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METHOD AND APPARATUS FOR CONTAINING WELL POLLUTANTS

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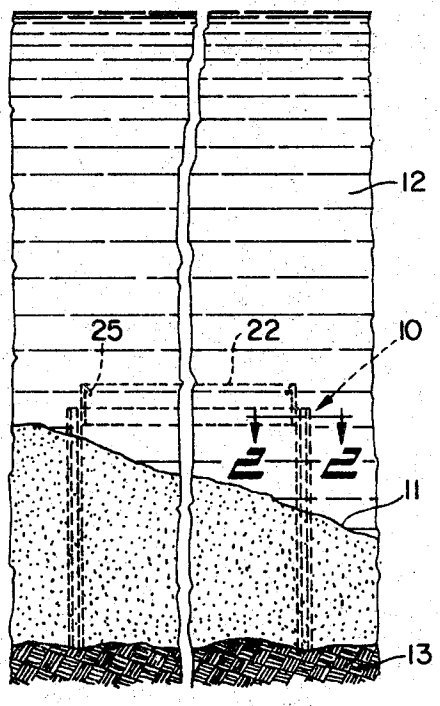


Fig. 1

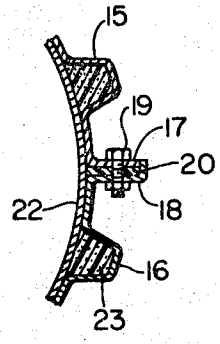


Fig. 2

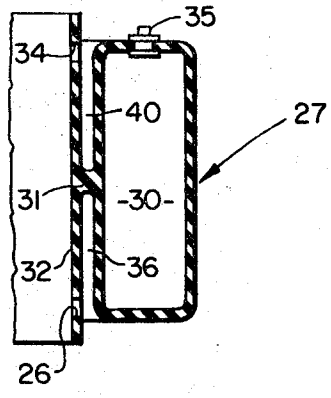


Fig. 6

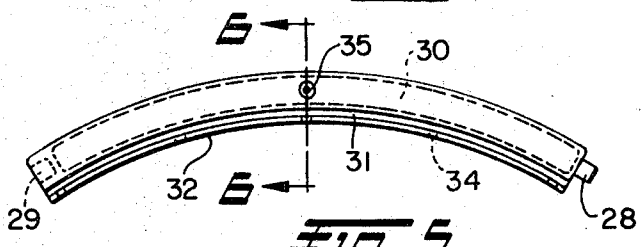


Fig. 5

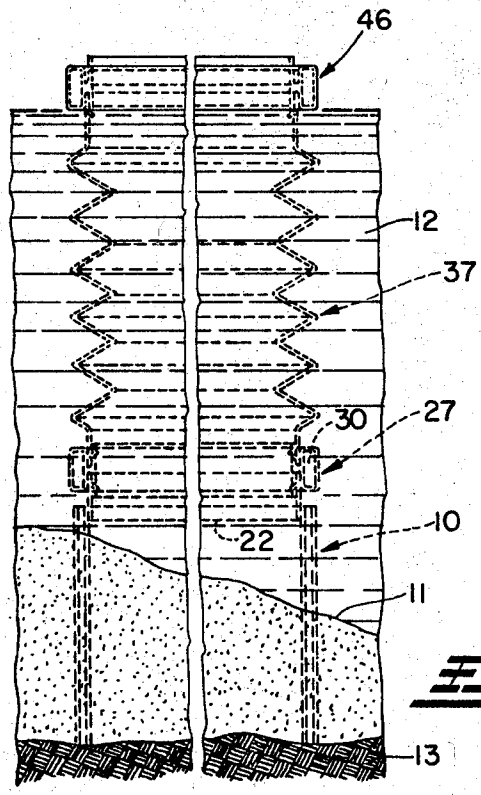


Fig. 3

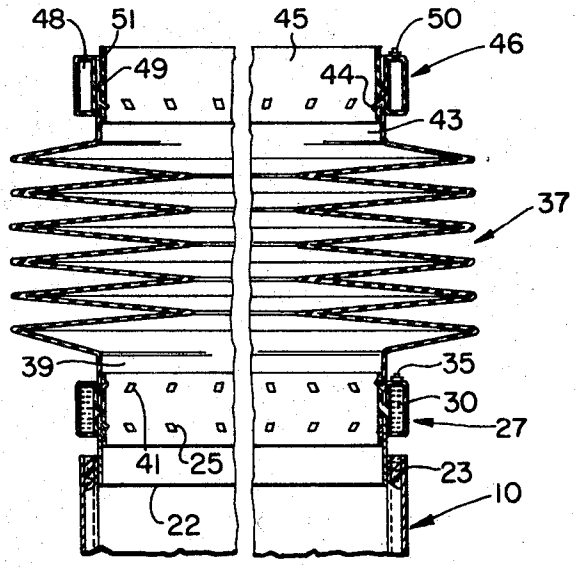


Fig. 4

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METHOD AND APPARATUS FOR CONTAINING WELL POLLUTANTS

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ABSTRACT OF THE DISCLOSURE

A well installation apparatus and method, particularly for offshore wells, utilizing a large coffer or caisson surrounding the well point, such coffer or caisson including a submerged caisson having secured to the top thereof an annular axially expansible substantially water impermeable extension secured at its lower end to the top of the submerged caisson and at its top to a floating ring.

