Method for improving the feasibility of a drilling rig of jack-up type and a drilling rig of jack-up type

The invention relates to a method for improving the feasibility of a drilling rig of jack-up type. The drilling rig has a frame part comprising a working deck and an essentially plane shaped bottom, inside of which there has been arranged at least a part of the power production and operating equipment of the drilling rig. In connection of the frame part there has been arranged at least three feet operated by lifting devices, by means of which the drilling rig may be supported on the sea bottom during an attachment phase through lowering the same from a standby position required by a transportation position of the drilling rig essentially in a vertical direction in respect to the frame part to a working position enabling at least a drilling situation and detached from the sea bottom during a detachment phase through lifting the feet in respect to the frame part upwards, and a drilling unit for drilling. The drilling unit is arranged moveable essentially in a horizontal plane in respect to the frame part by means of a first transferring arrangement, such as by actuators driven by electricity, pressurized medium and/or correspondingly and a slide rail assembly or a like, to perform the drilling during the drilling situation essentially from outside the frame part. An air-bed or a like known as such is being blown below the frame part of the drilling rig by means of a blow arrangement at least to eliminate strokes directed from the sea level to the bottom of the frame part.

In the above use it is nowadays known to use so called semi-submersible drilling rigs and the type of jack-up drilling rigs as described above. The kind of drilling rigs above differ from each other in such respect,

that semi-submersible drilling rigs comprise an underwater part, which supports the actual working deck existing on the sea level.

Such a drilling rig is not supported stationary on the ground at all during a drilling situation, that is why the type of drilling rig requires expensive and complicated joint and movement arrangements between the drilling device drilling the ground and the drilling rig, which enable drilling despite the roll of the sea. Both the costs of manufacturing and operating of such type of drilling rigs are multiple, when compared to the same of those drilling rigs of jack-up type described above. One crucial advantage of the type of drilling rigs above compared to nowadays drilling rigs of jack-up type is, however, that because of the massive construction of the same they may be transported in most heterogeneous circumstances, even during a relatively high roll of the sea. In addition to that, they may be used with clearly deeper depths of water, than jack-up rigs, which may be used when the depth of water is usually below 150 m.

Nowadays many problems are involved with a typical drilling rig of jack-up type, though it has certain significant advantages particularly when compared to those drilling rigs of semi-submersible type described above. First of all it is significantly cheaper to manufacture and to use, which is based on that, that the drilling rig of jack-up type is attached stationary on the sea bottom during the drilling situation. This is why complicated joint and movement arrangements are not needed, because the drilling unit drilling the ground does not move significantly in respect to the frame of the drilling rig during the drilling situation. However certain problems are

involved with the type of nowadays drilling rigs, that is why they are not safe enough in practice and useable not even during usual circumstances that are characteristic to certain operational areas.

First of all the type of drilling rig may not be transported safely, when the height of the waves is more than 2 m. This is due to the flat shape of the bottom of the frame part, whereby the waves, particularly during a so called transito-phase that is, when the frame part is rising above the sea level when the drilling rig is supported on the sea bottom or respectively when it is lowered on the sea level, when the drilling rig is detached from the sea bottom, hitting the same may cause damages to the frame part and to the devices and equipment placed inside the same. The flatness of the bottom is based on its part on that, that the type of drilling rigs are transported to their operating sites either by towing by towing ships or more commonly by transporting the same on the deck of a transporting ship. On the other hand the type of drilling rigs are equipped usually with only three feet to minimize the manufacturing costs, which on its part is the reason why an efficient working deck fitting the same is relatively small. This naturally makes functioning on the drilling rig difficult. In addition to that, the type of drilling rigs are not get considered safe enough in practice because of that reason, also, that because of the small size of the drilling rig the residence unit is situated always relatively close by the drilling unit performing the drilling.

