defining a target position d_x of the container, where the d_x may be 0 or some other value indicating a position of the spreader to the container, and it may include a compensation for the ground inclination;

defining safety distances, d_r, d_l, between the spreader and adjacent containers, where $d_r = d_l$, if d_r or d_l is not available;

defining weights for the target position and the safety distances for different heights of the spreader;

determining a height h of the spreader; and

driving the spreader to meet the safety distance and the target position under control of the weights corresponding to the determine height of the spreader.

In one example of the weights w_1 for the target position and weight w_2 for the safety distance may be defined as a function of the height h of the spreader as follows:

- when $h < h_1$, then $w_1 = 1$ and $w_2 = 0$
- when $h > h_2$, then $w_1 = 0$ and $w_2 = 1$
- *otherwise* $w_1+w_2 = 1$, *and* $0<= w_1 <=1$, *and* $0<= w_2 <=1$

In the above definition of the weight the two heights are such that $h_1 < h_2$.

It should be appreciated that also further heights and corresponding weights w_1 and w_2 for the heights may be defined. It is possible also to define only one height limit that may be used to determine which of two sets of weights should be applied in driving the spreader.

The weights may be used in driving the spreader in various ways. In one example the spreader may be driven by minimizing weighted deviations from the target position and the safety distance, where the weighted deviations maybe expressed as:

$w_1e_2 + w_2e_2$, where e_1 and e_2 are the deviations of the target position and the safety distance respectively.

Figure 6a and 6b illustrate container size detection according to an embodiment. Figures 6a and 6b have different sizes of containers 614a, 614b that are handled by a spreader 606 equipped with a distance sensor 608. The distance sensor and the spreader may be arranged operational to measure distances from the container that is handled by the spreader. The measured distances may be processed as described above to determine a reference line 620 matching a vertical side of the container. The container ~~614a~~ 614b of

height 2.6 m, has 0.3 meters smaller height than the container ~~614b~~ 614a of height 2.9 m. This height difference illustrates a typical situation observed between a high cube container having the height of 9 feet and 6 inches, approximately 2.9 m, and a normal height container having the height of 8 feet and 6 inches, approximately 2.6 m.

When the distance sensor performs the measurements, optical signals 609 are transmitted towards the container attached to the spreader. Distances are measured on the basis of those transmitted optical signals that reflected back from the vertical side 614a, 614b of the container. Accordingly, an optical signal transmitted at least at angle α intersects a reference line matching the vertical side of the container at an intersection point 615. The intersection point is located on the reference line below the container, when the container is a normal height container, and on the reference along the vertical side of the container, when the container is a high cube container.

The operation of the container size detection may follow the process described in Figure 7 to determine a reference line matching the vertical side of the container. When the reference line has been determined from the distance measurements received from the distance sensor, lengths of containers may be determined along the reference line. Different heights of containers extend to different lengths of the reference line in the downward direction. Accordingly, different container types may be determined on the basis of their length along the reference line.

The length of the container along the reference line may be determined on the basis of optical signals transmitted from the distance sensor for measuring distances based on the reflections of the transmitted optical signals. When the transmitted optical signals are reflected back from a length of the reference line that matches to a height of a specific type of container, e.g. a high cube container, it may be determined that the container attached to the spreader is of the specific type. When the transmitted optical signals are not reflected back from a length of the reference line that matches to a height of a specific type of container, e.g. the high cube container, it may be determined that the container attached to the spreader is shorter than the specific container, e.g. a normal height container. When an optical signal transmitted at a given angle α is not reflected back, distance measurements are not received from such transmission angle. This means that there are no objects within the open-

er and a side of the cargo being below the spreader, for example in a stack, on the ground or attached to the spreader.

7. A method according to any one of the preceding claims, wherein a plurality of reference lines ~~is~~ are determined, the method comprising:

defining a target position between the reference lines; and

driving, for example hoisting, the spreader on the basis of the reference lines towards the target position.

