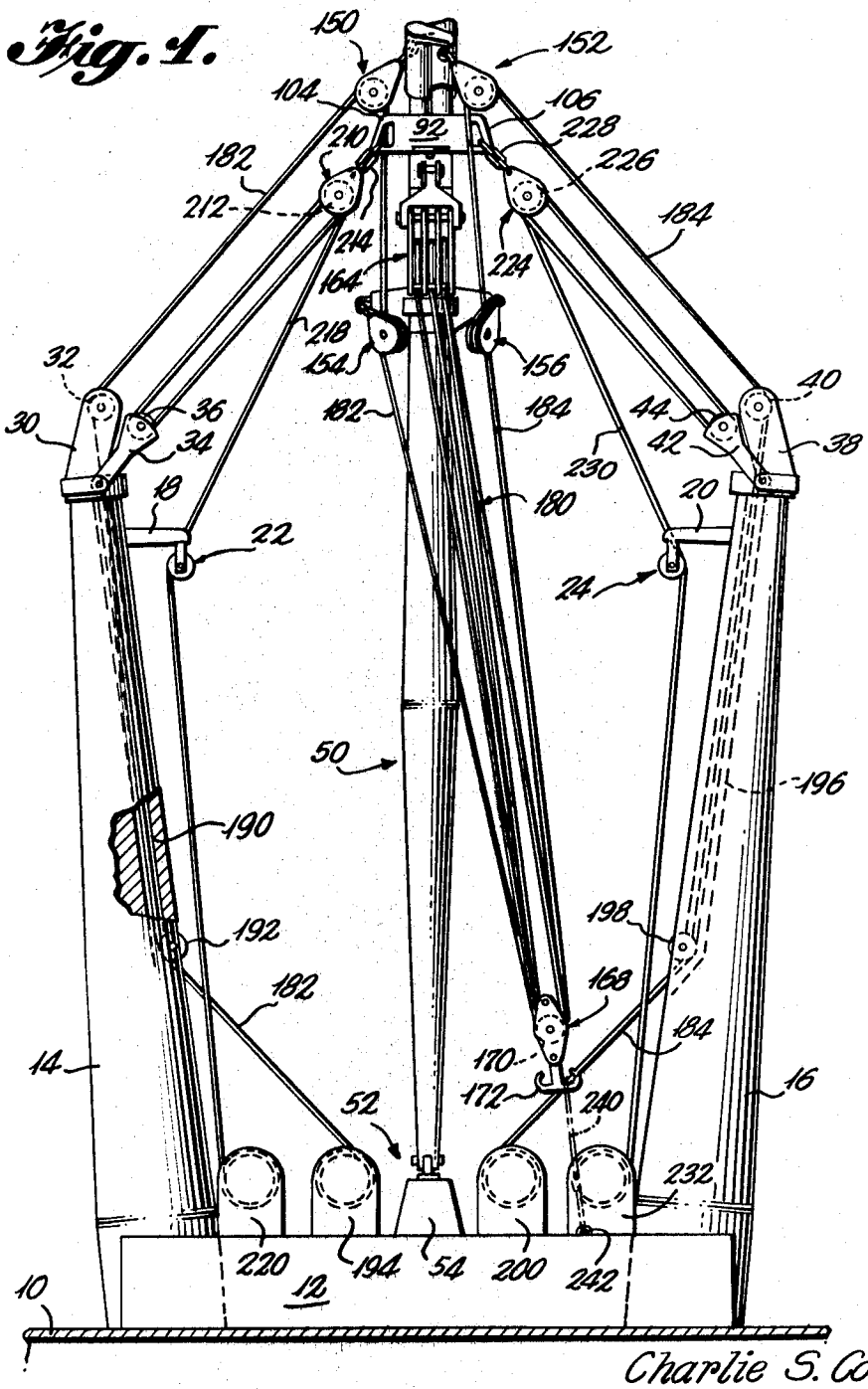
May 21, 1968 C. S. COCHRAN 3,384,246

CARGO HANDLING APPARATUS

Filed March 3, 1967 4 Sheets-Sheet 1

Fig. 1.



