

METHOD AND APPARATUS FOR RELATIVE MOVEMENT OF CONTAINERS

Field of Invention

The invention relates to the manipulation of intermodal units such as containers, flat racks and other devices used for containing freight for shipping. It further relates to the engagement of intermediate lifting units such as spreaders. In particular, the invention relates to devices and methods for engaging the intermodal units, either directly or through a spreader, including engaging multiple containers at one time and shifting their relative positions.

Background

It is well established that a key economic factor involved in the shipping of containers is the speed by which containers are loaded, unloaded and moved around a container yard. Recently inventions relating to the engagement and movement of more than one container have been suggested.

A characteristic of these multi-container devices is the problem of maintenance and the length of "downtime" of this capital intensive equipment. An example is described in WO03/104132, the contents of which are incorporated herein. If a problem arises with one of the head blocks, it is necessary to remove the entire device from the crane including disengaging the cables from the sheaves. As the separation mechanism between the head blocks uses a considerable number of actuators, this may be a significant cause of maintenance problems. If the repair or maintenance requires a workshop, the entire device must be removed from the crane by unthreading the cables.

The time taken to remove and then replace the device on the crane, so as to make the crane functional, is considerable leading to significant loss of lifting capacity.

Another drawback of these type of devices are the complexity that goes into their manufacture. Typically they are large complicated devices requiring significant engineering and control over the large number of actuators involved with their operation. For instance, there are seven or more actuators required to operate the device shown in WO03/104132 (see Figure 2). The control system or operator control needs to be complex in order to operate the device, not only for separation of the containers attached to the head blocks, but also to change their relative position, such as by “skewing” the containers, which requires operation of one set of actuators only.

It would, therefore, be advantageous to have a device which may improve the maintenance issues of said devices.

Statement of Invention

In a first aspect the invention provides a head block assembly comprising

a first head block having a first pair of cable engaging sheaves;

a second head block having a second pair of cable engaging sheaves; and

a separation device mounted intermediate the first and second head blocks,

for effecting relative transverse movement of said head blocks;

wherein the first pair of sheaves are selectively disengagable from the first head block,

and selectively engagable with the second head block

In a second aspect the invention provides a method for engaging a first and second head block, the method comprising the steps of:

- providing a first and second head block engaged in a side by side arrangement;

- biasing mutually coupled first and second sheaves from a first position on the second head block to a second position on the second head block;

- uncoupling the sheaves;

- engaging the second sheave to the second head block;

- biasing the first sheave to a third position on the first head block; and

- engaging the first sheave to the first head block at the third position.

In a third aspect, the invention provides a method of engaging a first and second head block, the method comprising the steps of:

- providing the first and second head blocks in a side by side arrangement;

- releasing a first sheave mounted to the second head block, said first sheave coupled to a second sheave;

- extending an actuator mounted between the second head block and the first sheave, and so sliding the first and second sheaves from the second head block toward the first head block;

- releasing the second sheave from the first sheave and engaging the second sheave to the second head block;

- extending the actuator, and so sliding the first sheave from the second head block to the first head block;

- engaging the first sheave with the first head block; and

disengaging the actuator from the first sheave and so engaging the first head block to the second head block.

In a fourth aspect the invention provides a method for disengaging a first and second head block, the method comprising the steps of:

providing a first and second head block engaged in a side by side arrangement;

releasing a first sheave mounted to the first head block;

retracting an actuator mounted between the second head block and the first sheave, and so sliding the first sheave from the first head block toward the second head block;

coupling the first sheave to a second sheave mounted to the second head block;

releasing the second sheave from the second head block;

retracting the actuator, and so sliding the coupled sheaves to a retracted position on the second head block, and so disengaging the first head block from the second head block.

