

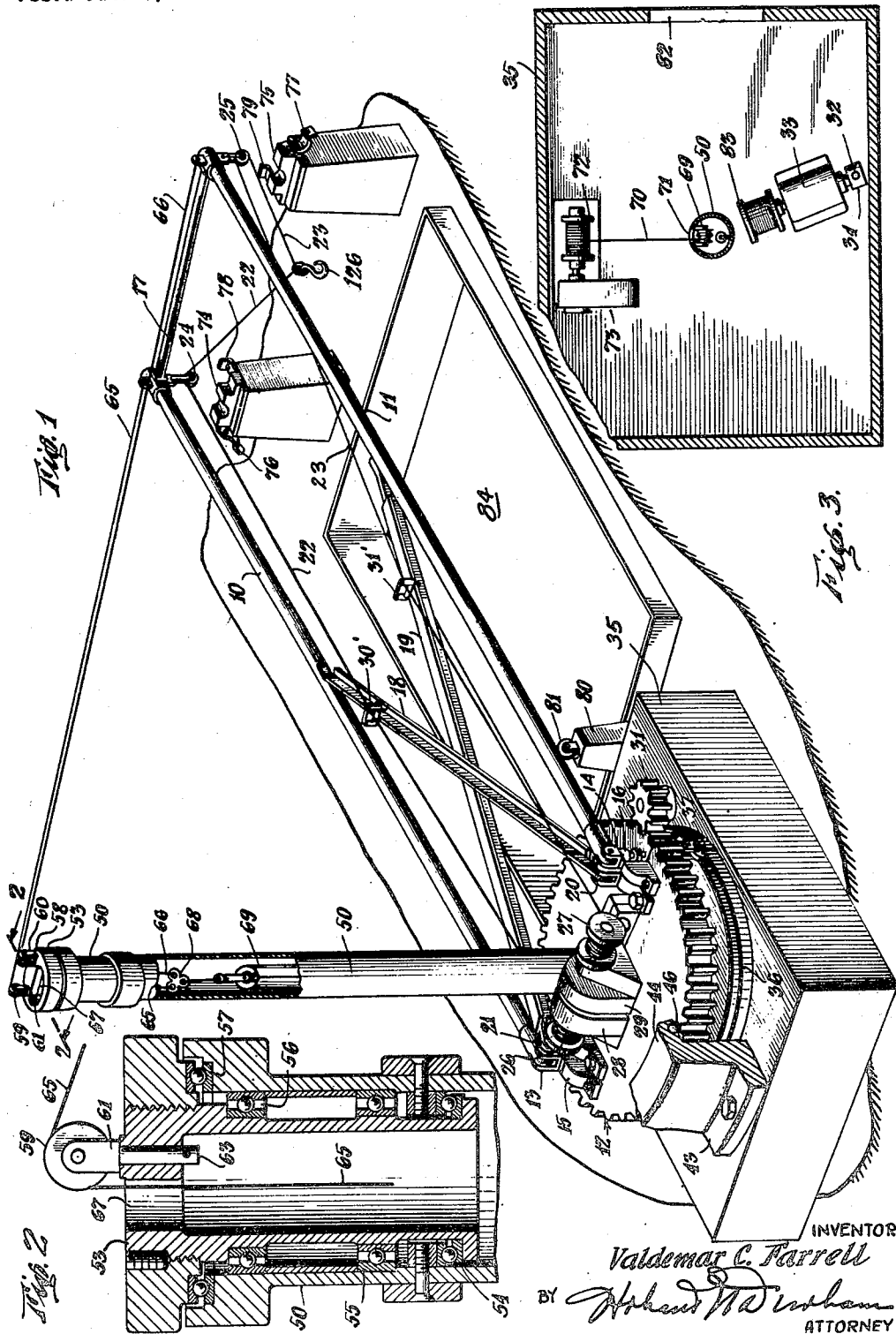
July 24, 1951

V. C. FARRELL
HOISTING APPARATUS

2,562,086

Filed June 5, 1945

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

Fig. 4

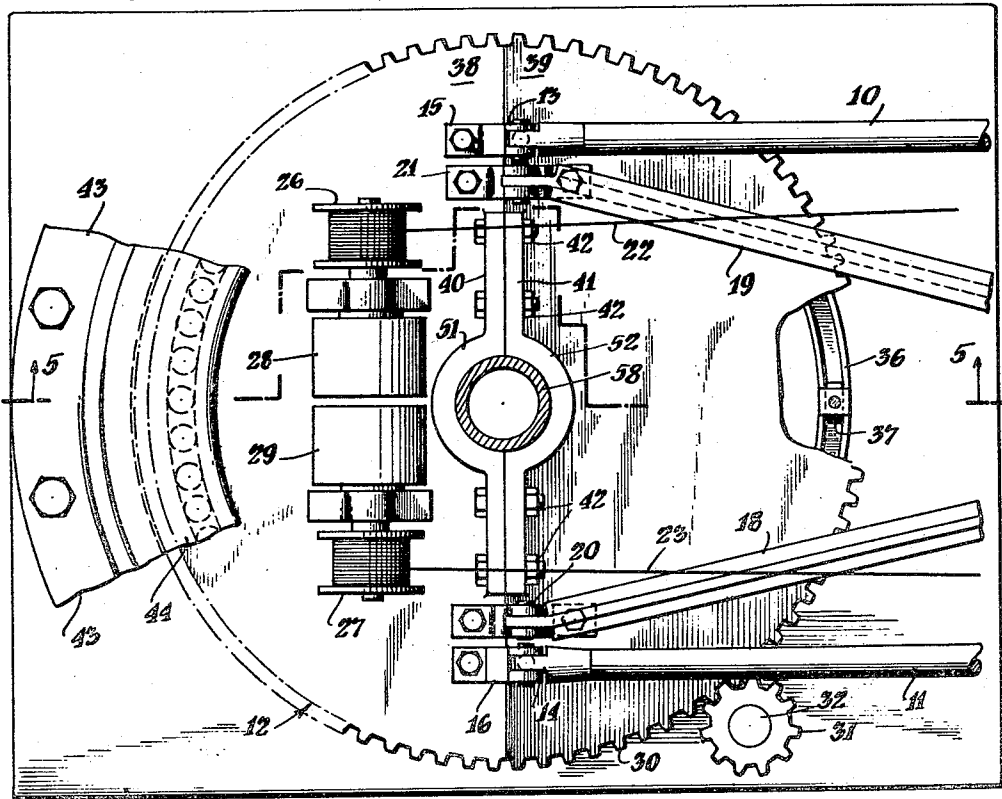
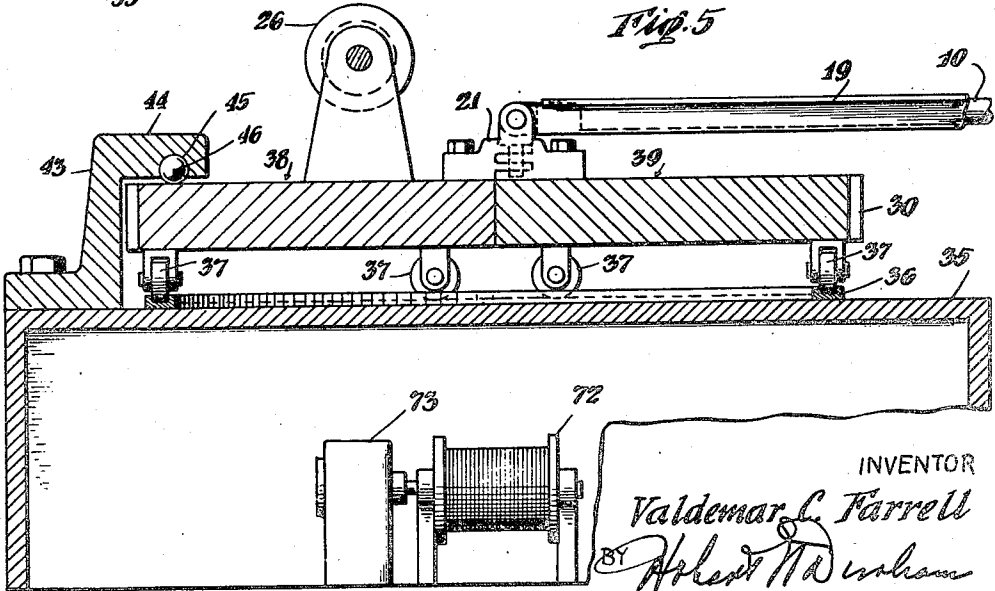


