United States Patent [19]

Mason

[11] **3,879,951**

[45] **Apr. 29, 1975**

[54] **UNDERWATER DRILLING POLLUTION CONTROL CURTAIN**

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[22] Filed: **June 25, 1973**

[21] Appl. No.: **373,580**

[52] **U.S. Cl.** ..... **61/1 R; 61/1 F; 61/46**

[51] **Int. Cl.** **E02b 17/00; E02b 15/04**

[58] **Field of Search** ..... 61/1 R, 1 F, 46, 46.5; 210/242, 121, DIG. 21

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[57] **ABSTRACT**

A pollution control curtain attached to the sea floor on one end and to a collar floating on the surface of the sea on the other end for positioning around a drilling platform to entrap the petroleum fluids seeping from the well head or sea floor being serviced by said platform and to convey said fluids to the surface within a predefined area from which they can be collected.

4 Claims, 6 Drawing Figures

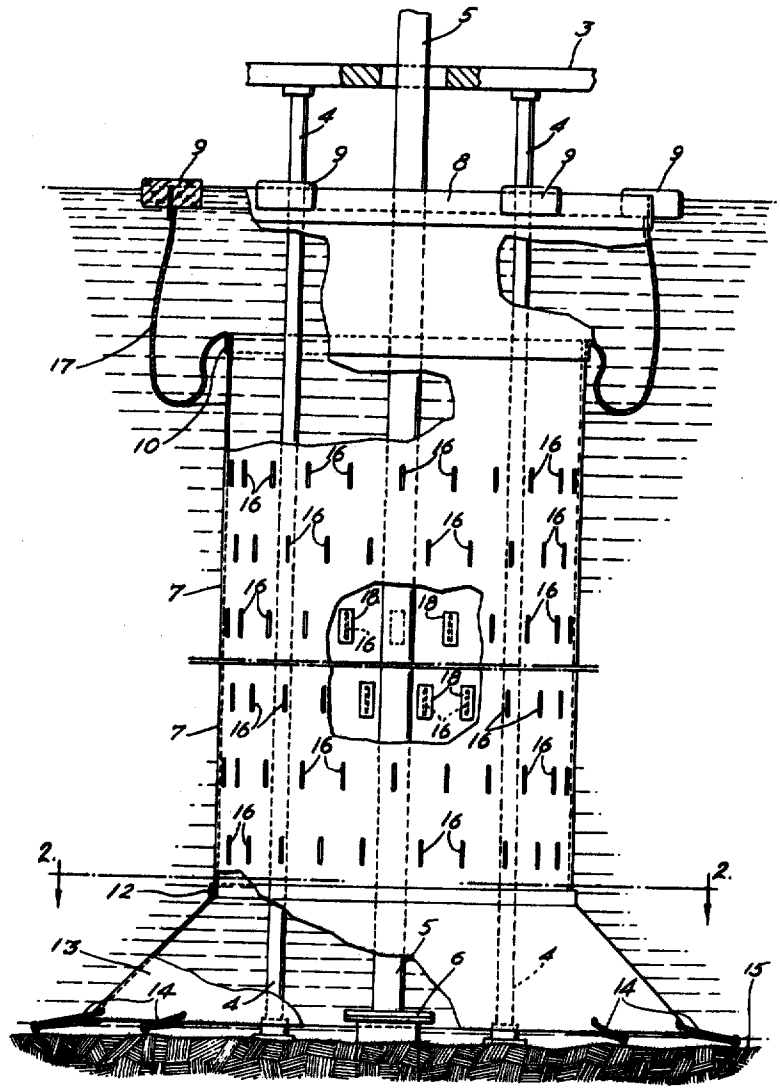


FIG. 1.

