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Busking

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[54] **FLOATING STRUCTURE WITH ROTATABLE TEMPLET FOR CONNECTING GUIDE LINES THERETO**

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[58] **Field of Search** .... 166/.5, .6; 175/7, 175/5; 114/.5 D

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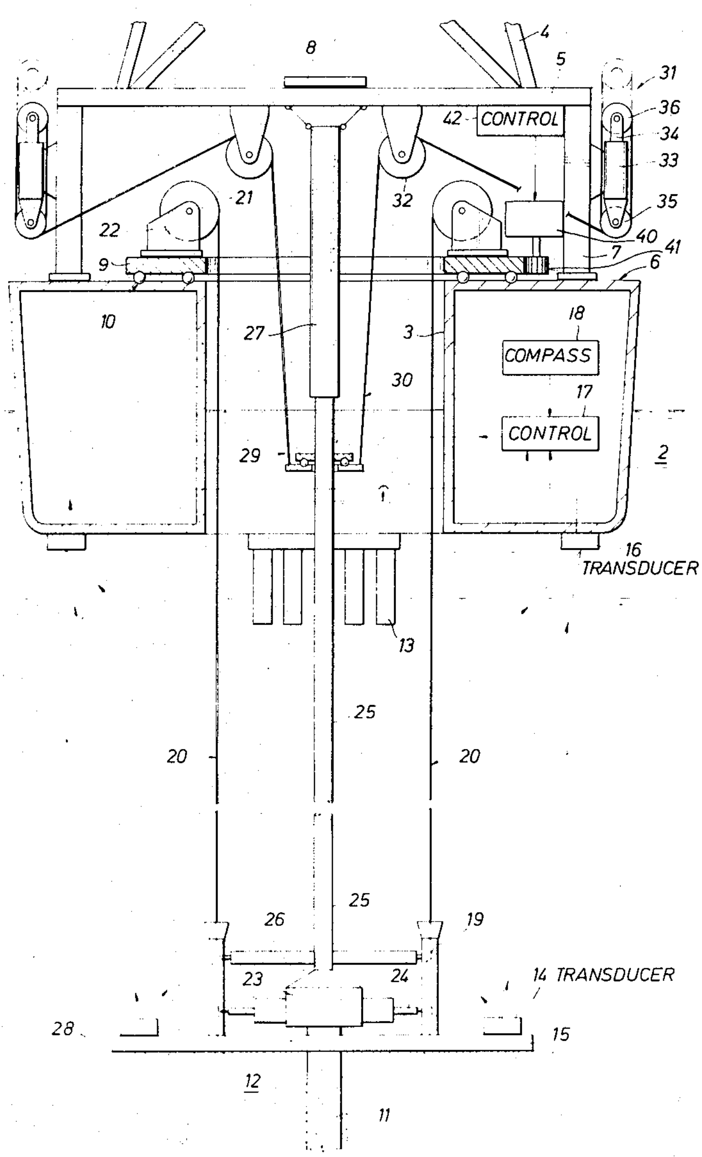
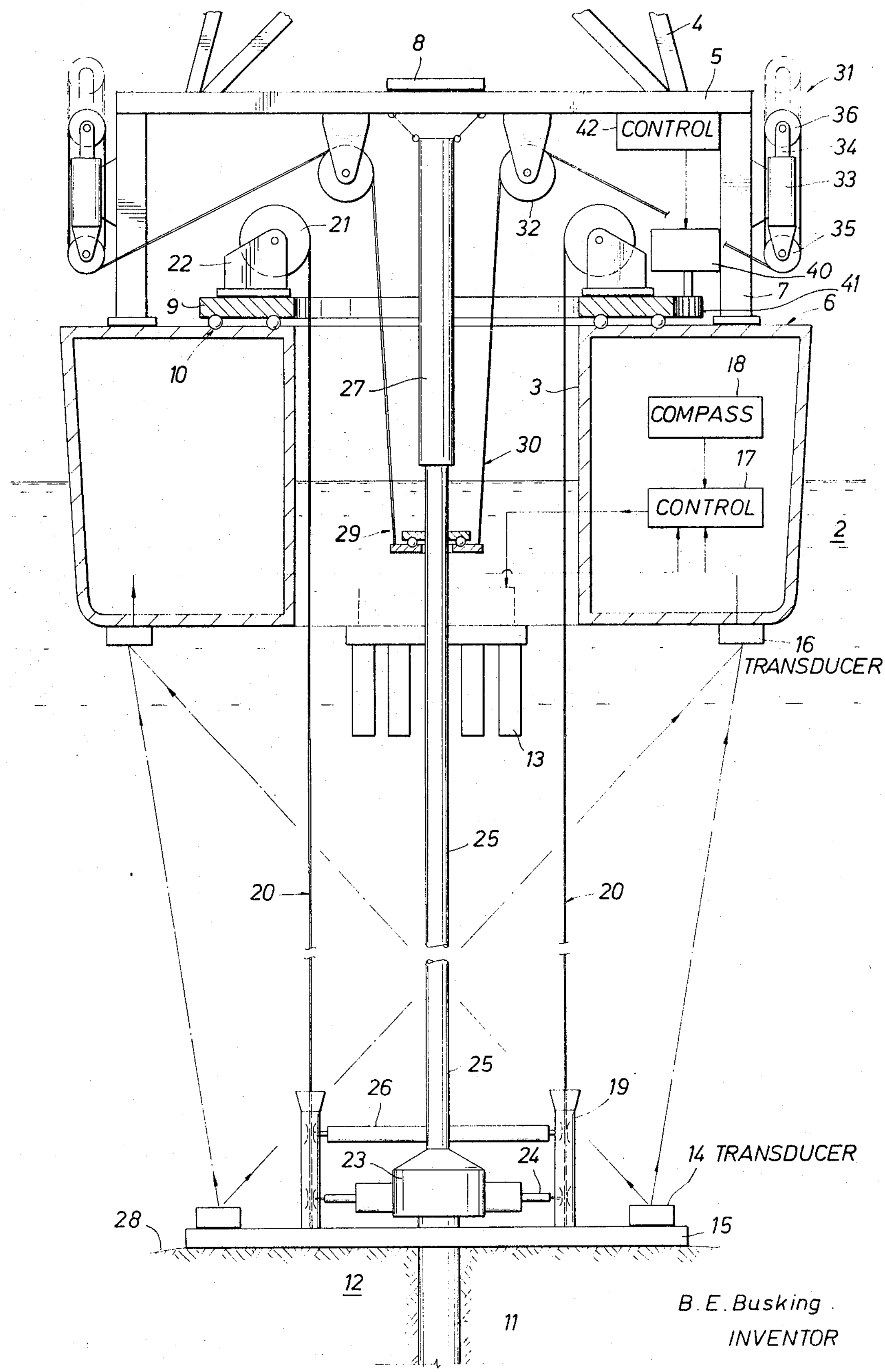
[57] **ABSTRACT**

