

PATENT SPECIFICATION

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(54) DERRICK FOR INSTALLATION ON BOARD A WATERBORNE VESSEL

(71) We, GROUPEMENT POUR LES ACTIVITES ATOMIQUES ET AVANCEES, formerly known as GROUPEMENT ATOMIQUE ALSACIENNE ATLANTIQUE, a French Body Corporate, of 20 Avenue Edouard Herriot, 92-Le Plesses-Robinson, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a derrick for installation on board a waterborne vessel.

It is known that in operations involving drilling at sea by means of a derrick on board a ship, it is accepted practice to guide a tackle-block and a hook employed for lifting, during the various drilling and hadling operations, elements such as drill pipe sections, during displacement of the tackle-block and hook in the derrick, so as to prevent the swell and the wind from giving rise to untimely movements of the tackle-block and hook. Since drilling at sea is extremely costly, it is desirable to be able to continue working even if the swell is relatively strong. Thus, any device which will make it possible to improve the guiding of the masses being lifted by the tackle-block and hook, which masses tend to swing owing to the swell, constitutes a highly desirable improvement. Additionally, it is clear that, when drilling at sea, it is particularly desirable to make maximum use of the time available and to operate by "optimum time" methods *i.e.*, for example, during an operation for demounting a drilling train of drill pipe sections, to hold the tubes constituting the drilling train at the same time as the tackle block descends along a path parallel to the axis of the drilling train while carrying a drill pipe section which has just been removed from the top of the drilling train. Thus, the present Applicants have endeavoured to de-

sign a derrick of which the tackle-block and the hook have two separate rectilinear travel paths, one perpendicular to the axis of the well and the other offset relative to this axis and parallel thereto so as to be free of the space above the well.

According to the invention there is provided a derrick for installation on board a waterborne vessel, the derrick having a longitudinal axis and additionally having two guide rails which are substantially parallel to the longitudinal axis of the derrick and offset relative thereto, a carriage mounted for movement in opposite directions along the guide rails and carrying a device for securement to a load to be lifted or lowered, and connecting means between the carriage and said device, the connecting means confining displacement of said device relative to the carriage of two opposite directions substantially perpendicular to the directions of movement of the carriage.

For a better understanding of the 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 side view of part of one form of derrick in accordance with the invention,

Figure 2 is the same view as Figure 1 except that a tackle-block and hook of the derrick are shown in a retracted position,

Figure 3 is a front view of part of the derrick, and

Figure 4 shows one form of locking arrangement for the derrick.

Referring to Figure 1, the derrick, which is installed on an oil drilling ship (not shown) above a well, has a longitudinal, vertical, axis. The derrick includes a truck or carriage 2 mounted on a rail 3, which is parallel to, and offset relative to, the longitudinal axis of the derrick, and adapted to travel on the rail 3 parallel thereto in

[Price 33p]

either the upward or downward direction by means of rollers or wheels 5, 8 and 18 and counter rollers or wheels 5', 8' and 18'. Rearwardly of the plane of the Figure 5 is a second, identical, rail 4 on which, as Figure 3 shows, is disposed an arrangement of parts identical to that shown in Figure 1.

10 In line with the hole being drilled in the sea bed is a tackle-block 6 carrying a hook 7 and supported by a cable 1 extending into the tackle block.

The assembly constituted by the tackle-block and the hook is connected to the truck or carriage 2 by links 9, 29 and 39 15 pivotally connected at one end to the tackle-block and hook by articulation means 12, 22 and 32 respectively, each having on axis perpendicular to the plane of Figure 1. The other end of the link 9 is 20 free to be displaced vertically relative to the carriage 2 owing to the provision of a roller or wheel 13 in a slideway 14 mounted on the carriage. In the same manner the other ends of the links 29, 39 are 25 provided with rollers 23, 33 respectively, adapted to travel vertically upwards and downwards in slideways 16 and 17 respectively which are mounted on the carriage 2. The three ends of the links 19, 29 and 39 which carry the rollers 13, 23 and 33 respectively are free to be displaced 30 vertically owing to their respective slideways 14, 16 and 17 and are connected together by means of a beam 19 (not shown in Figure 1 but shown in Figure 3). With this arrangement, the three links 9, 29 and 39, together with the assembly of the tackle-block and hook and also with 40 the beam 19, define two deformable parallelograms whose corner angles depend on the relative horizontal spacing between the assembly, comprising the tackle-block and hook, and the carriage 2.

