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(72) Inventor: **Vleeschouwers, Chris**
9500 Viane Geraardsbergen (BE)

(74) Representative: **Mackett, Margaret Dawn et al**
Gevers & Vander Haeghen
Holidaystraat 5
1831 Diegem (BE)

(71) Applicant: **Intrion**
1654 Huizingen (BE)

(54) **Container emptying apparatus**

(57) Described herein is a method and apparatus for automatically emptying bottles (132, 134, 136, 138) from a crate (110) without the need for supporting each of the bottles (132, 134, 136, 138) during the process. A housing (140) is moved to surround and to engage with the crate (110) containing a plurality of bottles (132, 134, 136, 138). The housing (140) is closed to form an enclosure

prior to being inverted. The enclosure is re-opened after inversion so that a base portion (112) of the crate (110) can be removed by an arm (170) leaving the bottles (132, 134, 136, 138) within the housing (140). The housing (140) is re-closed to form the enclosure and is then re-inverted prior to being re-opened to deposit the bottles (132, 134, 136, 138) on a delivery surface.

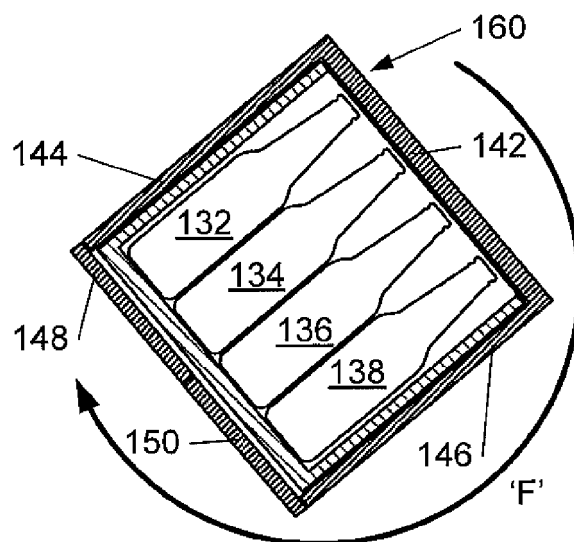
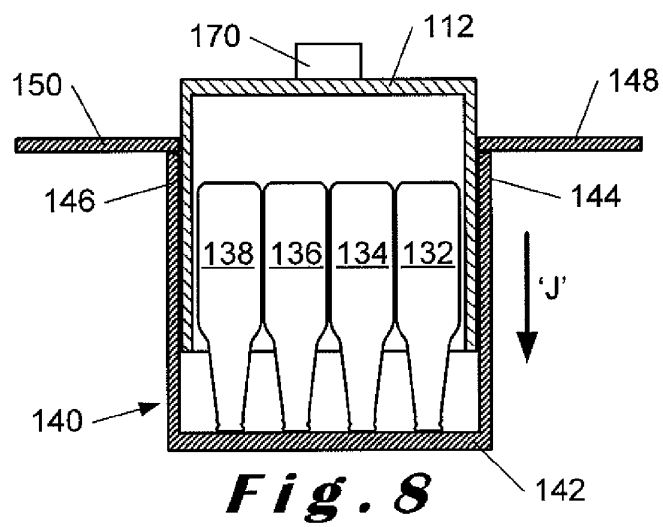
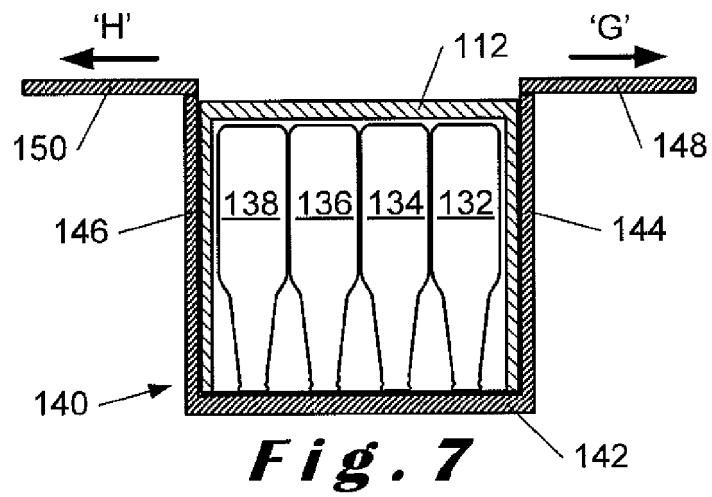
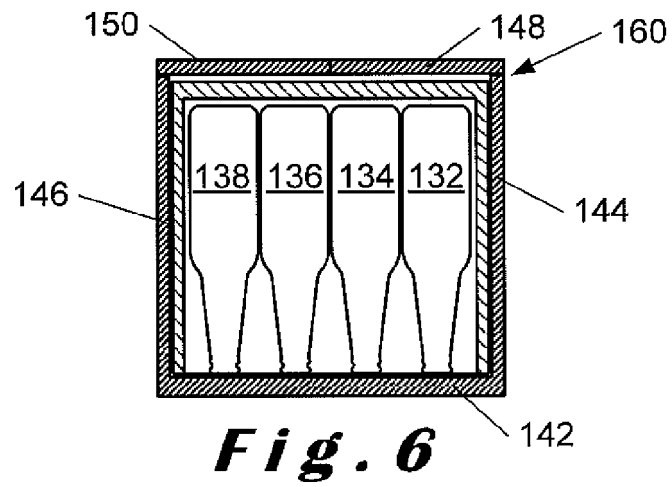


