 29, 1969, under Ser. No. 829,006 for Marine Oil Seepage Dam.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to offshore drilling and oil production and more particularly to a floating dam surrounding an oil well location or extending offshore along the coastline for retention of oil and preventing pollution of a coastline.

In the drilling and servicing of offshore oil wells, oil is sometimes lost or spilled on the surface of the water in the area of the drilling platform. It sometimes happens that subterranean oil-bearing earth formations force oil to the surface of the earth at an offshore well location as a result of a "blowout" or an improper seal between a casing equipped borehole and the surrounding strata. This results in a loss of oil which rises to the surface of the water due to the differences in specific gravity with a resulting pollution of the adjacent beaches or land areas when the oil is moved by wind or tide action to the shore.

This invention retards the oil spreading and shore pollution by providing a floating tube formed of interconnected sections to form a dam surrounding the well location or extending in offshore position along the coastline so that the oil may be picked up as by using a suction pump.

The principal distinction between this application and the above-referred-to copending application resides in the manner in which the tube sections are formed, such as the shape of the accordion pleating, the manner of interconnecting the ends of the respective joints and the central stabilizing member which simplifies construction, handling and operation of the boom.

2. Description of the Prior Art

One type of a previously known floating oil boom comprised a canvas curtain which was suspended in the water by cork floats attached to one edge portion of the canvas. The principal objection to this type of oil boom is the inability to handle the canvas when installing or retreiving it as well as the comparatively short life of the canvas and the difficulty in cleaning it after contact with crude oil.

Another type oil boom was formed of aluminum floats which were bulky during storage, easily damaged and difficult to clean.

The most pertinent prior art is Pat. Nos. 3,146,598 and 3,321,923. These patents disclose buoyant floats connected in spaced relation to a flexible sheet for surrounding a moored boat and subsequently storing the boom pleated in side-by-side sectional relation.

The floats or booms of these patents are intended primarily for relatively quiet waters surrounding a dock area without provision being made for conforming to rise and fall of water in offshore wave action.

The wall of the tubular section forming my boom is formed in continuous accordion-pleated fashion for greater flexibility of the sections to readily conform to undulating wave action.

SUMMARY OF THE INVENTION

A plurality of elongated flexible buoyant tube sections, preferably formed of oil resistant rubberlike material having an accordion-pleated wall, are connected together in end-to-end relation to form an endless tube surrounding an offshore well location or extending along a coastline in offshore relation. The assembled tubes are maintained in an approximate desired location by anchor means. The diametric size of the tube sections is such that they will retain a substantial quantity of oil in dam fashion. Means is provided for limiting the longitudinal expanding action of each tubular section and maintaining the depending peripheral portion of the sections submerged.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view, partially in section, illustrating the boom in operative position around an offshore drilling rig;

FIG. 2 is a fragmentary elevational view, to a larger scale, of a portion of the boom in a normal or pleated-wall-relaxed position;

FIG. 3 is a view similar to FIG. 2 illustrating a fragment of the boom in longitudinal expanded position;

FIG. 4 is a fragmentary elevational view of the boom, to a different scale, illustrating its wall-expanding and contracting properties in conforming to wave action;

FIG. 5 is a fragmentary vertical cross-sectional view, to an enlarged scale, illustrating clamp means connecting overlapping tubular sections forming the boom;

FIG. 6 is a fragmentary elevational view, to a different scale, partially in section, illustrating the manner of connecting a navigation lamp and anchor to the clamp means;

FIG. 7 is a vertical cross-sectional view, partially in elevation, taken along the line 7–7 of FIG. 6;

FIG. 8 is a fragmentary elevational view of an alternative tubular section clamp means;

FIG. 9 is a fragmentary elevational view of the alternative clamp means looking in the direction of the arrows 9–9 of FIG. 8;

FIG. 10 is a vertical cross-sectional view taken substantially along the line 10–10 of FIG. 9; and,

FIG. 11 is a view similar to FIG. 10 illustrating an alternative manner of closing a free and section of the boom.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Like characters of reference designate like parts in those FIGS. of the drawings in which they occur.

In the drawings:

Referring more particularly to FIGS. 1 to 4, the reference numeral 15 indicates, as a whole, a substantially conventional offshore drilling rig comprising a horizontal platform 16 supported above the surface of the ocean or water 18 by a plurality of elongated legs or piles 20 extending downwardly through the water and into the surface of the earth 22. The drilling rig includes a derrick 24 for handling drill pipe 26, or the like, extending downwardly into a borehole 28.