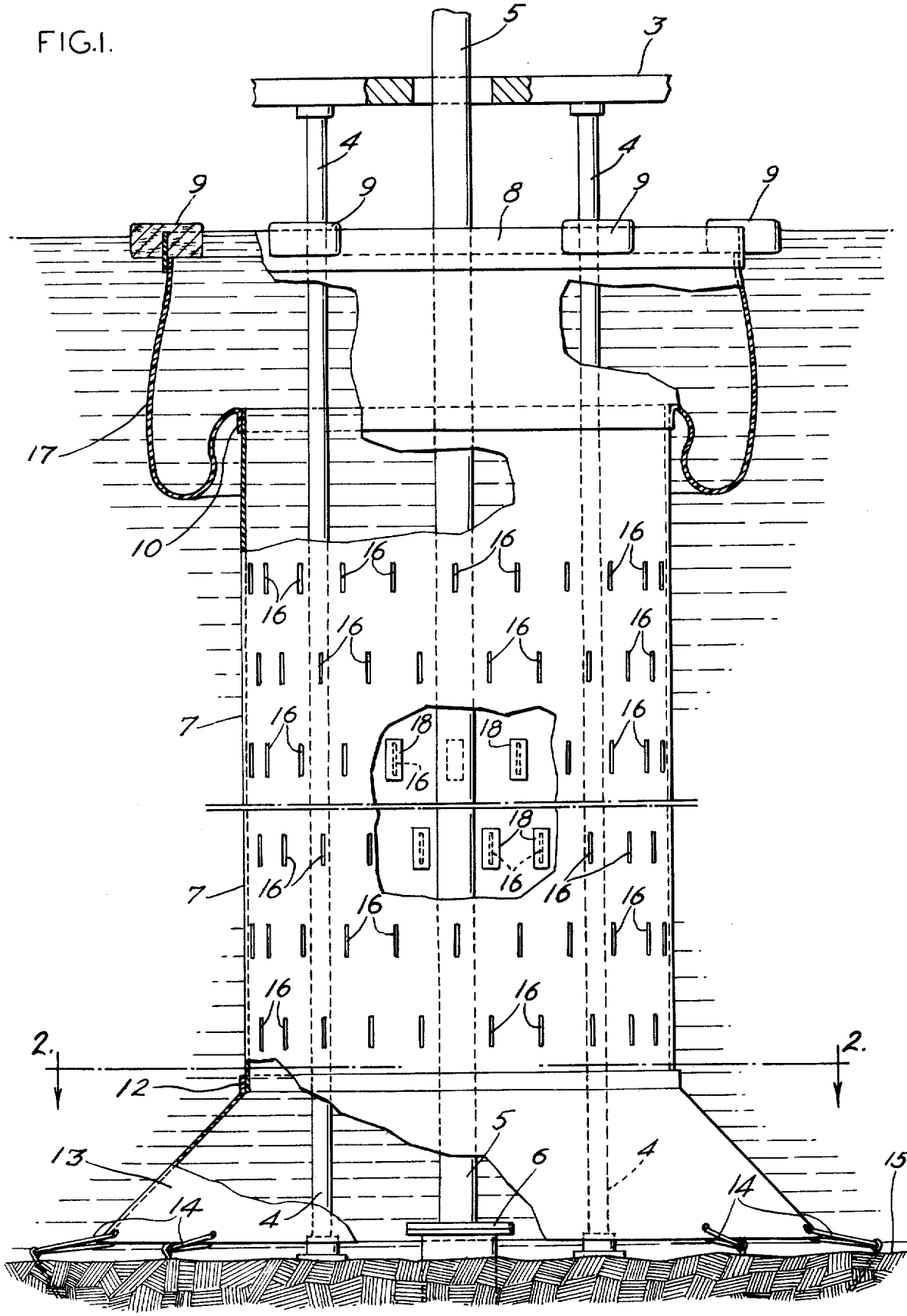


FIG.2.