Fig. 5



Description

Field of the Invention

[0001] The present invention relates to container emptying apparatus and is more particularly, although not exclusively, concerned with the automatic emptying of crates containing bottles.

Background to the Invention

[0002] Bottles, for example, beer bottles are typically supplied in a beer crate from the brewery where the beer is bottled. Such beer crates are also used to return the empty bottles to the brewery for re-use. Typically, the brewery, or original supplier, supplies full beer bottles in crates to a point-of-sale where the beer is sold. A deposit for the empty beer bottle may be included in the price of the beer and empty bottles are returned to the point-of-sale so that the deposit can be redeemed.

[0003] Once returned to the point-of-sale, the empty beer bottles are placed in the first available crate and often this means that bottles of different shapes and/or sizes are mixed in the same crate. Prior to returning the crate and empty bottles to the brewery or original supplier, the bottles need to be sorted so that bottles of the same shape and size, or from the same supplier, are in the same crate. Alternatively, the bottles can be sorted at the brewery. In any case, this sorting process requires the removal of bottles of different shapes and sizes from each crate so that they can be grouped more appropriately for return to the brewery or original supplier. This removal process tends to be done manually is therefore a labour-intensive process.

[0004] Apparatus for automatically removing or emptying the contents of a container, for example, bottles from a case or crate is known. In GB-A-1407782, apparatus is described in which bottles are removed from a case by inverting the case, opening its base, removing the case whilst supporting the bottles, and placing the bottles base first on a conveyor belt. The apparatus supports the cases as they move from an inverted position to a non-inverted position in which the bottles are deposited on the conveyor belt, and the case itself supports each bottle as the case is inverted and righted.

[0005] In DE-A-1154756, bottles are removed from a crate containing bottles that are both non-inverted and inverted. Bottles are removed from the crate by tilting the crate so that any inverted bottles are removed first and placed on a conveyor belt. After the inverted bottles have been removed, the non-inverted bottles are removed by gripping the bottles by their necks, loading the bottles into a bucket neck first, and inverting the bucket to place the bottles on the conveyor belt base first.

[0006] In EP-A-0126636, bottles are removed from a crate by inverting the crate and allowing the bottles to fall neck first into partitions provided on a rotating wheel as the crate moves relative to the rotating wheel. The bottles

fall into the partitions at the uppermost position of each partition on the rotating wheel and are placed base first on a conveyor belt when each partition retaining each bottle reaches its lowermost position on the rotating wheel. GB-A-0709238 describes a similar arrangement to that described in EP-A-0126636 in which the rotating wheel is replaced by a rotating drum but operates in the same way.

[0007] DD-A-0146926 describes an arrangement for emptying bottles from a case in which the case is inverted so that the inverted bottles fall into compartments neck first on a first closed loop conveyor belt. As the conveyor belt rotates, the bottles are released onto a second conveyor belt base first and are transported to another location by the second conveyor belt.

[0008] In each of the arrangements described above, it is necessary to support each bottle individually as it is inverted, removed from the crate or case, and placed base first onto a conveyor belt or other surface after removal from the associated container. This means that the apparatus or equipment tends to be complicated and extensive.

