

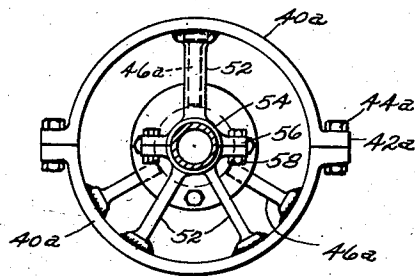
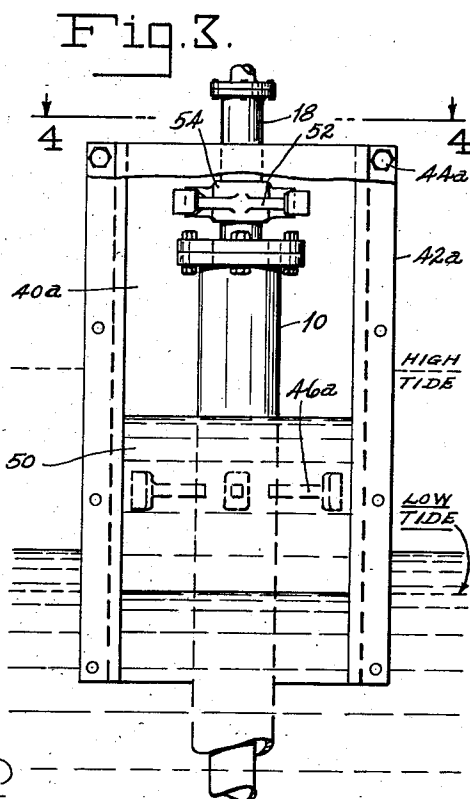
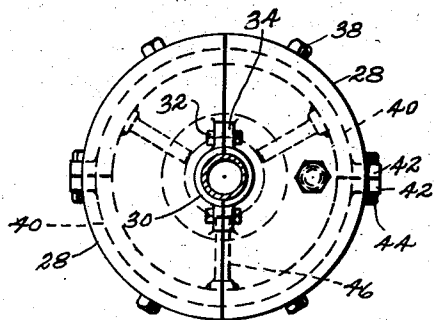
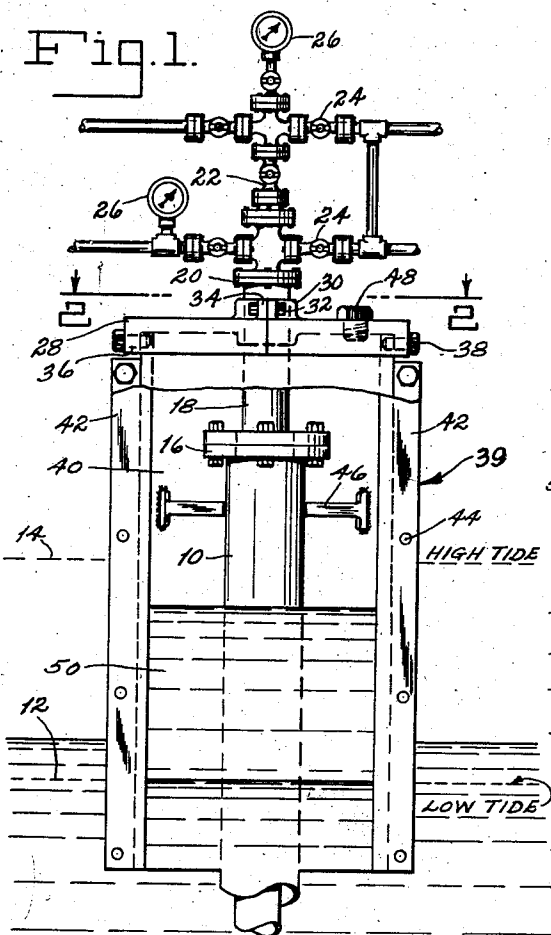
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CORROSION PREVENTION OF OFFSHORE WELL TUBING

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CORROSION PREVENTION OF OFFSHORE
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This invention relates to the prevention of corrosion and more particularly to means for preventing corrosion of equipment used in an offshore oil field. The principal object of the invention is the provision of a simple unitary structure requiring substantially no maintenance and adapted to be attached to that portion of an offshore Christmas tree which is exposed alternately to air and sea water due to tide and wave action, for preventing corrosion of that portion of the tree.

