

A METHOD FOR ALIGNING, LIFTING, AND TILTING
A CONTAINER RELATIVE TO A VERTICAL APERTURE

The invention concerns a method for aligning, lifting and tilting
5 a container relative to a vertical aperture, particularly rotating the
container and aligning a mouth of the container with the vertical
aperture.

In the specification and the appended claims the expression
"vertical aperture" means an aperture the mouth of which rather than
10 the axis of which extends in a vertical or substantially vertical plane
as by being provided in a vertical or substantially vertical wall.

The invention may be used in a process of applying a coating to
moulded or compressed articles such as caplets, tablets, pills, candy
and chewing gum. It is also anticipated that other industries, such as
15 those in the reclaiming, cleaning, or deburring of articles, may also
utilize the method disclosed in the invention.

The lifting and rotating of containers is the subject of several
prior patent specifications such as US-A-1,492,675, US-A-1,912,816, US-
A-2,131,771, US-A-2,411,228, US-A-2,647,651, US-A-2,657,815, US-A-
20 2,693,891, US-A-2,797,835, US-A-2,888,157, US-A-3,298,552, US-A-
3,868,003, US-A-3,942,663 and US-A-4,797,050.

US-A-2,131,771 discloses a device for discharging articles,
carried by a bucket, into a vertical opening and teaches an arrangement
of spaced guiding tracks and cables to lift and rotate the bucket. The
25 balance of the referenced patents disclose devices which begin and
complete the rotational movement between the mid-point and the upper
extent of the lifting movement. US-A-4,797,050 has been issued to the
inventor of this invention.

According to one aspect of the invention there is provided a
30 method of discharging articles from a container into a defined
substantially vertical aperture by lifting and selectively tilting the
container carried on a discharge lifting platform of a power assisted
lifting apparatus, which method includes the steps of:-

(a) placing a major axis of the discharge lifting platform
35 substantially vertically by positioning a bottom shelf of the discharge
lifting platform in a substantially downward and horizontal position,
and a tapered discharge chute in an upwardly extending vertical

position;

(b) aligning the vertical major axis of the discharge lifting platform in a selected spaced relationship with the centre of the vertical aperture;

5 (c) initially retaining the container of articles on the bottom shelf of the discharge lifting platform in a substantially vertical position;

(d) inserting the tapered discharge chute into and through the vertical aperture by lifting and rapidly tilting the discharge lifting
10 platform during a first segment of the lifting movement;

(e) maintaining the insertion of the tapered discharge chute in and through the vertical aperture by tilting the discharge lifting platform at a slower uniform angular rate during at least one subsequent lifting segment as and when the discharge lifting platform
15 is brought to a fully lifted height;

(f) guiding the articles discharging from the container into and through the vertical aperture by carrying the articles on and over the tapered discharge chute;

(g) returning the empty container substantially to its starting
20 position by lowering and tilting the discharge lifting platform and bringing its major axis to a substantially vertical position.

According to another aspect of the invention there is provided a method of discharging articles from a container into a defined substantially vertical aperture by lifting and selectively tilting the
25 container carried on a discharge lifting platform of a power assisted lifting apparatus and subsequently charging a suitable container carried on a charging platform of a second power assisted apparatus from said vertical aperture, which method includes the steps of:-

(a) placing a major axis of the discharge lifting platform
30 substantially vertically by positioning a bottom shelf of the discharge lifting platform in a substantially downward and horizontal position and a tapered discharge chute in an upwardly extending vertical position;

(b) aligning the vertical major axis of the discharge lifting
35 platform in a selected spaced relationship with the centre of the vertical aperture;

(c) initially retaining the container of articles on the bottom

shelf of the discharge lifting platform in a substantially vertical position;

(d) inserting the tapered discharge chute into and through the vertical aperture by lifting and rapidly tilting the discharge lifting platform during a first segment of the lifting movement;

(e) maintaining the insertion of the tapered discharge chute in and through the vertical aperture by tilting the discharge lifting platform at a slower uniform angular rate during at least one subsequent lifting segment as and when the discharge lifting platform is brought to a fully lifted height;

(f) guiding the articles discharging from the container into and through the vertical aperture by carrying the articles on and over the tapered discharge chute;

