United States Patent

Garrigus

[15] **3,677,016**

[45] **July 18, 1972**

[54] CORROSION PROTECTION FOR WELL CASING OF OFFSHORE STRUCTURE

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[22] Filed: **Feb. 8, 1971**

[21] Appl. No.: **113,190**

[52] **U.S. Cl.** **61/46.5**, 175/9

[51] **Int. Cl.** **E02d 21/00**, E21b 15/02

[58] **Field of Search** 61/46.5, 72.3; 175/7, 9

[56] **References Cited**

UNITED STATES PATENTS

3,563,042	2/1971	Ryan	61/46.5
3,517,517	6/1970	Blenkarn	61/46.5
3,524,323	8/1970	Miller	61/46.5

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[57] **ABSTRACT**

An offshore deep water oscillating oil well drilling or oil production structure having an oil drilling or oil production platform and support therefor having an essentially vertically displaced tubular template fixedly secured to the platform and platform support, said tubular template having its bottom end open and positioned to project below sea level when the platform is positioned offshore in a body of water, a closure at the upper end of the tubular template adapted to seal and close the annular space between the tubular template and a casing positioned in the tubular template, and a conduit communicating with the inside of the tubular template below the closure for feeding oil inside the tubular template.

7 Claims, 7 Drawing Figures

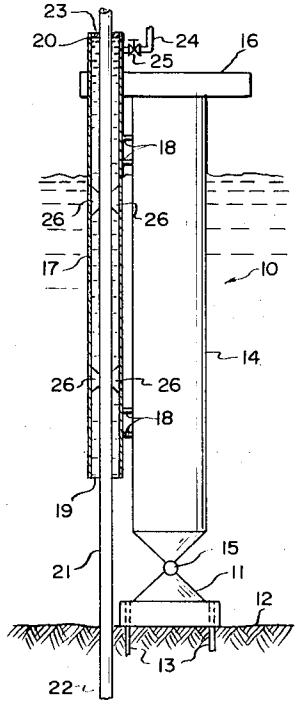


FIG. 2

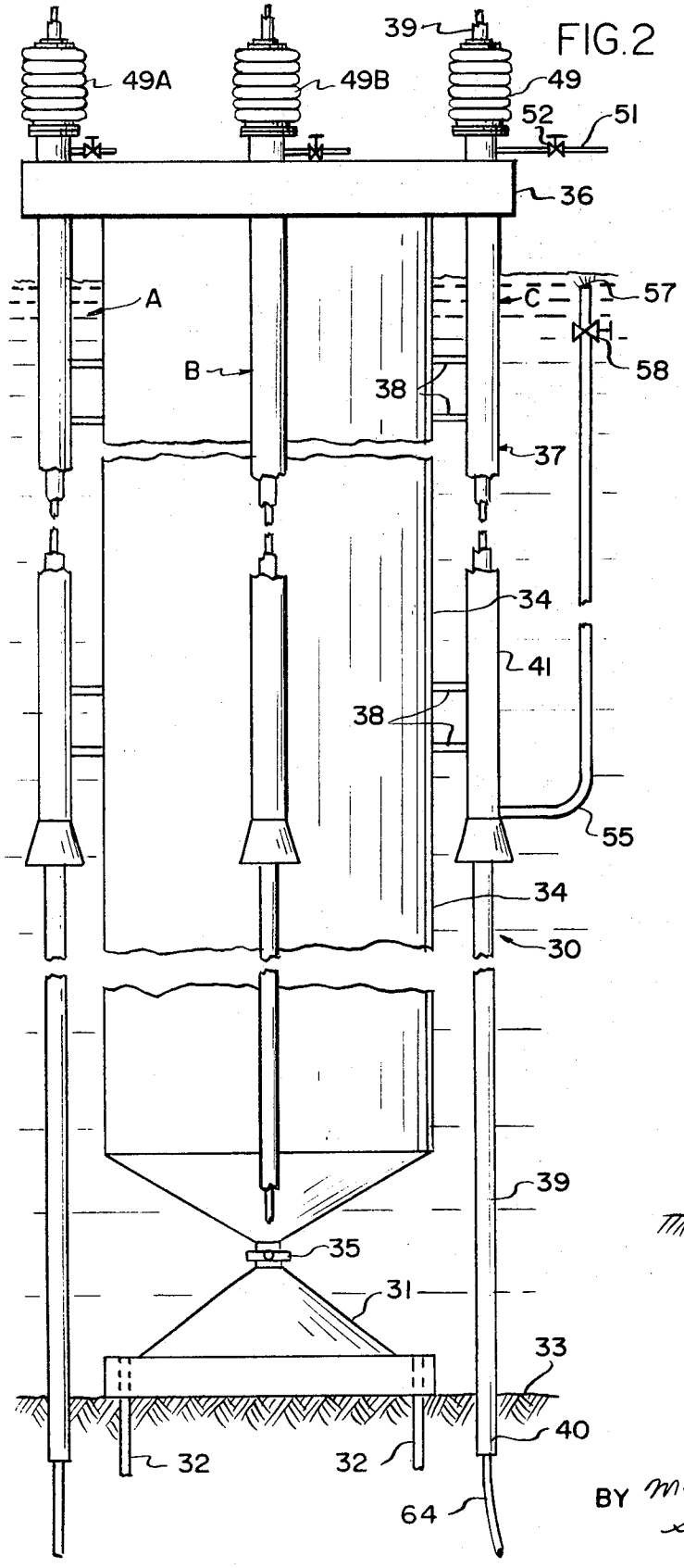
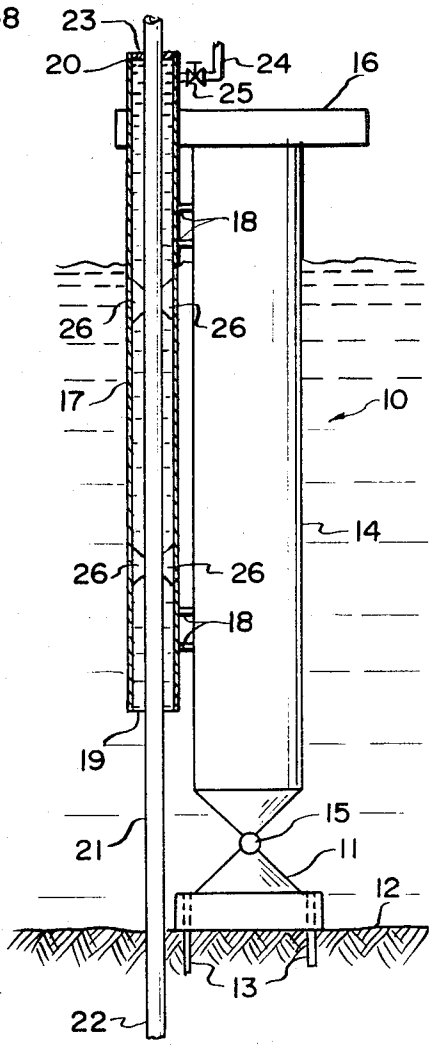


