

SYSTEM FOR INDICATING AND MEASURING THE POSITION OF A
CONTAINER IN A VEHICLE AND/OR TRAILER LOADED WITH CON-
TAINERS

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TECHNICAL FIELD

The invention relates to the loading of containers on
road transportation vehicles, in particular trailer
10 trucks designated for the transportation of contain-
ers, and to the unloading of containers therefrom. In
more detail, the invention relates to a system for de-
termining the position of a container in a vehicle
and/or trailer loaded with containers in a container
15 loading area, such as container terminal, for loading
and unloading the container or containers on or from
the vehicle and/or trailer, respectively, by a crane
handling the containers and moving over a lane or
lanes in the loading area, the crane provided with a
20 spreader grabbing the containers from the top and with
a positioning system for the crane and the spreader,
the system for determining the position of a container
being provided with a container position determining
apparatus arranged in connection with the lane.

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TECHNICAL BACKGROUND

Loading and unloading of road trailer trucks trans-
porting containers is an important part of the opera-
30 tions in nearly all container terminals. As a func-
tion, the unloading of trailer trucks does not differ
much from a situation where the container is picked up

in the container storage area, as in both cases an unladen spreader is lowered on top of the container, after which the container is locked to the spreader by means of twistlocks.

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In automatic container crane systems, the container can be automatically lifted from a trailer truck for example by means of measuring systems based on laser scanners. Systems have also been developed for loading
10 the containers on a trailer automatically. An absolutely essential requirement for these systems is, however, that the desired position of the container can be accurately measured. However, accurate measurement requires reference points that can be identified.
15 In most terminals, unloading and/or loading of trailer trucks is, nevertheless, a manual procedure due to security regulations.

The loading of trailer trucks is considerably more
20 challenging than the unloading. The trailer in road trailer trucks transporting containers is usually provided with twistlocks, by means of which it is ensured that the container stays in place during the transportation. Lowering the container with sufficient accuracy
25 in such a way as to align corner castings of the lowered container sufficiently accurately with the twistlocks requires accuracy. The visibility of the crane operator is disturbed by the container hanging from the spreader and blocking the twistlocks in the
30 truck at the final stage of the lowering process.

Handling of the trailers is facilitated by a variety of systems. For example, there are systems where the driver of a truck is assisted in stopping relative to the crane by means of a measuring system based on a laser scanner in such a way that the main movements of the crane would not have to be operated. By the main movements is meant the movement of the entire gantry or trolley.

10 An example of state of the art solutions representing laser scanner technology is patent publication CN201161875Y disclosing a system for determining locations of a spreader in a container crane and of a trailer truck to be loaded or unloaded, and particularly of twistlocks on a bed thereof (or of corner castings in a container) relative to the crane. Information produced by laser scanners in the system also allows one to conclude the type of a truck to be loaded and/or of a container to be lifted out from a truck.

Another example of solutions utilizing the laser scanner technology is disclosed in patent publication CN1884034A relating to a system for determining locations of a trailer truck loaded or unloaded by a container crane and of the containers on a bed thereof relative to the crane. Information produced by laser scanners in the system also allows one to conclude the type of a truck to be loaded and/or of a container to be lifted out from a truck.

A third example of solutions representing this technology is patent publication JP2005239343A relating to a system for determining locations of trailer trucks to be loaded or unloaded relative to a crane handling
5 containers. The system uses laser scanners disposed on the frame of the crane.

A container can be automatically lifted from a trailer truck for example by means of the measuring systems
10 based on laser scanners.

There are also systems based on cameras, wherein the aim is to recognize the desired position of the container of twistlocks in the trailer utilizing machine
15 vision. One such solution is disclosed in patent publication DE3606363A1 relating to a system for determining the location of a trailer truck to be loaded or unloaded relative to a crane handling containers. The system uses cameras disposed on the frame of the crane
20 at a height of a bed in the trailer truck. A problem of the camera-based machine vision systems is moderate reliability due to environmental conditions. In particular, wrong interpretations are caused by lighting that changes. When directing a spreader of a crane
25 based on information from a measuring system, reliability is extremely important. False measurement data may cause material damages.

