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Method for handling loads in a warehouse for containers, particularly standard containers.

The invention relates to a method for handling loads in a warehouse for containers, particularly standard containers, in which the containers are automatically placed into storage and removed
5 from storage by a container stacking crane, the containers are unloaded by the container stacking crane in a loading and unloading area adjacent to the warehouse onto a lorry parked in a parking space of the loading and unloading area or are picked up from a lorry parked in a parking space of the loading and unloading area.

10 From European patent application EP 1 490 286 B1 a method is known for handling loads of standard containers in a warehouse. The warehouse is a part of a port cargo handling installation which consists essentially of a water-side handling area, the warehouse and a land-side handling area. The water-side handling area has handling devices in the form of handling
15 bridges with which ships lying alongside a quay are loaded and/or unloaded. Between the handling devices and an area of the warehouse where containers are placed into and removed from storage, the containers are transported by floor-borne vehicles, in particular driverless transport vehicles. At the end opposite the area where containers are placed into and removed from storage, the warehouse is allocated a loading and unloading area for transport vehicles such as lorries, to which the transport vehicles travel via an entry and exit area of the handling
20 installation with an identification area.

The warehouse is an automated warehouse with a corresponding automated area specially secured against unauthorised access by a boundary such as e.g. a wall or fence. The automated area of the warehouse terminates in each case at the adjacent land-side loading and unloading
25 area for the lorries and at the adjacent water-side area where containers are placed into and removed from storage. In both these areas manual operation or semi-automatic operation takes place for safety reasons. The automated warehouse consists essentially of a rectangular, longitudinally extending warehouse area in which the containers are stored in columns and rows and stacked up to 5 containers one on top of another on the ground.

30 The warehouse area is located below an automatic stacking crane which can travel on rails. The



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automatic stacking crane consists essentially of a crane bridge, the ends of which run on elevated rails via running gears. The crane bridge is therefore able to travel in the longitudinal direction of the warehouse area. A trolley which can travel transverse to the warehouse area is disposed on the crane bridge. A vertically moveable mast is mounted on the trolley, the lower end of which mast is adjoined by a load-receiving means in the form of a spreader for containers. Gantry cranes or semi-gantry cranes can also be used instead of a stacking crane.

A handling process in this handling installation takes place e.g. as follows. A lorry to be loaded and/or unloaded travels into the handling installation via an entry and exit area and thus arrives in an identification area in which the lorry and possibly its transported containers are identified and measured. Access authorisation is then issued to the driver in the form of a magnetic card or chip card which contains all relevant data relating to the handling task. These data are also transmitted to a superordinate data processing system of a logistics administration facility. The driver then drives his lorry to an area of the loading and unloading area which he has been allocated and reverses his lorry into a parking position in the loading and unloading area. The lorry is recognised and identified during the parking procedure by a camera disposed in the loading and unloading area. The camera also makes it possible to deliver information relating to the position of the lorry, i.e. its distance from a demarcation within the loading and unloading area and its angle of rotation with respect to the ground, to the data processing system of the logistics administration facility. When the parking procedure is completed the exact position of the lorry is then known to the data processing system of the logistics administration facility. These data then serve as a target position for the stacking crane for setting down or picking up a container onto or from the lorry. In the usual manner an operator monitors and controls the loading process on a central monitor via cameras disposed on the load-receiving means. Before the loading and/or unloading process takes place the driver of the lorry goes to a registration office in order to use the magnetic or chip card to indicate that the lorry is ready to be loaded and unloaded. If the operator of the stacking crane should determine via the cameras that the twist locks are incorrectly positioned, he can use an intercom to ask the driver to rectify the incorrect positioning.

The object of the present invention is to optimise a method for handling loads in a warehouse

for standard containers in relation to its through-put rate and safety.

This object is achieved by a method for handling loads in a warehouse for standard containers having the features of claim 1. Advantageous embodiments of the present invention are given in the subordinate claims 2 to 6.

