

Jan. 23, 1968

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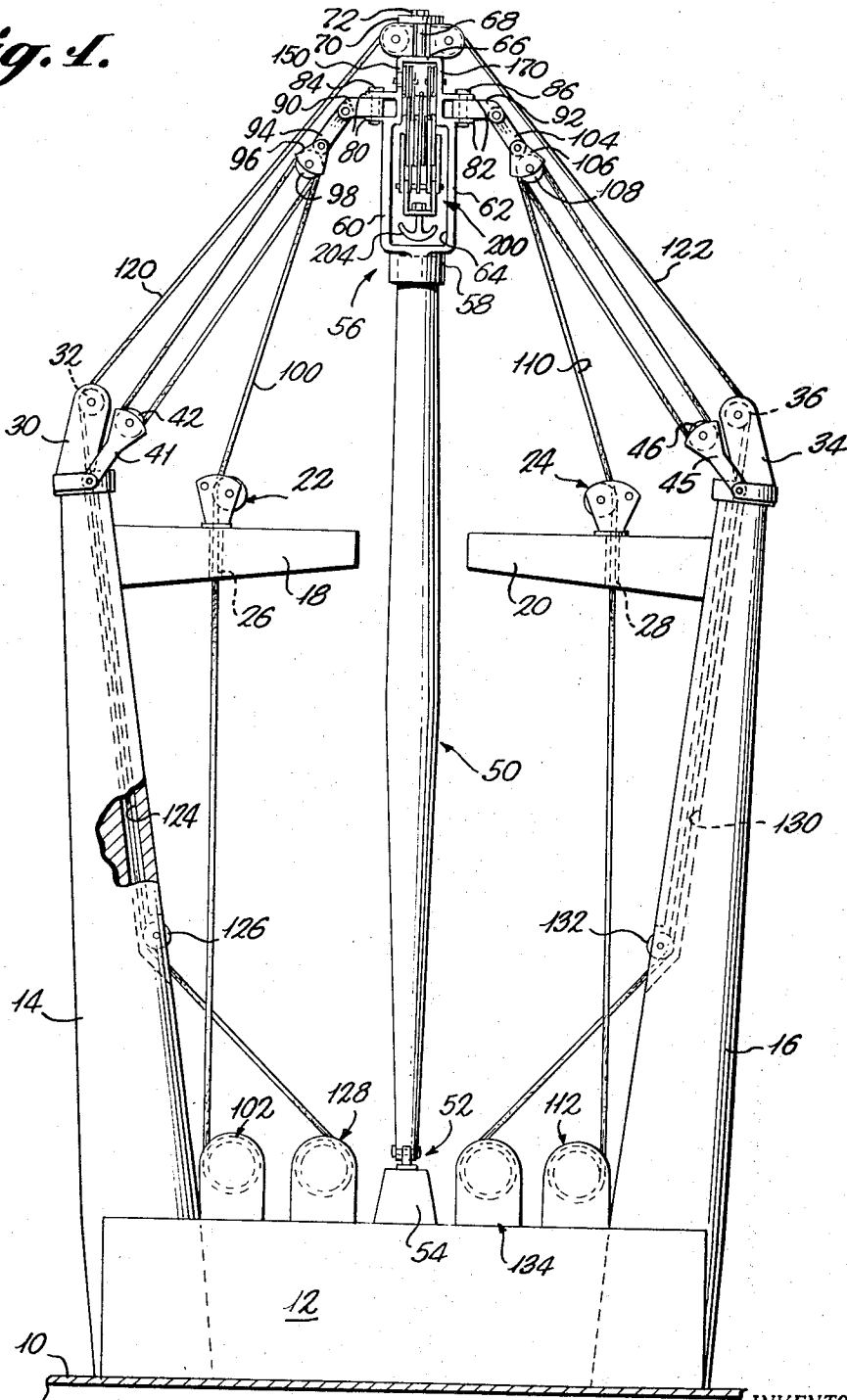
3,365,074

CARGO HANDLING APPARATUS

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Fig. 1.