Brief Description of Drawing

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

accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figure 1 is an isometric view of one embodiment of the present invention whilst in the single spreader arrangement;

Figure 2 is an isometric view of the support frame according to a further embodiment of the present invention;

Figures 3A and 3B are respectively a side elevation view and an isometric view of the embodiment of Figure 1 prior to commencement of conversion;

Figures 4A and 4B are respectively a side elevation view and an isometric view of the embodiment of Figure 1 at the first stage of conversion;

Figures 5A and 5B are respectively a side elevation view and isometric view of the embodiment of Figure 1 at the second stage of conversion and;

Figures 6A, 6B and 6C are respectively a side elevation view, an isometric view and a detailed view of the embodiment of Figure 1 in the double spreader arrangement.

Description of Preferred Embodiment

In general terms the invention relates to a head block assembly for engaging a single spreader in a first arrangement and two spreaders in a second arrangement. The first arrangement has two pairs of sheaves located on one head block and in the second arrangement, one pair of sheaves move to another head block through engaging a mechanism for sliding said sheaves from the one head block to the other head block.

In particular Figure 1 shows the single head block arrangement wherein the head block assembly 5 has a head block 15 to which is attached two pairs of sheaves 35, 40, in that both are mounted to a rail 45 which is in turn attached to the head block 15. The rail 45 permits sliding of the sheaves 35, 40 when said sheaves are detached from the head block.

In this arrangement the first pair of sheaves 40 is releasably fixed to the head block 15 through a pin 55 engaged with a recess 75. Engagement and disengagement of the pin 55 is achieved through an actuator 65 mounted between the sheave 40 and the pin 55. Thus by activating the actuator 65, the pin 55 is pushed downwards so as to engage with the recess 75 and thus fix the first sheave 40 so as to prevent sliding along the rail 45.

Also mounted to the head block 15 is a second pair of sheaves 35 having a similar pin 50 for engaging with a recess 70 which is moved through an actuator 60 to move the pin up and down so as to disengage or engage with the recess 70. Similarly with the pin 50 engaged with the recess 70, the second pair of sheaves 35 is fixed on the rail 45 and so prevented from sliding.

The sheaves 35, 40 are engaged with the head block 15 via the rail which in this embodiment is an "I" beam, whereby the sheaves are engaged with the rail 45 through a bracket which engages the upper flange of the "I" beam. By operating the cables 36A, 36B, load is transmitted through the sheaves 35, 40 to the head block 15 via engagement with the rail 45.

The separating device 10 is operable to move the first pair of sheaves 40 on to another head block (not shown). When suitably engaged with the other head block, the separating device 10 can then be used to effect relative movement between the head blocks by operation of the separating device 10.

The separating device 10 includes a linear actuator 20 which biases an arm 25 to push said arm 25 outwards. In the single head block arrangement, the separating device 10 is mounted directly to the first sheave 40 via a pin 30 which pushes horizontally into a recess 31 within the first sheave 40 for engagement and selectively disengages through withdrawing said pin 30. A further actuator is provided for the engagement and disengagement and so automating the process.

Further in this arrangement, the first and second sheaves 40, 35 are mounted together through the engagement pin 50 used to fix the second sheave 35 in place. The pin 50 is movable between two positions subject to the arrangement of the head block assembly 5. In the current single spreader arrangement, the pin 50 is located downwards so as to engage the head block recess 70, thus fixing the first sheave to both the head block 15. As will be described later, when the sheaves are moved together, the pin 50 will be

raised so as to disengage from the head block recess 70 and engage the first sheave recess 80 permitting sliding of both sheaves at the same time. On reaching a predetermined position, the pin 50 is moved back to the downward position such that it disengages from the first sheave recess 80 and engages with the second head block recess 75.

Figure 2 shows a support stand used to facilitate the conversion process from the single spreader arrangement to the dual spreader arrangement. The stand 90 comprises a base 95 having a plurality of upstands 100 with support portions 105 on top of each upstand 100. The upstands define two spaces 110, 115 which are sized to receive head blocks (not shown). By inserting the head blocks into the spaces 110, 115, the frame is arranged such that the head blocks bear directly on the support portion 105 rather than the underside of a spreader to which the head blocks may be mounted. Thus by maintaining a standard size head block for use with the invention, spreaders of different sizes can be used without interfering with the conversion process.