Fig. 5



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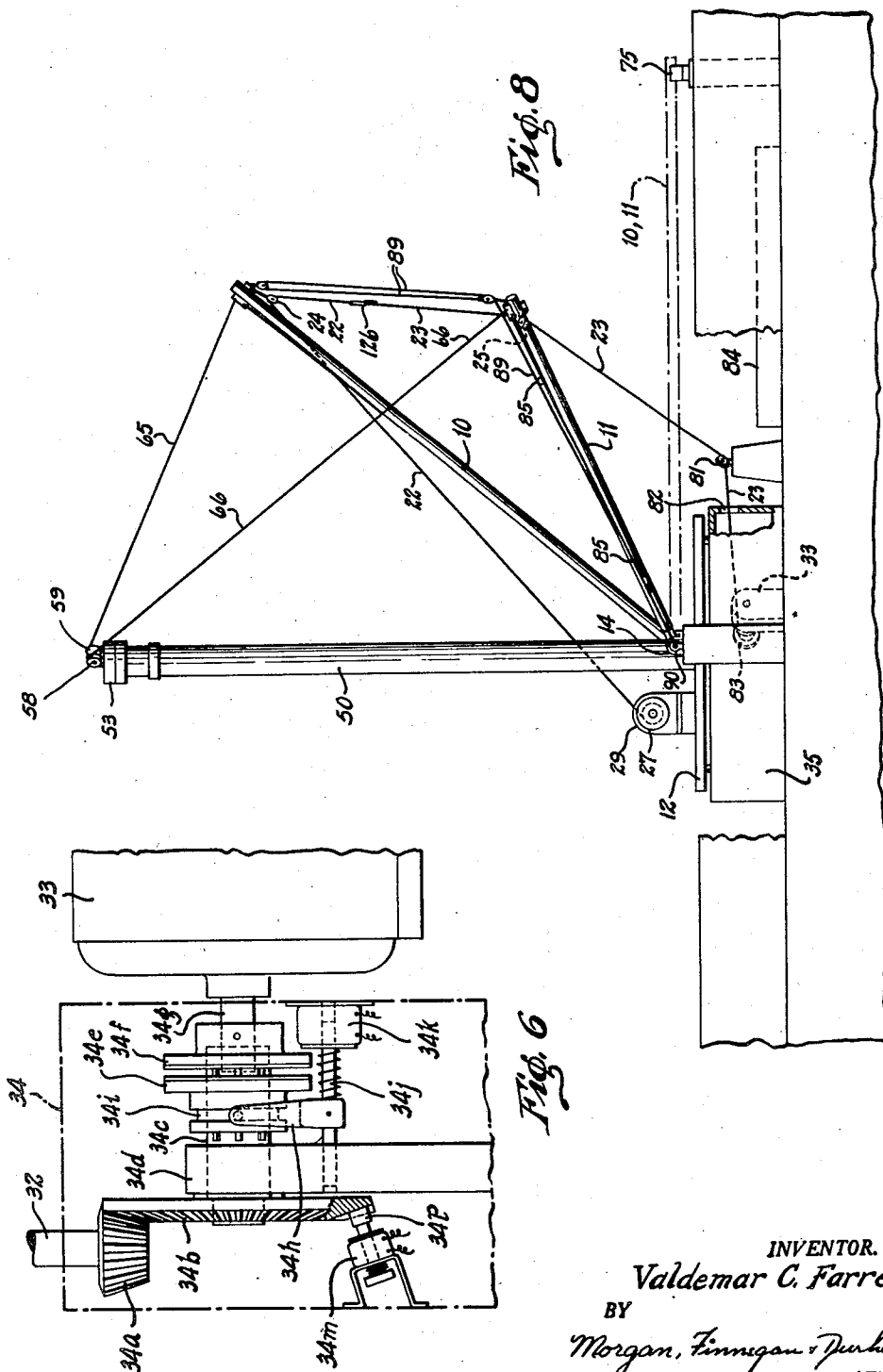
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4 Sheets-Sheet 3