FIG. 1



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FIG.3

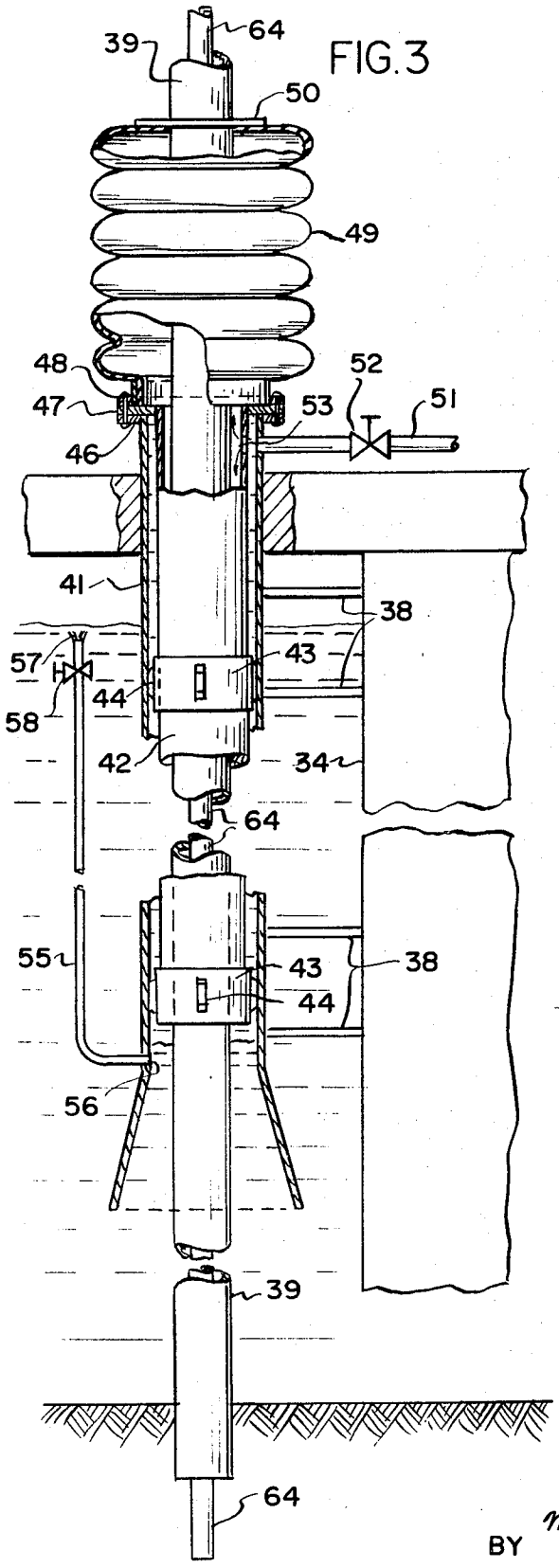
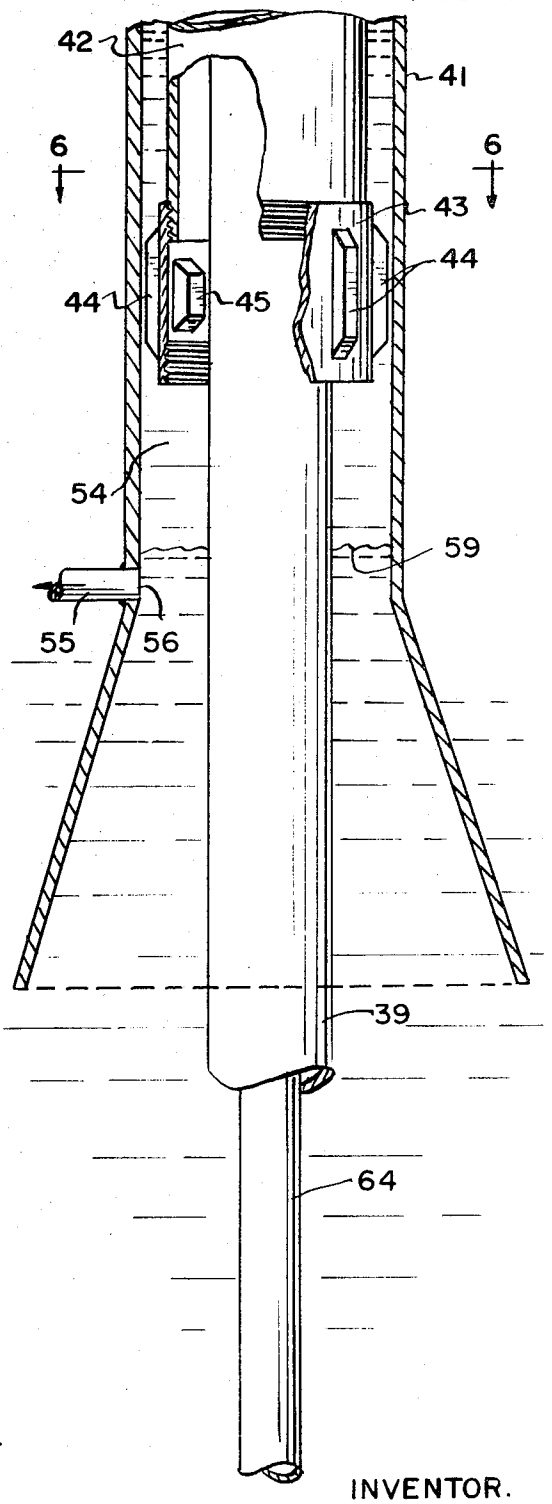


