

AN IMPROVED CONTAINER ENGAGEMENT SYSTEM

Field of the Invention

- 5 The invention relates to the process of engagement of a shipping container by a spreader. In particular, the invention relates to the assemblies used to assist in guiding a spreader into engagement with a container.

Background

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In order to move a shipping container, a spreader which is attached to a crane, will engage the container at four peripheral points on the upper portion of the container. The engagement of the spreader and container is achieved by what is termed a twist lock engagement which is arranged to provide a quick engagement and disengagement
15 arrangement. The engagement of said twist locks between the spreader and container, however, require a degree of precision which may not be readily available subject to environmental conditions.

To assist the crane operator, flipper assemblies are used to contact the container and
20 guide the spreader so as to align the twist lock engagement between the spreader and container.

Where a container has sufficient clearance around it, typically a spreader will approach from above with all flippers down. Flaring of the bottom portion of the flipper

envelopes the corners of the container and permitting the spreader to slide down onto the container using the length of the flippers as a guide. Alternatively if the container does not have sufficient clearance, a spreader may approach from the side with two flippers up and two flippers down. In the “up” position the flippers are clear of the spreader and container and do not participate in the guiding action. The spreader is moved horizontally into proximity with the corners of the container, and then lowered as before using the two down flippers as guides.

When the flippers contact the container, a corresponding impact force is applied. To avoid damage to the flippers from such impact force, particularly if a circumstance leads to a particularly high impact force, the flippers are permitted to “back drive”, that is, when a preset torque about the flipper hinge is exceeded corresponding to an unusually high impact force. The back drive capability for a conventional hydraulic flipper is achieved by providing a pressure release within the hydraulic circuit such that on exceeding the pressure, a release operates permitting free rotation of the flipper.

For flippers driven by electric motors, this is more difficult. The corresponding analogy to a pressure release for an electric motor is permitting the gear box to reverse drive when a certain applied force is exceeded. One such measure involves the gear box to back drive by disengaging and operating the motor without a brake and so allow the flipper to move back freely. In this case, the flipper provides no resistance and thus can be back drive freely but is effectively useless as a guide. This lack of a holding torque at the flipper down position is different from that of a hydraulic flipper in that at least a braking pressure can be maintained with a pressure release.

It would, therefore, be preferable to not have the flipper move freely at the down position. Accordingly such systems maintain a brake used at the motor end to brake the motor when the flipper is in the down position as so provide a holding torque.

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However, this arrangement can cause substantial damage to the gear box unless safety measures are incorporated. Particularly if the subsequent torque applied to the back drive is high or for a prolonged period.

10 A further problem with flipper design according to the prior art is the propensity for the motor and gear box to be damaged during operation. With the motor and gear box mounted at the corner of the spreader so as to drive the flipper through the hinged mounting of the flipper to the spreader, this places the motor and gear box proximate to the location of high impact loads either through the flipper or from external contact with
15 other objects.

Further, in order to drive directly through the hinge mounting, it is necessary to locate the motor and gear box at the corner of the spreader so as to be mounted with the flipper. This further reduces the size of the motor and gear box and so limits the rating
20 of either leading to a customised design of the motor and gear box in order to compromise between the contrary design parameters of size and rating.

The prior art shows a motor drive the flipper using a worm gear so as to maintain control and be consistent with the direct drive through the hinged mounting of the

flipper. However, whilst applicable to this motor/gear box/flipper arrangement, a worm drive is not useful to provide a back drive capability.

Summary of Invention

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In a first aspect the invention provides a flipper assembly for guiding a spreader to engage a container, the flipper assembly comprising a flipper hingedly mounted to the spreader, said flipper moveable between an open and closed position about said hinged mounting; a motor mounted to the spreader distal from said flipper; a spacing assembly
10 located between the motor and the hinged mounting of the flipper; wherein said spacing assembly is capable of transmitting a torque from the motor to the hinged mounting so as to move the flipper between the closed and open positions.

In a second aspect the invention provides a flipper assembly for guiding a spreader for
15 engagement with a container, the flipper assembly comprising a flipper hingedly mounted to the spreader; a motor mounted to the spreader; a spacing assembly between the motor and the hinged mounting of said flipper wherein said spacing assembly includes a torque limiter set at a predetermined maximum torque so as to prevent an applied back drive torque being applied to said gear box by an impact on said flipper.

20 To address the issue of impact, the present invention provides for the motor to be placed away from the corner of the spreader but still provide drive to the hinge mounting of the flipper through a spacing assembly which transmit torque from the motor to the hinged mounting.

Accordingly with the motor and gear box away from the danger zone for high impact, the likelihood of damage to the motor or gear box through such an action may be markedly reduced.

- 5 Further advantages achieved by this arrangement include the lifting of restrictions on the size of the motor and gear box. Therefore, a higher rated motor and/or gear box may be provided as compared to that of the prior art as space may be much less of a consideration. This also obviates the need to customize the design and, therefore, reduce manufacturing costs by being able to rely on off-the-shelf equipment.
- 10 Further, as placement of the motor and gear box is less critical, these may be placed at more convenient locations that will allow further protection such as within the structure of the spreader itself. Further still in one arrangement a protective guard may be placed around the motor and gear box at the location on the spreaders further protecting the motor and gear box from damage.