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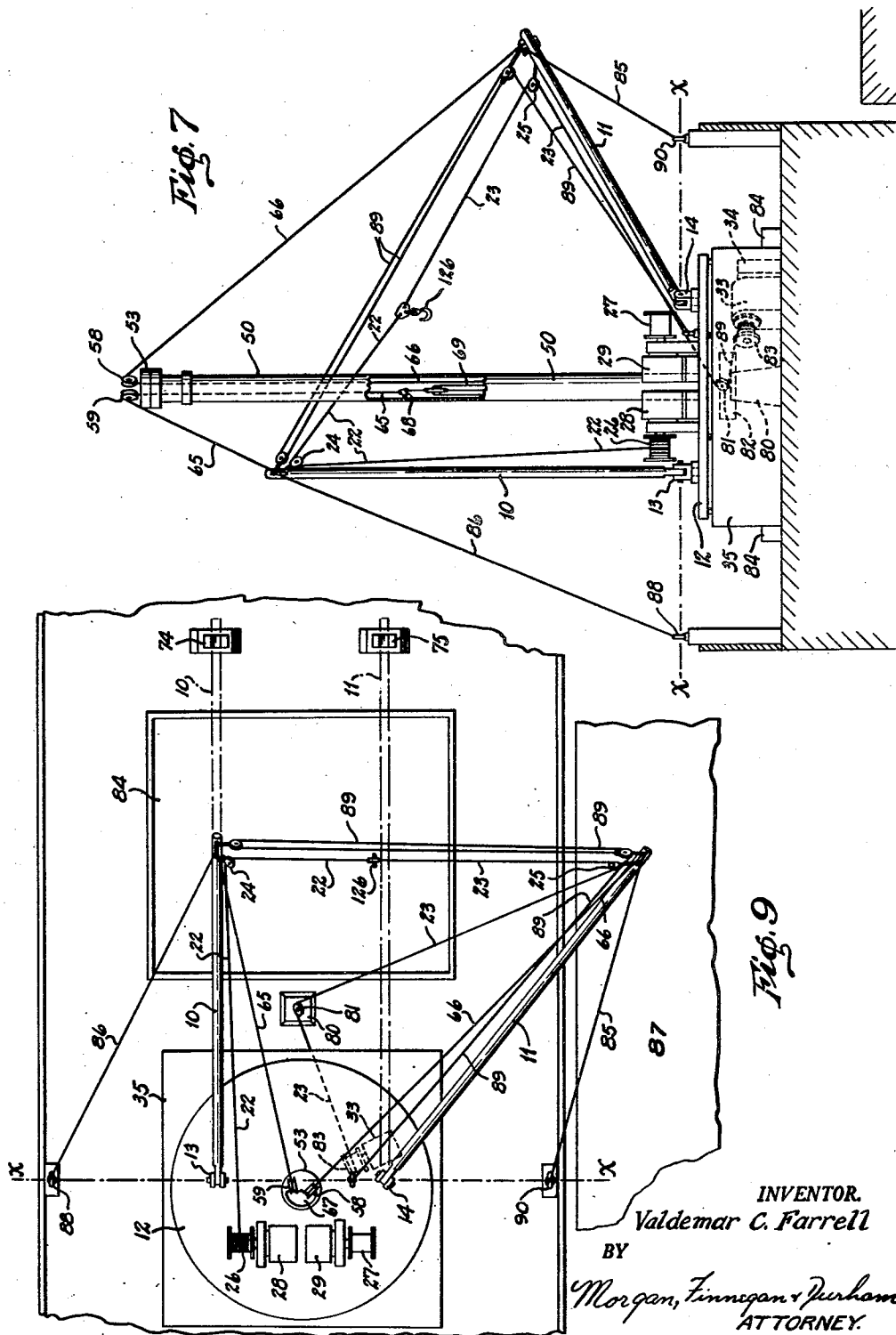
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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,562,086

HOISTING APPARATUS

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Application June 5, 1945, Serial No. 597,672

12 Claims. (Cl. 212—3)

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This invention relates to hoisting apparatus or derricks for transferring loads from one loading station to another and relates more particularly to cargo rigs for ships.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Objects of this invention are to provide a new, useful and improved hoisting apparatus that is particularly adapted for use as a cargo rig for ships and which will enable a load to be transferred from one loading station to another, as, for example, from dock to ship or vice versa, in a faster, safer and smoother fashion than is possible with the conventional so-called burton rig and which is capable of handling a load larger than can be handled by a burton rig and, if the need arise, of being converted easily, simply and quickly into a burton rig.

Another object of this invention is to provide a hoisting apparatus with which, through the provision of two single purchase wires, double the load can be lifted at the same speed as can be attained with a single wire rig.

In the accompanying drawings which form part of the instant specification and are to be read in conjunction therewith and in which like numbers refer to like parts throughout the several views:

Of the drawings:

Figure 1 is a view in perspective of a preferred embodiment of this invention as applied to a marine vessel;

Figure 2 is a view in section taken along the line 2—2 of Figure 1;

Figure 3 is a view in plan of the interior of the housing or wheel supporting structure of the device of Figure 1;

Figure 4 is a fragmentary view in plan of the device of Figure 1 with parts broken away in order to show more clearly the relationship of certain elements; and

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Figure 5 is a view in section taken along the line 5—5 of Figure 4.

Fig. 6 is a partly diagrammatic view in elevation with parts in section of the transmission-clutch mechanism for the boom table of Fig. 1;

Fig. 7 is a partly diagrammatic view in end elevation of the convertible cargo rig shown in Fig. 1, as applied to a marine vessel, as it would appear when converted for use as a burton rig and employed for transferring cargo between the vessel and a pier alongside, the view being taken looking from the heel toward the head of the boom structure as viewed in Fig. 1;

Fig. 8 is a view in side elevation of the cargo rig as converted and with the booms in the same position as in Fig. 7, the view being taken looking from the pier toward the vessel; and,

Fig. 9 is a view in plan of the cargo rig as converted and with the booms in the same position as in Fig. 7.

In accordance with this invention, a pair of relatively long cargo booms in parallel, widely spaced relation to each other are hingedly and pivotally connected at their heel or bottom ends on a common horizontal hinge axis and on separate vertical axes to and on diametrically opposite sides of a horizontally disposed revoluble platform, hereinafter termed a "boom table," mounted for 360° rotation. Means are provided for securely but detachably connecting the booms into a unitary, rigid structure. The embodied connecting means comprises a rigid bracing and spacing member detachably anchored to the booms at their head ends and a pair of brace members in crossed relation each leading from one boom at a point approximately two thirds of the length of the boom, where it is detachably secured, to the heel of the other boom where it is hingedly connected to the platform structure on an axis coaxial with the horizontal hinge axis of the booms. Thus, the booms through the provision of suitable tackle means to be hereinafter described, may be raised or lowered and, through the provision of the boom table, may be swung as a unitary structure and, by disconnecting the bracing members from the booms, either boom may be raised or lowered or swung independently of the other. Boom cradles are preferably provided at the head ends of the booms into which the boom heads may be lowered and secured when not in use.

Means are provided also for topping and lowering the boom structure either when the boom table is at rest or is turning, the embodied topping means comprising a hollow, rigid, stationary

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mast structure vertically disposed concentrically of the boom table through which it passes into a socket at a suitable deck or level therebeneath. The mast structure is provided with a hollow head portion rotatable on the vertical axis of the mast. Separate revolvable tackle blocks, one for each boom are mounted on the revolvable head portion and separate topping lifts lead from the head end of each boom over the respective blocks into the interior of the mast. The topping lifts have a common connection within the mast to a tackle whose handling part leads through an access opening in the base of the mast beneath the boom table to power-driven winch or reeling means situated beneath the boom table. This arrangement of the rotatable mast head portion and separate topping lifts assures an even distribution of the stress on the topping lifts and also serves to keep the boom heads in the same plane at all times.

