

**CONTAINER HANDLING VEHICLE, MEANS, SYSTEM AND METHODS**

FIELD OF THE INVENTION

This invention is directed to container handling vehicles and systems, and methods of container handling.

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BACKGROUND OF THE INVENTION

Vehicles having container handling mechanisms are known. One example is garbage or refuse collection vehicles, commonly having a hold area into which garbage is loaded, and a docking area where garbage containers are brought to be emptied into the hold area by a container handling mechanism.

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Previously considered garbage collection vehicles typically use an arm or pair of arms to raise a garbage container from the ground, and tip the container so that the contents are deposited in the garbage hold area. Because such systems require that the container is lifted directly from the ground, so that the container is suspended off the ground away from the vehicle, they require powerful actuators for the arms. These systems can also be slow and inefficient, due to the lifting action. If heavy containers are lifted, a significant counter balance is required for the container, such as a heavier vehicle.

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These garbage collection vehicles are usually not able to also load the container onto the vehicle. In other previously considered systems, a container is loaded onto a vehicle, by lifting the container. However, these systems also typically require direct lifting of the container before loading. Some require highly complex loading arms with cooperating components operating in different directions. Others require separate means for lifting and loading the container.

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The applicant does not concede that the prior art discussed above forms part of the common general knowledge in the art at the priority date.

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## STATEMENT OF INVENTION

- 5 Aspects and embodiments of the invention are set out in the accompanying claims.

In general terms, one embodiment of a first aspect of the invention can provide a container handling vehicle, comprising: a container bed; and a container handling  
10 means, the container handling means configured to: contact a container; lever the container around a pivot point on the vehicle to raise from a floor a first floor contact point of the container; and subsequently propel the raised container along the container bed.

- 15 This allows the container to be lifted, before any part of a floor-standing container has left the floor, by a lever action rather than a direct lift action. This makes the handling or lifting action less demanding on the mechanism employed, and therefore the lifting action can be more efficient.

- 20 The first floor contact point of the container may be the first point of contact of the container to leave the floor when raised. For example, a container may comprise a base having a plurality of contact points on the floor. On levering the container about the pivot point, the container is tilted and a first of the plurality of contact points is raised from the floor. Other contact points may still be in contact with  
25 the floor. The levering action may continue to raise second and other points of contact of the container from the floor. For example, a container with wheels may have a floor contact point at the base of each wheel.

- Preferably, the container handling means is configured to, following levering of  
30 the container around the pivot point, slide the raised container along a surface of

the container bed. The container may be propelled in a translational movement, such as a slide, or by rolling of a roller component of the bed or container.

Suitably, the container handling means is moveable with a single degree of freedom. Preferably, the container handling means is configured to lever and propel the container such that the container has two degrees of freedom.

This means that a single handling means component, having a single degree of freedom, can be used to produce both rotational/pivoting and translational movement of the container, reducing the need for complex cooperating components in a lifting/handling mechanism.

In an embodiment, the container handling means comprises a pivotable member, and a distal portion for contacting the container. Preferably, the pivotable member comprises a pair of arms hinged on the vehicle, the arms having distal ends for contacting the container. The hinge on the vehicle may comprise a rotational element, allowing rotation of the hinge and pivoting of the arms on the hinge.

Suitably, the pivot point is disposed at an end of the container bed. In an embodiment, the pivot point is configured to engage a pivot member coupled to and projecting outwardly from the container, to facilitate levering of the container around the pivot point.

In an embodiment, the container handling means is configured to engage a coupling member of the container in order to lever and subsequently propel the container. Preferably, the coupling member of the container comprises a curved surface, wherein the handling means is configured to engage the curved surface with a camming action in order to lever and subsequently propel the container.

The coupling member may be a bar or projection, or pair or set of projections from the container. The bar or projection may be cylindrical, such as a trunnion.

5 Suitably, each of the pair of pivotable arms is configured to engage the curved surface and, during pivoting of the arm, glide along and around the curved surface. Preferably, the pivotable arm is configured to exert a levering force on the coupling member around the pivot point, while allowing gliding of the curved surface on the arm. More preferably, the pivotable arm is configured to  
10 subsequently exert a linear translational force on the coupling member, while allowing gliding of the curved surface on the arm, to propel the container along the container bed.

In an embodiment, the container handling means is configured to be brought to engage the coupling member from below the coupling member, and to at least  
15 partially support the weight of the container during container handling.

