

DERRICK ASSEMBLY AND METHOD FOR USE OF SAME

The invention relates to a derrick assembly, the derrick assembly comprising a derrick and a gripping deck including a holding device for holding a casing. Further, the invention relates to a method of loosening a casing and pulling it out of a well with the use of said derrick assembly.

When closing down a well in the underground, for example a petroleum well, it is necessary to sever and pull out the casing. As a rule casings are fixed to the well by cementation and great force is required to tear them loose.

After the casing has been cut at a desired depth, a drill string is run down with a tool suitable to be attached inside the casing. Then the drill string is raised, and thereby the casing, by means of a hoisting device. It is known to use the hoisting device of the derrick, comprising drawworks and a block system to pull the casing. The challenge of this may be to provide sufficient power to loosen the casing with the use of a modular rig on old platforms. In some cases it will be necessary to replace the hoisting device on board the platform, rather than spending a good deal of money on upgrading an old rig. The more power to be transferred via the lifting system from the top of the derrick or via the top drive, the heavier and stronger the rest of the derrick has to be as well. The challenge will thus be to have enough power available while, at the same time, the derrick is not too heavy for the rest of the platform structure.

The invention has for its object to remedy or reduce at least one of the drawbacks of the prior art or at least provide a useful alternative to the prior art.

The object is achieved through the features which are specified in the description below and in the claims that follow.

The invention is defined by the independent claims. The dependent claims define advantageous embodiments of the invention.

In a first aspect, the invention relates more specifically to a derrick assembly, the derrick assembly including a derrick and a gripping deck which includes a holding device for holding a casing, characterized by the derrick assembly including a lifting device arranged to lift the gripping deck together with the casing.

- 5 The gripping deck may be part of the drilling floor, and the holding device may include a known rotary table, but the invention is not limited thereto.

The term derrick indicates a derrick or mast.

Here, the lifting device indicates a device suitable for raising or lowering the gripping deck. The lifting device will be specified further in what follows.

- 10 The effect of the lifting device being arranged to lift the gripping deck is that the casing that is held in the gripping deck via the holding device will be lifted at the same time. The lifting device lifting the gripping deck may be arranged to have a high lifting capacity, for example in the order of 600-800 tonnes, which makes it suitable for loosening casings fixed by cementation. Such a lifting device will bring a reduction in
15 the need for lifting power from the lifting system at the top of the derrick or from the top drive and, consequently, both weight and costs connected with the derrick structure may be reduced considerably as well.

The derrick assembly, as it is described above, can also be used to pull loose or lift any elements other than casing, wherever practical.

- 20 The derrick may be placed on the gripping deck and, thus, the derrick, too, will be lifted together with the gripping deck and the casing. The advantage of this is the simplicity of the system by the fact that, as it is being raised, the gripping deck will not come up inside the derrick and thus take up space. The different elements of the derrick assembly thus will not come into conflict with each other, and they take up
25 less space.

- The derrick assembly may include a hoisting device positioned in an upper portion of the derrick. The hoisting device and the lifting device may work in alternation, that is to say work together, or work independently of each other. The hoisting device will typically have a lower lifting capacity than the lifting device, and where the lifting device is engaged when great power is needed, the hoisting device may be used for
30 lighter tasks, such as lifting or pulling casings or other elements, which have already been loosened, out of the well. Further, the hoisting device is usually used to raise and

lower the drill string and for other tasks that are known from the state of the art and therefore not described in any further detail in what follows.

This combination of lifting systems is particularly practical because it allows the hoisting device to be relatively light, as it is supported by the lifting device which has a very high lifting capacity. The lifting device may thus be used for the heavy work of tearing loose a casing and raising it, before the hoisting device takes over and does the relatively lighter work of moving the casing when it is loose. By the concept of "moving" is primarily meant, in this connection, to pull the casing further upwards and out of the well, which must not be mixed up with lifting the casing aside after it has been pulled out of the well, as is known from the state of the art.

The lifting device and the hoisting device may be arranged to work in alternation then, as both the lifting device and the hoisting device are arranged to pull casing out of a well.

Pulling casing with the lifting device is a slow process in relation to the pulling with the hoisting device. The combination of the two lifting systems makes it possible, on the one hand, to have a system which is powerful enough and, on the other hand, to have a system which is also efficient and light.