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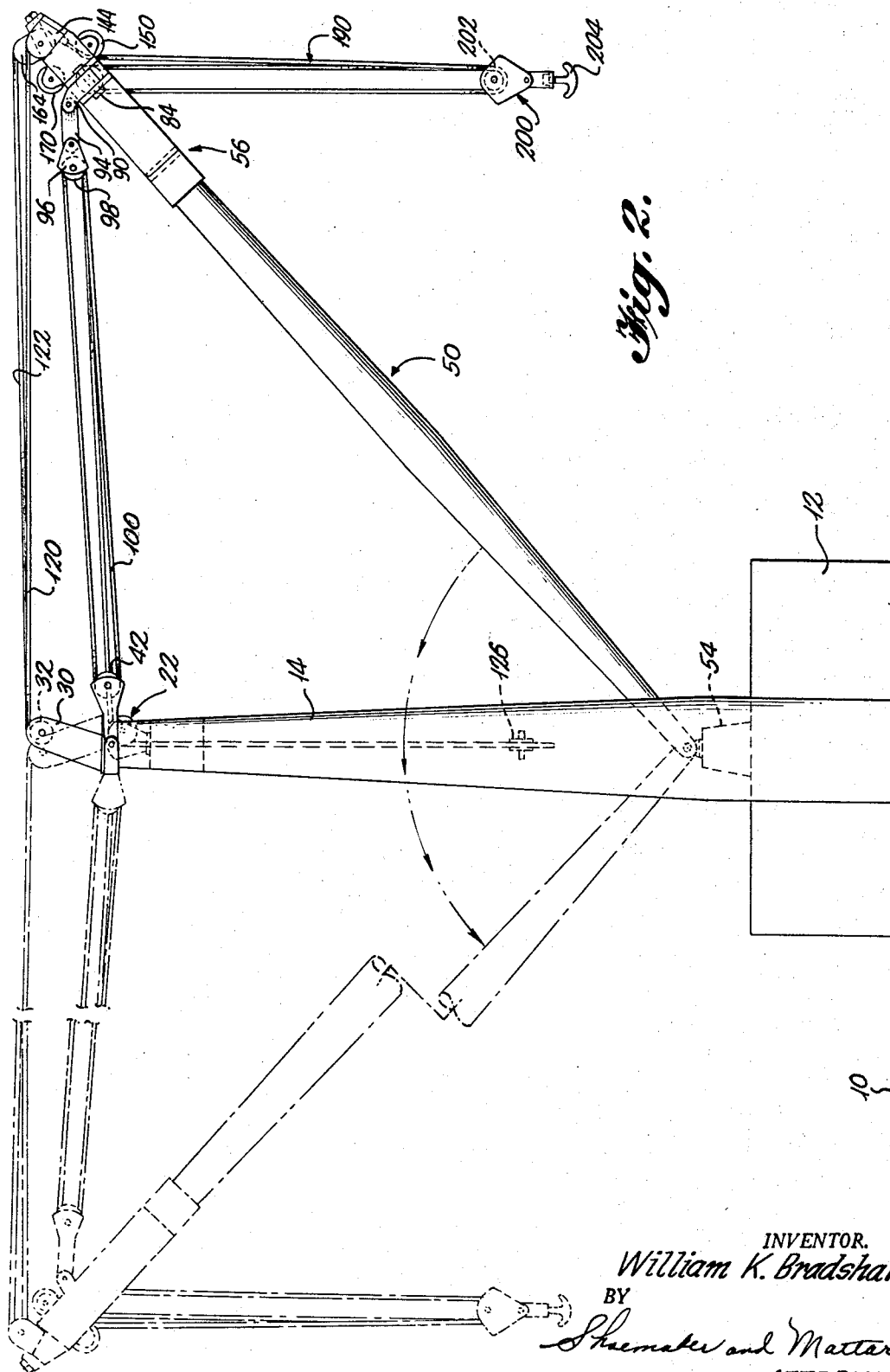
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Fig. 3.