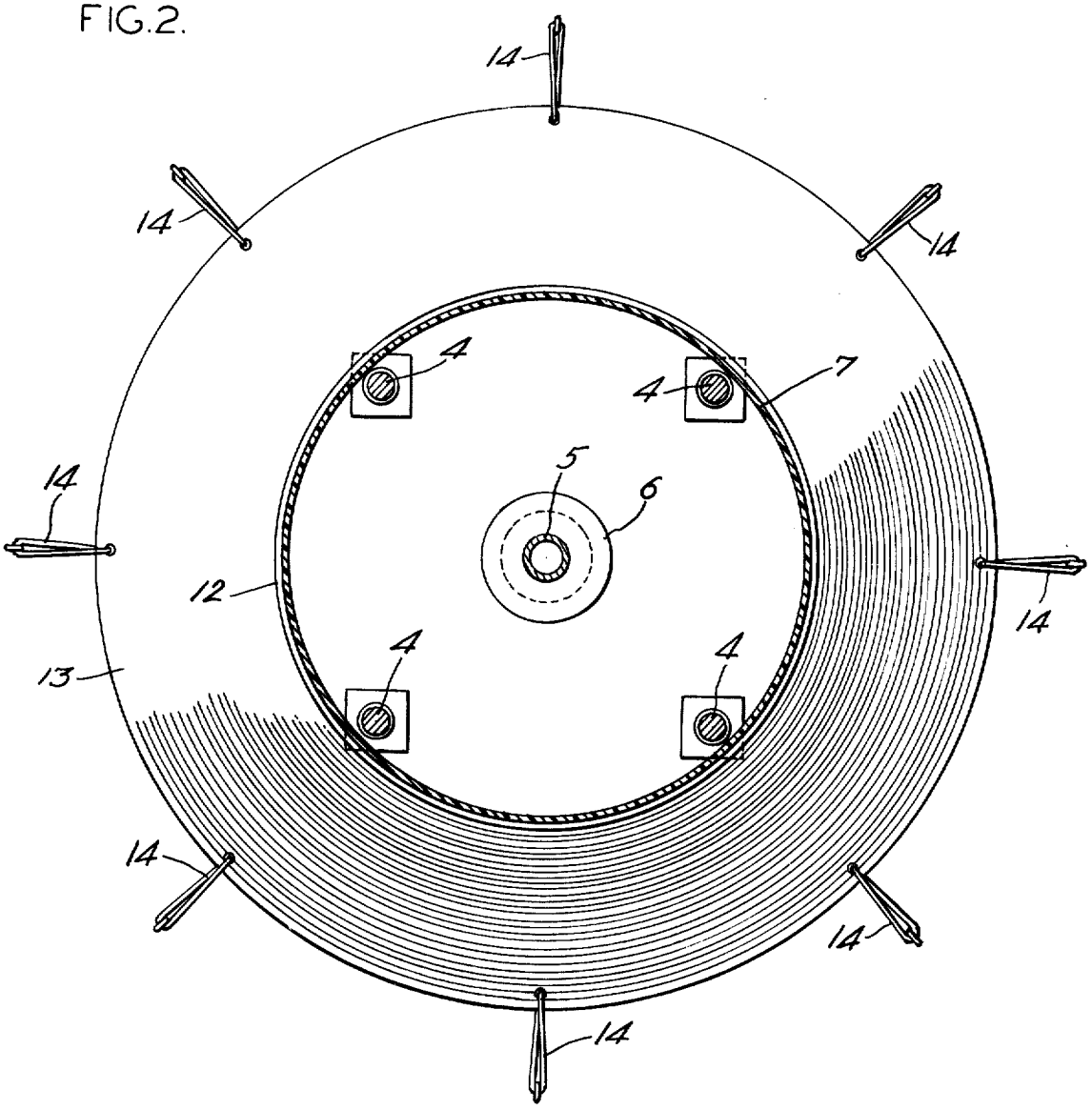


FIG.3.

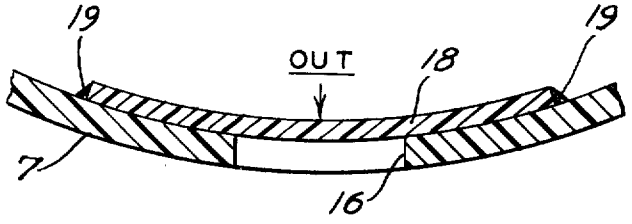


FIG.4.

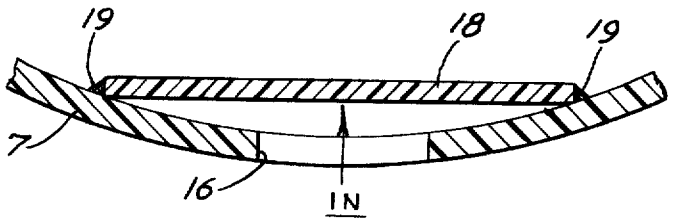


FIG. 5.

