

An Alignment System for a Spreader

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The invention relates to an alignment system for a spreader for lifting freight containers.

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Conventionally, freight containers are lifted by engaging a lifting device known as a spreader to the top of the container. The spreader is connected to a crane by a lifting cable so that the crane can lift or lower the spreader. Spreaders are generally comprised of a metal frame having four pickup elements, commonly known as twistlocks located at each of the corners of the spreader. The twistlocks are adapted to engage with respective twistlock apertures in the top of the container and are rotated to lock the spreader to the container.

The operator of the crane is located in an operator's cabin which is located approximately 60 to 80 feet above the ground and is vertically above the spreader. Therefore, when an operator is attempting to align the spreader with the top of a container to engage the spreader with the container, the alignment procedure is difficult as the upper surface of the container with which the operator is trying to align the spreader is at least partially obscured by the spreader. Hence, the operator can not see the twistlock apertures or the twistlocks themselves.

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Therefore, it is difficult for an operator to correctly align all four twistlocks with the respective twistlock apertures to engage the spreader with the container.

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In accordance with a first aspect of the present invention, there is provided a spreader alignment system comprising an image capturing device adapted to be mounted on a spreader for lifting freight containers, a display device and a communication link to transmit an image captured by the image capturing
5 device to the display device for display on the display device, the system also including an alignment reference mark for display on the display device.

In accordance with a second aspect of the present invention, there is provided a spreader alignment system comprising an image capturing device adapted to
10 be mounted on a spreader for lifting freight containers, a processor and a communication link to transmit an image captured by the image capturing device to the processor, the processor comparing the captured image with a reference image and the processor being adapted to control relative movement of the spreader and container to until the captured image is within a
15 predetermined deviation of the reference image.

In accordance with a third aspect of the present invention, a method of engaging a spreader with a freight container to be engaged by the spreader comprises causing relative movement between the spreader and the container
20 until an image of a surface of the container including an alignment feature is captured by an image capturing device, and aligning the alignment feature with a reference image to align the spreader with the container, and engaging the spreader with the container.

In accordance with a fourth aspect of the present invention, there is provided a spreader for lifting freight containers, the spreader comprising a frame, four pickup elements mounted on the frame, an image capturing device mounted on the frame to capture an image of a surface portion of a container to be engaged
5 by the spreader, the frame comprising four pickup element housings, one pickup element being located within each pickup element housing, and the image capturing device being located within one of the pickup element housings.

10 Preferably, the spreader comprises at least two image capturing devices, each image capturing device being located within a separate pickup element housing. Typically, where there are two image capturing devices, the image capturing devices are located in diagonally opposite pickup element housings.

15 If the spreader is a twinlift spreader which is adapted to lift two containers simultaneously, the spreader comprises four outer pickup element housings, with four respective outer pickup elements and four inner pickup element housings with four respective inner pickup elements, typically, four image capturing devices are provided. Preferably, each image capturing device is
20 located in a respective outer pickup element housing.

In one example of the invention, the method may further comprise displaying the captured image on a display device, the reference image is an alignment reference mark, and the alignment feature is aligned with the alignment
25 reference mark to align the spreader with the container.

In an alternative example of the invention, the captured image is compared with the reference image by a processor. Typically, the processor causes relative movement between the spreader and the container until the captured image is
5 within a predetermined deviation of the reference image to align the spreader with the container.

Preferably, the display device is adapted to display all the images captured by the image capturing devices simultaneously and a reference alignment mark is
10 displayed on the display device for each capturing device.

Preferably, the alignment feature on the container is a pickup aperture to be engaged by a pickup element. Typically, the pickup aperture forming the alignment feature is the pickup aperture corresponding to the pickup element
15 adjacent the image capturing device.

Preferably, the optical axis of the image capturing device is as close to the longitudinal axis of the adjacent pickup element as possible. Typically, the optical axis of the image capturing device is substantially parallel with the
20 longitudinal axis of the respective pickup element.

Typically, the image capturing device may have a fixed focal length and the focal length is preferably approximately the distance from the image capturing device to the alignment feature immediately prior to engagement of the
25 spreader with the respective container. This has the advantage that an

operator has an indication of the distance of the pickup elements from the pickup apertures by the sharpness of the image of the alignment feature on the display device.

- 5 Preferably, the image capturing device is mounted on the frame by a mounting device which comprises shock absorption means.

The communication link may comprise a wire communication link or a wireless communication link.

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An example of an alignment system for a spreader in accordance with the invention will now be described with reference to the accompanying drawings in which:

- 15 Figure 1 is a cross-sectional view through a twistlock element and twistlock element housing and a side view of a portion of a container prior to engagement of the twist lock element with the container; and Figure 2 shows a display device.