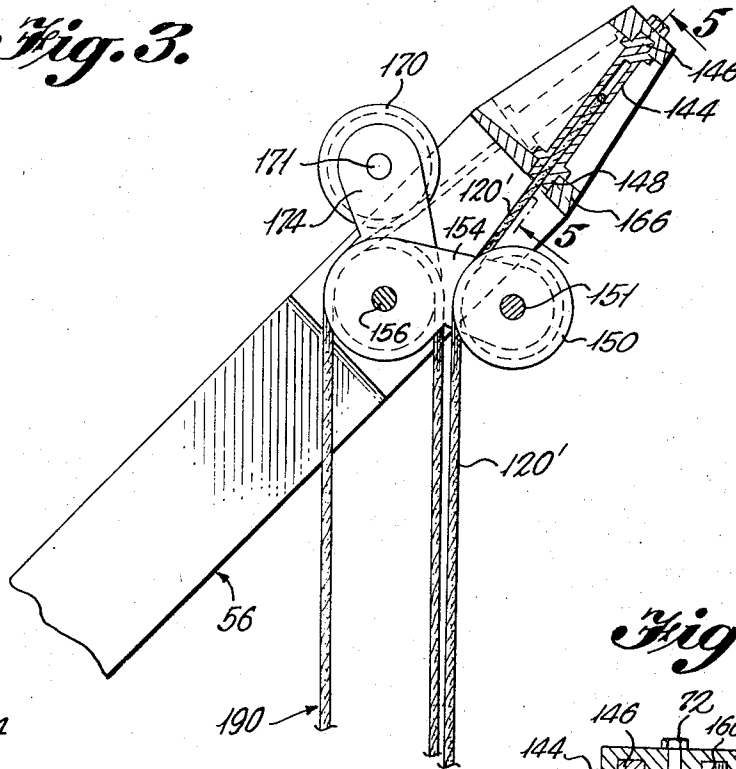


Fig. 5.

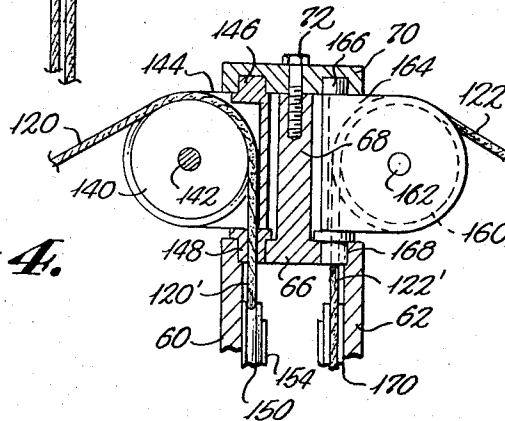
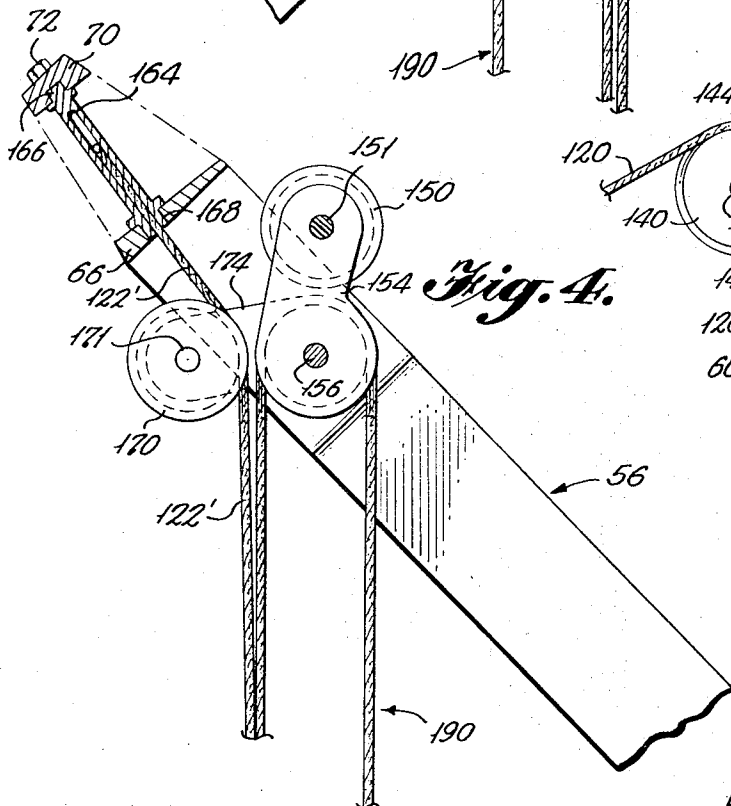


Fig. 4.



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Fig. 6.