(g) returning the now empty container substantially to its starting position by lowering and tilting the discharge lifting platform and bringing its major axis to a substantially vertical position;

(h) removing said discharge lifting platform from alignment with the vertical aperture;

(i) placing a major axis of a charging lifting platform substantially vertically by positioning a bottom support of the charging lifting platform in a substantially downward and horizontal position, and a contoured charging chute in a upwardly extending vertical position;

(j) aligning the major axis of the charging lifting platform in a selected spaced relationship with the centre of the vertical aperture;

(k) initially retaining the suitable container on the bottom support of the charging lifting platform in a substantially vertical position;

(l) abutting a top edge of the shaped charging chute in substantially parallel alignment with the vertical aperture by selectively lifting and rapidly tilting the charging lifting platform;

(m) guiding the articles from the vertical aperture into the suitable container by carrying the articles emerging from the vertical aperture on and over the shaped charging chute, and

(n) returning the suitable container with the articles

substantially to its starting position by lowering and tilting the charging lifting platform and bringing the major axis of the charging platform to a substantially vertical position.

According to a further aspect of the invention there is provided
5 a method of discharging articles from a container into a defined substantially vertical aperture by lifting and selectively tilting the container while it is carried on a discharge lifting platform, said lifting platform being carried on a power assisted apparatus and subsequently charging the container carried on the lifting platform
10 when used for charging of the container, which method includes the steps of:-

(a) placing a major axis of the lifting platform substantially vertically by positioning a bottom shelf of the lifting platform in a substantially downward and horizontal position;

15 (b) placing a tapered discharge chute in selected alignment with the lifting platform by engaging an attachment means;

(c) aligning the vertical major axis of the lifting platform in a selected spaced relationship with the centre of the vertical aperture;

20 (d) initially retaining the container of articles on the bottom shelf of the lifting platform in a substantial vertical position;

(e) inserting the tapered discharge chute into and through the vertical aperture by lifting and rapidly tilting the lifting platform during a first segment of the lifting movement;

25 (f) maintaining the insertion of the tapered discharge chute in and through the vertical aperture by tilting the lifting platform at a slower uniform rate during at least one subsequent segment as and when the lifting platform is brought to a fully lifted height;

30 (g) guiding the articles discharging from the container into and through the vertical aperture by carrying the articles on and over the tapered discharge chute;

(h) returning the now empty container substantially to its starting position by lowering and tilting the lifting platform and bringing its major axis to a substantially vertical position;

35 (i) removing said discharge chute by disengaging the attachment means;

(j) placing a contoured charging chute on the lifting platform

in a selected alignment by engaging the attachment means;

(k) abutting a top edge of the contoured charging chute in substantially parallel alignment with the vertical aperture by selectively lifting and rapidly tilting the lifting platform;

5 (l) guiding the articles from the vertical aperture into the container by carrying the articles emerging from the vertical aperture on and over the shaped charging chute, and

(m) returning the container with articles substantially to its starting position by lowering and tilting the lifting platform and
10 bringing the major axis of the lifting platform to a substantially vertical position.

Thus the invention concerns discharging of articles from a container into an associated processing machine or mill by way of a vertical aperture or charging of a container from an associated
15 processing machine by way of a vertical opening.

As far as it is known the transfer of articles to and/or from coating machines is a manual operation. This manual operation utilizes scoops and small pails for the transfer. The method of the invention can involve a minimum amount of manual labour and can handle the
20 articles in a gentle manner to minimize breakage.

The invention is diagrammatically illustrated by way of example with reference to the accompanying drawings, in which:-

Figure 1 is a side elevation view, partly diagrammatic and with portions in section, of a lifting platform, particularly showing the
25 positioning of the platform relative to a small vertical opening;

Figure 2 is a front elevation view of the lifting platform, particularly showing the alignment of a chute portion of the lifting platform relative to the vertical opening;

Figure 3 is a top plan view, partly diagrammatic, of the lifting
30 platform, taken on line 3-3 of Figure 1;

Figure 4 is a fragmentary elevational view, on an enlarged scale, showing the contour of a cam track for rotating the lifting platform;

