

PATENT SPECIFICATION

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DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Improvements in Derrick Cranes and Swinging Derricks.

We, SPEEDCRANES LIMITED, of Tarmachan Street, Gourock, Renfrewshire, Scotland, a British Company, 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:—

The invention relates to derrick cranes and swinging derricks and particularly to means for promoting speed and accuracy of operation, wide range of working, and stability when under load.

The invention has particular application to derrick cranes and swinging derricks used for loading and unloading ships in which work it is essential that maximum stability is available so as to ensure that any fore and aft, sideways (port or starboard) or other movement of the ship which may occur while work is in progress does not interfere with safe and rapid handling of the cargo.

Unless the structure is firmly mounted and the members of the rigging used for effecting movement of the crane are properly designed, rigged and adjusted in strength, length and disposition so that the interaction and combination of stresses applied in each of the members are correlated with the incidental stresses which arise in other members during operation there is a danger that a member of the rigging may be damaged or broken and/or the load go out of control.

It is possible, for example, in the operation of a derrick crane or a swinging derrick for the stresses to become unbalanced so that effort exerted to slew or swing the derrick may result in a build up in the topping or luffing rigging of tension in excess of the slewing effort with the result that an operation intended to slew the derrick becomes secondary to a topping operation and positive control of the load is lost.

It is among the objects of the invention to avoid such disadvantages and to provide a derrick in which the stresses and strains in the several members are balanced at all times during operation and when at rest.

According to the invention there is provided a derrick crane having separate cable means for effecting a topping movement and a slewing movement of the jib and balance means, interconnecting said cable means and including a pulley member secured to the jib, or a rigid member secured to the jib, said balance means being effective to ensure that a force exerted by the cable means for effecting a topping movement is not exceeded by the resultant force in the cable means for effecting a slewing movement, and a force exerted by the cable means for effecting a slewing movement is not exceeded by the resultant force in the cable means for effecting a topping movement.

Thus the means for dividing the topping effort may comprise one or more delta plates, rings or shackles, or equivalent means and/or pulley sheaves and the means for dividing the slewing effort may comprise one or more delta plates, rings or shackles and/or pulley sheaves or rigid members pivotally secured to the jib of the derrick and to the slewing rigging.

The invention is illustrated by way of example in the accompanying diagrammatic drawings, in which:—

Figure 1 shows the rigging of the jib head of a swinging derrick;

Figure 2 shows the mast, jib, the jib trunnion or gooseneck, and the rigging for topping, slewing, and cargo lifting;

Figure 3 shows an alternative rigging for topping and slewing, and

Figure 4 shows in 4a, 4b, and 4c to 4f, the distribution and the relative values of forces in the topping and slewing rigging

for the constructions illustrated in Figures 1 and 2, Figure 3, and four additional alternative systems of rigging respectively, and, in 4g, a construction including rigid members

5 pivotally secured to the jib and to the slewing rigging.

In the construction illustrated in Figures 1 and 2 the mast is denoted by 1, the jib, which is adapted to turn on pintle or trunion means disposed at or near the base of the mast, by 2, and the topping wire by D.

The topping wire D is led from topping winch A to pulley sheaves 3, 4 and 5, and is then secured to a delta plate 6 from which 15 two wires or ropes F pass to two pulley sheaves 7, each of which is secured to the jib 2, around further pulley sheaves 8, and are then secured to the jib 2 at 9. These compensate for (a) any twisting action on derrick head when the derrick is being slewed (b) 20 afford assistance in level luffing and level slewing and (c) reduce slewing stress on the jib and topping rigging.

Slewing wires E from slewing winch B pass around slewing blocks 10 and are secured to the pulley sheaves 8. The slewing blocks are positioned so as to give slewing spread, align the slewing wires, and reduce end bending moment.

30 C denotes the cargo loading winch from which the lifting wire, shown in dotted lines, passes over pulley sheave 11 near the top of the mast and over pulley sheave 12 at the top of the jib to hang vertically in a position ready for use.

35 After rigging, a "preventor" wire or cable H is included, one end being attached to the delta plate 6 and the other to the jib, with sufficient slack to allow free movement of the delta plate without fouling the rigging.

