

SHORE CRANE WITH THREE TROLLEYS

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to container cranes, and in particular, to a shore crane having three trolleys.

2. Background

[0002] With continuous upsizing of container vessels and rapid growth of container throughput, higher requirements for rapid handling at container terminals has to be addressed, meanwhile growing scarcity of land resources have become a bottleneck for increasing throughput as well. To meet the requirement of rapid handling of containers and maximizing throughput within a limited area, developing container yard towards space will become an explorable approach, such as using a double-deck container yard with upper and lower decks. The double deck yard allows for the yard capacity to be multiplied.

[0003] The question then arises is that, with the emergence of the double deck yard with the upper and lower floors, the existing container handling equipment, such as shore cranes with single or double trolleys, can not meet the requirement of rapid handling of double deck yard. All the existing shore cranes with single or dual trolleys are designed for handling mode of single deck yard, such that neither its loading and unloading capacity nor its handling mode can cater the needs of a double deck yard.

SUMMARY

[0004] The present invention aims to propose a shore crane with three trolleys, which is suitable for new mode of handling operation at a double deck yard.

[0005] A shore crane with three trolleys for application in double deck yard is proposed according to an embodiment of the present invention. A front girder and rear girder of the shore crane is arranged in the direction perpendicular to shoreline, with a girder rail disposed over the front and rear girders and extended from the former to the latter; a gantry rail is arranged along a horizontal beam; a transit platform is mounted below the horizontal beam; a front trolley runs along the girder rail, loading and unloading containers between a ship and the transit platform; a rear trolley runs along the girder rail, loading and unloading containers between an upper yard and the transit platform; and a gantry trolley runs along the gantry rail, loading and unloading containers between ground and the transit platform.

[0006] In an embodiment, the rear girder is higher than the upper yard and extends to a position above the upper yard, the girder rail also extends to a position above the upper yard.

[0007] In an embodiment, the front trolley, the rear trolley or the gantry trolley is driven by cable traction or independently by a driving device installed on the trolleys.

[0008] In an embodiment, the operation mode for the front trolley is one of manual control, remote control or automatic control; and the operation modes for the rear trolley and the gantry trolley are of automatic control.

[0009] In an embodiment, the transit platform is suspended below the horizontal beam, and laterally attached to a gantry crane column of the shore crane.

[0010] In an embodiment, the transit platform is provided with buffer trays.

[0011] In an embodiment, the front trolley, rear trolley or gantry trolley uses one telescopic container spreader or two parallel telescopic container spreaders.

[0012] In the present invention, by rationally providing the quantity and locations of the trolleys and breaking down the handling flow and using a transit platform, loading and unloading between the transit platform and a ship, between the transmit platform and each deck of the yard are allowed to be carried out simultaneously, such that the overall handling efficiency of a double deck yard may be significantly improved under the circumstance that the moving speed and lifting speed of trolleys can not be further increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The above-described and other features, properties and advantages of the present invention will become more apparent from the following description of the embodiments in combination with the accompanying drawings, in which like reference numerals refer to like features.

[0014] Figure 1 discloses the structure and layout of a shore crane with three trolleys according to an embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0015] The present invention discloses a shore crane with three trolleys, as shown in Figure 1, which is an illustration of the structure and layout of the shore crane with three trolleys. The shore crane 100 is to be operated in a double deck yard, the double deck yard includes an upper yard 109 and lower yard 110, typically, the lower yard 110 refers to ground 110.

[0016] The basic structure of the shore crane 100 is the same as traditional single or double trolley cranes, comprising a gantry crane, columns, a horizontal beam, girders (the front and rear girders), and cable-stayed mechanism for fixing the girders. The above-mentioned structure is common for shore crane, so it is not further described herein. According to an embodiment, the front girder 104 and rear girder

105 of the shore crane with three trolleys 100 are arranged in the direction perpendicular to the shoreline. The front girder 104 and the rear girder 105 may be an integral part. The girder rail 114 is disposed on the front girder 104 and rear girder 105, and extends from the front girder to the rear girder. Considering the operational requirements of the shore crane, the front girder 104 should extend out of the shoreline to a position above the ships, and the rear girder 105 need to extend to a position over the upper yard 109. The girder rail 114 may extend all the way from the front end of the front girder 104 to the rear end of the rear girder 105, essentially covering the entire length of the beam, such that the trolley may reach the desired operating position. The height of the rear girder 105 is obviously required higher than the height of the upper yard 109 to facilitate the container handling operation of the trolley. The gantry rail 115 is arranged along the horizontal beam 106. Under the horizontal beam 106 is installed a transit platform 108. The transit platform 108 is suspended below the horizontal beam 106 with suspension arms 116. In the illustrated embodiment, the transit platform 108 is laterally attached to the gantry crane column of the shore crane 100, in order to increase the stability of the transit platform 108. The transit platform 108 is provided with buffer trays 113. The buffer trays 113 are used for temporary placement of containers to be transferred.

[0017] The shore crane 100 is totally equipped with three trolleys, a front trolley 101, a rear trolley 102 and a gantry trolley 103 respectively. The front trolley 101 runs along the girder rail 114, loading and unloading containers between a ship 107 and the transit platform 108. The rear trolley 102 runs along the girder rail 114, loading and unloading containers between the upper yard 109 and the transit platform 108. The gantry trolley 103 runs along the gantry rail 115, loading and unloading container between ground 110 and the transit platform 108.