Figure 5 is a fragmentary elevational view of an alternative embodiment of a contoured cam track, on the same scale as Figure 4;

35 Figure 6 is a fragmentary view, to a reduced scale, of a lifting platform showing a lifting platform arrayed with a charging chute;

Figure 7 is a fragmentary view of a lifting platform showing

interchangeable chute members for charging or discharging of a container carried on the lifting platform;

Figure 8 is a first of a sequence of views showing the discharging of a container into a vertical opening and shows the positioning of a container on the lifting platform;

Figure 9 is a second view of the discharging sequence and shows the rotation of the lifting platform substantially at the end of a first segment of the lift;

Figure 10 is a third view of the discharging sequence and shows the lifting platform at a substantially horizontal attitude, during a subsequent segment of lift;

Figure 11 is a fourth view of the discharging sequence and shows the lifting platform in a substantially fully lifted and tilted attitude;

Figure 12 is a first of a sequence of views showing the charging of a container from a vertical opening and shows the positioning of a container on the lifting platform; and

Figure 13 represents a second view of the charging sequence showing the lifted and rotated attitude of the lifting platform and shows the position of the charging chute relative to the vertical opening.

In the following description and in the claims, various details are identified by specific names for convenience. These names are intended to be generic in their application. The corresponding reference characters refer to like members throughout the several figures of the drawings.

Referring to Figures 1 to 7 and firstly to Figure 1 and Figure 2, a processing machine generally identified as 20 is shown as having a defined aperture 22 located in a vertical wall member 24. The processing machine 20 has a rotating tumbler 26 in substantial alignment with the vertical aperture 22. This processing machine 20 may or may not be fitted with a door to close the aperture 22 during rotation of the tumbler.

A powered lift apparatus 30 is shown in a desired spaced alignment with the processing machine 20. This alignment is provided by a guiding track 32, which is shown as a channel fastened to the floor. An adjustable stop 34 is provided at the end of the guiding

track 32. The guiding track 32 and the adjustable stop 34 are used when the powered lifting apparatus 30 is of a mobile design. A stationary powered lift apparatus would be secured to the floor at a desired location.

5 The powered lift apparatus 30 has a base member 36. A vertical column 38 is secured to the base 36 at a desired position. An elongate slot 42 is formed in one face 40 of the column 38. Referring to Figure 3, a lifting carriage 44 is linearly carried in a pair of elongate vertical guideways 46. A housing portion 48 of the lifting carriage 44
10 carries a rotatable pivot shaft 50. A pivot arm 52 is mounted on a first end of the pivot shaft 50, within the column 38. A cam follower 54 is mounted at a selected position on the pivot arm 52. An elongate cam track 58 is secured to a wall 56 of the column 38. The wall 56 is preferably located opposite the face 40. The engagement of the cam
15 follower 54 in the cam track 58 causes rotation of the pivot shaft 50 as and when the lifting carriage 44 is moved upwardly or downwardly.

A lifting platform, generally identified as 60, is secured to a second end of the pivot shaft 50, distal the first end and externally of the column 38. The slot 42 is sized to allow the pivot shaft 50 to
20 rotate freely when and as desired during the lifting motion. The lifting platform 60 has a bottom shelf 62, a reinforced shaped sidewall 64 and retaining pins 66. The lifting platform 60 is fitted with an integral discharge chute 68, as shown in Figure 1 and 2. A similar
lifting platform 160 is shown fitted with a charging chute 168 in
25 Figure 6. The lifting platforms 60 and 160 allow the placement of a container 71 therein and thereon, as shown in Figure 8 and Figure 12 respectively.

Referring in particular to Figure 4, a typical elongate cam track 58 is shown. The cam track 58 is arrayed with a first curved segment
30 72, an inclined second segment 74, and a vertical segment 76. The cam track 58 is secured to the wall 56 of the column 38 by mounting brackets 78 and 80. The mounting brackets 78,80 are slotted to allow for fine adjustment of the cam track 58 relative to the column 38. The curved segment 72, provides a rapid rotation or tilting of the pivot
35 shaft 50 in a short vertical movement of the lifting carriage 44. The inclined segment 74 provides a slower uniform angular rotation of the pivot shaft 50, during the continued vertical movement of the lifting

carriage 44. The vertical segment 76 maintains the angular displacement of the pivot shaft 50 during any small overtravel movement of the lifting carriage 44.

