IMPROVED BULK MATERIAL HANDLING SYSTEM AND METHOD

Field of the Invention

The invention relates to intermodal devices, such as shipping containers. In particular, the invention relates to the devices for the transport of bulk materials and delivery systems related to such devices.

Background

Whilst the transport of freight using shipping containers is a well understood and widespread integrated system, the transport of bulk materials lacks the same level of integration.

When considering “last mile” delivery, containers modified to hold the bulk material have tended to be modified shipping containers. More recently, newly constructed bulk material containers have emerged, which are modelled on such modified shipping containers. Bulk material containers have lacked the “ground up” design history, as compared with the conventional systems. This is most clearly highlighted by “last mile” delivery, where the material may be transferred from the ship-based containers to land based delivery.

More recently, revolver type container spreaders have been developed to engage and deliver bulk material containers, then rotate to empty said containers. Whilst more practical than previous versions, they are still adapted systems which lack features to optimise such processes.

Summary of Invention

In a first aspect, the invention provides a bulk material handling system comprising: bulk material spreader arranged to engage and rotate a bulk material container; a guide mounted to the spreader such that, on rotation of the container, bulk material within said container is arranged to flow through said guide; wherein the guide includes an inlet for receiving the bulk material and an outlet through which the bulk material is arranged to flow.

Thus, by providing a guide to the bulk material handling system, the material may more efficiently be poured, which may allow for smaller openings in the “last mile” delivery systems, to receive the bulk material.

In a second aspect, the invention provides a bulk material handling system comprising: bulk material spreader arranged to engage and rotate a bulk material container; a side support mounted to the spreader, said side support arranged to support said bulk material container; wherein said side support includes a contact plate arranged to selectively extend from a body of the side support and contact a wall of the bulk material container.

In a third aspect, the invention provides a method of unloading a bulk material container, the method comprising the steps of: engaging the bulk material container with a bulk material spreader; rotating the bulk material container so as to direct bulk material into an inlet of a guide; guiding the bulk material through the guide, and so; unloading the bulk material container.

In one embodiment, a further step may include biasing bulk material from an inlet of the guide to an outlet of the guide using a plate inclined to a plane defined by the outlet.

In a fourth aspect, the invention provides a method of unloading a bulk material container, the method comprising the steps of: engaging the bulk material container with a bulk material spreader; extending a contact plate from a body of a side support; contacting a wall of the bulk material container; simultaneously rotating and supporting the bulk material container, and so; unloading the bulk material container.

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 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 a bulk material spreader according to one embodiment of the present invention;

Figures 1C to 1E are various views of the bulk material spreader, with a bulk material container, according to the embodiment of Figures 1A and 1B;

Figures 2A and 2B are elevation views of bulk material spreaders according to two embodiments of the present invention;

Figures 2C is an elevation view of a guide for a bulk material spreader according to a further embodiment of the present invention;

Figures 3A to 3F are sequential elevation views of a method for unloading bulk material from a bulk material container according to a further embodiment of the present invention, and;

Figures 4A and 4B are plan views of a bulk material spreader according to a further embodiment of the present invention.

Detailed Description

The invention includes various features, which may be taken together or separately, which are directed to the better management of bulk material, particularly during the transfer of the bulk material to “last mile” delivery systems, such as a rail car.

A rail car, having a smaller opening as compared with the hold of ship, requires more precise pouring of the bulk material. Being particulate, the material acts as a fluid and so requires a guide to provide sufficient accuracy for said smaller opening.

Figures 1A to 1E show a bulk material spreader 5 according to one embodiment of the present invention. The guide 15 takes the form of a pouring shaped bracket mounted to the spreader.

As shown in Figures 2A and 2B, as the container is progressively rotated, the bulk material 35 will pour 55 from the container. Without the guide 50, the effect would be similar to a waterfall, where unrestrained material flows outward in an unpredictable manner. For a ship's hold, the opening is so wide that the uncontrolled material will spread, but not outside the limit of the hold. For a rail car, for instance, where the rail car "hold" may be another bulk material container 60, in order to efficiently and effectively control the material into the narrower opening 62, the guide 50 channels the flow of material and so providing a narrower spread of material.

Figure 2B shows an additional embodiment, where a screen 65 is mounted to, or proximate to, the guide 50, so that any extraneous material is blocked from spreading 70 beyond the opening 62 of the rail car hold. Thus, in one embodiment, the screen 65 may act as a shield blocking material thrown into the void 75 beyond the range of the rail car hold. In a further embodiment, the screen 65 may be mounted closer, and so eliminating the void 75, and so act to guide the material as it flows into the rail car. The benefits between selecting the type of screen will depend upon the application. The screen of Figure 2B may require a material capable of resisting high impact from flying rock, whereas the screen of the latter application, which may be in constant contact with the bulk material may be better suited to a highly abrasion resistant material. The selection of the screen surface hardness, will be a function of the application, the position of the screen and the type of bulk material.

Taking a skewed distribution as an example, without the guide, the portion of material spreading beyond the rail car hold may represent up to 25% of the total material. With the guide 50, that portion may drop within the range of 0% to 10%. With the screen 65, the lost material is essentially zero.

In some circumstances, conventional systems may limit this material loss through slowing the speed of rotation, or even limiting the volume of bulk material within the container. The monetary loss incurred through slower turnaround time, or transporting less material, can represent substantial reduction in revenue when it is considered the many hundreds of tons of material involved in a single run. Consequently, apart from the obvious operational benefits provided by the guide, the actual monetary benefit can be calculated as compared with the prior art system.