The numeral 30 indicates a floating dam or boom, as a whole, comprising an elongated endless fluidtight section of tubing circumferentially surrounding the drilling rig 15 in radial outwardly spaced relation. The boom 30 is preferably formed by a plurality of tubular sections 32 interconnected by clamp means 34 in end-to-end relation. The outside diameter of each section is relatively large, for example 20 inches. Longitudinally each section 32 is substantially greater than its diameter. The wall of each tubular section is relatively thin when compared to the diameter and is preferably formed in accordion roll pleated fashion, except at its extreme end portions, describing a plurality of equally spaced circumferential U-shaped folds 33 permitting a bellows-type action and increasing the flexibility of the tube in conforming to variations in the surface of the water 18 and returning to its relaxed position. The radial spacing between the innermost limit of the accordion-pleated wall, defining the inside diameter of each section 32, and the outermost surface of the folds 33, is relatively small when compared to the diameter, for example, 2 inches. In its relaxed position, the folds, or accordion pleating assumes the position shown by FIG. 2. The spacing between the folds 33, in relaxed position is substantially equal to the width of each fold 33 measured longitudinally of the section.

Each section 32 may be longitudinally expanded or stretched wherein the folds or pleating assumes substantially the position shown by FIG. 3. This stretching or expanding action is limited by a flexible strand 36 extending through each tubular section and connected with the clamp means 34 in the manner presently explained. As clearly shown in FIG. 4 the expanding and contracting action of the pleated wall permits longitudinal bending action of the boom 30 in conforming to the surface of the water 18.

Referring also to FIGS. 5, 6 and 7, the clamp means 34 includes a strap-iron band 38 having spaced-apart cooperating ends 40 for receiving a bolt 42 to tighten the band 38 around the overlapped cylindrical end portions 44 and 46 of longitudinally aligned tubular sections 32. The overlapping tube end portion 46 is provided with a circumferential bead 48 cooperatively nested by a circumferential socket formed in the overlapped surface of the tube end portion 44. A diaphragm 50 is provided with a laterally extending flangelike wall 52 having its outer surface substantially equal to the inside diameter of the tube end 44 for contiguously contacting the latter. A similar bead 54, formed on the inner surface of the tube end 44, is cooperatively received by a circumferential recess formed in the outer wall surface of the diaphragm flange 52. A bandlike metallic ring 56, coextensive with the width of the diaphragm flange 52, contiguously contacts the inner wall surface of the diaphragm 52. Tightening the band clamp 38 by the bolt 42 thus impinges the overlapping tube end portions 44 and 46 and the diaphragm flange 52 against the metallic ring to maintain the tube sections 32 in coaxial longitudinally connected relation.

An eyebolt 58 is provided with a threaded shank portion 60 which projects through a suitable aperture formed in the diaphragm 50 and is secured by nuts 62 threadedly engaged with the shank 60 on opposing sides of the diaphragm. A pressured plate 64, of less diameter than the diameter of the diaphragm, is interposed between the respective surfaces of the diaphragm and nuts 62 thus forming a water- and airtight seal. The eyebolt shank 60 is centrally bored and threaded at its free end for receiving the threaded shank of an eyebolt 66. Each end of the ropelike strand 36 is connected with a suitable hook or connector, such as a split ring 68, which is in turn engaged with the respective eyebolt for joining the strand to the clamp means at the respective end of each tube section. In length the strand 36 is approximately one-fourth greater than the length of one tubular section 32 at its relaxed position. Thus, when connected to other tubes, each tube section forms an air- and watertight compartment with its longitudinal expanding feature limited by the length of the respective strand 36.

While the accordion pleating of the tubular section wall, under most conditions, will maintain a circular configuration, the accordion-pleated wall may be reinforced or strengthened by resilient rings 70 and 72, which are circular in cross section and are positioned respectively within the outward extending U-shaped fold 33 and around the tube between the U-shaped folds 33 which maintains the circular configuration of the respective section.

Since the specific gravity of the rubberlike material forming the tubular sections 32 is substantially equal to water, the boom 30 normally floats mostly above the water 18 and forms an efficient barrier for oil. It is desirable that the tubular sections be partially submerged so that the depending circumferential arc portion of the respective tubular section extends a sufficient distance below the surface of the water to form an effective barrier for the oil. Therefore, each tubular section 32, after connecting one end to another section, is loaded or partially filled with ballast, such as a quantity of water, indicated at 72 (FIGS. 6 and 7).

The reinforcing rings 70 tend to limit the longitudinal expanding action of the respective section 32 whereas the reinforcing rings 72 do not hamper the expanding action while still maintaining the circular cross section shape.

The assembled boom 30 is maintained in approximate position by anchors 74 connected in spaced-apart relation to selected ones of the clamp means 34 by flexible lines 76. The upper end of the line 76 is provided with a clevis 78 which is connected with a loop 80 secured to the clamp band 38. Opposite the loop 80 a battery containing bracket 82 is secured to the clamp band for exciting a lamp 84, mounted on the bracket, to provide a navigation light.

