

STRETCH COMPENSATION IN A HOISTING SYSTEM FOR A DERRICK.

The present invention relates to an apparatus for a derrick, comprising two or more hydraulic piston-cylinder arrangements for raising and lowering a yoke which travels on guide rails in the derrick itself, where two or more wire lines are strung over sheaves rotatably attached to the yoke, said wires being attached at one end thereof to the top drive and at the other end thereof being secured to an attachment point adjacent to a drill floor, said two or more wires being run in two sets of lines, the attachment points of which wire sets are spaced apart.

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A derrick structure which was developed in 1987 by the present inventor and which has shown great promise embodies the RamRigTM concept. Two hydraulic piston-cylinder arrangements are used in the derrick for raising and lowering the drill string. The cylinders operate between the drill floor and a yoke which travels on guide rails in the derrick itself. The advantages of this concept are numerous, some of the most important being that it is possible to place the drill floor at a higher level than the platform floor, that a derrick may be constructed having a significantly lower air resistance, that a higher level of safety and longer lifetime are attained for the most expensive components of the derrick.

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Since it is possible to position the drill floor higher than the platform floor, pipe handling is significantly simplified. There is no longer any need to arrange the pipe handling equipment at a high level in the derrick. All pipe handling equipment may be placed on the platform floor and the drill floor.

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The object of the present invention is to solve important, practical problems in the realization of the RamRigTM concept. This objective is achieved by means of the features apparent from the characterizing clause of the subsequently disclosed claim 1.

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The invention will now be explained in greater detail with reference to the enclosed drawings, where

Figure 1 shows a RamRigTM derrick in every essential detail;

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Figure 2 shows the derrick schematically, viewed from the side;

Figure 3 shows the derrick schematically, viewed from the front, with the top drive in its lowermost position;

Figure 4 shows the derrick schematically, viewed from the front, with the top drive in its uppermost position:

Figure 5 shows the tension equalizer assembly seen from the side,

Figure 6 shows a portion of the tension equalizer assembly, seen from the front, and

Figure 7 shows a portion of the tension equalizer assembly seen from above.

Figure 1 shows a derrick 1 positioned on a drill floor 2. The drill floor is arranged at a higher level than the platform floor 3, enabling the pipe handling equipment 4 to be placed mainly between the platform floor 3 and the drill floor 2. Derrick 1 is substantially gantry-shaped, having gantry legs 5, 6. Guide rails 7 for a yoke 8 and a top drive 9 run along each gantry leg 5, 6. Hydraulic piston-cylinder arrangements 10, 11 are positioned so as to extend along each gantry leg 5, 6, and operate between drill floor 2 and yoke 8, for moving yoke 8 vertically along guide rails 7.

The yoke 8 is provided with a plurality of sheaves 12, preferably four, for running the wire lines 13. Wire lines 13 extend from drill floor 2 along each gantry leg 5, 6, over sheaves 12 and down to top drive 9. By retracting and extending the piston-cylinder arrangement 10, 11, it is thereby possible to raise and lower top drive 9.

In Figures 2, 3 and 4 the function of the hoisting system is seen most clearly. In Figures 2 and 3 the piston-cylinder arrangement 10, 11 is shown in a completely retracted state. Top drive 9 is then at its lowermost position, quite close to the drill floor. Yoke 8 is at the upper end of the piston-cylinder arrangement.

When the pistons in the piston-cylinder arrangement are extended, yoke 8 is lifted along guide rails 7 up to the top of derrick 1. The top drive is then lifted, as a result of the transmission generated as wire lines 13 are run over sheaves 12, from its position adjacent drill floor 2 to a position directly below yoke 8. The height to which top drive 9 is hoisted is thus the double of that to which yoke 8 is lifted.

There may, for example, be as many as eight wire lines 13 arranged in the hoisting apparatus described above, with the wire lines being strung two by two in their respective tracks over the same sheave 12. Four sheaves are arranged in pairs at each end of yoke 8. Wire lines 13 are thus arranged in two sets 13a and 13b, extending from attachment points 14a and 14b at drill floor 2, over sheaves 12 and down to top drive 9. Attachment points 14a and 14b are spaced apart horizontally by a distance corresponding approximately to the length of yoke 8.

Wire lines 13 will seldom be of exactly the same length or exhibit exactly the same elasticity module. Therefore, as a rule, there will be different tensions in the wire lines 13. This can result in increased strain on some of the individual wires, which in turn increases the wear and tear thereof.

To help alleviate this problem, there is proposed according to the invention the provision of a tension equalizer assembly 15 at the point of attachment 14 of wire lines 13 adjacent drill floor 2.