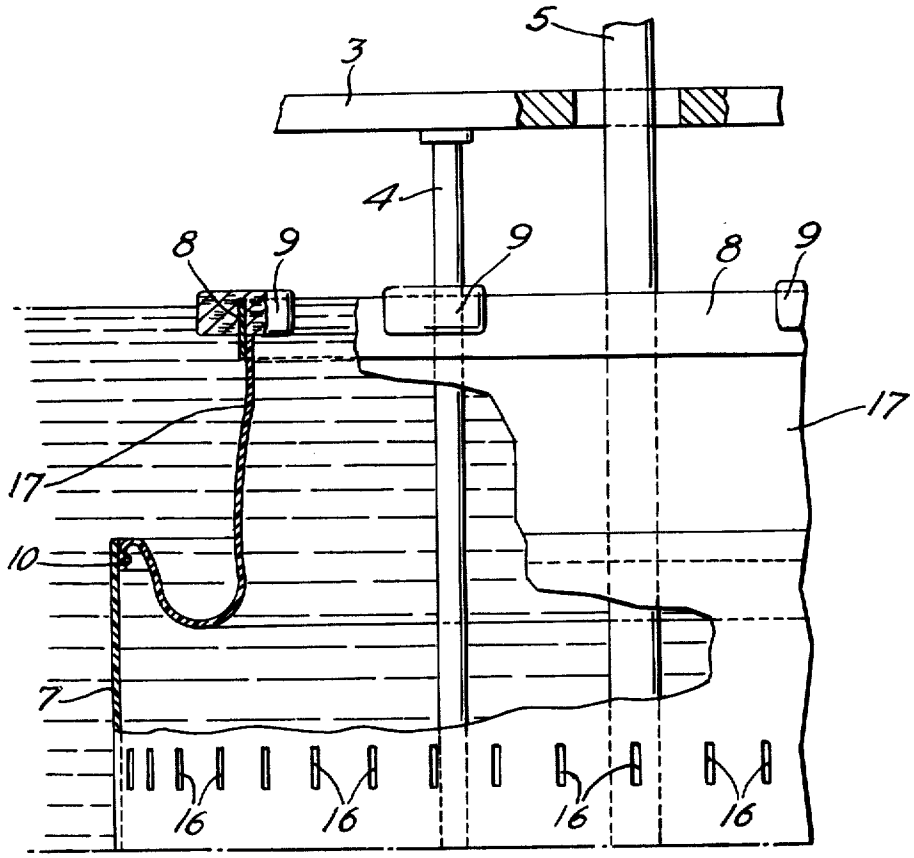
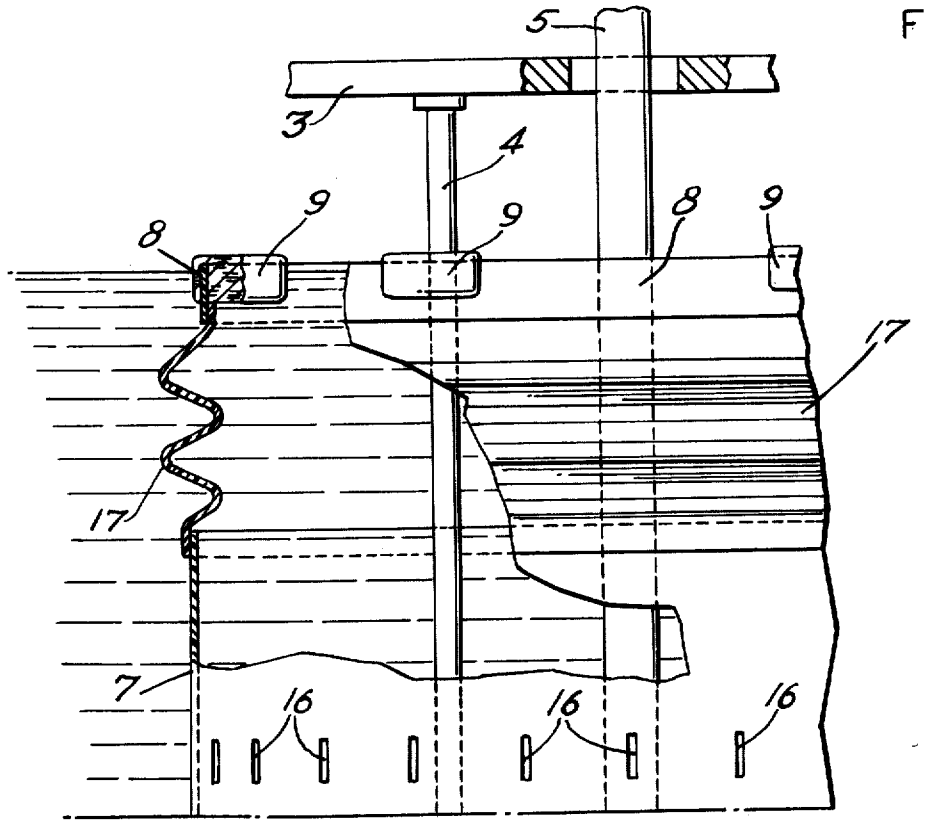


FIG. 6.