A cargo hook or other suitable load supporting means is carried by a pair of load falls between the head ends of the boom structure. Each load fall is connected at one end to the hook and extends upwardly therefrom in diverging relation to the other fall to and over a head block carried by each boom at the head end thereof. A pair of purchase winches is mounted on the boom table for turning therewith and the respective load falls lead directly from the respective head blocks to the respective winch drums.

The two purchase winches are preferably operable separately or together so that they can be locked together at will with the hook centered between the two booms and used as one unit when the rig is used as a straight swinging boom or crane for heavy or long lifts. The hook being centered between the two booms will assure even distribution of the load between the two booms and create opposing angles in the lead of the load falls which will prevent the load from swinging when the boom structure is swung quickly and stopped suddenly.

It will be understood that the foregoing general description and the following detailed description as well as exemplary and explanatory of the invention but are not restrictive thereof.

Referring now more particularly to the accompanying drawings, a pair of relatively long, parallelly disposed booms 10 and 11 are hingedly connected at their respective heels to a power-driven rotatable boom table 12. For this purpose, there is provided on the boom table, a pair of identical hinge clevis members 13 and 14 respectively journaled for rotation on a vertical axis in the respective units of a pair of journal members 15 and 16 which are bolted or otherwise suitably secured to the boom table 12 adjacent the perimeter of the boom table and at substantially diametrically opposed locations. The booms 10 and 11 are hingedly connected at their respective heels to the hinge clevis members 13 and 14, respectively, the hinge axes of the respective clevis members being horizontally disposed and in coaxial alignment so that the booms may be topped or lowered as a unit and in a vertical plane without disturbing their parallel relation.

At the outboard or head ends of the booms there is provided a rigid brace member 17 which is bolted or otherwise suitably detachably secured at its ends to the booms and serves to hold them in their desired fixed, parallel relation to each other. The booms are further strengthened and braced into a unitary rigid structure by means of brace members 18 and 19 extending in crossed

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relation to each other from the booms 10 and 11, respectively, at points approximately two thirds the length thereof, to the heel of the opposite boom. The brace members 18 and 19 are detachably bolted or otherwise suitably detachably secured at their outboard ends to the booms 10 and 11, respectively, and are hingedly connected at their inboard ends to a pair of identical hinge clevis members 20 and 21, respectively. The brace members 18 and 19 serve to brace the booms 10 and 11 in turning movement of the boom structure as a unit around the fixed mast structure 50 and particularly to brace the booms against stresses resulting from rapid starts and stops. Thus, on clockwise turning movement (as viewed in Fig. 4) the brace 18 would be placed in tension and the brace 19 would be placed in compression at the start of the movement. The stresses would be reversed as the turning motion is slowed down. The hinge clevis members 20 and 21 are bolted or otherwise suitably secured to the platform structure 12 with the hinge axis of each horizontally disposed and coaxial with the horizontal hinge axes of the boom clevis hinge members 13 and 14, thereby to provide a common hinge axis for the booms 10 and 11 and for the brace members 18 and 19. By having the brace clevis members 20 and 21 separate from the boom clevis members 13 and 14, not only are the latter relieved of the leverage which the brace members would impart thereto, but, in addition, the boom clevis members are left free to permit independent swinging of the respective booms about the respective vertical axis of the boom clevis members when the brace members 18 and 19 are disconnected from the booms.

Rigged on the boom structure formed by the twin booms 10, 11 and their bracing members 18, 19 is a purchase system comprised of a pair of independently actuatable load falls 22 and 23. The falls 22 and 23, each preferably consisting of a single wire cable, traverse a pair of head blocks 24 and 25, respectively, carried by the booms 10 and 11, respectively, at their respective head ends and lead from the blocks 24 and 25 to a centered load supporting member 26, preferably a cargo hook, as shown, to which they are securely anchored in any convenient fashion. The load falls 22 and 23 also extend inwardly from the head blocks 24 and 25, respectively, generally lengthwise of the booms 10 and 11 to the winding drums 26 and 27, respectively, of a pair of power-driven winches 28 and 29, respectively, carried by the platform structure 12. Suitable anti-friction guide members 30' and 31' may be mounted on the brace members 18 and 19, respectively, through which the load falls 22 and 23, respectively, are led and by which they are properly guided as they are payed in and out along the booms.

The rotatably mounted boom table 12 as embodied is of ample dimensions to permit of the desired diametral or substantially diametral spacing of the booms 10 and 11 and is of sufficiently sturdy construction to carry the booms and their required load and the purchase winches as well as any necessary ancillary operating gear for the winches which are preferably separately controlled electrically or hydraulically powered prime movers. As here preferably embodied, the boom table 12 is of circular contour with a toothed rim 30 which is engaged by a relatively small diameter driving gear 31 mounted on and rotatable with a vertical drive shaft 32 leading downwardly therefrom to a suitable winch or prime mover 33

to which it is connected preferably through a suitable gear box and clutch mechanism diagrammatically indicated at 34 in Figure 3 and more particularly described hereinafter with reference to Fig. 6.

For rotatably mounting the boom table 12, and for accommodating the boom table driving mechanism and boom topping winch, to be more particularly described hereinafter, there is provided a housing 35 which may be a deck housing and conveniently of generally rectangular contour in plan, upon the top of which the boom table 12 is mounted for rotation on a vertical axis. To this end, as here preferably embodied, there is secured to the top of the housing 35 an annular U-shaped channel member 36 forming a circular track concentric with the boom table upon which the boom table 12 is supported for rotation on its axis by means of a suitable number of anti-friction roller members 37. The members 37 are positioned at suitably arcuately spaced intervals beneath the boom table so as to engage said track channel and be guided therein.

The boom table 12 is preferably of sectional construction to enable its assembly around the mast structure 50, and, as here preferably embodied, comprises half sections 38 and 39 (Fig. 5) which are provided with the upstanding bolting flange portions 40 and 41, respectively, extending diametrically of the boom table between the brace clevis members 20 and 21 in opposed matching relation to each other and securely united as by means of bolts 42. An arcuate retaining member 43 is bolted or otherwise suitably detachably secured to the top of the housing 35 and is provided with an arcuate flange portion 44 overhanging the rim of boom table 12, preferably throughout a major portion of its circumference, outside the path of the boom heels and having an arcuate raceway 45 receiving and retaining ball bearings 46 between the member 43 and the boom table. It will be understood that the retaining member 43 functions to counteract the tipping of the boom table that would be imparted to it by the booms 10 and 11 in the absence of such provision.

Means are provided for topping and lowering the booms 10 and 11 together as a unit. The embodied topping means is suitably constructed and arranged so that the booms may be topped or lowered either with the boom table 12 at rest, or in motion, and so that there will be an equal distribution of stress on the boom heads at all times. As here preferably embodied, a hollow, rigid mast structure 50 extends vertically upwardly midway of the heels of the booms through the housing 35 and the boom table 12 with which latter it is concentric and is embraced by arcuate journal portions 51 and 52 of the upstanding flanges 40 and 41, respectively. A hollow revolvable mast head portion 53 is telescopically received within the mast structure at its top and is carried thereby on suitable anti-friction and thrust bearings 54, 55, 56 and 57 operative to prevent axial movement of the mast head portion in either direction while permitting its free rotation on a vertical axis concentric with that of the boom table 12 and mast structure 50.