[0009] Moreover, none of the arrangements described above have the ability to handle bottles or other items having the same or different shapes and/or sizes.

Summary of the Invention

[0010] It is therefore an object of the present invention to provide a method of automatically emptying the contents of an open-topped container without having to support each of the contents during the emptying process.

[0011] It is another object of the present invention to provide a simple apparatus that has the ability to empty the contents of such open-topped containers.

[0012] In accordance with a first aspect of the present invention, there is provided a method of emptying an open-topped container containing a plurality of items, the method comprising the steps of:-

- a) elevating the open-topped container from a receiving surface;
- b) inverting the open-topped container;
- c) removing the open-topped container;
- d) re-inverting the plurality of items; and
- e) depositing the plurality of items onto a delivery surface;

characterised in that the plurality of items are retained within the open-topped container during steps a) and b).

[0013] The term "open-topped container" as used herein includes any container without a top which is capable of containing one or more individual items. The term "item" as used herein includes bottles, packs, etc. and other items which may be stacked in a single layer or in multiple layers within the container.

[0014] Step b) may comprise forming an enclosure

around the open-topped container prior to its inversion.

[0015] Step c) preferably comprises opening the inverted enclosure prior to the removal of the open-topped container.

[0016] Step d) may comprise re-forming the enclosure prior to re-inversion of the plurality of items.

[0017] Preferably, step b) comprises engaging a portion of the open-topped container with at least one portion of the enclosure.

[0018] In one embodiment of the present invention, the open-topped container comprises a crate. In this case, the plurality of items comprises a plurality of bottles. The plurality of bottles may or may not be identical.

[0019] In accordance with another aspect of the present invention, there is provided apparatus for emptying an open-topped container containing a plurality of items, the apparatus comprising:-

an enclosure for arranging around the open-topped container, the enclosure including engagement means for engaging at least a portion of the open-topped container;

at least one movement imparting mechanism for elevating the enclosure, inverting the enclosure, and re-inverting the enclosure; and

a controller for controlling the enclosure and each movement imparting mechanism;

characterised in that the enclosure has a first position allowing access to its interior and a second position, and in that the apparatus further comprises a device for accessing the enclosure in its first position, the controller controlling the device for access to the interior of the enclosure.

[0020] Preferably, the enclosure includes at least one moveable portion that is moveable to provide the first and second positions.

[0021] In one embodiment of the present invention, the device may comprise a static arm and the movement imparting mechanism moves the enclosure in its first position so that the static arm accesses the interior of the enclosure.

[0022] Ideally, each movement imparting mechanism comprises a robotic arm.

Brief Description of the Drawings

[0023] For a better understanding of the present invention, reference will now be made, by way of example only, to the accompanying drawings in which:-

Figure 1 illustrates a schematic cross-sectional view of a crate containing a plurality of bottles which is positioned on a surface;

Figures 2 to 13 illustrate the steps for emptying the bottles from the crate;

Figure 14 illustrates the bottles on a surface after they have been emptied from the crate;

Figure 15 illustrates a schematic cross-sectional view of a crate containing a plurality of bottles of different shapes, sizes and orientations;

Figure 16 illustrates a schematic cross-sectional view of an open-topped container containing a plurality of items of regular shape and size; and

Figure 17 is similar to Figure 16 but illustrates an open-topped container containing a plurality of items of different shapes and sizes.

Description of the Invention

[0024] The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes.

[0025] It will be understood that the terms "vertical" and "horizontal" are used herein refer to particular orientations of the Figures and these terms are not limitations to the specific embodiments described herein.

[0026] The present invention relates to a method and apparatus for automatically emptying bottles from a crate, including bottles having different shapes and/or sizes, without having to support each bottle individually as it is removed from the crate.

[0027] Although the present invention will be described with referent to bottles in a crate, it is equally applicable to other open-topped containers containing other items either of the same shape and size or of different shapes and sizes. Moreover, the items may be stacked in more than one layer within the open-topped container.

[0028] In Figure 1, a schematic cross-sectional view of a crate assembly 100 is shown which comprises a crate 110 located on a receiving surface 120, the crate 110 containing a plurality of bottles 132, 134, 136, 138 which are to be removed therefrom.