8. A method according to any one of the preceding claims comprising:

defining an opening angle of the distance sensor, said opening angle including transmission directions of the optical signals;

determining a portion of the opening angle, wherein the transmission directions belonging to the determined portion correspond to a specific size, for example height, of the cargo along a reference line.

9. A method according to claim 8, comprising:

transmitting optical signals within the opening angle,

determining the size of the cargo as large, when distances are measured within the portion of the opening angle.

10. A method according to claim 8, comprising:

transmitting optical signals within the opening angle,

determining a reference line that matches a vertical side of the cargo within the opening angle;

determining the size of the cargo as small, when distances are measured within the portion of the opening angle are beyond the reference line.

11. A method according to any one of the preceding claims, wherein the spreader is driven on the basis of distances measured from a horizontal side of the cargo, when the spreader is at a high altitude with respect to the ground or the cargo, and the spreader is driven on the basis of distances measured from a vertical side of the cargo, when the spreader is at a low altitude with respect to the ground or the cargo.

12. A method according to any one of the preceding claims, wherein the measured distances comprise distances from a vertical structure of the spreader and distances from cargo adjacent to the spreader, and reference lines corresponding to the vertical structure and the adjacent cargo are determined on the basis of the measured distances, the method comprising:

determining a distance from a reference line corresponding to the vertical structure to the nearest reference line corresponding to the cargo;

driving the spreader on the basis of the distance.

13. A method according to any one of the preceding claims, wherein the spreader is driven to maintain a threshold for distance, for example the threshold determined as increasing as a function of height of the spreader from the ground or stack, to surrounding objects, for example adjacent cargo.

14. A method according to any one of the preceding claims, wherein the spreader is driven to pick up cargo at a target position determined by reference lines, while maintaining a threshold for distance to surrounding objects, whereby the target position and the threshold for distance to surrounding objects are weighted with respect to each other as a function of height of the spreader from the ground or stack.

15. A method according to any one of the preceding claims, wherein a reference line, for example a straight line, is determined by matching, for example, by linear regression, the measured distances to a shape of the cargo defined by the reference line.

16. A method according to any one of the preceding claims, wherein the spreader is driven to pick up or to stack or both to pick up and to stack the cargo, for example a container.

17. A method according to any one of the preceding claims, wherein the spreader includes several distance sensors.

18. A method according to any one of the preceding claims, wherein the spreader comprises a locking mechanisms for attaching to the cargo and at

least one vertically projecting structure, for example a steel panel, connected to the locking mechanism, wherein the vertically projecting structure is within the transmission direction of optical signals of the distance sensor.

19. A method according to any one of the preceding claims, wherein the distance sensor comprises a laser scanner including a rotatable mirror for selecting directions of the laser scanner.

20. A cargo handling apparatus including a spreader for attaching to a cargo including a plurality of interconnected sides, the spreader including a distance sensor capable of transmitting optical signals in selected directions, and a controller connected to the distance sensor to measure distances in the selected directions, the cargo handling apparatus further including means for determining on the basis of the measured distances a reference line that matches a shape of at least one of the interconnected sides of the cargo.

21. A cargo handling apparatus according to claim 20 comprising means configured to perform a method according to any one of claims 1 to 19.

22. A cargo handling apparatus according to claims 20 or 21, wherein the apparatus comprises a crane, for example a gantry crane or a bridge crane.

23. A cargo handling ~~n~~ apparatus according to any one of claims 20 to 22, wherein the distance sensor~~s~~ is connected to the spreader by a resilient member, for example a spring, a coil spring, a bending spring, a member of compressible elastic material, a member of compressible elastic material comprising hollow sections or rubber, for damping shocks or vibrations from the spreader.

24. A computer program product comprising executable code that when executed, causes execution of functions of a method according to any one of claims 1 to 19.

25. A kit for upgrading an apparatus for cargo handling by a spreader, the kit comprising: