The invention relates to a drilling rig (10) for deep well drilling for the onshore sector, comprising at least one drilling device (30), wherein the drilling rig (10) is designed to be movable with respect to the land surface. The object of the invention is to provide a drilling rig (10) with which a multiplicity of wells can be drilled at short distances apart with short set-up times. This object is achieved in that the auxiliary units (50 to 59) required for the drilling are arranged substantially inside the drilling rig (10), and in that the position of the drilling device (30) inside the drilling rig (10) is movable with respect to the drilling rig (10).
DRILLING RIG FOR DEEP WELL DRILLING

[0001] The invention relates to a drilling rig for deep well drilling for the onshore sector, comprising at least one drilling device, wherein the drilling rig is designed to be movable with respect to the land surface.

[0002] Deep wells have been produced for decades down to depths of over 5000 m for the exploration of petroleum and natural gas deposits.

[0003] The sinking of a deep well requires a drilling space of not inconsiderable size at the surface around the drilling site. The energy supply, the auxiliary units necessary for providing, conditioning, treating and pumping the drilling mud, washrooms, accommodation spaces and administration and a store for the drill rods and other operational equipment are necessary at this location, in addition to the drilling rig itself. For safety reasons and for emission protection reasons, the drilling rig also has to be at a considerable distance from any surrounding housing development.

[0004] Furthermore, the continuous drilling operation has considerable effects on the environment due to noise, dirt and construction site operation in general (emission protection), in particular on flora and fauna.

[0005] The deposits to be developed are also often in regions of an especially sensitive nature or of a nature to be protected, especially fauna sensitive to emissions, etc. On account of the above mentioned effects, the sinking of a deep well in such regions is often difficult. The term “deposits” refers in particular to deposits of hydrocarbons, gases, storage deposits for gases, liquids or other liquid products to be placed in pores and/or fissures, gases or waste of any kind.

[0006] It is also the case especially in sensitive regions that such a drilling space required for drilling entails a not inconsiderable use of land.

[0007] Furthermore, deposits are also often found in regions having an extreme climate. This refers, inter alia, to extreme cold and heat. This has to be taken into account when designing the drilling rig.

[0008] Furthermore, there are deposits which can be exploited efficiently only under certain conditions. Thus, for example, it may be necessary to sink many wells in the deposits at short distances apart, either in order to ensure the highest possible extraction or else in order to physically influence the deposits via the many wells. In particular, this may concern oil sands or oil shales.

[0009] For such wells following one another closely in a large number there must be as short a set-up time as possible between the individual wells in order to ensure an efficient operation. Mobile drilling devices are known, but these mobile drilling devices cannot venture into the deep well drilling sector since the hook load lifting capacities are not sufficient in this case.

[0010] The object of the invention is to provide a drilling rig with which a multiplicity of wells can be drilled, also as deep wells, at short distances apart with short set-up times. Additionally, and in an advantageous manner, the object of the invention is to be able to use such a rig in remote regions. Furthermore, it is advantageous if the rig can also be used under climatically extreme conditions. Since special ecological conditions also usually prevail in such regions, it is also advantageous if there is minimum ecological damage to the environment, in particular as far as the use of land is concerned.

[0011] This object is achieved in that the auxiliary units required for the drilling are arranged substantially inside the drilling rig, and that the position of the drilling device inside the drilling rig is movable with respect to the drilling rig.

[0012] Due to the use of the auxiliary units such as pumps, drilling mud production, treatment and conditioning, generators, cement production, storage, the area for operational control and accommodation for the crews (control stations, accommodation spaces), safety engineering (preventer, degasser, ventilation) and the auxiliary drilling devices such as drill rod stores, etc., inside the drilling rig, the use of land can be kept to a minimum since a large drilling space is not required. In such a design, the drilling rig is a type of three-dimensional drilling space which takes all the requisite elements along with it. At the same time, the rig is self-sufficient and can be used in remote regions. The individual drilling points can be approached due to the mobility of the rig, and, owing to the fact that the essential elements are already present on the drilling rig, most of the set-up time between the drilling points is dispensed with. Owing to the fact that the drilling device, that is to say the drilling tower together with the associated elements, can additionally be moved inside the drilling rig, a certain number of wells can be sunk at a close distance apart without shifting the drilling rig, a factor which again reduces the set-up times.

[0013] An advantageous teaching of the invention provides for at least two drilling devices to be provided. Due to the provision of two drilling devices, which are both separately movable with respect to the drilling rig, the speed of the drilling is greatly increased in close drilling patterns.