INVENTOR

Charlie S. Cochran

BY Shoemaker and Mattare

ATTORNEYS

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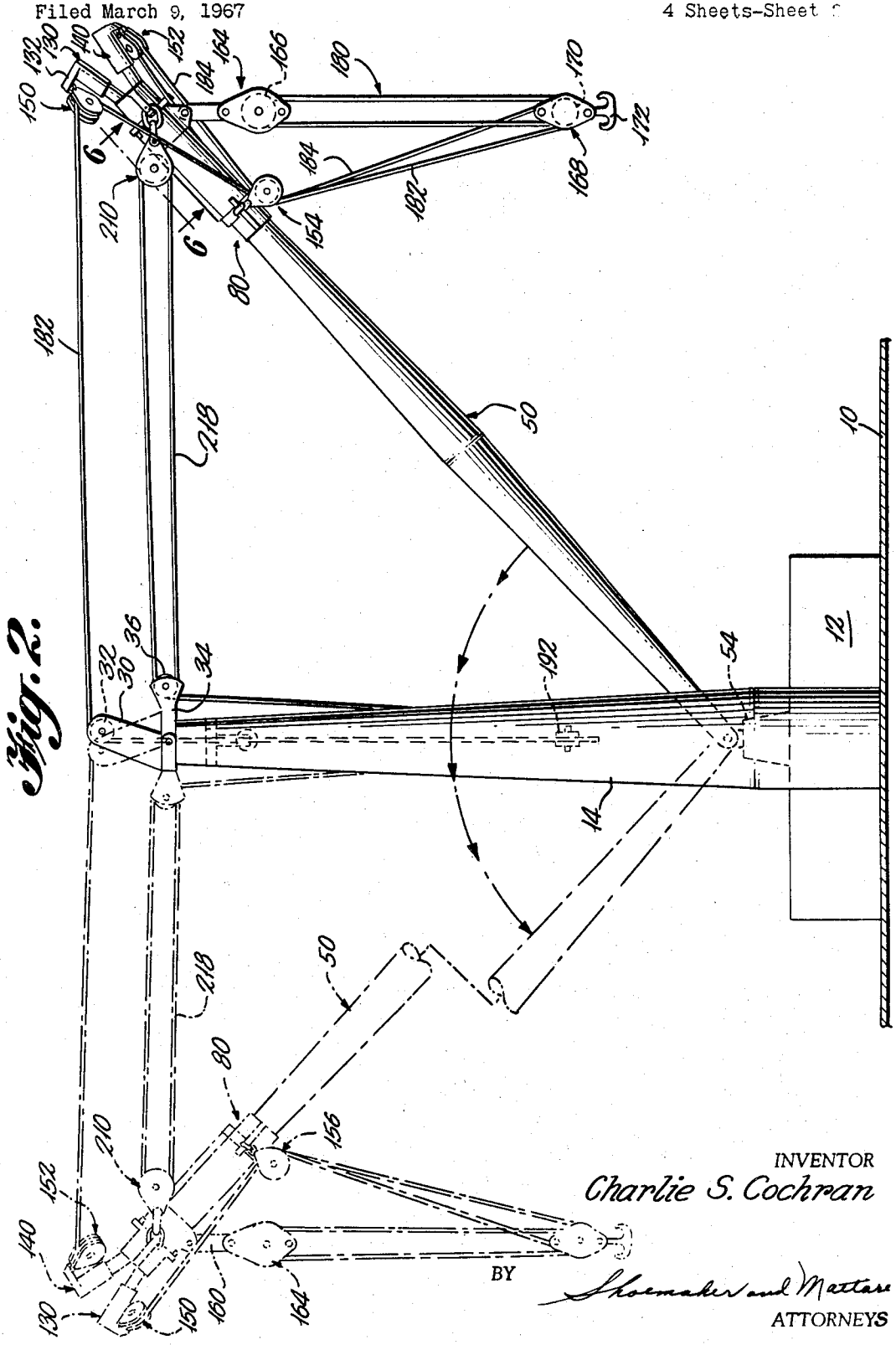


Fig. 2.

INVENTOR
Charlie S. Cochran

BY
Shoemaker and Mattare
ATTORNEYS

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CARGO HANDLING APPARATUS

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Fig. 4.

