

PATENT SPECIFICATION (11)

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(54) SYSTEM FOR CONNECTING A RISER PIPE TO A FLOATING STRUCTURE

(71) We, STANDARD OIL COMPANY, a corporation organized and existing under the laws of the State of Indiana, United States of America of 200 East Randolph Drive, Chicago, Illinois 60601, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a system for connecting a riser pipe to a floating structure particularly but not exclusively to a floating structure from which drilling or production operations are carried out. It relates especially to the installation of Vertically Moored Platforms in deep water.

In recent years, there has been considerable attention attracted to the drilling and production of wells located in water. Wells may be drilled in the ocean floor from either fixed platforms in relatively shallow water or from floating structures or vessels in deeper water. The most common means of anchoring fixed platforms includes the driving or otherwise anchoring of long piles in the ocean floor. Such piles extend above the surface of the water and support a platform attached to the top of the piles. This works fairly well in shallow water, but, as the water gets deeper, the problems of design and accompanying costs become prohibitive. In deeper water, it is common practice to drill from a floating structure.

In recent years, there has been some attention directed toward many different kinds of floating structures. One system receiving attention for mooring is the so-called Vertically Moored Platform. Such platforms are described in U.S. Patent Nos. 3,648,638 and 3,976,021. Key features of the disclosure in the former patent are that the floating platform is connected to an anchor only by elongated parallel members and the floating structure has buoyancy means designed especially with respect to the trough of a design wave so as to minimize mooring forces imposed on the vertically elongated members which anchor the struc-

ture, such as these forces which may be caused by passing waves.

As indicated, the present invention concerns, in one form, a riser/jacket vertical bearing assembly connecting the upper end of a riser pipe to a Vertically Moored Platform. The lower end of the riser pipe will generally be connected to anchor means on the floor of the body of water supporting the Vertically Moored Platform.

According to the present invention, there is provided a system for connecting the upper end of a riser pipe having an external shoulder to a floating structure which comprises:

a bracket for engaging said external shoulder and having a lower shoulder essentially perpendicular to said riser pipe.

a bulkhead on said floating structure for supporting said bracket, and

a jack arranged to act between said bulkhead and said lower shoulder, so that axial tension can be applied to said riser pipe.

In a preferred construction said external shoulder comprises an external ring, the bracket has an internal groove complementing and surrounding said ring and tapers downwardly and outwardly, a ring member is carried by the bracket at its lower end and a bearing plate for supporting the ring member is supported by the bulkhead, each of the shoulder and the ring being essentially perpendicular to said riser pipe.

The riser pipe will generally extend vertically through an opening in the Vertically Moored Platform, which is provided with a horizontal bulkhead near such opening. The purpose of the jack, which is provided between the bulkhead and the shoulder on the bracket, is to apply proper tension to the riser pipe through the support bracket. Shim plates may be inserted between the horizontal ring member of the bracket and a bearing plate supported by the bulkhead.

The invention will now be described in more detail with particular reference to the accompanying drawings, in which:

Figure 1 illustrates a Vertically Moored Platform;

Figure 2 is a sectional view taking along the line 2—2 of Figure 3 and illustrates means

for applying tension to a riser pipe located within buoyancy means; and

Figure 3 is a sectional view taken along the line 3—3— of Figure 2.

Referring to the drawings, Figure 1 illustrates a Vertically Moored Platform with gravity base and risers installed and ready for drilling. The gravity base is only one form of anchor means. There is shown a buoyancy means 10 supporting a deck 12 above the surface 14 of the body of water 16. The buoyancy means 10 is connected to gravity base 18 by four legs 20. Each leg 20 includes a plurality, in this case, eight, of riser pipes 22. Spacers 24 are provided vertically along each leg 20 to keep the riser pipes 22 apart and to modify their resonant frequency to prevent flutter. Each gravity base section 18 has a plurality of punch tubes 26 which are forced by the weight of the gravity base into the sea floor 21. Drive pipes 28 extend downwardly from punch tubes 26. After the Vertically Moored Platform is installed, as shown in FIGURE 1, drilling operations are conducted through individual risers 22 from the top of platform 12. One method of installation of a Vertically Moored Platform is shown in the aforesaid U.S. patent 3,976,021.

Attention is now directed to FIGURES 2 and 3 which show means for applying tension to the riser pipes. By this system, we can adjust the tension as desired. Shown thereon, is the riser pipe upper terminator or section 94 extending upwardly through jacket 74 which is a part of floating structure 10. An outer shoulder in the form of ring 64 is provided about the upper portion of the riser pipe section 94, shown in FIGURE 2. A complementing support bracket 62 is mounted about ring 64. Bracket 62, as can be seen in FIGURE 3, is made in three pieces and connected together by bolts or other connecting means 80. Bracket 62 extends downwardly and tapers outwardly to a member 68. Ring member 68 has three extensions or shoulders 69, as shown in FIGURE 3. A jack 76, supported from bulkhead 77, which is supported from the jacket 74, is provided with a ram 78 for each shoulder 69. By applying force to jack 76, the risers can be pushed upwardly with respect to jacket 74. A bearing plate 71 is attached to upright member 72 which is attached to jacket 74. Shim plates 70 are provided between items 71 and 68. In operation, the jacks 76 push the riser pipe upwardly with respect to the floating structure to obtain the desired tension on the riser pipe. Then a sufficient number of shims 70 are inserted, and then the jack is backed off and the force is transmitted through the shims 70 and the bearing plates 71. Proper tension is thus applied to riser pipes 94. All of the anchoring of the buoyancy means

is through the riser pipes. It is well to point out that there are a plurality of riser pipes, typically eight, in each leg, of which typically there are four in the particular embodiment shown. In this configuration, there would normally be 32 riser pipes, all installed as discussed herein. Drilling and subsequent production operations can be conducted through each riser.

WHAT WE CLAIM IS:—

1. A system for connecting the upper end of a riser pipe having an external shoulder to a floating structure, said system comprising: a bracket for engaging said external shoulder and having a lower shoulder essentially perpendicular to said riser pipe, a bulkhead on said floating structure for supporting said bracket, and a jack arranged to act between said bulkhead and said lower shoulder so that axial tension can be applied to said riser pipe.
2. A system according to Claim 1 wherein said bracket tapers downwardly and outwardly from said external shoulder.
3. A system according to Claim 1 or Claim 2 wherein the external shoulder comprises an external ring and the bracket has an internal groove complementing and surrounding said external ring.
4. A system according to Claim 1 or Claim 2 wherein a ring member is carried by the bracket at its lower end and a bearing plate for supporting the ring member is supported by the bulkhead.
5. A system according to Claim 4 including shim plates between said bearing plate and said ring member.
6. A system according to Claim 1 wherein said external shoulder comprises an external ring, the bracket has an internal groove complementing and surrounding said ring and tapers downwardly and outwardly, a ring member is carried by the bracket at its lower end and a bearing plate for supporting the ring member is supported by the bulkhead, each of the shoulder and the ring being essentially perpendicular to said riser pipe.
7. A system according to Claim 6 including shim plates between said bearing plate and said ring member.
8. A system for connecting the upper end of a riser pipe to a floating structure, substantially as hereinbefore described, with particular reference to the accompanying drawings.
9. A vertically moored platform comprising a floating structure and a riser pipe connected by a system as defined in any preceding claim.

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Figure 3 is a sectional view taken along the line 3—3— of Figure 2.

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