Referring in particular to Figure 5, an alternative cam track 158 is mounted and secured to the wall 56 of the column 38 by means of mounting brackets 178 and 180. These mounting brackets 178 and 180 are provided with elongate slotted holes to allow fine adjustment of the cam track 158 with respect to the column 38. The cam track 158 is arrayed with a first inclined segment 172, a second inclined segment 174, a third inclined segment 175, and a vertical segment 176. The first inclined segment 172 provides a rapid angular rotation or tilting of the pivot shaft 50 for a small amount of vertical lifting movement. The second inclined segment 174 provides a uniform angular rotation of the pivot shaft 50, at a slower rate than produced by the first segment 172. The third inclined segment 175 also provides a uniform angular rotation of the pivot arm 50, preferably with the rate of rotation imparted by the third segment 175 being less than that of the second segment 174. The vertical segment 176 allows for any overtravel movement of the lifting platform 60 without further angular rotation.

As previously mentioned the lifting platform 60 or 160, may be provided with either the container discharging chute 68 or the container charging chute 168 respectively. Referring in particular to Figure 1, Figure 2 and Figure 3, the discharging chute 68 is shown as having a semi-conical transition portion 82, and an elongate tapered nose portion 84. The nose portion 84 can fit into and through the vertical opening 22 and provide a clearance which eliminates any danger of damage to agitators which protrude inside the tumbler 26.

Referring in particular to Figure 6, there is shown one embodiment of the lifting platform 160 which has a bottom shelf 162, a reinforced shaped side-wall 164, a shelf portion 166, and the shaped nose portion 168. The shaped nose portion 168 has an inclined top edge 170 which can fit into the vertical opening 22 while being in substantially parallel alignment with a front vertical face of the tumbler 26.

The criteria for the shaping of the discharge chute 68 and the charging chute 168 will become apparent later in this disclosure.

Referring in particular to Figure 7, a lifting platform 260 is

shown and described. The lifting platform 260 is similar in function to the previously described lifting platforms 60 and 160. The lifting platform 260 provides a method and means for attaching and detaching either a discharging chute 268 or a charging chute 270. The lifting
 5 platform 260 has a bottom shelf 262, a shaped side wall portion 264, and a chute attachment means 265. The chute attachment means 265 is shown as having a flange portion 261 and a plurality of retaining lugs 263 secured to the flange 261 at desired spaced intervals.

A discharge chute 268 is similar in design and function to the
 10 integral discharge chute 68. The discharge chute 268 has semi-conical transition portion 282 and an elongate tapered nose portion 284. A flange 286 is secured to the enlarged end of the transition portion 282. The flange 286 can fit and mate with the flange portion 261 and fit into the retaining lugs 263. The chute attachment means 265
 15 provides alignment of the interior surfaces of the lifting platform 260 and the discharge chute 268.

A charging chute 270 which is similar, in design and function, to the charging chute 168 has a shaped side wall portion 269, a shaped top edge 271, a skirt portion 288, and a flange portion 287. The flange
 20 287 is sized to align and mate with the attachment means 265, for retention of the charging chute 270. It is to be noted that while one embodiment of the attachment means 265 has been shown and described, other means such as screws, pins or clamps may be used to align and retain either the interchangeable discharge chute 268 or the charging
 25 chute 270 to the lifting platform 260.

Referring now to the embodiment of Figures 8 to 11 and firstly to Figure 8, a mobile lifting apparatus 30 can be brought into a desired spaced alignment with the processing machine 20. The alignment means chosen for illustration purposes is a channel shaped track 32 with an
 30 adjustable stop 34 cooperating with the track 32 to position the lifting apparatus 30 as shown in Figure 2. In the preferred alignment, the vertical axis of the lifting platform 60 is in substantial alignment with the centre of the vertical aperture 22. A container 71, filled with product, is carried to the process machine 20 by and on the
 35 mobile lifting apparatus 30. The container 71 is positioned on the bottom shelf 62 of the lifting platform 60 when and as the platform 60 is in a substantially fully lowered or start position. The container