- 20 Figure 1 shows a container 1 having an upper corner piece 2 which includes a twistlock aperture (not shown) its upper surface. Above the container 1 is a twistlock element housing 3 which has a twist lock element 4 mounted within it. The twistlock element housing 3 forms part of the corner of a frame (not shown) of a spreader (not shown). In this particular example, the twistlock element

housing 3 comprises an inner housing 5 which is slidably movable within an outer housing 6.

Mounted on the outer housing 6 is a bracket 7 which extends through an aperture in the side wall of the inner housing 5 and located within the inner housing 5 on the bracket 7 is a CCD camera 8 which faces an aperture 9 in a lower wall of the inner housing 5. The CCD camera 8 is placed such that the optical axis 10 of the CCD camera 8 is as close as possible to the longitudinal axis 11 of the twist lock element to minimise parallax errors.

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The components within the CCD camera 8 are mounted within the housing of the camera 8 on shock absorption mountings. The shock absorption mountings help to minimise shocks on the camera components by, for example, the landing of the spreader on the container and from bumping of the spreader when the spreader is in use. Also, the mounting of the cameras 8 on the outer housing 6, helps to isolate the cameras 8 from the landing of the spreader on container by virtue of the slidable movement between the inner housing 5 and outer housing 6 which acts as a shock absorption mechanism. In addition, by locating the CCD camera 8 within the twist lock element housing 3, the CCD camera 8 is sheltered from the environment and therefore, less exposed to wind, sun and rain. The CCD camera 8 is coupled to a display device 15 located in an operator's cabin in the crane by a wire communication system. However, it is possible that the communication system between the CCD camera 8 and the display device 15 may comprise a wireless communication link.

Typically, for a spreader for lifting a single container, a CCD camera 8 may be located in two diagonally opposite twistlock element housings. However, it is possible that only one camera 8 may be used, that two or three cameras may
5 be used in adjacent twistlock element housings, or that four cameras may be used such that there is a camera 8 located in each twistlock housing.

In the case of a twinlift spreader that lifts two containers in end to end relationship, such as shown in International (PCT) Patent Application No.
10 WO 97/39973 or US Patent No 5,280,980, preferably, a camera 8 would be located in each of the four outer twistlock element housings. However, it is possible that the four cameras could be located in the four central twistlock element housings or in a combination of the central and outer twistlock element housings. It is also possible for a twinlift spreader that less than four cameras
15 or more than four cameras may be used.

A typical display device 15 used by an operator while operating the spreader and crane is shown in Figure 2. The display device 15 has a screen 16 which is split into four quadrants 17, 18, 20, 21. Each quadrant 17, 18, 20, 21 has an
20 alignment reference mark 19 marked in the centre of the quadrant.

Alternatively, to marking the reference alignment marks 19 on the screen, the alignment reference marks 19 may be marked on a lens of the cameras 8 so that it is displayed as part of the image captured by the cameras 8. In a further example, the alignment reference marks 19 may be generated by any other
25 suitable means.

The image captured by each camera 8 is displayed on a respective quadrant 17, 18, 20, 21 of the screen 16. This enables an operator to view the image from each camera 8 simultaneously on the display device 15. If, for example, there are four cameras mounted on the spreader, there is one image from each camera 8 shown in each quadrant. If there is less than four cameras, for example, two cameras 8, only two of the quadrants 17, 18, 20, 21 will show images from the cameras 8. If there are more than four cameras 8, the images may be alternated on the quadrants either automatically or under the control of an operator. Alternatively, the screen may be split into more than four sections, or more than one display device may be provided.

The camera 8 generates a video signal which is sent to a processor (not shown) via a communication link that may be a wire communication link or a wireless communication link. The processor receives the video signals from all the cameras 8 and combines the video signals so that the display device displays one video signal in each quadrant.

In use, an operator manipulating a spreader identifies a container to be lifted using the spreader and lowers the spreader towards that container. As the spreader is lowered, the images from the two cameras 8 can be viewed by the operator on the respective quadrants 17, 18, 20, 21 and the operator aligns the alignment reference marks 19 with the respective alignment aperture located at the top of the corner section 2 of the container 1. In addition, if the camera 8 has a fixed focal length, the operator will have an indication of the separation of

the spreader and the container by how focused the image is in the quadrants 17, 18, 20, 21. As the spreader is lowered closer to the container 1, the images of the alignment apertures in the quadrants 17, 18, 20, 21 will gradually come into focus.

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Therefore, an operator is able to align the spreader with the container 1 by aligning the alignment apertures with the alignment reference marks 19 on display device 15 and having the spreader until the twistlock elements engage with the twistlock apertures while maintaining the images of the twistlock apertures aligned with the alignment reference marks 19.

