July 17, 1956 V. C. FARRELL 2,754,975

TOPPING LIFT RIGGING FOR BOOM TYPE HOISTING APPARATUS

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Fig. 6.

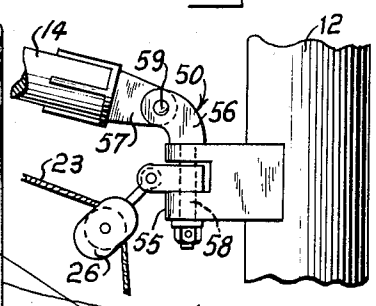



Fig. 2.




Fig. 1.

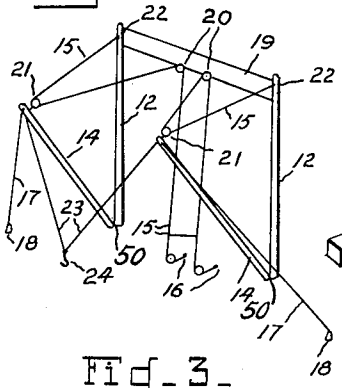



Fig. 3.




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Fig. 5.

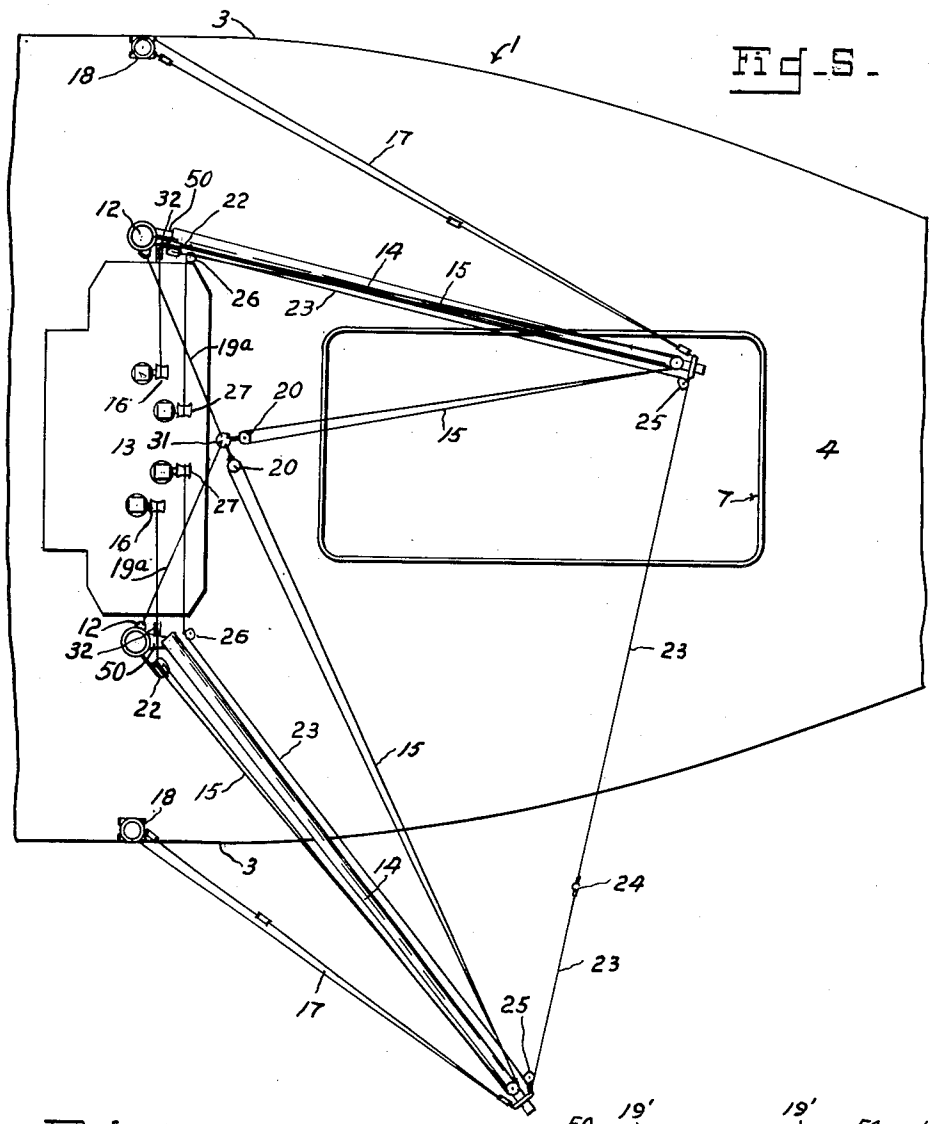
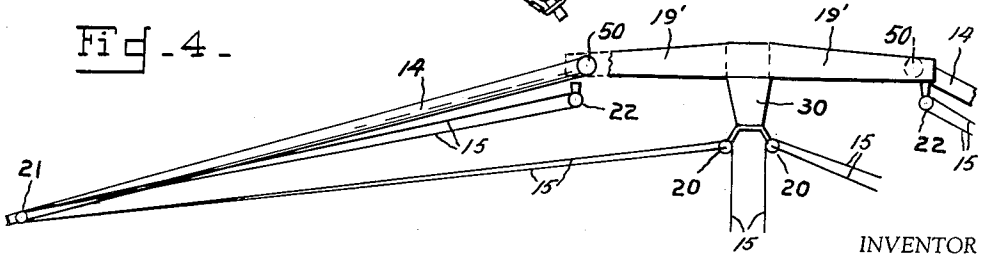