[0014] Furthermore, it is advantageous that at least two levels are provided in the drilling rig, on which levels the auxiliary units, the drilling device, safety equipment, auxiliary drilling devices and/or the control system of the drilling rig are provided. As a result, the idea of the three-dimensional drilling space is extended and the space above a travel mechanism which permits the mobility of the drilling rig is better utilized and the size of the base plate is reduced.

[0015] Furthermore, it is advantageous that all the auxiliary units required for the drilling are arranged inside the drilling rig. In this way, the greatest possible degree of self-sufficiency is achieved.

[0016] A further advantageous teaching of the invention provides for the drilling rig to be surrounded by a casing which completely screens the drilling rig from environmental influences. In this case, the casing is advantageously thermally and, if need be, acoustically insulated. In this way, the crews and the engineering equipment are protected in a simple manner against extreme conditions. At the same time, temperature stabilizing and also ventilation are possible. The environmental influences are slight.

[0017] Furthermore, it is advantageous that the casing is provided with closable openings. These openings permit complete enclosure of the drilling rig, but also allow sufficient and simple supply of the drilling rig, with provision of further material, etc.

[0018] A further advantageous teaching of the invention provides for the auxiliary units to be interchangeably arranged in a modular manner. As a result, all the technical regions of the drilling rig can be rapidly exchanged for maintenance and repair. In this simple manner, the downtime of the rig is further reduced and the repair area can be provided off-site. The transport to remote regions is also simplified. In
this case, it is advantageous if the modularity is achieved by an arrangement of the respective auxiliary units in containers, preferably standard containers, because in this way the transport capacity by truck or possibly also by helicopter is improved and the capacity to supply the drilling rig in remote regions is improved as a result.

[0019] A further advantageous teaching of the invention is that the auxiliary unit modules can be inserted and/or exchanged through the openings in the casing. In this case it is especially advantageous if the openings and the associated door openings are adapted directly to the slot of the module in the drilling rig. As a result, the modules can be changed quickly and the climatic impairment of the drilling rig can be minimized during the change. The speed with which the modules can be changed is additionally increased if quick-action connectors are provided.

[0020] Furthermore, it is advantageous that the drilling rig is provided with a travel mechanism, which preferably has cross-country mobility, and in particular preferably consists of individual crawler travel mechanisms. Said crawler travel mechanisms have good cross-country mobility in particular in the case of poor subsoil. Furthermore, the bearing capacity made possible by the particular soil can be achieved by said crawler travel mechanisms via the dimensioning in terms of length and width.

[0021] An advantageous teaching of the invention provides for a crane module to be arranged above the drilling device.

[0022] A further advantageous teaching of the invention provides for the drilling device and/or auxiliary drilling devices to be arranged on at least one movable base, in particular preferably a carriage, which is movable relative to the drilling rig. This constitutes a simple possibility of achieving the mobility of the drilling device. Furthermore, it is advantageous that a preventer of the drilling device and/or the hydraulic supply of the borehole (choke, manifold) are/is arranged on at least one movable base, in particular preferably a carriage, which is movable relative to the drilling rig. It is especially advantageous if the base elements can be moved synchronously.

[0023] A further advantageous teaching of the invention provides for a crane module to be provided on the top of the drilling rig. As a result, it also becomes possible, in remote regions or under aggravated climatic conditions (snow storms high in winter), to supply the drilling rig and to ensure a change of crew in rotation.

[0024] Instead of drill rods, the use of coil tubing is also conceivable. For this purpose, the wound-up drill string can be suspended in the shaft structure, if need be with an optimum offset from the initial drilling site, such that there are as few deflections as possible during the unwinding. The lifting mechanism used for the drilling rig can be a hydraulic system with lifting cylinders. Alternatively, or also additionally, for special cases, a rope lifting mechanism can also be used. Furthermore, a casing drilling method can also be used directly.

[0025] The invention is explained in more detail below with reference to an exemplary embodiment and with the aid of a drawing, in which:

[0026] FIG. 4 shows a three-dimensional view of the apparatus according to the invention.

[0027] FIG. 2a shows a side view of FIGS. 1.

[0028] FIG. 2b shows a further side view of FIG. 1

[0029] FIG. 3 shows a three-dimensional overall view of the apparatus according to the invention below the cover.

[0030] FIG. 4 shows a three-dimensional view of the drilling level of the apparatus according to the invention below the cover.

[0031] FIG. 5 shows a further three-dimensional view of the drilling level of the apparatus according to the invention below the cover.

[0032] FIG. 6 shows a three-dimensional view of the auxiliary unit level of the apparatus according to the invention.

[0033] FIG. 7 shows a three-dimensional detailed view of the auxiliary unit level of the apparatus according to the invention in accordance with FIG. 6, and

[0034] FIG. 8 shows a three-dimensional view of a container, for example having a mud pump, used in the apparatus according to the invention.

