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IMPROVED DETECTION SYSTEM



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Field of the Invention

5 The invention relates to the movement and control of shipping containers and particularly through use of spreader assemblies. Specifically, the invention to the automatic determination of the spatial position of containers to be engaged by the spreader assembly.

10 **Background**

The economic rationale of the use of shipping containers involves the standardization of dimensions of the various components so that when a container is shipped to any location it will be compatible with the means of transport and equipment irrespective of
15 the country. This compatibility allows large volume of equipment and containers to be manufactured by different entities on the understanding that there is global compliance with the system.

To this end, in excess of 80% of all shipping containers will fall into the category of a
20 20-foot or a 40-foot container with a smaller subset of 45-foot containers.

A more recent economic advantage is the ability to move multiple containers at one time with the last decade providing spreader assemblies for engaging the containers having the capabilities of engaging more than one container at one time. One member

within this family is the twin 20 spreader having the ability to engage a single 40-foot container or two 20-foot containers lying end to end. The difficulty arises when it may not be clear to the operator whether the containers to be engaged are in fact a single 40-foot or two 20-foot containers end to end due to the remote location of the operator.

5 Such spreader assemblies have container engagement devices at each end of the spreader corresponding to a one container arrangement and further container engagement devices intermediate the ends for the two container arrangement. The operator must then decide whether all of the container engagement devices are to be used in the case of the two container arrangement or only the end devices for a single
10 container arrangement. The consequences of making the wrong decision may lead to significant damage of the spreader assembly as well as the containers themselves as well as the delay in repairing the damage possibly to the ship itself.

Summary of Invention

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In a first aspect, the invention provides a detection system comprising: a spreader assembly having two end pairs of container engagement devices, each pair at opposed ends of the spreader assembly corresponding to a one container arrangement, and two intermediate pairs of container engagement devices located intermediate the ends of the
20 spreader, the end and intermediate pairs corresponding to a two container arrangement; an object recognition system including at least one sensor in communication with a processor arranged to identify a predetermined object detected by the sensor, said processor further arranged to signal to an operator on identification; wherein said object corresponds to the two container arrangement.

Accordingly, by providing a sensor, which may be a camera or a scanner, to detect whether an object corresponding to a two container arrangement is present in the

5 negative, it will be clear to the operator that a single 40-foot container is present.

However, if the predetermined object is in fact identified or detected the two container arrangement, that is two containers end to end, must be present and so requiring the intermediate container engagement devices.

10 **Brief Description of Drawings**

It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible and consequently, the particularity of the
15 accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figures 1A and 1B are various views of corner castings of a container;

20 Figures 2A to 2C are various views of a detection system according to one embodiment of the present invention;

Figures 3A and 3C are various views of a detection system according to a further embodiment of the present invention;

Figures 4A and 4B are various views of a detection system according to a further embodiment of the present invention;

- 5 Figures 5A to 5D are various views of a detection system according to a further embodiment of the present invention;

Detailed Description

- 10 The invention includes identifying an object or feature that corresponds to the spreader assembly being in a two container arrangement. That is, to be able to remotely identify when the twin 20 spreader according to one embodiment has engaged two 20-foot spreaders rather than a 40-foot or a 45-foot container. It does this by identifying an object such as a corner casting or an area of a corner of a container which may include
- 15 the corner casting. The corner casting is particularly useful as the object to be recognized as its features are very characteristic and can be readily included in a lookup table or other reference used by a processor processing the signal from a sensor.

- The object recognition system used to identify the object may be any one of a number of
- 20 standard commercially available machine vision systems used for the identification of objects using automated image analysis. The characteristic shape of a corner casting, or corner casting and surrounds, may be sufficient for the machine vision systems used.
- The sensor for the object recognition system may include camera, which may be a 3 dimensional camera in order to identify the object through depth perception also. Which

category of camera used, and the object recognition system adopted, will be at the discretion of the operator when designing a system falling within the scope of the present invention.

5 In this regard, two approaches may be used, being pattern recognition and feature-based geometric recognition. With the former, stored images of objects may be identified as representing patterns within a more complex. For feature-based geometric recognition, an object may be identified from a range of images of the object taken from different perspectives such that the comparison is made with each different view. Given the view
10 of the corner casting will be required from above, this may be a beneficial, though not limiting technique, as it may involve a relatively small number of images within the tolerance required to engage such a container.

Figures 1A and 1B show such an arrangement whereby the spatial placement 5 of the
15 corner casters 10, 15 for a container 20 may be readily used to determine whether a 20-foot container is in place based upon recognizing a corner casting 25 representing an intermediate position to engage intermediate container engagement devices such as twist locks.

20 Figures 2A to 2C and 3A to 3C show one embodiment of the present invention. Here a spreader assembly 35 which may be described as a twin 20 spreader because it is capable of engaging two 20-foot spreaders 40, 42 in an end to end arrangement. The spreader assembly 35 have two end container engagement devices 32, 38 which may be used to engage a single 40-foot container in the arrangement shown in Figure 2A or 45-

foot container when extended by the telescopic device 75 to accommodate a 45-foot container. Intermediate container engagement devices 34, 36 are then used to engage the corner castings of two 20-foot containers 40, 42. Accordingly, end engagement devices 32, 38 represent a one container arrangement for the spreader assembly 35.

- 5 When the end engagement devices 32, 38 are used with the intermediate engagement devices 34, 36, this corresponds to a two container arrangement whereby two 20-foot containers 40, 42 may be engaged.