Fig. 4.




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United States Patent Office 2,754,975 Patented July 17, 1956



2,754,975

# TOPPING LIFT RIGGING FOR BOOM TYPE HOISTING APPARATUS

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Application May 24, 1951, Serial No. 227,955

9 Claims. (Cl. 212—3)

This invention relates to hoisting apparatus, and more particularly to a topping lift rigging for a ship's cargo boom. This application is a continuation-in-part of application Serial No. 61,950, filed November 26, 1948, now issue as Patent No. 2,564,966, entitled Ship and Cargo Deck Construction.

The normal ship's hoisting apparatus comprises two booms spaced apart transversely of the ship, with a mast structure rising above the heels of the booms and cargo supporting load falls are suspended from the heads of the booms. To guide and position the booms, an inboard and outboard guy or vang is secured to the head portion of each boom and these guys or vangs are adjustably anchored respectively inboard of the booms and adjacent the respective sides of the ship, and a topping lift is also secured to the outer end portion of each boom and then run through sheave blocks on the mast structure and down to securing points on the deck.

The topping lift blocks may be secured to the mast structure substantially over the heels of the booms or they may be inboard of the booms in substantially central positions. The central running topping lifts have the advantage of causing the booms to gravitate inboard when the tackle is adjusted and eliminates the necessity of inboard guys or vangs. On the other hand, the over the heel running tackle slightly lessens the stress on the vangs and causes slightly less change in elevation of the booms when the booms are swung laterally than the change caused by the central running gear.

Having in mind the defects of the prior art apparatus, it is the principal object of the present invention to provide a topping lift rigging which enables more accurate control of the boom.

It is another object of the invention to provide a topping lift rigging that reduces the stress on the vang over the prior art rigging.

It is a further object of the invention to provide a topping lift rigging that causes the boom to gravitate inboard while reducing the stress on the vang.

It is still another object of the invention to provide a topping lift rigging that reduces the automatic change in elevation of the boom head when it is moved laterally.

It is a still further object of the invention to provide a topping lift rigging that has economy of construction, simplicity of organization and efficiency in operation.

The foregoing objects, and others ancillary thereto, are preferably accomplished, in accordance with the present invention, by a topping lift rigging comprising two supporting means or points which are widely spaced athwartship with one of said points being inboard of the boom and at least one of said points comprising a sheave block, and a block on the boom head. The topping lift cable is anchored at one of said points and runs through the boom block to the other of said points, which comprises the block, and then down to securing means such as a winch.

Preferably, but not necessarily, the two spaced supporting means or points both comprise single sheave



blocks, and a double sheave block is secured on the boom head. In this case, the topping lift cable is anchored adjacent one of said points, preferably to the becket of one single block or near said block, and runs through the boom block to the other single block, back through the boom block to the one single block and then down to the winch.

By using the three running points or blocks and taking only half of the lift cable to the centerline, the desired inboard gravitation is obtained but it is modified because each boom rolls in the bight of the respective lift. In addition the divided lift materially reduces the stress transmitted to the vang, while also materially reducing the automatic change in elevation of the boom head when the boom is swung laterally by adjustment of the vang.