This invention relates generally as indicated to a method and apparatus for containing well pollutants and more particularly to a coffer or caisson construction for enclosing offshore wells to prevent the escape of pollutants such as drilling tailings, mud, brine, oil and the like. This invention represents certain improvements in appplicant's copending application filed Mar. 1, 1968, Ser. No. 709,704, entitled, "Method and Apparatus for Containing Well Pollutants."

In the drilling of offshore well installations, the containment of pollutants such as oil, mud, brine, drilling tailings, etc., can be a serious problem. If the well is drilled in a considerable depth of water it is difficult to provide a caisson or coffer which will adequately contain any pollutants which might result.

It is accordingly a principal object of the present invention to provide a coffer or caisson for an offshore well installation which will adequately contain pollutants resulting from the well regardless of the depth of water in which the well is completed.

Another principal object is the provision of apparatus for containing offshore well pollutants which includes a submerged coffer or caisson to which is secured an annular extension which is axially expansible and secured at its top to a floating ring.

Still another principal object is the provision of a coffer or caisson of flexible water impermeable material which is anchored to the bottom and supported at its top by a floating ring.

Still another object is the provision of a container for offshore well pollutants which comprises an axially expansible water impermeable flexible cylindrical structure which may quickly and easily be installed about an offshore well point.

A still further object is the provision of a caisson for containing well pollutants which includes a flexible accordion extension, the lower end of which may readily be submerged and secured in place.

A still further object is the provision of a process for containing offshore well pollutants which comprises anchoring the lower end of a flexible cylindrical liquid barrier while the upper end is floated about the well point.

Other objects an advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, the following description and the annexed drawing setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principles of the invention may be employed.

In said annexed drawing:

FIG. 1 is a fragmentary schematic illustration of a caisson placed in the bottom surrounding an offshore well point;

FIG. 2 is a fragmentary horizontal section taken through the top of the caisson as seen substantially from the line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 1 illustrating the axial flexible caisson extension secured in place;

FIG. 4 is a fragmentary vertical section showing in greater detail the axial caisson extension;

FIG. 5 is a top plan view of one of the ring segments forming the floating top or the submerged bottom of the axial extension; and

FIG. 6 is an enlarged vertical fragmentary section taken substantially on the line 6—6 of FIG. 5.

Referring now first to FIG. 1, it will be seen that an anchoring or footing caisson shown generally at **10** may be driven into bottom **11** submerged beneath body of water **12**. The caisson may be driven through the bottom **11** to clay **13** or other suitable solid substructure. The annular caisson **10** may be formed of corrugated sheet piling sections such as seen at **15** and **16** in FIG. 2 with each section being provided with lateral mating flanges indicated at **17** and **18** secured together by fasteners **19**. A seal seen at **20** may be provided between such flanges.

The piling may be driven under water using an annular form in conventional manner. The diameter of the annular casing may be selected based upon the size and number of well points to be completed within the caisson. The caisson may be several hundred feet in diameter, for example.

Secured to the interior of the footing caisson is an adaptor ring **22** and the corrugations of the piling may be provided with a suitable sealant seen at **23** so that the caisson is connected to the adaptor ring in an essentially watertight manner.

As seen perhaps more clearly in FIG. 4, the upper interior portion of the adaptor ring **22** is provided with a plurality of downwardly and inwardly projecting locking fingers **25**. Such fingers cooperate with apertures **26** in anchoring ring **27**, the details of which are seen more clearly in FIGS. 5 and 6. Such anchoring rings may be comprised of a plurality of interconnected arcuate sections, one end of each section being provided with a tongue seen at **28** while the opposite end is provided with groove or slot **29**.

The anchoring ring sections may be constructed of a reinforced rubberized fabric material and include an arcuate vertically elongated chamber **30**, the interior wall of which is connected through web **31** to vertically extending interior ring **32**. The apertures **26** are provided near the lower edge of the ring **32** on the same peripheral or arcuate spacing as the fingers **25**. The top of the ring **32** is also provided with a series of similarly spaced and shaped apertures as seen at **34**. The chamber **30** of each ring sector is provided with valves seen at **35** so that either air or liquid may be admitted into such chamber.

The top of the adaptor ring **22** fits into the downwardly facing slot **36** between the interior wall of the chamber and the lower portion of the interior ring **32**. The fingers **25**, of course, fit within the apertures **26** securing the anchor ring **27** to the top of the adaptor ring **22**.

The anchor ring **27** is also secured in similar manner to flexible caisson extension **37**. The lower cylindrical axial portion **39** of the extension **37** fits within the annular slot **40**, seen in FIG. 6. The axial lower cylindrical end **39** is provided with inwardly and upwardly directed fingers **41** which fit within the apertures **34** thus securing the lower end **39** of the extension **37** to the anchor ring **27**.

