Sept. 12, 1950 A. E. R. SCHNEIDER 2,522,466

GENERAL UTILITY LOADING AND UNLOADING APPARATUS FOR SHIPS AND THE LIKE

Filed March 3, 1945 4 Sheets-Sheet 1

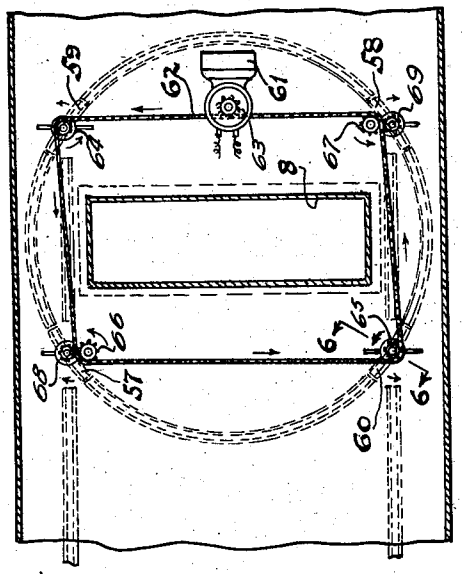


Fig. 7

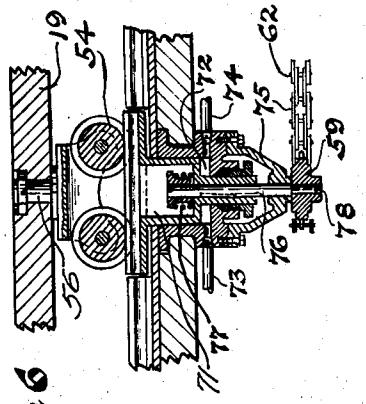


Fig. 6