The lifting device may be connected to the gripping deck.

When casings are loosened in accordance with the prior art, a hoisting mechanism placed in the derrick is used, which carries with it the fact that the derrick structure itself will have to be heavy to be able to withstand the forces that are active. The fact that the lifting device according to the invention is connected to the gripping deck makes it possible for the structure of the lifting device to be smaller and lighter, but still have at least as high a lifting capacity as prior-art hoisting mechanisms.

The lifting device may be positioned under the gripping deck.

The lifting device may include at least one jack.

Here, the term "jack" indicates a raising and lowering device which is placed in a lower part of the derrick assembly, and which is arranged to be able to lift the gripping deck. The term "jack" is to be interpreted in a wide sense, and may include various hoisting devices and lifting mechanisms which will be further elaborated on in what follows.

The fact that the lifting device comprises at least one jack constitutes one possible embodiment of the lifting device.

The at least one jack may comprise four jacks. What is the most appropriate number of jacks will depend on the design and extent of the gripping deck that the jacks are going to lift. In one embodiment it will be possible to imagine the gripping deck as a mostly square deck, wherein the jacks are placed in the respective corners of the gripping deck, for example.

The at least one jack may be fluid-operated or electrically operated, or it may include rack gearing. There are several ways of operating the jack and, basically, it is possible to use all known operating means that are suitable for the purpose. It must be understood that hydraulic and pneumatic operating means are covered by the concept of "fluid-operated".

The at least one jack may be a screw jack.

The lifting device may comprise a wire system, which may be operated by electrical winches, for example. The wire system constitutes a possible embodiment of the lifting device.

The hoisting device may comprise a pulley system.

By a pulley system is meant, here, a conventional lifting system lifting from the top of the derrick, the pulley system comprising components like snatch blocks, winches and associated drawworks.

The holding device may include a rotary table. The advantage of the holding device including a rotary table is that, basically, the rotary table is already holding the drill string with the casing. The rotary table together with the part of the drill string that connects the casing to the gripping deck will thus constitute the holding device of the derrick assembly for holding the casing. Not having to provide a further holding device is an advantage.

In a second aspect, the invention relates more specifically to a method of loosening and pulling a casing with a derrick assembly according to the first aspect of the invention, the method including the steps:

- severing the casing at a specified depth; and
 - attaching the casing to the holding device of the gripping deck;
- the method further being characterized by including the step:
- lifting the gripping deck with the lifting device to loosen the casing.

The method may further include placing the derrick on the gripping deck in order thus to be able to lift the derrick together with the casing.

The method may further include the steps:

- attaching the casing to the hoisting device;
- 5 - releasing the casing from the holding device of the gripping deck; and
- pulling the casing up by means of the hoisting device.

In this way, the powerful lifting device will do the first job of loosening the casing from the well wall, and, after that, the hoisting device, which is less powerful, but faster, will take over and pull the pipe further out when it has been loosened.

- 10 It is conceivable that the casing gets stuck again on its way out of the well. In such cases, the method may further include repeating the following steps:
- attaching the casing to the holding device of the gripping deck;
 - lifting the gripping deck with the lifting device to loosen the casing;
 - attaching the casing to the hoisting device;
 - 15 - releasing the casing from the holding device of the gripping deck; and
 - pulling the casing up by means of the hoisting device.

The above-mentioned method thus specifies alternating use of the lifting device and the hoisting device which is very useful where there is a varying need for great power and great speed, respectively.

- 20 In addition, this alternating action may be used in other operations in which, for example, a tool has got stuck in a well. It must then be understood that it may be other elements, for example the drill string, that are alternatingly attached to the gripping deck and to the hoisting device, for loosening and subsequent pulling.

- 25 In a third aspect, the invention comprises an oil rig which includes a derrick assembly, the oil rig including an underbody and a deck, and the derrick assembly being placed on the deck.

In what follows, an example of a preferred embodiment is described, which is visualized in the accompanying drawings, in which:

Figure 1 shows a principle drawing of a derrick assembly;

- 30 Figure 2 shows a principle drawing of a derrick assembly as a drill string is being run into a well;

Figure 3 shows a principle drawing of a derrick assembly after the casing has been severed and is ready to be pulled out; and

Figures 4-8 shows principle drawings of a derrick assembly in various stages of pulling the casing.