71 is also positioned under the retaining pins 66. A safety chain or strap, not shown, may be used together with the retaining pins 66 to hold the container 71 in position on the lifting platform 60 during the lifting operation. In Figure 8, the lifting platform 60 has been cut-
5 away to show the position of the container 71 in relation to the lifting platform 60. The container 71 is held in a substantially vertical or start position by and on the lifting platform 60. The position of the lifting platform 60 is controlled by the pivot shaft 50. The lifting movement of the pivot shaft 50 is provided by a power
10 type linear actuator. The rotation or tilting of the pivot shaft is controlled by the interaction of the cam follower 54, which is mounted on the pivot arm 52, with the cam track 58.

Referring to Figure 9, the container 71 and the lifting platform 60 have been rotated to a desired tilt. Preferably this rapid tilting
15 segment begins immediately as and when the lifting platform 60 is moved vertically. As an example, for a vertical lift of 20.3cm (8in) the container is tilted 63° from a vertical position. The nose portion 84 of the discharge chute 68 has been positioned into and through the vertical aperture 22 and within the tumbler 26.

20 Referring to Figure 10, the container 71 and the lifting platform 60 have been raised to a higher position through a subsequent lifting segment. This position places the container 71 in a substantially horizontal position as and when the pivot shaft 50 is brought into substantial alignment with the centre of the vertical aperture 24 and
25 the tumbler 26. For example the pivot shaft 50 has been lifted 68.58cm (27in). The nose portion 84 of the discharge chute 68 continues to be positioned within the tumbler 26. This positioning of the nose portion 84 within the tumbler 26 allows any articles which begin to discharge from the container 71 to fall onto the discharge chute 68 for guidance
30 into the tumbler 26.

Referring in particular to Figure 11, the container 71 and the lifting platform 60 are shown in a substantially fully lifted and tilted condition at or near the end of the last tilting segment. The container 71 rests against the retaining pins 66. The nose portion 84
35 of the discharge chute 68 continues to be positioned within the vertical aperture 24 and the tumbler 26. Maintaining the nose portion 84 within the vertical aperture 24 and the tumbler 26 is necessary to

prevent any articles, being discharged from the container 71, from falling onto the floor. As an example the container 71 has been rotated or tilted through an included angle of 120 degrees during a total lift of 111.8cm (44.5in).

5 After all of the articles are discharged, the lifting platform 60, carrying the empty container 71, is lowered to its start position, with the container in a substantially vertical condition, as shown in Figure 8. The process machine 20 is operated to process the articles. During the processing cycle the mobile lifting apparatus is removed
10 from the area in front of the processing machine 20.

Referring to Figures 12 and 13, the processing cycle generally includes the rotation of the tumbler 26 in a desired direction to coat, clean or deburr articles. The direction of rotation and the design of the agitators inside the tumbler 26 provide the necessary processing
15 action. Some process equipment may require manual removal of the articles, whereas other process machinery have been designed automatically to remove any articles within the tumbler by reversing the direction of tumbler rotation. Referring in particular to Figure 12, a mobile lifting apparatus 130 is selectively positioned and
20 aligned with the process machine 20. The preferred alignment positions the vertical axis of the lifting platform 160 in substantial alignment with the centre of the vertical aperture 24. This lifting platform 160 is fitted with an integral charging chute 168. A suitable container 71, which is empty or partially filled, is carried by and on the
25 lifting platform 160. The lifting platform 160 is lifted by a powered linear actuator.

Referring to Figure 13, the lifting platform 160 is lifted and rapidly rotates to a position which abuts the face of the tumbler 26. The top edge 170 of the nose portion 168 may be fitted with a flange,
30 felt, or a plastic edging which aligns with a suitable portion of the processing machine, during the reverse rotation of the tumbler 26 for removal of the articles. The articles leaving the tumbler 26 are guided down the nose portion 168. The shelf 166 provides a raised surface to allow the articles to fall into the container. The
35 container has been rotated 63 degrees from the vertical. This rotation of the container 71 places the side walls of the container at substantially a 27 degree angle with the floor. This angle provides a

gentle slope for the articles being charged into the container 71. After the tumbler 26 is emptied or when the container 71 is sufficiently filled, the lifting platform 160 is lowered to a start position as shown in Figure 12.