FIG.4

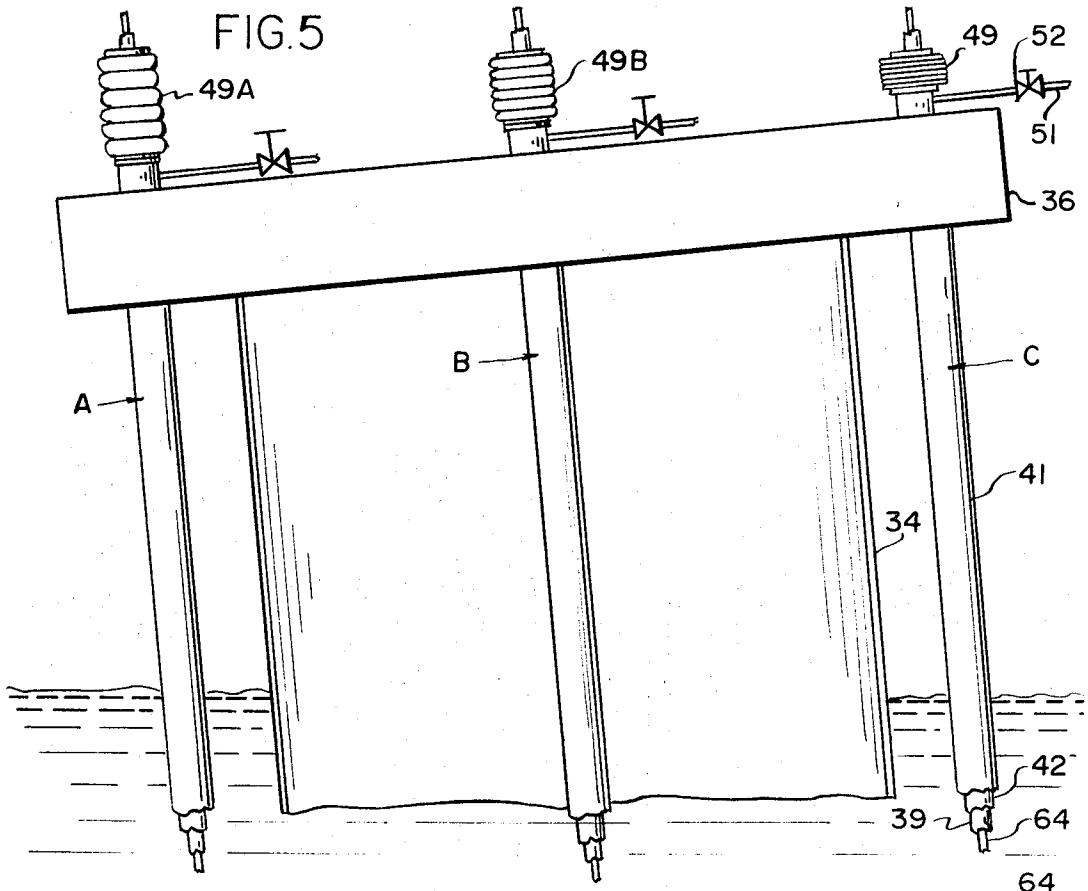


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FIG.5



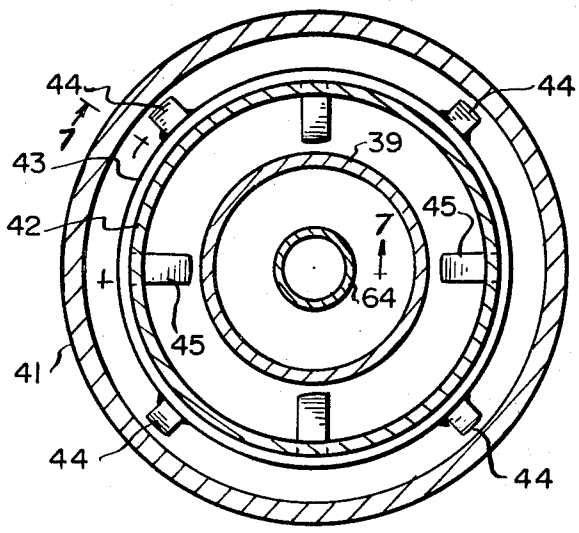
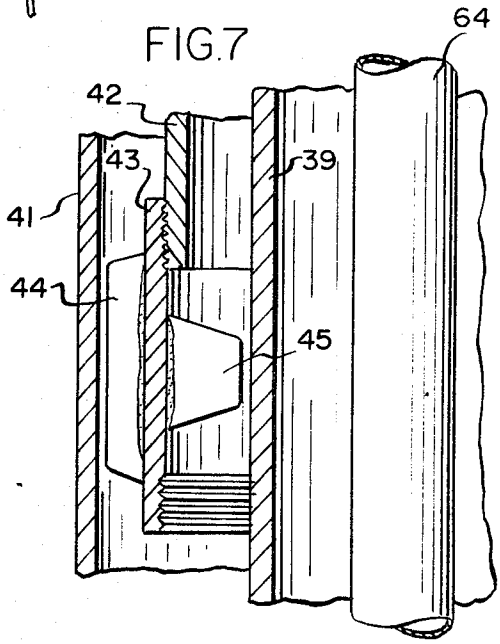


FIG.6

FIG.7



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CORROSION PROTECTION FOR WELL CASING OF OFFSHORE STRUCTURE

This invention relates to offshore structures for oil well drilling and oil production, particularly in deep water. More specifically, the invention is concerned with apparatus and ways of protecting oil well casings, and tubular templates which guide and support the casings, from sea water corrosion.

Offshore structures are used in oil well drilling and oil production. Such structures normally have a platform from which the work is performed and controlled. The platform contains the machinery, equipment and utilities required for the well drilling and/or oil production.

The platform is mounted above the water level on a suitable support. It can be either a floating support or a support which is mounted on the bottom or floor of the body of water. In relatively shallow water, the structure can be rigidly mounted or secured on the sea bottom. However, in deep water it is necessary that the support be permitted to oscillate because overturning moments about the base of a rigidly fixed structure would prohibit this approach as a practical matter.

Oscillating offshore structures for deep water use can be of the floating type or of the type which is pivotally mounted to a base secured to the sea floor. The floating type structure is anchored to the sea floor by one or more guy lines. It oscillates because of the action of sea currents, wave action, wind and tides. These same forces cause a pivotally mounted offshore structure to oscillate.

