

# PATENT SPECIFICATION

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## (54) MARINE-CARGO HANDLING EQUIPMENT

(71) We, MITSUBISHI JUKOGYO KABUSHIKI KAISHA, a Japanese corporation, of 5-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan, and THE DAIWA NAVIGATION COMPANY LIMITED, a Japanese corporation, of 25-1, Minamikyutaro-cho 4-chome, Higashi-ku, Osaka, Japan, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a marine-cargo handling equipment suited for handling cargoes, such as bags, between ships and piers or wharves.

In loading and unloading bags and such-like freight into and out of the holds of ships, it has been customary to use either the vessels' own gears, such as derricks and deck cranes, or similar stevedoring equipment located on land.

A disadvantage common to the already available facilities is that they are incapable of moving the cargoes uninterruptedly and they therefore require rather too much time and labour for the handling activities.

The present invention is directed to the circumvention of the foregoing disadvantage, and has for its object to provide a cargo handling equipment including a combination of a transfer carriage adapted to traverse in the upper part of the hold of a ship, a turntable and a tilting conveyor assembly associated with the carriage so that continuous handling of the freight is made possible and the operation is automatized and expedited.

The handling equipment, in accordance with the present invention, comprises a transfer carriage located in the upper part of the hold of a ship and capable of travelling horizontally, a turntable carried by the carriage, a tilting conveyor assembly

composed of a main conveyor base pivotally connected at the upper end to the turntable and adapted to incline at a desired angle from the horizontal and a main belt conveyor held over the base, and a terminal conveyor assembly composed of a terminal conveyor base pivotally connected to the lower end of the main conveyor base and adapted to take a desired attitude and an auxiliary belt conveyor held over the base.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings showing a preferred embodiments thereof. In the drawings:

FIGS. 1 and 2 are side and plan views, respectively, of a section of a hull illustrating the general construction of the embodiment of the invention incorporated in the vessel;

FIG. 3 is a cross sectional view of the hull showing the equipment of the invention in more detail;

FIGS. 4 and 5 are details of the encircled portion A of FIG. 3, FIG. 4 being a side view and FIG. 5 a plan view; and

FIGS. 6 and 7 are details of the encircled portion B of FIG. 3, FIG. 6 being a side view and FIG. 7 a plan view.

Referring to FIGS. 1 to 3, there are shown a pier or wharf 1 and a horizontal belt conveyor 2 extended along the wharf. Cargo 3, such as bags, is carried by the conveyor 2, an inclined belt conveyor 4, and thence by a horizontal conveyor 5, into a ship.

The cargo 3 is then moved by a distribution conveyor system consisting of roller conveyors 6 and horizontal belt conveyors 7, 8 installed on the upper part of the hold of the ship, and is delivered to desired points in the upper space of the hold.

On the surrounding walls of the upper hold space a track equipped with racks 9 is laid horizontally, and is associated with a traveling transfer carriage 10 equipped with pinions 10a in mesh with the racks 9. The pinions 10a are separately driven by motors not shown (FIG. 4).

The traveling transfer carriage 10 supports a turntable 13, over which a transfer belt conveyor 12 extends. The transfer belt conveyor 12 is adapted to receive the cargo, piece by piece, from a movable ramp 8a of the horizontal belt conveyor 8. The ramp 8a is tiltable upward and downward with respect to the conveyor 2.

As shown in FIGS. 4 and 5, the upper end of a main conveyor base 16 is pivotally connected to the turntable 13 by a horizontal hinge pin 14. Between the main conveyor base 16 and the transfer carriage 10 is installed a hydraulic expansion arm 15 which holds the main conveyor base 16 at a given angle of inclination from the horizontal. One end of the arm 15 is pivotally connected to the conveyor base 16 by a horizontal pin 15a, and the other end to the transfer carriage 10 by a universal coupling 15b.

The main conveyor base 16 is combined with a main belt conveyor 17 laid on its upper surface by usual support means to constitute a tilting conveyor assembly.

Further, as shown in FIGS. 6 and 7, the front end of a terminal conveyor base 20 is pivotally connected by a horizontal hinge pin 28 to a fixed arm 18 projecting from the lower end of the main conveyor base 16. A hydraulic expansion arm 19 is stretched between the rear end of the terminal conveyor base 20 and the lower end of the main conveyor base 16, so that the conveyor base 20 can take a desired attitude although, when in use, it is laid flat on the bottom of the hold.

The terminal conveyor base 20 and an auxiliary belt conveyor 21 supported thereon by conventional support means constitute a terminal conveyor assembly.

Turning to FIG. 4, the base 29 of the transfer belt conveyor 12 is tiltable mounted on the turntable 13 via an expansion mechanism 30 composed of hydraulic cylinders. The turntable 13 has a center shaft 13a extending downward from its underside and turnably supported by a knuckle 22 projecting from the transfer carriage 10.

The turning mechanism for the turntable 13 is such that, as illustrated in FIGS. 4 and 5, a gear 23 fast on the center shaft 13a under the turntable is driven and rotated by a motor 25 on a bracket 24 secured to the transfer carriage 10, via a reduction means 26 and a drive gear 27.