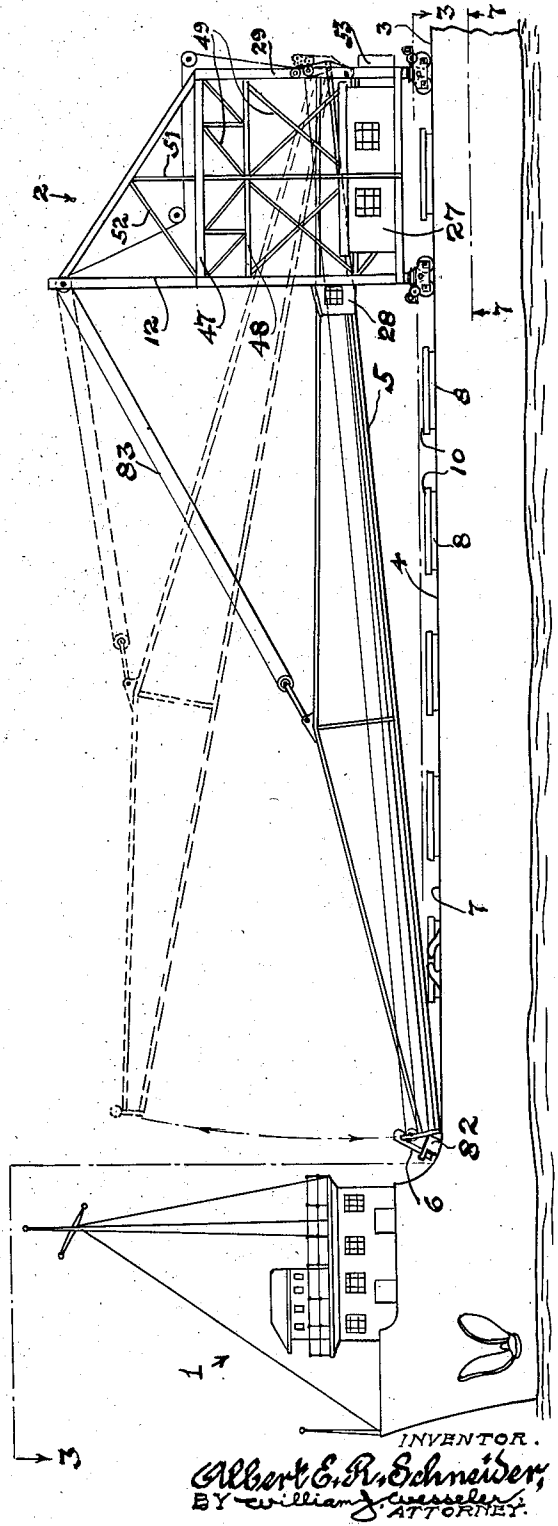


Fig. 1

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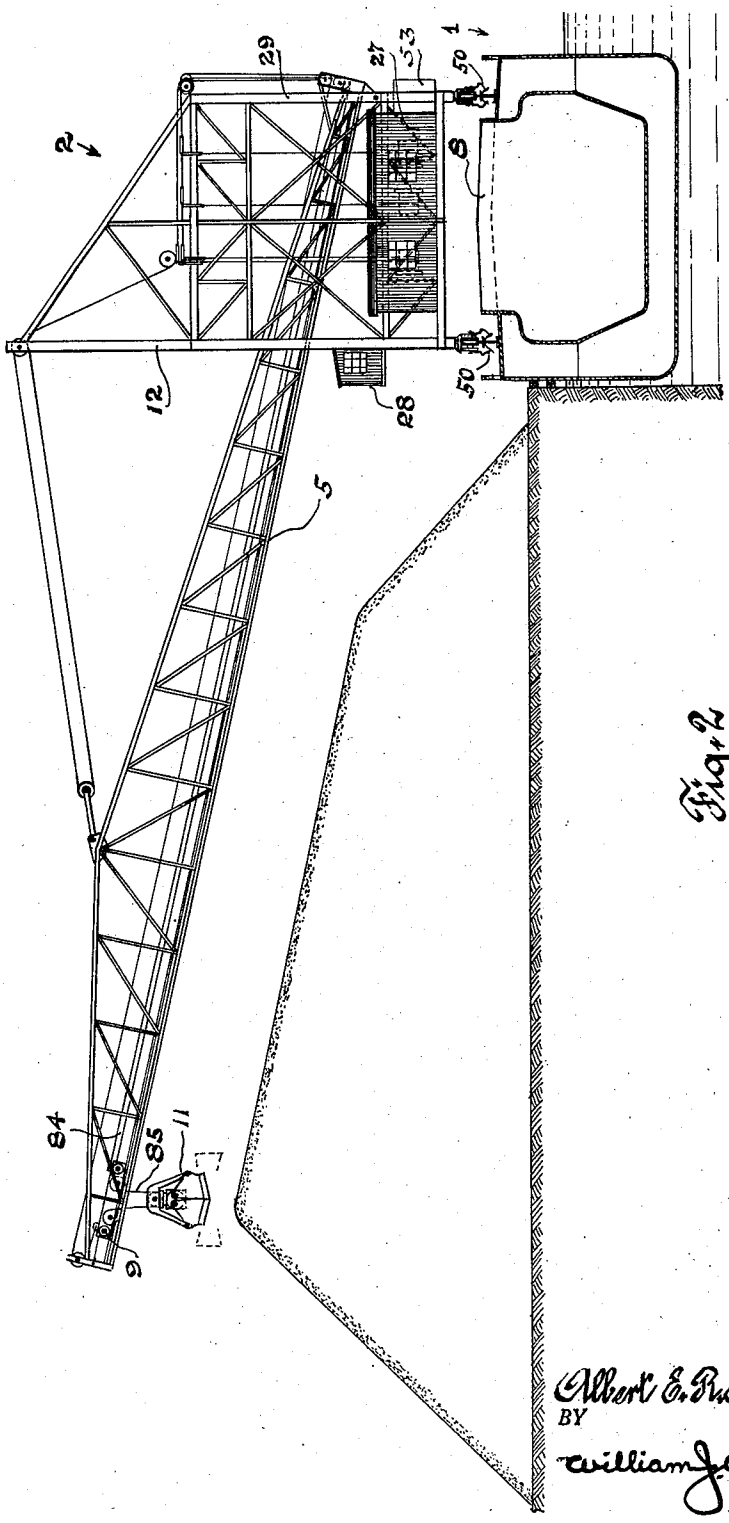


Fig. 2

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GENERAL UTILITY LOADING AND UNLOADING APPARATUS FOR SHIPS AND THE LIKE