This is why despite the advantages of drilling rigs of jack-up type, the advantages of such type of drilling rigs may not be exploited with nowadays constructions efficiently enough, not even during usual operating

circumstances, that are typical to certain areas, at which the use of the jack-up drilling rig would be otherwise idealistic or clearly more advantageous than the use of a drilling rig of semi-submersible drilling rig described above.

On the other hand for example from patent US 3 461 828 it is previously known particularly in connection with the semi-submersible drilling rig to blow air below the frame part of the drilling rig to eliminate strokes directed from the sea level towards the bottom of the frame part. The solutions represented in the patent in question are stationary, fixed constructions, which thus may not in any ways be adapted particularly in connection with jack-up type drilling rigs, because the bottom of such type of a drilling rig has to be a uniformly flat surface particularly to enable the transportation of the same that is the transferring of the same to the operating site. Though the air-bed being used for example in connection with the US-patent above is meant in principle to eliminate the strokes of the sea level to bottom of the frame part, this matter has a totally different meaning in practice in connection of a drilling rig of jack-up type, because in this connection the type of air-bed arrangement is needed particularly during a so called transito-phase only, that is at that stage, when the frame part rises above the sea level, when the drilling rig is supported on the sea bottom or correspondingly when it lowers on the sea level, when the drilling rig is detached from the sea bottom. Exactly this situation is dangerous particularly for a drilling rig of jack-up type, which in practice limits the use of nowadays drilling rigs of jack-up type very efficiently.

It is the aim of the method for improving the feasibi-

lity of a drilling rig of jack-up type according to this invention to achieve a decisive improvement in the problems presented above and thus to raise substantially the level of knowledge in the field. To achieve this aim, the method according to the invention is primarily characterized in, that, to improve the feasibility of the drilling rig, particularly with a view to the safety of the attachment phase and/or the detachment phase, below the bottom of the frame part there has been arranged an air space, that is dischargeable for the transportation position of the drilling rig and into which air is blown to achieve an air-bed or a like particularly for the time of the attachment phase and/or the detachment phase.

The method according to this invention approves significantly the feasibility of a jack-up type drilling rig, whereby an extremely efficient drilling techniques in principle is made possible, that is the use of a drilling rig is enabled, that is to be supported stationary on the sea bottom in a way, that is significantly more efficient and versatile compared to nowadays drilling rigs of corresponding type and which secures adequate safety of the crew. Through blowing air into the air space below the drilling rig the use of drilling rigs of this type is enabled in difficult circumstances, that are typical to certain areas, in which the roll of the sea is almost always too big for nowadays drilling rigs of corresponding type. As an advantageous embodiment of the drilling rig the three or four feet belonging to the same are placed at the corners of the drilling rig, in which case the deck space of the drilling rig is achieved as big as possible both during the said attachment and detachment phases as well as during an actual drilling situation. The air space that is arranged according to the method below the bottom of the frame part during

the attachment and the detachment phases is dischargeable for the transportation position, which enables the transportation of the drilling rig by traditional ways. Due to the method above it is further possible to make the use of the drilling rig more efficient in a way, that at the same time the residence unit belonging to the same is arranged moveable preferably at least partly outside the drilling rig. In addition to psychological factors this matter has also concrete influences on improving the efficiency of the use of the drilling rig, because when the residence unit moves efficiently also more deck space is freed simultaneously as a working area.

Advantageous embodiments of the method according to the invention are presented in the dependent claims directed to the method.

The invention relates to a drilling rig of jack-up type applying the method, also. The drilling rig is represented in greater detail in the preamble of the independent claim related to the same. The primary characteristics of the drilling rig are represented in the characterizing part of the corresponding claim.