[0035] FIG. 1, FIG. 2a and FIG. 2b show a drilling rig 10 according to the invention in an external view. The drilling rig 10 has a casing 11, which consists of two larger side parts 12 and two smaller side parts 13, and a roof 14. Provided in the side parts 12, 13 are ventilation openings 15 which are partly connected to air duct systems 58 (see FIG. 6). Provided in the side wall 12 are container doors 16, through which the container units 27 can be moved into the drilling rig 10 and out of the drilling rig 10 again. The side walls 13 have supply doors 17, via which the supply of the drilling rig 10 is ensured.

[0036] Arranged on the underside of the drilling rig 10 are travel mechanisms 18 which are designed as crawler travel mechanisms and which can be rotated by up to 360°. Furthermore, a compensating unit (not shown) is provided for leveling the levels 24, 25, 26 relative to soil irregularities.

[0037] Arranged on the roof 14 of the casing is a helicopter landing place 19, which is connected to an elevator 20 via a gangway 21. The elevator 20 connects all the inner levels 24, 25, 26 of the drilling rig to one another. Crews and possibly also commodities or material can be transported via the helicopter landing place.

[0038] In the interior, the casing has a framework 23 (see FIG. 3) on which a roof substructure 22 rests. The material of the casing is insulating, both thermally and acoustically. A crane module 66 which is connected to the framework 23 is arranged below the roof substructure 22.

[0039] The drilling apparatus has a plurality of levels. The lowest level is the supply level 24, on which the container units 27, tanks and silo 28 are arranged. Arranged thereabove is the drilling level 26, on which the drilling devices 30 together with the associated units (generators 38, storage for coil tubes 37) are located. Furthermore, supply units for the drilling devices 30 are likewise provided. Located thereabove is the level for the crews 26. The control station 39 for the drilling rig 10 is also located at the level for the crews 26. FIG. 4 shows a detailed view of this region.

[0040] The drilling devices 30 are shown in FIG. 5. They have a mast 31 and a drill rod magazine 32, either one each (not shown) or a central drill rod magazine 32, and the associated pipe handler 33, which in the case of coil tubing or case drilling serves as a backup system. The mast 31 is connected to the floor 29 and can also be connected to the roof substructure 22 in order to ensure better application of force. Furthermore, the drilling devices 30 have roughnecks 34, rotary tables 35 and top drives 36. Furthermore, the drilling devices are arranged on a carriage 40 which can move on rails 41 via a drive 62, said rails being arranged on the surface 29 of the drilling level 25. In addition, the drilling devices 30 can be brought one after the other over various initial drilling sites,
which lie in a line in this embodiment (other geometries are likewise conceivable, as required for the deposits), in order to sink a well.

[0041] The preventers 45 and choke manifolds 44 (see FIG. 7) necessary for the deep wells are arranged on the supply level lying underneath. Said preventers 45 and choke manifolds 44 are likewise mounted on a carriage 42 arranged on guides 43 and are driven and displaced in conformity with the drilling devices 30.

[0042] The supply level 24 is divided into setting-up areas for the container units 27 and silos 28 and into areas of movement for the carriages 42. An auxiliary unit area 48 and an auxiliary unit area 49 are provided per drilling device 30 and are each equipped identically and therefore so as to be redundant. As a result, sufficient stability of the drilling rig 10 on all sides is achieved.

[0043] An auxiliary unit area is equipped with Bentonite tanks 51, in which the drilling mud is produced and stored, oil-base mud tanks 52, hydraulic containers 53, which also contain the hydraulic control system, a heating system 54, electrical control containers 55, a cementing unit 56 and mud pump containers 57 (see FIG. 8). A mud pump 59 and the associated control system are provided in the mud pump container 57. Silos 28 for Bentonite, cement and drills are also provided.

[0044] Arranged centrally upstream is the treatment plant 50 of the drilling mud for discharging, drying and storing the drillings. A tank designed as a container is provided for receiving the treated mud. Furthermore, screens, desanders, desludging devices and, if need be, centrifuges are provided in the treatment plant 50.

[0045] The drilling apparatus 10 is moved to a predetermined drilling site by means of GPS or other navigation. The drilling device 30 is brought to the desired site in the drilling rig by means of the carriage 40. The preventer 45 is likewise brought to the desired site via the carriage 42. The first well is then prepared according to a drilling pattern and sunk by means of the drilling device. At the same time, this is repeated using the second drilling device. If the well is sunk, the drilling device 30 and the preventer 45, after the well has been completed, for example by inserting a casing or liner or the like, are moved by means of the carriages 40, 42 to the next drilling point until the pattern has been drilled. The drilling rig 10 is then shifted to the next point and the drilling is repeated. Both drilling devices 10 and the units and devices associated therewith can be moved independently of one another.