Use of the frame 90, therefore, provides an advantage in facilitating the conversion from the single spreader arrangement to the double spreader arrangement where spreaders of different size are being used. Whilst the use of the frame 90 is not essential to the conversion process, it does facilitate its conversion and further permits the conversion to take place in areas which would not normally be available.

Without the frame 90, a large flat space such as a road way is required in order to support the head blocks and spreaders. It follows that whilst the conversion is taking

place, the road way will be blocked and, therefore, may interfere with the flow of traffic within the container yard. By using the frame, the head blocks automatically align, to permit sliding of the sheaves. Further, the frame allows more convenient locations to be used for conversion such as on a beam of the quayside crane.

Figures 3A and 3B show the head block assembly just prior to the commencement of the conversion process. In this embodiment, a first head block 16 and a second head block 15 are positioned within respective spaces 115, 110 of the support frame 90. The head blocks 15, 16 are supported on an underside by support member 105 which extends passed the respective spreaders 17, 18 and so aligning the head blocks 15, 16 irrespective of the size of the spreaders 17, 18 to which they are attached. In this arrangement the frame 90 ensures alignment of the rail portions 45A, 45B which together form what is essentially a single rail upon which the first sheave 40 will slide. Thus, the frame 90 provides a further benefit in ensuring the alignment of the rail portions 45A, 45B so that the first sheave 40 can slide freely.

As can be more clearly seen in Figure 3A, the alignment of the head blocks 15, 16 show the respective recesses 70, 75, 81 within the head blocks. These recesses define positions along the rail 45A, 45B along which the sheaves 35, 40 will slide and so engage at the various positions. The first recess 70 defines the position of the second sheave in the single spreader arrangement. The second recess 75 shows the position of the first sheave in the single spreader arrangement which also coincides with the second sheave in the dual spreader arrangement. The third recess 81 defines the position of the first sheave 40 in the dual spreader arrangement.

The conversion process commences with the first and second sheave pins 55, 50 being raised by the respective actuators 65, 60 so as to disengage from the recesses 75, 70. At this point the separating device 10 activates, such that the linear actuator 20, to which is mounted the first sheave 40 via engagement pin 30, biases the first sheave 40 so as to slide it along the rail 45A, B. As the sheaves 35, 40 are in mutual engagement through pin 50, engaging first sheave recess 80, the second sheave 35 also commences to slide.

Figures 4A and 4B show the device as the sheaves 35, 40 reach the first position. Here the second sheave pin 50 now aligns with the second recess 75 and so placing the second sheave in the dual spreader position on the second head block 15. The actuator 60 pushes the pin 50 into its lowest most point and so engaging the second recess 75 preventing further sliding of the second sheave 35. At the same time, the second sheave pin is now out of engagement with the first sheave recess 80 and so separating the sheaves 35, 40 from further mutual sliding.

Figures 5A and 5B show the next stage in the conversion process whereby the first sheave 40 is now aligned with the third recess 81 in the first head block 16. Here the actuator 65 pushes the first sheave pin 55 downwards so as to engage with the third recess 81 and so preventing further sliding of the first sheave 40 along the rail 45B.

In this position the sheaves 35, 40 are positioned in the dual spreader arrangement and so if desired, the head blocks may now be lifted free from the frame 90 ready for use.

However, as the separating device 10 is fully extended, its functionality as a separating device is limited. Accordingly, the separating device must be repositioned to a usual orientation and so must retract. In order to effect this, the separating device pin 30 withdraws from the recess in the first sheave and thereby releasing, temporarily, the separating device 10 from the first head block 16. As shown in Figures 6A to 6C following retraction of the separating device pin 30, the separating device through retraction of the linear actuator 20 withdraws from the first head block and re-engages with a recess 32 adjacent to the second head block 15. In this position the linear actuator 20 is only partially extended and thus has the substantial stroke available to the actuator available to it for effecting the relative movement of the head blocks 15, 16.

In this orientation several modes of relative movement are available including lateral separation by extending both linear actuators at the same time and for the same distance. Skewing of the head blocks 15, 16 can be achieved by differential extension or retraction of the linear actuators 20A, 20B. An offset of the head blocks 15, 16 can be effected by use of the offset actuators 120A, 120B and so moving the head blocks 15, 16 relative to each other parallel to the longitudinal axes of said head blocks.