A pair of sheaves 58 and 59 carried by sheave frames 60 and 61, respectively, are located atop the mast head portion 53 at opposite sides of the vertical axis of the mast structure with their rotational axes horizontal, the sheave frames being journaled in turn in the mast head portion for rotation each on a separate vertical axis so

that the sheaves may freely swivel. To this end, the sheave frames 60 and 61 are each provided with a separate axle, such as the axle 63 of the sheave frame 61 shown in Fig. 2, these axles being identical and being journaled in the mast head portion 53 so that their respective rotational axes lie in the same vertical plane in offset relation to the rotational axis of the boom table 12. In general, the relationship of the sheaves, sheave frames and frame axles is preferably such that the plane of the vertical rotational axis of the boom table or carriage and mast will be substantially tangential to the sheaves 58 and 59 when their horizontal rotational axes are aligned.

Topping lifts 65 and 66 are separately anchored at one end of each to the booms 10 and 11 respectively at the boom heads and lead therefrom upwardly and in converging relation to each other to and over the sheaves 59 and 58, respectively, and thence down through an opening 67 in the hollow revolvable mast head portion 53 into the interior of the mast 50. The topping lifts are connected together in the mast 50 by a link member 68 (Fig. 1), such as a clover-leaf type link, which in turn is connected to a tackle 69 whose handling part 70 leads through an access opening 71 in the bottom of the mast, to the winding drum 72 of a topping winch 73 located suitably within the housing 35. This arrangement of the topping lifts assures an even distribution of the stress on the two topping lifts and keeps the two boom heads in the same horizontal plane at all times.

Rotation of the boom table 12 and consequent swinging of the booms 10 and 11 as a unit structure around the mast 50 is effected at will by the remotely controlled winch 33 operating through the transmission and clutch mechanism 34 which may be of any suitable form enabling the boom table 12 to be rotated in either a clockwise or counterclockwise direction. The transmission-clutch mechanism 34 is also preferably provided with a locking mechanism so that the boom table or carriage may be coupled to and uncoupled from the prime mover 33 and, when uncoupled, locked in any desired position. One form of such transmission-clutch mechanism 34 with provision for locking the boom table 12 is diagrammatically depicted in Fig. 6. As there shown, the vertical drive shaft 32 may terminate within the unit 34 in a driven bevel gear 34a operatively coupled to a driving bevel gear 34b. The latter may be carried at one end of a driven shaft 34c journaled for rotation in a bearing 34d and carrying at its other end a clutch plate 34e splined thereto for to-and-fro movement axially thereof. A second clutch plate 34f is fixedly mounted on the driving shaft 34g of the prime mover 33 and is adapted to be frictionally engaged by the clutch plate 34e to thereby permit the prime mover 33 to turn the shaft 32, and hence the boom table 12, through the gear train 34a-34b. Movement of the clutch plate 34e into and out of operative coupling engagement with the clutch plate 34f may be effected by means of a yoke member 34h engaging a circumferentially recessed hub portion 34i of the clutch plate 34e and carried by a yoke actuating rod 34j suitably supported for reciprocation. The rod 34j may be manually actuated but is preferably electrically actuated as by means of the solenoid unit 34k under the control of the operator. Locking mechanism for holding the gear 34b, and hence the boom table 12 against rotation, when uncoupled from the prime mover 33, is provided and may be in the form of a locking pin

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34p movable into and out of engagement with the gear 34b between the gear teeth. Preferably a solenoid unit 34m in which the pin 34p is mounted for reciprocation, is employed for effecting such movement under control of the operator.

A pair of stationary boom cradles 74 and 75 are located so as to receive the boom heads in a horizontal, at rest, position. The boom cradles are preferably provided with suitable fastening devices 76 and 77, respectively, by which the booms may be lashed securely to the respective cradles when not in use. Ancillary cradles 78 and 79 secured to the cradles 74 and 75, respectively, are adapted to receive and hold the brace member 17 when the booms are cradled and also when the brace member is detached from the boom heads.

A fair lead post 80 is positioned forwardly of the housing 35 and aft the boom cradles 74 and 75 (as viewed in Fig. 1) substantially midway between the sides of the housing 35 and carries a swivelled fair lead block 81. When the rig is used aboard ship as a burton rig, as depicted in Figs. 7, 8 and 9, with the booms separated and independently guyed for transferring cargo between a dock 87, for example, and hatch 84, the load fall 23 (assuming the vessel to be tied up with its starboard side to the dock 87 as shown) may be disconnected from the winch drum 27 and led over the fair-lead block 81 through an opening 82 (Fig. 3) in the housing 35 to winding drum 83 on the winch 33. The other load fall 22 is left connected to the winding drum 26 of the winch 28 in such case. If the vessel were tied up with its portside to the dock, the load fall 22 would be disconnected from the winding drum 26 and run over the fair lead block 81 to the winding drum 83, the other load fall 23, in such case, being left on the winding drum 27. This use of the fair-lead block and winding drum 83 is of advantage in order to avoid the difficult approach angle which the load fall would have to make with the winding drum 27 or 26 from the boom over the dock.

This invention is particularly adapted for use as a cargo rig for ships, in which case, the housing 35 and boom cradles 74 and 75 are located centrally longitudinally of the vessel with the cargo hatch 84 (Fig. 1) therebetween. In such case, the booms may be in the order of 65 to 70 feet long with their heels and heads approximately 20 feet apart. When working light cargo from or to double decked piers with narrow aprons, the twin purchase winches 28 and 29 which are preferably magnetically or mechanically releasably coupled, would be unlocked from each other and used as separate winches in order to put the hook 126 directly under the boom over the dock, for example, boom 11 to pick up the load and transfer it to the boom nearest the hatch 84, boom 10 in such case, in a burtoning operation. With the booms 10 and 11 united into a rigid structure, as in Fig. 1, it would be apparent that to place the head of the boom 11, for example, over the pier or dock at the righthand (starboard) side of a vessel, as viewed in Fig. 1, it is merely necessary to rotate the boom table 12 by means of the prime mover 33 under the control of the operator. Obviously, if the ship is tied up to the dock on the opposite side, the arrangement would be reversed so as to bring the boom 10 over the dock with boom 11 nearest the hatch 84. As the boom heads are in the order of 20 feet apart, this burtoning operation will place the

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load almost over the hatch 84 and it will only be necessary to swing the boom structure back a short distance to place the load over the hatch which can be done by rotating the boom table 12, counterclockwise, as viewed in Fig. 1, by means of the prime mover 33 while the load is being transferred from the boom 11, the outboard boom in this case, to the other boom 10, the inboard boom in this case. It will be understood that the boom structure may be topped and lowered by means of the topping lifts 65, 66 powered by the winch 73 (Fig. 3), to place the load in the forward, midship, or aft part of the hatch 84, as desired, and that this topping operation may be carried out while the structure is being swung and/or the load burtoned between the boom heads. Due to the wide angle between the falls 22 and 23 at the hook, swinging or oscillation of the load between the boom heads is substantially eliminated, and this burtoning operation can be carried out much more safely, quickly and smoothly than with the conventional burton rig. The ability to swing the boom table 12 and hence the boom structure as a unit assures faster taking of larger loads from the dock to the ship's hold than is possible with the universally used burton rig with the broad angle between the stationary boom over the hatch and the one over the dock. Moreover, there is substantially no sharp swinging of the load between the booms as the boom structure is set in motion or stopped in its swing inboard or outboard of its fore and aft position.

