

This invention relates to a skid assembly for supporting a drilling tower, a drilling module including a drilling tower mounted on such a skid assembly, and an offshore drilling platform having such a drilling module mounted thereon.

During oil and gas exploration it is frequently desired to drill a grid of wellbores. This is usually accomplished by setting up a drilling module and drilling a first wellbore. When the wellbore is completed the drilling module is moved to the next location and the process repeated until the required grid of wellbores has been drilled and completed. At this stage the drilling module is removed and taken to a new site for future use.

10 In the case of 'shallow water' offshore drilling (typically with a water depth of less than 500m) it is conventional to erect an offshore drilling platform over the area of sea bed to be explored. Typically such offshore platforms are made of steel and have legs which extend down and into the sea bed and are anchored thereto.

Once the offshore platform is in place drilling can commence. Typically the owner of the offshore platform will subcontract the drilling and completion of the wellbores to a specialist contractor who will arrange for a drilling module to be taken to the offshore platform on a purpose build barge. The drilling module is then lifted onto the offshore platform by a floating crane. Once the drilling module is in position and connected to the requisite services, drilling can commence.

20 The requisite services may be provided from additional modules craned onto the offshore drilling platform or carried on board a tender moored alongside the offshore drilling platform.

In the former case once everything that is required for drilling is craned onto the offshore drilling platform the offshore drilling platform is self-contained and can then operate independently subject to periodic replenishment of consumables. In such an arrangement the drilling module (commonly referred to as a 'Derrick Equipment Set' or 'DES') is accompanied by one or more support modules which include one or more generators, fuel storage tank(s), mud storage containers, mud mixing facilities, screening equipment and all the ancillary handling and processing equipment and spares which are normally associated with wellbore construction

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and completion.

In the latter case the drilling module is craned onto the offshore platform and the tender which is moored nearby the offshore platform is connected to the drilling module by umbilical(s) which convey power and drilling mud to the drilling module. Typically, the tender will also be used for storage, mud mixing and other support as needed.

In either case the drilling module itself comprises a skid assembly and a drilling tower.

The cost of drilling is very substantial both in terms of the capital cost of the equipment and the highly skilled manpower involved. Accordingly, there is considerable competition amongst contractors to be able to offer a package which promises to reduce the overall time from the time the drilling module is craned onto the offshore platform until the time it is craned off.

Skid assemblies for supporting drilling towers are frequently made by specialist manufacturers. They are designed to enable the drilling tower to be moved in both the x and y directions so that a grid of wellbores can be drilled.

At the present time there are two types of skid assemblies which are commonly used. For convenience these will be referred to as 'a low level skid assembly' and 'a high level skid assembly'. Both these types of skid assembly are described in greater detail hereinafter. Suffice it to say that with low level skid assemblies the structure provides an obstacle course which rig staff and equipment have to go over or under every time they need to access the space beneath the drilling tower. This can be very difficult, particularly during inclement weather, and can add considerably to the time which would otherwise be needed if the structure was not in the way. With the high level skid assembly this problem disappears since staff can walk freely into the space beneath the drilling tower and tools and heavy equipment can simply be carried or pushed on trolleys into the space beneath the drilling tower without hindrance. However, this advantage is not obtained without a penalty. In particular, when it is desired to move the drilling tower to a new location, depending on the intended direction of movement it is

necessary to disconnect some of the ancillary equipment. When the drilling module is in the desired position the ancillary equipment then has to be reconnected and the integrity of the remade connections tested. This is time consuming and expensive because it is not possible to use the drilling module until the testing is complete and the appropriate paperwork completed and logged.

The present invention is based on the realisation that if a skid assembly is provided with a high level skid rail and a low level skid rail then a structure can be provided on which ancillary equipment can be mounted and which will remain in juxtaposition (ie in a fixed position) with respect to the drilling tower. This means that those items of ancillary equipment which are mounted on the structure do not have to be disconnected and reconnect when the drilling tower is moved. In turn this means that it is not necessary to retest the integrity of the connections and consequently non-productive time can be reduced.

According to the present invention there is provided a skid assembly for supporting a drilling tower said skid assembly comprising:

- (i) a first member for slidably supporting a drilling tower; and
 - (ii) a second member for slidably supporting said drilling tower; said first member and said second member being spaced apart in a horizontal direction;
- wherein said first member comprises a cross beam;
- wherein said second member is located at a higher level than said first member; and
- wherein said skid assembly further comprises at least one cross beam slidably mounted on said second member and a substructure which extends downwardly from said at least one cross beam and is slidably mounted on said first member.

