(12) STANDARD PATENT (11) Application No. **AU 2008342468 B2**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Submarine device

(51) International Patent Classification(s)
E21B 43/013 (2006.01)

(21) Application No: **2008342468** (22) Date of Filing: **2008.06.10**

(87) WIPO No: **WO09/082888**

(30) Priority Data

(31) Number	(32) Date	(33) Country
200710304438.9	**2007.12.27**	**CN**

(43) Publication Date: **2009.07.09**
(44) Accepted Journal Date: **2011.06.30**

(71) Applicant(s)
CHINA OILFIELD SERVICES LIMITED;CHINA NATIONAL OFFSHORE OIL CORPORATION

(72) Inventor(s)
Guo, Yongfeng;Tang, Changquan;Ji, Shaojun

(74) Agent / Attorney
Pegasus IP, Suite 1, Coronation Place 10 Benson Street, Toowong, QLD, 4066

(56) Related Art
EP 1659257 A1
US 5676209 A
US 4616707 A

(12) 按照专利合作条约所公布的国际申请

(19) 世界知识产权组织
国 际 局

(43) 国际公布日
2009 年7 月9 日 (09.07.2009)

PCT

(10) 国际公布号
WO 2009/082888 A1

(51) 国际专利分类号:
E21B 43/013 (2006.01)

(21) 国际申请号: PCT/CN2008/071248

(22) 国际申请日: 2008 年6 月10 日 (10.06.2008)

(25) 申请语言: 中文

(26) 公布语言: 中文

(30) 优先权:
200710304438.9
2007 年12 月27 日 (27.12.2007) CN

(71) 申请人 (对除美国外的所有指定国): **中国海洋石油总公司(CHINA NATIONAL OFFSHORE OIL CORPORATION)** [CN/CN]; 中国北京市东城区朝阳门北大街25号4705信箱, Beijing 100010 (CN)。 **中海油田服务股份有限公司(CHINA OILFIELD SERVICES LIMITED)** [CN/CN]; 中国河北省三河市燕郊开发区海油大街18号, Hebei 065201 (CN)。

(72) 发明人; 及

(75) 发明人/申请人 (仅对美国): **郭永峰(GUO, Yongfeng)** [CN/CN]; 中国河北省三河市燕郊开发区海油大街18号, Hebei 065201 (CN)。 **纪少君(JI, Shaojun)** [CN/CN]; 中国河北省三河市燕郊开发区海油大街18号, Hebei 065201 (CN)。 **唐长全(TANG,**

[见续页]

(54) **Title:** SUBMARINE DEVICE

(54) **发明名称:** 一种海洋水下装置

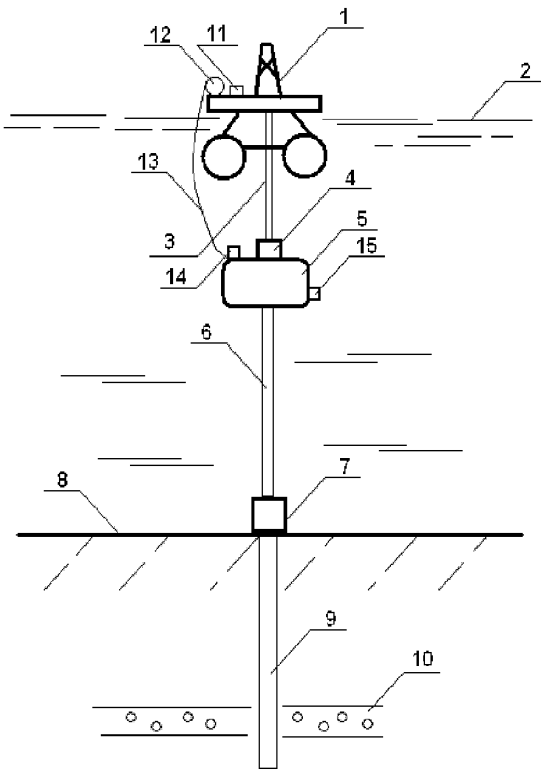

图 1 / Fig. 1

(57) **Abstract:** A submarine device includes a hollow tank body (5), a marine riser (3), blowout preventer (BOP) (4) and tie back stem (6). The BOP (4) is located on the hollow tank body (5). The marine riser (3) is connected to a drilling vessel (1) at the upper end and connected to the BOP (4) at the lower end. The tie back stem (6) is connected to the hollow tank body (5) at the upper end and connected to the seabed wellhead by the submarine wellhead apparatus (7) at the lower end and thus connected to the casing (9) for producing oil or gas in the reservoir by the submarine wellhead apparatus (7). A passage for communicating the BOP and the tie back stem system is provided on the hollow tank body. The pipe string for conveying oil, gas, or bit cuttings and drilling mud in the drilling process is divided into two sections, i.e. the tie back stem (6) and the casing (9), by the wellhead apparatus settled on the seabed. Thereby the security of the drilling platform or the drilling vessel in the drilling process is ensured and the operability of the producing system is enhanced.