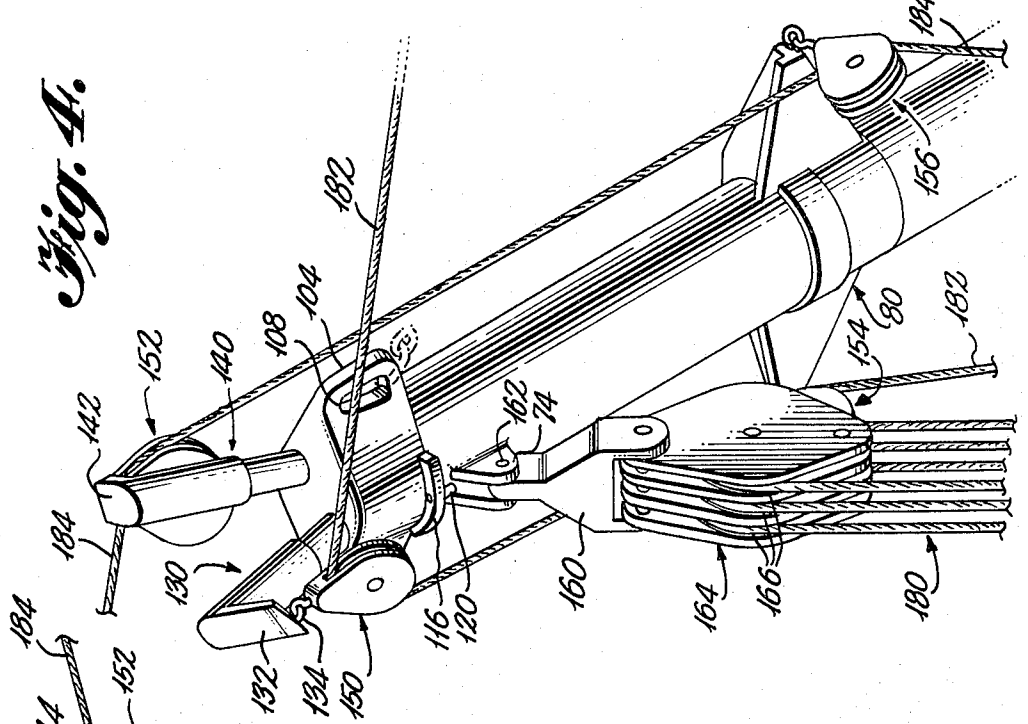
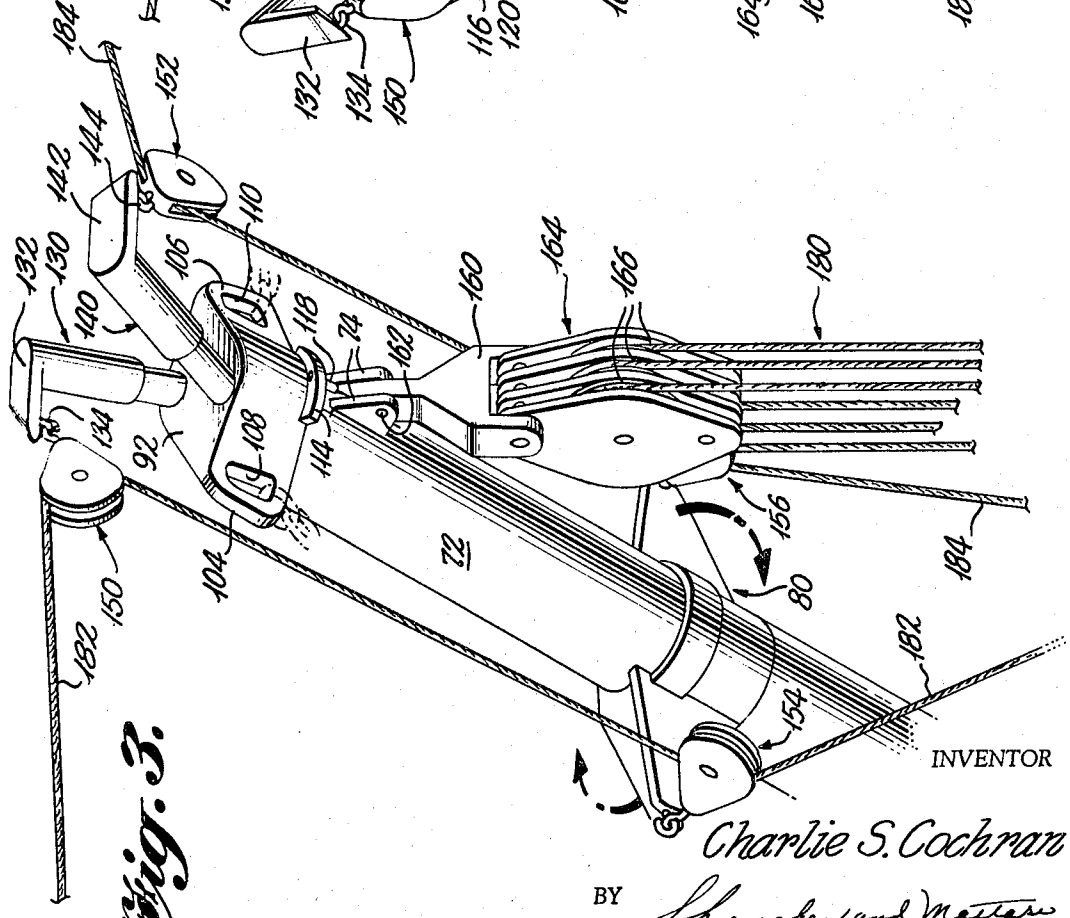