40 In operation the topping movement, that is to say, the movement of the jib in a vertical plane, is effected by operation of the winch A which acts through the topping wire D, the pulley sheaves 3, 4 and 5, the delta plate 6, and the pulley sheaves 7.

45 The slewing movement, that is to say, any positive side-way movement of the jib, is effected by operation of the winch B which acts through the slewing lines E and the pulley sheaves 8.

50 As shown in the diagram of forces in Figure 4a, a force of 1 ton, for example, on a slewing wire, results in a tension of $\frac{1}{2}$ ton, in each of the topping wires secured to the delta plate 6, and therefore a tension in the topping line D of 1 ton. There is therefore no danger of the balance of forces between slewing and topping being upset by having the resultant force in a 55 topping wire during a slewing operation greater than the slewing force.

60 In the construction and alternative system of rigging illustrated in Figure 3 the jib 2 is pivotally secured to the mast near the

base of the mast and a delta plate 6 is used to balance the slewing effort in the slewing system. The two slewing wires E, port and starboard, from the slewing winch B are each connected to the base of the delta plate 6, after passage of each through a pulley sheaves lay out comprising, two sheaves 10 secured to the mast 1, two lower slewing block systems denoted by X and Y and an upper slewing block system denoted by Z, 75 and, if required, through grouping blocks or sheaves G. The lower slewing block systems X and Y are located at the limits of the required slewing spread, and connection of the upper slewing block Z to the jib 2 is made by means of slewing pendants denoted by E¹.

The path of each of the two slewing wires is; from winch B to sheave 10, to lower slewing block X, to the upper slewing block Z, to lower slewing block Y and then, either direct to delta plate 6 or, by the alternative route indicated in dotted lines, through sheaves or blocks G to delta plate 6.

In the topping (or luffing) system the line from the topping winch is passed through a pulley sheave block 3¹ near the top of the mast to a pulley sheave 4¹ at the end of the jib and back to a second pulley sheave block 5¹ near the mast head and then to the apex 95 of the delta plate 6.

The four additional alternative force diagrams shown in Figure 4 result from the inclusion of additional pulley sheaves and/or from different dispositions of pulley 100 sheaves and delta plates in the rigging.

The topping span or spans can be rigged from separate wires, but preferably from one and the same wire, that is to say, the topping span is virtually a single acting two-way 105 purchase which equally distributes the loading so that in the outboard position there is no extreme loading on the long or trailing slew tackle and the loading throughout the wire is constant so that there is no slackening of the wire on either of the outboard spans.

As the topping and luffing systems are correlated when the ship is on a level keel the locus of the derrick head is maintained at 115 a constant distance from a horizontal plane until the distance is altered by heaving on the topping or luffing winch.

WHAT WE CLAIM IS:—

1. A derrick crane having separate cable 120 means for effecting a topping movement and a slewing movement of the jib and balance means, interconnecting said cable means and including a pulley member secured to the jib, or a rigid member secured to the jib, 125 said balance means being effective to ensure that a force exerted by the cable means for effecting a topping movement is not exceeded by the resultant force in the cable means for

for the constructions illustrated in Figures 1 and 2, Figure 3, and four additional alternative systems of rigging respectively, and, in 4g, a construction including rigid members pivotally secured to the jib and to the slewing rigging.

In the construction illustrated in Figures 1 and 2 the mast is denoted by 1, the jib, which is adapted to turn on pintle or trunnion means disposed at or near the base of the mast, by 2, and the topping wire by D.

The topping wire D is led from topping winch A to pulley sheaves 3, 4 and 5, and is then secured to a delta plate 6 from which two wires or ropes F pass to two pulley sheaves 7, each of which is secured to the jib 2, around further pulley sheaves 8, and are then secured to the jib 2 at 9. These compensate for (a) any twisting action on derrick head when the derrick is being slewed (b) afford assistance in level luffing and level slewing and (c) reduce slewing stress on the jib and topping rigging.

Slewing wires E from slewing winch B pass around slewing blocks 10 and are secured to the pulley sheaves 8. The slewing blocks are positioned so as to give slewing spread, align the slewing wires, and reduce end bending moment.

