April 5, 1966

E. J. KINKOPF

3,244,297

CONTAINER SHIP CRANES

Filed Dec. 18, 1963

3 Sheets-Sheet 1

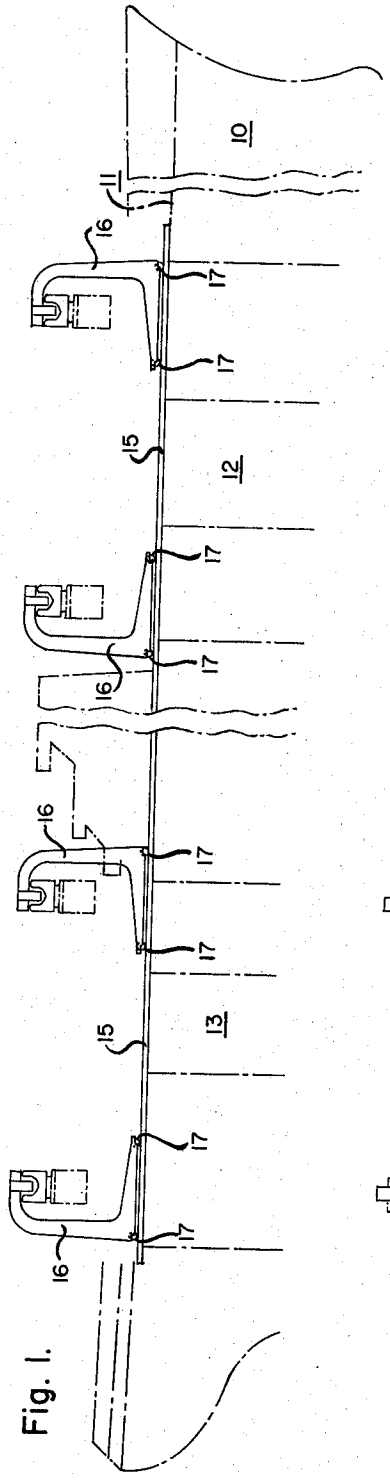



Fig. 1.

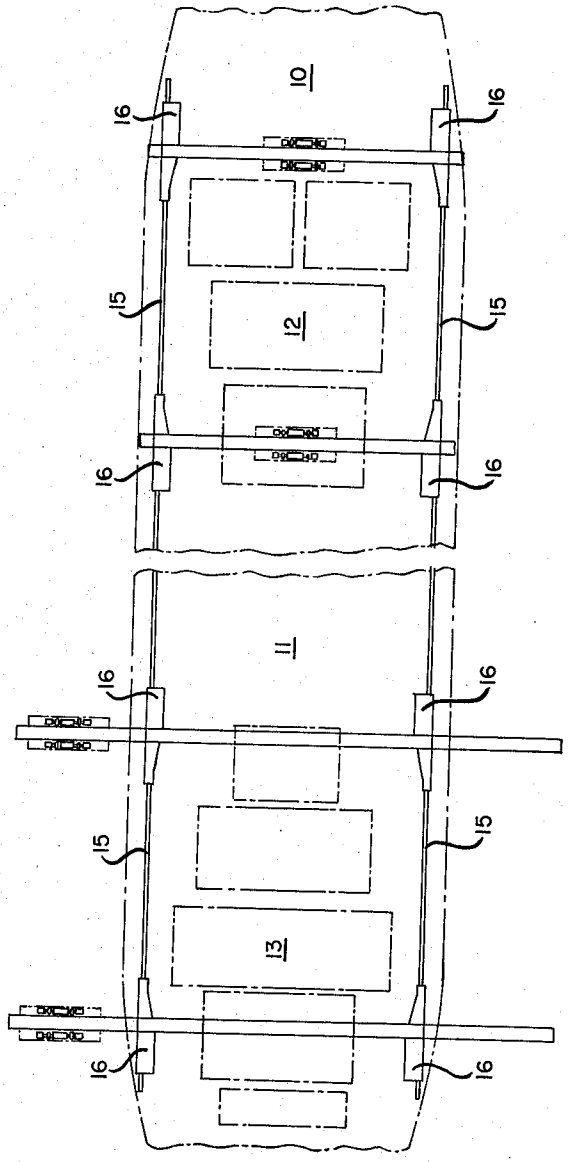



Fig. 2.