Fig. 3.



INVENTOR

Charlie S. Cochran

BY Shoemaker and Mattare

ATTORNEYS

May 21, 1968 C. S. COCHRAN 3,384,246

CARGO HANDLING APPARATUS

Filed March 9, 1967 4 Sheets-Sheet 4

Fig. 5.

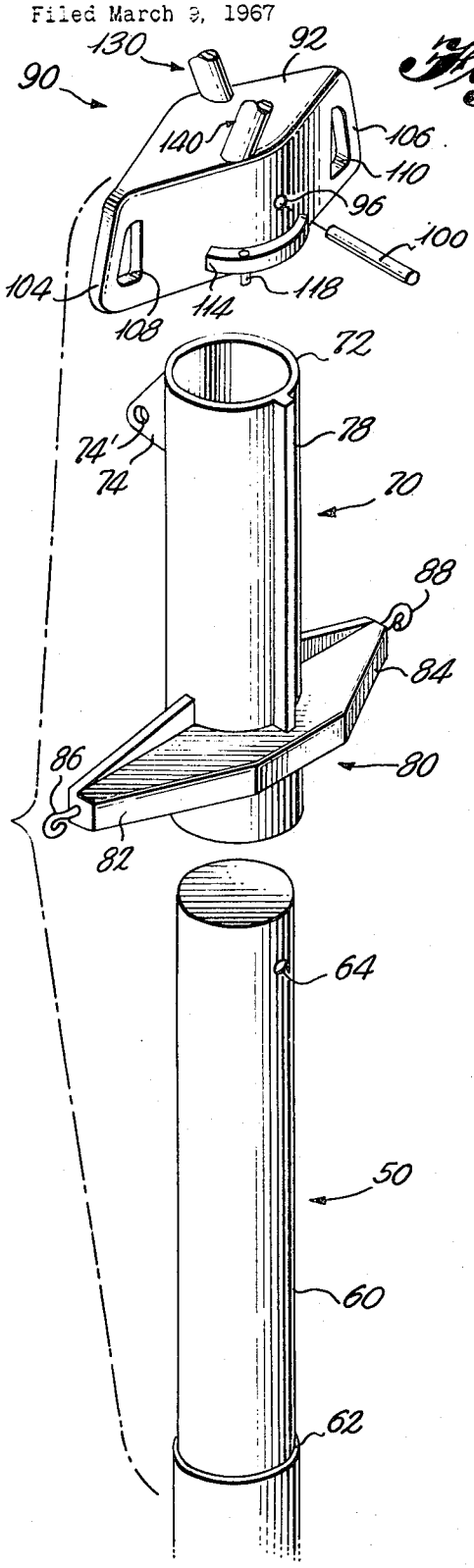


Fig. 6.

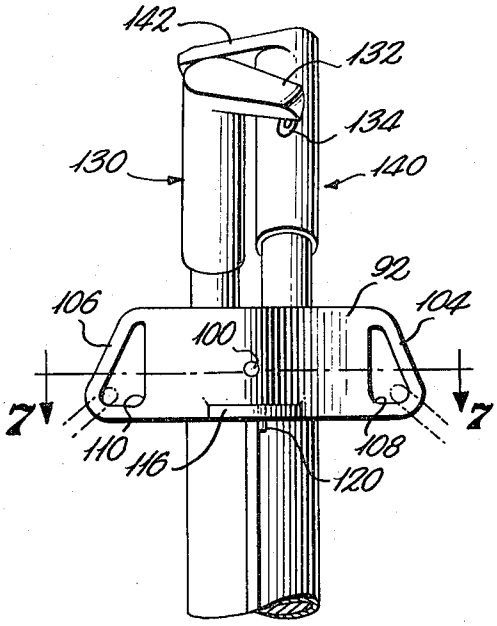
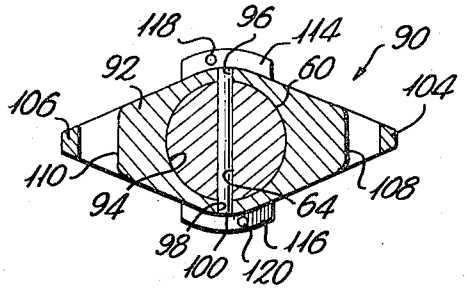


Fig. 7.