[见续页]

WO 2009/082888 A1

Changquan) [CN/CN]; 中国河北省三河市燕郊开发区海油大街18号, Hebei 065201 (CN)。

(74) 代理人：北京安信方达知识产权代理有限公司 (**AFD CHINA INTELLECTUAL PROPERTY LAW OFFICE**); 中国北京市海淀区学清路8号 科技财富中心B座三层305A, Beijing 100085 (CN)。

(81) 指定国 (除另有指明，要求每一种可提供的国家保护)：AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW。

(84) 指定国 (除另有指明，要求每一种可提供的地区保护)：ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), 欧亚 (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), 欧洲 (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)。

本国际公布：
— 包括国际检索报告。

(57) 摘要：

本发明公开了一种海洋水下装置，包括：空心罐体、隔水管、防喷器和回接管，防喷器设置在空心罐体上，隔水管的上端连接至钻井船，隔水管的下端安装在防喷器上，回接管的上端固定在所述空心罐体上，该回接管的下端通过水下井口装置安装在海床的井口，并通过该水下井口装置与采集贮藏于地层中的石油或天然气的套管相连，所述空心罐体上还设置有连通所述防喷器与所述回接管体系的通道。本发明通过安装在海床上的井口装置，将输送油气以及钻探过程的钻屑与泥浆的管道设置为两段，即回接管和套管，从而即保证钻探过程的钻井平台或钻井船的安全，又使整个生产系统具有更强的可操作性。

Submarine Device

Technical Field

The present invention relates to a subsea device for engineering of drilling in deepwater.

Background Art

It has been a traditional technology to use the semi-submersible platform (or rig) to explore oil in the deepwater in the world; its development process is rather perfect. However, due to high cost of the semi-submersible platform (or rig) for the deepwater oil exploration, using such method would cause enormous cost for the deepwater oil exploration.

Summary of the Invention

A technical problem to be solved by the present invention is to provide a subsea device capable of reducing greatly construction cost.

In order to solve the technical problem described above, the present invention provides a subsea device comprising a can, a string of risers, a blowout preventer and a tie-back pipe system. The blowout preventer is installed on the can. The top of risers is connected to a rig and its bottom is mounted on the blowout preventer. The upper of tie-back pipe system is fixed to the can. The lower of tie-back pipe system is mounted to a wellhead of a seabed by a subsea wellhead apparatus and connected to formation casings for collecting oil or natural gas stored in formations by the subsea wellhead apparatus. A passage which communicates the blowout preventer with the tie-back pipe system is jointed on the can.

Preferably, the tie-back pipe system comprises an outmost tie-back pipe, in which more than two casings are nested successively. The upper of tie-back pipe is fixed to the can and its lower is mounted to the wellhead of the seabed. The upper of casings is fixed

to the can and its lower is mounted to the wellhead of the seabed. The innermost casing is communicated to the formation casings.

Preferably, the subsea device further comprises a buoyancy force adjustment device, by which the can regulates the magnitude of its buoyancy force.

Preferably, the buoyancy force adjustment device comprises a set of compressors mounted on the rig, an inject valve fixed on the can, and a cable connected between the set of compressors and the inject valve. The set of compressors transfer gas to the can through the cable and control incoming gas through the inject valve.

Preferably, a vent valve for discharging the gas in the can is provided on the can.

The advantages of the present invention will be described bellow.

1. A pipeline, which transports oil and gas as well as drilling cuttings and mud in drilling process, is divided into two sections, i.e., both the tie-back pipe system and the formation casings, by the subsea wellhead apparatus settled on the seabed, thereby ensuring the security of the drilling platform or rig in the drilling process and the stronger operability of entire production system.

2. The upper of tie-back pipe system is fixed to a buoy and its lower is fixed to the subsea wellhead apparatus mounted on the seabed. The lower of tie-back pipe system is connected to the casings below the seabed, which transports oil and gas as well as drilling cuttings and mud in drilling process, by the subsea wellhead apparatus. Therefore, in actual drilling operation process, facilities of the tie-back pipe system may be added to make the operation process more compact. That is, it is possible to mount the tie-back pipe system after the formation casings are installed and fixed to the seabed using cement, such that the installation process is more unconstrained and secure.