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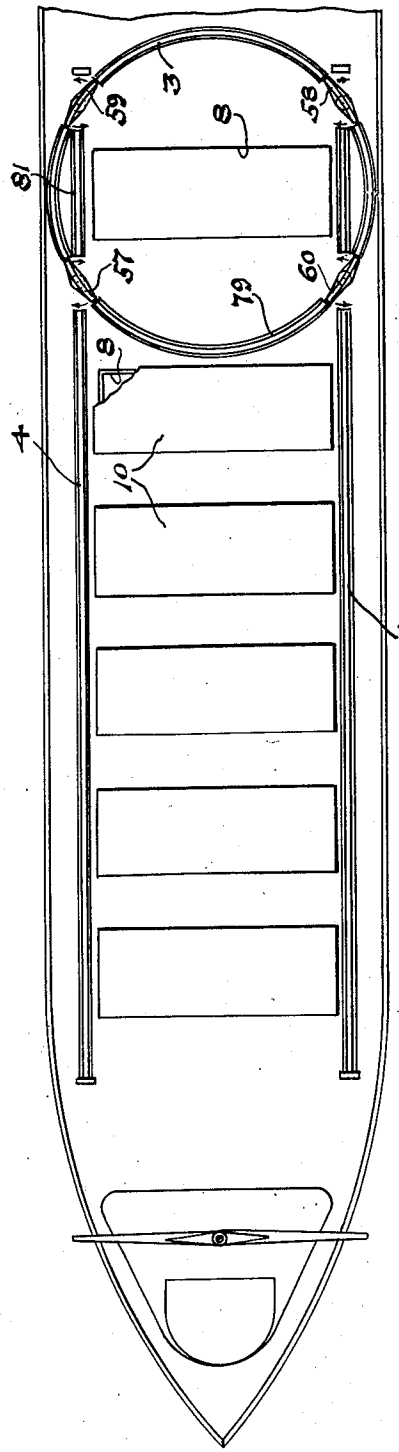


Fig. 8

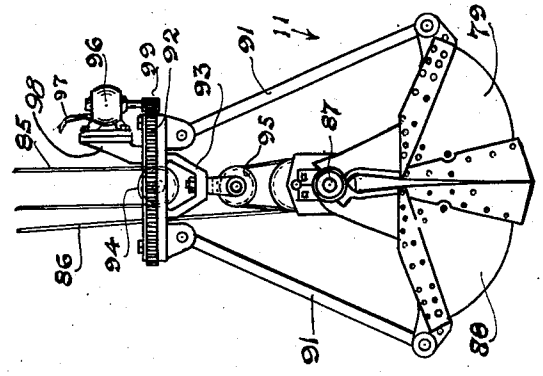
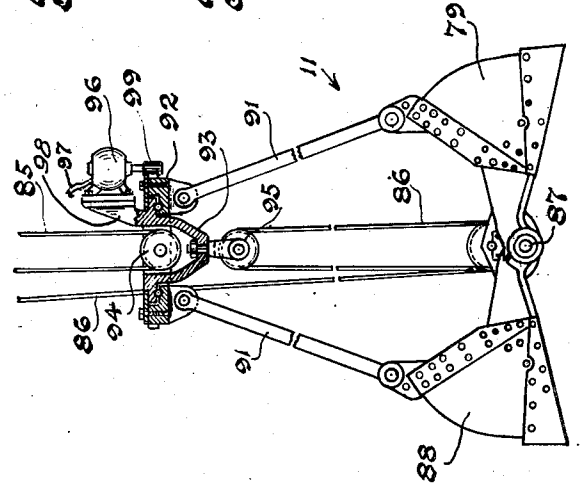


Fig. 3

Fig. 9



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GENERAL UTILITY LOADING AND UNLOADING APPARATUS FOR SHIPS AND THE LIKE

