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(71) Applicant: **Bumi Armada Berhad**
50450 Kuala Lumpur (MY)

(72) Inventors:
- **Withall, Timothy Latham**
  Notting Hill Victoria 3168 (AU)
- **Marcollo, Hayden**
  Notting Hill Victoria 3168 (AU)

(74) Representative: **Walsh, David Patrick**
Appleyard Lees
15 Clare Road
Halifax, Yorkshire HX1 2HY (GB)

(54) **Riser support system**

(57) A riser system for offshore oil and gas production for communicating systems located on the seabed with floating facilities suitable for accommodating floating facility static and dynamic offsets and motions. The riser system comprises a riser extending from the seabed to a floating facility that is supported by a hybrid support system.

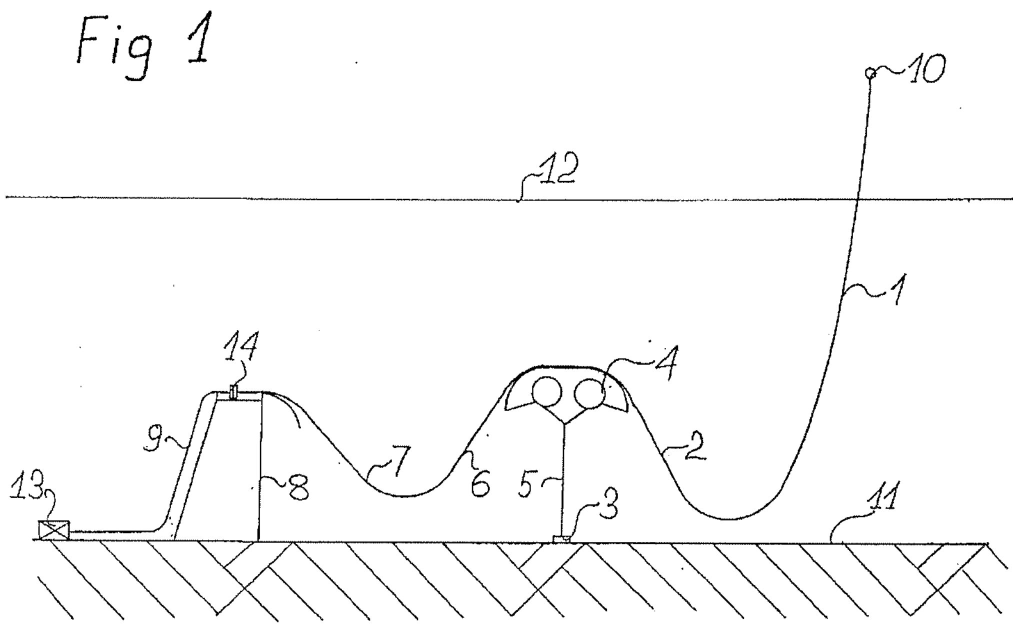

Figure 1.

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Description

Field of The Invention

[0001] The present invention relates to a riser system for offshore oil and gas production, and more particularly relates to a riser system suitable for offshore oil and gas production situated in a shallow water.

Background of The Invention

[0002] Riser systems are used in offshore oil and gas production for communicating systems located on the seabed with floating facilities.

[0003] Dynamic riser systems are required to accommodate static and dynamic offsets and motions of a floating facility. This can become a challenging task in a shallow water especially when the floating facility such as a vessel is subject to rough weather conditions such as storms, typhoons, cyclones that will affect the riser system.

[0004] It is an aim of the present invention to provide a riser system which could alleviate the above disadvantages.

Summary of The Invention

[0005] The present invention provides a riser system well suited to use in offshore oil and gas production located in a shallow water with large static and dynamic floating facility offsets and motions.

[0006] The riser system comprising::

i) A hybrid support system comprising a mid depth tower and a mid depth buoyant support.

ii) The mid depth tower of the hybrid support system provides a termination point for a dynamic portion of a riser wherein the tower is fully restrained.

iii) The mid depth buoyant support of the hybrid support system provides a vertical support for the dynamic riser along the span away from the mid depth tower end while also offering some compliance in the horizontal direction. The mid depth buoyant support consists of an enclosed volume of displaced water tethered to the seabed.