[0029] Although only four bottles 132, 134, 136, 138 are shown in the crate 110, it will be appreciated that the crate 110 may be of standard size with the capacity to contain 12 or 24 bottles, or it may be capable of holding much more bottles. The crate 110 may have partitions for each bottle 132, 134, 136, 138, or, as shown in Figure 1, there are no partitions and the bottles can be in contact with one another. Each bottle 132, 134, 136, 138 as shown in the Figures represents a row of bottles aligned within the crate 110. Moreover, the bottles in the crate do not need to be of the same shape and size and a mix of different shaped and sized bottles can also be automatically emptied from the crate 110.

[0030] The crate 110 has a base portion 112 and four side wall portions 114, 116 (only two of which are shown) extending from the base portion 112 which define an open top portion 118. As stated above, the crate 110 is of standard construction and does not need to be modified for use in the method of the present invention or with

the apparatus of the present invention.

[0031] The receiving surface 124 may be a static or fixed surface, for example, a bench, a table top, or a floor, or may be a dynamic or moveable surface, for example, a conveyor belt. The receiving surface 120 is effectively any suitable surface on which the crate 110 is positioned from which it can be emptied.

[0032] Figures 2 to 13 illustrate the steps for emptying the crate 110. In Figure 2, a housing 140 is connected to the crate 110 by moving it in a generally downward vertical direction as indicated by arrow 'A' over the crate 110. The housing 140 comprises a top portion 142 and four side wall portions 144, 146 (only two of which can be seen in Figures 2 to 13). At least one of side wall portions 144, 146 includes engagement means (not shown) for engaging with at least one portion the crate 110, the engagement supporting the crate 110 substantially near to its open top portion 118. For example, the engagement means may comprise a pair of retractable pegs arranged to engage with openings formed in the crate which define handles.

[0033] It will be appreciated that the present invention is not limited to crates, but can be used with any open-topped container containing a plurality of items which need to be emptied therefrom. Naturally, other suitable engagement means may be provided for engaging with the open-topped container.

[0034] The housing 140 also includes two plate portions 148, 150 slidably mounted with respect to the side walls 144, 146. When in a first position, the plate portions 148, 150 are retracted so that the housing 140 can be positioned over the crate 110 and its rows of bottles 132, 134, 136, 138, and when in a second position, the plate portions 148, 150 can be deployed to form an enclosure 100 with the top portion 132 and side wall portions 144, 146 as described below with reference to Figures 4 to 6.

[0035] Once the housing 140 has been connected to the crate 110 by the engagement means, the housing 140, together with the crate 110 and its rows of bottles 132, 134, 136, 138, is lifted away from the receiving surface 120 in a generally upward vertical direction as indicated by arrow 'B' in Figure 3. As the housing 140 continues in its generally vertical upwards direction, arrow 'C' in Figure 4, the plate portions 148, 150 move towards one another as indicated by respective arrow 'D' and 'E' to form the enclosure 160 around the crate 110 and rows of bottles 132, 134, 136, 138.

[0036] The enclosure 160, together with the crate 110 and its rows of bottles 132, 134, 136, 138 inside, is rotated in the direction of arrow 'F' in Figure 5 so that it is inverted as shown in Figure 6. Rotation of the enclosure 160 is about an axis (not shown) which passes through the enclosure 160 in a direction parallel to the walls thereof. It will be appreciated that the axis of rotation may be located in any suitable position to effect rotation of the enclosure 160 so that it can be inverted and subsequently re-inverted as will be described in more detail below.

[0037] In Figure 6, the rows of bottles 132, 134, 136,

138 are now resting with their necks on the top portion 142 of the housing 140. In this position, any liquid remaining in the rows of bottles 132, 134, 136, 138 is drained out under the action of gravity. The top portion 142 may incorporate a drainage system (not shown) that allows the drained liquid from the rows of bottles 132, 134, 136, 138 to be removed from the enclosure 160.

[0038] Once the enclosure 160 is fully inverted, the plate portions 148, 150 are retracted to the first position, as indicated by arrows 'G' and 'H' respectively, to reveal the base portion 112 of the crate 110 as shown in Figure 7. The base portion 112 of the crate 110 is grasped by an arm 170 or other similar device to retain it whilst the housing 140 is lowered in a generally downward vertical direction, as indicated by arrow 'J' in Figure 8, to remove the crate 110 leaving the rows of bottles 132, 134, 136, 138 in the housing 140 without any other support than the top portion 142 and four side walls 146, 148 (only two of which are shown).