A constant tension system for guide lines used in connecting an underwater wellhead to a dynamically stationed ship wherein twisting of the guidelines is prevented by mounting the guidelines on a rotatable templete disposed on the structure.

3 Claims, 1 Drawing Figure





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FLOATING STRUCTURE WITH ROTATABLE TEMPLET FOR CONNECTING GUIDE LINES THERETO

BACKGROUND OF THE INVENTION

The invention relates to a floating structure which is suitable for carrying out well drilling, completion, workover and/or production operations. Since the structure has to remain above the location where these operations are carried out, means are provided for maintaining the structure, such as a ship or a floating platform, at such location during the period that these operations are carried out.

In particular, the present invention relates to a floating structure provided with a dynamic stationing system, which can be applied with special advantage in deep waters where anchoring by means of anchors and anchor cables is not possible or attractive. Such a dynamic stationing system comprises measuring means for measuring the displacement of the floating platform from a desired location, and means for controlling propulsion units of the structure in such a manner that this displacement is kept as small as possible. Such a system may, if desirable, further include measuring means for measuring the deviation of the floating platform from a desired heading, and means for controlling propulsion units of the structure in such a manner as to keep this deviation as small as possible. It will be understood that in such a system the forces for stationing the floating structure are solely provided by the propulsion units of the floating structure, which units may include bow and/or stern propellers and/or propellers of the Voith Schneider type (also referred to as vertical blade vertical axis variable pitch propellers). The equipment for measuring the displacement of the floating structure from a desired location may include a measuring line kept taut between the desired location and the floating structure, a radio position fixing system, or acoustic transmitters mounted on the sea bottom at the desired location. The equipment for measuring the deviation of the structure from a desired heading may include a compass.

In a preferred method of operation, the desired heading corresponds to the direction from which the wind is blowing, and the floating structure is, notwithstanding the wave, wind and current forces acting on the structure, kept at the desired location in the desired heading by the dynamic stationing system. It will be appreciated that a change in wind direction calls for a resetting of the desired heading, since, in particular when the floating structure is a ship, such a change may result in an increase of the forces exerted by the wind on the ship. However, if the forces exerted on the structure by the water current are dominant, the desired heading will be set in relation to the prevailing water current.

A floating structure as mentioned hereinabove for carrying out well drilling, completion, workover and/or production operations is generally provided with flexible lines and conduits or hoses extending between the structure and well equipment located below the water level. It will be appreciated that such lines and/or conduits cannot be used for anchoring the structure to the sea bottom, and that the structure has to be kept at the desired location solely by the action of its propulsion units. Should these units be unable to keep the structure at the desired location, the cables and/or lines would be ruptured.

