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Apparatus and Method for Contactless Cargo Load Control on Crane Systems

The invention relates to an apparatus for contactless cargo load control on crane systems in accordance with the preamble of the first patent claim and to a method of operating said apparatus.

Apparatus for the radiation scanning of piece goods are known and generally rely for operation on x-rays or gamma rays. They are used to suitably and non-invasively inspect the luggage of passengers for determining whether said luggage contains dangerous objects. Radiation scanning processes and scanning apparatus for inspecting larger sized shipment boxes or containers are known as well. These are larger sized units that transmit radiation through a container or a shipment box in order to find out whether the container contains any objects and devices for which transport is not provided for. This is more specifically the case where containers or larger sized shipment boxes are to be transported across borders, more specifically with containers that are shipped to other countries in trucks, planes or ships. The problem with such type apparatus that are placed on the ground is that a transport means has to drive the container through the apparatus, which requires the driver or any nearby person to be accordingly protected from radiation. It is more specifically necessary to perform another handling or transporting step in order to allow for radiation scanning of such a container. Such type methods are not suited for application where a great number of containers is to be loaded and unloaded rapidly because it is not possible for the containers to wait for a long time or for vessels to lie too long in the port.

U.S. Patent No. 5,638,420 discloses an apparatus for the radiation scanning of a container from the top, said device having a movable frame that straddles the container, thereby taking radiation scans thereof. DE 198 26 560 A1 presents an apparatus for inspecting the contents of closed cargo carriers, more specifically of containers, using x-rays, by means of which containers are scanned from the side by a radiation scanning unit that is disposed on a vehicle.

The disadvantage of these two apparatus is that only single containers can be scanned by the crane, and this only after they have been placed on the ground, and that this makes it necessary to provide for a separate device that has to straddle the container.

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It is therefore the object of the invention to develop an apparatus and a method for contactless cargo load control that allows for fast and safe radiation scanning of containers, more specifically of containers that are unloaded from a vessel, e.g., during unloading, without directly endangering persons.

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This object is achieved by an apparatus having the characteristic features of the first patent claim and by a method for operating said apparatus.

Advantageous implementations of the invention are apparent from the subclaims.

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The solution in accordance with the invention provides for an apparatus for contactless cargo load control on crane systems, preferably on container lifting crane systems, by means of which the containers are inspected by radiation scanning while they are loaded onto and unloaded from transport vehicles, a radiation scanning unit for contactless control of the shipment box being disposed on the very crane. The shipment boxes may be containers of various size. They may be inspected in two different ways. The shipment box is either placed in series and scanned by means of a movable transmitter and receiver unit or the shipment box is moved through the radiation scanning unit so that transmitter and receiver unit are stationary. The radiation scanning unit may rely for operation on x-rays or on gamma rays.

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If the operator control cabin is located in proximity to the radiation scanning unit, the operator of the crane is protected by a suited screen that is disposed between the operator control cabin and the radiation scanning unit.

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The radiation scanning unit may be mounted to the crane in different locations. On the one hand, it is advantageous to mount the radiation scanning unit underneath the trolley so that the shipment box is passed through the radiation scanning unit while it is being hoisted from the transport means and so that, at this stage already, a decision may be taken to either further transport the piece good or to cease its unloading.

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In another variant, the radiation scanning unit is mounted at or on the trolley that carries it along. The advantage thereof is that the shipment box may be scanned for a longer period of time as it is being moved along the crane jib, which allows for more intensive examination of

the cargo load. If the unloaded container is suspect, it may be placed for control onto a special stack or yard.

In still another variant, the radiation scanning unit is non-movably mounted to the crane jib or to the crane bridge and the trolley carrying the shipment box and the load unit is passed through the radiation scanning unit. In the variant in which, during trolley travel, the container is moved through the radiation scanning unit that is non-movably mounted to the crane jib, it is appropriate to rotate the container 90 degrees so that scanning may be performed from the long side thereof. This allows for short scanning of the shipment box upon which decision may be taken as to whether the shipment box will be conducted further in accordance with its destination or whether it has to be placed in a particular location for more intensive examination.

In still another advantageous implementation of the invention the radiation scanning unit is disposed in the region of the land-side steel construction of the crane. This makes it possible to control the shipment box or the container as it is being lowered onto a yard or another transport vehicle. There are two possibilities of mounting such a unit to the land-side steel construction. On the one hand, the shipment box that is to be lowered may be passed through a stationary or a movable shaft or funnel in which the radiation scans are taken while it is also possible, on the other hand, to place the shipment box in the radiation scanning unit on the steel construction and to scan it there prior to releasing it for further shipping or to lowering it onto a transport vehicle.

Such a cargo control apparatus mounted to crane units, or rather such a radiation scanning unit are capable of being readily retrofitted to conventional cranes. The radiation scanning unit may be monitored, and the shipment box controlled, at a safe distance from the crane, with the radiation scanning device being couplable to the control system of the crane in such a manner that a decision is taken as to where the scanned piece good is to be transported upon completion of the scanning procedure.