[0007] The riser system has advantages in being able to accommodate floating facility static and dynamic offsets and motions which can become challenging. The mid depth buoyant support may include an axial, horizontal and vertical restraint with suitable over curvature protection.

[0008] The mid depth tower comprises of rigid steel like structure offering full translational and rotational restraint for the riser and the termination of which is placed in a vertical and horizontal position, with correctly selected lengths of riser so as to offer compliance for the riser section connected to it.

[0009] The mid depth tower termination end of the riser may comprise of a rigid steel pipeline connection to a dynamic riser. The mid depth tower termination end of the riser may comprise a continuos dynamic section of riser, laterally constrained all the way to the seabed and then continuing along the seabed to connect to seabed infrastructure.

[0010] Objects of the present invention include a configuration of a riser that is compliant to large vessel horizontal offsets, large dynamic motions of the floating system, large environmental conditions and large changes to the mass per unit length of the riser (both through internal contents density variations and marine growth).

Brief Description of The Drawing

[0011]

Figure 1 diagrammatically shows a riser system of a preferred embodiment according to the present invention.

Detailed Description Of The Preferred Embodiment

[0012] Figure 1 shows a riser system of a preferred embodiment according to the present invention. The riser system has a hybrid support system comprising a mid depth tower and a mid depth buoyant support.

[0013] As illustrated, the riser system includes at least one riser. A plurality of riser may be provided to the riser system. The riser, for example may be arranged horizontally offset in the direction normal to the plane of the drawing.

[0014] The riser is in the form flexible tube having an upper termination point. The upper termination **10** of the riser comprises for example a connection to a dynamic floating facility such as a vessel. The connection point of the dynamic floating facility can be arranged at a location above or below the water line **12.**

[0015] Portions denoted with reference numeral 1 and 2 define an upper catenary of the riser. The riser are configured as such that there is a sag or lower point in this upper catenary (when the floating facility is at its nominal central position). The purpose of the catenary configuration is to offer some compliance for the riser system such that it is not damaged when accommodating the static and dynamic motions of the floating facility or the environmental conditions. The floating facility is subject to the rough forces of the water i.e. sea waves and currents.

[0016] The upper catenary of the riser is laid over the mid depth buoyant support **4** of the hybrid support system. The support there may or may-not be provided some local axial restraint for the riser and there may or may-not be provided some vertical restraint with suitable over curvature protection. The mid depth buoyant structure is substantially disposed in a vertical position at a suitable location in a water column that is not necessarily at the exact middle depth, but will not be at the extreme top or bottom of the water depth. The mid depth buoyant support provides a vertical support system for the portions of the riser laid over either side of it. The mid depth buoyant support derives its buoyancy force from an enclosed volume of displaced water. The mid depth buoyant support is connected to a base connection **3** located on the seabed via tethers **5.** This connection allows the mid depth buoyant support to move in any directions restricted by the length of the tethers. By its nature the mid depth buoyancy support can undergo upside down pendulum type motions when forced to do so by either direct environmental forces or by the riser system forcing it to do so.

[0017] The portion of the riser configuration attached to the mid depth buoyant support but on the opposite side to the upper catenary is termed the mid span catenary **6** and **7.** The mid span catenary consisting of both components **6** and **7** offers superior horizontal compliance to what would be offered by a configuration with only say component **6** extending straight down to the seabed, either by a tangential or a normal connection to the seabed. The mid span catenary is configured such that in the nominal benign condition it has a lower sag between **6** and **7.**