UNDERWATER DRILLING POLLUTION CONTROL CURTAIN

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a marine structure for the reduction of the pollution caused by petroleum fluids seeping from underwater drilling operations. More particularly, it relates to a curtain which surrounds the underwater portion of a drilling platform, forming a barrier between the escaping fluids and the open sea and defining an enclosure from which these fluids can be easily collected.

2. Description of the Prior Art

Production of oil and gas from offshore locations is now commonplace in many parts of the world using surface equipment such as "Jack-up" rings, floating rigs and drilling platforms.

Upon discovery of a field, it is common practice to build a permanent production platform and drill directional wells from the platform in a radial pattern. These platforms usually comprise a rectangular truss-like structure composed of hollow tubular sections which is known as a jacket. The jacket is towed to sea, set in position and then anchored by driving piling through the vertical hollow members of the truss.

When the drilling is commenced, one problem that frequently arises is controlling the seepage of petroleum fluids from around the well head. Riser pipes of many designs, through which drilling equipment is operated between the surface and the well head, are not designed to adequately control this problem.

SUMMARY OF THE INVENTION

A system has now been found for containing this underwater seepage and transporting it to the surface within a small area whereby it can be easily collected and not pose a serious threat to the marine environment. This system comprises:

a. a curtain which encloses the subsurface in a body of water, attached at its upper end to the truss below the surface of the body of water and at its lower end to the floor of the body of water,

b. a floating collar which defines an area on the surface including the drilling platform, and

c. a flexible barrier surrounding the truss attached at one end to the collar and at the other end to the top of the curtain whereby seeping fluid is communicated from the sea floor upward to a predefined area on the surface.

The advantages of such a system are many and they include more efficient clean-up in the event of major seepage and less need for expensive surface clean-up equipment to stand by, since any seepage will be contained in a predefined area.

These and other advantages of the present invention will become apparent upon reading the more detailed description which follows.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of the pollution control curtain in its preferred embodiment surrounding a drilling platform.

FIG. 2 is a cross-section on line 2—2 of FIG. 1.

FIG. 3 is a cross-section of the inwardly opening flap in a closed position.

FIG. 4 is a cross-section of the inwardly opening flap in an open position.

FIGS. 5 and 6 are schematic diagrams of alternate embodiments of the pollution control curtain.

THE PREFERRED EMBODIMENT

FIG. 1 shows a drilling platform, 3, positioned on a truss support 4 which extends to the floor of the body of water in which the drilling is taking place, 15. The riser pipe 5 through which the drill bit and conduit pass is shown reaching from the platform to the well head 6. Surrounding the entire truss is the pollution control curtain 7, which is attached to the truss at point 12 on its lower section and at point 10 by a support member below the water surface. An extension flap, 13, attached to the bottom of the curtain, extends over an area of the floor 15 which is greater than the cross-sectional area of the curtain. This flap is attached to the floor by cables 14 with a space between the bottom of the flap and the floor itself. The curtain contains numerous slots, 16, which open inwardly to allow equalization of pressure on both sides of the curtain. The spaces left between the flap and the floor also serve this function.

Attached to the upper end of the curtain at point 10 is a flexible barrier 17 which allows for communication of fluid to the surface within an area defined by a rigid collar 8, attached to floats 9 and to the upper end of the flexible barrier. As the water level changes due to tidal activity, etc., the collar rides upon the surface and the flexible barrier maintains the connection between the collar and the curtain. The collar is operable whether it is larger or smaller in the surface area then the curtain. The smaller collar is shown in FIG. 5. It is also envisioned (not shown) that a second collar, surrounding the first collar, can be utilized to provide a lock for the ingress and egress of boats. Also, the collar itself can be constructed from a floating material.

Fluids seeping from the well head, or from a fault in the sea floor in another embodiment, rise to the surface within the area defined by the control curtain. At the surface, the resulting oil slick is confined to the area defined by the floating collar from which it can be collected. As the water level changes, due to tidal activity, winds, or storms, the collar rides on the surface and the flexible section of the barrier maintains communication between the collar and the control curtain.

Water currents and pressure necessitate inwardly opening flaps and a space between the lower end of the curtain and the sea floor so as to equalize these effects on both sides of the curtain and prevent collapse.