In accordance with the invention in a method for handling loads in a warehouse for containers, particularly standard containers, in which the containers are automatically placed into and removed from storage by a container stacking crane, the containers are unloaded by the container stacking crane in a loading and unloading area adjacent to the warehouse onto a lorry parked in a parking space of the loading and unloading area or are picked up from a lorry parked in a parking space of the loading and unloading area, an increase in the handling rate is achieved in that after the lorry has entered the parking space and after the driver of the lorry has left the parking space, the parking space is secured against the presence of at least one person, particularly the driver of the lorry, and an authorisation signal for the automatic loading or unloading process is transmitted to the container stacking crane. By means of the securing process, the parking space into which the lorry travels and in which the driver is consequently present, is converted into a secured area which a container stacking crane can also enter and in which it can travel in automatic operation. In terms of the invention the "presence of at least one person" is understood to mean that intrusion of a person or later entry of persons is prevented or discovered.

In a simple embodiment provision is made that, after the lorry has entered the parking space and after the driver of the lorry has left the parking space, the parking space is secured against access by at least one person, particularly the driver of the lorry. Moreover, provision can be made that, according to the operational regulations of the handling installation, the presence of persons in the region of the parking space is prohibited and thus the driver must merely be compelled by suitable measures to leave the parking space in order to allow automatic operation. The security measure can be limited to preventing access since no further persons are present in the region of the parking space.

Security in relation to the area where the driver is present can be increased in that, after leaving the parking space, the driver of the lorry locates a waiting area, the presence of the driver is established in the waiting area, and the authorisation signal to the container stacking crane for the loading or unloading process is maintained as long as the driver stays in the waiting area.

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In order to achieve high speed in the loading or unloading process, after the loading or unloading process is completed, i.e. after the container stacking crane has left the parking space, the driver is informed of this fact and the security of the parking space against access by persons, particularly the driver of the lorry, is lifted and the authorisation signal to the container
10 stacking crane for the automatic loading or unloading process is withdrawn.

A suitable method step for securing the parking space is proposed in that the parking space is secured by closing a gate, which is part of a demarcation surrounding the parking space, against access by persons, particularly the driver of the lorry. It is also possible to replace the gate by
15 suitable sensor groups which provide a sufficiently high level of recognition security.

In order to increase security further, provision is made for the number of persons in the lorry to be established before it is driven in and only a single person travels into the parking space with the lorry.

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The invention is explained in more detail hereinunder with the aid of an exemplified embodiment shown in a drawing in which:

Figure 1 shows a layout plan of a handling facility for standard containers in a port area,

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Figure 2 shows an enlarged section of Figure 1 from the region of an area of a warehouse where containers are placed into and removed from storage,

Figure 3 shows a side view of Figure 2 and

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Figure 4 shows an enlarged section of Figure 3 and an illustration of the viewing angle of the

camera attached to an automatic container crane.

Figure 1 shows a layout plan of a handling installation 1 in a port area in which containers 2, particularly standard containers, are handled. The layout plan shows only a section of the handling installation but the essential components are visible. The handling installation 1 consists essentially of a land-side handling area 3, a warehouse 4 and a water-side handling area 5.

The land-side handling area 3 adjoins a land-side end 4a of the warehouse 4 and consists essentially of an entry and exit area 6 for lorries 7 in order to transport the containers 2 to be handled in and/or out, and - adjoining this - a loading and unloading area 8 at the land-side end 4a of the warehouse 4. The entry and exit area 6 for the lorries 7 is divided into a public area 6a, which is connected to the public road network, and an area 6b within the port. The public area 6a and the area 6b within the port are separated by a control area 9. With the exception of the public area 6a of the entry and exit area 6, the handling installation 1 is accordingly surrounded by a boundary 10, e.g. formed as a fence, wall or a combination thereof. In the control area 9 incoming and outgoing lorries 7 are identified, possibly measured, weighed and processed with respect to their handling task. Cameras, not illustrated, are also mounted in the control area 9 and used to record the lorry 7 from all sides, its official number plate and also an identification number provided on the container 2. The data thus generated, which are also required for the loading and/or unloading of the lorry 7, are transmitted to a superordinate data processing system, not illustrated, of a logistics administration facility of the handling installation 1. It is also ensured, in accordance with the safety guidelines of the port operation, that the driver's cabin 7a of the lorry 7 contains only a driver and that any passenger leaves the lorry and waits in the control area 9. After passing through the control area 9 an incoming lorry then travels into the internal area 6b of the entry and exit area 6 and via appropriate lanes 11 of the entry and exit area to one of the plurality of parking spaces 12 within a loading and unloading area 8 of the warehouse 4.