5 Referring to Figure 7, the above disclosure teaches or suggests the use of separate mobile lifting apparatus 30 for discharging or charging a container 71. When and if a stationary lifting platform 30 is positioned and mounted in spaced alignment with a process machine 20, it is necessary to provide a convenient method for discharging or
10 charging of a container 71.

The stationary lifting apparatus 30 utilizes a universal lifting platform 260 mounted to the pivot shaft 50. When and as it is desired to discharge the articles in a container 71 into a vertical aperture 22 of the process machine 20, the discharging chute 268 is positioned on
15 and retained by the chute attachment means 265. The lifting apparatus is cycled as in Figure 8 to Figure 11. The operation of the apparatus is substantially the same as previously described in Figure 8 to Figure 11. After the articles have been emptied from the container, the lifting apparatus 30 is brought to a fully lowered position.

20 An operator removes the discharging chute 268 from the lifting platform 260. A charging chute 270 is positioned and retained in an attachment means 265 on the lifting platform 260. At the end of the process cycle, the lifting platform 260 is raised as shown in Figure 13. The tumbler 26 is rotated in the reverse direction to remove the
25 articles from the tumbler. The articles are guide down the side wall 269 then over the skirt portion 288, and finally into the container 71. After the container is filled to the desired level, the lifting platform 260 is lowered to its start position as shown in Figure 12. It is to be noted that while the embodiment of Figure 7 has been
30 described in connection with a stationary lifting device, this embodiment will operate equally as well when mounted on a mobile lifting apparatus, or whether the lifting apparatus has a left hand tilt, as shown, or a right hand tilt, mirror image.

It is to be noted further that each of the cam tracks 58 and 158
35 will provide an immediate and rapid rotation of the lifting platform as and when it is lifted a small distance during the first segment 72 or 172 of the cam track 58 or 158. Since there are various manufacturers

of process machinery it is anticipated that slight modifications will be necessary to the contour of the cam tracks to provide the proper discharging or charging of a container.

5 In the above disclosure one alignment means is shown and described in the various figures of the drawings. However, it is anticipated that this alignment means may take the simple form of suitable markings made on the floor or a male/female coupling arrangement. Should the mobile lifting apparatus be of the automated robotic type, guiding wires may be placed in the floor together with a
10 position detecting means to control the stopping position of the lifting apparatus. In this case the mobile lifting apparatus would be self-propelled. It is anticipated that the lifting platform will be lifted by a suitable linear actuator, which may be powered by pneumatic, hydraulic, or electro-mechanical means and the tilting of
15 the lifting platform may be provided by a processor controlled servomotor, which may be powered electrically or hydraulically.

CLAIMS

1. A method of discharging articles from a container into a defined substantially vertical aperture by lifting and selectively tilting the container carried on a discharge lifting platform of a power assisted lifting apparatus, which method includes the steps of:-

(a) placing a major axis of the discharge lifting platform substantially vertically by positioning a bottom shelf of the discharge lifting platform in a substantially downward and horizontal position, and a tapered discharge chute in an upwardly extending vertical position;

(b) aligning the vertical major axis of the discharge lifting platform in a selected spaced relationship with the centre of the vertical aperture;

(c) initially retaining the container of articles on the bottom shelf of the discharge lifting platform in a substantially vertical position;

(d) inserting the tapered discharge chute into and through the vertical aperture by lifting and rapidly tilting the discharge lifting platform during a first segment of the lifting movement;

(e) maintaining the insertion of the tapered discharge chute in and through the vertical aperture by tilting the discharge lifting platform at a slower uniform angular rate during at least one subsequent lifting segment as and when the discharge lifting platform is brought to a fully lifted height;

(f) guiding the articles discharging from the container into and through the vertical aperture by carrying the articles on and over the tapered discharge chute;

(g) returning the empty container substantially to its starting position by lowering and tilting the discharge lifting platform and bringing its major axis to a substantially vertical position.