INVENTOR

Charlie S. Cochran

BY Shoemaker and Mattare

ATTORNEYS

United States Patent Office 3,384,246 Patented May 21, 1968

3,384,246

CARGO HANDLING APPARATUS

Charlie S. Cochran, Newport News, Va., assignor to Newport News Shipbuilding and Dry Dock Company, Newport News, Va., a corporation of Virginia

Filed Mar. 9, 1967, Ser. No. 621,957
10 Claims. (Cl. 212—3)

ABSTRACT OF THE DISCLOSURE

A boom including a head portion and a heel portion is mounted for substantially universal movement at the heel portion thereof and is adapted to swing between a pair of spaced kingposts. A cargo fall support means in the form of a sleeve is rotatably mounted at the head portion of the boom and is axially fixed relative thereto. The cargo fall means includes an upper purchase block means pivotally supported by the cargo fall support means and a lower purchase block means. A cargo fall cable is reeved around the upper and lower purchase block means and includes a pair of hoisting leads. A first pair of guide sheaves are swivelly supported above the head portion of the boom and laterally thereof. A second pair of guide sheaves are swivelly supported at the outer ends of a guide support means including portions extending outwardly from the cargo fall support means. The guide support means is secured to the cargo fall support means for turning movement therewith. Each of the hoisting leads of the cargo fall cable are reeved through one of said first pair of guide sheaves and one of said second pair of guide sheaves, the arrangement being such that the hoisting leads and the remaining portions of the cargo fall cable will not become fouled as the boom moves into different operative positions and swings through between the spaced kingposts. Stop means includes a pair of pins fixed with respect to the boom which engage a rib formed on the cargo fall support means for limiting relative rotation of the cargo fall support means in opposite directions with respect to the boom.

Background of the invention

The present invention relates to a heavy lift boom as used on shipboard of the type wherein the boom swings through between a pair of spaced kingposts for operation with more than one hatch.

Various arrangements have been provided in the prior art to enable a heavy lift boom on shipboard to operate with a hatch disposed either fore or aft of the boom. In order to successfully enable the boom to so operate, it is necessary to provide some sort of an arrangement whereby the boom can be swung through a plane defined by the spaced kingposts.

United States Patent No. 3,110,403 is directed to such an arrangement wherein a cargo fall support means is movably mounted at the head portion of the boom to enable the cargo fall means to be supported at opposite sides of the boom for operation both fore and aft of the heel of the boom. This type of arrangement employs a single hoisting lead thereby seriously limiting the speed of operation of the apparatus, and further requires the utilization of relatively large expensive winch mechanism.

When employing two hoisting leads with cargo handling apparatus as illustrated in this aforementioned U.S. patent, the hoisting leads would not clear the boom and each other and would tend to become fouled and twisted during swinging of the boom into its various operative positions.

An additional disadvantage of the arrangement as shown in the aforementioned U.S. patent is the fact that

the hoisting winch is necessarily positioned remote from the heel of the boom since a certain amount of hoisting lead is required between the winch and the first adjacent fairlead over which the hoisting lead is reeved.

United States Patent No. 2,924,193 also discloses a heavy lift boom adapted to be swung between a pair of kingposts. This arrangement employs a pair of hoisting leads, but in order to swing the boom through between the kingposts, it is necesary to raise the lower purchase block into snug engagement with the upper purchase block and then to cause these purchase blocks to tumble through between the spaced arms at the upper end of the boom. This operation is of course time consuming and further causes the boom and the upper and lower purchase blocks to be heavily loaded when swinging through between the kingposts.

Summary of the invention

In the present invention, the cargo fall support means which supports the upper and lower purchase blocks is movably mounted at the head portion of the boom, and a pair of hoisting leads are provided in the cargo fall cable so as to enable the apparatus to be operated at maximum speed. Additionally, smaller winches may be employed resulting in a lower initial cost and further presenting the advantage of providing a reserve winch in case one of the winches should be disabled.