45 When the tackle-block and its hook approach the rail, the rollers 13, 23 and 33 slide along their slideways 14, 16 and 17 respectively so that the links 9, 29 and 39 are able to adopt, during this sliding 50 movement, a variable angle relative to the horizontal without thereby driving the carriage. In order to obtain, in every case, displacement of the assembly of the tackle-block and hook relative to the carriage in 55 a horizontal sense and thus perpendicular to the upward and downward direction of travel of the carriage 2 on the rails 3, 4 and so as also to diminish accordingly the magnitude of the force required to cause 60 the tackle-block and its hook to approach, and come into contact with, the carriage so as to bring the assembly comprising the tackle block and hook into a retracted position, the Applicants have completed 65 the assembly of links by adding further

links 10 and 20. The link 10 is articulated by a pivot 11 to the centre of the link 9 and, on the other hand, it is pivotally connected to the carriage also by means of articulation means 15 provided with an axis 70 of rotation perpendicular to the plane of the Figure so that, when the articulation means 12 of the tackle-block approaches the rail 3, the roller 13 travels vertically upwards in the slideway 14, whereas the 75 pivot 11 is displaced on an arc of a circle having its centre on the axis of rotation of the articulation means 15 and a radius which is equal to half the length of the link 9. Thus, it is clear that the straight 80 line joining the articulation means 12 to the articulation means 15 is perpendicular to the direction of the rail, irrespective of the spacing between the assembly of the tackle-block and hook and the carriage. 85 Thus the articulation means 12 describes a horizontal line as the tackle-block and hook are retracted.

By means of a pivot 21, one end of the link 20 is articulated to the centre of the 90 link 29, the length of the link 20 being equal to half that of the link 29 and the other end of the link 20 being pivotally connected to the carriage by means of articulation means 25. The articulation 95 means 22 is then also subjected to a horizontal displacement as the assembly of the tackle-block and hook is retracted. Thus, during retraction, both articulation means 12 and 22 are displaced 100 horizontally, so that the tackle-block (together with its hook) is displaced horizontally too. The connection established owing to the beam 19 ensures that the roller 33 is displaced vertically along 105 the slideway 17, simultaneously with the rollers 23 and 13. The articulation means 32 of the hook 7 and the connection of the hook with the tackle-block are displaced horizontally, as is also the hook itself. 110

The relative displacement of the hook and of the tackle block with respect to the carriage 2 is controlled by a hydraulic jack 26 connected at one end to the tackle-block by means of articulation means 27 115 having a vertical axis which is parallel to the plane of the Figure. The jack is also provided, at the other end, with an articulation flange or cheek 37 connected to the carriage 2. Reference numerals 28 120 designates a hydraulic accumulator, mounted on the carriage and hydraulically connected to the jack by ducting, and an electromagnetic valve (not shown) permitting the introduction into the jack of 125 the full hydraulic pressure from the accumulator in order to bring about the required horizontal displacement of the tackle-block and hook at high speed. The hydraulic accumulator is charged by a 130

motor-pump (not shown) which may advantageously also be mounted on the carriage in view of its moderate bulk.

The derrick incorporates, in addition, a second jack 46 (not shown in this Figure) but which is shown in the front view (Figure 3). It is self-evident that the horizontal travel of the tackle-block and hook is equal to the travel of the two jacks 26, 46.

Figure 2 shows the mechanism in the retracted position. The Figure shows the roller 5 and its counter roller 5' permitting the carriage 2 to slide on the rail 3. The roller 13 has reached the end of the slideway 14 connected to the carriage. The centre 11 of the link 9 has ascended to point 13 whereas the articulation means 15 connected to the carriage has not moved. The articulation means 12 of the rod 9 has come to rest adjacent the articulation means 15. A corresponding displacement takes place at the ends of the other links, whereas the beam 19 has been displaced upwardly by a distance equal to the vertical displacement of the rollers 13, 23 and 33.

Figure 3 shows a front view of a part of the derrick with the tackle-block and hook in the retracted position. Thus, as may be determined from Figure 2, the link 9 is positioned along the carriage and the roller 13 is disposed at the upper end of the slideway 14. The perfectly symmetrical structure of the tackle-block and hook retracting mechanism as a whole are to be noted. It will be seen that there corresponds to the travel roller 5, bearing on the rail 3, a roller 45 bearing on the rail 4. To the link 9 corresponds a link 49 and to link 10 corresponds a link 40. Moreover, to the fixed articulation means 15 corresponds articulation means 55.

It will also be noted that the tackle-block is supported at one side by the articulation means 12 and 22 and at the other side by corresponding articulation means 42 and 52. To the beam 19 which ensures that the displacements of the rollers 13, 23 and 33 are synchronised corresponds a beam 59 fulfilling an analogous function. It will be noted that throughout the structure of the illustrated part of the derrick it has been endeavoured to achieve a degree of symmetry which readily maintains the mass, carried by the hook, which sways owing to the effects of swell and wind.

Similarly, wind-bracing of the structure is effected by symmetrical braces such as the elements 43 and 44 or 53 and 54. At 26 there is shown the jack and at 37 is articulation flange or cheek. The jack 46 on the other side of the derrick is provided with components corresponding to the ones

with which the jack 26 is provided, the articulation flange or cheek of the jack 46 being shown at 47.