Also, no flaps should be located in the upper most section of the curtain which comprises the oil zone.

Referring to FIGS. 3 and 4, the slot in the curtain is merely a cut in the curtain and a piece of flexible material 18 is attached to the inside of the curtain over the slot at points 19 to act as a check valve. Since the cross-sectional area of all of the slots is kept well below the cross-sectional area of the curtain, the downward water velocity will be slower than the bubble rise velocity of the liquid petroleum so as to maintain the flotation mechanism at the interior volume of the curtain.

It is envisioned that similar systems can be used to control seepage from the sea floor where no platform has been placed by positioning the present apparatus over the seeping fault. The system can also be used

around a drill pipe being operated from a floating vessel.

It is also envisioned that the entire assembly can be within the drilling platform supports rather than surrounding them. Also, the flexible position can comprise the uppermost section of the curtain which will shift in a random cantilevering fashion as the water level changes as shown in FIG. 6. This system, too, can be within or without the drilling platform supports.

The body of the curtain can be fabricated from any flexible or rigid material with sufficient strength and resistance to corrosion to serve in a subsurface structure, such as steel plate and cable, plastic, heaving gauge, Neoprene, canvas or combinations of and the like. The flexible flap can be fabricated from heavy canvas, Neoprene and the like.

The invention claimed is:

1. Apparatus for production of liquids lighter than water and immiscible therewith through offshore wells which comprises

a. a conduit for conveying said liquids from beneath the ground through a body of water to a point above the surface of the water,

b. a float enclosing an area surrounding said conduit on the surface of the water,

c. a curtain extending from said float to a point essentially above the floor of the body of water thereby defining a passageway and enclosing a volume surrounding said conduit beneath the surface of the water, said volume being in fluid communication with the water surrounding said curtain via said passageway thereby equaling inside and outside pressure, said curtain further comprising a flexible upper portion and a lower portion,

d. a support member surrounding said conduit at a fixed level,

e. a flexible upper portion of said curtain which extends from said float to said support member whereby the float can vary in vertical location with respect to the support member as the surface level of the body of water changes,

f. a lower portion of said curtain extending downwardly from said support member to a point above the floor of said body of water, the cross-sectional area defined by said float being different than the cross-sectional area defined by said member,

g. a plurality of inwardly opening slots positioned in the walls of said lower portion to allow water from outside the curtain to flow into the curtain and thereby be in fluid communication with water flowing through the passageway at the bottom of said curtain thereby equaling inside and outside pressure and

h. means for anchoring the lower end of said curtain to the sea floor to maintain its vertical position whereby liquid leaking from said conduit into said body of water rises through said volume and collects at the surface of the water in said area in a body of said liquid confined by said float.

2. The apparatus according to claim 1 wherein the cross-sectional area defined by said float is greater than the cross-sectional area defined by said member.

3. The apparatus according to claim 1 wherein the cross-sectional area defined by said float is less than the cross-sectional area defined by said member.

4. Apparatus for production of liquids lighter than water and immiscible therewith through offshore wells which comprises

a. a conduit for conveying said liquids from beneath the ground through a body of water to a point above the surface of the water,

b. a float enclosing an area surrounding said conduit on the surface of the water,

c. a curtain extending from said float to a point essentially above the floor of the body of water thereby defining a passageway and enclosing a volume surrounding said conduit beneath the surface of the water, said volume being in fluid communication with the water surrounding said curtain via said passageway thereby equaling inside and outside pressure, said curtain further comprising a flexible upper portion and a lower portion,

d. a support member surrounding said conduit at a fixed level,

e. a flexible upper portion of said curtain which extends from said float to said support member whereby the float can vary in vertical location with respect to the support member as the surface level of the body of water changes in a random cantilever type action,

f. a lower portion of said curtain extending downwardly from said member to a point above the floor of said body of water, the cross-sectional area defined by said float being essentially the same as the cross-sectional area defined by said support member,

g. a plurality of inwardly opening slots positioned in the walls of said lower portion to allow water from outside the curtain to flow into the curtain and thereby be in fluid communication with water flowing through the passageway at the bottom of said curtain thereby equaling inside and outside pressure and

h. means for anchoring the lower end of said curtain to the sea floor to maintain its vertical position whereby liquid leaking from said conduit into said body of water rises through said volume and collects at the surface of the water in said area in a body of said liquid confined by said float.

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