In terms of the invention and also in conjunction with the present description of the exemplified embodiment, lorries 7 are also understood to mean towing vehicles with trailers.

In the loading and unloading area 8 a lorry 7 parked in the parking space 12 is loaded and/or unloaded by a container stacking crane 13 operating in the warehouse 4. The container stacking crane 13 operates automatically. The warehouse 4 consists of a plurality of warehouse areas 4c which are disposed in parallel and linearly next to each other, to each of which at their land-side end 4a the loading and unloading area 8 is allocated and at their water-side end 4b the area 14 where containers are placed into and removed from storage is allocated. Each warehouse area 4c has one or a plurality of container stacking cranes 13 which can travel along the warehouse areas 4c on rails 15. The container stacking cranes 13 transport the containers 2 between the warehouse area 4c and the loading and unloading area 8 and/or the area 14 where containers are placed into and removed from storage. In addition to the one or more container stacking cranes 13 each warehouse area 4c also has an area 4d where the containers 2 are set down. The set-down area 4d has a rectangular and elongate base surface on which the containers 2 are disposed in columns and rows. Up to five containers 2 are stacked one on top of another. The set-down containers 2 are aligned with their longitudinal extension substantially in parallel with the rails 15 of the container stacking cranes 13. This alignment of the containers 2 is also found in the loading and unloading area 8 with the incoming and outgoing lorries 7 and in the area 14 where containers are placed into and removed from storage with incoming and outgoing driverless transport vehicles 17, so that the container stacking cranes 13 do not have to pivot the respective containers 2, apart from any necessary alignment corrections, during pick-up and set-down.

At the water-side end 4b of the warehouse 4 the containers 2 are set down by the container stacking crane 13 on stationary support frames 16 in the area 14 where containers are placed into and removed from storage, or are picked up therefrom for onward transportation. These support frames 16 serve as interfaces to the driverless transport vehicles 17 which pick up the containers from the support frames 16 and/or set them down thereon and transport them into the area of handling bridges 18 by means of which ships lying alongside a quay 19 in the region of the water-side handling area 5 of the handling installation 1 are loaded and unloaded.

Figure 2 shows an enlarged section of Figure 1 from the region of the loading and unloading area 8 and of a part of the adjoining warehouse area 4c. It is clear that in each loading and

unloading area 8 a plurality of parking spaces 12 for lorries 7 are disposed next to each other and at the smallest possible distance from each other. In the case of a warehouse area 4c with nine rows of containers 2 set down next to each other, six parking spaces for lorries 7 are provided next to each other. Each parking space 12 is closed laterally by its demarcation 12a when seen in the longitudinal direction of a lorry 7. This demarcation 12a adjoins a warehouse demarcation 21 which defines the whole warehouse 4 since the container stacking cranes 13 in operation at that point operate automatically and access to this automated area must therefore be prevented. The demarcation 12a between the parking spaces can be formed as a fence, wall or a combination thereof. In this case lateral concrete troughs are preferred which facilitate reverse parking of the lorries 7 since the wheels of the lorry 7 can be guided at this location. A fence is then additionally erected in each case on these concrete troughs. At the end of the parking space 12 facing the container area 4c the warehouse demarcation 21 is also provided which surrounds the warehouse 4. The parking space 12 is therefore provided with an opening 12b in the manner of a gate at the front. The lorry reverses into the parking space 12 through this opening 12b for the subsequent loading and/or unloading process.