Preferably, said substructure comprises at least one platform for supporting ancillary equipment.

Preferably, said first member is spaced between 9m and 14m from said second member in a substantially horizontal plane.

Advantageously, the top of said second member lies in a plane which is between 9m and 14m above the plane in which the top of said first member lies.

Preferably, the top of said second member lies in a plane which is between 10m and 12m above the plane in which the top of said first member lies.

Advantageously, said second member comprises a cross beam mounted on legs and the distance from the ground to the bottom of said cross beam is at
5 least 8m.

The present invention also provides a drilling module comprising a drilling tower mounted on a skid assembly in accordance with the present invention.

Preferably, said drilling module includes a skid assembly in accordance with a preferred embodiment of the present invention and ancillary equipment mounted
10 on said platform.

Advantageously, said ancillary equipment includes one or more of the following, a scalping screen, a shale shaker, a mud mixer and a generator.

The present invention also provides an offshore drilling platform having a drilling module in accordance with the present invention mounted thereon.

15 Preferably, said drilling platform is provided with a first skid rail for slidably supporting said drilling module and a second skid rail disposed alongside said first skid rail for slidably supporting said drilling module, and wherein said first skid rail and said second skid rail lie in a substantially common horizontal plane.

For a better understanding of the present invention and to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a simplified perspective view showing a drilling module including
5 a known low level skid assembly mounted on an offshore drilling platform;

Figure 2 is a simplified perspective view showing a drilling module including a known high level skid assembly mounted on an offshore drilling platform;

Figure 3 is a simplified perspective view showing a drilling module including a skid assembly in accordance with the present invention mounted on an offshore
10 drilling platform.

Figure 4 is a simplified exploded side (driller's side) elevation of a skid assembly in accordance with the present invention;

Figure 5 is a simplified exploded left end (drawworks) side elevation of the skid assembly shown in Figure 4;

15 Figure 6 is a simplified a exploded right end (off-drawworks) side elevation of the skid assembly shown in Figure 4; and

Figure 7 is a plan view showing a preferred order in which the wellbores should be drilled and completed.

Referring to Figure 1, there is shown the top of an offshore drilling platform
20 100.

The offshore drilling platform 100 is provided with two parallel skid rails 102 and 104 which extend substantially the entire length of the offshore drilling platform 100 and are typically from 30m to 60m in length and about 13.5m apart.

A drilling module 106 is mounted on the skid rails 102 and 104 and is
25 slidable therealong.

The drilling module 106 comprises a drilling tower 108 which is mounted on a low level skid assembly 110.

The low level skid assembly 110 comprises two end members 112 and 114 which are connected by two spacer beams 116 and 118. The end members 112
30 and 114 are typically separated by about 9m.

Each of the end members 112 and 114 are of similar construction and comprises a deep cross beam and two legs. As can be seen in Figure 1 the end member 112 comprises a deep cross beam 120 and two legs 122 and 124 the lower extremities of which are provided with guides (which are not visible in Figure 1) which lie either side of the skid rails 102 and 104.

The drilling module 106 can be moved along skid rails 102 and 104 (in the 'x-direction') by, for example cables, chains or hydraulic rams which can conveniently be mounted on the skid rails 102 and 104 and act between the skid rails 102 and 104 and the respective legs 122, 124. The upper edge of each of the end members 112, 114 is provided with flat flanges 126 and 128 which form skid rails on which the drilling tower 108 can be displaced in the y-direction. In particular the drilling tower 108 comprises a drilling derrick 130, a drilling floor 132 and a substructure 134 which comprises two separate and distinct support structures 136 and 138.

The drilling tower 108 can be moved along the flat flanges 126 and 128 (in the 'y-direction') by hydraulic rams one of which, hydraulic ram 140 is shown in the figure. The hydraulic ram 140 is detachably mounted to the flange 126 and acts between the flange 126 and the support structure 138 to displace the drilling tower 108 with respect to the flanges 126 and 128.

By moving the low level skid assembly 110 with respect to the skid rails 102 and 104 in the x-direction and the drilling tower 108 with respect to the skid rails defined by the flanges 126 and 128 the drilling derrick 130 can be positioned to drill a number of wellbores arranged in a grid of rows and columns.