INVENTOR

Edward J. Kinkopf

By Hopgood, Leonard & Buell

his attorneys

April 5, 1966 E. J. KINKOPF 3,244,297

CONTAINER SHIP CRANES

Filed Dec. 18, 1963 3 Sheets-Sheet 2

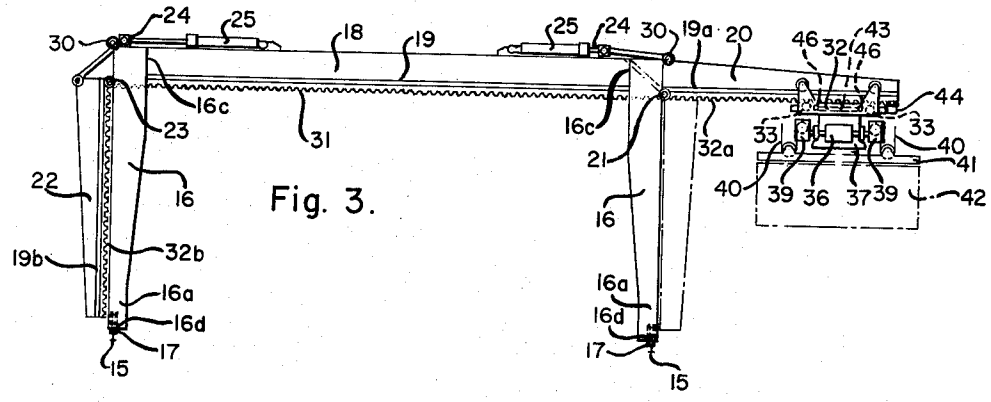


Fig. 3.

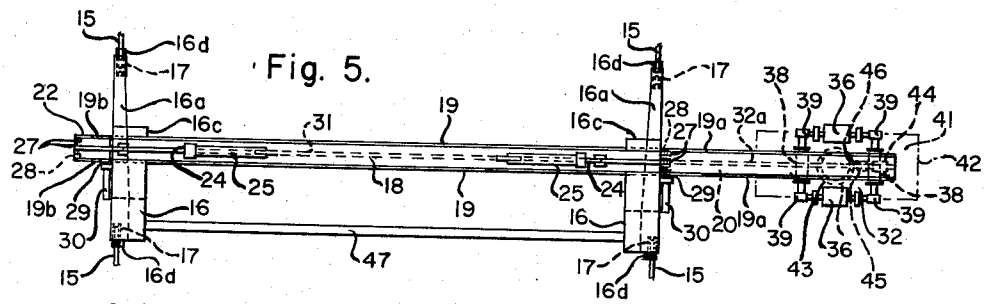


Fig. 5.

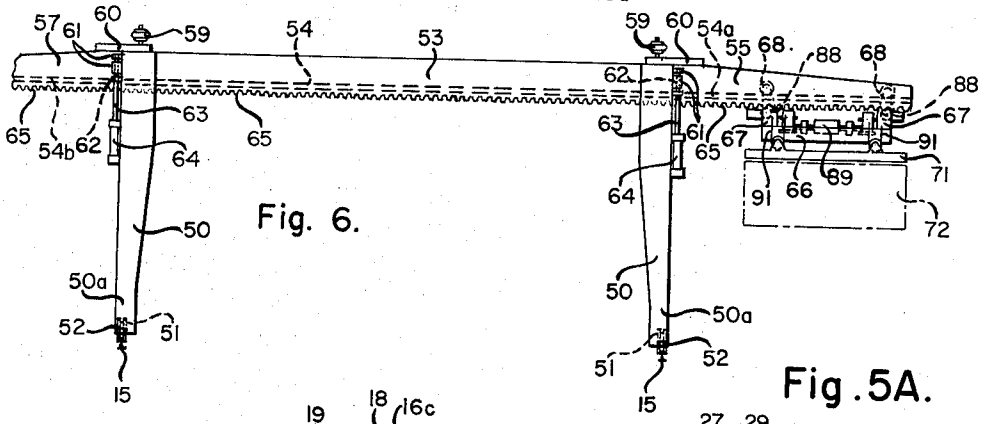


Fig. 6.