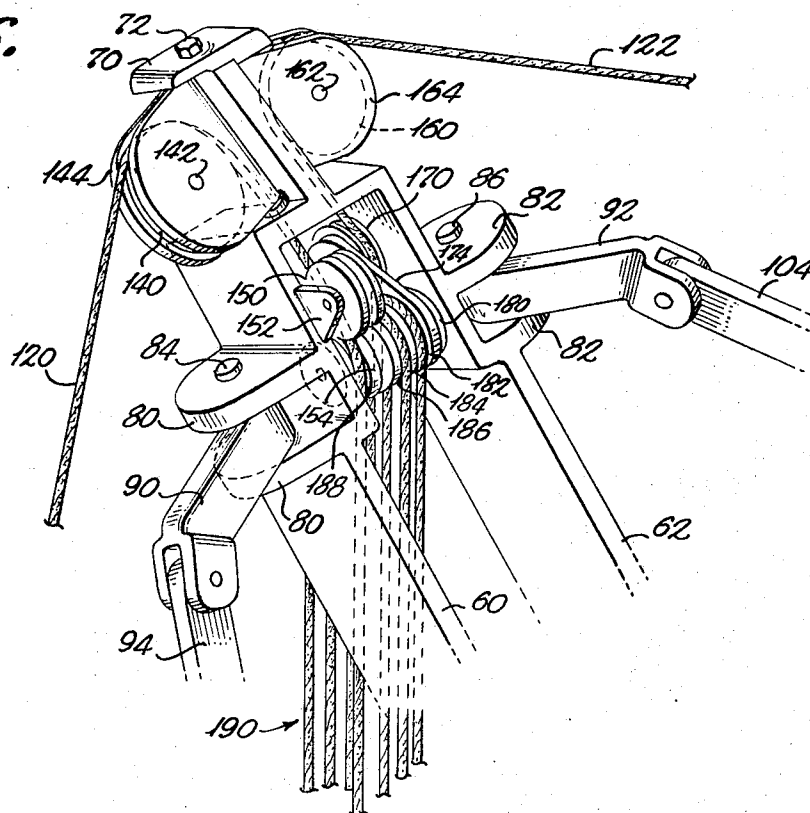
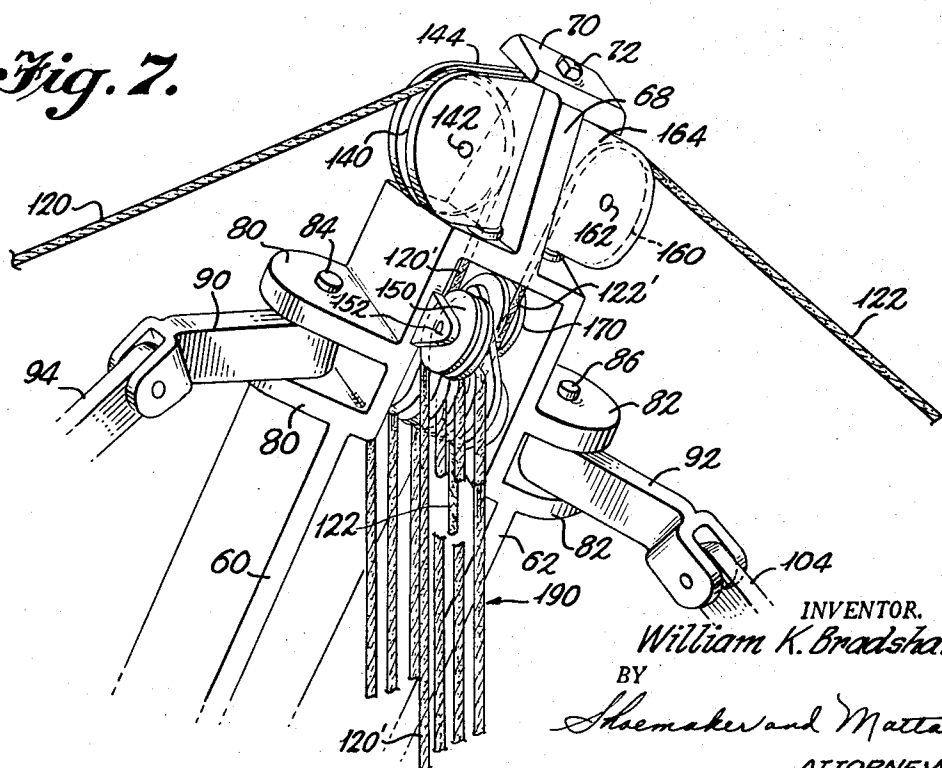


Fig. 7.



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CARGO HANDLING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A heavy lift boom for shipboard use is provided to be swung between the king posts adjacent thereto. The upper end of the boom defines spaced portions so that the lower purchase block means can be swung therethrough, while the upper purchase block means includes sheave means mounted for rotation about an axis of rotation which is fixed with respect to the boom. Suitable fairlead sheaves and guide sheaves are provided for preventing fouling of the cargo fall cable.

The present invention relates to new and novel cargo handling apparatus, and more particularly, to a heavy lift boom as employed on shipboard.