A drawback attached to the use of these lines or cables extending between the floating structure provided with a dynamic stationing system and submerged well equipment is that the lines or cables are liable to become twisted and damaged owing to contact with the marine riser pipe by the movements of the structure, or the re-setting of the desired heading.

BRIEF SUMMARY OF THE INVENTION

The object of the present invention is to prevent such twisting and damage of cables and/or lines extending between underwater well equipment and a floating structure which is provided with a dynamic stationing system.

According to the invention, a floating structure provided with a dynamic stationing system comprises a moonpool extending substantially vertically through the structure and suitable for passing equipment therethrough when carrying out well drilling, completion, workover and/or production operations, a derrick mounted on the structure at a location above the moonpool, a templet mounted around the moonpool, which templet is rotatable with respect to the floating structure and the derrick mounted thereon, and at least one constant tension device mounted on the templet, an elongated flexible means being coupled at one end thereof to the constant tension device, the other end of said means being suitable for connection to underwater well equipment.

The elongated flexible means may be a guide line or a hose cable.

Means may be provided for rotating the rotatable templet.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described by way of example with reference to the drawing, which shows schematically a cross-section of a ship at the place where the moonpool and the rotatable templet are located.

DESCRIPTION OF PREFERRED EMBODIMENT

The ship **1** floating in the sea **2** comprises a well or moonpool **3** extending vertically through the body of the ship and suitable for passing drilling equipment as well as completion equipment therethrough. Above the moonpool **3** a derrick **4** is mounted on the drilling floor **5**, which in its turn is mounted on the deck **6** of the ship **1** by means of columns **7**. With the exception of the rotary table **8**, all the other equipment as used on the drilling floor **5** and in the derrick **4** is not shown for sake of simplicity.

The templet **9** is mounted above the moonpool **3** and below the drilling floor **5**, in a rotatable manner around the central axis of the moonpool **3** by means of the bearing elements **10**.

The ship **1** is kept at the desired location above the well **11** penetrating the sea bottom **12**, by propulsion means of which only one, being a Voith Schneider propeller **13** installed forward of the moonpool is shown. Acoustic transmitters **14** (of which only two are shown) are mounted on the base member **15** of the well **11**, and the acoustic signals generated by the transmitters are received by the listening microphones **16** carried by the ship **1** (only two microphones being shown in the drawing). The signals received by the microphones are sent to a measuring and control device **17**, in which the displacement from the desired location is measured and control signals are generated for controlling the operation of the Voith Schneider propeller **13** as well as the operation of any other propulsion unit (not shown) which is used for stationing the ship **1**. The control signals generated may include information obtained on the deviation of the ship from a desired heading. To this end, a compass **18** is provided suitable for determining the magnitude of this deviation, which is then supplied to the measuring and control device **17** and combined with the information on the displacement for generating control signals to be supplied to the propulsion units acting to keep the ship on the desired location and on the desired heading.

In the dynamic stationing system as shown in the drawing, the transmitters **14** operate on different frequencies and the time intervals between the moments of arrival of the signals of a common frequency at the receivers **16** are used for calculating the displacement of the ship from the desired location.

It will be appreciated that the dynamic stationing system as schematically shown in the drawing is only indicated by way of example. There are various other types of dynamic stationing systems which are known per se and which may be used in a floating structure according to the present invention.

The base member **15** of the well **11** further carries guide posts **19** to which are connected guide lines **20** running upwards to the ship **1**. The lines are connected to the drums **21** of constant tension winches **22** which are mounted on the rotatable templet **9**. The guide lines **20** are used for guiding well equipment from the ship **1** to the well **11**, such as the wellhead **23** which is provided with guide bars **24** co-operating with the guide lines **20**, and the marine conductor **25** provided with guide bars **26** near the lower end thereof. The guide bars are in contact with the guide posts **19** over the lower part of their track along the guide lines **20**, thus exactly centering the well equipment on the entrance to the well **11**.

The upper part of the marine conductor **25** includes a telescopic section **27** of which the upper part is carried by the drilling floor **5**, the section **27** allowing the length of the conductor **25** to be adapted to the variations in distance between the drilling table **8** and the sea bottom **28** resulting from the wave action.

At a level below the telescopic section **27**, a rotatable bearing element **29** is arranged around the marine conductor **25**. One side of the bearing element is connected to the conductor **25**. The other side of the bearing element is supported by supporting cables **30**. Each cable **30** is connected at the other end thereof to a constant tension device **31** and guided thereto via a sheave **32**. The constant tension devices are each connected to a column **7**. Each device **31** comprises a high pressure pneumatic cylinder **33** mounted on the column **7**, the cylinder having a piston with piston rod **34** slidably arranged therein. Means (not shown) are provided for maintaining a constant pressure within the cylinder space below the piston. Each cable is guided over two sheave blocks, one block **35** being mounted at the closed end of the cylinder **33**, the other block **36** being mounted on the free end of the piston rod **34**. The end of each cable **30** is connected to a point fixed with respect to the cylinder **33**.