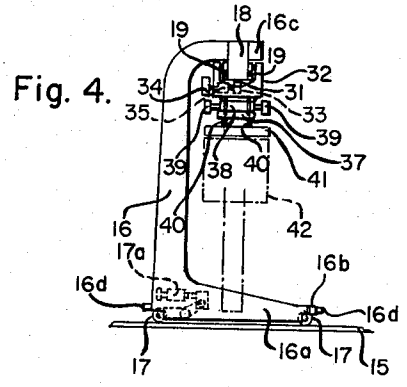


Fig. 4.

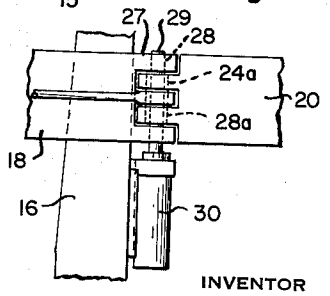


Fig. 5A.

INVENTOR

Edward J. Kinkopf

Hoopes, Leonard & Budd

his Attorneys

April 5, 1966 E. J. KINKOPF 3,244,297

CONTAINER SHIP CRANES

Filed Dec. 18, 1963 3 Sheets-Sheet 3

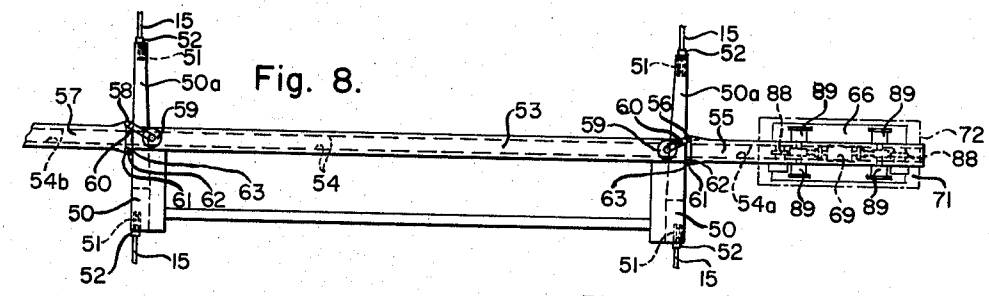


Fig. 8.

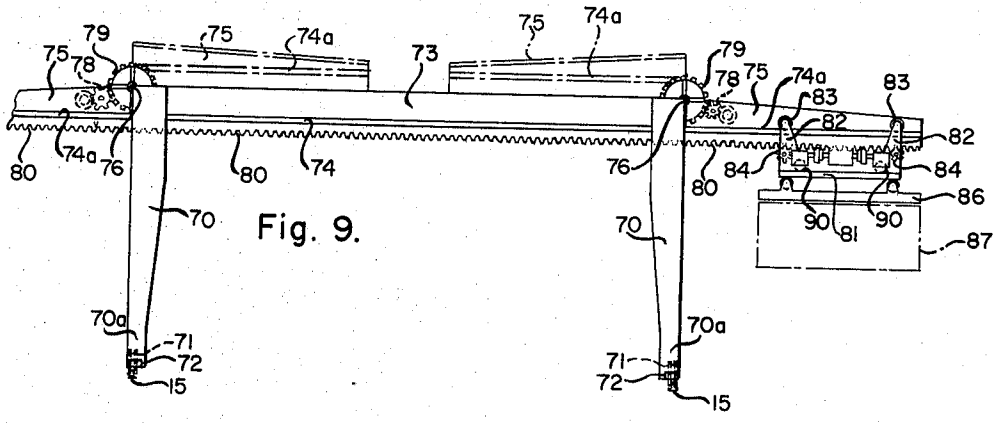


Fig. 9.