The novel features that are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings, wherein like reference characters indicate like parts throughout the several figures and in which:

Fig. 1 is a diagrammatic view is perspective of a ship's hoisting apparatus incorporating a topping lift rigging in accordance with the present invention;

Fig. 2 is a diagrammatic view in perspective showing a modification of the rigging shown in Fig. 1;

Fig. 3 is a view in perspective showing a modification of the rigging shown in Fig. 2;

Fig. 4 is a fragmentary top plan view of Fig. 3;

Fig. 5 is a plan view of still another modification, and

Fig. 6 is an enlarged fragmentary view of a typical universal mounting for a boom.

Referring now to the drawings, specifically to Figs. 1 and 2, the usual ship hoisting apparatus may comprise a mast structure which may include king posts 12, preferably mounted on opposite sides of a mast table or resistor house 13, and cargo booms 14 which are universally mounted at their heels or lower ends on the mast table 13 or the bases of the king post 12 by universal mounting means 50. The king posts may be connected at their upper ends by a spanner 19. The cargo booms 14 are angularly supported by topping lift cables 15 extending between the mast structure and sheave blocks 21 secured to the heads of the booms, and are angularly positioned by outboard guys or vangs 17 secured to the heads of the booms 14 and selectively anchored to vang posts 18 on the top deck 4 adjacent the sides 3 of the ship 1.

The topping lifts are adjustably secured to or operatively connected with securing points or means such as winches 16. The anchorage of the vangs 17 to the posts 18 is, preferably, located on an athwartship line or axis passing through the heels or mountings of the respective booms, as disclosed in co-pending application Serial No. 195,884, filed November 15, 1950, and now issued as Patent No. 2,562,087. Cargo is handled by cargo falls or cables 23 which are usually joined at their ends to a cargo hook or like member 24 and extend through suitable tackle 25 on the heads of the booms 14, longitudinally of the booms and through tackle 26 near the boom heels to cargo winches 27. Preferably, the winches 16 and 27 are mounted substantially athwartship between the king posts 12 on top of the mast table or resistor house 13 to free the top deck 4 and permit extension of the hatch 7, as shown in Fig. 1.

A typical universal mounting 50 for the booms 14 is shown in Fig. 6 as a gooseneck mounting so that the booms can have substantially 180 degrees of transverse swing with respect to the mast structure. As here disclosed, this mounting is mounted on the king post 12 and

includes a bracket 55 carried by a king post 12 and has journaled therein a pin 58 forming part of a gooseneck bearing member 56. The heel of the boom 14 has a bearing portion 57 mounted by a pivot 59 on the gooseneck portion 56 for up and down swinging movement about the substantially horizontal axis of the pivot 59, horizontal swinging movement being accommodated by the pin 58 turning within the bearing portion 55 about a substantially vertical axis. The cargo fall block 26 may also be swingably mounted by the bearing portion 55 so that it is conveniently disposed to receive the load fall 23.

The present invention resides in a novel arrangement of the topping lifts wherein the topping cables each run between the boom and supporting means including two spaced points or means on the mast structure, the blocks 21 on the swinging ends of the booms running in the bights of the cables. Referring to Fig. 1, for example, the topping cables 15 are each anchored at one end to an anchor point or means 22 on the king posts 12 and extend through the sheave of the block 21, on the respective boom 14, to and around a sheave 20 on the spanner 19 and then down to the respective topping lift securing means 16. This arrangement of the topping lifts is advantageous in that the boom supporting tackle has reduced load and friction, lessens the stress on the outboard vangs, eliminates the inboard vangs, provides more accurate control and permits the booms 14 to gravitate inboard in the bights of the cables regardless of the load or lack thereof.

Although the boom may be supported by a single cable running from each side, as shown in Fig. 1, it is preferred to support the booms by two cables running from each side of the boom sheave 21. Referring to Fig. 2, for example, the topping cables 15 are each anchored at one end to an anchor point or means on the spanner 19, between the king posts 12 and near the sheave 20, or to the becket of the sheave tackle 20 supported by the spanner. The cables each extend from said anchorage through one sheave 21*a* of a double block 21 on the respective boom 14, to and around a single sheave block 22 on the respective king post 12, back through the second sheave 21*b* of the block 21, through the respective spanner sheave 20 and down to the respective topping lift winch 16. This arrangement of the topping lifts is advantageous in that the boom supporting tackle has an even more reduced load and friction and provides even greater control than the single cable arrangement.