Suitably, the container bed is inclined away from an end of the vehicle at which the container handling means is configured to lever the container. In an embodiment, the container bed extends beyond a hinge point of the pivotable  
20 member.

In another embodiment, the container bed is positioned such that the pivot point is contactable by the container below an upper portion of the container.

25 A position of the container bed low to the ground allows for the movement of the centre of gravity of the container to be used to aid in tilting and/or lifting the container around the pivot point.

Suitably, the pivot point comprises a rotary element, such as a wheel or roller. In  
30 an embodiment, the container handling means comprises a distal end hook member.

In an embodiment, the container bed comprises an inlet to accommodate the pivot member projecting from the container, and propelling of the pivot member along the container bed with the container.

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One embodiment of a second aspect of the invention can provide a container handling means for a vehicle according to any embodiment described above.

One embodiment of a third aspect of the invention can provide a container  
10 handling system comprising a vehicle according to any of the above described embodiments, and a container leverable around the pivot point by the container handling means.

One embodiment of a fourth aspect of the invention can provide a container for a  
15 container handling system according to the above embodiment.

One embodiment of a fifth aspect of the invention can provide a method of handling a container with a container handling vehicle, the vehicle comprising a container bed, the method comprising: contacting the container; levering the  
20 container around a pivot point on the vehicle to raise from a floor a first floor contact point of the container; and subsequently propelling the raised container along the container bed.

Preferably, the method further comprises: propelling the raised container back  
25 along the container bed; and pivoting the container around the pivot point to lower the container to a floor contact point. More preferably, the step of pivoting the container comprises, during propelling of the container back along the container bed, engaging at the pivot point a pivot member coupled to and projecting outwardly from the container.

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The above aspects and embodiments may be combined to provide further aspects and embodiments of the invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

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The invention will now be described by way of example with reference to the accompanying drawings, in which:

10 Figures 1 to 4 are diagrams illustrating a container handling vehicle and a container according to an embodiment of the invention, in a series of in-use positions according to embodiments of the invention..

## DETAILED DESCRIPTION OF EMBODIMENTS

15 Embodiments of the invention provide mechanisms that can lift, tilt and slide a container onto a vehicle. These actions can be undertaken sequentially, and achieved using a single component or system acting in a single degree of freedom. Embodiments of the invention can begin a lifting action for a container, before any part of the floor-standing container has left the floor, by a lever action  
20 rather than a direct lift action, making the handling or lifting action less demanding and more efficient.

In embodiments, a vehicle, such as a garbage collection vehicle, has a bed of the vehicle on which a container can be placed. This bed can be attached to the  
25 base of the vehicle, or suspended above it. The vehicle also has a container handling mechanism or device. In use, this mechanism is brought into contact with a floor-standing container, engages the container and levers the container around a pivot point on the vehicle, for example at an end of the container bed nearest the container, raising the container off the ground. The mechanism then  
30 moves the raised and tilted container along the container bed.

The contents of the container can then be removed, to be placed in the vehicle's garbage hold area. This removal can be achieved by any of various previously considered techniques, for example by a screw removal device inserted into an aperture in the top of the container, which moves the refuse from inside the  
5 container along the screw and drops it into the hold.

Once emptied, the container is moved back along the container bed by the mechanism, or allowed to slide under the force of gravity along the bed. The container is then pivoted around the pivot point to return it to the ground.

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Embodiments of the invention may be of particular use in a system in which a vehicle is able to collect garbage from bin chutes located at the basement level of each of a number of residential blocks, and after collection from several bin chutes (for example, collecting one or more black bin bags from each bin chute),  
15 for example when the container on the vehicle is full, the vehicle can proceed to a garbage disposal hub/centre and unload the container from the vehicle. The container can then be emptied into a larger garbage bin or container, by any previously considered means, for example by lifting the container using a pair of lifting arms and tipping the contents of the container into the larger bin. The  
20 container may be separable from the rest of the vehicle to facilitate this.

In such an embodiment, the hold area of the vehicle may be the container itself, so that its contents are not removed on the vehicle, but at a central garbage centre. In this manner, the container can be levered off the vehicle for a  
25 collection, then levered back onto the vehicle for transit to another collection location, where the process may be repeated.

One embodiment of the invention is illustrated in Figures 1 to 4. Figure 1 is a side view of a vehicle (102) having a container handling mechanism, in this case  
30 a pair of actuating arms 112 attached to the vehicle base. A container 103 is shown on the ground behind the vehicle.