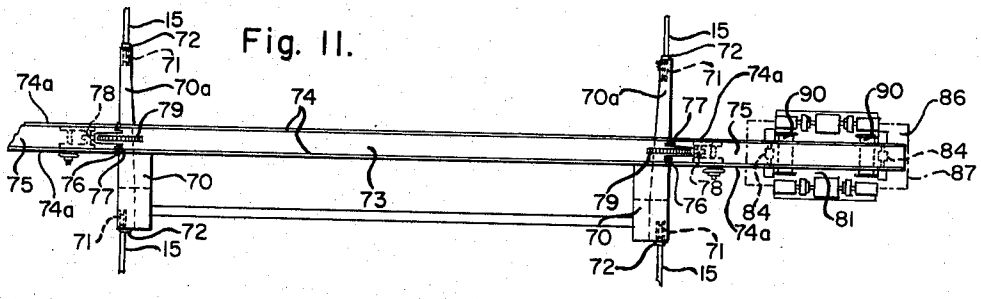


Fig. 11.

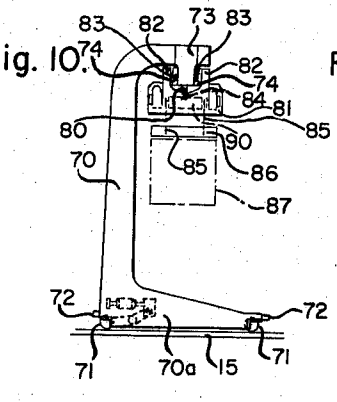


Fig. 10.

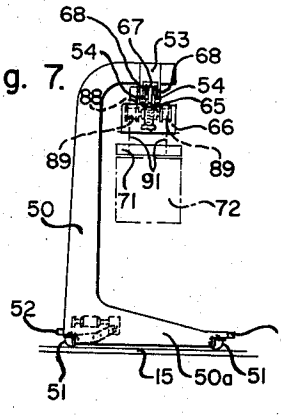


Fig. 7.

INVENTOR
Edward J. Kinkopf

By Hoopes, Leonard & Buell
his Attorneys

United States Patent Office 3,244,297 Patented Apr. 5, 1966



3,244,297

# CONTAINER SHIP CRANES

Edward J. Kinkopf, Alliance, Ohio, assignor to The Alliance Machine Company, a corporation of Ohio

Filed Dec. 18, 1963, Ser. No. 331,506
10 Claims. (Cl. 214—15)

This invention relates to container ship cranes and particularly to container ship cranes having a single girder adapted to be extended over either side of the ship so as to carry a lifting trolley over a loading and unloading dock.

Container ship cranes have heretofore been proposed for the purpose of loading and unloading containers from ships. They have existed in several forms. All of the cranes heretofore known to me have required a pair of spaced girders carried by a gantry and a pair of spaced extensible members to carry the ends of a trolley. Such devices are complex, heavy and have limited utility and are subject to many problems and limitations. The present invention provides a container ship crane having a single girder capable of extending over either side of the ship at any position lengthwise of the ship and capable of placing a container at any position on the dock through 90° from the ship side. None of the devices heretofore available have provided such a structure.

Preferably, there is provided a single frame girder extending across the width of the ship, leg means supporting the girder at each end, trackways parallel to the center line of the ship adjacent each side of the ship upon which the legs are adapted to move, drive means for moving the leg means on said trackway, a single extensible arm pivotally mounted on each end of the main frame for rotation about said end from a position parallel to the main grider to a position in line with and forming an extension of same main girder member, and the leg means and to a position in which the extensible arm extends over the ship on one side forming a continuation of the main girder, a pair of spaced tracks on said main girder and arms, a load trolley movable on said tracks from one end to the other, hoist means on the load trolley and drive means moving the load trolley and the hoist means. Preferably, the leg means carrying the main frame are in the form of C-shaped members. One leg of each C member carrying rollers operable on trackways on the ship deck, the other leg of each C member carrying the main frame above and spaced from the said one leg.

In the foregoing general description, certain purposes, objects and advantages of this invention have been set out. Other objects, purposes and advantages will become apparent from the following description of the accompanying drawings in which,

FIGURE 1 is a side elevation of a ship showing the arrangement of cranes according to this invention;

FIGURE 2 is a plan view of the deck of FIGURE 1 showing the arrangement of cranes according to this invention;

FIGURE 3 is an enlarged side elevation of preferred embodiment of a crane according to this invention;

FIGURE 4 is an enlarged end elevation of the crane of FIGURE 3;

FIGURE 5 is an enlarged top plan view of the crane of FIGURE 3;

FIGURE 5A is an enlarged fragmentary view of the locking pin arrangement of the crane of FIGURE 5;

FIGURE 6 is an enlarged side elevation of a second embodiment of crane according to this invention;

FIGURE 7 is an enlarged end elevation of the crane of FIGURE 6;

FIGURE 8 is an enlarged top plan view of the crane of FIGURE 6;



FIGURE 9 is an enlarged side elevation of a third embodiment of this invention;

FIGURE 10 is an enlarged end elevation of the crane of FIGURE 9; and

FIGURE 11 is an enlarged top plan view of the crane of FIGURE 9.