The present invention may be incorporated in any desirable type of hoisting apparatus to which it is applicable. For example, as shown in Fig. 3, the mast structure may comprise a mast 12′ provided with a cross-tree 19′. In this event, the booms are stepped directly on the mast table or resistor house 13 substantially beneath the end portions of the cross-tree 19′ and the outboard sheaves 22 are mounted on the cross-tree end portions while the inboard sheaves 20 are mounted adjacent the mast 12′. Fig. 3 shows the topping lift cables 15 anchored directly to the beckets of the pulley blocks 20 and it will be understood that in the double reeving of the topping lift cables, the anchor means for the cables will be adjacent the pulley means 20, that is, near the pulley 20 as shown in Fig. 2 or to the pulley block 20 as shown in Fig. 3, so that the parts of the topping cable running from the boom sheave 21 to the anchor means and the pulley means 20 extend along together in substantially the same direction.

The structure shown in Fig. 3 is substantially identical to that of Fig. 2 except that the inboard sheaves 20 are spaced in front (that is forwardly or aft, depending upon the direction in which the booms are facing) of the outboard sheaves 22. The sheaves 20 are carried in spaced relation to the cross-tree 19′ by a bracket 30 which extends perpendicularly from the cross-tree 19′ and mast 12′, while the sheaves 22 are carried directly by the cross-tree. Thus the sheaves 20 are spaced longitudinally of the ship from the sheaves 22 in the direction of the booms 14.

This arrangement has the advantage of spacing the supporting means of the topping lift both transversely and longitudinally of the ship. Consequently, even though the boom is guyed to extend substantially directly outboard, as illustrated in Fig. 4, it will have a frontward and inboard bias and be prevented from passing over center because the point or sheave 20 is forward of the sheave 22 and the boom heel.

On many ships, the king posts 12 are independent and not connected by a spanner 19. To accommodate this type of structure for the present invention, as shown in Fig. 5, a bridle 19*a* may be strung between the king posts 12, the bridle being provided with a centrally disposed ring 31 or the like to which the central sheaves 20 are connected. To prevent extra stresses on the bridle 19*a*, the topping lift cables are taken down from the outboard sheaves 22 to guide sheaves 32 on the lower portions of the king posts and then inboard to the winches 16. As, usually, at least one of the booms is guyed in a frontward, inboard position, its topping lift will pull the bridle ring 31 frontwardly of the sheaves 22 so that the outboard boom will be biased inboard and prevented from passing overcenter as previously described with respect to Figs. 2 and 3.

In operation, this apparatus is normally employed for burtoning loads to and from the ship's hold. This is a well known system wherein the topping lifts 15 and vangs 17 are adjusted to guy the booms into selected positions, and then the cargo hook 24 is moved back and forth between the booms and lowered from each boom for loading or discharging cargo, the hook being manoeuvred through operation of the cargo falls 23 by means of the cargo winches 27.

In the usual operation the booms are guyed into position by hauling on the vangs 17 while operating the topping lift winches 16 and simultaneously adjusting some inboard guy means such as a midship or schooner guy or an inboard vang. As disclosed in the previously mentioned Patent No. 2,562,087, the inboard guy means may be eliminated by running the topping lifts inboard so that they provide both the upward lift and the inboard pull against the vangs. As also disclosed in said prior patent, if the vangs 17 are anchored on the athwartship axis of the boom heels, the booms can be topped or lowered by operation of the topping lifts 15 without the necessity of adjusting the vangs, and the vangs will guide the boom heads through an arc of direct fore and aft movement.

For the burtoning operation, one boom is usually guyed to an outboard position wherein it extends beyond the side of the ship and the other boom is guyed to an inboard position wherein it overlies the ship, usually the hatch 7, as best shown in Fig. 5. Except for topping or lowering the booms to spot loads, the booms are usually maintained in the same positions during operation and the load is burtoned from one boom to the other by operation of the cargo falls 23.