[0039] It will be appreciated that it is not necessary that the housing 140 be lowered but the arm 170 could be raised to provide the relative movement between the crate 110 and the housing 140 in the direction indicated by arrow 'J', so that the crate 110 is separated from the rows of bottles 132, 134, 136, 138.

[0040] After the crate 110 has been removed, the plate portions 148, 150 are deployed to the second position once again, as indicated by respective arrows 'K' and 'L' in Figure 9, to re-form the enclosure 160. Here, the rows of bottles 132, 134, 136, 138 are not supported individually but by the walls 146, 148 of enclosure 160 and one another. The enclosure 160 is then rotated in the direction of arrow 'M' in Figure 10 to a position where the rows of bottles 132, 134, 136, 138 are upright and the enclosure 160 is placed on a delivery surface 180 as shown in Figure 11.

[0041] It will be appreciated that, as the rows of bottles 132, 134, 136, 138 are not supported in a fixed position within the enclosure 160, they will slide over top portion 142 so that bottle 138 (and all bottles in the same row) falls against wall portion 146 and the other bottles 136, 134, 132 (and all bottles in the same rows) follow as shown in Figure 10.

[0042] Once the enclosure 160 is fully re-inverted, it is placed on a delivery surface 180 and the plate portions 148, 150 are then moved to their first position in the direction of respective arrows 'N', 'P' so that the rows of bottles 132, 134, 136, 138 are in direct contact with the delivery surface 180 as shown in Figure 12. Movement of the housing 140 in a generally upward vertical direction as indicated by arrow 'Q' in Figure 13 leaves the rows of bottles 132, 134, 136, 138 on the delivery surface 180 as shown in Figure 14.

[0043] As described above in relation to the receiving surface 120, the delivery surface 180 may be a static or fixed surface, for example, a bench, a table top, or a floor, or may be a dynamic or moveable surface, for example, a conveyor belt. The delivery surface 180 is effectively

any suitable surface on which the rows of bottles 132, 134, 136, 138 are positioned at the end of the emptying process.

[0044] In one embodiment, the delivery surface 180 is the same as the receiving surface 120, and may comprise either a static or a dynamic surface. In another embodiment, the delivery surface 180 is different to the receiving surface 120 and either one of the delivery surface 180 or the receiving surface 120 may be static and/or dynamic in accordance with the particular arrangement of the apparatus.

[0045] It will readily be appreciated that the housing 140 may be attached to a robotic arm (not shown) which controls its movement in a generally vertical direction as described above. In addition, suitable connections may be provided which allow the deployment of the plate portions 148, 150 to form the enclosure 160 and the retraction of the plate portions 148, 150 to allow access to the crate 110 for its removal from the housing 140 as described above. Such connections may be mechanical, electrical, hydraulic or pneumatic so that deployment and retraction of the plate portions 148, 150 are operated mechanically, electrically, hydraulically or pneumatically.

[0046] A robotic arm also controls the rotation of the enclosure 160 to invert the crate 110 and its rows of bottles 132, 134, 136, 138, as shown in Figure 5, and to re-invert the rows of bottles 132, 134, 136, 138 after the crate 110 has been removed as shown in Figure 10.

[0047] It will be appreciated that the present invention is not limited to one robotic arm, and that depending on the particular arrangement of the container emptying apparatus, more than one robotic arm may be utilised.

[0048] Although motion of the housing 140 and the enclosure 160 formed thereby when the plate portions 148, 150 have been deployed has been described as being substantially in one plane, for example, movement in generally vertical upward and downward directions, it will be appreciated that in other embodiments, there may also be translational movement in more than one direction. In addition, the rotational movement described with reference to Figures 5 and 10 may be about more than one axis passing through the enclosure 160. Alternatively, the axis or axes about which rotation takes place may be outside the enclosure 160.

[0049] Whilst the method and apparatus of the present invention is used to empty a full crate, partly filled crates can also be emptied. Typically, crates that are around 75% full can also be emptied using the present invention as the bottles support one another when the crate is removed.

[0050] It will be appreciated that the present invention is not limited to a particular 'fill' percentage and other percentages can be used in accordance with the type of open-topped container and/or the type of items which need to be removed and/or emptied from the container.