Referring to the drawings, there is illustrated a ship **10** having a deck **11** beneath which are provided forward holds **12** and rearward holds **13**. Above each of the forward hold **12** and rear hold **13**, there is provided a pair of spaced apart rails **15**, one on each side of the ship parallel to the center line.

A pair of container ship cranes according to this invention are mounted on each set of rails **15**. Each of these cranes is provided with C-shaped end leg members **16**, one leg **16***a* of each C carrying wheels **17** running on rails **15**. Wheels **17** are driven by electric motors **17***a* in conventional manner. Each pair of cranes is arranged so that the openings in the C members face each other and couplings **16***b* are provided at each leg **16***a* whereby the pair can be coupled to form an operative unit. The other leg **16***c* of each C member is connected to the main frame girder **18**. Each base leg **16***a* is also provided with snubbers or bumpers **16***d*. The main frame girder **18** is provided with rails **19** on each bottom edge forming a trackway of spaced parallel rails. A girder arm **20** is hinged at the bottom edge of one end to the bottom edge of one end of the main girder **18** by means of a pivot pin **21**. A second girder arm **22** is similarly hinged to the opposite end of the main girder **18** on pivot pin **23**. The girder arms **20** and **22** are pivoted on their respective pins **21** and **23** from a position parallel to the legs to a position forming an extension of the main girder. This pivotal movement is carried out by means of hydraulic pistons **24** and cylinders **25** fixed at one end to the top of the main girder **18** and at the opposite end to the top of the girder arm intermediate its ends by a hollow pin **24***a* in openings **28***a* in latch members **27**. Each girder arm is provided with rails **19***a* and **19***b* along its bottom edges to form spaced trackway joining with the spaced rails on the main girder to form a continuous trackway. The top end of the main girder **18** and the top end of each leg **20** and **22** are provided with interfitting latch members **27** having openings **28** aligned with the opening through pin **24***a* through which a pin **29** is inserted and withdrawn by means of hydraulic cylinder **30**.

A rack **31** is provided along the bottom of main girder **18**. Corresponding rack segments **32***a* and **32***b* are provided on the bottom of each girder arm **20** and **22** and form with rack **31** a continuous gear rack along the entire girder system base.

A trolley **32** is moved along the rails **19**, **19***a* and **19***b* by drive pinion **33** driven by motor **34** and gear drive **35** mounted on the trolley. The drive pinion **33** engages the racks **31**, **32***a* and **32***b*. This arrangement assures positive drive control and eliminates any possibility of danger of broken cables or stretched cables and the minimum of difficulty with icing, etc.

A pair of hoist motors **36** are mounted on trolley lift frame **37**. The motors **36** drive hoist reels **38** at each corner of the lift frame **37** through gear reducers **39**. Cables **40** on reels **38** connect to lift beam **41** which in turn engages the container **42** in known manner. The trolley lift frame **37** is mounted on a carrier ring **43** rotatable in the trolley frame and driven by motor **44** through pinion **45** and 120° segmental rack **46**. This makes possible the rotation of the lift frame **37** through 120° and the placement of container **42** at any desired position relative to the ship.

A thrust girder **47** connects the vertical legs of the two members on opposite sides of the ship to provide

rigidity to the structure. This girder 47 may be used to carry the electrical conduit and other services throughout the apparatus.