Oscillation of offshore structures requires that well casings be flexible enough to bend without breaking. To restrict this bending and to reinforce the casing, it is conventional to employ a tubular template to support each casing. Each tubular template is vertically mounted or joined to the offshore structure and the upper end of the template extends to above the platform and the lower end is located as far below sea level as is needed to support the casing adequately. The casing is positioned inside of the tubular template and projects above the platform and also above the upper end of the tubular template. The lower end of the casing is grouted into the sea floor. A suitable drilling pipe or oil production pipe is placed inside of the casing. Because of the oscillating action of the offshore structure, the casing must be slidably mounted in the tubular template. However, sliding of the casing in the tubular template causes abrasion between their adjacent surfaces. This causes the protective coatings on the casing and tubular template to wear, particularly in those locations where spacers are present to keep the casing centered in the template. Since sea water surrounds the casing inside of the tubular template, corrosion of the casing in unprotected areas can occur. This is undesirable, particularly in permanent offshore structures because of the cost of making repairs, loss of production and the likelihood of oil escaping and polluting the water. There is thus a need for apparatus and ways of protecting casings and supports therefor on oscillating offshore structures.

According to the present invention there is provided a novel apparatus and system for protecting oil well casings, and tubular template supports therefor, from sea water induced corrosion. The desired result is achieved by means which makes it possible to fill the annular space between the casing and the tubular template with a corrosion-preventing oil and to thereby exclude sea water from contact with the casing, inside of the template.