The hoisting leads are reeved over first and second pairs of guide sheaves which are so mounted with respect to the head portion of the boom that they will automatically move into position as the boom is moved about so that the hoisting leads of the cargo fall cable as well as the remaining portion thereof do not become fouled regardless of the position of the boom, thereby enabling the boom to be moved into any desired operative relationship and permitting the cargo fall means to be effectively operated.

By having the hoisting leads extending down through the kingposts, the hoisting winches can be disposed closely adjacent to the heel of the boom which is a very desirable arrangement.

The apparatus is also provided with stop means which automatically limits rotation of the cargo fall support means in opposite directions relative to the head of the boom thereby insuring that the movable guide sheaves will always be retained in proper relationship to one another so that no fouling occurs between any portions of the cargo fall cable and the remaining components of the apparatus including the upper and lower purchase block means.

An object of the present invention is to provide new and novel cargo handling apparatus adapted to operate at maximum speed with the use of relatively small winches, and wherein the cargo fall cable and the hoisting leads thereof will not foul with the boom or one another or any of the adjacent components during operation of the apparatus in any of its various operative positions.

Brief description of the drawings

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 shown in FIG. 1 with the boom in an inclined position;

FIG. 3 is a top perspective view on an enlarged scale of the head portion of the boom illustrating the relative position of the components in one inclined position of the boom;

FIG. 4 is a view similar to FIG. 3 illustrating the position of the components in a second inclined position of the boom;

FIG. 5 is a top perspective exploded view of the components disposed at the head portion of the boom;

FIG. 6 is a view taken substantially along line 6—6 of FIG. 2 looking the direction of the arrows; and

FIG. 7 is a sectional view taken substantially along line 7—7 of FIG. 6 looking in the direction of the arrows.

Description of the preferred embodiment

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, the upper deck of a ship is indicated generally 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, such conventional gear having been eliminated for the sake of clarity in order that the heavy lift boom mechanism may be more clearly understood.

A pair of kingposts **14** and **16** extend upwardly from the winch house, the kingposts being spaced a part athwartships 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 kingposts **14** and **16** respectively. A pair of topping lift lead blocks **22** and **24** are swivelly supported by the outer ends of brackets **18** and **20** respectively, these topping lift lead blocks receiving the topping lift cables hereinafter described.

A head **30** is rotatably mounted at the upper end of kingpost **14** and rotatably supports a sheave **32**. A block **34** is pivotally connected to head **30** and rotatably supports topping lift sheaves **36**. In a similar manner, a head **38** is rotatably mounted at the upper end of kingpost **16** and rotatably supports a sheave **40**. A block **42** is pivotally connected to head **38** and rotatably supports topping lift sheaves **44**.

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 previously referred to.

Referring now particularly to FIG. 5, the upper end of boom **50** is provided with a reduced end portion **60**, an annular shoulder **62** being defined between this reduced end portion and the remainder of the boom. A cylindrical bore **64** is provided through the upper end of the reduced end portion of the boom.

Cargo fall support means is indicated generally by reference numeral **70** and comprises a substantially cylindrical body portion **72** which is adapted to fit about the reduced end portion **60** of the boom. The lower end of cylindrical body portion **72** is adapted to rest on the shoulder **62** on the boom so that the cargo fall support means can rotate with respect to the boom, and yet at the same time is axially fixed with respect thereto as will hereinafter more fully appear.

A pair of spaced ears **74** as seen most clearly in FIGS. 3 and 4 are formed integral with and extend outwardly of the body portion **72**, each of these ears having a hole **74'** formed therethrough as seen in FIG. 5.

A rib member **78** formed integral with the body portion **72** extends outwardly thereof and furthermore extends longitudinally of the body portion. This rib member serves as a stop means as hereinafter described.

Guide support means is indicated generally by reference numeral **80**, this guide support means being secured to body portion **72** for movement therewith as by welding or the like. This guide support means includes portions **82** and **84** extending in substantially opposite directions from opposite sides of the boom, suitable attaching means **86** and **88** such as eye bolts or the like being secured at the outer ends of portions **82** and **84**.