The operation of the crane of this invention is as follows: The drive motors 17*a* are energized to drive the wheels 17 and thereby the main frame 18 and rack members 16 to the desired position on the ship to load or unload containers. In the case of loading from the dock, the girder arm 22 is raised by operating the cylinder 25 to draw piston 24 into the cylinder. The lock pin 29 is inserted through the aligned openings 28 in the latch members 27 by the hydraulic cylinder 30 to lock the girder arm in position over the dock. The trolley 32 is positioned relatively to the arm 22 and the girder 18 by energizing the drive pinion 33 in engagement with one of the racks 31, 32*a* and 32*b*, whereby the trolley is moved on rails 19, 19*a* and 19*b* by means of the drive pinion 33 acting on one of the racks 31, 32*a* and 32*b*. The trolley lift frame 37 is rotated on the carrier ring 43 by means of motor 44 acting through pinion 45 and segmented rack 46, so as to move the lift beam 41 into proper position over the container to be lifted. The lift frame 41 is lowered on cables 40 by means of motors 36 driving hoist reels 38 until the lift beam engages the container 42. The container is raised until the lift beam 41 engages the trolley lift frame 37. The lift frame 37 is then rotated into proper position for movement along the frame 18 and the trolley driven to a position over the hold into which the container is to be placed. The lift beam 41 is then lowered until the container is in place.

In FIGURES 6, 7 and 8, I have illustrated a second embodiment. In this embodiment, I provide a container ship crane adapted to be mounted on each set of rails 15 as in the case of the preferred embodiment illustrated in FIGURES 3, 4 and 5. Each of these cranes is provided with a C-shaped end leg member 50, one horizontal arm portion 50*a* being provided with wheels 51 running on the rails 15. The wheels 51 are driven by electrical motors in conventional manner as described in the preferred embodiment. Each pair of cranes may be arranged as described in the preferred embodiment so that they can be used jointly as a single operative unit. Each base leg 50*a* is provided with a snubber or bumper 52. The main frame girder 53 is provided with rails 54 adjacent each bottom edge forming a trackway of spaced parallel rails. A girder arm 55 is hinged at one side of the main frame 53 by means of a pivot pin 56. A second girder arm 57 is similarly hinged to the opposite end of the main girder 53 on a pivot pin 58. The girder arms 55 and 57 are pivoted on their respective pins 56 and 58 from a position on the center line of the girder 53 to a position alongside of the main girder 53. This is accomplished by means of a drive motor 59 and lever arm 60. The side of the main girder and of each of the girder arms 55 and 57 opposite the pivot pins 58 and 56 respectively are provided with interfitting latch members 61 with openings 62 through which is inserted a lock pin 63 by means of hydraulic cylinder 64 vertically aligned with the openings 62 in the latches. Each girder arm 55 and 57 is provided with spaced rails 54*a* and 54*b* joining with the spaced rails 54 of the main girder to form a continuous trackway within the main girder and the two girder arms as best shown in FIGURE 7.

A rack 65 is provided along the bottom surface of the main girder 53 and each of the girder arms 55 and 57 to provide a continuous drive rack from the end of arm 55 through the main girder to the end of arm 57.

A trolley 66 is suspended on vertical arms 67 extending upwardly between the rails 54, 54*a* and 54*b* of the arms and main frames. These arms 67 are provided with wheels 68 which run on the rails 54, 54*a* and 54*b* and support the main trolley 66. The arms 67 also carry a drive pinion 88 which engages the rack 65 and provides positive drive for operating the main trolley along the rails 54, 54*a* and 54*b*. A pair of hoist motors 69 are provided as in the case of the preferred embodiment to drive hoist reels 89 adjacent the four corners of the main lift frame.



In the form of lift trolley shown in this second embodiment, the lift beam 71 is suspended directly from the main trolley 66 by means of cables 91 from the hoist reels 89, and there is no provision made for a separate lift frame rotatable on the trolley as in the case of the preferred embodiment although this could obviously be provided if desired. The container 72 to be stored is engaged by the lift beam 71 in known manner.

The operation of the device of this embodiment is essentially the same as that of the preferred embodiment with the exception that the girder arms are rotated in a horizontal plane rather than in a vertical plane and in the second embodiment the rotatable lift frame is omitted.