5 Like or corresponding elements are indicated by the same reference numerals in the figures.

Specifications of position and orientation, such as upper, lower, over, under, vertical and horizontal refer to the position shown in the figures.

Figure 1 shows a derrick assembly 1, the derrick assembly 1 comprising a derrick 11,
10 a lifting device 12, a gripping deck 13 and a hoisting device 14. The derrick assembly 1 is placed in a centred manner over a blowout preventer (BOP) 3 and connected to this via a telescopic pipe 4. The blowout preventer 3 is further connected to a high-pressure riser 5 extending down to a wellhead 6. The wellhead 6 forms an attachment for a casing 2 and a so-called conductor casing 7, which is an outer casing extending a
15 distance down the well. The casing 2 extends from the wellhead 6, inside the conductor casing 7, through a wellhead deck 61 and further down into a well (not shown). The lifting device 12 is shown, in this exemplary embodiment, as jacks or screws placed under the gripping deck 13. The hoisting device 14 is shown as a pulley system 14 including a crown block 141, a wire 142, a travelling block 143, an elevator 144
20 and drawworks (not shown).

The gripping deck 13 includes a holding device 131, which, in this exemplary embodiment, includes a rotary table 1311 and slips 1312.

Figure 2 shows the derrick assembly 1 as a drill string 1313 is being run into the well, for the casing 2 to be cut. Drill pipes are screwed together and stored in a fingerboard
25 in a known manner, and the hoisting device 14 is used together with pipe-handling systems known *per se* to move and screw the drill string 1313 together in a conventional manner. This will therefore not be described in any further detail in what follows.

The drill string 1313 is held by the elevator 144 as it is being run in. A cutting tool 8
30 for cutting the casing 2 is attached to the drill string 1313. After the casing 2 has been cut, the drill string 1313 may be pulled back out and an attachment mechanism or pulling tool 1314 (see figure 3) may be connected to it and then run into the well and attached to the casing 2.

In figure 3 is shown the situation after a cut *k*, extending over the entire circumference of the casing 2, has been made in the casing 2. The drill string 1313 has been run down with the attachment mechanism 1314 which is arranged to fixingly engage with the severed casing 2. When the attachment mechanism 1314 is connected to the casing 2, everything is ready for loosening the casing 2 and pulling it out. The slips 1312 are attached after any slack in the hoisting device 14 has been pulled up and a force may be applied to the casing 2 through the drill string 1313 by means of the hoisting device 14. In figure 4, it is further shown that the lifting device 12, shown here as jacks 12, is activated, lifting the entire gripping deck 13. The jacks 12 have great power and can loosen elements that are stuck in the well, including casings 2 fixed by cementation, then. The jacks 12 may raise the gripping deck by two to three metres, for example, and the loosened casing 2 will follow upwards.

In figure 5, the jacks 12 are shown at their maximum elevation. The force of the slips 1312 and rotary table 1311 is removed and the casing 2 hangs from the hoisting device 14. The lifting device 12 may thus be lowered again, figure 6, so that it is ready for a new lift if power exceeding the capacity of the hoisting device 14 is required.

In figure 7, it is shown that the hoisting device 14 has hoisted the severed casing 2 up through the rotary table 1311. After that, the casing 2 is pulled in a manner known *per se*, by the casing 2 first being held fixed with the slips 1312 in the rotary table 1311 while the drill string 1313 is pulled out by means of the hoisting device 14. Further, in figure 8, the hoisting device 14 is lowered and the elevator 144 is attached to the casing 2 which is to be pulled. Then the slips 1312 may be disengaged so that the hoisting device 14 may hoist the casing 2 out of the well. When the casing 2 has been hoisted as far as it may, it is secured in the slips 1312 again before it is severed above the slips 1312. The elevator 144 is attached again and the hoisting device 14 activated anew. If, while the pulling is going on, additional power is needed, for example by the casing 2 being stuck, the lifting device 12 is activated anew.

In another embodiment of the invention, the lifting device 12 may be used alone, without working together with a hoisting device, then, to loosen and hoist out casing 2. Further, in yet another embodiment, it is conceivable for the lifting device 12 to be arranged in such a way that it forms the lower part of the derrick 11, for example by the lifting device 12 comprising jacks as defined earlier herein, the jacks forming the legs of the derrick 11.