2. A method according to claim 1, wherein the step of aligning the vertical major axis of the discharging lifting platform in a selected spaced relationship with the centre of the vertical aperture includes the steps of:-

(a) guiding a plurality of wheels supporting the powered lifting



apparatus by and with a selectively positioned track, and

(b) stopping the movement of the lifting apparatus by abutting an adjusted stop.

5 3. A method according to claim 1 or claim 2, wherein the step of retaining the container further includes the step of engaging a top open surface of the container by a plurality of retaining pins.

4. A method according to any one of claims 1 to 3, which includes:-

10 (a) lifting of the discharge lifting platform by energizing a linear actuator;

(b) tilting of the discharge lifting platform by camming a pivot shaft attached to the discharge lifting platform, and

15 (c) lowering of the discharge lifting platform by reversing the linear actuator.

5. A method according to claim 4, wherein the camming includes a first rapid tilting segment, a second slower uniform rate tilting segment, and a third yet slower uniform rate segment.

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6. A method of discharging articles from a container into a defined substantially vertical aperture by lifting and selectively tilting the container carried on a discharge lifting platform of a power assisted lifting apparatus and subsequently charging a suitable container
25 carried on a charging platform of a second power assisted apparatus from said vertical aperture, which method includes the steps of:-

(a) placing a major axis of the discharge lifting platform substantially vertically by positioning a bottom shelf of the discharge lifting platform in a substantially downward and horizontal position
30 and a tapered discharge chute in an upwardly extending vertical position;

(b) aligning the vertical major axis of the discharge lifting platform in a selected spaced relationship with the centre of the vertical aperture;

35 (c) initially retaining the container of articles on the bottom shelf of the discharge lifting platform in a substantially vertical position;



(d) inserting the tapered discharge chute into and through the vertical aperture by lifting and rapidly tilting the discharge lifting platform during a first segment of the lifting movement;

5 (e) maintaining the insertion of the tapered discharge chute in and through the vertical aperture by tilting the discharge lifting platform at a slower uniform angular rate during at least one subsequent lifting segment as and when the discharge lifting platform is brought to a fully lifted height;

10 (f) guiding the articles discharging from the container into and through the vertical aperture by carrying the articles on and over the tapered discharge chute;

(g) returning the now empty container substantially to its starting position by lowering and tilting the discharge lifting platform and bringing its major axis to a substantially vertical position;

(h) removing said discharge lifting platform from alignment with the vertical aperture;

20 (i) placing a major axis of a charging lifting platform substantially vertically by positioning a bottom support of the charging lifting platform in a substantially downward and horizontal position, and a contoured charging chute in a upwardly extending vertical position;

25 (j) aligning the major axis of the charging lifting platform in a selected spaced relationship with the centre of the vertical aperture;

(k) initially retaining the suitable container on the bottom support of the charging lifting platform in a substantially vertical position;

30 (l) abutting a top edge of the shaped charging chute in substantially parallel alignment with the vertical aperture by selectively lifting and rapidly tilting the charging lifting platform;

(m) guiding the articles from the vertical aperture into the suitable container by carrying the articles emerging from the vertical aperture on and over the shaped charging chute, and

35 (n) returning the suitable container with the articles substantially to its starting position by lowering and tilting the charging lifting platform and bringing the major axis of the charging



platform to a substantially vertical position.

7. A method according to claim 6, wherein the step of aligning the vertical major axis of the discharging lifting platform in a selected spaced relationship with the centre of the vertical aperture includes the steps of:-

- (a) guiding a plurality of wheels supporting a power assisted lifting apparatus by a selectively positioned track, and
- (b) stopping the movement of said power assisted lifting apparatus by abutting an adjusted stop.

8. A method according to claim 7, wherein the step of aligning the major axis of the charging lifting platform in a selected spaced relationship with the centre of a vertical aperture includes the steps of:-

- (a) guiding a plurality of wheels supporting a second power assisted lifting apparatus by said selectively positioned track, and
- (b) stopping the movement of the second power assisted lifting apparatus by said adjusted stop.