3. The lower of tie-back pipe system is fixed on the seabed and its upper is fixed on the buoy. Thus, the can bears most of the weight of the tie-back pipe system and the buoyancy force adjustment device may regulate a levitation force of the hollow buoy such that the hollow buoy can better bear the weight of the tie-back pipe system in the sea, thereby reducing the load of the rig greatly.

4. Using the tie-back pipe system in accordance with the present invention makes it possible to connect the buoy with the wellhead of the oil (gas) well in the seabed. In addition, a number of casings inside the tie-back pipe system may improve the reliability and security of the tie-back pipe system transporting oil and gas and make it possible to perform drilling operation at water depth of 1500m using a semi-submersible drilling platform operating at water depth of 500m.

Brief Description of the Drawings

FIG. 1 is a structural diagram of a subsea device installed in the sea in accordance with the present invention; and

FIG. 2 is a cross-sectional view of a tie-back pipe system.

Preferred Embodiments of the Invention

As shown in FIG. 1, a subsea device in accordance with the present invention comprises a can 5, a string of risers 3, a blowout preventer 4 and a tie-back pipe system 6. The blowout preventer 4 is provided on the can 5, which may be one or a set of hollow tank bodies and may be suspended between a sea surface 2 and a seabed 8. The top of risers 3 is connected to a rig 1 (or semi-submersible drilling platform) and its bottom is mounted on the blowout preventer 4. The upper of tie-back pipe system 6 is fixed to the can 5. The lower of tie-back pipe system 6 is mounted to a wellhead of the seabed 8 by a subsea wellhead apparatus 7 and connected to formation casings 9 for collecting oil or natural gas 10 stored in formations by the subsea wellhead apparatus 7. A passage 17 which communicates the blowout preventer 4 with the tie-back pipe system 6 is jointed on the can 5. Oil or natural gas 10 is collected and then transported by the formation casings 9 to the tie-back pipe system 6, which in turn further transports the oil or natural gas 10 to the rig 1 on the sea surface 2 by the risers 3 so as to accomplish the entire exploitation of oil and gas. The blowout preventer 4 is installed such that as a drill bit encounters high pressure oil and gas in the formations, the

blowout preventer 4 in a position above the seabed 8 may be closed quickly in the drilling process so as to cut off a borehole, through which the high pressure oil and gas in the formations pass, and a passage, through which the high pressure oil and gas in the formations spray upwardly out of the wellhead to guarantee the security of equipments and workers in the drilling operation.

In order to reduce the load of the rig 1 and better bear the weight of the tie-back pipe system 6 in the sea, the present invention also designs a buoyancy force adjustment device 11, by which the can 5 may regulate the magnitude of its buoyancy force. As shown in FIG. 1, the buoyancy force adjustment device 11 comprises a set of compressors 16 mounted on the rig 1, an inject valve 14 fixed on the can 5, a cable 13 connected between the set of compressors 16 and the inject valve 14, and a cable control winch 12 mounted also on the rig 1. The set of compressors 16 transfer gas to the can 5 through the cable 13 and control incoming gas through the inject valve 14. The cable control winch 12 is used for controlling the length of the cable 13. A vent valve 15 is also provided on the can 5. When a buoyancy force is required to be increased, the set of compressors 16 and the inject valve 14 are opened to transport the gas, which may be air or nitrogen gas, etc., to the can 5. When the buoyancy force is required to be decreased, the vent valve 15 is opened to discharge proper amount of gas so as to reduce the buoyancy force.

In general, the design length of the tie-back pipe system is about more than 1000m, and it is impossible to bear its weight by the seabed. The buoyancy force of the can 5 may be used to support the weight of the tie-back pipe system 6 under it. Meanwhile, the subsea wellhead apparatus 7 fixed on the seabed 8 may in turn fix the can 5 in a proper position in the sea by the tie-back pipe system 6. The subsea wellhead apparatus 7 is fixed by a huge cementation force generated by cement consolidation of the formation casings 9 under the subsea wellhead apparatus 7 and rock under the seabed 8 so as to maintain both the fixture of the subsea wellhead apparatus 7 and the relative fixture of the can 5 in the sea. The role of the subsea wellhead apparatus 7 is to connect the casings 9 at its lower end with the tie-back pipe system 6 located in the sea at its

upper end.