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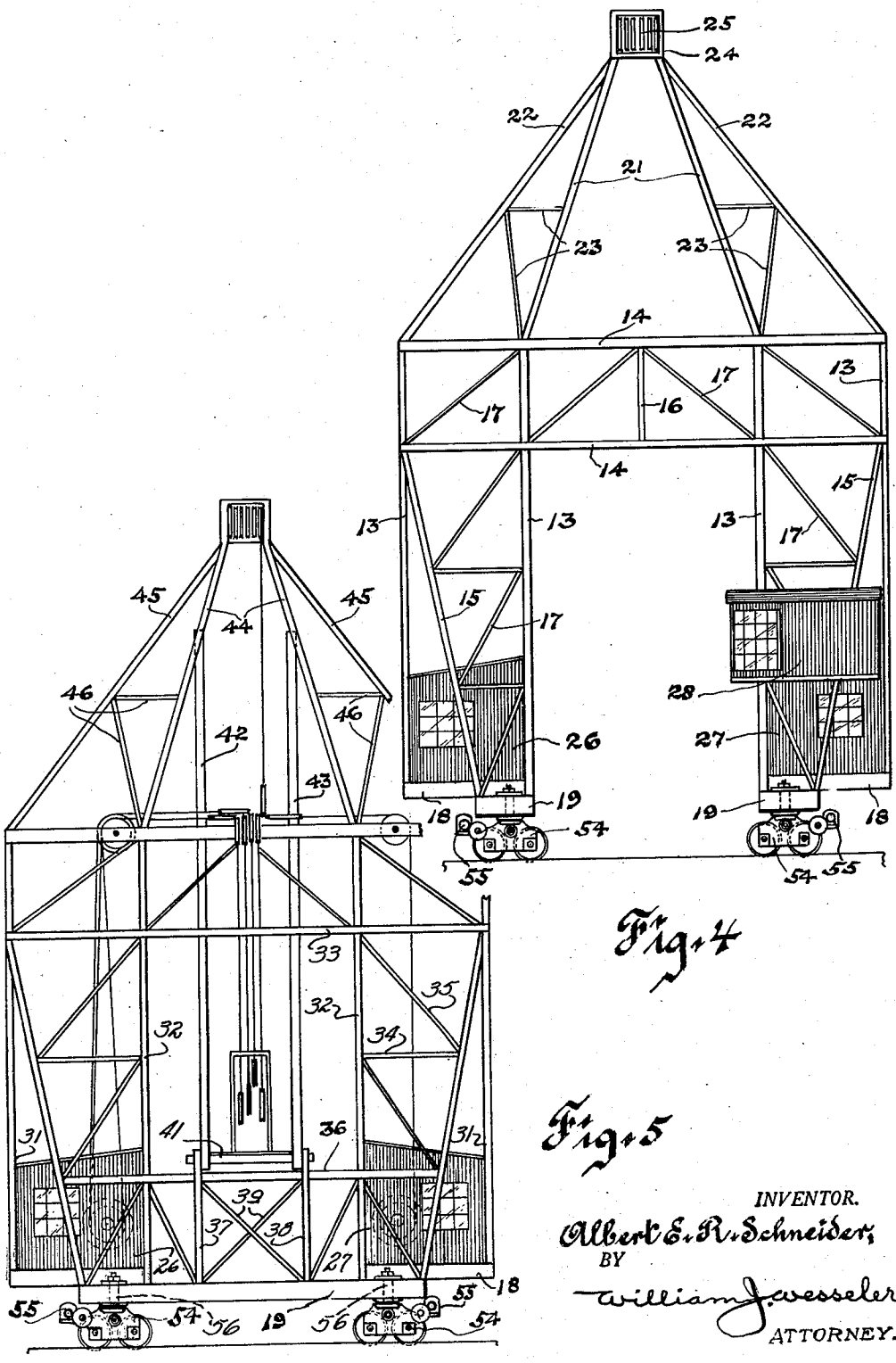


Fig. 4

Fig. 5

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Patented Sept. 12, 1950 2,522,466

UNITED STATES PATENT OFFICE

2,522,466

GENERAL UTILITY LOADING AND UNLOADING APPARATUS FOR SHIPS AND THE LIKE

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Application March 3, 1945, Serial No. 580,854

10 Claims. (Cl. 214—15)

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This invention relates to a general utility loading and unloading apparatus for ships and the like. More particularly, it comprises a crane or main supporting unit running on a trackway with which is associated a turn-table whereby the crane may be turned to either side of the trackway and the boom operated over an extended area over which the cargo is to be transported in the course of loading or unloading a vessel or other means of transportation.

In certain aspects the invention is of general application, but its specialized use is in relation to the loading and unloading of ships, more particularly bulk freighters such as are used on the Great Lakes in the transportation of bulk cargo, such as iron ore, coal, grain and the like.

The invention includes the use of a novel type of turn-table whereby the crane may be turned to extend the boom on either side of the vessel as the conditions of the port facilitates require and, in addition, the turn-table permits the crane to be turned to the proper angle to align the boom with the central axis line of the vessel, permitting the structure to be firmly secured in position during the voyage and to withstand heavy weather which may at times be encountered.

The invention includes a specialized type of trolley unit and bucket controls whereby the operator in a cab mounted in an elevated position on the crane can control the various adjustments, such as the angular position vertically of the boom and the operative movements of the trolley and such load handling terminal as may be utilized.

The invention also includes a specialized clam shell bucket adapted to be controlled not only as to the opening and closing movements, but arranged to be rotated to any desired adjustment within a full circle of 360 degrees.