The heavy lift boom of the present invention is especially adapted for use with a plurality of hatches, namely one hatch forward of the boom step and another hatch aft of the boom step. The boom is adapted to be employed with both a forward and an aft hatch without disassembling the gear, without requiring the use of special complicated and expensive fittings and mechanisms and further without requiring very careful coordination of operations when switching from one hatch to another.

The arrangement of the present invention is especially designed so that the boom may be swung between the king posts from one hatch to another in a simple manner so that relatively untrained operating personnel can carry out the maneuver with safety and without difficulty and without fouling the various cables and associated components; and further wherein the time required to carry out the operation is reduced to a minimum.

In order to carry out this desired end result, the upper portion of the boom is provided with spaced portions defining an opening through which the lower purchase block means of the cargo fall means is adapted to swing when the boom is in a substantially vertical topped position. Pivotaly mounted fairlead sheaves and associated guide sheaves are mounted on the boom to insure that the various portions of the cargo fall cable will not become fouled when operating at opposite hatches and when swinging through the boom structure as the boom is passed between the king posts.

An important feature of the present invention is the arrangement wherein the number and mass of the swingably mounted components is reduced to a minimum. In the present invention, only the lower purchase block means is actually a swinging member which acts like a pendulum when swung through the upper spaced portions of the boom. The upper purchase block means is disposed in fixed relationship to the boom and no swinging movement thereof is necessary. By so reducing the number and mass of swinging components, the size and complexity of the mounting structure may be substantially reduced.

An object of the present invention is to provide new and novel cargo handling apparatus including a heavy lift boom which is adapted to be used with two different hatches, one forward and one aft of the boom step.

Another object of the invention is the provision of cargo handling apparatus which may be swung through the king posts in a most simple and effective manner without fouling of the various parts, and wherein this

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maneuver can be carried out in a minimum amount of time by relatively unskilled personnel.

A further object of the invention is to provide cargo handling apparatus wherein a minimum number of parts are mounted for swinging movement about an axis at the upper end of the boom.

Still another object of the invention is the provision of cargo handling apparatus which is relatively simple and inexpensive in construction, and yet which is sturdy, reliable and efficient in operation.

Other objects and many attendant advantages of the invention will become more apparent when considered in connection with the specification and accompanying drawings, wherein:

FIG. 1 is a front elevation, partly broken away, illustrating the cargo handling apparatus of the present invention with the boom in a substantially vertical position;

FIG. 2 is a side view of the structure showing the boom in an inclined position;

FIG. 3 is a vertical section taken through the upper portion of the structure shown in FIG. 2;

FIG. 4 is a view similar to FIG. 3 taken on a plane parallel with that of FIG. 3 and illustrating the opposite side of the structure when inclined in the opposite direction from that shown in FIG. 3;

FIG. 5 is a sectional view taken substantially along line 5—5 of FIG. 3 looking in the direction of the arrows;

FIG. 6 is a top perspective view illustrating the upper portion of the boom in the inclined position as illustrated in FIG. 4; and

FIG. 7 is a top perspective view of the upper portion of the boom in the inclined position shown in FIGS. 2 and 3.

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, the upper deck of a ship is indicated by reference numeral 10, a winch housing 12 being supported on this upper deck. It should be understood that the usual ship's gear for loading and discharging cargo may also be mounted on or adjacent to the winch house, but such conventional gear has been eliminated for the sake of simplicity in order that the heavy lift boom mechanism may be more readily understood.

A pair of king posts 14 and 16 extend upwardly from the winch house, the king posts being spaced apart athwart ships and being of a symmetrical tapered configuration. As seen most clearly in FIG. 1, a pair of laterally inwardly projecting brackets 18 and 20 are supported by king posts 14 and 16 respectively. A pair of swivelly mounted topping lift lead blocks 22 and 24 are supported on brackets 18 and 20, the brackets having vertical holes 26 and 28 formed therethrough respectively for receiving the topping lift cables hereinafter described.

A head 30 is rotatably mounted at the upper end of king post 14 and rotatably supports a sheave 32. A block 41 is pivotally connected to head 30 and rotatably supports a topping lift sheave 42. In a similar manner, a head 34 is rotatably mounted at the upper end of the king post 16 and rotatably supports a sheave 36. A block 45 is pivotally connected to head 34 and rotatably supports a topping lift sheave 46.

A heavy lift boom is indicated generally by reference numeral 50, this boom including a heel portion indicated generally by reference numeral 52 which is mounted for substantially universal movement within a boom pedestal 54. The construction of the heel portion of the boom as well as the boom pedestal arrangement may be substantially the same as that shown in U.S. Patent 3,110,403.