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With reference to the back drive capability, safety devices may be incorporated within the assembly which provide for both a back drive capability and better protection against the initial high impact load leading to exceeding of the preset limit.

- 20 For instance, the gear box instead of relying on a worm drive may now be able to use a planetary gear arrangement or a helical or bevel gear arrangement. In these arrangements the ability to transmit a back drive torque from the flipper to the motor via the gear box may be at a significantly lower risk to damage of the gear box as compared to a worm drive gear box in direct drive engagement with a flipper.

Further still, a torque limiter may be provided in series with the gear box. Such a device may provide slippage when the torque is exceeded and so protecting both the high impact load applied and any subsequent high back drive torque.

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In one embodiment of the present invention, the motor and gear box provide torque to the hinged mounting of the flipper through one portion of the hinged mounting. Such an arrangement may require a drive strength from the motor and gear box to the hinged mounting to pass through an angle of 45 degrees. It will be noted that a flipper being
10 located at the corners of a spreader may, therefore, be directed at an angle of 45 degrees to the rectangular frame of the spreader. Accordingly, to drive a hinge of the flipper from a motor or gear box which may be located collinear with a framed member of the spreader will require the drive strength to pass through 45 degrees in order to apply the torque. The change in direction may be achieved through a number of alternatives
15 including a bevel gear or universal linkage capable of transmitting said torque.

Brief Description of Drawings

Figure 1 is an isometric view of a spreader incorporating a flipper assembly according
20 to the present invention;

Figure 2A is an isometric view of the flipper assembly according to one embodiment of the present invention with the flipper in the open position;

Figure 2B is an isometric view of the flipper assembly of figure 2A with the flipper in the closed position;

Figure 2C is an isometric view of a flipper assembly according to one embodiment of
5 the present invention showing the spacing assembly;

Figure 3 is a plan view of the flipper assembly of figure 2C;

Figure 4 is a plan view of the spacing assembly according to a further embodiment of
10 the present invention.

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.

Description of Preferred Embodiment

20 Figure 1 shows a spreader assembly 5 according to one embodiment of the present invention. Here a spreader frame 10 has flipper assemblies 15A to D at each corner of the frame 10. The flipper assemblies 15A to D are directed outwards at an inclined angle to the frame 10, such as 45 degrees. In this embodiment, the flippers 25A to D are closed ready for guiding the spreader into engagement with a container.

Engagement with the spreader is achieved through twist lock assemblies 20A to D which require a degree of precision in order to achieve engagement. To achieve this the spreader is brought into proximity with the top of the container and within the tolerance provided by flaring of a bottom portion of the flipper 25A to D. Once within the
5 enlarged area defined by the flared portion, the spreader may be lowered with the flippers acting as a guide to slide these spreaders into contact with the container for subsequent engagement by the twist locks.

It will be appreciated that on bringing the spreader into proximity with the container
10 may result in a high impact load being applied to the flared portion of a flipper. To provide the guiding function to the spreader onto the container, the flipper must resist impact loads with the container if it is to provide a guiding function. It will be appreciated that as the spreader approaches contact with the container, a considerable amount of “rattling” of the spreader as it “bounces” around the flippers as the container
15 is approached. Eventually the spreader will contact the container and through guidance by the flipper, be in an engagement orientation to a high degree of precision so as to engage the twist locks.

During this lowering, the “rattling” or “bouncing” can lead to impact loads which must
20 be resisted by the flipper. However, the initial contact between a flipper and the container as the spreader is first lowered may be considerably higher than that normally experienced during the sliding portion. If this very high impact load is too high without safety precautions, the flipper may be damaged and therefore not be able to provide a guiding function. The guiding function is directly related to the speed with which

containers can be engaged and, therefore, a damaged flipper can affect the efficiency of the process. Accordingly repairing a flipper is an important exercise even though it may put a spreader out of commission during the repair process. It would, therefore, be preferable for a flipper to be able to resist normal impact loads but under a high impact,
5 be able to release before damage is caused.

Figures 2A and 2B show a flipper assembly according to the present invention with Figure 2A having the flipper 25 in an open position and Figure 2B having the flipper 25 in a closed position. The flipper assembly 15 includes a hinged mounting 35A, B about
10 which the flipper 25 can rotate. Located within the frame 10 of the spreader is the motor and gear box 30 protected by a protective plate 33. It will be noted that it is positioned away from the flipper 25 through a spacing assembly (not shown).

As discussed high impact loads during the container engagement process may be
15 experienced. For a gear box and motor located proximate to the flipper, these high impact loads occur very close to the motor, leading to the potential for the motor to also be damaged. Further by providing a direct drive to the hinged mounting of a flipper, the motor may not readily be able to resist a “back drive” which as discussed is required for the safe operation of a flipper. As will be discussed, the present invention having
20 located the motor and gear box distal from the flipper 25, allows for a range of benefits including embodiments having safety equipment within the overall assembly.