If desired, the rig can be converted to a burton rig such as is shown in Figs. 7, 8 and 9, upon lowering the booms 10 and 11 to their respective cradles 74 and 75 by paying out the topping lifts 65 and 66 through operation of the topping winch 73. The brace member 17 is then unbolted from the boom heads and left in the cradles 78 and 79, and the brace members 18 and 19 are disconnected from the booms 10 and 11, respectively, and hoisted upright against the mast 50 where they will be lashed out of the way. When the booms are operated independently, it is necessary to guy them from both sides, that is inboard and outboard. The inboard guying is usually effected by tying the booms together by a midship or schooner guy 89, or by running the topping lifts inboard, and both arrangements are shown. The outboard guying is effected by a vang or outboard guy extending from each boom to a point outboard of the boom. In the present instance, a set of outboard guys 85 and 86 is then rigged to the booms in order to hoist them independently and to fix them in a normally operative position with one boom, boom 11 for example (which will be referred to as the outboard boom), extending outwardly at a suitable angle over the dock 87 (assuming the vessel is tied up with the dock on its starboard side), to which position it is adapted to be turned by reason of the universal mounting provided by the journalled clevis 14, and the other boom 10 (which will be referred to as the inboard boom) is positioned over the hatch, as is depicted in Figs. 7, 8 and 9. In such case, the topping lift 66 of the outboard boom 11 will be disconnected from the clover-leaf connecting link 68 and placed on a cleat (not shown) within the mast structure 50, access to the link 68 being had through the opening 71 in the base of the mast. The topping lift 65 of the inboard boom 10 will be left connected to the link 68, as shown in Fig. 7, so that the boom 10 can be lowered to

land a load in the forward end of the hatch 84 and topped up (raised) to land a load in the after end of the hatch, so that two gangs can be worked with one rig. To do this, it will be necessary to rig two outboard guys on the inboard boom of which one will be set for holding the boom 10 in the desired position for landing loads in the after end of the hatch and one will be set for landing loads in the forward end of the hatch. This can be done so that the change will be made automatically without having to adjust guys. Preferably, however, and as shown in Figs. 7, 8 and 9, this can also be accomplished by securing the bottom end of the outboard guy 86 of the inboard boom 10 at a point 88 on the athwartship axis X—X of the heel or bottom end of the boom. When this is done, the topping and lowering of the boom will not change the angles between the boom, said athwartship axis and the guy 86, respectively, and the guy 86, therefore will not have to be tightened or slackened. Therefore, when the boom is topped or lowered, it and the guy unitarily revolve about the said axis, regardless of the angle between the boom and its axis, and the boom head, or its load fall connection, moves directly fore and aft, that is through an arc that lies in a plane which is perpendicular to said axis. The angle of the midship guy 89, when it is connected between the two booms, is such that the lowering and topping of the inboard boom will not cause any appreciable tightening or slackening. Moreover, since normally only the boom 10, in such case, is to be topped up or lowered to haul cargo at different locations longitudinally of the hatch and hold, the anchorage point of the bottom end of the outboard guy 85 is not critical so long as the outboard boom 11 is to be held to its selected position over the dock 87. However, since the ship may be tied up with either its starboard side or its port side to the dock, and since, in the latter case, the boom 11 would be over the hatch, or if the outboard boom is handling cargo in railway cars or the like spaced along the dock, the guy 85 is preferably also anchored to a point 90 on a common horizontal hinge axis X—X of the booms so that it may also be moved straight fore and aft without adjusting the guy 85. As previously noted, with the booms 10 and 11 thus separated and independently guyed for use as a burton rig, the load fall 23 of boom 11 is preferably disconnected from the winding drum 27 and is led over the fair-lead block 81 through the opening 82, Fig. 3, in the housing 35 to the winding drum 83 on the winch 33. This is desirable for the practical reason that the runner of the boom swung out over the dock thus is imparted a much more practical angle of approach to the winding drum 83 than to the drum 27. Obviously, the same considerations would apply were the boom 10 the outboard or dock boom.

It will be understood that in the operation of the preferred embodiment of this invention as in Fig. 1, the operator may take his station on the boom table 12 and operate the purchase winches 28 and 29, the topping winch 73 and the boom table driving winch 33 therefrom by suitable control means connecting with the several winches which are preferably electric motor operated. It will be apparent that in the arrangement of Fig. 1, the winch 73 will operate to raise and lower the twin booms 10 and 11 as a unit, that the winches 28 and 29 will operate to pay in or out the purchase falls

22 and 23, separately or together so as to permit burtoning of the hook 126 between the boom heads; and, that the winch 33 may drive the boom table 12 in either direction while the foregoing operations are carried out simultaneously, or separately.

It will be further understood that when the device of Fig. 1 is rigged for a burtoning operation, as in Figs. 7, 8 and 9, with the inboard boom 10 separate from the outboard boom 11, that the winch 73 will operate through the topping lift 65 to raise and lower the boom 10 whereas the load fall 23 of the boom 11 will be rigged over the head block 25, and fair-lead block 81 to the winch drum 83 in such case.

Thus, it will be seen that the objects of this invention have been accomplished.

Cumbersome rope and wire guys are completely eliminated in the crane which will save a substantial amount of operating costs during the life of a ship in their purchase, maintenance, rigging and unrigging of them four times each voyage. With this rig, a ship will be able to moor at a dock with all booms in the crutches or cradles and have them up and working cargo in two to five minutes.

Its operation is so simple that an inexperienced person of average intelligence will learn to operate it efficiently and safely with very little practice or experience, whereas, with the presently used burton rig, it takes months of experience to make a good winch driver and they are scarce.