OPERATION OF PREFERRED EMBODIMENT

The ship **1** is dynamically stationed on a desired heading and on a location vertically above the well **11**, and the cables **20** are arranged to form a guide for any equipment which is to be displaced between the ship **1** and the well **11** and vice versa. The winches **22** are actuated to keep the tension in these cables **20** substantially constant notwithstanding variations in distance between the ship **1** and the sea bottom **28** due to wave action. The same applies to the constant tension devices **31** which by means of the supporting cables **30** maintain a substantially constant tension in the upper part of the marine conductor **25** independent of wave action.

When the desired heading of the ship **1** has been reset (e.g., after shifting of the wind), the dynamic stationing system will keep the heading of the ship as close as possible to this new heading, which means that the ship will be rotated with respect to the well over an angle corresponding to the deviation between the old heading and the new heading. To prevent twisting of the guide cables **20** and to prevent them from touching the marine riser pipe **25**, the templet **9** together with the constant tension devices **22** carried thereby is rotated through an angle equal to the deviation between the two headings. Thus the cables **20** remain parallel to each other and to the marine conductor **25** and will not be twisted.

Since the supporting cables **30** are suspended from the sheaves **32** which are mounted to the drilling floor **5**, these cables will be displaced through an angle equal to the deviation between the old heading and the new heading after re-setting the desired heading. As, however, the lower ends of these cables are connected to a part of the supporting element **29** which is rotatably arranged with respect to the conductor **25**, the cables **30** will remain in a common plane but move to a plane different from the plane in which they were originally positioned. The guide cables **20**, however, always remain in the same plane.

It will be understood that the templet **9** is preferably rotated by means of an electric motor **40** driving the templet through a gear arrangement **41**. The templet may also be rotated by hydraulic means which may actuate the templet by means of a pinion co-operating with gear teeth arranged around the circumference of the circular templet.

The operation of the electric motor or the hydraulic system may be controlled by a push button. However, a control system **42** may be applied for controlling the operation of the electric motor automatically such that the templet is kept in a desired position under all circumstances. This arrangement is particularly preferred when applying a dynamic positioning system which controls only the displacement of the ship from a desired location, and not the deviation of the ship from a desired heading.

It will be understood that the invention is not restricted to the particular embodiment as shown in the drawing by way of example. Thus, the constant tension devices **22** as used for maintaining a substantially constant tension on the guide cables **20** need not be winches, but may be of any other type suitable for the purpose, such as the type **31** as applied for tensioning the cables **30**. However, these constant tension devices **22** will always be mounted on the templet **9**.

Since the lateral loads exerted on the templet by the guide cables **20** are of only small magnitude, no special measures have to be taken to support the templet **9** against lateral loading. The bearing elements **10** may be of any type suitable for the purpose.

The number of guide cables **20** may be more than two (as shown in the drawing) or even one. Further, any other connection between the ship **1** and the well **11** and formed by an elongated flexible means, such as a hose cable, may be protected against twisting with respect to other cables or to the marine conductor in the manner as described with reference to the cables **20.** The hose cable as mentioned may be applied for communication purposes by passing hydraulic signals therethrough from the ship **1** to the equipment on the well **11.**

Although the derrick **4** as applied is mounted in a fixed position on the deck **6** of the ship during drilling, completion or workover operations, this derrick may be displaced with respect to the moonpool **3** between such operations.

I claim as my invention:

1. An improvement in a floating structure provided with a dynamic stationing system, including a moonpool extending substantially vertically through the structure and suitable for passing equipment therethrough when carrying out well drilling, completion, workover and/or production operations, a derrick mounted on the structure at a location above the moonpool, and underwater wellhead equipment disposed on the floor of the body of water, said improvement comprising:

a templet mounted around the moonpool, said templet being rotatable with respect to the floating structure and the derrick mounted thereon,

at least one constant tension device mounted on the templet, and

an elongated flexible hose cable being coupled at one end thereof to the constant tension device, the other end of the hose cable being suitable for connection to the underwater well equipment.

2. A floating structure according to claim **1,** and in addition a marine conductor extending from the floating structure to the wellhead, a supporting cable which is connected at one end thereof to a rotatable bearing element suitable for being connected to said marine conductor, and connected at the other end to a constant tension device which is mounted on a part of the structure which is stationary with respect to the templet.

3. A floating structure according to claim **1** and in addition drive means for rotating the rotatable templet, measuring means for measuring the deviation of the structure with respect to a predetermined heading and for controlling the drive means for so rotating the rotatable templet that the deviation of the templet with respect to the predetermined heading is as small as possible.

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