Referring now more particularly to FIGS. 8 to 11, inclusive, an alternative clamp means is illustrated at 90. In this embodiment the respective end portions of the tubular sections 32A terminate at the center one of the outwardly extending folds 33 which, when oppositely disposed in abutting relation, are surrounded by a split U-shaped clamp member 92 having its ends joined by a toggle joint 94 including a handle 96 pivotally connected to one end of the clamp 92 and having a loop 98 pivotally connected with the handle and removably engaging lugs 100 formed on the other end portion of the clamp 92. In this embodiment opposing cooperating reinforcing ring sections 102 and 103 are nested by the inner surface of the abutted end portions of the tubular sections 32A to add rigidity to the clamp connected ends. Obviously the reinforcing ring sections 102 and 103 may be formed as a single ring, if desired. The flexible strands 36A, which may be tubular if desired, are provided at their respective ends with a conventional quick connect and disconnect coupling 104 having slip-fitted male and female end portions connected, respectively, with cooperating end portions of the strands 36A so that the respective ends of the strand sections 36A may be easily joined in longitudinal aligned relation. The toggle joint 94 may be used for joining the ends of the band clamp 38, if desired.

As mentioned hereinabove, the boom 30 may be employed to extend in offshore relation with respect to a coastline to form an impediment for oil or debris moving toward the coastline or the boom may only partially surround the drilling rig 15, for example having its open ends projecting away from the shoreline. In this embodiment the respective free end of the boom 30 is preferably closed. The clamp means 34 forms such a closed end, however, the clamp means 90 does not close the free end of the respective outermost tubular section. This is accomplished, as shown in FIG. 11, where one of the rings 103A forms a diaphragm 106 to form the closed end. A packing gland 108, connected with the diaphragm 106, secures the adjacent end of the strand 36A.

When using tubular material for the elongated strands 36A, an aperture may be formed in each or selected ones of the tubular strands, intermediate their ends, for the purpose of adding air under pressure to the interior of the boom 30 thus assuring its circular configuration and enhancing its buoyancy. This may be accomplished by a flexible tubular strand connected with the endmost strand at one end of the boom and connected at its other end with a source of air under pressure, neither of which are shown.

OPERATION

In operation oil rising to the surface of the water 18 around the drilling rig as a result of seepage, blowout, or any other source, is trapped within the confines of the boom 30, as indicated by the lines 110 (FIG. 1) due to the difference in the specific gravity of oil and water. The oil will rise to a level within the boom 30 higher than the surface of the water 18 and under such conditions the oil may then be picked up as by the use of a suction pump, or the like, not shown. In the event the boom is used as an elongated length extending in offshore relation to a shoreline, the boom simply forms a wall or dam preventing movement of oil or floating debris toward the shoreline.

Obviously the invention is susceptible to changes or alterations without defeating its practicability, therefore, I do not wish to be confined to the preferred embodiment shown in the drawings and described herein.

I claim:

1. A floating boom forming a dam for restricting movement of floating material, said boom, comprising:

an elongated resilient buoyant tube having a flexible accordion-pleated wall;

ballast means maintaining the depending peripheral wall portion of said tube submerged;

means limiting longitudinal expansion of said tube; and,

anchor means maintaining said tube in place.

2. Structure as specified in claim 1 in which said elongated tube is formed by a plurality of coaxially aligned tubular sec-

tions, and clamp means joining said tubular sections in end overlapping relation and dividing said elongated tube to form a like plurality of closed compartments.

3. Structure as specified in claim 2 in which said ballast means comprises a quantity of fluid within each closed compartment.

4. Structure as specified in claim 3 in which said clamp means comprises:

a straplike ring within one end portion of each said tubular section;

a diaphragm having a flangelike wall interposed between said ring and the inner wall surface of said one end portion of each said tubular section; and,

a straplike clamp surrounding overlapped end portions of said

tubular sections.

5. Structure as specified in claim 4 in which the expansion limiting means comprises:

a pair of eyebolts having interconnected shank portions extending through and connected with each said diaphragm; and, a like plurality of elongated strands each having a length at least as great as each said tubular section and extending therethrough and connected, at respective ends with said eyebolts on respective sides of said diaphragms.

6. Structure as specified in claim 1 in which said elongated tube is formed by a plurality of coaxially aligned tubular sections, and further including clamp means joining said tubular sections in end abutted relation, said clamp means comprising:

a split ring, U-shaped in cross section, surrounding respective abutted end portions of said tubular sections;

a toggle joint connected with the respective end portions of said split ring; and,

a reinforcing ring disposed within the respective abutted end portions of said tubular sections.

7. Structure as specified in claim 6 in which the expansion limiting means comprises:

a plurality of elongated flexible strands, each having a length at least as great as the length of each said tubular section and projecting through the interior thereof; and,

a plurality of quick connect couplings connected with and joining said strands in end to end relation.