The invention has in view not only using clam shell buckets, but magnets when the cargo consists of scrap iron and the like, slings and hooks for handling crates and packing cases, automobiles and the like, as well as various other specialized types of handling apparatus.

The invention includes the provisions of means for loading and unloading cargoes from a freighter through the respective hatchways thereof and, as has been indicated, can use a wide variety of port facilities, even where the dock equipment at the port of call would be found to be inadequate for such work.

A feature of the invention is embodied in the turn-table portion of the trackway wherein the cooperation of the wheels of the crane with the

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trackway simplifies the matter of turning the crane to any desired side of the vessel. The arrangement includes the use of a circular turn-table of greater diameter than the space between the rails, made possible through the turning of the wheels supporting the crane from a parallel position to a position perpendicular to the radius of each independent wheel or truck. This arrangement provides an inexpensive and fully dependable loading and unloading apparatus and has the additional advantage of anchoring the crane securely by means of the angular position of the wheels just referred to, whereby they are set perpendicular to the radius of each wheel with reference to the center of the turn-table and thus prevent movement of the crane transversely or longitudinally or in any other direction except radially around the turn-table. When the crane is thus locked on the turn-table and the boom is positioned along the axis line of the vessel and securely lashed to it in inactive position, the structure will be found not to interfere with the stability of the vessel nor with its seaworthiness, even in heavy weather.

The principal object of the invention is to provide an apparatus particularly adapted for use on ships and the like which may be carried as a permanent part of the ship's structure during its voyages and may be used after reaching port to load or unload the vessel irrespective of which side of the ship is brought along side of the dock or other mooring facilities.

Another object of the invention is to provide an apparatus of the character above stated which operates progressively over a series of hatchways in a bulk cargo ship.

Another object of the invention is to provide an apparatus of the character above stated wherein a movable crane carries a boom extending completely across the ship and over the shoreward area adjacent thereto, whereby cargo of various types may be carried directly from the hold of the vessel to a point of unloading spaced an adequate degree from the margin of the pier or other structure against which the ship is secured.

Another object of the invention is to provide an apparatus of the character set forth wherein the crane may be rotated around circular trackways associated with a longitudinal trackway on the deck and turned to either side of the vessel or into longitudinal alignment with the central axis of the vessel.

Another object of the invention is to provide an apparatus of the character described wherein an

operator in a control cab on the crane may control the inward and outward movements of the trolley carrying the handling equipment and may rotate such handling equipment to any desired angular position of adjustment and may also open and close such handling equipment to load or unload cargo, as may be required.

Another object of the invention is to provide various details of the apparatus for controlling the angular position of sections of the trackway and the angular positions of the boom and the handling equipment to bring about a simplified and dependable procedure in loading and unloading vessels, particularly of the bulk cargo type.

Other and further objects of the invention will appear in the course of the following description.

To the accomplishment of the foregoing and related ends, said invention consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but several of various forms in which the principle of the invention may be used.

In said annexed drawings:

Figure 1 is a side elevation of the forward portion of a freighter of the conventional Great Lakes type of ship, showing a crane and boom on the deck thereof in the position in which the structure is secured during a voyage, the raised position of the boom being shown in dotted lines;

Fig. 2 is a side elevation showing a crane and boom involving the principles of the invention as positioned on a vessel shown diagrammatically in cross section, the boom being extended in operative position over an ore pile on an ore dock;

Fig. 3 is a top plan view taken along the line 3—3, shown in Figure 1;

Fig. 4 is a diagrammatic view of the crane structure showing the cab and power unit housings, as well as the supporting trucks and driving motors therefor, as seen from the landward side of the structure when in operating position;

Fig. 5 is a view of the structure shown in Figure 4 as seen from the opposite or remote side of the structure shown in Figure 4;

Fig. 6 is an enlarged detailed view illustrating a movable portion of the turn-table track, together with the associated mechanism for turning such movable section and illustrating a supporting truck for the crane shown diagrammatically without its motor drive;

Fig. 7 is a diagrammatic view as seen along the line 7—7, shown in Figure 1, looking in the direction of the arrows and illustrating the mechanism for turning the four movable sections of the trackway through the action of a single motor and associated mechanism;

Fig. 8 is a front elevation of an automatically rotatable grab bucket shown in closed position with the controlling cables and driving motor; and

Fig. 9 is a view of the apparatus shown in Figure 8 with the bucket halves in open position.