The advantage of the apparatus in accordance with the invention is that shipment boxes may be quickly and safely scanned while being loaded and unloaded and that a decision as to whether the transport container is to be conducted to its primary destination, i.e., to be

shipped on, is to be subjected to more intensive examination or is not to be accepted may be taken without any further working step, immediately after scanning.

The invention will be understood better upon reading the following description of four
 5 Figures and of an exemplary embodiment of a crane system for unloading vessels and loading trucks. In the Figs.:

Fig. 1: shows a container lifting crane system for unloading vessels and loading automotive
 10 vehicles in which the radiation scanning unit is mounted beneath the trolley that carries it along on the crane jib.

Fig. 2: shows the crane system with two hoist trolleys and one transfer trolley, with the radiation scanning unit being located on the transfer trolley.

15 Fig. 3: shows the crane system in which the radiation scanning unit is rigidly mounted to the crane bridge, the trolley carrying the piece good to be controlled traveling through said unit (container rotated 90 degrees).

Fig. 4: shows a container lifting crane in which the radiation scanning unit is movably
 20 mounted in the region of the land-side construction.

Fig. 1 shows a container lifting crane 1 for unloading vessels by means of a trolley 4 below which there is located a container 3 that is surrounded by a radiation scanning unit 2. The radiation scanning unit 2 carrying the container 3 travels along the jib 5, the travel time being
 25 made use of for scanning the container 3. Then, container 3 is placed onto the pier or onto transport vehicles.

Fig. 2 shows a crane system 1 with two trolleys 4 and one transfer trolley 8, the radiation scanning unit 2 being located on the transfer trolley.

30 Fig. 3 shows a crane 1 with a jib and a bridge 5, a radiation scanning unit 2 through which the shipment box 3 is moved below the trolley 4 being mounted to the crane bridge 5. The container is rotated 90 degrees.

Fig. 4 shows a crane 1 with a trolley 4 below which there is located a container 3 in which the radiation scanning unit 2 is located in the land-side part of the steel construction 6. In the instant case, the radiation scanning unit 2 is shaped like a funnel and is horizontally slidably mounted to the transverse girder of the steel construction 6 so as to be capable of straddling the automotive vehicle 9 that is to be loaded for example. As a result thereof, the lowered shipment box 3 may be moved through the radiation scanning unit 2 and be scanned before it is placed onto the pier or the automotive vehicle 9.

The variants suggested herein have the advantage that the shipment boxes may be scanned quickly during transport on the very crane so that control of the shipment boxes 3 will not require increased time, organization and equipment expense.

Listing of the numerals used herein

	1	crane
	2	radiation scanning unit
5	3	shipment box, container
	4	trolley (hoist trolley)
	5	jib / crane bridge
	6	land-side part of the steel construction
	7	funnel or guide shaft, horizontally movable
10	8	transfer trolley
	9	automotive vehicle such as a truck, a train or a stacking yard

Patent Claims

1. An apparatus for contactless cargo load control on crane systems, preferably for container lifting crane systems, by means of radiation scanning during loading and unloading of transport vehicles, characterized in that a radiation scanning unit (2) for contactless control of the shipment box (3) is mounted to the crane (1), the shipment box(es) (3) being moved therethrough.
2. The apparatus as claimed in claim 1, wherein the radiation scanning unit (2) is mounted beneath/above the trolley (4).
3. The apparatus as claimed in the claims 1 and 2, wherein the radiation scanning unit (2) is mounted so as to be carried along by the trolley (4) or (8).
4. The apparatus as claimed in claim 1, wherein the radiation scanning unit (2) is mounted to the jib or to the crane bridge (5) in the region of the trolley's travel path in such a manner that the piece good (3) to be transported is moved therethrough.
5. The apparatus as claimed in claim 1, wherein the radiation scanning unit (2) is rigidly mounted in the region of the land-side steel construction (6) of the crane (1) in such a manner that the piece good (3) to be transported is moved therethrough.
6. The apparatus as claimed in claim 1, wherein the radiation scanning unit (2) is movably mounted in the region of the land-side steel construction (6) of the crane (1) in such a manner that the piece good (3) to be transported is moved therethrough.
7. The apparatus as claimed in any of the claims 1 through 6, wherein the radiation scanning unit (2) is mounted to a multiple-trolley crane.
8. A method of operating an apparatus as claimed in any of the claims 1 through 7, wherein a shipment box (3) is inspected both during hoisting or lowering thereof or during the trolley's travel and during temporary storage of the box on the construction (6) of the crane (1) and wherein, as a result of the radiation scanning operation, a

decision is taken as to whether the inspected piece good (3) is returned to its original site, is cast out or transshipped for further transport.