C denotes the cargo loading winch from which the lifting wire, shown in dotted lines, passes over pulley sheave 11 near the top of the mast and over pulley sheave 12 at the top of the jib to hang vertically in a position ready for use.

After rigging, a "preventor" wire or cable H is included, one end being attached to the delta plate 6 and the other to the jib, with sufficient slack to allow free movement of the delta plate without fouling the rigging.

In operation the topping movement, that is to say, the movement of the jib in a vertical plane, is effected by operation of the winch A which acts through the topping wire D, the pulley sheaves 3, 4 and 5, the delta plate 6, and the pulley sheaves 7.

The slewing movement, that is to say, any positive side-way movement of the jib, is effected by operation of the winch B which acts through the slewing lines E and the pulley sheaves 8.

As shown in the diagram of forces in Figure 4a, a force of 1 ton, for example, on a slewing wire, results in a tension of $\frac{1}{2}$ ton, in each of the topping wires secured to the delta plate 6, and therefore a tension in the topping line D of 1 ton. There is therefore no danger of the balance of forces between slewing and topping being upset by having the resultant force in a topping wire during a slewing operation greater than the slewing force.

In the construction and alternative system of rigging illustrated in Figure 3 the jib 2 is pivotally secured to the mast near the

base of the mast and a delta plate 6 is used to balance the slewing effort in the slewing system. The two slewing wires E, port and starboard, from the slewing winch B are each connected to the base of the delta plate 6, after passage of each through a pulley sheaves lay out comprising, two sheaves 10 secured to the mast 1, two lower slewing block systems denoted by X and Y and an upper slewing block system denoted by Z, and, if required, through grouping blocks or sheaves G. The lower slewing block systems X and Y are located at the limits of the required slewing spread, and connection of the upper slewing block Z to the jib 2 is made by means of slewing pendants denoted by E¹.

The path of each of the two slewing wires is; from winch B to sheave 10, to lower slewing block X, to the upper slewing block Z, to lower slewing block Y and then, either direct to delta plate 6 or, by the alternative route indicated in dotted lines, through sheaves or blocks G to delta plate 6.

In the topping (or luffing) system the line from the topping winch is passed through a pulley sheave block 3¹ near the top of the mast to a pulley sheave 4¹ at the end of the jib and back to a second pulley sheave block 5¹ near the mast head and then to the apex of the delta plate 6.

The four additional alternative force diagrams shown in Figure 4 result from the inclusion of additional pulley sheaves and/or from different dispositions of pulley sheaves and delta plates in the rigging.

The topping span or spans can be rigged from separate wires, but preferably from one and the same wire, that is to say, the topping span is virtually a single acting two-way purchase which equally distributes the loading so that in the outboard position there is no extreme loading on the long or trailing slew tackle and the loading throughout the wire is constant so that there is no slackening of the wire on either of the outboard spans.

As the topping and luffing systems are correlated when the ship is on a level keel the locus of the derrick head is maintained at a constant distance from a horizontal plane until the distance is altered by heaving on the topping or luffing winch.

WHAT WE CLAIM IS:—

1. A derrick crane having separate cable means for effecting a topping movement and a slewing movement of the jib and balance means, interconnecting said cable means and including a pulley member secured to the jib, or a rigid member secured to the jib, said balance means being effective to ensure that a force exerted by the cable means for effecting a topping movement is not exceeded by the resultant force in the cable means for



effecting a slewing movement, and a force exerted by the cable means for effecting a slewing movement is not exceeded by the resulting force in the cable means for effecting a topping movement.

2. A derrick crane according to claim 1 in which the said balance means include one or more delta plates.

10 3. A derrick crane according to claim 1 in which said balance means include a delta plate included in the cable means for effecting a topping movement of the jib, first pulley members secured to the jib adjacent the head of the jib and around which rigging

members from the delta plate are passed said rigging members being then secured to the jib to form bights in the rigging and second pulley members located in said bights, the cable means for effecting slewing of the jib being secured to said second pulley members.

4. A derrick crane substantially as hereinbefore described and illustrated in the accompanying drawings.

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