Figure 2C shows the flipper assembly 15 comprising a motor and gear box 30, a spacing assembly 40, a flipper 25 which is mounted to a frame 10 of a spreader. Mounting

occurs through a hinged mounting 35A, B with the spacing assembly mounted to one such hinged mounting 35A. For clarity much of the frame 10 has been removed including the protective plate 33 which is used to protect the motor and gear box from external damage.

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Figure 3 shows a plan view of the assembly 15 with the motor 31 mounted to the gear box 32 which in turn is mounted to the spacing assembly 40. The spacing assembly 40 includes a drive string having a shaft 45 and a torque limiter 50 in line with the shaft 45. Connection of the spacing assembly 40 to the hinged mounting 35A, B is through one of said hinged mountings 35A through a linkage 50 being a universal joint capable of transmitting the torque applied by the motor 31 to the hinged mounting 35 sufficient to drive the flipper 25 from an open to closed position. Further, the linkage 55 within the spacing assembly 40 is capable of transmitting a back drive torque where the flipper must suffer a release on application of a particularly high impact load.

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In this case, the motor 31 is a servo-motor to assist with maintaining resistance against torque during the back-drive. Further, even when stationary, as a result of the feedback capability, the servo-motor will maintain the resistance against the torque, as compared to a conventional electric motor which cannot provide a continuous force against the applied forces from the flipper assembly. Accordingly, as the applied torque is maintained, or even periodically increased during use, the servo-motor automatically compensates for the applied torque.

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This embodiment provides substantial benefits over the prior art in that the linkage 55 is not subject to the same damage that a worm drive in direct connection to a hinged mounting may suffer on back drive torque being applied. Further, the provision of a torque limiter 50 provides for a slippage when such a high impact load is applied and so
5 preventing damage to the gear box when the torque reaches a particular level.

Such a torque limiter may be provided by a number of different arrangements. Such torque limiters are available as proprietary items and the appropriate device can be provided as will be appreciated by the skilled person. One such device is the ROBA™
10 type 132. This device is a positive locking flexible safety clutch with adjustable torque for connecting to shafts. The flexible coupling component is designed as a positive locking claw coupling. The input and the output can be disconnected without dismantling the clutch. The torque is transmitted via an interchangeable flexible intermediate ring. Other such devices may be suitable and may be used accordingly.

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As the gear box is less constrained for size, as compared to the prior art, a range of torque resistant gear arrangements can be used. Whereas a worm drive is required for a gear box of the prior art, in this case a planetary gear box or a gear box having helical or bevel gears may be incorporated. As size is less of a consideration, a higher rated gear
20 box may be used so as to overcome anticipated back drive torques.

In this arrangement it will be noted that drive of the hinged mounting 35A must be applied at 45 degrees to the direction of the drive strength. The application of the linkage 55 achieves this result. An alternative arrangement is shown in Figure 4

whereby a bevel gear 65, 70 may also be used to provide the drive from the drive strength to the hinge mounting. Further a lubrication nipple 36 is also applied as a means of maintaining lubrication to the joint as an automatic process.

Claims

1. A flipper assembly for guiding a spreader to engage a container, the flipper assembly comprising
 - 5 a flipper hingedly mounted to the spreader, said flipper moveable between an open and closed position about said hinged mounting;
 - a motor mounted to the spreader distal from said flipper;
 - a spacing assembly located between the motor and the hinged mounting of the flipper;
 - 10 wherein said spacing assembly is capable of transmitting a torque from the motor to the hinged mounting so as to move the flipper between the closed and open positions; and
 - the spacing assembly includes a torque limiter for limiting the transmission of torque to a predetermined maximum value..
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2. The flipper assembly according to claim 1 wherein the spacing assembly comprises a shaft and a torque transmitter for transmitting torque through a specified angle.
- 20 3. The flipper assembly according to claim 2 wherein the torque transmitter includes any one of: a bevel gear arrangement, a dog clutch and a linkage.
4. The flipper assembly according to claim 3 wherein said linkage includes a universal joint.

5. The flipper assembly according to claim 1 wherein said torque transmitter includes transmitting torque to one portion of the hinged mounting.
- 5 6. The flipper assembly according to claim 5 wherein said hinged mounting includes two hinges, said portion of said hinged mounting including one of said hinges.
7. The flipper assembly according to any one of the preceding claims wherein
10 said motor is a servo motor capable of providing a holding torque against a back drive torque.
8. The flipper assembly according to any one of claims 1 to 6, wherein said motor includes a brake capable of providing a braking torque against a back
15 drive torque.
9. The flipper assembly according to claim 8 wherein said brake is pre-set by an operator as a percentage of the rating of said motor.
- 20 10. The flipper assembly according to any one of the preceding claims wherein the motor is mounted to a mounting portion on said spreader, said mounting portion including a guard to protect the motor from an external impact.

11. A flipper assembly for guiding a spreader for engagement with a container,
the flipper assembly comprising
a flipper hingedly mounted to the spreader;
a motor mounted to the spreader;
5 a spacing assembly between the motor and the hinged mounting of said
flipper wherein said spacing assembly includes a torque limiter set at a
predetermined maximum torque so as to prevent an applied back drive
torque being applied to said gear box by an impact on said flipper.