[0018] The front trolley 101 and the rear trolley 102 are disposed on the same rail, that is the girder rail 114. The front trolley 101 and the rear trolley 102 perform different handling operations. The front trolley 101 is responsible for the handling operation A illustrated in Figure 1, i.e. transferring containers between the vessel 107

and the transit platform 108, as shown in Figure 1. And the rear trolley 102 is responsible for the handling operation B illustrated in Figure 1, i.e. transferring containers between the upper yard 109 and the transit platform 108, as shown in Figure 1. The operating range of the front trolley 101 is from the ship 107 to the transit platform 108, and the operation range of the rear trolley 102 from the upper yard 109 to the transit platform 108. Though the front trolley 101 and the rear trolley 102 share the girder rail 114, the front and rear trolleys will not interfere with each other, because the operating ranges of the front and rear trolleys are different. The handling operation C is also shown in Figure 1, in which the gantry trolley 103, alone occupying the gantry rail 115, performs the operation of transferring containers between the lower deck or ground 110 and the transit platform 108.

[0019] The front trolley 101, rear trolley 102 or gantry trolley 103 may be driven by one of the following: being driven by cable traction or by an independent driving device provided on the trolley. It should be noted that the front trolley 101, the rear trolley 102 or the gantry trolley 103 are independently driven, so their driving modes may be chosen to be different. However, typically, all the three trolleys will be selected to be driven in the same mode, to facilitate maintenance.

[0020] The operation modes of the trolleys are as follows. The front trolley 101 is operated by an artificial, remote or automatic control, and both the rear trolley 102 and gantry trolley 103 are by automatic control.

[0021] The front trolley 101, rear trolley 102 or gantry trolley 103 utilizes one telescopic container spreader or two parallel telescopic container spreaders. The operation of the spreader(s) provided on each trolley spreader is independently controlled, so the quantity of spreaders provided for each trolley can be determined according to operating requirements. When the throughput is big, two parallel sets of telescopic container spreaders will be used simultaneously, and when the throughput is small, only one set of telescopic container spreader will be used. For example, in the embodiment shown in Figure 1, two parallel telescopic container spreaders 111 are

operated on the front trolley 101, and one telescopic container spreader 112 is used by the rear trolley 102 and the gantry trolley 103 respectively.

[0022] Described below is an example of unloading procedure executed by the inventive shore crane with three trolleys, referring to the layout shown in Figure 1:

[0023] Two containers are lifted by the front trolley from the ship, moved through path A and placed on two buffer trays 113 provided on the transit platform, and container rotary locks are removed by a worker on the platform (if needed).

[0024] One container is lifted by the rear trolley from one of the buffer trays, moved through path B and laid down in a handling lane of the upper yard, and transferred to a specified stowing location of the upper yard by a horizontal transport device waiting at the lane.

[0025] Another container is lifted by the gantry trolley from another of the buffer trays, moved through path C and laid down in a handling lane on the ground, and transferred to a specified stowing location of the upper yard by a horizontal transport device waiting at the lane.

[0026] Described below is an example of loading procedure executed by the inventive shore crane with three trolleys, again referring to the layout shown in Figure 1:

[0027] One container is lifted by the rear trolley from the handling lane of the upper yard, moved through path B and placed onto one the two buffer trays 113 on the transit platform, and container rotary locks are mounted by a worker on the platform (if needed).

[0028] Another container is lifted by the gantry trolley from a handling lane on the ground, moved through path C and placed onto another buffer tray on the transit platform, and container rotary locks are mounted by a worker (if needed).

[0029] The two containers are lifted by the front trolley from the transit platform, moved through path A to a specified unloading location on a ship.

[0030] In the present invention, by rationally providing the quantity and locations of the trolleys and breaking down the handling flow and using a transit platform, loading and unloading between the transit platform and a ship and between the transmit platform and each deck of the yard are allowed to be carried out simultaneously, such that the overall handling efficiency of a double deck yard may be significantly improved under the circumstance that the moving speed and lifting speed of trolleys can not be further increased.

[0031] The above embodiments are for persons skilled in the art to implement or apply the present invention, the persons skilled in the art may make various modifications or variations of the above embodiments without departing from the inventive idea of the present invention, such that the present invention is not restricted by the above embodiments, but consistent with the maximum scopes of innovative features specified in the claims.

What is claimed is:

1. A shore crane with three trolleys, applied to a double deck yard, comprising,
a front girder and a rear girder arranged in a direction perpendicular to shoreline, and a girder rail disposed over the front girder and the rear girder and extending from the front girder to the rear girder;
a gantry rail arranged along a horizontal beam;
a transit platform mounted below the horizontal beam;
a front trolley running along the girder rail, loading and unloading containers between a ship and the transit platform;
a rear trolley running along the girder rail, loading and unloading containers between an upper yard and the transit platform; and
a gantry trolley running along the gantry rail, loading and unloading containers between ground and the transit platform.
2. The shore crane with three trolleys according to Claim 1, wherein
the rear girder is higher than the upper yard, the rear girder extends to a position above the upper yard, and the girder rail extends to a position above the upper yard.
3. The shore crane with three trolleys according to Claim 1, wherein,
the front trolley, the rear trolley or the gantry trolley are driven by cable traction or by an independent driving device installed thereon.
4. The shore crane with three trolleys according to Claim 1, wherein,
the operation mode of the front trolley is one of manual, remote or automatic control; and the operation modes of the rear and gantry trolleys are automatic control.
5. The shore crane with three trolleys according to Claim 1, wherein,

the transit platform is suspended below the horizontal beam, and laterally attached to a gantry crane column of the shore crane.

6. The shore crane with three trolleys according to Claim 1, wherein, the transit platform is provided with buffer trays.

7. The shore crane with three trolleys according to Claim 1, wherein, the front trolley, rear trolley or gantry trolley use one telescopic container spreader or two parallel telescopic container spreaders.