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In an alternative example to that described above, the processor may compare each image from the cameras 8 with a reference image of the alignment feature, for example a twistlock aperture, and the processor could control movement of the spreader automatically, without operator intervention, until the captured image from the cameras 8 is within a predetermined deviation of the reference image. The processor could then automatically align and engage the spreader with the container.

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Further advantages of the invention are that by locating the camera 8 within the twist lock element housing, the camera 8 is sheltered from the environment and from the effects of wind, sun and rain. In addition, parallax effects are reduced as the camera 8 is relatively close to the longitudinal axis 11 of the twistlock element 4 which permits easier alignment of the spreader by the operator.

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CLAIMS

1. A spreader alignment system comprising a camera device adapted to be mounted on a spreader for lifting freight containers, a display device and a communication link to transmit a photographic image captured by the camera device to the display device for display on the display device, the system also including an alignment reference mark for display on the display device.
2. A system according to claim 1, wherein the display device comprises a number of image display sections, one display section for displaying the image from each camera device, and a number of alignment reference marks, one alignment reference mark being for display in a respective image display section.
3. A system according to claim 2, wherein the images captured by the camera devices are displayed simultaneously on the display device on separate portions of the display device, one reference alignment mark being for display on one portion of the display device and the other reference alignment mark being for display on the other portion of the display device.
4. A spreader alignment system comprising a camera device adapted to be mounted on a spreader for lifting freight containers, a processor and a communication link to transmit a photographic image captured by the camera device to the processor, the processor comparing the captured image with a reference image and the processor being adapted to control relative movement

of the spreader and container to until the captured image is within a predetermined deviation of the reference image.

- 5 5. A system according to any of the preceding claims, wherein the system comprises a number of camera devices.
6. A system according to any of the preceding claims, wherein the camera device has a fixed focal length.
- 10 7. A system according to any of the preceding claims, wherein the focal length is less than 2m.
8. A method of engaging a spreader with a freight container to be engaged by the spreader, the method comprising causing relative movement between
15 the spreader and the container until a photographic image of a surface of the container including an alignment feature is captured by a camera device, and aligning the alignment feature with a reference image to align the spreader with the container, and engaging the spreader with the container.
- 20 9. A method according to claim 8, wherein the reference image is an alignment reference mark, and further comprising displaying the captured image and the reference alignment mark on a display device, and aligning the alignment feature with the alignment reference mark on the display to align the spreader with the container.

10. A method according to claim 8, further comprising comparing the captured image with the reference image, and causing relative movement between the spreader and the container until the captured image is within a predetermined deviation of the reference image.

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11. A method according to any of claims 8 to 10, wherein the alignment feature on the container is a pickup aperture to be engaged by a pickup element.

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12. A method according to claim 11, wherein the pickup aperture forming the alignment feature is the pickup aperture corresponding to the pickup element adjacent the camera device.

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13. A spreader for lifting freight containers, the spreader comprising a frame, four pickup elements mounted on the frame, an image capturing device mounted on the frame to capture an image of a surface portion of a container to be engaged by the spreader, and transmission means for transmitting an image captured by the image capturing device for display on a display device, the frame comprising four pickup element housings, each pickup element housing including one of the pickup elements, and the image capturing device being located within one of the pickup element housings.

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14. A spreader according to claim 13, comprising a number of image capturing devices, each image capturing device being located within a separate pickup element housing.

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15. A spreader according to claim 14, wherein there are two image capturing devices, and the image capturing devices are located in diagonally opposite pickup element housings.

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16. A spreader according to claim 14, wherein the spreader is a twinlift spreader comprising four outer pickup element housings, with four respective outer pickup elements and four inner pickup element housings with four respective inner pickup elements, and four image capturing devices, each
10 image capturing device being located in a separate pickup element housing.

17. A spreader according to claim 16, wherein each image capturing device is located in a respective outer pickup element housing.

15 18. A spreader according to any of claims 13 to 17, wherein the optical axis of the image capturing device is adjacent to the longitudinal axis of the pickup element in the respective pickup element housing.

19. A spreader according to any of claims 13 to 18, wherein the optical axis
20 of the image capturing device is substantially parallel to the longitudinal axis of the pickup element in the respective pickup element housing.

20. A spreader according to any of claims 13 to 19, wherein the image capturing device has a fixed focal length.

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21. A spreader according to claim 20, wherein the fixed focal length is less than 2m.
22. A spreader according to any of claims 13 to 21, wherein the image
5 capturing device is mounted on the frame by a mounting device which comprises shock absorption means.