For example, if the ship is loading cargo, the outboard boom cargo fall 23 is hauled in and the inboard boom cargo fall 23 is slacked off to transfer the cargo hook 24 to the outboard boom. Both cargo falls 23 are then slacked off to lower the hook over the side of the ship to the dock, or the like, where it is attached to a cargo load. To lift the load, both falls 23 are hauled in until the load is aboveboard, whereupon it is burtoned to the inboard boom by continuing to haul in the inboard fall 23 but slacking off the outboard fall. When the hook 24 and its load is supported solely by the inboard fall and boom, it is lowered down through the hatch 7 into the hold by slacking off both falls 23, the outboard fall being sufficiently slack to prevent pulling on the load. The procedure is then reversed to move the hook 24 outboard again and, obviously, the loading and unloading procedure

is reversed if the ship is discharging instead of taking on cargo.

The prior topping lifts for the burtoning gear have had certain defects. For instance, with the usual prior arrangement, the topping lifts ran from the booms to points on the mast structure substantially directly over the boom heels so that all of the weight of the booms and the cargo load was taken directly by the topping lifts while the vangs were stressed only when the load was between the booms.

As the over the heel running topping lift tackle requires inboard guys and, therefore, is difficult to adjust, it is proposed in the previously mentioned patent to run the topping lift tackle inboard, which provides the necessary inboard guying and also has the advantage of causing the booms to gravitate inboard. This arrangement, however, increases the stress on both the topping left and the vangs, and it also causes a greater change in elevation of the booms when they are swung laterally.

The foregoing difficulties are obviated and the operation of the apparatus is enhanced by a topping lift in accordance with the present invention because the load of the boom is equally divided between the two branches or parts of the topping lift reeved from the boom sheave 21 in diverging relation to each other to the widely spaced supporting means 20, 22. As the boom is not fixed to the topping lift but merely has a running connection through the sheave 21 with the topping lift 15, the load is divided equally between the two supporting means, that is the spaced points or sheaves 20 and 22. Furthermore, in the preferred arrangement, as the point or sheave 21 is connected to each of the points or sheaves 20 and 22 by at least two free running cables, the load between said points is further divided between each cable.

Thus, the load on the topping lift 15 is so divided that there is reduced friction on the running tackle, and lighter topping cables may be used. Because of the position of the point or sheave 22 substantially over the heel of the boom, there is less stress on the vang 17, while, on the other hand, as the point or sheave 20 is inboard of the boom heel, the boom gravitates inboard regardless of the load or lack thereof. Moreover, by positioning the inboard point or sheave 20 forwardly of the outboard point or sheave 22, the boom will gravitate inboard even from a position directly outboard or perpendicular to the centerline of the ship. As the boom has a running connection in the bight of the topping lift cables, the change of elevation when it is moved laterally is reduced by one-half. Finally, as movement of the boom upon operation of the topping lift winches 16 is only half of that which would take place with a direct connection, more accurate control of the boom is provided by the present invention.

Although certain specific embodiments of the invention have been shown and described, it is obvious that many modifications thereof are possible. The invention, therefore, is not to be restricted except in so far as is necessitated by the prior art and by the spirit of the appended claims.

What I claim is:

1. A cargo handling apparatus including a mast structure, a boom, means for universally mounting the heel of said boom adjacent the lower portion of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of said boom, guy means connected to the boom head portion and secured laterally of said vertical axis to guy the boom on one side, a sheave mounted on the boom head, means for supporting the boom in operative position and including an anchor means and a pulley means, said two supporting means being widely spaced laterally with one of said supporting means being disposed laterally of said vertical axis on the side opposite said guy means and the other of said supporting means being disposed on said mast structure susbtantially above the heel portion of the boom and closer to said vertical axis than said laterally disposed supporting means, and a cable anchored to said anchor means and passing through said boom sheave then through said pulley means to a winch means, whereby the opposite parts of said cable reeved from said boom sheave are in diverging relation to each other with said boom sheave running in the bight of the cable and the cable guys the boom on the side opposite the guy means.