It will be noted that the top surfaces of skid rails 102 and 104 are in the same horizontal plane. Similarly the tops of the flanges 126 and 128 are in the same horizontal plane. These two horizontal planes are typically separated by about 2.5m.

Space is invariably at a premium on offshore drilling platforms.

As shown In Figure 1 substantially all the space on the drilling floor 132 is occupied by the drawworks 142, tongs 144, pipe racks 146 and 148 and the

driller's cabin 150.

Mud processing equipment 152 is mounted on a platform within the support structure 138. The mud processing equipment 152 will typically comprise a scalping screen for removing large debris from drilling mud being returned to the surface during drilling and one or more shale shakers arranged in series or parallel for removing unwanted debris from the drilling fluid before it is sent to a holding vessel ready for reuse.

For practical reasons the mud processing equipment is normally located close to and at the same height as the bell nipple on the blow out preventer 154 which is mounted on a shut-off valve at the level of the offshore drilling platform 100.

It will be appreciated that on the positive side the mud processing equipment 152 moves with the drilling tower 108 and hence there is no need to disconnect and reconnect the electric motors which drive the scalping screen and the shale shakers each time the drilling tower (108) is moved. However, there is limited clearance between the bottom of the cross beam 120 and the top of the offshore drilling platform 100. This means that the cross beams form obstructions which impede the easy movement of personnel and equipment into the area beneath the drilling tower 108. This causes delays which are particularly significant in inclement weather.

Electrical power is provided from a tender (not shown) moored alongside the offshore drilling platform 100 and connected to the drilling module 106 by umbilicals (not shown).

Turning now to Figure 2 there is shown the top of an offshore drilling platform 200.

The offshore drilling platform 200 is provided with two parallel skid rails 202 and 204 which extend substantially the entire length of the offshore drilling platform 200 and are typically from 30m to 60m in length and about 13.5m apart.

A drilling module 206 is mounted on the skid rails 202 and 204 and is slidable therealong.

The drilling module 206 comprises a drilling tower 208 which is mounted on a high level skid assembly 210.

The high level skid assembly 210 comprises two end members 212 and 214 which are connected by two spacer beams, one of which 216 is visible in Figure 2.. The end member 212 and 214 are typically separated by between 9m and 14m.

Each of the end members 212 and 214 are of similar construction and comprises a deep cross beam and two legs. As can be seen in Figure 2 the end member 212 comprises a deep cross beam 220 and two legs 222 and 224 the lower extremities of which are provided with guides which lie either side of the skid rails 202 and 204. It will be noted that the legs 222 and 224 are significantly longer than the legs 122 and 124. Similarly, the end member 214 comprises a deep cross beam 221 and two legs 223 and 225 the lower extremities of which are provided with guides which lie either side of the skid rails 202 and 204. The lower extremities of the legs 222 and 223 and legs 224 and 224 are connected by spacer beams 217 and 219.

The drilling module 206 can be moved along skid rails 202 and 204 (in the x-direction') by, for example cables, chains or hydraulic rams which can conveniently be mounted on the skid rails 202 and 204 and act between the skid rails 202 and 204 and the respective legs 222 and 224.

The upper edge of each of the cross beams 220 and 221 is provided with a flat flange 226 and 228 which form skid rails on which the drilling tower 208 can be displaced in the y-direction. In particular the drilling tower 208 comprises a drilling derrick 230, a drilling floor 232 and a substructure 234 which comprises two separate and distinct support beams 236 and 238 which rest on the flat flanges 226 and 228.

The drilling tower 208 can be moved along the flat flanges 226 and 228 (in the 'y-direction') by hydraulic rams which act between the flat flanges 226 and 228 and the substructure 234 to displace the drilling tower 208 with respect to the flanges 226 and 228.

By moving the high level skid assembly 210 with respect to the skid rails 202 and 204 in the x-direction and the drilling tower 208 with respect to the skid rails defined by the flanges 226 and 228 the drilling derrick 230 can be positioned to drill a number of wellbores arranged in a grid of rows and columns.

5 It will be noted that the top surfaces of skid rails 202 and 204 are in the same horizontal plane. Similarly the tops of the flanges 226 and 228 are in the same horizontal plane. These two horizontal planes are typically separated by about 10m.

Space is invariably at a premium on offshore drilling platforms.