[0051] In Figure 15, a crate 200, containing bottles of different sizes, shapes and orientations, is shown. Bottles 210 are of the same size, shape and orientation, and

bottles 220 are of the same size and shape to bottles 210 but their orientation is different, that is, inverted with respect to bottles 210. Bottles 230 have a different shape and a different size than bottles 210 and can be located between bottles 210 in the crate 200. As shown, inverted bottles 230 form an upper layer within the crate 200, the non-inverted bottles 210, 220 forming a lower layer.

[0052] Crate 200 can be emptied using the same apparatus as described above in relation to crate 110. However, in this configuration, packing-density of bottles within the crate may be critical to ensure that all bottles are correctly supported after the housing 140 is removed as shown in Figures 13 and 14. Naturally, if bottles in the upper layer are smaller and/or lighter than bottles in the lower layer, the packing density of bottles in the crate is not so critical.

[0053] Although bottles 230 are shown as inverted with respect to bottles 210, it will be appreciated that if the crate 200 is large enough to accommodate both the upper and lower layers one on top of the other and/or the bottles are small enough to allow their positioning in the crate in more than one layer, the bottles do not need to be inverted.

[0054] Figure 16 illustrates an open-topped container 300, for example, an open-topped box, containing identically sized and shaped items 310 arranged in three layers 320, 330, 340. As shown, items 310 do not need to be packed closely together and spaces can be left between adjacent items in each layer. However, it will be appreciated that the items 310 may be more closely packed in at least one of the layers 320, 330, 340.

[0055] Figure 17 is similar to Figure 16 and illustrates an open-topped container 400 containing non-identical items 410, 420, 430. Three item types 410, 420, 430 are shown, each having a different size and shape, arranged in four layers 440, 450, 460, 470. Spaces may be left between adjacent items in each layer 440, 450, 460, 470.

[0056] It will be appreciated that Figures 15 to 17 illustrate the flexibility of the method and apparatus of the present invention, and that it is not limited to bottles of the same size as described with reference to Figures 1 to 14, but can be used with other items of different shapes, sizes and orientations located within a suitable open-topped container.

[0057] The present invention has been described as a method of emptying one crate or container at a time. It will be appreciated that the apparatus may be adapted to allow for more than one crate or container to be emptied at the same time using one or more robotic arms.

[0058] Whilst the present invention has been described in relation to a specific embodiment of emptying bottles from crates (Figures 1 to 14), it will be appreciated that the invention is not limited to this particular embodiment, and can be used for other open-topped containers from which other items need to be removed and/or emptied as described with reference to Figures 15 to 17.

Claims

1. A method of emptying an open-topped container (110; 200; 300; 400) containing a plurality of items (132, 134, 136, 138; 210, 220, 230; 310; 410, 420, 430), the method comprising the steps of:-
 - a) elevating the open-topped container (110; 200; 300; 400) from a receiving surface (120);
 - b) inverting the open-topped container (110; 200; 300; 400);
 - c) removing the open-topped container (110; 200; 300; 400);
 - d) re-inverting the plurality of items (132, 134, 136, 138; 210, 220, 230; 310; 410, 420, 430); and
 - e) depositing the plurality of items (132, 134, 136, 138; 210, 220, 230; 310; 410, 420, 430) onto a delivery surface (180);

characterised in that the plurality of items (132, 134, 136, 138; 210, 220, 230; 310; 410, 420, 430) are retained within the open-topped container during steps a) and b).
2. A method according to claim 1, wherein step b) comprises forming an enclosure (140, 142, 144, 146, 148, 150; 160) around the open-topped container (110; 200; 300; 400) prior to its inversion.
3. A method according to claim 2, wherein step c) comprises opening the inverted enclosure (140, 142, 144, 146, 148, 150; 160) prior to the removal of the open-topped container (110; 200; 300; 400).
4. A method according to claim 3, wherein step d) comprises re-forming the enclosure (140, 142, 144, 146, 148, 150; 160) prior to re-inversion of the plurality of items (132, 134, 136, 138; 210, 220, 230; 310; 410, 420, 430).
5. A method according to any one of the preceding claims, wherein step b) comprises engaging a portion of the open-topped container (110; 200; 300; 400) with at least one portion of the enclosure (132, 134, 130, 138; 210, 220, 230; 310; 410, 420, 430).
6. A method according to any one of the preceding claims, wherein the open-topped container (110; 200; 300; 400) comprises a crate (110; 200).
7. A method according to claim 6, wherein the plurality of items (132, 134, 136, 138; 210, 220, 230; 310; 410, 420, 430) comprises a plurality of bottles (132, 134, 136, 138; 210, 220, 230).
8. A method according to claim 7, wherein the plurality of bottles (132, 134, 136, 138) are identical.
9. A method according to claim 7, wherein the plurality of bottles (210, 220, 230) are not identical.
10. Apparatus for emptying an open-topped container (110; 200; 300; 400) containing a plurality of items (132, 134, 136, 138; 210, 220, 230; 310; 410, 420, 430), the apparatus comprising:-