2. A cargo handling apparatus including a mast structure, a boom, means for universally mounting the heel of said boom adjacent the lower portion of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of said boom, guy means connected to the boom head portion and secured laterally of said vertical axis to guy the boom on one side, a plurality of sheaves mounted on the boom head portion, means for supporting the boom in operative position and including first and second pulley means and an anchor means adjacent one of the pulley means, said two pulley means being widely spaced laterally with one of said pulley means being disposed laterally of said vertical axis on the side opposite said guy means and the other of said pulley means being disposed on said mast structure substantially above the heel portion of the boom and closer to said vertical axis than said laterally disposed pulley means, and a cable anchored to said anchor means and passing through one of said boom sheaves then through said first pulley means and back through another of said boom sheaves and through said second pulley means to a winch means, whereby the opposite parts of said cable reeved from said boom sheaves are in diverging relation to each other with said boom sheaves running in the bight of the cable and the cable guys the boom on the side opposite the guy means.

3. A cargo handling apparatus including a mast structure, a boom, means for universally mounting the heel of said boom adjacent the lower end of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of said boom, guy means connected to the boom head portion and secured laterally of said vertical axis to guy the boom on one side, a sheave mounted on the boom head, means for supporting the boom in operative position and including an anchor means and a pulley means, said two supporting means being widely spaced laterally with one of said supporting means being disposed laterally of said vertical axis on the side opposite said guy means and the other of said supporting means being disposed on said mast structure substantially above the heel portion of the boom and closer to said vertical axis than said laterally disposed supporting means, said first mentioned laterally disposed supporting means being spaced in front of the supporting means substantially above the boom heel, and a cable anchored to said anchor means and passing through said boom sheave then through said pulley means to a winch means, whereby the opposite parts of said cable reeved from said boom sheave are in diverging relation to each other with said boom sheave running in the bight of the cable and the cable guys the boom on the side opposite said guy means with the frontwardly spaced supporting means preventing passage of the boom beyond ninety degrees of horizontal arc on either side of the boom.

4. A cargo handling apparatus including a mast structure, two booms spaced at opposite sides of said mast structure, means for universally mounting the heel of each boom adjacent the lower portion of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of each boom and respectively connected to a cargo hook between said booms, guy means connected to the head portion of each boom and secured laterally of the respective vertical axes to guy the booms on one side, a sheave mounted on the head of each boom, means for supporting each boom in operative position including an anchor means and a pulley

means, said two supporting means for each boom being widely spaced laterally with one of said supporting means being disposed laterally of the respective vertical axis on the side opposite the respective guy means and the other of said supporting means being disposed on said mast structure substantially above the heel portion of the boom and closer to said vertical axis than said laterally disposed supporting means, and a cable for each boom anchored to said anchor means and passing through said boom sheave and then through said pulley means to winch means, whereby the opposite parts of said cables reeved from the respective boom sheaves are in diverging relation to each other with said boom sheaves running in the bights of the cables and the cables guy the booms on the side opposite said guy means.

5. A cargo handling apparatus including a mast structure, two booms spaced at opposite sides of said mast structure, means for universally mounting the heel of each boom adjacent the lower portion of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of each boom and respectively connected to a cargo hook between said booms guy means connected to the head portion of each boom and secured laterally of the respective vertical axes and on the side opposite the other boom to guy the booms away from each other, a sheave mounted on the head portion of each boom, support means on said mast structure for supporting each boom in operative position and including an anchor means and a pulley means, said two supporting means for each boom being widely spaced laterally with one of said supporting means being disposed laterally of the respective vertical axis and toward the other boom and the other of said supporting means being disposed substantially above the heel portion of the boom and closer to the respective vertical axis than said laterally disposed supporting means, and a cable for each boom anchored to said anchor means and passing through said boom sheave and then through said pulley means to winch means, whereby the opposite parts of said cables reeved from the respective boom sheaves are in diverging relation to each other with said boom sheaves running in the bights of the cables and the cables guy the booms toward each other.

6. A cargo handling apparatus including a mast structure, two booms spaced at opposite sides of said mast structure means for universally mounting the heel of each boom adjacent the lower portion of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of each boom and respectively connected to a cargo hook between said booms, guy means connected to the head portion of each boom and secured laterally of the respective vertical axes and on the side opposite the other boom to guy the booms away from each other, a plurality of sheaves mounted on the head of each boom, means for supporting each boom in operative position and including first and second pulley means and an anchor means adjacent one of the pulley means, said two pulley means for each boom being widely spaced laterally with one of said pulley means being disposed laterally of the respective vertical axis and toward the other boom and the other of said pulley means being disposed on said mast structure substantially above the heel portion of the boom and closer to the respective vertical axis than said laterally disposed pulley means, and a cable for each boom anchored to said anchor means and passing through one of said boom sheaves and then through said first pulley means and back through another of said boom sheaves and through said second pulley means to winch means, whereby the opposite parts of said cables reeved from the respective boom sheaves are in diverging relation to each other with said boom sheaves running in the bights of the cables and the cables guy the booms toward each other.