When an oil well is completed at an underwater location, it is of course necessary that certain piping, valves and fittings be disposed at the top of the well. This assembly of valves and fittings is usually termed a "Christmas tree." The lower portion of the Christmas tree is usually below the low tide level and is, therefore, always wet by the sea water. The upper portion of the Christmas tree is usually above the high tide level and is seldom wet by the sea water. The upper portion of the tree can be protected from corrosion by the use of special paints, and other means such as cement surrounding the lower portion of the tree serve to protect that portion. The protection of the intermediate portion is, however, a real problem since that portion is wet by sea water at high tide and by air at low tide, and it is generally impossible to coat that portion with any material which will adhere to the material and which will prevent the corrosive action of the air and salt water.

In accordance with the present invention an arrangement has been provided which has proven to be successful in preventing corrosion and which requires a minimum of time for installation and maintenance. A tubular skirt or sleeve member is suspended on the Christmas tree in annularly spaced relation thereto around that portion between the low and high tide marks which is subject to alternate air and water contact, and extends downwardly so that it is below the low tide level. Within the annular space between this tubular member and the Christmas tree is placed a quantity of a non-corrosive liquid such as oil having a density lower than the water and immiscible therewith. Therefore, since the oil will float upon the water, it will rise and fall with the tides and protect the intermediate portion of the Christmas tree from being alternately exposed to air and water.

For a better understanding of the invention, reference may be had to the accompanying drawing in which

Fig. 1 is a vertical elevation partly in section

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of a Christmas tree provided with means for preventing the corrosion of its intermediate portion;

Fig. 2 is a plan view taken on the line 2—2 of Fig. 1;

Fig. 3 is a view similar to that of Fig. 1 but showing a modification and

Fig. 4 is a plan view taken on the line 4—4 of Fig. 3.

Referring to the drawing, the upper end of a casing or surface string 10 is shown, its lower portion being below the low tide level indicated at 12 and its upper portion being above the high tide level 14. The top of the casing 10 is provided with a head or flange 16 and extending upwardly through and above the top of the casing is shown the upper portion of a production string 18. The upper end of the production string is also provided with a flange 20 and extending upwardly therethrough is shown a tubing string 22. Several flow lines are shown as connected to the production and tubing strings, these lines being provided with valves 24 and gages 26. Such an assembly comprising the upper ends of the casing, production string and tubing string together with their associated valves, gages, etc. is usually called a "Christmas tree."

Attached to the upper portion of the production string 18 is a support in the form of a pair of semi-circular cover members 28 as shown more clearly in Fig. 2, these members being provided with a pair of central mating half collars or bosses 30 forming a central collar adapted to be rigidly secured or clamped around a production string as by tightening the bolts 32 through upstanding flanges or ears 34. The cover members 28 are each provided with a downwardly extending peripheral flange 36 through which a plurality of set screws 38 are threaded for supporting a skirt. Surrounding the intermediate portion of the Christmas tree is a tubular skirt or sleeve member indicated generally at 39 and formed of a pair of semi-cylindrical elements 40. Each of the elements 40 is provided with a pair of side flanges 42 and bolts 44 pass through these flanges so as to form the skirt member into a unitary cylinder. The skirt elements are shown as provided with three inwardly projecting spacer lugs 46 welded to the inner surface of the skirt members at a position spaced longitudinally from the support 28 and of a length such that they will barely touch the outer surface of the casing 10 to maintain an annularly spaced relation when the device is assembled. Skirt 39 is open at the

bottom for the access of water to the annular space around the Christmas tree, whereby the level of the liquid therein rises and falls with the tide.

In assembling the device described above, the two cover members 28 are bolted around the production string at a predetermined height above the high tide mark so that the cover members are protected from submersion in the water, and the two skirt elements 40 are then positioned around the upper end of the casing string and secured together by means of the bolts 44. The assembled skirt member is then raised and the set screws 38 at the edges of the cover 28 tightened to engage its upper end above the high tide mark and suspend it. The lugs 46 will serve to position the skirt parallel to the vertical axis of the tree. Set screws 38 and bolts 32 permit the cover 28 to be removed at will from engagement with Christmas tree 10 and skirt 39.