The invention as embodied in a ship structure 1 is shown in Figures 1 and 2. In Figure 1 the crane 2 is positioned on the turn-table section 3 of the trackway 4 and the boom 5 is firmly secured by fastening elements 6 to the deck 7, in alignment with the central longitudinal axis thereof. In Figure 2, the crane 2 is shown over an open hatchway 8 with the trolley 9 at the free end of the boom and the grab bucket 11

over an ore pile on a dock. The hatchways may be covered by single hatch covers 10 (see Figs. 1 and 3), which may be lifted and replaced by the use of the crane, or if desired, sectional hatch covers may be used instead.

The boom 5 is of a length to extend completely across the vessel and preferably extends for the greatest possible extent outwardly over the land cargo area of which the length of the ship will permit.

The crane 2 is a framed structure clearly illustrated in Figures 1, 2, 4 and 5 and has a tall vertical front structure 12 having a somewhat rectangular lower portion with vertical uprights 13 and horizontal cross-members 14 with suitable struts 15, 16, and diagonal bracing bars 17. This portion of the frame is substantially of inverted U-shape and has heavy bottom frame-members 18 and heavy bolsters 19 to which the trucks presently to be described are swivelly connected. The upper portion of the front frame has inclined supporting members 21, 22, with suitable bracing members 23, and these inclined members meet at the top pulley housing 24. The pulley housing carries the necessary number of sheave-wheels 25 to provide for the operating cables hereinafter referred to. The crane thus has a large open area at the front and the grab bucket or other load handling unit can ride freely through this space into the proper position above an open hatchway for either loading or unloading of the cargo.

Immediately above the bottom frame members 18, housings 26, 27, for the cable drums and operative mechanism are provided, and, preferably, on the rearmost leg of the front portion of the frame an overhanging operator's cab 28 is secured.

The rearward portion 29 of the frame has vertical uprights 31, 32; horizontal cross-members 33; struts 34; and diagonal bracing bars 35, but also has an additional cross-member 36, associated with rigid pivot frame-members 37, 38, having cross-bracing members 39. The boom 5 is supported on the pivot bar 41 engaged with the upper ends of the pivot frame-members 37, 38, intermediate the upper portions of the housings 26, 27, and the boom frame-members 42, 43, project outwardly and upwardly above said pivot support.

The rearward frame has upper inclined supporting members, 44, 45, with suitable bracing-members 46, which meet at the top pulley housing 24, heretofore described.

The lower portions of the front and rear frame structures are connected with each other by horizontal members 47, 48, with suitable bracing 49, and an intermediate vertical support 51 may extend to the upper frame structure and have a diagonal brace 52 associated therewith. A heavy counterweight 53 serves to insure abundant stability for the structure.

The crane 2 is supported on the trackway 4 by means of individual two-wheel trucks 54 each having a driving motor 55 with suitable reversing mechanism, which are connected by swivel mountings 56 with the respective corners of the bolsters 19. Angularly positioned guard wheels 50 may be carried by the trucks and contact the underside of the rail bond.

The motors are preferably controlled in unison from the cab 28, and the trucks 54 are so spaced as to ride simultaneously on each of the four movable track sections of the turn-table portion 3 of the track. These track sections are short

and may be straight or slightly curved, and the wheels of the trucks are sharply beveled to ride freely thereover. These movable sections 57, 58, 59, 60, of the turn-table portion of the trackway are shown more particularly in Figures 3, 6 and 7, and are turned in unison by means of a reversing motor 61, preferably mounted below deck but with control connections preferably extending to the operator's cab 28. The diagonally opposite movable sections 57, 58, may be moved counter-clockwise as seen in Figure 7, and the companion diagonal movable sections moved clockwise, by means of the motor 61 and the driving chain 62, actuated by the pinion 63, and engaged over the gears 64, 65, directly connected with the movable track sections 59, 60, and engaged over reversing gears 66, 67, driving the gears 68, 69, directly connected with the movable sections 57, 58.

In order to counteract undue friction due to the weights involved in the crane 2 and boom 5, each movable track section is supported on a piston base 71 within a cylinder 72, providing a fluid-tight chamber with pressure oil line connections 73, 74, and with a packing gland mounting 75, for its splined driving pivot-member 76 having a spring cushion connection 77 at its top and a gear on its outer end 78. The oil pressure is preferably controlled from the cab 28, and when released will frictionally hold the movable sections in fixed position. Thus, the operator can drive the crane on to the respective movable track sections and by energizing the reversing truck motors 55 in the proper direction the crane may be rotated on the turn-table section of the trackway or driven forward or back on the straight section of the trackway.