Yet another example of known state of the art is patent
30 publication EP1337454A1, wherein a system for determining the location of a trailer truck to be loaded or unloaded relative to a crane handling containers is

disclosed. The system uses sensors disposed on the frame of the crane at a height of a bed in the trailer truck.

5 However, not all trailers have measurable reference points, such as twistlocks; instead, cargo is fastened to the trailer e.g. by tie down straps or chains. In addition, the twistlocks in some trailers are not exposed until points for the fastening of a container
10 are subjected to the weight of the container.

SUMMARY OF THE INVENTION

The objective of the present invention is to provide a
15 novel solution for indicating and measuring the position of a container in a vehicle and/or trailer loaded with containers. To this end, the invention is mainly characterized in that a container position determining apparatus comprises a fixed structure which is mounted
20 alongside a lane and the location of which relative to ground is known, and an indicator that is movable on the fixed structure and can be moved manually to indicate either end of the desired position of the container on the vehicle parked on the lane or on the
25 trailer connected thereto, whereupon information about the position of the indicator on the fixed structure is determined and transmitted to a crane.

The fixed structure mounted alongside the lane is
30 preferably an elongated rail parallel to the lane or the like, along which the indicator is movable. One or more sensors are appropriately provided in connection

with the indicator or in the fixed structure to determine the position of the indicator on the fixed structure.

- 5 Alternatively, the position of the indicator on the fixed structure can also be determined by the positioning and measuring systems of the crane.

To improve the measuring accuracy, the indicator may
10 be provided with a mechanical accessory part extending out from the indicator to the lane to reduce distance to a vehicle parked on the lane and/or to a trailer connected thereto. Said accessory part may in this case be formed as a fixed part of the actual indica-
15 tor.

Alternatively, the indicator may be provided with a laser sight or suchlike laser light emitting a visible laser line, the laser line being pointed out from the
20 indicator to the lane and a parked vehicle or a trailer connected thereto.

The invention provides considerable advantages as compared to prior art. By the system according to the in-
25 vention, the position of cargo, particularly of a container, on a trailer can be indicated and determined also when the trailer has no measurable reference points, such as twistlocks. Measuring the position of a container accurately on the trailer of a truck is
30 generally quite difficult, and the good measuring systems are expensive. In state of the art solutions, all cases cannot even be measured accurately because there are no reference points in the target area. To indi-

cate and determine the position of a container, the invention provides an economic and reliable method which is mainly based on operations of the driver and on manual use. Thus, the driver is always able to supervise that determination of the position of a container is correctly performed.

Other advantages and characteristics of the invention are set out below by detailed disclosure of the invention, wherein the invention is described with reference to the figures of the accompanying drawing, to the details of which the invention is not exclusively limited.

SHORT DESCRIPTION OF THE FIGURES

Fig. 1 schematically illustrates a container crane which is used in a port and in connection with which the system according to the invention is applicable.

Fig. 2 schematically illustrates a gantry crane which is used in a container terminal and in connection with which the system according to the invention is also applicable.

Fig. 3 schematically illustrates a front view, seen from the incoming direction of vehicles, of an automatic stacking crane which is used in a container terminal and in connection with which the system according to the invention is applicable.

Fig. 4 illustrates one embodiment of the system according to the invention as a schematic top view.

Fig. 5 shows an illustration of another embodiment of the system according to the invention corresponding to Fig. 4.

Fig. 6 shows an illustration of yet another embodiment of the invention corresponding to Fig. 4 and 5.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 of the drawing schematically illustrates, by way of example, a side view of a container crane, in connection with which the system according to the invention is applicable. In Fig. 1, the container crane is generally referenced as number 10 and it is of the so-called STS (Ship-to-Shore) crane type arranged on a quay 11 to move along rails 12. The container crane 10 is arranged to move containers 13 from a container ship 14 onto transportation beds 15 or suchlike trailers 17 pulled by a vehicle 16 and vice versa during loading of the ship 14 and unloading of cargo. The container crane 10 is provided with a vertical frame that comprises legs 18, 19 and supports a horizontal boom 20, along which a trolley 21 is adapted to move. The trolley 21 carries, by means of hoisting ropes 22, a spreader 23 grabbing the container 13 from the top. An operator's cabin connected to the trolley 21 is referenced as number 24 and an electrical power machinery of the crane is referenced as number 25. Under the crane, there are lanes 26, along which vehicle-

trailer combinations drive under the crane to move containers 13 from the trailer to the container ship 14 or vice versa.