7. A cargo handling apparatus including a mast structure, two booms spaced at opposite sides of said mast structure, means for universally mounting the heel of each boom adjacent the lower portion of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of each boom and respectively connected to a cargo hook between said booms, guy means connected to the head portion of each boom and secured laterally of the respective vertical axes and on the side opposite the other boom to guy the booms away from each other, a plurality of sheaves mounted on the head portion of each boom, means on said mast structure for supporting each boom in operative position and including first and second pulley means and an anchor means adjacent one of said pulley means, said two pulley means for each boom being widely spaced laterally with one of said pulley means being disposed laterally of the respective vertical axis and toward the other boom and the other of said pulley means being disposed substantially above the heel portion of the boom and closer to the respective vertical axis than said laterally disposed pulley means, and a cable for each boom anchored to said anchor means and passing through one of said boom sheaves and then through said first pulley means and back through another of said boom sheaves and through said second pulley means to winch means, whereby the opposite parts of said cables reeved from the respective boom sheaves are in diverging relation to each other with said boom sheaves running in the bights of the cables and the cables guy the booms toward each other.

8. A cargo handling apparatus including a mast structure, two booms spaced at opposite sides of said mast structure, means for universally mounting the heel of each boom adjacent the lower portion of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of each boom and respectively connected to a cargo hook between said booms, guy means connected to the head portion of each boom and secured laterally of the respective vertical axes and on the side opposite the other boom to guy the booms away from each other, a plurality of sheaves mounted on the head portion of each boom, means for supporting each boom in operative position and including first and second pulley means and an anchor means adjacent one of the pulley means, said two pulley means for each boom being widely spaced laterally with one of said pulley means being disposed laterally of the respective vertical axis and toward the other boom and the other of said pulley means being disposed on said mast structure substantially above the heel portion of the boom and closer to the respective vertical axis than said laterally disposed pulley means, said laterally disposed pulley means being spaced in front of said pulley means substantially above the boom heel portion, and a cable for each boom anchored to said anchor means and passing through one of said boom sheaves and then through said first pulley means and back through another of said boom sheaves and through said second pulley means to winch means, whereby the opposite parts of said cables reeved from the respective boom sheaves are in diverging relation to each other with said boom sheaves running in the bights of the cables and the cables guy the booms toward each other with said frontwardly spaced pulley means preventing passage of the booms beyond ninety degrees of horizontal arc on either side of the booms.

9. A cargo handling apparatus including a mast structure, two booms spaced at opposite sides of said mast structure, means for universally mounting the heel of each boom adjacent the lower portion of said mast structure for movement about vertical and horizontal axes, cargo falls reeved from the head portion of each boom and respectively connected to a cargo hook between said booms, guy means connected to the head portion of each boom and secured laterally of the respective vertical axes and on the side opposite the other boom to guy the booms away from each other, a plurality of sheaves mounted on the head portion of each boom, means on said mast struc-

ture for supporting each boom in operative position and including first and second pulley means and an anchor means adjacent one of the pulley means, said two pulley means for each boom being widely spaced laterally with one of said pulley means being disposed laterally of the respective vertical axis and toward the other boom and the other of said pulley means being disposed substantially above the heel portion of the boom and closer to the respective vertical axis than said laterally disposed pulley means, said laterally disposed pulley means being spaced in front of said pulley means substantially above the boom heel portion, and a cable for each boom anchored to said anchor means and passing through one of said boom sheaves and then through said first pulley means and back through another of said boom sheaves and through said second pulley means to winch means, whereby the opposite parts of said cables reeved from the respective boom sheaves are in diverging relation to each



other with said boom sheaves running in the bights of the cables and the cables guy the booms toward each other with said frontwardly spaced pulley means preventing passage of the booms beyond ninety degrees of horizotnal arc on either side of the booms.

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