10 As shown In Figure 2 substantially all the space on the drilling floor 232 is occupied by the drawworks 242, tongs 244, pipe racks 246 and 248 and the driller's cabin (not visible in Figure 2).

Mud processing equipment 252 is mounted on a platform secured to the legs 222 and 223. The mud processing equipment 252 will typically comprise a
15 scalping screen for removing large debris from drilling mud being returned to the surface during drilling and one or more shale shakers arranged in series or parallel for removing unwanted debris from the drilling fluid before it is sent to a holding vessel 253 ready for reuse.

For practical reasons the mud processing equipment is normally located
20 close to and at the same height as the bell nipple on the blow out preventer 254.

It will be appreciated that on the positive side the height of the cross beams 220 and 221 is sufficient to pass over the top of the blow out preventer 254. In addition the mud processing equipment 252 moves with the drilling tower 208 in the x-direction and hence there is no need to disconnect and reconnect the
25 electric motors which drive the scalping screen and the shale shakers each time the drilling tower 208 is moved in this direction. However, when the drilling tower 208 is moved in the y-direction, the distance between the mud processing equipment 252 and the drilling tower 208 changes. In practice this means that before the drilling tower 208 can be moved in the y-direction the mud processing
30 equipment 252 has to be disconnected. After the drilling tower 208 has been moved to the desired location the mud processing equipment 252 is reconnected

and everything tested before drilling can recommence. The disconnecting, connecting and testing is a time consuming and expensive process.

Electrical power is provided from a tender (not shown) moored alongside the offshore drilling platform 200 and connected to the drilling module 206 by
5 umbilicals (not shown).

Referring to Figure 3, there is shown the top of an offshore drilling platform 300 in accordance with the present invention.

The offshore drilling platform 300 is provided with two parallel skid rails 302 and 304 which extend substantially the entire length of the offshore drilling platform
10 300 and are typically from 30m to 60m in length and about 13.5m apart.

A drilling module 306 is mounted on the skid rails 302 and 304 and is slidable therealong.

The drilling module 306 comprises a drilling tower 308 which is mounted on a skid assembly 310 in accordance with the present invention.

15 The skid assembly 310 comprises a low end member 312 and a high end member 314.

The low end member 312 comprises a deep cross beam 320 the lower extremity of which is provided with guides which lie either side of the skid rails 302 and 304.

20 As can be seen in Figures 3 and 6, the high end member 314 comprises a deep cross beam 321 and two legs 323 and 325 the lower extremities of which are provided with guides 343 which lie either side of the skid rails 302 and 304. The lower extremities of the legs 324 and 325 of the high end member 314 are connected to the low end member 312 by spacer beams 316 and 318.

25 The vertical distance between the top of the flat flange 328 on the high end member 314 and the top of the flange 326 on the low end member 312 is about 10m.

The drilling module 306 can be moved along skid rails 302 and 304 (in the 'x-direction') by, for example cables, chains or hydraulic rams which can
30 conveniently be mounted on the skid rails 302 and 304 and act between the skid

rails 302 and 304 and the respective legs 324 and 325. An exemplary hydraulic ram is shown in Figure 4.

The flat flanges 326 and 328 form skid rails on which the drilling tower 308 can be displaced in the y-direction. In particular the drilling tower 308 comprises a drilling derrick 330, a drilling floor 332 and a substructure 334 which comprises a pair of cross beams 336a and 336b one end of each of which slidably rests on flat flange 328 and the other end of each of which is supported by a support structure 337a and 337b each of which has a load bearing surface 338a and 338b which slidably rests on the flat flange 326. The substructure 334 also supports platforms 339 and 341 which support ancillary equipment only examples of which are shown.

The drilling tower 308 can be moved along the flat flanges 326 and 328 (in the 'y-direction') by, for example hydraulic rams which act between the flanges and the cross beams 336a and 336b and support structures 337a and 337b to displace the drilling tower 308 with respect to the flat flanges 326 and 328. Hydraulic ram 340 can be seen in Figure 5 acting between a member attached to the flange 326 and the support structure 337b.

By moving the skid assembly 310 with respect to the skid rails 302 and 304 in the x-direction and the drilling tower 308 with respect to the skid rails defined by the flanges 326 and 328 the drilling derrick 330 can be positioned to drill a number of wellbores arranged in a grid of rows and columns.

The order in which the holes are drilled and completed is important to obtain the maximum benefit from the present invention as will be discussed later.