The boom has a head portion indicated generally by reference numeral 56 and includes a boom head structure 58 which is rigidly affixed to the upper end of the

boom and defines a pair of spaced portions 60 and 62. An opening 64 extends through the head structure of the boom and between said spaced portions thereof for receiving the lower purchase block means as hereinafter described. The spaced portions of the boom head are joined as indicated at 66, and an integral upstanding portion 68 is provided which has a cap 70 secured thereto as by a screw 72.

A first laterally extending pair of ears 80 projects outwardly from portion 60 of the boom head, and a similar pair of laterally extending ears 82 projects outwardly from the portion 62 of the boom head. A pair of pivot pins 84 and 86 are supported by ears 80 and 82 respectively for swivelly mounting the swivel members 90 and 92 respectively.

A link member 94 is pivotally interconnected with swivel member 90 and is also pivotally connected with a block 96 supporting a topping lift sheave 98. A topping lift cable 100 is reeved over the topping lift sheaves 42 and 98 and passes downwardly over the sheave 22 to the topping winch 102.

A link 104 is pivotally connected with swivel member 92 and is also pivotally connected with a block 106 which rotatably supports a topping lift sheave 108. A topping lift cable 110 is reeved over the sheaves 46 and 108 and passes downwardly over the sheave 24 to a topping winch 112.

The cargo fall cable includes a pair of hoisting leads 120 and 122, the lead 120 passing over sheave 32 extending downwardly through a passage 124 formed in king post 14 and over a sheave 126 to a hoisting or cargo winch 128. The other hoisting lead 122 passes over sheave 36, extends downwardly through a passage 130 in the king post 16 and over a sheave 132 to a hoisting or cargo winch 134.

Referring now particularly to FIG. 5, the hoisting lead 120 passes over a first fairlead sheave 140 rotatably supported on a shaft 142 which is disposed between substantially parallel wall portions of a bracket 144. This bracket includes a first bearing portion 146 of a generally cylindrical configuration which fits within a correspondingly shaped recess provided in cap 70. A second cylindrical bearing portion 148 is provided on bracket 144 in alignment with portion 146, and is disposed within a correspondingly shaped recess provided in portion 66 of the boom head structure. Bearing portion 148 has a bore formed therethrough which is adapted to permit the depending portion 120' of the hoisting lead 120 to pass freely through the bearing portion.

A guide sheave 150 is disposed beneath fairlead sheave 140 and is rotatably supported by a shaft 151 which in turn is supported between a bracket 152 as seen most clearly in FIG. 7 and a further bracket 154 as seen in FIG. 3. Bracket 152 extends integrally from portion 60, while bracket 154 is mounted upon a shaft 156 which extends between the opposite portions 60 and 62 of the boom head structure, the shaft being fixed in such position.

Referring again to FIG. 5, the hoisting lead 122 passes over a sheave 160 rotatably supported on a shaft 162 which is disposed between opposite parallel portions of a bracket 164. This bracket includes a cylindrical bearing portion 166 which is rotatably supported within a correspondingly shaped recess in cap 70. A cylindrical bearing portion 168 is also formed integral with bracket 164 and is rotatably received within a corresponding recess formed in portion 66 of the boom head structure. Bearing portion 168 has a bore formed therethrough which allows the depending portion 122' of the hoisting lead 122 to pass therethrough.

A guide sheave 170 is disposed beneath fairlead sheave 160 and is mounted upon a shaft 171 supported by a first bracket similar to bracket 152 but which extends in the opposite direction from portion 62, this bracket not being visible in the drawings. Shaft 171 is also supported by a second bracket 174 similar to the bracket 154 previously discussed. Bracket 174 extends in an opposite

direction from bracket 154 and is also supported by shaft 156.

It will be noted as seen in FIG. 3 that the bracket 144 is mounted for pivotal movement about an axis of rotation extending through the bearing portions 146 and 148. Accordingly, the associated fairlead sheave is pivotally supported about an axis which is oblique to the longitudinal axis of the boom and which lies in a plane separate and spaced from the plane in which the axis of the boom lies when considering such planes to be disposed substantially fore and aft of the apparatus.