The present invention utilizes the buoyancy force of the can 5 in the sea to bear the weight of the tie-back pipe system 6 in deepwater oil exploration operation so as to reduce the load of the rig 1 (or semi-submersible platform) greatly, thereby decreasing construction cost of the rig 1 (or semi-submersible platform) and decreasing eventually cost and expense of the deepwater oil exploration.

The tie-back pipe system 6 may be a single tie-back pipe or a composite structure tube as shown in FIG. 2. Specifically, the tie-back pipe system 6 includes an outmost tie-back pipe 61, in which two casings 62 are nested successively. The upper of tie-back pipe 61 is fixed to the can 5 and its lower is mounted to the wellhead of the seabed 8. One of roles of the tie-back pipe 61 is to support and centralize the casings 62, and the other role is to install first the tie-back pipe 61 and then the casings 62 at the beginning of installation of lower tubes for the sake of waterproof and separation of mud. The upper of casings 62 are fixed to the can 5 and its lower is mounted to the wellhead of the seabed 8. The innermost casing of the casings 62 is communicated to the formation casings 9 to transport high pressure oil and gas collected in the stratum, and mud is transported between the innermost casing and the second casing. If the casings 62 include more than three casings, then the casings 62 from the third casing to the outmost casing, along with the tie-back pipe 61, are used for support and centralization.

In view of the above, what is described above is only a preferable embodiment of the present invention and is not intended to limit the protection scope of the present invention. Therefore, any modification, equivalent replacement and improvement made within the spirit and principle of the present invention should be included in the protection scope of the present invention.

EDITORIAL NOTE

Application No. 2008342468

The following Claims pages 6 to 7 have been numbered pages 1 to 2.

What we claim is:

1. A subsea device comprising a can, a string of risers, a blowout preventer and a string of tie-back pipes, the blowout preventer being installed on the can, the top of risers being connected to a rig and its bottom being mounted on the blowout preventer, the upper of tie-back pipes being fixed to the can, the lower of tie-back pipes being mounted to a wellhead of a seabed by a subsea wellhead apparatus and being connected to a casing for collecting oil or nature gas stored in formations by the subsea wellhead apparatus, and a passage which communicates the blowout preventer with the tie-back pipes being jointed on the can.

2. The subsea device according to claim 1, further comprising a buoyancy force adjustment device, by which the can regulates the magnitude of the buoyancy force thereof.

3. The subsea device according to claim 2, wherein the buoyancy force adjustment device comprises a set of compressors mounted on the rig, an inject valve fixed on the can, and a cable connected between the set of compressors and the inject valve, and wherein the set of compressors transfer gas to the can through the cable and control incoming gas through the inject valve.

4. The subsea device according to claim 3, wherein a vent valve for discharging the gas in the can is provided on the can.

5. A subsea device comprising a can, a string of risers, a blowout preventer and a tie-back pipe system, the blowout preventer being installed on the can, the top of risers being connected to a rig and its bottom being mounted on the blowout preventer, the upper of tie-back pipe system being fixed to the can, the lower of tie-back pipe system being mounted to a wellhead of a seabed by a subsea wellhead apparatus and being connected to a formation casing for collecting oil or natural gas stored in formations by the subsea wellhead apparatus, a passage which communicates the blowout preventer with the tie-back pipe system being jointed on the can.

6. The subsea device according to claim 5, wherein the tie-back pipe system

comprises an outmost tie-back pipe, in which more than two casings are nested successively, and wherein the upper of tie-back pipe is fixed to the can and its lower is mounted to the wellhead of the seabed, the upper of casings are fixed to the can and its lower is mounted to the wellhead of the seabed, the innermost casing is communicated to the formation casing.

7. The subsea device according to claim 6, further comprising a buoyancy force adjustment device, by which the can regulates the magnitude of the buoyancy force thereof.

8. The subsea device according to claim 7, wherein the buoyancy force adjustment device comprises a set of compressors mounted on the rig, an inject valve fixed on the can, and a cable connected between the set of compressors and the inject valve, and wherein the set of compressors transfer gas to the can through the cable and control incoming gas through the inject valve.

9. The subsea device according to claim 8, wherein a vent valve for discharging the gas in the can is provided on the can.

