

Arrangement in a hose connection between a wellhead and a surface installation

The invention relates to an arrangement in a hose connection on a riser provided between a wellhead and a floating surface installation, in particular a connecting means arranged between fluid pipes on the riser and flexible hoses that connect the fluid hoses with the surface installation. The invention includes rotatable connecting sleeves arranged on the pipes on the riser and a connecting assembly connected to the flexible hoses and provided with an actuator arranged for rotation of the connecting sleeve during connection and disconnection.

Between a floating exploration and/or production unit (in the following, for convenience, termed "production unit"), for example a rig, and a subsea hydrocarbon well, a number of pipe connections extend, for example fluid transferring hoses, which are vital for the control of the well. The pipes extend through the so called riser which is secured to the well head and is connected to the movable production unit via a telescopic connection. At the entrance of the riser the pipes are provided with a connector which enables disconnection of the pipe connection between the production unit and the riser.

The pipe connections are of significant importance for the control of the blowout preventer (BOP), for example, the drilling mud transportation return and the hydraulic operation of the well installations. On modern, large production units, these pipe connections have large dimensions, for example are pipes having 100mm inner diameter and dimensioned for 1000 bar pressure, not unusual, and total weight of the unit which is connected to the riser can exceed 10 tons. Each hose connector needs to be locked individually and resist huge forces, over 100 tons each in hydraulic connecting force is not unusual.

In operative state the hose connectors are located in an area where they are heavily exposed to wave splash, and this entails substantial risk for malfunctions in the connectors.

Connection or disconnection involves great efforts by a substantial number of persons

who in some extent need to carry out highly hazardous operations from improvised working decks, suspending in straps over open sea having structures in motion due to waves and wind.

- 5 The object of the invention is to remedy or to reduce at least one of the drawbacks of the prior art.

The object is achieved by the features stated in the description to follow and in the appended patent claims.

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The invention relates to an arrangement in a hose connector on a riser provided between a wellhead and a floating surface installation, where one or more hoses provides a flexible, fluid communicating connection between an upper portion of the riser and the floating surface installation, distinguished in that

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a first end part of at least one fluid pipe is secured to the riser by a first upwardly directed pipe muzzle and provided with a rotatable connecting sleeve;

each of one or more flexible hoses are connected to the pipe spool of a connecting assembly provided with a second pipe muzzle which is arranged for releasable connection with the first end part of the fluid pipe;

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a lifting yoke is connected to the connecting assembly in such a way that the lifting yoke can be displaced vertically relative to the connecting assembly and forms an actuator which by the vertical motion of the lifting yoke relative to the connecting assembly is arranged to be able to introduce a rotary motion to the connecting sleeve, said actuator being in engagement with at least one connecting

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sleeve.

The actuator may include an element provided with a guide groove which is inclined relative to the central axis of the connecting sleeve.

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A first connecting sleeve can be provided with a guide pin arranged for sliding movement in the longitudinal direction of the guide groove by the vertical movement of the lifting yoke relative to the connecting assembly.

The guide pin can by the inclination of the guide groove and the longitudinal extension thereof be arranged to enable a rotational movement on the first connecting sleeve from an open and to a locked position relative to the pipe spool of the connecting assembly.

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The rotational movement of the connecting sleeve may constitute a sector of $360^\circ/n \pm 2^\circ$, where n is an even number and can be 16.

The first connecting sleeve can be connected to adjacent second and third connecting sleeves by means of transmission means arranged for simultaneous and synchronised rotational motion of several connecting sleeves.

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The transmission means can be formed of one or more parts projecting radially outward from each of the connecting sleeves and interconnected by means of articulated joints and possibly an intermediate linkage.

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The connecting sleeves may be provided with means for sliding, axial guiding of the end part of the pipe spools and with means for axial fixation of the pipe spools within the connecting sleeve.

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The connecting sleeve can internally be provided with several axially directed guiding grooves, where intermediate, radially inward directed guiding ridges in a portion located remote from the muzzle of the fluid pipe, exhibit a lesser height than an adjacent portion located close to the muzzle of the fluid pipe, an arresting surface being formed in each guiding ridge. The end part of the pipe spool can have an external form complementary to the internal shape of the connecting sleeve, where more abutment surfaces formed in the guiding ridges are arranged to abut against each respective arresting surface when the pipe spool is introduced into the connecting sleeve and the connecting sleeve by rotation is moved toward its one extreme positions.