In order to prepare the area of a parking space 12, in which a lorry 7 is parked for subsequent loading and/or unloading, for automatic loading and/or unloading by the container stacking crane 13 it must still be ensured that the driver of the lorry 7 leaves not only the driver's cabin 7b but the area of the parking space 12 via the opening 12b within the demarcation 12a. Various possibilities exist to achieve this. In the present case the opening 12b of the demarcation 12a is closed by a gate 12c after the driver leaves his parked lorry 7. For this purpose the driver can actuate a switch disposed outside the parking space 12. The switch is located e.g. in the region of a waiting area 22 in the form of a communication stand which is disposed as an extension of the lateral demarcation 12a of the parking space 12 and outside the demarcation 12a. In the region of the waiting area 22 provision is additionally made so that the driver may not leave the waiting area 22 during the process of loading and unloading the lorry 7 by the automatically operating container stacking crane 13. If he did leave the waiting area this would immediately lead to the cessation of automatic operation in the area of the respectively associated parking space. This can be effected by suitable means such as a contact mat on the floor or light barriers or suitable recognition electronics. After the gate 12c is closed and the

driver has entered the waiting area 22, corresponding data are transmitted to the data processing system of the logistics administration facility. The working area of the container stacking crane 13, which is otherwise bounded by the warehouse demarcation 21, is then extended by the now cleared individual parking space 12 so that in relation to this parking space 12 the container stacking crane 13 can now carry out the desired loading or unloading process automatically. After completion of the loading or unloading process by the container stacking crane 13 the driver waiting in the waiting area 22 receives an appropriate notification. The gate 12c associated with the respective parking space 12 opens either automatically or is unlocked so that the driver can open it manually. It is also possible for the driver to operate a switching element which has been released in the meantime in order to open the gate 12c.

It is fundamentally also possible to close off the parking space 12 in the region of its opening by a secure sensor group rather than by a gate 12c.

In addition, in the region of the communication stand 22 provision can be made for a canopy to be positioned in order to provide additional protection for the driver in the event of malfunction of the container stacking crane 13.

It becomes clear from this description that the demarcations 12a, which can be closed by the gate 12c, individual parking spaces 12 are defined as an automated area if required [sic]. When a parking space 12 is defined as an automated area, the gate 12c is closed and the driver is outside the parking space 12. The respective parking space 12 becomes a manual area which the container stacking crane 13 is not allowed to enter when the gate 12c is opened and the driver is in the region of the lorry 7 or no lorry 7 is parked. In this way it is achieved that the container stacking crane 13 can carry out the loading or unloading of the lorry 7 automatically.

It is fundamentally also possible for the loading or unloading process also to take place semi-automatically or, in the event of one or more unsuccessful attempts in automatic operation, an operator intervenes via a central control stand using cameras disposed on the container stacking crane 13 and in the region of the parking space 12.

Furthermore, Figure 2 shows the more detailed construction of the container stacking crane 13 per se. This container stacking crane 13 consists essentially of a bridge 13a which can travel along the rails 15 which are disposed laterally next to the set-down areas 4d of the respective warehouse area 4c, on which bridge a trolley 13b can travel transversely to the travel direction of the bridge 13a. A vertically moveable mast 13c is mounted on the trolley 13b, on which mast a load-receiving means 13d, preferably a spreader frame, for receiving the containers 2 is mounted. The container stacking crane 13 is therefore able to travel in the longitudinal direction of the respective warehouse area 4c and its mast 13c with the load-receiving means is able to travel transversely to the longitudinal direction of the warehouse area 14c via the trolley 13b.

It is fundamentally also possible to use a gantry crane or semi-gantry crane instead of a container stacking crane 13.