Figure 2C shows an example of a guide 51, through which the bulk material 58 flows. The bulk material is received in an inlet 59, which subsequently flows out through an outlet 54. At an upper limit, a plate 52 provides an upper boundary to guide the material through the outlet 54. In one embodiment, the area of the inlet may be greater than the area of the outlet, to reduce the area of the exiting material as it flows through the outlet. Alternatively, the inlet may be of an equivalent area to the outlet. A recess 64 within the guide receives material, which is biased by an inclined plate 66 toward the outlet 54, said inclined plate inclined to a plane 53 defined by the outlet. Thus, the upper 52 and lower 66 limits of the guide restrict the flow of material exiting the outlet 54, and so provide an accurate, controlled flow 56 that can be directed into the type of narrow opening provide by “last mile” delivery systems.

Figures 3A to 3F show the sequential process of rotating a container 84, having bulk material 80 therein. As the bulk material spreader rotates the container 84, the fluid behaviour of the bulk material 80 shifts the material toward a guide 95. In the manner described above, the material is guided to provide a controlled flow of material 100, so as to allow the material to flow into the opening 90 of the new container 85. The material, in this fluid state settles 105 until the contents of the bulk container 84 has been emptied. The bulk material spreader then rotates back (not shown) and moves to engage a new container.

Returning to Figures 1A to 1E, the bulk material spreader 5 includes side supports 10, which are arranged to grip the sides of the bulk material container 40 whilst within the void 35. The side supports may be positioned well outside the void 35 by brackets 20, all of which is arranged to be rotated by motor 25.

The bulk material spreader 5 may include one side support one side only – where the rotation is limited to 180° the returned, or two side supports (Figure 1C showing side supports 10A and 10B). In this configuration, the rotation be to either side for 180° or for a full rotation of 360°.

In some prior art systems, the side support may be fixed, and so a container must fit between said side supports with little tolerance. This inevitably leads to some level of gap between the side support and the container, placing rotation stress upon the engagements (such as twist locks) coupling the container to the spreader.

In other systems, the side supports may rotate into position. However, such rotation requires a long lever arm for the swinging arm, leading to a lack of applied force to support the container and/or a much heavier mechanism to accommodate the strength and applied force issues.

As shown in Figures 4A and 4B, one embodiment of the bulk material spreader, 110 side supports 115 may be placed on both sides of the spreader 110, though in other embodiments, the side supports may be on one side only.

In the embodiment of Figures 4A and 4B, the side supports are selectively actuated by rams 125, which project a contact plate 120 outward from the body 117 of the side support 115. The contact plate 120 positively contacts the wall 135 of the container and so applies the required force to stabilise the container during rotation. The rams may be actuated hydraulically, pneumatically or mechanically geared.

By having the contact plate projecting towards the container, as the container is first engaged, there is ample clearance to fit within the void of the spreader, alleviating the need to compromise tolerance and space. The contact plates may be triggered by proximity switches when the container is in place. Alternatively, they may be activated automatically once each of the twist locks have engaged correctly. In a further embodiment, the contact plates may be engaged manually. Still further, sensors may be set at predetermined value to detect the contact with the container. In this way different widths of containers may be handled.

In a further embodiment, the force applied by the contact plate may semi-autonomously or autonomously vary the applied force. During rotation, the system may detect – either by measure rotation or directly by load cells or pressure sensors within the hydraulic system – that the container requires a greater applied force. The system will then increase the applied force through the contact plates, as required.

Claims

1. A bulk material handling system comprising:

   bulk material spreader arranged to engage and rotate a bulk material container;

   a guide mounted to the spreader such that, on rotation of the container, bulk material within said container is arranged to flow through said guide;

   wherein the guide includes an inlet for receiving the bulk material and an outlet through which the bulk material is arranged to flow.

2. The bulk material handling system according to claim 1, wherein the area of the inlet is greater than the area of the outlet.

3. The bulk material handling system according to claim 1 or 2, wherein the guide includes a plate inclined to a plane defined by the outlet.

4. The bulk material handling system according to claim 3, wherein the inclined plate is arranged to bias bulk material from the inlet toward the outlet.

5. A bulk material handling system comprising:

   bulk material spreader arranged to engage and rotate a bulk material container;

   a side support mounted to the spreader, said side support arranged to support said bulk material container;

   wherein said side support includes a contact plate arranged to selectively extend from a body of the side support and contact a wall of the bulk material container.

6. The bulk material handling system according to claim 5, wherein there are two side supports mounted on either side of the spreader.

7. The bulk material handling system according to claim 5 or 6, wherein the side support is arranged to vary a load applied by the contact plate to the container.

8. The bulk material handling system according to claim 7, wherein the side support is arranged to increase the applied load as the bulk material container is rotated.

9. A method of unloading a bulk material container, the method comprising the steps of:

engaging the bulk material container with a bulk material spreader;

rotating the bulk material container so as to direct bulk material into an inlet of a guide;

guiding the bulk material through the guide, and so;

unloading the bulk material container.

10. The method according to claim 9, further including the step of biasing bulk material from an inlet of the guide to an outlet of the guide using a plate inclined to a plane defined by the outlet.

11. A method of unloading a bulk material container, the method comprising the steps of:

engaging the bulk material container with a bulk material spreader;

extending a contact plate from a body of a side support;

contacting a wall of the bulk material container;

simultaneously rotating and supporting the bulk material container, and so;

unloading the bulk material container.