Figure 4 shows a detail of a locking system permitting the securement of the assembly comprising the tackle-block and hook, relative to the carriage, in the extended position above the well or vertical shaft carrying a cutting bit and arranged in the drilling position. The locking system comprises essentially a spring 60 and an opposing jack 61 secured to the carriage 2 by pivots 62 and 63 respectively. A latching means 64 is pivotally mounted by means of a pivot 65 on a connecting member 66 mounted on the carriage. Furthermore, the latching means is secured to a pivot 67 at the common end of the spring 60 and of the jack 61.

A flat 68 on the latching means 64 bears on the roller 13 of the link 9 when the tackle-block and hook are in the extended position. The beam 19 then simultaneously locks the rollers 23 and 33 and the links 29 and 39 remain in their position in which the tackle-block and hook are in the extended position. The latching means is maintained in the latching position to bear on the roller 13, owing to the action of the spring 60.

Locking in the latching position is thus mechanical. Unlocking is effected hydraulically by the jack 61. Under the action of the jack the pivot 67 ascends and the latching means pivots about the pivot 65, thus freeing the roller 13 which no longer bears on the flat 67 on the latching means 64 and is able to ascend freely along the slideway 14.

With the derrick described, it is possible to maintain at a relatively low value the energy necessary for the displacement of the tackle-block and the hook away from the axis of the well towards the retracted position since such displacements are effected in a substantially horizontal direction. Moreover, the required displacement may then be effected at a high speed since only a substantially horizontal displacement is involved. Whereas, in general, the displacement of the assembly constituted by the tackle-block and the hook to a position away from the axis of the well may, in the case of some previously proposed derricks, occupy a considerable proportion of the time required for hoisting the tackle-block from its lowest position in the derrick towards the top of the derrick, the corresponding displacement with the Applicants described derrick may be effected in a relatively short time. The person skilled in the art will readily appreciate the advantages which may be derived from an improvement of this kind.

The existence of the two interconnected,

identical, link assemblies, one on each side of the derrick and both attached to the carriage and disposed symmetrically relative to a plane containing the axis of the well and the line midway between the two upright rails of the derrick, makes it possible to ensure transverse rigidity of the assemblies and to render the horizontal displacement of the link ends connected to the tackle-block and hook substantially insensitive to the influence of accelerations due to the swell, to rolling or lurching, to pitching and to the wind.

WHAT WE CLAIM IS:—

1. A derrick for installation on board a waterborne vessel, the derrick having a longitudinal axis and additionally having two guide rails which are substantially parallel to the longitudinal axis of the derrick and offset relative thereto, a carriage mounted for movement in opposite directions along the guide rails and carrying a device for securement to a load to be lifted or lowered, and connecting means between the carriage and said device, the connecting means confining displacement of said device relative to the carriage to two opposite directions substantially perpendicular to the directions of movement of the carriage.
2. A derrick according to claim 1, wherein the connecting means consist of two interconnected link assemblies permitting the displacement of said device in a plane containing said longitudinal axis and the line midway between the guide rails, each link assembly comprising a first pair of links each of these links being pivotally connected at one end to said device and provided at the other end with a roller, guide means mounted on the carriage for guiding the rollers of the links of said first pair in the directions parallel to the guide rails, a second pair of links, each of these links being pivotally connected at one end to said carriage and at the other end to the mid point of a respective one of the links of said first pair, the links of said first pair being twice as long as those of said second pair, and connecting rods respectively interconnecting the said one ends of the links of said first pair in one of the link assemblies with the said one ends of the links rods of said first pair in the other link assembly.
3. A derrick according to claim 2, wherein all those ends of the links which

carry a said roller are interconnected by a rigid beam.

4. A derrick according to claim 2 or 3, wherein the two link assemblies are arranged to be actuated by respective jacks mounted on the carriage.

5. A derrick according to claim 4, wherein the displacement of said device relative to the carriage is equal to the travel of the jacks.

6. A derrick according to any preceding claim, wherein each link assembly is provided with latching means for locking one of said rollers at one end of its travel so as to hold said device in a predetermined position and wherein each link assembly also has a hydraulic jack for unlocking the latching means so as to release the said roller.

7. A derrick according to any preceding claim, wherein said device comprises a tackle-block carrying a hook.

8. A derrick according to claim 7 when appended directly or indirectly to claim 2, wherein said one ends of the links of said first pair are pivotally connected to the tackle-block and wherein each link assembly additionally comprises a further link of the same length as the links of said first pair and pivotally connected at one end to said hook and provided at the other end with a roller, there being further guide means mounted on the carriage for guiding the said roller of the further link in the directions parallel to the guide rails.

9. A derrick for installation on board a waterborne vessel, substantially as hereinbefore described with reference to the accompanying drawings.

10. A drilling waterborne vessel on which is installed a derrick in accordance with any preceding claim.

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identical, link assemblies, one on each side of the derrick and both attached to the carriage and disposed symmetrically relative to a plane containing the axis of the well and the line midway between the two upright rails of the derrick, makes it possible to ensure transverse rigidity of the assemblies and to render the horizontal displacement of the link ends connected to the tackle-block and hook substantially insensitive to the influence of accelerations due to the swell, to rolling or lurching, to pitching and to the wind.

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