5 Fig. 2 schematically illustrates a gantry crane 10a which is used in the container terminal and in connection with which the system according to the invention is also applicable. The gantry crane 10a may be a rail mounted gantry crane (RMG) or, as illustrated in Fig.
10 2, a rubber tyred gantry crane (RTG). The gantry crane 10a is designated to move containers 13 from transportation beds 15 or suchlike trailers pulled by a vehicle and stack the containers 13 in rows in the container yard and vice versa. The gantry crane 10a is
15 provided with a vertical frame that comprises legs 18a, 19a and supports a horizontal bridge 20a, along which a trolley 21a is adapted to move. The trolley 21a carries, by means of hoisting ropes 22a, a spreader 23a grabbing a container 13 from the top. The container rows are disposed between the legs 18a, 19a of
20 the gantry crane 10a, and between the legs there is also a lane 26a, along which vehicle-trailer combinations drive under the crane to move containers 13 from the trailer to the container rows or vice versa.

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Fig. 3 schematically illustrates an automatic stacking crane 10b (ASC) which is used in the container terminal and in connection with which the system according to the invention is also applicable. In structural
30 terms, the automatic stacking crane 10b is similar to the gantry crane 10a of Fig. 2 and it is, in the corresponding manner, designated to move containers 13

from vehicles 16 and trailers 17 pulled thereby and stack the containers 13 in container rows in the container yard and vice versa. The crane 10b according to Fig. 3 is designed to operate automatically, i.e. without an operator. The structure of the automatic stacking crane 10b is thus for the most part similar to the gantry crane 10a of Fig. 2, and it is hence provided with a vertical frame that comprises legs 18b, 19b and supports a horizontal bridge 20b, along which a trolley 21b is adapted to move. The trolley 21b carries, by means of hoisting ropes 22b, a spreader 23b grabbing a container 13 from the top. The automatic stacking crane 10b of Fig. 3 and 4 operates e.g. in the container terminal or, respectively, in the port in the landside interchange area (LS) provided with lanes 26b for vehicles 16 and trailers 17. This area comprising the lanes 12b functions as the loading area, particularly in the case of Fig. 3 as an automated loading area, where the loading and unloading of the containers takes place. Rows formed by the containers 13 as well as the lanes 26b are disposed between the legs 18b, 19b of the crane 10b.

In a situation illustrated in Fig. 4, a vehicle 16 and its trailer 17 have been driven or reversed onto the free lane 26 and parked to load or unload the container 13 onto or from the trailer 17. In the system according to the invention, in connection with the lane 26 there is provided a container position determining apparatus which comprises an elongated fixed structure 1, e.g. a rail or the like, which is mounted alongside the lane 26 in parallel to the lane 26 and the loca-

tion of which relative to ground is thus accurately known. The fixed structure 1 is further mounted with an indicator 2 that is movable along the structure in the longitudinal direction. When a vehicle 16 with a trailer 17 is parked, the driver of the vehicle manually moves the indicator 2 to indicate either end of the desired position of a container. Thus, the position of a container does not depend on the type of the vehicle 16 or the trailer 17 and succeeding of measurement does not depend on reference points which can be detected in the trailer 17.

Location of the indicator 2 on the fixed structure 1, such as a rail, is determined and this location information is transmitted to the crane 10, 10a, 10b. Position of the crane relative to ground is determined by other measuring systems which may be present on the actual crane 10, 10a, 10b or external to the crane. Accurate determination of location of the indicator 2 can be performed e.g. by a sensor solution comprising one or more sensors provided in connection with the indicator 2 or in the fixed structure 1. The location of the indicator 2 can also be determined by measuring systems present in the crane 10, 10a, 10b, in which case the position of a container can be determined directly relative to the crane or relative to ground if desired.