The actuating arms 112 are disposed either side of the vehicle base – as this is a side view, only one of the pair of arms is shown. The pair of arms can be driven via a common axle running through the base of the vehicle and attached to both arms, or independently. The arms are mounted on the vehicle base by a rotary hinge (which may incorporate such a common axle), so that they can pivot/rotate relative to the vehicle – the arms pivot on the hinge, thereby rotating around the hinge. In a starting position each arm is inclined upwards, for example, slightly upwards towards the container 103, ready to engage the container. In this embodiment, each arm has a generally longitudinal shape, with a curved portion at the distal end for aiding in capturing and maintaining in contact the trunnion of the container (see below).

Each arm is pivotable from the starting position to a vertical position, and may move from start to vertical through an angle of around 70 degrees. In embodiments, the arms may be moveable beyond vertical, should the container require further translation along the container bed (see below). The arms are arranged so that in use they are brought from the starting position up to meet the container trunnions, rather than being moved horizontally towards the container, or being fixed and positioned by moving the vehicle, or descending towards the container from a higher position. This allows for a more efficient levering action, and also allows the arms, as they are largely positioned below the trunnion throughout the lifting, tilting and sliding action, to directly take some of the weight of the container.

The container is a typical refuse or garbage container with some modifications for cooperating with the container handling mechanism. The container has a set of wheels 114, which contact the ground to facilitate movement. To initiate the lift, the container is moved on the wheels to meet the handling mechanism. A trunnion (110) is provided either side of the container, for engagement with the pivoting (rotating) arms 112. The container also has a pivot member (108)

attached to the face of the container nearest the vehicle – here this is a metal plate having a section protruding outwardly towards the vehicle, generally perpendicularly to the container surface. This pivot member is positioned so that when the container is brought to the vehicle, the pivot member ends up just  
5 above the pivot roller (106) on the end of the container bed.

The vehicle has a container bed (104), which is mounted on top of the base of the vehicle in this case, rather than just allowing the base of the vehicle to be used. The container bed is also inclined away from the cab of the vehicle, so that  
10 it slopes down towards the container. Other arrangements for the container bed are also envisaged, including the container bed being horizontal or substantially horizontal, and also being inclined towards the cab of the vehicle. The container pivots about the distal end of the container bed. At the distal end (106) is a rotary element, such a roller, which provides for an easier levering action. The roller  
15 may be accepted by or engage a runner or similar feature incorporated onto the body of the container 103.

In action, as shown in Figure 2, each pivoting arm (112) is brought up from the starting position and contacts the underside of the trunnion 110. The arms could  
20 be made without the upward curving hook formation as shown in Figure 2, and these arms would still impart the necessary pivoting, levering and sliding movements on the container. However, the hook formations serve to stabilise the movements by preventing some lateral movement of the trunnion past the end of the arm, and increasing contact area on the arm with the trunnion.

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As the pivoting arm 112 rotates (pivots from its lowered position to towards its raised position), the trunnion and the upper surface of the arm move with respect to each other, so that the trunnion glides along the arm with a cam action, either translating along the arm or rotating against it (or both). The trunnion is raised  
30 higher and moved towards the vehicle, describing a similar arc to that of the pivoting arm, and the container (to which the trunnion is fixed) follows. The

container is brought into contact with the vehicle (if not already in contact) by this initial movement. The point of contact may be on the face of the container nearest the vehicle, just underneath the pivot member (108) projecting from the container towards the vehicle. The roller (106) on the end of the container bed  
5 104 contacts the container face, and this point provides the pivot around which the container is now to be levered.

As the arm pivots/rotates further, a levering force is now exerted by the arm on the trunnion around the now established pivot on the roller of the container bed  
10 end. This levering action tilts the container, so that one of the pairs of wheels 114 (the first ground contact point) loses contact with the ground, thereby beginning the lift of the container. The pivot member aids in providing a more stable pivot for the container, and also allows the lifting of the remaining points of floor contact for the container.

15 As the arm rotates still further, the levering action pivots/rotates the container further around the pivot, and the trunnion is raised further along the arc of the pivoting arm. The remaining wheel(s) 114 or points of contact of the container on the floor are thus raised from the floor.

20 In an alternative embodiment, one or both arms 112 may include a finger element (not shown), disposed along the length of the arm, and angled away from the arm. This finger element can catch the trunnion (110) of the container (103), between the finger and the arm, as the trunnion moves along the arm during the  
25 lifting, tilting and moving stages. This may prevent the trunnion from moving too far down the arm, aiding the levering action. The finger may also support the container (by the trunnion), or even raise the container slightly from the container bed, in order to aid the movement of the container along the container bed (as in Figures 3 and 4).