[0046] The drilling rig 10 can be supplied with power either via generators driven by a diesel or the like or via an external cable connection. In the case of a diesel-electric operation, diesel supply tanks are to be provided in the drilling rig 10.

[0047] The drilling devices are designed at least with hook loads of 60 t in order to be able to ensure adequate deep wells.

LIST OF DESIGNATIONS

[0048] 10 Drilling rig
[0049] 11 Casing
[0050] 12 Side wall
[0051] 13 Side wall
[0052] 14 Roof
[0053] 15 Ventilation opening
[0054] 16 Container door
[0055] 17 Supply door
[0056] 18 Crawler travel mechanism
[0057] 19 Helicopter landing place
[0058] 20 Elevator
[0059] 21 Gangway
[0060] 22 Roof substructure
[0061] 23 Framework
[0062] 24 Supply level
[0063] 25 Drilling level
[0064] 26 Crew area
[0065] 27 Container unit
[0066] 28 Silo
[0067] 29 Surface
[0068] 30 Drilling device
[0069] 31 Mast
[0070] 32 Drill rod magazine
[0071] 33 Pipe handler
[0072] 34 Roughneck
[0073] 35 Rotary table
[0074] 36 Top drive
[0075] 37 Coil tube
[0076] 38 Generator container
[0077] 39 Control station
[0078] 40 Carriage
[0079] 41 Rail
[0080] 42 Carriage
[0081] 43 Guide
[0082] 44 Choke manifold
[0083] 45 Blow-out preventer
[0084] 46 First aid
[0085] 47 Workshop
[0086] 48 Auxiliary unit area 1
[0087] 49 Auxiliary unit area 2
[0088] 50 Cuttings separator
[0089] 51 Bentonite tank
[0090] 52 Oil-base mud tank
[0091] 53 Hydraulic container
[0092] 54 Heating system
[0093] 55 Electrical control container
[0094] 56 Cementing unit
[0095] 57 Mud pump container
[0096] 58 Air duct systems
[0097] 59 Mud pump
[0098] 60 Mud tank
[0099] 62 Drive
[0100] 66 Crane module

1. A drilling rig for deep well drilling for the onshore sector, comprising at least one drilling device, wherein the drilling rig is movable with respect to the land surface, wherein auxiliary units required for the drilling are arranged substantially inside the drilling rig, and the position of the drilling device inside the drilling rig (10) is movable with respect to the drilling rig.

2. The drilling rig as claimed in claim 1, wherein at least two drilling devices are provided.

3. The drilling rig as claimed in claim 1, wherein at least two levels are provided in the drilling rig, on which levels at least on of the auxiliary units, the drilling device, safety equipment, auxiliary drilling devices and the control system of the drilling rig are situated.

4. The drilling rig as claimed in claims 1, wherein all the auxiliary units required for the drilling are arranged inside the drilling rig.

5. The drilling rig as claimed in claim 1, wherein the drilling rig is surrounded by a casing which completely screens the drilling rig from environmental influences.
6. The drilling rig as claimed in claim 5, wherein the casing is provided with closable openings.

7. The drilling rig as claimed in claim 1, wherein the auxiliary units are interchangeably arranged in a modular manner.

8. The drilling rig as claimed in claim 7, wherein the modularity is achieved by an arranging the respective auxiliary units in containers.

9. The drilling rig as claimed in claim 1, wherein the drilling rig includes a travel mechanism.

10. The drilling rig as claimed in claim 6, wherein the auxiliary unit modules can be at least one of inserted and exchanged through the openings in the casing.

11. The drilling rig as claimed in claim 1, wherein a crane module is arranged above the drilling device.

12. The drilling rig as claimed in claim 1, wherein the drilling device and/or auxiliary drilling devices are arranged on at least one movable base.

13. The drilling rig as claimed in claim 1, wherein a preventer for at least one of the drilling device and the hydraulic supply of the borehole (choke, manifold) is arranged on at least one movable base.

14. The drilling rig as claimed in claim 12 wherein the base elements can be moved synchronously.

15. The drilling rig as claimed in claim 1, including a helicopter landing deck on the top of the drilling rig.

16. The travel mechanism of claim 9 wherein the travel mechanism has cross-country mobility.

17. The travel mechanism of claim 9 wherein the travel mechanism consists of individual crawler travel mechanisms.

18. The movable base of claim 12 wherein the movable base is a carriage, which is movable relative to the drilling rig.

19. The movable base of claim 13 wherein the movable base is a carriage, which is movable relative to the drilling rig.

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