ABSTRACT: A crane or swinging derrick which can be quickly and easily converted for lifting either light or heavy loads by means of pulley block members which are secured to the jib when operating with light loads and are released from the jib to engage the lifting line of the rigging when operating with heavy loads and one or more pulley blocks, in particular an adjustable friction block, disposed in the rigging to assist in controlling the movement of the load during lifting and or transfer of the load.
The invention relates to cranes, derricks, or like lifting gear and, in particular to the conversion of such gear for dealing economically with either heavy or light loads and to the control of the load during lifting or slewing of the jib.

The invention has particular application to cranes, derricks, or like lifting gear, which include a winch with twin barrels rotating in the same direction or a winch having a single barrel with a central flange, the cargo wire or wires being secured to each barrel, or to each of two of the parts of the single barrel adjacent to the central flange, in such a way that the two ends of the one wire, or the ends of the two wires, wind on or pay out at the same time.

A winch having twin barrels, one of which may be put out of operation, may also be used.

More particularly the invention relates to such cranes or derricks winch, so as to provide for lifting either light or heavy loads which can be changed for use with relatively light loads.

It is a disadvantage with known constructions that a long labor-consuming process of rerigging the crane is required to change from lifting and transferring from ship to dock, or vice versa, relatively light loads, say 1 to 5 tons, to lifting and transferring heavy loads, say 20 tons and upwards.

It is among the objects of the invention to reduce the time taken and the labor force required to effect the necessary changes in the rigging of the crane from that required for work with heavy loads to that required for smaller loads.

It is also a disadvantage of known constructions that prevention of a pendulum or swinging movement of the load during operation of the lifting gear is effective mainly only with respect to swirling and, furthermore, that the stresses imposed on the members of the apparatus are sometimes excessive.

It is among the objects of the invention to prevent or minimize oscillation of the load in all directions during operation of the lifting gear in a controlled manner and without submitting the supporting structure to undue stresses.

According to the invention means for converting a crane or swinging derrick, so as to provide for lifting either light or heavy loads comprises pulley block members adapted to be secured to the jib or outrigger of the jib of the crane when operating with light loads and to be released from the jib and to engage the lifting line of the rigging of the crane when heavy loads are to be lifted.

Thus, for example, by disengaging a pulley block, disposed according to the invention and comprising two pulleys, from the jib and interposing the pulley block in the lifting line of the crane a single purchase lifting effort can be converted to a multiple purchase, for example, a four-part purchase.

According to the invention furthermore, means for controlling the movement of a load during lifting (luffing of the jib) and transfer (slewing of the jib) of the load by a crane, derrick or the like comprises pulley blocks and the like disposed in the rigging of the crane or derrick and adapted for cooperation with an adjustable friction block having a lining of material with a relatively high coefficient of friction.

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

FIGS. 1-4 illustrate the conversion, by means of pulley blocks comprising one or more pulleys, from a single part purchase to a multiple part purchase as, for example, a two, three, four, five or six part purchase as required.

In FIGS. 1-4 the cargo rope is denoted by A, the cargo block by B, standard sheaves of pulleys by C and D, and E an additional cargo block.

An alternative or additional cargo block means are denoted by E1 and E2 (FIG. 2) and alternative or additional pulleys by D1, D2 and D3.

In the construction shown in FIG. 1 the full lines show the cargo rope A passing over pulleys C and D to the cargo block suspended from the head of the jib to give a single part purchase.

By inserting cargo block E in a bight of the rope intermediate C and D and anchoring B to any part of the jib structure a two part purchase is obtained.

By securing B to E, as shown in the dotted lines, a three part purchase is obtained.

Instead of using a pulley sheave D a swivel eye block can be used.

FIG. 2 shows the arrangement of pulley means adapted for a different shape of jib head, as for example a jib of box section.

FIG. 3 shows a construction in which a pulley D2 is included to provide toppling relief. With cargo block E1 inserted in the bight of the rope between C and D, a single, two part, or three part purchase is afforded depending on whether B is used as the cargo block, is secured to the jib structure or to E1. By inserting the twin cargo block E2 a two part, three part, four part, or five part purchase is afforded.

FIG. 4 shows a construction with pulleys C, C1, D, D1, and pulley blocks B, E, and E2 disposed in the bight of the rope A adapted to provide from single to six-part purchases and also an antipendulum effect on the load during lifting and/or slewing of the jib.

FIG. 5 shows a construction in which pulleys F1 and F2 are interpolated between C and D and C1 and D1 respectively so that the pulley block B is disposed centrally between E and E2 to provide a balanced loading of the cargo head.

FIG. 6 shows a construction to provide an antioscillatory effect similar to that of FIG. 4 but in which by connection of pulley block B in the manner shown to the two blocks E1 and E2 a twin single part purchase or alternatively a double three part purchase is afforded.

FIGS. 7, 8 and 9 illustrate a construction using either a single or double rope and either a double-barrelled winch or a single barrel winch provided with a dividing central flange, in which an adjustable friction block having a lining of material of relatively high coefficient of friction is utilized to minimize the oscillatory effect during movement of the load.

FIG. 7 shows the disposition of lifting wires and pulley sheaves, and FIGS. 8 and 9 illustrate the manner in which the disposition and operation of the lifting gear according to the invention can be quickly adjusted to provide for economic operation with heavy or light loads and also a modified construction in which joining links are included in the rigging.