With the construction described, the con-

tinuous marine-cargo handling equipment in accordance with the present invention operates in the following manner. When loading the hold H of a ship, the cargo 3 is delivered by the conveyors 2, 4 through 8, and 8a onto the transfer belt conveyor 12. Next, the cargo in the form of bags, for example, is transferred to the main belt conveyor 17 of the tilting conveyor assembly and the auxiliary belt conveyor 21 of the terminal conveyor assembly connected to the lower end of the conveyor 17, and is finally piled up on the bottom of the hold as shown in FIGS. 1 and 3.

As the position where the cargo 3 is being stowed on the hull bottom is shifted, the transfer carriage 10 is caused to travel along the rack type track 9, the turntable 13 is rotated, and the length of the expansion arm 15 is adjusted in order to control the position and direction of the base 16 of the tilting conveyor assembly. At the same time, the terminal conveyor base 20 too is controlled in orientation by the expansion arm 19. In this way the front end of the auxiliary belt conveyor 21 of the terminal conveyor assembly can be moved to a desired place and properly positioned.

When unloading the cargo 3 from the hold H of the ship, the afore-described procedure is repeated in reverse order. In this case, however, the movable ramp 8a must be adjusted to a height lower than that of the transfer belt conveyor 12 and the conveyor 12, in turn, must be lowered to a position below the upper end of the main belt conveyor 17 by the expansion mechanism 30. As will be obvious to those skilled in the art, guide means (not shown) is installed between the transfer belt conveyor 12 and the horizontal belt conveyor 8 to assist in the transfer of the cargo from the former to the latter.

The operation of the individual conveyors, travelling of the transfer carriage 10, rotation of the turntable 13, and expansion and shrinkage of the expansion arms 15, 19 may be remotely controlled from a conventional control panel or console (not shown) in a convenient location.

Although the tilting conveyor assembly 16, 17 in the embodiment of the invention has thus far been described as arranged at substantially right angles to the sides of the ship when viewed from above, it is, of course, possible to install the assembly generally in parallel to the shipside.

Also, while gears and motors are used as drives for the transfer carriage 10 and turntable 13, they may be eliminated and replaced by chains or ropes, rollers and/or winches.

Further, the attitude control of the bases 16, 20 for the tilting and terminal conveyor

assemblies, respectively, may be accomplished by means of chains, ropes, hoists and/or torque hinges instead of by the expansion arms 15, 19.

- 5 As has been described hereinabove, the continuous marine-cargo handling equipment of the invention includes a transfer carriage 10 capable of running along the upper part of the hold of a ship, a tilting conveyor assembly 16, 17 associated with the carriage through a turntable 13, and a terminal conveyor assembly 20, 21 pivotally connected to the lower end of the tilting conveyor assembly to assume a desired attitude. Consequently, the terminal conveyor is allowed to follow precisely the changes in the loading and unloading point within the hold, and the handling of bags and other similar cargoes that would otherwise need much time and labour will be continuously and automatically carried out with very high efficiency.

#### WHAT WE CLAIM IS:

1. A marine-cargo handling equipment 25 comprising a transfer carriage adapted to travel horizontally along the upper wall of the hold of a ship, a turntable carried by the carriage, a tilting conveyor assembly composed of a main conveyor base 30 pivotally connected at the upper end to the turntable and adapted to maintain a desired angle of inclination from the horizontal and a main belt conveyor held over the base, and a terminal conveyor assembly 35 composed of a terminal conveyor base pivotally connected to the lower end of the main conveyor base and adapted to take a

desired position and direction and an auxiliary belt conveyor held over the base.

2. An equipment according to claim 1 40 wherein the turntable includes a base made liftable by an expansion mechanism and a transfer belt conveyor held over the base.

3. An equipment according to claim 1 45 wherein the upper end of the main conveyor base is pivotally connected to the turntable by a horizontal hinge pin, and the lower end of the main conveyor base has a fixed arm projecting therefrom and pivotally connected to the terminal conveyor base by a horizontal hinge pin.

4. An equipment according to claim 1 50 wherein a movable ramp of a horizontal belt conveyor aboard the ship is adjustable in height relative to the transfer belt conveyor and the transfer belt conveyor, in turn, is adjustable in height relative to the main belt conveyor.

5. An equipment according to claim 1 60 wherein the main and terminal conveyor bases are adapted to be inclined at desired angles by means of expansion arms, chains, ropes, hoists, winches, and/or torque hinges.

6. A marine-cargo handling equipment 65 constructed, arranged and adapted to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.

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desired position and direction and an auxiliary belt conveyor held over the base.

2. An equipment according to claim 1 wherein the turntable includes a base made liftable by an expansion mechanism and a transfer belt conveyor held over the base.

3. An equipment according to claim 1 wherein the upper end of the main conveyor base is pivotally connected to the turntable by a horizontal hinge pin, and the lower end of the main conveyor base has a fixed arm projecting therefrom and pivotally connected to the terminal conveyor base by a horizontal hinge pin.

4. An equipment according to claim 1 wherein a movable ramp of a horizontal belt conveyor aboard the ship is adjustable in height relative to the transfer belt conveyor and the transfer belt conveyor, in turn, is adjustable in height relative to the main belt conveyor.

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