The boom lashing 6 may be of the type to be unlatched from the cab by means of a solenoid 82, and the operator can thus release the boom, lift it by means of the cable 83, drive the trolley 9, by means of its cable 84, and operate the grab bucket 11 by means of its cables 85, 86. He can also turn the grab bucket by means of the mechanism shown in Figures 8 and 9, providing a swivelling bucket support.

The grab bucket 11 has a pivot member 87 for the bucket halves 88, 79, supported by bracket links 91 on an annular geared ring 92 rotatably engaged on the stationary head-frame 93 supported on the pulley 94 and cable 85. A swivelling pulley 95 is supported on the non-rotatable head-frame 93, and carries the bucket opening and closing cable 86 which engages over the pulley 94 associated with the pivot member 87 of the bucket. The rotation of the annular ring 92 with the bucket supporting and operating members is brought about by means of a reversible motor 96 having a conducting cable 97 carried on a bracket arm 98 on the non-rotatable frame 93. A pinion 99 on the motor shaft engages the gear teeth of the annular gear ring 92 and rotates the ring and bucket through any desired arc of movement in the selected direction, and locks the ring in adjusted position when the motor is stopped.

The control switch board and transmission control means for cables and cable drums may follow conventional practice.

The description of the operation of the apparatus has already been indicated in connection with the several parts described. The steps, when taken in succession, for either the loading or unloading operation are substantially as follows:

When the ship 1 or other vehicle on which the apparatus is supported, reaches the point for the transfer of cargo, the operator in the cab 28 may operate the proper switch to electrically unlock the boom from its central position along the longitudinal line of the deck or other support by unlocking the latching device 6. Immediately thereafter the cable 83 for raising the boom is operated by means of its proper control in the cab and when suitable height is attained the boom is held in such position preliminary to its being turned with its free end over the other cargo area. The turning of the boom involves a series of operations. It is assumed that the apparatus, when latched to the deck of a vessel, has its trucks 54 on the circular trackway 3, each set at an angle on the fixed sections of the trackway. The crane portion of the apparatus is thus firmly held against movement in any direction.

With the wheels of the trucks on the circular trackway the operator in the cab energizes the respective truck driving motors 55 to turn the crane and its associated boom in the selected direction, and when such point has been reached the respective trucks will be positioned over their individual movable track sections. The operator of the cab then conditions the movable track sections for rotation by releasing pressure oil into the cylinder 72 beneath the piston base 71 supporting each individual movable track section and rendering each freely movable when actuated by the chain 62 and its associated mechanism.

The chain 62 is driven by means of the motor 61 energized in the proper direction by the operator in the cab closing the selected switch. This operation will turn the movable track sections into alignment with the fixed track sections 81 of the trackway 4, whereupon the fluid pressure is released, by operating a suitable control, from the cylinder 72 and the movable track sections are locked into aligned position with the straight trackway. Thereupon the operator in the cab will turn the proper switch to energize the driving motors 55 of the trucks 54 and will move the crane with its extended boom into any predetermined position over the cargo space at either end of the boom, as the loading or unloading operation requires. The motors on the trucks will prevent shifting of the crane along the trackway when not energized, due to irreversible worm or eccentric gearing. The apparatus is then in position for movement of the cargo in either direction along the boom, and the operator in the cab may adjust the vertical height of the free end of the boom to any angle desired by use of the proper controls and thereafter may traverse the trolley 9 back and forth along the trackway of the boom 5 to load and unload the cargo at the respective ends thereof. The operator may also control the load handling terminal supported on the trolley and, when a grab bucket of the character illustrated in Figures 8 and 9 is used, may raise and lower the grab bucket by means of the cable 85 and control the opening and closing movements of the grab bucket by means of the cable 86. The operator in the cab may also energize the motor 96 through its flexible conducting cable, and by means of the action of the pinion 99 rotate the grab bucket through any desired degree of angularity in any direction as might facilitate the proper handling of the cargo, especially if the same is bulk material, such as iron ore or the like.

It is to be understood also that loading and unloading apparatus of various different forms may be used and, if desired, an underslung trolley or other type of carriage can be substituted for the one illustrated.