The extension **37** comprises for its major part an accordion pleated flexible rubberized fabric so that it can collapse into a relatively small vertical package. A vulcanized rubber fabric having reinforcing cords of nylon, polyester or rayon, for example, can be employed to fabricate the extension.

The top of the extension has an annular axial cylindrical portion **43** which may be of the same dimension and configuration as the bottom cylindrical portion **39**. The top cylindrical portion **43** is provided with downwardly and inwardly directed fingers **44** which lock into apertures in the inner ring **45** of top ring **46**. The top ring **46** may be identical in form to the anchoring ring **27** and is provided with an annular exterior chamber **48** secured to the inner ring **45** by central web **49**. The chamber **48** is provided with valves **50** for inflation of the chamber or filling the same with liquid.

An upper extension, not shown, may be provided by mounting a ring in the upwardly opening slot **51**. This may serve to prevent pollutants from splashing over exteriorly of the containing caisson. In many applications, however, a further extension of the caisson may not be required.

In installation, the rings **46** and **27** are secured to the ends of the extensible extension **37** with the fingers **44** and **41** placed within the apertures in the internal rings **45** and **32**, respectively. The chambers **48** and **30** may now be inflated and this causes the interior chamber wall to bear against the axial cylindrical end portions of the extension **37** tightly confining such end portions in the slot and, of course, the fingers in the apertures. This locks the ring to the extension and provides a substantially water impermeable seal therebetween.

After the submerged foundation caisson **10** has been placed with the adaptor ring **22** thereon, the caisson extension is floated to a position above the caisson. The lower or anchor ring **27** may now be filled with water or ballast and the lower end of the extension dropped to fit onto the adaptor ring **22**. As the lower ring drops, the extension axially expands. The locking fingers **25** are positioned within the apertures **26** and the chamber **30** may then be pressurized to provide a secure substantially watertight connection between the caisson extension **37** and the anchor caisson **10**.

The axial cylindrical extensions **39** and **43** may be made of neoprene or rubber of a thickness greater than that of the pleated portion of the rubberized fabric therebetween. The locking fingers may be molded into such end portions and cotter pins connected together by a chain may be employed to ensure against disassembly. The top floating ring **46** may be anchored to the drilling platform inside the caisson to ensure against lateral drift.

In some installations it may be possible to omit the anchoring or footing caisson **10**. In this case the bottom ring **27**, suitably weighted or anchored, would simply rest on bottom **11**, its flexibility permitting substantial conformance thereto.

It can now be seen that there is provided an easily installed simplified caisson which includes a pliable, rubber fabric with floating or submersible collars which may readily be anchored to a submerged caisson to form a complete containment about an offshore well site. If oil or other contaminants spill into the water at the well site, they can be pumped or clam-shelled from within the caisson into a barge or like vessel alongside the caisson. The hydrostatic pressure balance can readily be maintained by pumping sea water into the inteiror of the caisson.

I, therefore, particularly point out and distinctly claim as my invention:

1. Apparatus for containing offshore well pollutants comprising an annular submerged caisson surrounding an offshore well point, and an annular extension of said caisson comprising an annular axially expansible water impermeable member secured at its lower end to the top of said caisson and extending to the waterline to form a liquid barrier surrounding such well point.

2. Apparatus as set forth in claim **1** including a floating ring to which the top of said extension is secured.

3. Apparatus as set forth in claim **2** wherein said floating ring includes an inner vertical wall and an outer chamber, the top of said extension being positioned between said wall and chamber, and means to pressurize said chamber to squeeze the top of said extension between said chamber and wall.

4. Apparatus as set forth in claim **3** wherein said wall is provided with a plurality of apertures, and locking fingers on the top of said extension extending through such apertures.

5. Apparatus as set forth in claim **2** including a ring identical to said floating ring securing the lower end of said extension to said annular submerged caisson.

6. Apparatus as set forth in claim **1** wherein said annular extension comprises an accordion pleated rubberized fabric.

7. A method of containing offshore well pollutants comprising the steps of forming an annular submerged caisson surrounding an offshore well point, floating a caisson extension into position over said caisson, axially downwardly extending such caisson extension and securing the lower end thereof to such caisson while maintaining the upper end thereof floating.

8. Apparatus for containing offshore well pollutants comprising a cylinder which is axially collapsible and extensible, rings at the top and bottom of said cylinder, and chambers in said rings whereby the buoyancy of the top and bottom of said cylinder can be controlled.

9. Apparatus as set forth in claim **8** wherein the major extent of said cylinder is a flexible fabric having accordion pleats therein.

10. Apparatus as set forth in claim **8** wherein said rings include a plurality of interconnected individual sections each including a chamber, and valve means for admitting fluid to said chambers.

11. Apparatus as set forth in claim **8** wherein each ring is connected to the ends of said cylinder by a locking connection, the pressure in said chambers maintaining said connection and enhancing the water seal therebetween.

No references cited.

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