Considering FIG. 4, it will be noted that the bracket 164 is mounted for pivotal movement about an axis extending through the bearing portions 166 and 168 so that the associated fairlead sheave is mounted for pivotal movement about an axis which is also oblique to the longitudinal axis of the boom and which lies in a plane separate and spaced from the plane in which the longitudinal axis of the boom lies when considering such planes to be disposed substantially fore and aft of the apparatus.

When considering the two pivotal axes of the fairlead sheaves as shown in FIGS. 3 and 4, it will be noted that they are inclined in opposite directions downwardly and away from the longitudinal axis of the boom, and this particular relationship of the fairlead sheaves will insure that the hoisting leads are properly guided to the apparatus at all times regardless of the position of the boom.

Considering now the positioning of the guide sheaves 150 and 170, viewed from the front as seen in FIG. 1, it is apparent that the guide sheaves are offset laterally on opposite sides of the longitudinal axis of the boom. Additionally, as seen in FIGS. 3 and 4, these guide sheaves are also offset fore and aft of the boom, the sheave 150 being fore of the longitudinal axis of the boom, while the guide sheave 170 is aft of the longitudinal axis of the boom.

As seen in FIG. 3, when the boom is in this inclined position, the hoisting lead portion 120' passing downwardly from the fairlead sheave 140 will pass over the guide sheave 150, the hoisting lead 120' extending down through the hollow portion between the opposite parallel sides of bracket 144 and through the bore in the bearing portion 148, thence in a more or less straight line to the guide sheave 150. In a corresponding manner, as seen in FIG. 4, when the boom is inclined in the opposite direction, the hoisting lead 122' extends downwardly from the fairlead sheave 160 in the space between the opposite parallel parts of bracket 164 and through the bore in bearing portion 168, and thence in a more or less straight line to the guide sheave 170.

As seen most clearly in FIG. 6, the upper purchase block means of the cargo fall means includes a plurality of sheaves 180, 182, 184, 186 and 188, these sheaves all being rotatably supported upon the shaft of 156 previously described which is disposed in fixed relation between the opposite portions 60 and 62 at the upper end of the boom head structure.

As seen most clearly in FIG. 2, the cargo fall cable portions reeved about the various sheaves of the upper purchase block means are indicated generally by reference numeral 190, this cargo fall cable also being reeved around a plurality of sheaves 202 mounted for rotation upon a common axis in the lower purchase block 200 which supports a cargo hook 204 in a conventional manner.

In order to understand the operation of the apparatus, let it be assumed that the boom is initially in the inclined position as shown in FIGS. 2, 3 and 7. In this position, the hoisting lead 120 extends over fairlead sheave 140 thence down over the guide sheave 150 and downwardly to a first one of the sheaves 202 mounted in the lower purchase block 200. In the example illustrated, there are four such sheaves 202 in the lower purchase block. The hoisting cable is then reeved from the first sheave in

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the lower purchase block to the sheave 186 of the upper purchase block means, thence down over a second sheave of the lower purchase block, thence up over the sheave 184 of the upper purchase block means, thence downwardly over a third sheave of the lower purchase block and upwardly over the sheave 182 of the upper purchase block means. The cable then extends downwardly from sheave 182 over a fourth sheave in the lower purchase block means whereupon it extends upwardly and over and in contact sheave 180 from whence it extends upwardly through the bore formed in the lower bearing 186 of fairlead sheave support bracket 164, and over the fairlead sheave 160. In this position of the apparatus, it will be noted that the guide sheave 150 is supporting the load, while the sheave 180 of the upper purchase block means is supporting the load, and guide sheave 170 is not supporting the load in this particular operative position.

When it is desired to swing through between the king posts for operation at another hatch, the boom means is topped out into its vertical position as shown in FIG. 1. Prior to moving it into this position, the lower purchase block 200 is moved upwardly until it is disposed in a position relatively close to the upper purchase block means so that the lower purchase block and the associated cargo hook may swing through the opening 64 provided at the upper end of the boom. The lower purchase block is then swung through the opening in the boom which is readily accomplished due to the fact the lower purchase block may swing like a pendulum as supported by the upper purchase block means.

The boom may then be moved to the other side of the king posts so that the components may move into the operative position shown for example in FIGS. 4 and 6. The operative relationship of the various parts is substantially the same as previously described with the exception that in this operative position, the guide sheave 150 does not support the load on hoisting lead 120', but this load is now carried by the sheave 188. On the other hand, the load on hoisting lead 122' is no longer carried by sheave 180, but is carried by guide sheave 170.