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9. A method according to any one of claims 6 to 8, which includes:-

- (a) lifting of the discharge lifting platform by energizing a linear actuator;
- (b) tilting of the discharge lifting platform by camming a pivot shaft attached to the discharge lifting platform, and
- (c) lowering of the discharge lifting platform by reversing the linear actuator.

10. A method according to any one of claims 6 to 9, which includes:-

- (a) lifting of the charging lifting platform by energizing a linear actuator on the second power assisted lifting apparatus;
- (b) tilting of the charging lifting platform by camming a pivot shaft attached to the charging lifting platform, and
- (c) lowering of the charging lifting platform by reversing the linear actuator of the second power assisted lifting apparatus.

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11. A method of discharging articles from a container into a defined



substantially vertical aperture by lifting and selectively tilting the container while it is carried on a discharge lifting platform, said lifting platform being carried on a power assisted apparatus and subsequently charging the container carried on the lifting platform when used for charging of the container, which method includes the steps of:-

- (a) placing a major axis of the lifting platform substantially vertically by positioning a bottom shelf of the lifting platform in a substantially downward and horizontal position;
- 10 (b) placing a tapered discharge chute in selected alignment with the lifting platform by engaging an attachment means;
- (c) aligning the vertical major axis of the lifting platform in a selected spaced relationship with the centre of the vertical aperture;
- 15 (d) initially retaining the container of articles on the bottom shelf of the lifting platform in a substantial vertical position;
- (e) inserting the tapered discharge chute into and through the vertical aperture by lifting and rapidly tilting the lifting platform during a first segment of the lifting movement;
- 20 (f) maintaining the insertion of the tapered discharge chute in and through the vertical aperture by tilting the lifting platform at a slower uniform rate during at least one subsequent segment as and when the lifting platform is brought to a fully lifted height;
- (g) guiding the articles discharging from the container into and through the vertical aperture by carrying the articles on and over the tapered discharge chute;
- 25 (h) returning the now empty container substantially to its starting position by lowering and tilting the lifting platform and bringing its major axis to a substantially vertical position;
- 30 (i) removing said discharge chute by disengaging the attachment means;
- (j) placing a contoured charging chute on the lifting platform in a selected alignment by engaging the attachment means;
- (k) abutting a top edge of the contoured charging chute in substantially parallel alignment with the vertical aperture by selectively lifting and rapidly tilting the lifting platform;
- 35 (l) guiding the articles from the vertical aperture into the



container by carrying the articles emerging from the vertical aperture on and over the shaped charging chute, and

(m) returning the container with articles substantially to its starting position by lowering and tilting the lifting platform and bringing the major axis of the lifting platform to a substantially vertical position.

12. A method according to claim 11, wherein the step of retaining the container further includes the step of engaging a top open surface of the container by a plurality of retaining pins.

13. A method according to claim 11 or claim 12, which includes:-

(a) lifting of the lifting platform by energizing a linear actuator;

(b) tilting of the lifting platform by camming a pivot shaft attached to the lifting platform, and

(c) lowering of the lifting platform by reversing the linear actuator.

14. A method according to claim 13, wherein the camming includes a first rapid tilting segment, a second slower uniform tilting segment, and a third yet slower uniform rate tilting segment.

15. A method of discharging articles from a container into a defined substantially vertical aperture by lifting and selectively tilting the container carried on a discharge lifting platform of a power assisted lifting apparatus substantially as hereinbefore described with reference to Figures 1-3, Figure 4 or Figure 5 and Figures 8-11 of the drawings.

16. A method of discharging articles from a container into a defined substantially vertical aperture by lifting and selectively tilting the container carried on a discharge lifting platform of a power assisted lifting apparatus and subsequently charging a suitable container carried on a charging platform of a second power assisted apparatus from said vertical aperture substantially as hereinbefore described with reference to Figures 1-3, Figure 4 or Figure 5, Figure 6, and



Figures 8-13 of the drawings.

17. A method of discharging articles from a container into a defined substantially vertical aperture by lifting and selectively tilting the container carried on a discharge lifting platform, said lifting platform being carried on a power assisted apparatus, and subsequently charging the container carried on the lifting platform when used for charging of the container substantially as hereinbefore described with reference to Figures 1-3, Figure 4 or Figure 5 and Figures 7-13 of the drawings.