One of the cover elements 28 is provided with a filler opening and a screw cap or closure 48. After the device has been assembled and positioned as shown in Figs. 1 and 2, a quantity of a substantially non-corrosive fluid such as oil 50 is poured in by removing the cap 48. The liquid 50 should be lighter than water so that it will float as a pool upon the water in contact with the Christmas tree. It is not intended that the skirt 39 and the cover members 28 be hermetically sealed. On the other hand, there will be sufficient leakage of air so that while the tide is rising or falling, the liquid 50 will rise and fall in the same manner. That portion of the Christmas tree above the low tide level 12 will therefore always be exposed either to air or to the oil rather than to sea water and corrosion will therefore be prevented or reduced to a minimum.

It may be desired to add to the oil 50 a small quantity of an anti-rust agent such as an alkenyl succinic acid prepared by condensing maleic anhydride with a high molecular weight olefin polymer. If this is done corrosion of the intermediate portion of the Christmas tree should be reduced to a negligible quantity. It may also be desired to add to the oil 50 a suitable quantity of a tackiness agent, for example, a high molecular weight isobutylene polymer. This will insure the oil or rather a film of the oil adhering to the surface of the tree during periods of low tide.

In Figs. 3 and 4 a slight modification is illustrated. Two semi-circular skirt elements 40a corresponding to the elements 40 of Fig. 1 are provided with flanges 42a and bolts 44a so that the cylindrical skirt can be positioned around the portion of the Christmas tree to be protected. In this case, no cover member is provided but rather the skirt is open at the top. Elements 40a are provided with internal brackets 52 in the form of a spider, and the inner ends of these brackets have attached thereto a pair of mating half collars to form a central collar or clamping ring 54, the ring elements being provided with flanges 56 and bolts 58 for removably attaching the device to the production string 18. At a point preferably below the center of the skirt 40a spacing lugs 46a are attached as by welding to the inner surface of the skirt elements. These correspond to the lugs 46 of Fig. 1 and they are of sufficient length to hold the skirt in concentric

relation to the casing 10. A body of a non-corrosive liquid such as oil 50 is placed within the skirt so that it will float upon the sea water as it moves up and down due to tide and wave action.

Where the outer surface of the skirt is in contact with the sea water it is therefore subjected to corrosion, but this is not objectionable in that the skirt can be readily replaced or may be formed of corrosion resistant material.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, but only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. Oil well apparatus comprising, in combination, an off-shore oil well Christmas tree projecting up through the water to a point above the high tide mark; a tubular skirt surrounding at least the part of said Christmas tree between high and low tide marks in annularly spaced relation thereto, and extending above and below said tide marks; a support for said skirt secured to both said Christmas tree and said skirt above said high tide mark, whereby said support is protected from submersion in said water; and a pool of substantially non-corrosive liquid in the annular space between said Christmas tree and said skirt, said liquid having a density lower than said water and being immiscible with water to float in contact with said part of said Christmas tree and protect said part from exposure to air and water alternately.

2. Oil well apparatus in accordance with claim 1 wherein said skirt is open at the bottom for the access of water to said annular space, whereby the level of said liquid rises and falls with the tide.

3. Oil well apparatus in accordance with claim 1, also comprising spacing means between said Christmas tree and said skirt spaced longitudinally from said support for maintaining said annularly spaced relation.

4. Oil well apparatus in accordance with claim 1 wherein said support comprises a cover for the top of said skirt having a central collar clamped on said Christmas tree, said cover being engaged adjacent the edges thereof to said skirt for suspending the latter, said cover being removable at will from engagement with said Christmas tree and said skirt.

5. Oil well apparatus in accordance with claim 1 wherein said skirt is open at the top, and wherein said support comprises a spider carried by said skirt and having a central collar clamped on said Christmas tree.

6. Oil well apparatus in accordance with claim 1 wherein said support comprises a pair of mating half collars clamped on said Christmas tree and removable at will therefrom.

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