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The riser may be provided with several guide pins arranged to be in engagement with guiding surfaces in the connecting assembly.

The lifting yoke can be connected to the connecting assembly by means of at least one sliding guide including an end stop.

- 5 In the following an example of a preferred embodiment is described, which is illustrated in the appended drawings, where:

Fig. 1 shows schematically an elevational view of an arrangement for a floating surface installation where an arrangement according to the invention is associated with the riser;

- 10 Fig. 2 shows in larger scale a perspective view of the arrangement according to the invention, in which a connecting assembly is about to be connected to fluid pipes secured to the riser;

Fig. 3 shows in larger scale a pipe spool on the connecting assembly arranged for connection with a fluid pipe on the riser;

- 15 Fig. 4 shows three interconnected connecting sleeves arranged for receipt of the pipe spool shown in figure 3 and where one connecting sleeve is provided with a guide pin;

Fig. 5 shows an initial stage of the interconnection, where the connecting assembly, which for the sake of clarity is not shown, and the lifting yoke by means of guide pins is guided towards fluid pipes arranged on the riser, and an actuator is abutting against the guide pin on the one connecting sleeve; and

- 20 Fig. 6 shows the actuator displaced downwards in which it has caused that the connecting sleeves have been rotated until locked position (the connecting assembly is for the sake of clarity not shown).

- 25 A portion of a floating installation is denoted by the reference number 1. The floating installation 1 includes a drill floor 11 and a cellar deck 12 where a riser 2, extending in a per se known manner from a sea bed installation (not shown), for example a wellhead, is interconnected with the floating installation 1 by means of a telescopic unit 22 and heave compensators (not shown) according to known technology. Along the riser 2, a number of fluid pipes 21 are arranged for transportation of fluids back and forth from

the well head, and are interconnected via flexible hoses 3 to the floating installation 1.

Several hoses 3, here shown three, are connected to a common connecting assembly 4 which is provided with a number of pipe spools 41 which in a first end are provided with hose connectors 411 for depending connection of the hose 3, and in a second end is provided with pipe muzzle 42 which in the operative position of the connecting assembly 4 faces downwards and toward a pipe muzzle 212 on the fluid pipes 21 where each of the pipe spools 41 exhibit an inverted U-shape.

At least the upper end parts 211 of the fluid pipes 21 are located in groups on the riser 2, each group of fluid pipes 21 being arranged for connection to each respective connecting assembly 4. In figure 1, the exemplified embodiment is shown with two connecting assemblies 4. However, for a riser 2 having huge diameter and many fluid pipes 21, it may be convenient to use more connecting assemblies 4.

The upper end parts 211 of the fluid pipes 21 are secured to a frame 23 which projects outwardly from the periphery of the riser 2. The upper end parts 211 of each of the fluid pipes 21 are provided with a connecting sleeve 213a, 213b, 213c which is rotatable supported in its respective fluid pipe 21. The pipe spool 41 is provided with a gasket 424 which is arranged for abutment against an internal surface at the end part 211 of the fluid pipe 21 to create a fluid tight connection when the fluid pipe 21 and the respective pipe spool 41 is connected.

The connecting sleeve 213a, 213b, 213c is internally provided with several axially directed guide grooves 213g, where intermediate radially inwards projecting guide ridges 213h in a portion located remote from the pipe muzzle 212 of the fluid pipe 21, exhibit a smaller height than in an adjacent part located close to the pipe muzzle 212 of the fluid pipe 21, and an arresting surface 213i is provided in each guide ridge 213h.

An area of the end part of the pipe spool 41 has an external shape complementary to the internal shape of the connecting sleeve 213a, 213b, 213c, and several guide grooves 421 having intermediate, outwardly extending guide ridges 422 form abutment surfaces 423

which by introduction of a pipe spool 41 into the connecting sleeve 213a, 213b, 213c and subsequent rotation of the connecting sleeve 213a, 213b, 213c, are arranged to rest abutting against the arresting surface 213i and thus cause that the pipe spool 41 is kept connected in a fluid tight way with its respective fluid pipe 21. The arresting surface
5 213i forms a slight slanting inclined plane to effect that rotation of the connecting sleeve 213a, 213b, 213c from a position A (open) to position B (locked) moves the pipe spool 41 in axial direction to sealing abutment of the gasket 424 against the fluid pipe 21.