Claims:

1. A head block assembly comprising:
a first head block having a first pair of cable engaging sheaves;
a second head block having a second pair of cable engaging sheaves; and
a separation device mounted intermediate the first and second head blocks,
for effecting relative transverse movement of said head blocks;
wherein the first pair of sheaves are selectively disengagable from the first
head block, and selectively engagable with the second head block;
the assembly further including discrete first and second pairs of rail portions, the
first pair of rail portions mounted to the first head block and the second pair of rail
portions mounted to the second head block, said first and second sheaves in sliding
engagement with said rail portions.
2. The assembly according to claim 1, wherein the sheaves are slidable between
the head blocks along said rails when the head blocks are aligned in side by
side relation.
3. The assembly according to any one of the preceding claims, wherein the
second head block is capable of engaging both pairs of sheaves, whereupon
the first head block is disengaged from the assembly.

4. The assembly according to any one of the preceding claims, wherein each sheave includes a vertically displaced shear pin for selectively fixing said sheave against sliding along said rail.
5. The assembly according to claim 4, wherein the first head block includes a central recess and the second head block includes an offset recess and a central recess each arranged to receive the vertically displaced shear pins.
6. The assembly according to claim 5, wherein engagement of the first sheave with the central sheave of the first head block and engagement of the second sheave with the central recess of the second head block permits use of the assembly to simultaneously engage two spreaders.
7. The assembly according to claim 5 or 6, wherein engagement of the first sheave with the central sheave of the second head block and engagement of the second sheave with the offset recess of the second head block permits use of the assembly to engage a single spreader.
8. The assembly according to any one of the preceding claims, wherein the separation device includes at least two projection arms, each located adjacent one of each of the first pair of sheaves.
9. The assembly according to claim 8, wherein the linkage is fixedly mounted to the second head block and releasably mounted to the first head block.

10. The assembly according to claim 8 or 9, wherein the releasable mounting to the first head block includes a first mounting to slide the first sheave to the first head block, and a second mounting to effect separation of the head blocks.
11. A method for engaging a first and second head block, the method comprising the steps of:
 - providing a first and second head block engaged in a side by side arrangement;
 - biasing mutually coupled first and second sheaves from a first position on the second head block to a second position on the second head block;
 - uncoupling the sheaves;
 - engaging the second sheave to the second head block;
 - biasing the first sheave to a third position on the first head block; and
 - engaging the first sheave to the first head block at the third position.
12. The method according to claim 11, wherein the biasing steps include sliding said sheaves along rail portions mounted to said head blocks.
13. The method according to claim 11 or 12, wherein the biasing steps including extending an actuator releasably engaged with the first sheave at a position distal from the actuator.

14. The method according to claim 13, further comprising the step on disengaging the actuator from the first sheave, retracting the actuator and re-engaging the actuator to the first sheave at a point proximate to the actuator.
15. A method of engaging a first and second head block, the method comprising the steps of:
 - providing the first and second head blocks in a side by side arrangement;
 - releasing a first sheave mounted to the second head block, said first sheave coupled to a second sheave;
 - extending an actuator mounted between the second head block and the first sheave, and so sliding the first and second sheaves from the second head block toward the first head block;
 - releasing the second sheave from the first sheave and engaging the second sheave to the second head block;
 - extending the actuator, and so sliding the first sheave from the second head block to the first head block;
 - engaging the first sheave with the first head block; and
 - disengaging the actuator from the first sheave and so engaging the first head block to the second head block.

16. A method disengaging a first and second head block, the method comprising the steps of:

providing a first and second head block engaged in a side by side arrangement;

releasing a first sheave mounted to the first head block;

retracting an actuator mounted between the second head block and the first sheave, and so sliding the first sheave from the first head block toward the second head block;

coupling the first sheave to a second sheave mounted to the second head block;

releasing the second sheave from the second head block;

retracting the actuator, and so sliding the coupled sheaves to a retracted position on the second head block, and so disengaging the first head block from the second head block.