It will be noted that in the various operative positions of the apparatus, the pivotally mounted fairlead sheaves, and the associated guide sheaves are so interrelated with one another as to automatically guide the hoisting leads into the proper operative position while further assuring that there is no fouling of the lines nor any undue friction or wear applied to any of the portions of the cargo cable. The load will be automatically transferred to the different guide sheaves as the boom swings into the different inclined positions as illustrated.

It is apparent from the foregoing that there is provided according to the present invention new and novel cargo handling apparatus including a heavy lift boom arrangement which is especially adapted for use with different hatches, one forward and one aft of the boom step. The boom may be swung through between the king posts in a safe and expeditious manner without fouling of the cables and components, this maneuver being carried out in a minimal amount of time and being readily accomplished by relatively unskilled personnel. Only the lower purchase block need actually be swung through the upper portion of the boom thereby reducing to a minimum the number of parts which must be swung about an axis at the upper end of the boom. This, of course, minimizes the mass of the moving components and reduces the loading on various members of the structure. The cargo handling apparatus of the present invention is relatively simple and inexpensive in construction, and yet at the same time is quite sturdy, reliable and efficient in operation.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes

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that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

I claim:

1. Cargo handling apparatus comprising a mast structure, a boom having a heel portion and a head portion, means mounting the heel portion of the boom for substantially universal movement, topping lift means connected between said mast structure and said boom, the upper end of said boom defining spaced portions for receiving cargo fall means, a pair of fairlead sheaves movably mounted at the uppermost end of said boom, a pair of guide sheaves rotatably supported by said boom and disposed below said fairlead sheaves on the boom, each of said guide sheaves being positioned so as to receive a portion of a cargo fall cable passing over an associated fairlead sheave, cargo fall means including a cargo fall cable having a pair of hoisting leads each of which passes over one of said fairlead sheaves, upper purchase block means including sheave means mounted for rotation about an axis of rotation, said axis of rotation being fixed with respect to said boom, lower purchase block means for supporting a load and including rotatably mounted sheave means, said lower purchase block means being operatively connected with said upper purchase block means by said cargo fall cable which is reeved around said rotatable sheave means on said upper purchase block means and said lower purchase block means.

2. Apparatus as defined in claim 1 wherein each of said fairlead sheaves is mounted for pivotal movement about an axis which is oblique to the longitudinal axis of the boom and further which lies in a separate plane from a plane passing through said longitudinal axis.

3. Apparatus as defined in claim 1 wherein said fairlead sheaves are each mounted for pivotal movement about an axis, said axes lying in spaced planes disposed at opposite sides of the longitudinal axis of said boom, said pivotal axes each being oblique to the longitudinal axis of the boom and being inclined in opposite directions down and away from the longitudinal axis of the boom.

4. Apparatus as defined in claim 1 wherein said guide sheaves are disposed intermediate said fairlead sheaves and the upper purchase block means.

5. Apparatus as defined in claim 1 wherein said guide sheaves are offset both laterally and fore and aft of the boom.

6. Apparatus as defined in claim 1 wherein said upper purchase block means includes a plurality of sheaves mounted for rotation about a common axis which is disposed in fixed relationship relative to said boom, each of said fairlead sheaves being mounted for pivotal movement about a pivotal axis which is oblique to the longitudinal axis of the boom and which lies in a separate plane from a plane passing through the longitudinal axis of the boom.

7. Apparatus as defined in claim 6 wherein said guide sheaves are each mounted for rotation about an axis disposed intermediate said fairlead sheaves and the axis of rotation of the sheaves of said upper purchase block means.

8. Apparatus as defined in claim 7 wherein said guide sheaves are offset both laterally and fore and aft of the boom.

9. Apparatus as defined in claim 1 wherein said spaced portions at the upper end of the boom define an opening through which the lower purchase block means of the apparatus is adapted to swing in a fore and aft direction with no fouling of the cargo fall cable and the associated parts, said boom being closed at a portion above said spaced portions thereof, said fairlead sheaves each being mounted for pivotal movement about a pivotal axis which is oblique to the longitudinal axis of the boom, said pivotal axes each lying in a separate plane from a plane passing through the longitudinal axis of the boom, said fairlead

sheaves each being mounted for pivotal movement by hollow support means which receives a part of the cargo fall cable passing over the fairlead sheaves, said guide sheaves being positioned intermediate said fairlead sheaves and said upper purchase block means and being offset both laterally and fore and aft of the boom, said lower purchase block means including a plurality of sheaves mounted for rotation about a common axis, and a cargo hook suspended from the lower portion of said lower purchase block means.

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