an enclosure (140, 142, 144, 146, 148, 150; 160) for arranging around the open-topped container (110; 200; 300; 400), the enclosure (140, 142, 144, 146, 148, 150; 160) including engagement means for engaging at least a portion of the open-topped container (110; 200; 300; 400);

at least one movement imparting mechanism for elevating the enclosure (140, 142, 144, 146, 148, 150; 160), inverting the enclosure (140, 142, 144, 146, 148, 150; 160), and re-inverting the enclosure (140, 142, 144, 146, 148, 150; 160); and

a controller for controlling the enclosure (140, 142, 144, 146, 148, 150; 160) and each movement imparting mechanism;

characterised in that the enclosure (140, 142, 144, 146, 148, 150; 160) has a first position allowing access to its interior and a second position, and **in that** the apparatus further comprises a device for accessing the enclosure (140, 142, 144, 146, 148, 150; 160) in its first position, the controller controlling the device for access to the interior of the enclosure (140, 142, 144, 146, 148, 150; 160).
11. Apparatus according to claim 10, wherein the enclosure (140, 142, 144, 146, 148, 150; 160) includes at least one moveable portion (148, 150) that is moveable to provide the first and second positions.
12. Apparatus according to claim 10 or 11, wherein the device comprises a static arm and the movement imparting mechanism moves the enclosure (140, 142, 144, 146, 148, 150; 160) in its first position so that the static arm accesses the interior of the enclosure (140, 142, 144, 146, 148, 150; 160).
13. Apparatus according to any one of claims 10 to 12, wherein each movement imparting mechanism comprises a robotic arm.