In the embodiment illustrated in FIGURES 9, 10 and 11, I have illustrated a container ship crane adapted to operate on rails 15 and made up of spaced C-shaped end leg members 70, each one of which has a horizontal lower arm 70*a* provided with wheels 71 adapted to run on rails 15. Wheels 71 are driven by electrical motors in conventional manner as shown and described in the preferred embodiment. Each of the lower or base arms 70*a* is provided with snubbers 72 as in the case of the preferred embodiment. The main frame girder 73 extends between the spaced C-shaped legs 70 and is provided adjacent its two bottom edges with rails 74 which are adapted to carry a trolley to be hereafter described. A girder arm 75 is pivoted at each end of the main girder 73 on a pivot pin 76 which extends through latch members 77 on the top of each of the girder arms 75 and main girder 73. A segmented gear 78 is fixed to each of the arms 75. This gear is engaged by a gear 79 mounted in the main frame 73 and driven by an electrical motor not shown so as to rotate the girder arm 75 from a horizontal position on the center line of the main girder 73 to a position above and resting on the main girder as shown in chain line in FIGURE 9. Each girder arm is provided with spaced rails 74*a* which correspond to the rails 74 on the main girder 73 and forming a continuation of those rails when the arm 75 is extended as shown in solid line on FIGURE 9. A rack 80 is provided along the bottom of each of the main girder 73 and the girder arms 75 to form a continuous drive means. A trolley 81 is suspended beneath the main girder 73 and girder arms 75 on vertical arms 82 carrying wheels 83 which run on the rails 74 and 74*a*. A drive pinion 84 is mounted on the trolley 81 and is driven in conventional manner in contact with the rack 80 to operate the trolley along the rails 74 and 74*a*. Hoist drums 90 are provided adjacent each corner of the trolley 81. These hoist drums carry cables 85 which suspend the lift beam 86 which engages and carries the container 87. The operation of the device of this embodiment is generally the same as described in connection with the preferred embodiment, and it is not deemed essential to repeat here the various operation details of this embodiment.

In the foregoing specification, I have set out certain preferred embodiments of my invention together with details of their operation and structure. It will be understood that while these disclosures represent a preferred practice and embodiment of my invention, the invention may be otherwise embodied within the scope of the following claims.

I claim:

1. In a container ship having spaced apart rails adjacent each edge of the deck parallel to the center line, a crane structure adapted to move on said rails comprising a single main frame member extending transversely of the ship, leg means each bearing on the rails at two spaced points, said leg means supporting the main frame member at each end at a point above and intermediate the said spaced points to form with said points the three points of a triangle, drive means for moving the leg means on the trackway on said ship, an extensible arm pivotally

mounted on each end of the frame member for rotation about said end from a position at least 90° out of alignment with the main frame member to a position in line with and forming an extension of said main frame member and extending over the side of the ship, a pair of spaced rails on said main frame member, a pair of like spaced rails on each of said extensible arms, a load trolley movable on said rails, hoist means on the load trolley and drive means moving the load trolley on the spaced rails.

2. In a container ship, a crane structure as claimed in claim 1 wherein the extensible arms are pivoted at the bottom of the main frame for rotation in a vertical plane from a position parallel to the leg member to a position in line with the main frame member, latch means connecting the top of the main frame and the top of said arm and means rotating the arms from one position to the other about the pivot.

3. In a container ship, a crane structure as claimed in claim 1 wherein the extensible arms are pivoted at one side of the main frame for rotation in a horizontal plane from a position alongside and parallel to the main frame to a position in line with the main frame member, latch means connecting the other side of the main frame and the arms and means rotating the arms from one position to the other about the pivot.

4. In a container ship, a crane structure as claimed in claim 1 wherein the extensible arms are pivoted about a point at the top of the main frame member from a rest position on top of and parallel to the main frame to an operative position in line with the main frame and means rotating the arms from one position to the other about the pivot.

5. In a container ship, a crane structure as claimed in claim 1 wherein the load trolley is provided with a rotatable lift frame carrying the hoist means and drive means for rotating said lift frame on the trolley.