Figure 3 shows a more advanced stage. The wheels 114 have been raised from the floor, and the container has been rotated so that its front face is now parallel with the surface of the inclined container bed 104. The pivot member 108 has also rotated with the front surface, and now protrudes through an opening in the centre of the container bed which accommodates the pivot member. The container rests on a surface of the container bed, in this case a series of runners on the container bed running between the ends of the container bed. These runners do not obscure the opening for the pivot member.

Here the pivoting arm 112 has reached nearly vertical, though because of the pivoting of the container around the roller 106, the trunnion on the container has actually moved down the arm as it traverses the pivoting arc. This allows room on the arm for the upcoming translational movement of the container (see below).

As the arms rotate further, because the container is now resting on the container bed, which prevents any further rotation around the pivot, the remaining allowable movement under the force exerted by the pivoting arm is translational movement along the container bed. The container thus moves along the bed, the pivot member through the aperture accommodating it, and the arm pivots towards the finishing position.

Figure 4 shows the final position – the arm is now vertical, and the trunnion has moved back up the arm due to the translation of the container up the slope of the container bed. From this position the contents of the container can now be removed, for example by the screw (not shown) described above.

The combination of the tilting and lifting (by the levering action) and the sliding movement mean that the container can be at least partially and potentially wholly loaded onto the container bed, without any part of the container ever being suspended above the ground without the container first being in contact with either the pivot point or the container bed. In contrast, a previously considered

direct lifting mechanism may lift the container above the ground with no contact between the container and the container bed (or any pivot point or edge of the container bed), for example by a hoist attached to the top of the container. The combination of tilting and lifting (and sliding) actions in embodiments of the invention requires less power than a direct lifting mechanism, due to the lever (rather than lift only) action. The pivot point on the container bed effectively takes some of the weight of the container, so that it is not all borne by whatever mechanism is being used to lift the container.

It is also more secure, as the container is in contact with the vehicle at all times. The lever action is also provided wholly on the pivot point of the vehicle, rather than in some previously considered systems in which a container is tilted before being lifted into contact with the vehicle. This again provides a more efficient tilting/lifting action.

The positioning of the hinging of the pivoting arms (112) low down on the vehicle towards the ground, allows for a longer arm between the hinge and the trunnion of the container, thereby making the lever action more efficient and requiring less torque to lift and load the container. This position also allows the pivot point at the end of the container bed to be lower down.

The low position of the pivot point means that the container's centre of gravity can traverse the pivot point sooner and therefore the force of gravity on the container can aid the pivoting/levering action. In another embodiment, the pivot point can be made even lower, so that for example by the point shown in Figure 3, the centre of gravity of the container will have already passed the pivot point, and be contributing to the rotation of the container, reducing the torque needed on the pivoting arms.

The extension of the container bed, and therefore the end of the container bed with the pivot roller 106, past the end of the vehicle and therefore past the hinge

point of the arms, means that the container can in the final part of the arms' rotation be moved along the container bed, rather than simply rotated to a position similar to that of the container in Figure 3, with no movement up the slope. If the end of the container bed were above the hinge point, once the arm  
5 were vertical there would be no further sliding of the container up the bed (without moving the pivoting arm past vertical, which can be done in other embodiments).

The use of pivoting arms having a single degree of freedom (rotation) also makes  
10 for a more simple mechanism, with less likelihood of failure. This arrangement also means that the component providing the drive (the arms) is well out of the way of the container bed surface, so it does not interfere with the container and/or bed, and does not have to be removed, packed away, or folded away in order to avoid such interference.

15 In spite of the single degree of freedom of the pivoting arm, the movement of the container nevertheless has two degrees of freedom – rotation and translation along the container bed. This is due to the camming action of the trunnion on the arm, which allows first the levering of the trunnion around the pivot, and second  
20 the transfer of the arms' rotary/pivoting movement into the linear movement of the container along the bed.

The use of an inclined container bed allows a smoother dismount of the container once unloaded. The container can be allowed to slide back down the container  
25 bed 104 under the force of gravity, and once the container re-attains the position shown in Figure 3, where the pivot member contacts the pivot roller 106, the container is pivoted around the roller on the pivot member, and deposited back on the ground. The dismount pivot is managed by the pivoting arms taking the weight of the container on the way down.