Figure 3 shows a side view of Figure 2, which more clearly shows the construction of the container stacking crane 13 with its vertical mast 13c. It also shows that the rails 15 are elevated to a level above the stacked containers 2. The warehouse area 4c and the loading and unloading area 8 are separated from each other by the warehouse demarcation 21.

Figure 4 shows a side view corresponding to Figure 3 but in this case the container stacking crane 13 has entered the loading and unloading area 8 from the warehouse area 4c, the gate 12c of which loading and unloading area has previously been closed after the driver has left the lorry 7 and confirmed his presence in the waiting area 22. A camera 23 is disposed on the container stacking crane 13 in the region of the trolley 13b, by means of which camera the positions of the anchoring points on the platforms of the lorries 7 and/or the anchoring points on the containers 2, which are to be unloaded and which are located on a lorry, are recognised and transmitted to the data processing system of the warehouse administration computer. These data are then used for the automatic loading or unloading process.

Reference list

- 1 handling installation
- 2 container
- 5 3 land-side handling area
- 4 warehouse
- 4a land-side end
- 4b water-side end
- 4c warehouse area
- 10 4d set-down area
- 5 water-side handling area
- 6 entry and exit area
- 6a public area
- 6b area within the port
- 15 7 lorry
- 7a driver's cabin
- 8 loading and unloading area
- 9 control area
- 10 boundary
- 20 11 lane
- 12 parking space
- 12a demarcation
- 12b opening
- 12c gate
- 25 13 container stacking crane
- 13a bridge
- 13b trolley
- 13c mast
- 13d load-receiving means
- 30 14 area where containers are placed into and removed from storage
- 15 rails

- 16 support frame
- 17 driverless transport vehicle
- 18 handling bridge
- 19 quay
- 5 20 ship
- 21 warehouse demarcation
- 22 waiting area
- 23 camera

Claims

- 1 Method for handling loads in a warehouse (4) for containers (2), particularly standard
containers, in which the containers (2) are automatically placed into and removed from
5 storage by a container stacking crane (13), the containers (2) are unloaded by the container
stacking crane (13) in a loading and unloading area (8) adjacent to the warehouse (4) onto
a lorry (7) parked in a parking space (12) of the loading and unloading area (8) or are
picked up from a lorry (7) parked in a parking space (12) of the loading and unloading
area (8), characterised in that after the lorry (7) has entered the parking space (12) and
10 after the driver of the lorry (7) has left the parking space (12), the parking space (12) is
secured against the presence of at least one person, particularly the driver of the lorry (7),
and an authorisation signal for the automatic loading or unloading process is transmitted to
the container stacking crane (13) and that, before the lorry is driven in, the number of
persons in the lorry (7) is established in a control area (9) and only a single person travels
15 into the parking space (12) with the lorry (7).
- 2 Method as claimed in claim 1, characterised in that after the lorry (7) has entered the
parking space (12) and after the driver of the lorry (7) has left the parking space (12), the
parking space (12) is secured against access by persons, particularly the driver of the lorry
20 (7).
- 3 Method as claimed in claim 1 or 2, characterised in that after leaving the parking space
(12), the driver of the lorry (7) locates a waiting area (22), the presence of the driver is
established in the waiting area (22), and the authorisation signal to the container stacking
25 crane (13) for the loading or unloading process is maintained as long as the driver stays in
the waiting area (22).
- 4 Method as claimed in any one of claims 1 to 3, characterised in that after the loading or
unloading process is completed the driver is informed of this fact and the security of the
30 parking space (12) against access by persons, particularly the driver of the lorry (7), is
lifted and the authorisation signal to the container stacking crane (13) for the automatic

loading or unloading process is withdrawn.

- 5 Method as claimed in any one of claims 1 to 4, characterised in that the parking space (12)
is secured by closing a gate (12c), which is part of a demarcation (12a) surrounding the
5 parking space (12), against access by persons, particularly the driver of the lorry (7).