In a broad embodiment, the invention provides an offshore deep water oscillating oil well drilling or oil production structure having a platform and support therefor. The structure can be adapted to float or it can be mounted on a sea floor. It has an essentially vertically displaced tubular template fixedly secured to the platform and platform support. The bottom end of the tubular template is open and positioned to project below sea level when the platform is positioned offshore in a body oF water. A closure is mounted at the upper end of the tubular template which is adapted to contact a casing therein, in slidably sealing contact to close the annular space between the template and casing. A conduit is provided to communicate with the inside of the tubular template below the closure for feeding oil inside the tubular template. Means is also provided to determine when the level of an oil-water interface in the tubular template is near the bottom end thereof. The structure as described in particularly useful in conjunction with a casing secured in the sea bed at its lower end and supported by, and inside of, the tubular template.

The invention will now be described further in conjunction with the attached drawings in which:

FIG. 1 is an elevational view of an offshore deep water oil drilling and producing structure showing a well casing supported by a tubular template with oil therebetween;

FIG. 2 is a broken away elevational view of an offshore structure showing a plurality of tubular templates supporting casings and with a bellows closure between each template and casing;

FIG. 3 is an elevational view, partly in section and partly broken away, showing the bellows closure and tubular template of FIG. 2 in greater detail;

FIG. 4 is partly a vertical sectional view and partly a broken away view of the bottom portion of the tubular template shown in FIGS. 2 and 3;

FIG. 5 is an elevational view of the upper portion of the offshore structure of FIGS. 2 to 4 in tilted position;

FIG. 6 is a sectional view taken along the line 6-6 in FIG. 4; and

FIG. 7 is a sectional view taken along the line 7-7 in FIG. 6.

So far as is practical, the same or similar elements which appear in the various figures comprising the drawings shall be identified by the same numbers.

With reference to FIG. 1, the offshore seep water structure 10 has a base 11 mounted on sea floor 12 and secured in place by piles 13. Column or shaft 14 is connected to base 11 by universal joint 15 which permits the column to oscillate through action of water current, waves, wind and tide. Column 14 is totally or partially hollow to provide the necessary buoyancy to keep it essentially vertical under normal conditions. Supported by column 14 is platform 16 which extends beyond the width of the column.

Tubular template 17 is supported by column 14 by means of braces 18. The lower end 19 of the tubular template is open to the sea. The upper end 20 of the template is located above platform 16. Well casing 21 has its lower end 22 grouted into the sea floor and is thus fixed in position. The casing 21 extends upwardly inside of template 17 and ends above the end 20 of the template. Closure 23 at the end 20 of template 17 seals off the annular space between the template and the casing yet permits slidable movements of the casing in the template during oscillation of the offshore structure. Conduit 24 communicates with the interior of the template and is used to feed oil thereto. Sufficient oil is fed under pressure to displace the sea water from substantially all of the template thereby forming an oil-water interface just above the template lower end 19. After sufficient oil has been added, valve 25 can be closed to prevent escape of the oil. The oil protects the casing surface, as well as the inside of the template, from corrosion. Spacers 26 can be positioned between the casing and the template to keep them axially positioned relative to one another.

With reference to FIG. 2, an example of such an offshore structure 30 has a base 31 secured by piles 32 to sea floor 33. Column or shaft 34 is pivotally joined at its lower end by universal joint 35 to base 31. Platform 36 is supported on the top of column 34 above sea level. The offshore structure 30 as shown has three oil well units A, B and C, which can be essentially identical. More or less than three oil well units can be mounted on the structure 30. Accordingly, it should suffice to describe unit C in detail, it being understood that units A and B have similar elements.

Well unit C has a tubular template 37 supported by brackets 38 to column 34. Casing 39 has its lower end 40 grouted into seabed 33. The casing extends vertically inside of the template 37 to above the platform. As shown in greater detail in FIGS. 3 and 4, the template is composed of an outer guide pipe 41 and

a centralizer pipe 42. Centralizer pipe 42 is provided with a plurality of couplings 43 having outwardly extending spacers 44 and inwardly extending spacers 45 (FIGS. 4, 6 and 7). The couplings 43 join together lengths of pipe to make up the centralizer pipe 42. Casing 39 runs inside of centralizer pipe 42. Inside of casing 39 is centrally located oil drilling or production tubing 64.