10 The connecting sleeves 213a, respectively 213b, 213c are provided with two, respectively one, projecting arm(s) 213e. The arms 213e of the intermediate connecting sleeve 213a form together with a bolt 213f an articulated joint linked to the arm 213e on the second, respectively third connecting sleeve 213b, 213c, said arm 213e on the second and third connecting sleeve 213b, 213c being provided with an elongated groove
15 (not shown) for receipt of the bolt 213f.

The one connecting sleeve 213a is provided with a guide pin 213d which project radially outwards.

20 The connecting assembly 4 and a lifting yoke 43 are connected to each other by means of several vertical, in an operative position, guides 432 having end stops 433 which provide a confined relative movement between the connecting assembly 4 and the lifting yoke 43 when the connecting assembly 4 is landed onto the riser 2 or being lifted up there from. The lifting yoke 43 thus forms a linear actuator 431 which is provided
25 with a tongue 431a extending downwardly toward the guide pin 213d of the connecting sleeve 213a and is laterally stabilized by the side edges of a recess 214 (see fig. 2) in close proximity to the first connecting sleeve 213a. A guide groove 431b is formed in the tongue 431a in such a way that the guide pin 213d can be guided along the groove 431b. By its inclined position in respect of the moving direction of the tongue 431a, the
30 groove 431b causes the vertical motion of the lifting yoke 43 relative to the connecting assembly 4 to impart a rotating motion of the connecting sleeves 213a, 213b, 213c between an open position A and a locked position B.

The riser 2 is in immediate proximity to the first end part 211 of the fluid pipes 21 provided with several guide pins 5 arranged in parallel with the end parts 211 of the fluid pipes 21 and having a free end projecting upwardly. The guide pins 5 are provided
5 with a conical end part 51.

The connecting assembly 4 is provided with a number of guiding sleeves 44 each being arranged for receipt of a guide pin 5, where the internal surface of the sleeve wall forms a guiding surface 441 (see fig. 1). Some of the guiding sleeves 44 are provided with a
10 guiding cone 442 in its lower end.

The lifting yoke 43 is connected to a manipulator 6 via a connecting device 61 provided with means 611 for remote controlled disconnection of the connecting assembly 4, and means 612 for rotation of the connecting assembly 4. The manipulator 6 is rotatable
15 fixed to the floating installation 1 in immediate proximity to the riser 2 and is provided with a drive unit (not shown) and a control unit (not shown) for manipulation of the connecting assembly 4 with connected hoses 3 during connection and disconnection of the hoses 3 and the fluid pipes 21.

20 When the hoses 3 are to be connected to or from the fluid pipes 21 on the riser 2, the manipulator(s) 6 is operated to manipulate the connecting assembly 4 with the connected hoses 3 depending from the connecting assembly 4. During connection the connecting assembly 4 is lowered towards the end part 211 of the fluid pipes 21, the connecting assembly 4 is guided in that the guiding sleeves 44 enter the guide pins 5
25 and slide thereon. The connecting sleeves 213a, 213b, 213c remain rotated to open position A, and the pipe spools 41 can slide into their corresponding fluid pipes 21, the abutment surfaces 423 on the guide ridges 422 adopt a position at the arresting surfaces 213i of the connecting sleeves 213a, 213b, 213c. When the connecting assembly 4 rests on the riser 2, the lifting yoke 43 is moved by its own gravity and the one of the hose 3
30 down towards the connecting assembly 4 by sliding motion along the guides 432, and the tongue 431a engages its guide groove 431b about the guide pin 213d of the

intermediate connecting sleeve 213a and, together with the articulated joint 213e, 213f, causes that all the connecting sleeves 213a, 213b, 213c are rotated to locked position B.

During disconnection, the manipulator(s) 6 causes that the lifting yoke 43 initially is
5 vertically elevated from the connecting assembly 4 by guiding motion along the guides 432 until abutment against the end stops 433, where the tongue 431a during this motion rotates all the connecting sleeves 213a, 213b, 213c to open position A. When the lifting yoke hits the end stops 433, the connecting sleeves 213a, 213b, 213c are in open
position A, and the pipe spools 41 can freely slide out of their corresponding fluid pipes
10 21 by continued elevation of the connecting assembly 4.

P a t e n t c l a i m s

1.

Arrangement in a hose connection on a riser (2) which is arranged between a wellhead
5 and a floating surface installation (1), in which one or more hoses (3) form a flexible
fluid communicating connection between an upper portion of the riser (2) and the
floating surface installation (1),

characterized in that the first end portion (211) of at least one fluid pipe (21) is fixed
to the riser (2) by an upwardly directed, first pipe muzzle (212) and is provided with a
10 rotatable connecting sleeve (213a, 213b, 213c);

each of one or more flexible hoses (3) are connected to a pipe spool (41) of a connecting
assembly (4) provided with a second pipe muzzle (42) which is arranged for releasable
engagement with the first end portion (211) of the fluid pipe (21);

a lifting yoke (43) is connected to the connecting assembly (4) in such a way that the
15 lifting yoke (43) can be displaced vertically relative to the connecting assembly (4) and
forms an actuator (431) which by the vertical movements of the lifting yoke (43)
relative to the connecting assembly (4) is arranged to be able to effect a rotary motion to
the connecting sleeve (213a, 213b, 213c), said actuator (431) being in engagement with
at least one connecting sleeve (213a).

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2.

Arrangement according to claim 1,

characterized in that the actuator (431) includes an element (431a) provided with a
guide groove (431b) provided inclined relative to the central axis of the connecting
25 sleeve (213a, 213b, 213c).

3.

Arrangement according to claim 1 or 2,

characterized in that a first connecting sleeve (213a) is provided with a guide pin
30 (213d) arranged for sliding motion in the longitudinal direction of the guide groove
(431b) by the vertical movement of the lifting yoke (43) relative to the connecting
assembly (4).

4.

Arrangement according to claim 1,

- characterized in that** the guide pin (213d) by the inclination and longitudinal extension
5 of the guide groove (431b) is arranged to be able to provide a rotating motion on the
first connecting sleeve (213a) from an open position (A) and to a locked position (B)
relative to the pipe spool (41) of the connecting assembly (4).

5.

- 10 Arrangement according to claim 4,

characterized in that the rotary motion of the connecting sleeve (213a) makes a sector
of $360^\circ/n \pm 2^\circ$, where n is an even number.

6.

- 15 Arrangement according to claim 5,

characterized in that n is 16.

7.

Arrangement according to claim 3,

- 20 **characterized in that** the first connecting sleeve (213a) is connected to adjacent second
and third connecting sleeves (213b, 213c) by means of transmission means (213e, 213f)
arranged to simultaneous and synchronized rotary motion of several connecting sleeves
(213a, 213b, 213c).

- 25 8.

Arrangement according to claim 5,

- characterized in that** the transmission means is formed by one or more parts (213e)
projecting radially out from each of the connecting sleeves (213a, 213b, 213c) and
interconnected by means of articulated joints (213f) and possibly an intermediate link.

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9.

Arrangement according to claim 1,

characterized in that the connecting sleeves (213a, 213b, 213c) are provided with means (213g, 213h) for sliding axial guiding of the end part of the pipe spool (41) and with means (423) for axial fixation of the pipe spool (41) within the connecting sleeve.

5 10.

Arrangement according to claim 1,

characterized in that the connecting sleeve (213a, 213b, 213c) is internally provided with a number of axially directed guide grooves (213g), where intermediate, radially inwardly facing guide ridges (213h) in one portion located remote from the pipe muzzle
10 (212) of the fluid pipe (21), exhibit a smaller height than in an adjacent portion which is located proximate to the pipe muzzle (212) of the fluid pipe (21), each guiding ridge (213g) being formed with an arresting surface (213i); and that the end part of the pipe spool (41) has an external shape complementary to the internal shape of the connecting sleeve (213a, 213b, 213c), where several abutment surfaces (423) formed in the guide
15 ridges (422) are arranged to abut against each respective arresting surface (213i) when the pipe spool (41) is introduced into the connecting sleeve (213a, 213b, 213c) and the connecting sleeve (213a, 213b, 213c) by rotation is moved toward one of its extreme positions (B).

20 11.

Arrangement according to claim 1,

characterized in that the riser (2) is provided with several guide pins (5) arranged to be in engagement with guiding surfaces (441) in the connecting assembly (4).

25 12.

Arrangement according to claim 9,

characterized in that the lifting yoke (43) is connected to the connecting assembly (4) by means of at least one sliding guide (432) including an end stop (433).