Topping lift attachment means is indicated generally by reference numeral **90** and includes a body means **92** having a socket **94** formed therein and opening in a downward direction, this socket being seen most clearly in FIG. 7 and being adapted to snugly receive the upper end of the reduced end portion **60** of the boom. Body means **92** has a pair of holes **96** and **98** formed in opposite sides thereof and in communication with the socket **94**. A pin **100** fits through aligned holes **96** and **98** as well as hole **64** formed in the upper reduced end of the boom for rigidly securing the topping lift attachment means to the upper end of the boom. It is apparent that any suitable means may be provided for securing the topping lift attachment means in position.

Topping lift attachments means **90** includes oppositely directed ears **104** and **106** having holes **108** and **110** formed therethrough.

The topping lift attachment means also includes integral laterally extending arcuate portions **114** and **116** having pins **118** and **120** supported within suitable holes provided therein and fixedly secured thereto, these pins extending downwardly beneath the undersurface of portions **114** and **116** to serve as stop means in cooperation with the rib **78** previously described as hereinafter set forth.

A first support means indicated generally by reference numeral **130** extends upwardly from the upper surface of the topping lift attachment means, this support means being directed obliquely to the axis of the boom and laterally outwardly thereof and including an arm **132** extending normally therefrom. A suitable attaching means such as an eye bolt **134** is secured to the outer end of arm **132** in depending relationship therefrom.

A similar support means **140** extends upwardly from the topping lift attachment means, support means **140** also extending upwardly and outwardly of the boom at an oblique angle to the boom axis and including a normally extending arm portion **142** having a suitable attaching means such as an eye bolt **144** depending from the outer end thereof.

A first pair of guide sheaves **150** and **152** are swivelly connected with attaching means **134** and **144** respectively, and a second pair of guide sheaves **154** and **156** are swivelly connected with the attaching means **86** and **88** previously described.

The cargo fall means includes a link member **160** pivotally supported upon a pin **162** extending between the ears **74** on the cargo fall support means. Link **160** serves to pivotally support an upper purchase block indicated generally by reference numeral **164** and having a plurality of sheaves **166** rotatably supported thereby, and as illustrated three sheaves are shown. It is apparent that any suitable number of sheaves may be employed as required.

The cargo fall means also includes a lower purchase block **168** having a plurality of sheaves **170** rotatably supported thereby, and in a typical example four sheaves **170** may be provided, although the number of sheaves may be varied as desired. A suitable cargo hook **172** is pivotally supported by the lower purchase block.

The cargo fall means also includes a cargo fall cable **180** which is reeved about the sheaves of the upper and lower purchase blocks and which further includes a pair of hoisting leads **182** and **184**. Hoisting lead **182** as seen most clearly in FIG. 1 is reeved over guide sheave **154** as well as guide sheave **150** and thence downwardly over sheave **32**. Hoisting lead **182** then extends downwardly through a passage **190** formed in kingpost **14** and over a sheave **192** to a hoisting winch **194**.

The other hoisting lead **184** is reeved over guide sheaves **156** and **152** and thence downwardly over sheave **40**. Hoisting lead **184** then extends downwardly through a passage **196** formed in kingpost **16** and over a sheave **198** to hoisting winch **200**. It will be noted that both of

hoisting winches **194** and **200** are positioned closely adjacent to the heel portion of the boom.

A block **210** rotatably supports topping lift sheaves **212**, block **210** being swivelly interconnected with the ear **104** of the topping lift attachment means as by a chain or link member **214**. A topping lift cable **218** is reeved around the topping lift sheaves **36** and **212**, and passes downwardly over the topping lift lead block **22** to a topping winch **220**.

A block **224** rotatably supports topping lift sheaves **226**, block **224** being swivelly connected with ear **106** of the topping lift attachment means by a chain or link member **228**. A second topping lift cable **230** is reeved about the topping lift sheaves **44** and **226**, and passes downwardly over the topping lift lead block **24** to a topping winch **232**.

As illustrated in FIG. 1, a pendant or other suitable means may be attached to the cargo hook, this pendant being indicated by a phantom line **240**, the pendant being passed through a suitable guide means such as a padeye **242** secured to the upper surface of the winch housing **12**. This pendant may be employed for rotating the cargo fall support means when the boom is in a substantially vertical position when it is desired to pass the boom through between the kingposts. In other words, the cargo hook is swung around between the boom and the adjacent kingposts to cause the components at the head of the boom to switch position for operation with a different hatch.

In the operative position as illustrated in FIGS. 2, 3 and 6, it will be noted that the cargo fall means is pivotally supported at one side of the boom with the stop rib **78** of the cargo fall support means in engagement with pin **120** so as to limit rotation of the cargo fall support means in one direction with respect to the boom. The guide sheaves are automatically moved into the operative position as seen in these figures.