Other modes of applying the principle of my invention may be employed instead of those explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. An apparatus of the character described having in combination a straight trackway and a circular trackway superimposed upon a supporting structure, the circular trackway being of greater diameter than the transverse width of the straight trackway, a crane, and four swivelling supporting trucks for said crane adapted to operate selectively over said straight trackway and said circular trackway.

2. An apparatus of the character described having in combination a straight trackway and a circular trackway superimposed upon a supporting structure, the circular trackway being of greater diameter than the transverse width of the straight trackway, a crane, four swivelling supporting trucks for said crane adapted to operate selectively over said straight trackway and said circular trackway, and means for driving said trucks.

3. An apparatus of the character described having in combination a straight trackway and a circular trackway superimposed upon a supporting structure, swivelling track sections adapted to be aligned selectively with the straight and circular trackways, the circular trackway being of greater diameter than the transverse width of the straight trackway, a crane, and four swivelling supporting trucks for said crane adapted to operate selectively over said straight trackway and said circular trackway.

4. An apparatus of the character described having in combination a straight trackway and a circular trackway superimposed upon a supporting structure, swivelling track sections adapted to be aligned selectively with the straight and circular trackways, means for rotating said swivelling track sections, the circular trackway being of greater diameter than the transverse width of the straight trackway, a crane, and four swivelling supporting trucks for said crane adapted to operate selectively over said straight trackway and said circular trackway.

5. An apparatus of the character described having in combination a cargo vessel a straight trackway and a circular trackway superimposed upon the deck of said vessel, swivelling track sections adapted to be aligned selectively with the straight and circular trackways, means for rotating said swivelling track sections, the circular trackway being of greater diameter than the transverse width of the straight trackway, a crane, and four swivelling supporting trucks for said crane adapted to operate selectively over said straight trackway and said circular trackway.

6. An apparatus of the character described having in combination a vessel for carrying bulk freight, a plurality of transverse hatchways extending in series over the major portion of the deck space of said vessel, a crane supporting rail on each side of the vessel outside of the ends of said hatchways, a circular turn-table trackway overlaid at one end of said straight trackway with movable track sections adapted to become part of said straight trackway and said turn-table trackway, selectively, motorized trucks for engaging said crane on one of said trackways, and means for turning said movable track sections.

7. An apparatus of the character described having in combination a vessel for carrying bulk freight, a plurality of transverse hatchways extending in series over the major portion of the deck space of said vessel, a crane supporting rail on each side of the vessel outside of the ends of said hatchways, a circular turn-table trackway overlaid at one end of said straight trackway with movable track sections adapted to become part of said straight trackway and said turn-table trackway, selectively, motorized trucks for engaging said crane on one of said trackways, means providing a pressure oil support for each of said movable track sections, and means for turning said movable track sections.

8. A trackway for a movable crane having a pair of straight rails over which four wheel units of the crane are adapted to travel, a circular track, providing a turn-table, in combination with said straight trackway with swivelling track sections at the intersecting points of said trackways adapted selectively to form part of the straight trackway and the circular trackway, and unitary means for operating said swivelling track sections whereby said crane may be operated over said straight trackway or rotated on said circular trackway.

9. In apparatus of the class described, the combination with a supporting structure, of a straight trackway on said structure, a circular trackway disposed in overlaid relation to said straight trackway and having a diameter greater than the transverse width of said straight trackway and consisting of alternately related fixed and swivelling track sections, each swivelling section being adapted to be alined with the opposed ends of adjacent fixed track sections of said circular trackway or with one of the tracks of said straight trackway, a crane, swivel mounted trucks arranged to traverse said trackways, for supporting said crane, and means for driving the wheels of certain of said trucks.

10. In apparatus of the class described, the combination with a supporting structure, of a straight trackway on said structure, consisting of parallel main tracks and parallel track sections each alined with one of said tracks, a turntable mounted on said structure, consisting of curvilinear track sections disposed outwardly of said parallel track sections and separate curvilinear track sections disposed intermediate said first mentioned curvilinear track sections, said first mentioned curvilinear track sections and said separate curvilinear sections having the same radius of an imaginary circle the diameter of which is greater than the width of said straight trackway, pairs of swivelling track sections on said structure between said first mentioned curvilinear track sections and said separate curvilinear track sections, each swivelling track section being disposed on said imaginary circle in diametrical relation to another swivelling track section and swingable about an axis alined with one of said tracks for connecting said track and the adjacent parallel track section, a crane, swivel mounted trucks for supporting said crane ar-

ranged to traverse said trackway and turntable, and power mechanism for driving the wheels for certain of said trucks.

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