It will be appreciated by those skilled in the art that the invention has been described by way of example only, and that a variety of alternative approaches may be adopted without departing from the scope of the invention, as defined by the appended claims.

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It will be understood that the invention disclosed and defined in this specification extends to all alternative combinations of two or more of the individual features mentioned or evident from the text or drawings; all of these different combinations constitute various alternative aspects of the invention.

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**CLAIMS**

1. A container handling vehicle, comprising:  
a container bed; and  
5 a container handling means, the container handling means  
configured to:  
contact a container;  
lever the container around a pivot point on the vehicle to raise from  
a floor a first floor contact point of the container; and  
10 subsequently propel the raised container along the container bed.
2. A vehicle according to Claim 1, wherein the container handling  
means is configured to, following levering of the container around the pivot  
point, slide the raised container along a surface of the container bed.  
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3. A vehicle according to Claim 1 or Claim 2, wherein the container  
handling means is moveable with a single degree of freedom.
4. A vehicle according to Claim 3, wherein the container handling  
20 means is configured to lever and propel the container such that the  
container has two degrees of freedom.
5. A vehicle according to any preceding claim, wherein the container  
handling means comprises a pivotable member, and a distal portion for  
25 contacting the container.
6. A vehicle according to Claim 5, wherein the pivotable member  
comprises a pair of arms hinged on the vehicle, the arms having distal  
ends for contacting the container.  
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7. A vehicle according to any preceding claim, wherein the pivot point is disposed at an end of the container bed.

5 8. A vehicle according to any preceding claim, wherein the pivot point is configured to engage a pivot member coupled to and projecting outwardly from the container, to facilitate levering of the container around the pivot point.

10 9. A vehicle according to any preceding claim, wherein the container handling means is configured to engage a coupling member of the container in order to lever and subsequently propel the container.

15 10. A vehicle according to Claim 9, the coupling member of the container comprising a curved surface, wherein the handling means is configured to engage the curved surface with a camming action in order to lever and subsequently propel the container.

20 11. A vehicle according to Claim 10 as dependent on Claim 6, wherein each of the pair of pivotable arms is configured to engage the curved surface and, during pivoting of the arm, glide along and around the curved surface.

25 12. A vehicle according to Claim 11, wherein the pivotable arm is configured to exert a levering force on the coupling member around the pivot point, while allowing gliding of the curved surface on the arm.

30 13. A vehicle according to Claim 12, wherein the pivotable arm is configured to subsequently exert a linear translational force on the coupling member, while allowing gliding of the curved surface on the arm, to propel the container along the container bed.

14. A vehicle according to any of the Claims 9 to 13, wherein the container handling means is configured to be brought to engage the coupling member from below the coupling member, and to at least partially support the weight of the container during container handling.

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15. A vehicle according to any preceding claim, wherein the container bed is inclined away from an end of the vehicle at which the container handling means is configured to lever the container.

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16. A vehicle according to any of the Claim 5 to 15, wherein the container bed extends beyond a hinge point of the pivotable member.

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17. A vehicle according to any of the Claims 7 to 16, wherein the container bed is positioned such that the pivot point is contactable by the container below an upper portion of the container.

18. A vehicle according to any preceding claim, wherein the pivot point comprises a rotary element.

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19. A vehicle according to any preceding claim, wherein the container handling means comprises a distal end hook member.

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20. A vehicle according to any of the Claims 8 to 19, wherein the container bed comprises an inlet to accommodate the pivot member projecting from the container, and propelling of the pivot member along the container bed with the container.

21. A container handling means for a vehicle according to any preceding claim.

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22. A container handling system comprising a vehicle according to any of the Claims 1 to 20, and a container leverable around the pivot point by the container handling means.

5 23. A container for a container handling system according to Claim 22.

24. A method of handling a container with a container handling vehicle, the vehicle comprising a container bed, the method comprising:

contacting the container;

10       levering the container around a pivot point on the vehicle to raise from a floor a first floor contact point of the container; and  
subsequently propelling the raised container along the container bed.

15 25. A method according to Claim 24, further comprising:  
propelling the raised container back along the container bed; and  
pivoting the container around the pivot point to lower the container to a floor contact point.

20 26. A method according to Claim 25, wherein the step of pivoting the container comprises, during propelling of the container back along the container bed, engaging at the pivot point a pivot member coupled to and projecting outwardly from the container.

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