The tension equalizer assembly 15 is seen most clearly in Figures 5-7. In Figure 5 we see that wire lines 13 in each wire set are rotatably attached in pairs to their respective ends of a wire pair balance arm 16 for each pair of wires. Each wire pair balance arm 16 is pivotably attached, via its respective wire pair bar 17 extending downward from the center of wire pair balance arm 16, to one end of a wire set balance arm 18. Wire set balance arm 18 is in turn pivotably attached, via a wire set bar 19 extending downward from the center of wire set balance arm 18, to an angle lever 20a, which is best seen in Figure 6.

Angle lever 20a consists of a horizontal arm 21, extending in the direction of the opposing wire set 13b, and two vertical downward-oriented arms 22. Arms 22 are firmly connected to arm 21 via two horizontal bars 23, which extend perpendicularly to arm 21, and arms 22 are firmly connected to arm 21 at the end thereof opposite to the attachment point for wire set bar 19, and to arms 22 at the uppermost end thereof.

Angle lever 20a is pivotably mounted in drill floor 2 about bar 23. The lowermost ends of arms 22 are rotatably connected to their respective balance bar 24. Balance bars 24 extend horizontally in a direction toward the opposing wire set 13b. Here, balance bars 24 are rotatably connected to an angle lever 20b corresponding to angle lever 20a. In other respects the tension equalizer assembly 15 has an identical form at attachment point 14b for wire set 13b.

If, for example, one of the wires 13 in wire set 13a were to be slightly shorter than the other wires 13, this would pull on wire pair balance arm 16, causing it to assume a tilted position, with the end to which the shortest wire is attached being furthest up. If both of
5 the wires 13 in this pair of wire lines were to be shorter than the wires attached to the other wire pair balance arm 16 in wire set 13a, then wire set balance arm 18 would also assume a tilted position.

If the wire lines in wire set 13a together exert a greater tension than the wire lines in
10 wire set 13b, then the arm 21 of angle lever 20a would be drawn upward causing the arms 22 and therewith also balance bars 24 to be drawn in a direction away from the other wire set 13b. The opposite angle lever 20b would thereby also be turned about its attachment point in drill floor 2, thus exerting tension on wire set 13b, which tension is further equalized between the individual wire lines in wire set 13b in the same manner
15 as for wire set 13a.

With the aid of the above described wire tension equalizer assembly 15, it is possible to avoid overloading and/or premature wear and tear on individual wires. It is also possible to reduce the demands for tolerance with respect to, for example, the length of
20 the wires. Furthermore, it is possible to utilize a plurality of thinner and more flexible wires instead of a few heavier wires, inasmuch as the tension may be uniformly distributed among all of the wires.

Although, in the above, there is described a tension equalizer assembly comprising a
25 plurality of balance arms, it is clear that with the use of fewer wires, there would be no need for as many arms. When using only one wire line on each side, for example, this one wire could, of course, be connected directly to arm 21.

P a t e n t C l a i m s

1.

An apparatus for a derrick, comprising two or more hydraulic piston-cylinder
5 arrangements (10, 11) for raising and lowering a yoke (8) which travels on guide rails
(7) in the derrick (1) itself, where two or more wire lines (13) are strung over sheaves
(12) rotatably attached to the yoke, which wire lines (13) are attached at one end thereof
to the top drive (9) and at the other thereof are secured to an attachment point (14a, 14b)
adjacent to a drill floor (2), said two or more wire lines being run in two sets (13a, 13b)
10 of lines, the attachment points (14a, 14b) for which are spaced apart,
characterized in that the attachment point (14a, 14b) for each set of wire lines
is connected to its respective end of at least one balance bar joined to the drill floor (2),
which bar is movable in order to equalize different tensions in the wire lines (13).

15 2.

The apparatus in accordance with claim 1, characterized in that the wire lines
(13) are connected to the balance bar (24) via an angle lever (20a, 20b) for each wire set
(13a, 13b), which angle lever (20a, 20b) is pivotably mounted in the drill floor (2), that
the wires are attached to one arm (21) of the angle level (20a, 20b) and that the balance
20 bar (24) is attached to the other arm (22) of the angle lever (20a, 20b).

3.

The apparatus in accordance with claim 1 or 2,
characterized in that the wire set (13a, 13b) is connected to the angle lever
25 (20a, 20b) via a wire set balance arm (18), said wires (13) being attached to the ends of
the wire set balance arm (18), while the angle lever is attached to the center of the wire
set balance arm (18).

4.

The apparatus in accordance with claim 1, 2 or 3,
30 characterized in that the wire set (13a, 13b) is connected to the wire set
balance arm (18) via two wire pair balance arms (16), said wires (13) being attached to
the ends of the wire pair balance arms (16), whereas the wire set balance arm (18) is
attached to the center of the wire pair balance arms (16).

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