Its smooth operation will enable one to double the size of loads of package freight by taking two pallets with each load by merely doubling the length of the spreader and adding a set of legs in the middle with two hooks in a long eye of each. This will enable one to place two pallets side by side and unite them in one load with the two center legs of the sling. The size of loads of freight that are made up under the hook with wire choker slings can be doubled or increased as much as desired up to the capacity of the booms by merely adding more men or equipment to the load-building gangs. In the case of heavy railroad car or lighter freight such as steel beams, pipe, plate, etc., the loads can be increased by merely slipping the slings around the additional amount desired.

The ability to lower and raise the boom or booms quickly enables ready lowering to the horizontal position for maximum reach, which facilitates loading from or discharging to railroad cars on the third set of rails on railroad piers.

The ability to lift the loads, swing and raise or lower the boom simultaneously, take loads alternately from or to any point in the large area of dock within the long reach of this rig; and to land or take loads from any point within the area of the hatch or deck will eliminate several bottlenecks and a lot of bulling of cargo which slows up loading and discharging.

The flexibility of this rig will enable one to load steel beams, plates and pipe as long as any ship's hold will take without touching the ship's side or deck which will eliminate broken or bent bulwarks or gunnels, kinked or crimped steel plates and beam flanges and sprung hatch coamings that frequently occur when most of the weight of such loads is banged against and dragged over the bulwarks, decks and hatch coamings with the presently used burton rig.

This rig will load heavy lifts such as cargo

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containers, vans and other items of any description within its designed capacity at least twice as fast as existing heavy lift rigs on ships.

The above described features and operating possibilities lead one to believe that if they are properly utilized this rig will handle a general cargo twice as fast as the existing burton rigs and that it will work two gangs in a long hatch faster and more efficiently than similar hatches with two burton rigs.

The ability of this rig to revolve 360 degrees will enable one to use it on either hatch on the two sides of it or both such hatches simultaneously; this will eliminate the crippling effect of a breakdown of gear at one hatch. It will also enable one to finish loading or discharging hatches together.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantage.

What is claimed is:

1. A convertible cargo rig for ships comprising a boom table mounted for rotation on a substantially vertical axis; power means for rotating said boom table; a fixed hollow mast structure concentric with said boom table, said mast structure having a rotatable head portion; a pair of independently operable winches carried by said boom table; a pair of relatively long, widely spaced and substantially parallel extending booms hinged at their heels at opposite sides of said mast structure to said boom table on a common horizontal axis and on separate vertical axes; a pair of brace members each extending from a different boom of said pair of booms to the heel of the other boom and having a hinged connection to said boom table and a releasable connection to the boom from which it extends, the hinge axes of said brace members being coaxial with each other and with the horizontal hinge axis of said booms; a pair of load falls each leading from a different load fall winch of said pair of load fall winches to the head of a different boom of said pair of booms, said load falls being fixedly interconnected and anchored together at one pair of corresponding ends between said boom heads to provide a common load-attachment point from which the load falls lead in diverging relation to each other to the boom heads; a purchase member carried by said load falls at said common load-attachment point beneath and between the boom heads; and, means for topping said booms including a topping winch disposed beneath said boom table, separate topping lifts separately extending in converging relation to each other from the respective heads of said booms into the interior of said mast structure through said revolvable head portion, and hauling means connecting said topping lifts and said topping winch through the interior of said mast structure.

2. A convertible cargo rig for ships comprising a fixed hollow mast structure having a rotatable head portion; a rotatably mounted boom table concentric with said mast structure, a pair of relatively long, widely spaced and substantially parallel extending booms hingedly mounted at their heels on said boom table; brace members releasably connecting said booms; a pair of load falls carried by said booms at the heads thereof, said load falls being fixedly interconnected and anchored together at one pair of corresponding

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ends between said boom heads to provide a common load attachment point from which the load falls lead in diverging relation to each other to the boom heads; a purchase member suspended by said load falls between the boom heads at said common load attachment point so as to be shiftable laterally and vertically therebetween; means for independently hauling on said load falls; and, topping means extending through said revolvable head portion to said booms from beneath said boom table, said means including separate topping lifts separately extending in diverging relation to each other from said revolvable head portion to the respective boom heads.

3. A convertible crane comprising a mast structure having a revolvable head portion; a revolvable boom table concentric with said mast structure; locking means for securing said boom table in a selected position; a pair of relatively long, widely spaced booms extending in substantially parallel relation from said boom table at substantially diametrically opposite sides of said mast structure; brace means coupling said booms for use normally as a twin boom rig, said brace means comprising a brace member detachably connected to said booms at their head ends and separate brace members, in crossed relation, hingedly connected at one set of corresponding ends to said boom table for vertical swinging movement and detachably connected at their other set of corresponding ends to said booms whereby when detached therefrom they may be hoisted and lashed to said mast structure; means hingedly connecting each boom at its heel end to said boom table for vertical swinging movement of said booms together when used as a twin boom rig and for vertical and horizontal swinging movement of one independently of the other when said brace means are detached and said booms are guyed for use as a burton type ring; a load fall for each boom carried by each said boom at its head, said load falls being fixedly interconnected and anchored together at one pair of corresponding ends between said boom heads to provide a common load attachment point from which the said load falls lead in diverging relation to each other to the boom heads; a purchase member suspended at said point from said booms by said load falls between the boom heads; means for separately and independently hauling on said load falls whereby said purchase member may be raised, lowered and moved laterally in a burtoning operation between said boom heads; separate topping lifts separately extending in converging relation to each other from the respective boom heads to said revolvable mast-head portion; means for hauling on said topping lifts; and means detachably connecting said topping lifts together below said revolvable mast-head portion whereby the hauling effort may be applied to said lifts equally when said booms are connected for use as a twin boom rig and may be applied to either lift when said booms are separated and independently guyed for use as a burton type rig.

4. A convertible cargo rig for ships comprising a boom table mounted for rotation on a substantially vertical axis; a mast structure concentric with said table, said mast structure having a revolvable head portion; separate booms extending in spaced substantially parallel relation to each other from said table at opposite sides of said mast structure, each said boom being hingedly mounted at its heel for swinging movement about both a vertical and a horizontal axis; means

releasably securing said booms together into a rigid twin boom structure in which the horizontal hinge axes of said booms are coaxially aligned; separate topping lifts separately extending in converging relation to each other from the respective boom heads to the revolvable head portion of said mast structure; means for hauling on said topping lifts; means detachably connecting said topping lifts together below said revolvable head portion whereby the hauling effort may be applied to said topping lifts equally when said booms are connected for use as a twin boom rig and may be applied to either lift when said booms are separated and independently guyed for use as a burton type rig; a load fall for each boom carried by each boom at its head; and, means for separately and independently hauling on said load falls.