6. In a container ship having spaced apart rails adjacent each edge of the deck parallel to the center line, a crane structure adapted to move on said rails comprising a main frame member extending transversely of the ship, leg means in the form of C-members supporting the main frame member at each end above the deck of the ship, said leg members each bearing on the rails at two spaced points and said frame member being supported above said rails at a point intermediate said spaced points forming with said points the three corners of a triangle, drive means for moving the leg means on the trackway on said ship, a pair of extensible arms one pivoted on the bottom of each end of the frame member for rotation about said end from a position parallel to the C-member to a position in line with and forming an extension of said main frame member and extending over the side of the ship, a pair of spaced tracks one on each side of the bottom of said main frame member and on each side of the bottom of said extensible arms, a fluid cylinder and link means connecting the top of each arm with the top of the main frame member to raise and lower the respective arm about its pivot, a plurality of interfitting latch members on the top of the main frame member and each arm having an opening therethrough to receive a pin, a fluid actuated cylinder on each leg means having its axis on the axis of the opening through the latch members, a pin operatively connected to the cylinder and movable thereby from a locking position in the openings in the latch members to a free position removed from the latch members, a load trolley movable on said tracks, hoist means on the load trolley and drive means moving the load trolley on the tracks.

7. In a container ship, a crane structure as claimed in claim 6 wherein rack means are provided on the bottom of the main frame member and the arms and the drive means includes pinion means engaging said rack means to move the load trolley on the tracks.

8. In a container ship, a crane structure as claimed in



claim 7 wherein the load trolley is provided with a rotatable lift frame carrying the hoist means and drive means for rotating said lift frame on the trolley.

9. In a container ship having spaced apart rails adjacent each edge of the deck parallel to the center line, a crane structure adapted to move on said rails comprising a main frame member extending transversely of the ship, leg means in the form of C-members supporting the main frame member at each end above the deck of the ship, said leg members each bearing on the rails at two spaced points and said frame member being supported above said rails at a point intermediate said spaced points forming with said points the three corners of a triangle, drive means for moving the leg means on the trackway on said ship, a pair of extensible arms one pivoted on the side of each end of the frame member for rotation about said end from a position alongside and parallel to the main frame member to a position in line with and forming an extension of said main frame member and extending over the side of the ship, an elongated well extending centrally of the bottom of each of the main frame members and the arms, a pair of spaced tracks on each side of said well in said main frame member and each of said extensible arms, drive means connecting the main frame member and each of the arms for rotating said arms about their pivot on the main frame member, releasable latch means on the main frame member and each of said arms holding the arms against movement when in line with the main frame member, a load trolley movable on said tracks, hoist means on the load trolley and drive means moving the load trolley on the track.

10. In a container ship having spaced apart rails adjacent each edge of the deck parallel to the center line, a crane structure adapted to move on said rails comprising a main frame member extending transversely of the ship, leg means in the form of C-members supporting the main frame member at each end above the deck of the ship, said leg members each bearing on the rails at two spaced points and said frame member being supported above said rails at a point intermediate said spaced points forming with said points the three corners of a triangle, drive means for moving the leg means on the trackway on said ship, a pair of extensible arms one pivoted on the top of each end of the frame member for rotation about said end from a position on top and parallel to the main frame member to a position in line with and forming an extension of said main frame member and extending over the side of the ship, a pair of spaced tracks one on each side of the bottom of said main frame member and each of said extensible arms, a gear segment mounted on each arm and centered on the pivotal axis of said arm, drive gear means on the main frame member engaging said gear segment for rotation of said arms in a vetrical plane from one position to another, a load trolley movable on said tracks, hoist means on the load trolley and drive means moving the load trolley and the hoist means.


**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,421,787 | 7/1922 | Kininmonth | 214—14 X |
| 1,547,536 | 7/1925 | Van der Graaf et al. | 214—14 |
| 2,343,014 | 2/1944 | Langan | 212—13 |
| 2,424,899 | 7/1947 | Priester | 212—15 |
| 2,440,306 | 4/1948 | Smith | 214—15 X |
| 2,799,403 | 7/1957 | Friedman | 214—15 X |
| 3,042,227 | 7/1962 | Tantlinger | 212—15 X |
| 3,051,321 | 8/1962 | Ramsden | 212—14 |
| 3,077,992 | 2/1963 | Bevard | 214—15 X |
| 3,130,840 | 4/1964 | Myers et al. | 214—15 |



GERALD M. FORLENZA, *Primary Examiner.*

R. G. SHERIDAN, *Assistant Examiner.*