Referring again to FIG. 3, each of guide pipe 41 and centralizer pipe 42 has a flange 46 and 47 respectively at their top ends. These flanges abut one another and, together with flange 48 at the lower end of flexible bellows 49, are held sealed tightly together by bolts. Flange 50 at the upper end of bellows 49 is sealably joined to casing 39. The bellows constitutes a closure between the guide pipe 41 and casing 39 which permits slidable movement of the casing 39 relative to centralizer pipe 42 and guide pipe 41 although such movement is limited by the ability of the bellows to compress and extend. For the purpose of this invention, the size of the bellows needed to adapt to oscillatory movement of the offshore structure can be readily calculated. The bellows can be manufactured of any suitable material which has enough flexiblity to withstand the compression and tension applied to it and is chemically resistant to the oil contained therein. An elastomeric material such as nitrile rubber, fabric reinforced if desirable, can be satisfactorily employed.

Conduit 51 having valve 52 communicates with the inside of guide pipe 41 and is used to supply oil under pressure thereto. Port 53 in the upper end of centralizer pipe 42 is provided so that oil fed by conduit 51 can also flow between casing 39 and centralizer pipe 42. Oil under pressure is supplied by conduit 51 until the sea water inside centralizer pipe 42 and guide pipe 41 is nearly all forced out and replaced by oil 54. Conduit 55 communicates with the bottom interior space of guide pipe 41. When the oil-water interfere reaches opening 56, oil flows upwardly and out the mouth 57 of conduit 55. When oil emerges in this manner, the maximum amount has been supplied and valve 52 is closed. Obviously, mouth 57 can extend above sea level and feed overflow oil to a reservoir to prevent pollution of the sea. Each of well units A, B and C can be provided with such means to determine when the tubular template is full of oil. Such means can be specific for each well unit or set up in series so that only one observation, and one conduit 55, need be made to determine that all of them are full of oil. Valve 58 can also be provided in conduit 55 and closed to prevent escape of oil in those instances when the structure tilts and raises opening 56 above the oil-water interface 59.

A comparison of FIG. 2 with FIG. 5 shows the action of the bellows when the column 34 tilts. The offshore structure as shown in FIG. 2 is vertical and each of bellows 49, 49B and 49C is in its normal or relaxed position. Upon tilting of column 34, the sea floor fixed position of the casings in each well unit A, B and C is slidably displaced relative to each tubular template so that a force is exerted on the bellows attached to that respective casing. The casing in unit C together with the tubular template apply a force which compresses bellows 49. The casing in unit B applies a less compressive force on bellows 49B; and the casing in unit A applies a tensile force to bellows 49A causing it to extend. The various bellows thus permit relative movement of each casing in its supporting tubular template without release of oil under pressure from therein or from inside of guide pipe 41 or centralizer pipe 42.

What is claimed is:

1. An offshore deep water oil well drilling or oil production structure comprising:
- a vertical oscillating support secured to the bottom of a body of water,
- a platform mounted on the vertical support above the water,
- a vertical tubular template attached to the vertical support having an upper end extending above the platform and terminating at its open lower end in the water,
- a well casing secured at its lower end in the bottom of the body of water and extending upwardly inside the tubular template and ending above the template,
- a closure at the upper end of the tubular template adapted to seal and close the annular space between the tubular template and the casing while permitting slidable axial movement of the casing relative to the closure, and
- a conduit communicating with the inside of the tubular template below the closure for feeding oil inside the tubular template and around the casing.

2. An offshore structure according to claim 1 in which spacers are located between the casing and the tubular template to maintain them in substantially axial position relative to one another and prevent their wearing against each other.

3. An offshore structure according to claim 1 in which the closure is a bellows which is secured at one end to the template and the other end is secured around the casing.

4. An offshore structure according to claim 1 in which the tubular template has means to determine when the level of an oil-water interface in the tubular template is near the bottom end thereof.

5. An offshore structure according to claim 1 in which the vertical support is pivotally mounted to a base support on the bottom of the body of water.

6. An offshore structure according to claim 1 in which the tubular template comprises a guide pipe secured to the vertical support and a centralizer pipe therein, said casing being positioned inside the centralizer pipe, and spacers are positioned between the guide pipe and the centralizer pipe, and between the centralizer pipe and the casing.

7. An offshore structure according to claim 6 in which the guide pipe and centralizer pipe are attached together to move in unison.

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