In the constructions illustrated in FIG. 7 in which two wires are employed the parts (denoted as R & S) of the wires adjacent the winch are passed over blocks L and N attached to the load hook means and then (denoted as B1 and B2) to blocks F and G and then (denoted as in FIG. 1B) forward in a substantially horizontal plane to blocks N and K and then (denoted as in A1 and A2) to an adjustable friction block P.

The two wires are passed round block P at least one turn in opposite directions and securely fastened to the sheave, thus forming an oblique prism or polyhedron with the hook or load attachment means at the apex.

If one endless wire is used it is passed round block P at least twice.

If during operation the load tends to move in the direction of the arrows T and/or U, the movement either shortens or lengthens A1 and A2, thereby making B1 and B2 lift or lower the load. The effort involved in lifting the load in turn exerts through block P a restraining effect on the movement of the load hook.

If during operation, movement of the load takes place in the direction of the arrows W and/or V, then C1, C2, B1 and A1 will lengthen or shorten and C2, B2 and A2 will shorten while C1, B1 and A1 lengthen, and vice versa.

Any pendulation which takes place because of the movement already described, will cause A1 and A2 to rotate block P and the effect of the load on the adjustable friction block P will, by engaging the lining of material of relatively high coefficient of friction slow up and retard the changing lengths of C1, B1 and A1, and C2, B2 and A2 and thereby reduce pendulation.

FIGS. 8 and 9 illustrate how, in combination with the antipendulum effect construction illustrated in FIG. 7 rapid ad-
justment of the number of "purchases" can be effected to deal with heavy loads or light loads as the occasion demands.

FIG. 8 shows (in full lines) wires or ropes A₁-A₄ and supporting block P in a position which enables a load within the winch power to be lifted at winch speed and, (in dotted lines) A₁'-A₄' and supporting block P disposed to effect lifting of heavy loads. In the first case, L and N are pulled into the upper position shown and secured in that position. FIG. 9 shows a view from the front of the frame of the disposition of the sheaves and blocks for operation in the above rig.

Alternatively block P can be secured to a structure in a position between blocks H and K, and blocks L and N can be used to provide a four part purchase to lift a load of approximately twice the power of the winch and at half the winch speed.

Joining links X and Y comprising suitable sockets or shackles with or without ball bearing swivels may be provided as shown at the end of rope A₁ between H and P and at the end of rope A₄ between K and P and disposed at such distances on either side of the block P that the connecting means will not foul block P in any movement which may take place in the friction damper rope which connects the joining links X and Y and passes around the friction block P and such that the joining links X and Y will not foul blocks H and K in general use.

The friction damper rope is attached to the above-mentioned joining links X and Y on A₁ and A₄ and passes round friction block P.

This construction provides a convenient method of removal and replacement of the friction damper rope should wear occur and also facilitates the rigging of the crane since it is not necessary to deal with the whole of ropes A₁ and A₄.

FIG. 10 shows the head of the jib of a crane and the means for converting from light duty to heavy duty operation.

In FIG. 10 the head of the jib carries a lifting line which passes around a pulley, not shown in the drawing, but located in a position on the head of the jib on the other side of the jib from pulley 4 in a position corresponding to the pulley 4, the conversion pulley block member 5 comprising two pulleys and being secured to the jib.

To convert to four part purchase the pulley block member 5 is released from the jib 1 by removing pin 6 to receive the lifting wire 2 which then follows a path from pulley (such as pulley D₁ in FIG. 2), to which it is secured, to and around one pulley of the pulley block member 5, around directing pulley 7 (which corresponds to pulley block E₁ in FIG. 2) secured to the jib, and around the other pulley (pulley block E₂ in FIG. 2) (which corresponds to pulley D in FIG. 2) of the pulley block member 5, and to and around pulley 4 (pulley C in FIG. 2) and to the lifting winch (not shown). In this mode, the load is lifted at half the winch speed.

It will be understood that neither pulley block member 5 nor directing pulley 7 will engage the lifting line so that the crane can run freely when operating single purchase, thereby permitting a load to be lifted at the winch speed, and that the position of the pulley block member 5 and the directing pulley 7 are such that conversion can be simply effected.

The four part purchase may be converted to a five part purchase by providing a connecting or link line between a ring on the jib head and a crossmember of the pulley block member 5.

The invention provides a comprehensive lifting apparatus which provides for:

1. An antidendulum effect in all directions; lifting of loads which may be two or three times the pull available at winch at a half or one-third winch speed.

2. A quickly adaptable method of reducing the number of "purchases" so that loads equal to winch power can be moved at winch speed with an antidendulum.

3. A method of obtaining the above facilities without imposing violent stresses on the supporting members.

I claim:

1. A crane including at least one cargo block member, at least one cargo-lifting line and means for converting the crane to provide for lifting either light or heavy loads, comprising a pulley block member adapted to be secured to the jib of the crane while leaving the lifting line free of load bearing engagement with the pulley block member when operating with light loads and to be released from the jib and to engage the lifting line of the rigging of the crane when heavy loads are to be lifted, and cooperating means for controlling movement of the load during lifting and during transfer of the load, said cooperating means comprising pulley blocks disposed in the rigging of the crane and an adjustable friction block having a suitably high coefficient of friction, a friction damper rope, and links comprising shackles disposed in the lifting line adjacent the adjustable friction block to secure said friction damper rope to said line, said damper rope passing around the adjustable friction block so that said friction damper rope will engage said friction block to retard the movement thereof.