With the aid of the invention it is possible with a simple and reliable way to carry out a drilling rig construction of jack-up type, which operates with idealistic drilling techniques so, that it may be supported stationary on the sea bottom. The drilling rig according to the invention is significantly more useful than those corresponding nowadays drilling rigs particularly with a view to the safety of the attachment phase and the detachment phase. The air space arranged below the frame part, that is dischargeable for the transportation position, may be carried out

with an extremely simple and reliable bottom structure of the frame part, whereby the lifting devices moving the feet are placed advantageously for example below the frame part. The drilling rig according to the invention is also much more well balanced than those nowadays drilling rigs particularly during a drilling situation by arranging in addition to the drilling unit, also the residence unit belonging to the same moveable outside the drilling rig. This for its part leads to that, that the drilling rig is significantly more well balanced as a whole than nowadays drilling rigs both during transportation and drilling situations, because during the drilling situation, when the drilling unit is outside the drilling rig, also the residence unit is outside at the opposite side. The moveability of the residence unit away from the drilling unit increases the safety of the crew, also, as well as it brings concrete additional space at the working deck of the frame part.

Advantageous embodiments according to the invention are represented in the dependent claims related to the drilling rig of jack-up type.

In the following description, the invention is illustrated in detail with reference to the appended drawings. In the drawings,

Fig. 1a shows an advantageous drilling rig applying the method according to the invention during a transportation situation seen from above,

Fig. 1b shows the corresponding embodiment during a drilling situation,

Fig. 2 shows the corresponding drilling rig during a drilling situation as a sideview,

Fig. 3 shows an advantageous wall structure arrangement that forms a dischargeable air space,

Fig. 4a shows an advantageous principle of the method according to the invention during a transportation situation seen from above,

Fig. 4b shows the corresponding embodiment as a similar view during a drilling situation and

Fig. 5 shows the drilling rig as shown in figures 4a and 4b during a drilling situation as a side view.

The invention relates to a method for improving the feasibility of a drilling rig of jack-up type. The drilling rig 1 has a frame part 2 comprising a working deck 1a and an essentially plane shaped bottom 1b, inside of which there has been arranged at least a part of the power production and operating equipment of the drilling rig 1. In connection of the frame part 2 there has been arranged at least three feet 3 operated by lifting devices 5, by means of which the drilling rig 1 may be supported on the sea bottom during an attachment phase through lowering the same from a standby position required by a transportation position of the drilling rig 1 essentially in a vertical direction in respect to the frame part 2 to a working position enabling at least a drilling situation and detached from the sea bottom during a detachment phase through lifting the feet 3 in respect to the frame part 2 upwards, and a drilling unit 4 for drilling. The drilling unit 4 is arranged moveable essentially in a horizontal plane in respect to the frame part 2 by means of a first transferring arrangement 6, such as by actuators driven by electricity, pressurized medium and/or correspondingly and a slide

rail assembly or a like, to perform the drilling during the drilling situation essentially from outside the frame part 2. An air-bed or a like known as such is being blown below the frame part of the drilling rig by means of a blow arrangement 10b at least to eliminate strokes directed from the sea level to the bottom of the frame part. To improve the feasibility of the drilling rig 1, particularly with a view to the safety of the attachment phase and/or the detachment phase, below the bottom 1b of the frame part there has been arranged an air space 10a, that is dischargeable for the transportation position of the drilling rig and into which air is blown to achieve an air-bed or a like particularly for the time of the attachment phase and/or the detachment phase.

A drilling rig applying the method according to the invention has been presented in fig. 1a during transportation position, whereby both the drilling unit 4 and a residence unit 7 are totally above the frame part 2. In figures 1b and 2 there has been shown correspondingly a drilling situation, whereby as an advantageous embodiment of the method the residence unit 7 and the drilling unit 4 are moved advantageously partly outside the frame part 2 particularly to increase the useable, free space on the working deck 1a of the frame part 2.

Further as an advantageous embodiment of the method, the drilling rig 1 comprises feet 3, that are placed at the corners of the frame part 2, whereby the said air space 10a is being opened/discharged through moving the wall structures 10c, that are advantageously moveable against support structures 3a placed in connection with the said feet 3, to an essentially vertical/ to an essentially horizontal position. By this way an ideal construction of the drilling rig is

enabled, whereby it may be transported from one operating site to another with traditional transporting arrangements thanks to the bottom of the same being still essentially flat.