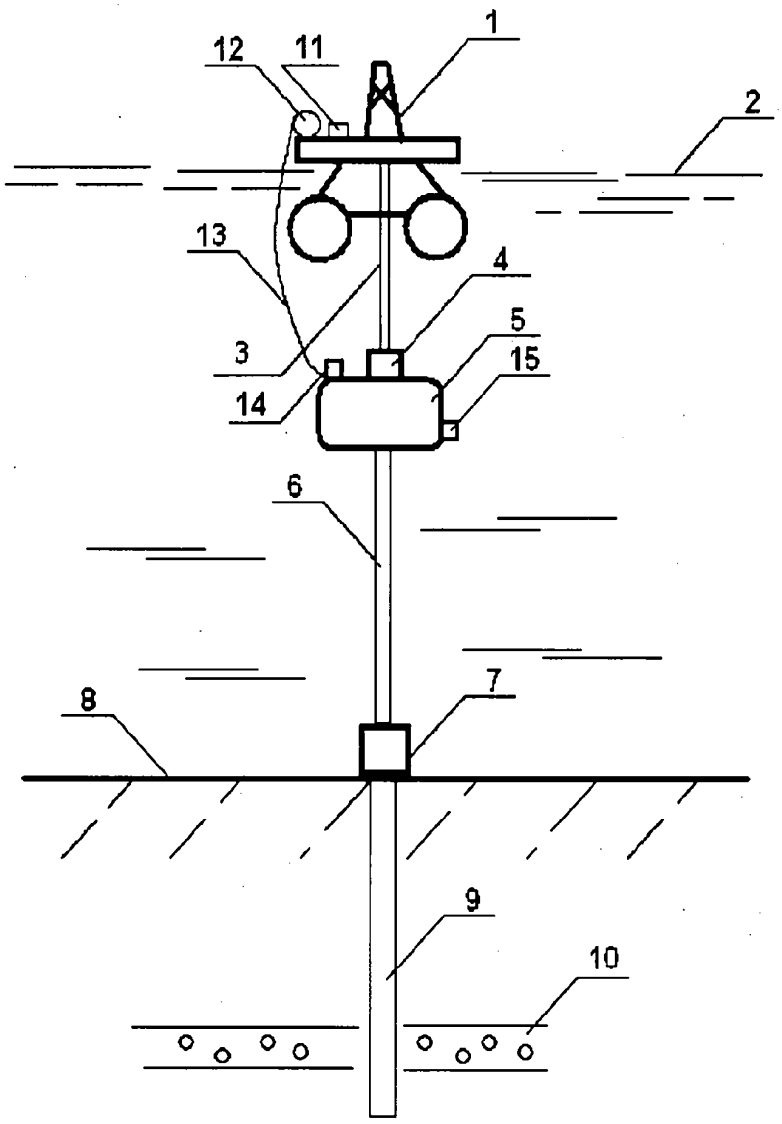

FIG. 1

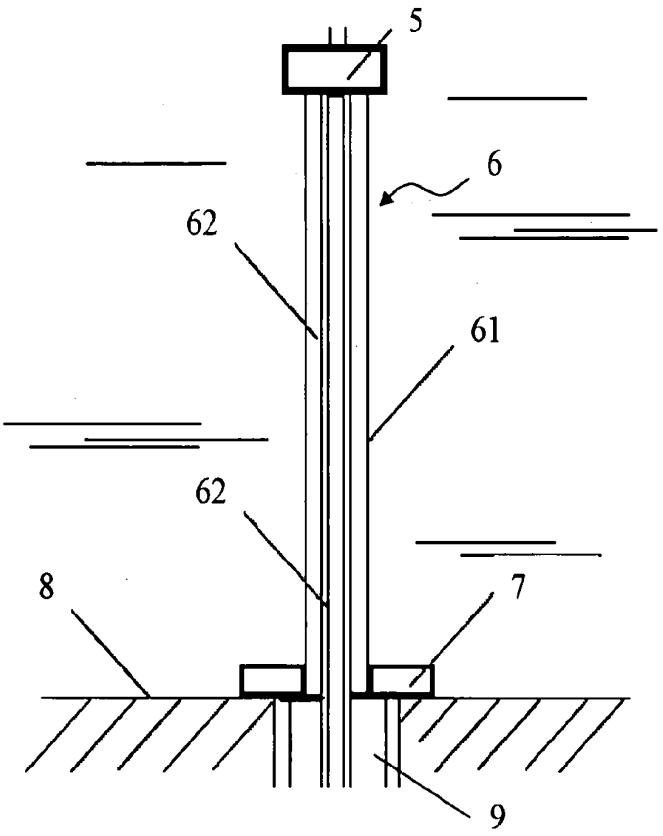

FIG. 2