It will be noted that the top surfaces of skid rails 302 and 304 are in the same horizontal plane. However, the tops of the flanges 326 and 328 are in vertically separated horizontal planes. These two horizontal planes are typically separated by about 11m.

Space is invariably at a premium on offshore drilling platforms.

As shown In Figure 3 substantially all the space on the drilling floor 332 is occupied by the drawworks 342, tongs , pipe racks 346 and 348 and the driller's cabin.

Mud processing equipment 352 is mounted on a platform within the support structure 337a and 337b. The mud processing equipment 352 will typically comprise a scalping screen for removing large debris from drilling mud being returned to the surface during drilling and one or more shale shakers arranged in series or parallel for removing unwanted debris from the drilling fluid before it is sent to a holding vessel ready for reuse. The mud processing equipment also includes a vessel 317 divided into (Figure 5) a degasser tank 317a, a desilter tank 317b, a desander suction tank 317c, a second desander suction tank 317d and a sand trap tank 317e.

10 For practical reasons the mud processing equipment is normally located close to and at the same height as the bell nipple on the blow out preventer.

It will be appreciated that the mud processing equipment 352 moves with the drilling tower 308 and hence there is no need to disconnect and reconnect the electric motors which drive the scalping screen and the shale shakers each time the drilling tower 308 is moved in both the x-direction and the y-direction. Furthermore there is substantial working clearance as a result of the legs 323 and 325.

Electrical power and provided from a tender (not shown) moored alongside the offshore drilling platform 300 and connected to the drilling module 306 by umbilicals (not shown).

Figures 4, 5 and 6 are simplified views which facilitate understanding how the skid assembly 310 is constructed and operates.

Figure 7 is a plan view showing the preferred order in which fifteen well bores should be drilled and completed in a 3 x 5 grid. In particular, by following the order recommended the low end member 312 offers minimal interference to the drilling operation.

Whilst primarily intended for use on offshore drilling platforms it will be appreciated that there is no reason why skid assemblies in accordance with the present invention should not be used on dry land.

Claims:

1. A skid assembly for supporting a drilling tower, said skid assembly comprising:
 - (i) a first member for slidably supporting a drilling tower; and
 - (ii) a second member for slidably supporting said drilling tower (308); said first member and said second member being spaced apart in a horizontal direction; wherein said first member comprises a cross beam; wherein said second member is located at a higher level than said first member; and
- 10 wherein said skid assembly further comprises at least one cross beam (336a, 336b) slidably mounted on said second member and a substructure which extends downwardly from said at least one cross beam (336a, 336b) and is slidably mounted on said first member.
- 15 2. A skid assembly as claimed in Claim 1, wherein said substructure comprises at least one platform for supporting ancillary equipment.
3. A skid assembly as claimed in Claim 1 or 2, wherein said first member is spaced between 9m and 14m from said second member in a substantially horizontal plane.
4. A skid assembly as claimed in Claim 1, 2 or 3, wherein said the top of said
- 20 second member lies in a plane which is between 9m and 14m above the plane in which the top of said first member lies.
5. A skid assembly as claimed in Claim 1, 2, 3 or 4, wherein the top of said second member lies in a plane which is between 10m and 12m above the plane in which the top of said first member lies.
- 25 6. A skid assembly as claimed in any of Claims 1 to 5, wherein said second member comprises a cross beam mounted on legs and the distance from the ground to the bottom of said cross beam is at least 8m.
7. A drilling module comprising a drilling tower mounted on a skid assembly as
- 30 claimed in any preceding claim.
8. A drilling module as claimed in Claim 7 including a skid assembly as claimed in Claim 2 or any of Claims 3 to 7 when dependent directly or indirectly on Claim 2, and further including ancillary equipment mounted on said platform.
- 35 9. A drilling module as claimed in Claim 8, wherein said ancillary equipment includes one or more of the following, a scalping screen, a shale shaker, a mud mixer and a generator.

10. An offshore drilling platform having a drilling module as claimed in Claim 7, 8 or 9, mounted thereon.
 11. An offshore drilling platform as claimed in Claim 10, wherein said drilling platform is provided with a first skid rail for slidably supporting said drilling module and a second skid rail disposed alongside said first skid rail for slidably supporting said drilling module, and wherein said first skid rail and said second skid rail lie in substantially common horizontal plane.
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