- The difficulty for the operator is determining whether the containers be engaged are two
10 20-foot containers or a 40-foot container. It may not be apparent given the remote location of the operator from the containers. However, with the use of sensors according to the present invention, this becomes more apparent.

- In the embodiment shown in Figures 2B and 3B, the sensors 45, 50, 55, 60 are each
15 located adjacent to the intermediate engagement devices 34, 36, thus as the spreader 35 is lowered ready to engage the containers 40, 42, the sensors will detect the corner castings associated with the intermediate engagement devices and the processor will recognize these based upon the standard dimensions of a corner casting. And so indicate to the operator that the two container arrangement is required.

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Figures 2C and 3C show an alternate embodiment in that instead of four sensors only two sensors 65, 70 are used. As in previous embodiment, the sensors are located adjacent to intermediate engagement devices and so whether in the retracted

arrangement as shown in Figure 2A or the extended arrangement as shown in Figure 3A, the sensors will still identify the corner casting and so communicate this to the operator.

It will be appreciated that if a 40-foot container would have been engaged (or 45-foot as
5 shown in Figure 3A) the sensors would not identify a corner casting and so the operator would immediately assume that a 40-foot (or 45-foot) container was to be engaged.

Figures 4A ad 4B show an alternative arrangement 80 whereby the spreader engages two containers 40, 42 and mounted to the spreader are two sensors 85, 90. Where this
10 embodiment varies is the nature of the object. In this case, the object to be detected by the sensors 85, 90 is in fact a broader view encompassing two adjacent corner castings rather than one. To this end, this demonstrates that the object “to be identified” by the sensors is not merely limited to the corner castings but can extend to other features also. Apart from the advantage of having a reduced number of sensors and so reducing the
15 infrastructure cost. In this case the sensors 85, 90 are fixed to the spreader and to the telescopic device and so remain fixed in a central position. This has a number of advantages. First, it ensures that it may require both castings to be identified in order to permit engagement. Alternatively, it may only require identifying one casting and so if the other casting is obscured for whatever reason, the scanner with its broader scope is
20 able to still identify that a two container arrangement is required.

Figures 5A to 5D show a further embodiment whereby many sensors 115, 120, 125, 130, 135, 140 are fixed directly to the spreader and so again do not move on extension of the

telescopic device 97. The embodiment includes two pairs of outer sensors 115, 130, 125, 135 and a single pair of internal scanners 120, 140.

The sensors work together in order to determine whether:

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- (i) There are two 20-foot containers in a retracted condition (Figure 5B);
- (ii) Two 20-foot containers in an extended condition (Figure 5D);
- (iii) A single container only.

10 If the internal sensors 120, 140 identify at least one corner casting, then the operator will know the condition of (i) exists. If at least one of the external sensors 115, 125, 130, 135 identify a corner casting, then the operator will know that the (ii) condition exists. If no corner castings are identified, then the single container condition must exist.

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Claims

1. A detection system comprising:
 - 5 a spreader assembly having two end pairs of container engagement devices, each pair at opposed ends of the spreader assembly corresponding to a one container arrangement, and two intermediate pairs of container engagement devices located intermediate the ends of the spreader, the end and intermediate pairs corresponding to a two container arrangement;
 - 10 an object recognition system including at least one sensor in communication with a processor arranged to identify a predetermined object detected by the sensor, said processor further arranged to signal to an operator on identification; wherein said object corresponds to the two container arrangement.
- 15 2. The detection system according to claim 1 wherein in the one container arrangement, the spreader is arranged to engage a 40 foot container and in the two container arrangement the spreader is arranged to engage two 20 foot containers end to end.
- 20 3. The detection system according to claim 1 or 2 wherein the pre-determined object includes at least one corner casting of a container.

4. The detection system according to claim 3 wherein the pre-determined object includes two corner castings each on separate containers placed adjacent to each other.
5. The detection system according to any one of claims 1 to 4, wherein the at least one sensor is mounted to the spreader proximate to at least one of the intermediate container engagement devices.
6. The detection system according to any one of claims 1 to 4, wherein the spreader is extendable so as to engage a 45 foot container in an extended one container arrangement, said intermediate engagement devices positioned such that on extension the intermediate engagement devices move to maintain a distance to the end engagement devices corresponding to a 20 foot container.
7. The detection system according to claim 5, wherein the sensors are movably mounted to the spreader such that, on extension, the sensors move together with the intermediate engagement devices.
8. The detection system according to claim 5, wherein the sensors are fixedly mounted to the spreader such that, on extension, the sensors remain in a fixed position.

9. The detection system according to any one of claims 1 to 6, wherein there are four sensors each located proximate to the intermediate engagement devices.
- 5 10. The detection system according to any one of claims 1 to 6, wherein there are two sensors positioned proximate to diagonally opposed intermediate engagement devices.
- 10 11. The detection system according to claim 1 or 2, wherein the sensor is mounted centrally to the spreader, said object comprising two adjacent corner castings.
- 15 12. The detection system according to claim 7, wherein there are at least three sensors each fixedly mounted to the spreader comprising two external sensors mounted at positions corresponding to the intermediate engagement devices in an extended position and an internal sensor mounted centrally to the spreader.
13. The detection system according to any one of claims 1 to 11, wherein the object comprises a corner casting and a portion of the container adjacent to said casting.
- 20 14. The detection system according to any one of claims 1 to 11, wherein the object comprises an end of the container comprising two corner castings and an edge of said container.

15. The detection system according to any one of claims 1 to 14, wherein said object recognition system is arranged to identify said object by comparing images captured by said sensor and comparing said images with a database of object images.