Further as an advantageous embodiment, the bottom 1b of the frame part is being reinforced through an auxiliary support assembly 11, such as a deep water pipe 11a, auxiliary drilling unit and/or a like, by means of which essentially the central part of the bottom 1b of the frame part is supported stationary on the sea bottom at least during a drilling situation. Due to this it is possible to increase the stiffness of the significantly wide bottom surface, enabled by the construction in question, particularly in extremely difficult circumstances.

Particularly to improve the safety and feasibility of the drilling rig 1, the method may thus be carried out so, that the residence unit 7 is arranged moveable as described above, whereby it is being transferred at least for the time of the drilling situation essentially away from the drilling unit 4, advantageously at least partly outside the frame part 2 of the drilling rig 1 to increase the free working deck space of the frame part 2 useable during the drilling situation.

An advantageous drilling rig 1 of jack-up type applying the method according to the invention is represented in figs. 1a - 5 in principle, whereby to improve the feasibility of the drilling rig 1, particularly with a view to the safety of the attachment phase and/or the detachment phase, below the bottom 1b of the frame part there has been arranged an air space 10a, that is dischargeable for the transportation position of the drilling rig, to achieve an air-bed or

a like particularly for the time of the attachment phase and/or the detachment phase, which principle may be found for example from figs 2 and 3.

As an advantageous embodiment, the drilling rig 1 comprises feet 3, that are placed essentially at the corners of the frame part 2, whereby the said air space 10a is arranged to be opened/discharged through moving the wall structures 10c, that are moveable essentially against support structures 3a placed in connection with the said feet 3, to an essentially vertical/ to an essentially horizontal position as shown in fig. 3.

Further as an advantageous embodiment particularly with reference to fig. 2, the bottom 1b of the frame part is arranged reinforced through an auxiliary support assembly 11, such as a deep water pipe 11a, auxiliary drilling unit and/or a like, by means of which essentially the central part of the bottom 1b of the frame part is arranged to be supported stationary on the sea bottom at least during a drilling situation. By this way the significantly wide bottom surface of the bottom of the frame part is furthermore reinforced particularly in extremely difficult circumstances.

As shown for example in figs. 2 and 3, the lifting devices 5 for moving the feet 3 are arranged in lifting device rooms 5a placed underneath the frame part 2 and acting, as shown in fig. 3, as support structures 3a forming the said air space 10a in co-operation with the said wall structures 10c. By placing the lifting device rooms 5a underneath the frame part 2, the efficient working deck space of the frame part has been increased simultaneously.

As shown particularly in fig. 3, the wall structures 10c comprise plate structures, sheet structures or like, that are connected from the top moveably, such as by a joint, a hinge and/or a like in connection to the frame part 2 and the side edges x of which are arranged to touch continuously the counterpart surfaces of the support structures 3a, while the wall structures 10c are moving, and the wall structures 10c being arranged operated by means of an actuator arrangement 10d, that is arranged yieldable by influence of stroke energy of the waves.

Further an advantageous drilling rig 1 of jack-up type applying the method according to the invention is represented in figs. 4a, 4b and 5 in principle, in which the residence unit 7 is arranged moveable by means of a second transferring arrangement 9 to transfer the residence unit 7 essentially away from the drilling unit 4 partly outside the drilling rig, by moving the same advantageously in a direction s opposite to the moving direction of the drilling unit 4. This has been carried out in the presented embodiment by arranging four feet 3 to the frame part of the drilling rig, placed at the corners of the same, whereby the movement of the residence unit 7 is enabled further between the pair of feet 3' placed opposite to the pair of feet 3" in connection of the drilling unit 4 in a totally opposite direction essentially outside the frame part 2. With reference to fig. 5 in connection to the moveable residence unit 7 there has been arranged an emergency exit 8c, that is at least partly shut, through which the exit of the crew from the drilling rig 1 is enabled in a way essentially protected from the surroundings. By arranging for example a helicopter deck 8b advantageously in connection of the top of the residence unit 7, it is possible to place the life boats below the

same in a way, that further a covered protecting space 8d is achieved to protect the passing of the crew to the life boats 8a.

Further with respect to fig. 5, in connection of the residence unit 7 there has been arranged inbuilt a protected emergency exit space 8c and a covered protect space 8d, to enable exit of the crew to the sea below the said space 8c/8d through getting down by means of one or several ladders, slides and/or correspondingly. As an advantageous embodiment the said emergency exit space 8c and/or the protect space 8d is placed essentially at the lower edge of a part of the moveable residence unit 7, that moves outside the frame part 2.

It is obvious, that the invention is not limited to the embodiments presented or described above, but it can be modified within the basic idea even to a great extent. Thus a method according to the invention may be exploited technically with very many kinds of constructions and bottom shapes of the drilling rig. In addition to that, it is naturally possible to equip the drilling rig more abundantly than shown above by adapting for example a usual propeller arrangement in connection with the drilling rig, that enables independent moving of the drilling rig, and for example anchoring arrangements and so on.

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Claims:

1. Method for improving the feasibility of a drilling rig of jack-up type, which drilling rig (1) has a frame part (2) comprising a working deck (1a) and an essentially plane shaped bottom (1b), inside of which there has been arranged at least a part of the power production and operating equipment of the drilling rig (1) and in connection of which there has been arranged at least three feet (3) operated by lifting devices (5), by means of which the drilling rig (1) may be supported on the sea bottom during an attachment phase through lowering the same from a standby position required by a transportation position of the drilling rig (1) essentially in a vertical direction in respect to the frame part (2) to a working position enabling at least a drilling situation and detached from the sea bottom during a detachment phase through lifting the feet (3) in respect to the frame part (2) upwards, and a drilling unit (4) for drilling, that is arranged moveable essentially in a horizontal plane in respect to the frame part (2) by means of a first transferring arrangement (6), such as by actuators driven by electricity, pressurized medium and/or correspondingly and a slide rail assembly or a like, to perform the drilling during the drilling situation essentially from outside the frame part (2), and whereby an air-bed or a like known as such is being blown below the frame part of the drilling rig by means of a blow arrangement (10b) at least to eliminate strokes directed from the sea level to the bottom of the frame part, characterized in, that to improve the feasibility of the drilling rig (1), particularly with a view to the safety of the attachment phase and/or the detachment phase, below the bottom (1b) of the frame part there has been arranged

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an air space (10a), that is dischargeable for the transportation position of the drilling rig and into which air is blown to achieve an air-bed or a like particularly for the time of the attachment phase and/or the detachment phase.

2. Method according to claim 1 above in connection with a drilling rig of jack-up type having at least three feet (3), characterized in, that the drilling rig (1) comprises feet (3), that are placed preferably essentially at the corners of the frame part (2), whereby the said air space (10a) is being opened/discharged through moving the wall structures (10c), that are preferably moveable against support structures (3a) placed in connection with the said feet (3), to an essentially vertical/ to an essentially horizontal position.

3. Method according to claim 1 or 2 above, characterized in, that the bottom (1b) of the frame part is being reinforced through an auxiliary support assembly (11), such as a deep water pipe (11a), auxiliary drilling unit and/or a like, by means of which essentially the central part of the bottom (1b) of the frame part is supported stationary on the sea bottom at least during a drilling situation.

4. Method according to any of the above claims 1 - 3 in connection with a drilling rig comprising further at least a residence unit (7) for the crew of the drilling rig, in addition to which in connection with the drilling rig there has been arranged preferably at least life boats (8a) or the like for an emergency exit of the crew and/or a helicopter deck (8b) or a like for air transportation needs, characterized in, that, at least to improve the safety and feasibility of the drilling rig (1), the said residen-

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ce unit (7) is arranged moveable, whereby it is being transferred at least for the time of the drilling situation essentially away from the drilling unit (4), preferably at least partly outside the frame part (2) of the drilling rig (1).