It should be noted that all the above-mentioned embodiments illustrate the invention, but do not limit it, and persons skilled in the art may form many alternative embodi-

ments without departing from the scope of the dependent claims. In the claims, reference numerals in brackets should not be regarded as restrictive. The use of the verb "to comprise" and its different forms does not exclude the presence of elements or steps which are not mentioned in the claims. The indefinite article "a" or "an" before
5 an element does not exclude the presence of a plurality of such elements. The invention may be implemented with the help of hardware comprising several separate elements and with the help of an appropriately programmed computer. In device claims mentioning a plurality of means, several of these means may be included in one and the same element of the hardware. The fact that some features are specified in mutu-
10 ally different dependent claims does not indicate that a combination of these features cannot be used with advantage. In the figures, similar or corresponding features are indicated by the same reference numeral or marking.

C l a i m s

1. A derrick assembly (1), the derrick assembly (1) including
 - a derrick (11); and
 - a gripping deck (13) including a holding device (131) for holding a casing (2) ;

5 c h a r a c t e r i z e d i n that the derrick assembly (1) further includes a lifting device (12) arranged to lift the gripping deck (13) together with the casing (2).
2. A derrick assembly (1) according to claim 1, wherein the derrick (11) is
10 placed on the gripping deck (13) and is lifted together with it.
3. The derrick assembly (1) according to claim 1 or 2, wherein the derrick assembly (1) further includes a hoisting device (14) placed in an upper portion of the derrick (11).
4. The derrick assembly (1) according to claim 3, wherein the lifting device (12) and the hoisting device (14) are arranged to work in alternation and
15 wherein both the lifting device (12) and the hoisting device (14) are arranged to pull the casing (2) out of a well.
5. The derrick assembly (1) according to any one of claims 1-4, wherein the lifting device (12) is connected to the gripping deck (13).
6. The derrick assembly (1) according to any one of claims 1-5, wherein the
20 lifting device (12) comprises at least one jack.
7. The derrick assembly (1) according to claim 6, wherein the at least one jack comprises four jacks.
8. The derrick assembly (1) according to any one of claims 6-7, wherein the at
25 least one jack is fluid-operated.
9. The derrick assembly (1) according to any one of claims 6-7, wherein the at least one jack is electrically operated.
10. The derrick assembly (1) according to any one of claims 6-7, wherein the at least one jack comprises rack gearing.

11. The derrick assembly (1) according to any one of claims 6-9, wherein the at least one jack comprises a screw jack.
12. The derrick assembly (1) according to any one of claims 1-5, wherein the lifting device (12) comprises a wire system.
- 5 13. The derrick assembly (1) according to any one of claims 3-12, wherein the hoisting device (14) comprises a pulley system.
14. The derrick assembly (1) according to any one of claims 1-13, wherein the holding device (131) comprises a rotary table (1311).
- 10 15. A method of loosening and pulling a casing (2) with a derrick assembly (1) according to claim 1, the method including the following steps:
- severing the casing (2) at a defined depth; and
 - attaching the casing (2) to the holding device (131) of the gripping deck (13);
- 15 c h a r a c t e r i z e d i n that the method further includes the following step:
- lifting the gripping deck (13) with the lifting device (12) to loosen the casing (2).
16. The method according to claim 15, wherein the method further includes the following step:
- 20 - placing the derrick (11) on the gripping deck (13).
17. The method according to claim 15 or 16, wherein the method further includes the following steps:
- attaching the casing (2) to the hoisting device (14);
 - releasing the casing (2) from the holding device (131) of the gripping deck (13); and
- 25 - pulling the casing (2) up by means of the hoisting device (14).
18. The method according to claim 17, wherein the method further includes repeating the following steps:
- attaching the casing (2) to the holding device (131) of the gripping deck (13);
- 30 - lifting the gripping deck (13) with the lifting device (12) to loosen the casing (2);
- attaching the casing (2) to the hoisting device (14);

- releasing the casing (2) from the holding device (131) of the gripping deck (13); and
- pulling the casing (2) up by means of the hoisting device (14), to alternat-
ingly loosen and pull the casing (2) by means of the lifting device (12) and
the hoisting device (14), respectively.

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19. An oil rig including a derrick assembly (1) according to claim 1, the oil rig in-
cluding an underbody and a deck, and wherein the derrick assembly (1) is
placed on the deck.