5. A crane for ships comprising a boom table mounted for rotation on a substantially vertical axis; a mast structure concentric with said table, said mast structure having a revolvable head portion; separate booms extending in spaced substantially parallel relation to each other from said table at opposite sides of said mast structure, each said boom being hingedly mounted at its heel on a common horizontal hinge axis; means securing said booms together into a rigid boom structure; separate topping lifts separately extending in converging relation to each other from the respective boom heads to said revolvable head portion, said topping lifts being connected together below said revolvable head portion whereby equal hauling effort for raising and lowering said boom structure may be applied to said topping lifts; means for hauling on said topping lifts and for rotating said boom table about its said rotational axis; separately powered winding drums carried by said boom table; and, separate load falls leading from the respective winding drums to the respective boom heads, said load falls being fixedly interconnected and anchored together between said boom heads to provide a common load attachment point therebetween from which the load falls lead in diverging relation to each other to the boom heads; and, a purchase member carried by said load falls at said point.

6. A convertible crane for ships and other purposes comprising a boom table mounted for rotation on a substantially vertical axis; a mast structure concentric with said table, said mast structure having a revolvable head portion; separate booms extending in spaced substantially parallel relation to each other from said table at opposite sides of said mast structure, each said boom being hingedly mounted at its heel for swinging movement both on a vertical and a horizontal axis; means releasably securing said booms together into a rigid twin boom structure in which the horizontal hinge axes of said booms are coaxially aligned; separate topping lifts separately extending in diverging relation to the respective booms inwardly from the respective boom heads to the revolvable head portion of said mast structure; means for hauling and slackening on said topping lifts and separate means for rotating said boom table about its said rotational axis, in either direction; means releasably connecting said topping lifts together below said revolvable head portion whereby the hauling and slackening effort may be applied to said topping lifts equally when said booms are connected for use as a rigid twin boom crane and may be applied to either lift when said booms are separated

and guyed for use as a burton type rig; separately powered winding drums carried by said boom table; separate load falls interconnected and anchored together below and substantially midway between said boom heads to provide a common load attachment point from which the load falls lead in diverging relation to each other to the boom heads and thence to the respective winding drums; and, a load supporting member carried by said load falls at said common load attachment point whereby loads may be carried by said member without developing a swinging movement when said boom structure is rotated quickly and stopped suddenly.

7. A crane for ships and other purposes comprising a boom table mounted for rotation on a substantially vertical axis; a mast structure concentric with said table, said mast structure having a revolvable head portion; separate booms extending in spaced substantially parallel relation to each other from said table at opposite sides of said mast structure, said booms being hingedly mounted at their heels on a common horizontal hinge axis; means securing said booms together into a rigid twin boom structure, separate topping lifts separately extending in diverging relation to the respective booms of the boom structure, inwardly from the respective boom heads of said structure to the revolvable head portion of said mast structure, said topping lifts being connected together below said revolvable head portion whereby equal hauling and slackening effort for topping up and lowering said boom structure may be applied to said topping lifts; means for hauling and slackening equally on said topping lifts and separate means for rotating said boom table about its said rotational axis, in either direction; separately powered winding drums carried by said boom table for providing substantially equal and coordinated hauling power to separate load falls; and, separate load falls interconnected and anchored together below and between said boom heads to provide a common load attachment point below and substantially midway therebetween from which said load falls lead in diverging relation to each other to said boom heads and thence to the respective winding drums; and, a load supporting member carried by said load falls at said common load attachment point whereby loads may be carried by said member without developing a swinging movement thereof when said boom structure is rotated quickly and stopped suddenly.

8. Hoisting apparatus comprising a support, a pair of booms mounted on said support in spaced relation and supported at their heels for respective independent swinging movement on vertical and horizontal axes, topping means for said booms including a mast structure disposed adjacent said boom heels and topping lifts extending respectively from said booms to said mast structure for respectively raising and lowering said booms, individual load falls for said booms and respectively extending from the booms to a common load attachment point for jointly supporting a load, and braces releasably connectable to and between said booms to hold said booms in unitary relation as a rigid boom structure wherein said horizontal hinge axes are co-axially aligned and said load falls may constantly and cooperatively support a load substantially midway between said booms, whereby said booms may be operated independently or as a rigid unitary crane structure.

9. A crane comprising a support, a boom table rotatably mounted on said support, means con-

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trolling rotation of said boom table relative to said support, a crane boom pivotally mounted at one end portion on a horizontal axis on said boom table, the outer swinging end portion of said boom being relatively wide, means for raising and lowering said boom about said horizontal axis, two guides on the outer end portion of said boom, said guides being mounted on substantially opposite sides of the wide outlet end portion of said boom to be relatively widely spaced transversely of the boom, load fall means including two load falls respectively passing through said guides and converging to a substantially common connection with a load device below and substantially midway between said guides, and winch means operatively connected with said load fall means for simultaneously operating said two load falls, whereby said converging load falls prevent objectionable swinging of a load carried by said device as the boom is swung around by rotation of said boom table.

10. A crane comprising a support, a boom table rotatably mounted on said support, means controlling rotation of said boom table relative to said support, a rigid crane boom pivotally mounted at one end portion on a horizontal axis on said boom table, the outer swinging end portion of said boom being relatively wide, a mast structure rising above said boom table, topping lifts running from said mast structure to anchor points on said outer boom end portion and which are relatively widely spaced transversely of said boom to prevent twisting of said boom, two guides on the outer end portion of said boom, said guides being relatively widely spaced transversely of the boom, load fall means including two load falls respectively passing through said guides and converging to a substantially common connection with a load device below and substantially midway between said guides, and winch means operatively connected with said load fall means for simultaneously operating said two load falls, whereby said converging load falls prevent objectionable swinging of a load carried by said device as the boom is swung around by the rotation of said boom table.

11. A crane comprising a support, a boom table rotatably mounted on said support, means controlling rotation of said boom table relative to said support, a pair of rigidly connected booms pivotally mounted at one of their end portions about a common horizontal axis on said boom table, the free end portions of said booms being relatively widely spaced apart, a mast structure rising above said boom table, topping lifts running from said mast structure to anchor points at the free end portions of said booms, a guide on the free end portion of each boom and substantially coinciding with the respective topping lift

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anchor point, load fall means including two load falls respectively passing through said guides and connected with a common load device below and substantially midway between said guides, and winch means operatively connected with said load fall means for simultaneously operating said two load falls, whereby said converging load falls prevent objectionable swinging of a load carried by said device as the boom is swung around by rotation of said boom table.

12. A crane comprising a support, a boom table rotatably mounted on said support, means controlling rotation of said boom table relative to said support, a pair of rigidly connected booms pivotally mounted at one of their end portions about a common horizontal axis on said boom table, the outer swinging end portions of said booms being relatively widely spaced apart, means for unitarily raising and lowering said booms, a guide on the outer swinging end portion of each boom, said guides being mounted in a substantially common horizontal plane, load fall means including two load falls respectively passing through said guides and connected with a common load device below and substantially midway between said guides, and winch means operatively connected with said load fall means for simultaneously operating said two load falls, whereby to prevent objectionable swinging of a load carried by said device as said boom is swung around by rotation of said boom table.

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