To improve and facilitate the determination of the position of a container, the indicator 2 in the system according to Fig. 5 may be provided with a mechanical accessory part 3 which extends from the indicator 2

and, as the indicator 2 is being moved, moves in proximity to the trailer 17 for sufficient accuracy. Said accessory part 3 thus extends from the indicator 2 to the lane 26 in such a way that distance between the
5 accessory part 3 and the trailer 17 is sufficiently small. The accessory part 3 may also be formed as a fixed part of the actual indicator 2.

Another solution improving accuracy of the indicator 2
10 is illustrated in Fig. 6. In this embodiment, the indicator 2 is provided with a laser sight or suchlike laser light emitting a visible laser line 4. The laser line 4 is pointed out from the indicator 2 to the lane 26. The position of a container or actually the end of
15 the position of a container can be determined very accurately by this solution.

It is essential and common for different embodiments of the invention to perform the determination of the
20 position of a container by means of a fixed structure 1, such as a rail, and an indicator 2 moving thereon manually, chiefly by driver of the vehicle 16.

The invention has been described above by way of example with reference to the figures of the accompanying
25 drawing. The invention is not, however, limited merely to the examples illustrated in the figures; instead, different embodiments of the invention may vary within the scope of the inventive idea defined in the accompanying
30 claims.

CLAIMS

1. A system of determining the position of a container in a vehicle and/or trailer loaded with containers in a loading area for containers (13) of a container terminal in which , wherein the system comprises
- a crane (10, 10a, 10b) is configured to load at least one container (13) on the vehicle (16) and/or trailer (17) and correspondingly to unload therefrom and to move over at least one lane (26, 26a, 26b) in the loading area for containers (13), wherein the crane (10, 10a, 10b) comprises
 - a spreader (23, 23a, 23b) configured to grab the at least one container (13) from the top, and
 - a positioning system for the crane (10, 10a, 10b) and the spreader (23, 23a, 23b),
 - a container position determining apparatus arranged in connection with the at least one lane (26, 26a, 26b),
 - characterized in that the container position determining apparatus comprises
 - a fixed structure (1) mounted alongside the at least one lane (26, 26a, 26b) and the location of which relative to ground is known,
 - an indicator (2) that is movable on the fixed structure (1) and is manually movable to indicate either end of the desired container position on a vehicle (16) parked on the lane (26, 26a, 26b) or on a trailer (17) connected thereto, wherein the container position determining apparatus is configured to deter-

mine information about the position of the indicator (2) on the fixed structure (1) and to transmit the information to the crane (10, 10a, 10b), and

5 one or more sensors provided in connection with the indicator (2) or in the fixed structure (1) configured to determine the position of the indicator (2) on the fixed structure (1).

2. The system according to claim 1, characterized in
10 that the fixed structure (1) mounted alongside the lane (26, 26a, 26b) is an elongated rail parallel to the at least one lane (26, 26a, 26b), along which the indicator (2) is movable.

15 3. The system according to any preceding claim, characterized in that the position of the indicator (2) on the fixed structure (1) is arranged to be determined by the positioning and measuring systems of the crane (10, 10a, 10b).

20 4. The system according to any preceding claim, characterized in that the indicator (2) is provided with a mechanical accessory part (3) extending out from the indicator (2) to the lane (26, 26a, 26b) to reduce distance to a vehicle (16) parked on
25 the lane (26, 26a, 26b) and/or to a trailer (17) connected thereto.

5. The system according to claim 4, characterized
30 ized in that the accessory part (3) is formed as a fixed part of the actual indicator (2).

6. The system according to any claim 1-5, characterized in that the indicator (2) is provided with a laser sight or suchlike laser light emitting a visible laser line (4), the laser line (4) being
5 pointed out from the indicator (2) to the lane (26, 26a, 26b) and a vehicle (16) parked thereon or a trailer (17) connected to the vehicle.