When it is desired to swing the boom through for operation with a hatch at the other side of the kingposts, the boom is firstly swung into the vertical position shown in FIG. 1, whereupon a pendant is attached to the cargo hook and the cargo fall support means is rotated through an angle of substantially 180°. The boom may then be lowered on the other side of the kingposts into the operative position shown in FIG. 4 wherein the stop rib **78** of the cargo fall support means will be in engagement with pin **118**, and the cargo fall means will be supported at the opposite side of the boom. The guide sheaves again automatically move into the position illustrated in this figure since the lower pair of guide sheaves **154** and **156** have been reversed in relationship to the boom since the guide support means **80** turns with the cargo fall support means.

As these various components shift from one operative position to another, the arrangement is such that the cargo fall cable including the pair of hoisting leads thereof do not foul with one another or with any of the other components of the apparatus so that the components of the structure may readily move into proper operative position regardless of the position of the boom with respect to the kingposts.

It is apparent from the foregoing that there is provided according to the present invention a new and novel cargo handling apparatus employing a pair of hoisting leads which enables the apparatus to be operated at maximum speed with the use of relatively small winches. The two pairs of guide sheaves ensure that the hoisting leads will not foul with the remainder of the cargo fall cable or any of the remaining components of the apparatus during operation regardless of the relative position of the boom with respect to the kingposts of the mast structure.

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 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 for moving the boom relative to the mast structure, cargo fall support means movably mounted at the head portion of the boom, cargo fall means supported by said cargo fall support means and including upper purchase block means, lower purchase block means and a cargo fall cable reeved around said upper and lower purchase block means, said cargo fall cable including a pair of hoisting leads, support means fixedly secured to the head portion of said boom, a first pair of guide sheaves movably supported by said support means, a second pair of guide sheaves movably supported laterally outwardly of said boom by said cargo fall support means and spaced a substantial distance from said first pair of guide sheaves, each of said hoisting leads being reeved over one of said first pair of guide sheaves and one of said second pair of guide sheaves, whereby during operation of the apparatus, the hoisting leads and the remaining portions of the cargo fall cable do not become fouled.

2. Apparatus as defined in claim **1** wherein said cargo fall support means is mounted for rotation with respect to said boom and is axially fixed relative thereto, said topping lift means being connected with a topping lift attachment means fixedly secured to the head portion of the boom.

3. Apparatus as defined in claim **2** including guide support means connected for rotation with said cargo fall support means, said guide support means including portions extending outwardly from opposite sides of said boom, said second pair of guide sheaves being movably supported at opposite end portions of said guide support means.

4. Apparatus as defined in claim **2** including stop means for limiting rotation of said cargo fall support means in opposite directions of rotation relative to said boom.

5. Apparatus as defined in claim **4** wherein said stop means includes at least one stop member fixed with respect to said boom, said cargo fall support means including a stop member formed thereon and engageable with said first-mentioned stop member for positively limiting rotation of the cargo fall support means with respect to said boom.

6. Apparatus as defined in claim **5** wherein said boom includes a pair of substantially diametrically opposite stop members supported thereby, the stop member on said cargo fall support means being engageable with each of the stop members supported by the boom.

7. Apparatus as defined in claim **1** wherein said first pair of guide sheaves are supported above and laterally outwardly of the head portion of the boom.

8. Apparatus as defined in claim **1** wherein said topping lift means is connected with topping lift attachment means fixedly secured to the head portion of the boom, said cargo fall support means being mounted for rotation with respect to the boom and being axially fixed relative thereto, said boom and said cargo fall support means including interengageable stop means for limiting relative rotation of said cargo fall support means with respect to said boom, said first pair of guide sheaves being swivelly mounted above and laterally outwardly of said topping lift attachment means.

9. Apparatus as defined in claim **8** including guide support means secured to said cargo fall support means for movement therewith, said guide support means in-

cluding portions extending outwardly from opposite sides of the boom, said second pair of guide sheaves being swivelled to the outer ends of said oppositely extending portions of the guide support means.

10. Apparatus as defined in claim **9** wherein said upper purchase block means is pivotally supported by said cargo fall support means for pivotal movement about a pivot axis, said outwardly extending portions of the guide support means extending in a direction substantially parallel with said pivot axis.

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EVON C. BLUNK, *Primary Examiner.*

H. C. HORNSBY, *Assistant Examiner.*