[0018] Riser portion **7** extends in the opposite direction to **6** is connected to the component of the hybrid support system termed the mid depth tower **8** which is a rigid structure offering complete rotational and translational restraint for the riser system. The tower **8** maybe made from a steel type rigid structure. The riser can be terminated at **14** to a rigid static steel pipeline termination or it may extend as a static flowline down to the seabed. The rigid steel static flowline option is shown in Figure 1 as **9** whereby it extends down to the seabed **11** and then connects to seabed infrastructure **13.** The purpose of the tower **8** is to provide complete restraint to the riser whereby large environmental forces, mass per unit length variations of the riser and displacements that the riser undergoes can be restrained. The mid depth tower support provides a vertical, horizontal and rotational support system for the lower end termination of the riser. The mid depth tower does not necessarily need to be at exactly the middle depth of the water column but it is placed at a depth such that in the nominal position riser portion **7** offers some horizontal compliance.

Claims

1. A riser system suitable for offshore oil and gas production for communicating systems on the seabed with floating facilities comprising
a riser extending from the seabed to a floating facility, said riser is supported by a hybrid support system wherein the hybrid supporting system comprises a mid depth tower and a mid depth buoyant support.

2. A riser system of claim 1 wherein the mid depth buoyant support structure of the hybrid supporting structure comprises buoyant enclosed structure tethered to the seabed arranged to raise and support at a point over a span of the riser for providing a sagging portion of the riser.

3. A riser system of claim 1 wherein the mid depth buoyant support of the hybrid support system includes an axial, horizontal and vertical restraint with suitable over curvature protection.

4. A riser of claim 1 wherein the mid depth tower of the hybrid support system comprises rigid steel like structure offering full translational and rotational restraint for the riser and the termination of which is placed in a vertical and horizontal position, with correctly selected lengths of riser so as to offer compliance for the riser section connected to it.

5. A riser of claim 1 wherein the mid depth tower having a termination end connectable to the riser comprises of a rigid steel pipeline connection of dynamic riser.

6. A riser of claim 1 wherein the mid depth tower termination end of the riser comprises a continuos dynamic section of riser, laterally constrained all the way to the seabed and then continuing along the seabed to connect to seabed infrastructure.

Fig 1

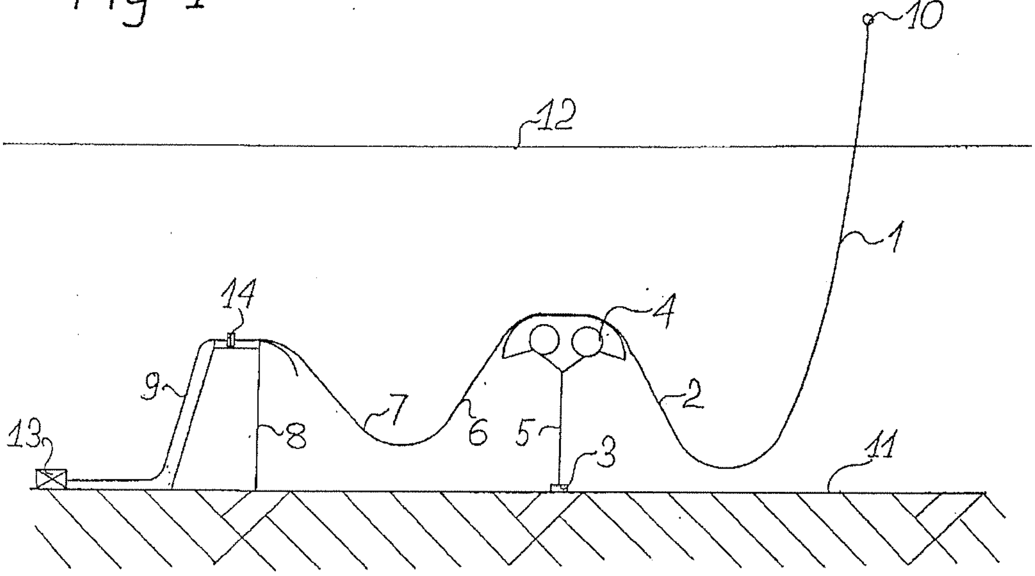

Figure 1.