5. A drilling rig of jack-up type, which drilling rig (1) has a frame part (2) comprising a working deck (1a) and an essentially plane shaped bottom (1b), inside of which there has been arranged at least a part of the power production and operating equipment of the drilling rig (1) and in connection of which there has been arranged at least three feet (3) operated by lifting devices (5), by means of which the drilling rig (1) may be supported on the sea bottom during an attachment phase through lowering the same from a standby position required by a transportation position of the drilling rig (1) essentially in a vertical direction in respect to the frame part (2) to a working position enabling at least a drilling situation and detached from the sea bottom during a detachment phase through lifting the feet (3) in respect to the frame part (2) upwards, and a drilling unit (4) for drilling, that is arranged moveable essentially in a horizontal plane in respect to the frame part (2) by means of a first transferring arrangement (6), such as by actuators driven by electricity, pressurized medium and/or correspondingly and a slide rail assembly or a like, to perform the drilling during the drilling situation essentially from outside the frame part (2), and whereby an airbed or a like known as such is arranged to be blown below the frame part of the drilling rig by means of a blow arrangement (10b) at least to eliminate strokes directed from the sea level to the bottom of the frame part, characterized in, that to improve the feasibility of the drilling rig (1), particularly with a view

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to the safety of the attachment phase and/or the detachment phase, below the bottom (1b) of the frame part there has been arranged an air space (10a), that is dischargeable for the transportation position of the drilling rig, to achieve an air-bed or a like particularly for the time of the attachment phase and/or the detachment phase.

6. A drilling rig of jack-up type according to claim 5, having at least three feet (3), **characterized** in, that the drilling rig (1) comprises feet (3), that are placed preferably essentially at the corners of the frame part (2), whereby the said air space (10a) is arranged to be opened/discharged through moving the wall structures (10c), that are preferably moveable against support structures (3a) placed in connection with the said feet (3), to an essentially vertical/ to an essentially horizontal position.

7. A drilling rig of jack-up type according to claim 6, **characterized** in, that the lifting devices (5) for moving the feet (3) are arranged in lifting device rooms (5a) placed underneath the frame part (2) and acting preferably as support structures (3a) forming the said air space (10a) in co-operation with the said wall structures (10c).

8. A drilling rig of jack-up type according to claim 7, **characterized** in, that the wall structures (10c) comprise plate structures, sheet structures or like, that are connected from the top moveably, such as by a joint, a hinge and/or a like in connection to the frame part (2), the side edges (x) of which are arranged to touch continuously the counterpart surfaces of the support structures (3a), while the wall structures (10c) are moving, and the wall structures (10c) being arranged operated by means of an actuator

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arrangement (10d), that is arranged yieldable by influence of strike energy of the waves.

9. A drilling rig of jack-up type according to any of claims 5 - 8 above, characterized in, that the the bottom (1b) of the frame part is arranged reinforced through an auxiliary support assembly (11), such as a deep water pipe (11a), auxiliary drilling unit and/or a like, by means of which essentially the central part of the bottom (1b) of the frame part is arranged to be supported stationary on the sea bottom at least during a drilling situation.

10. A drilling rig of jack-up type according to any of claims 5 - 9 above, comprising further at least a residence unit (7) for the crew of the drilling rig, in addition to which in connection with the drilling rig there has been arranged preferably at least life boats (8a) or the like for an emergency exit of the crew and/or a helicopter deck (8b) or a like for air transportation needs, characterized in, that, at least to improve the safety and feasibility of the drilling rig (1), the said residence unit (7) is arranged moveable, whereby the said drilling rig comprises a second transferring arrangement (9) to transfer the residence unit (7) at least for the time of the drilling situation essentially away from the drilling unit (4), preferably at least partly outside the frame part (2) of the drilling rig (1).

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