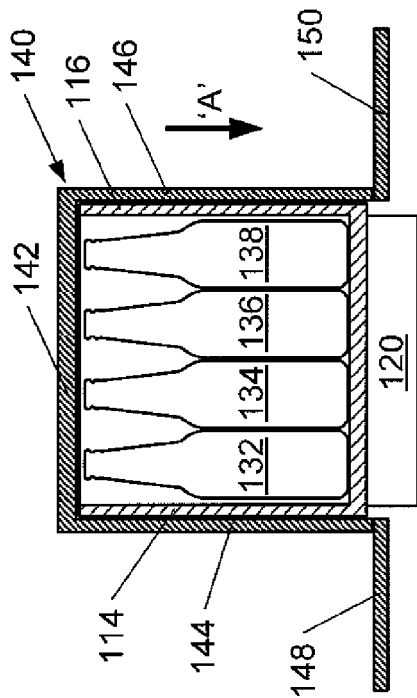


Fig. 2

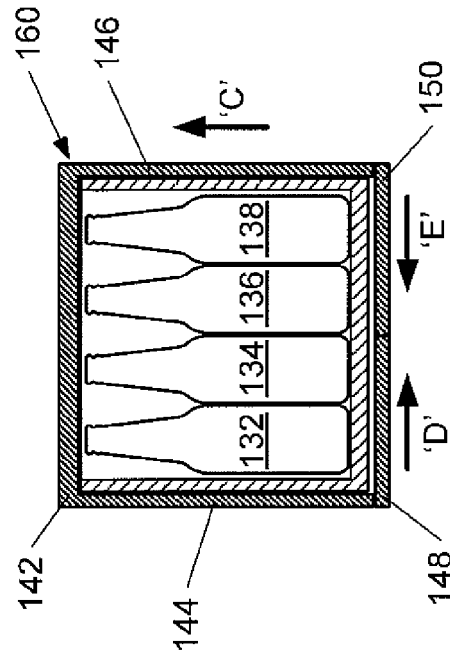


Fig. 3

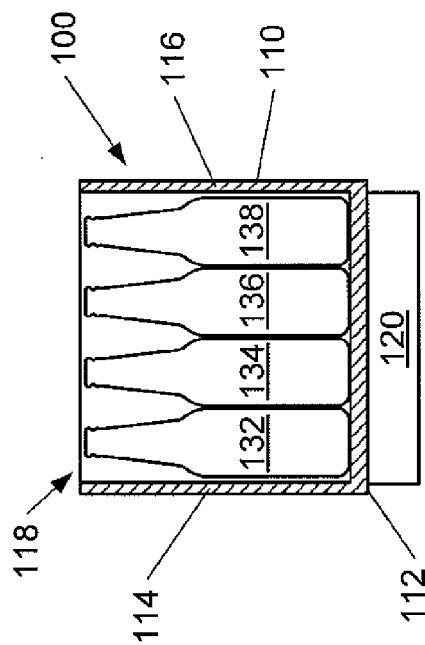


Fig. 4

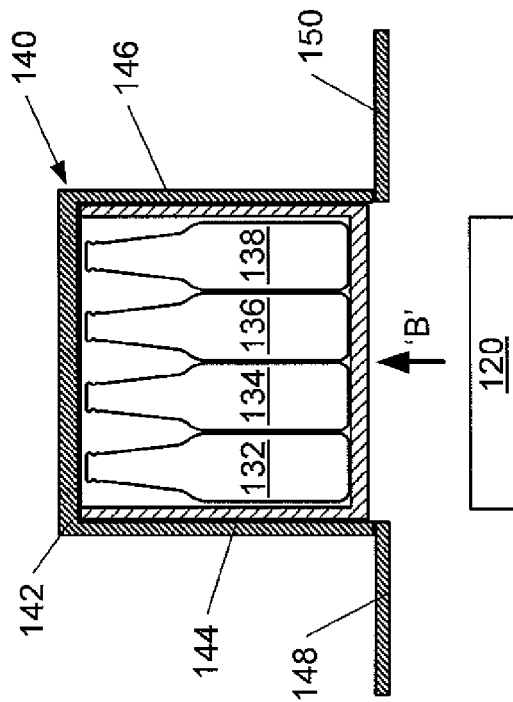


Fig. 5

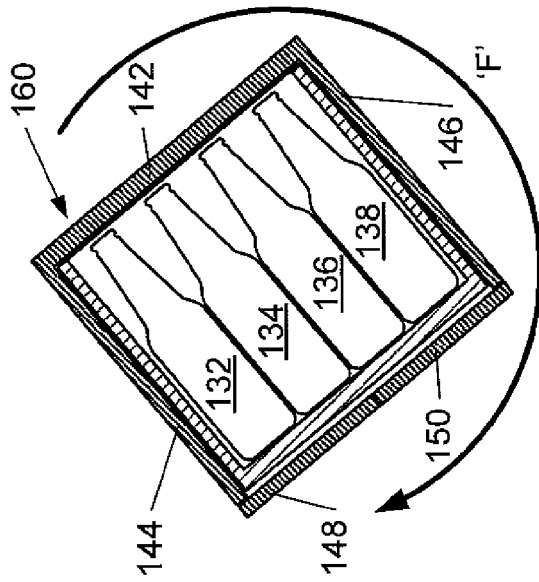


Fig. 5

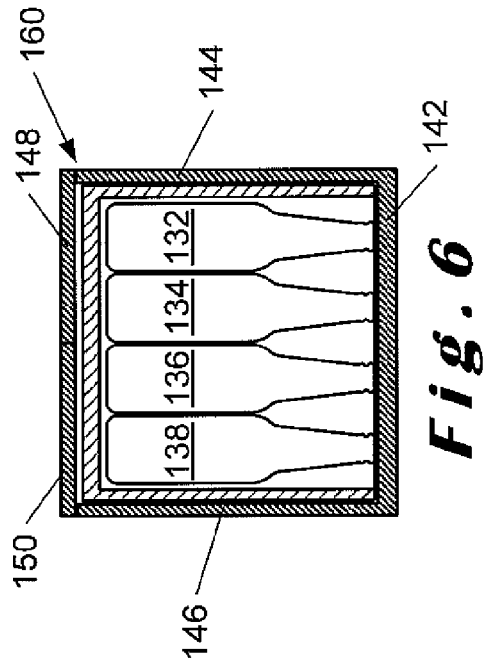


Fig. 6

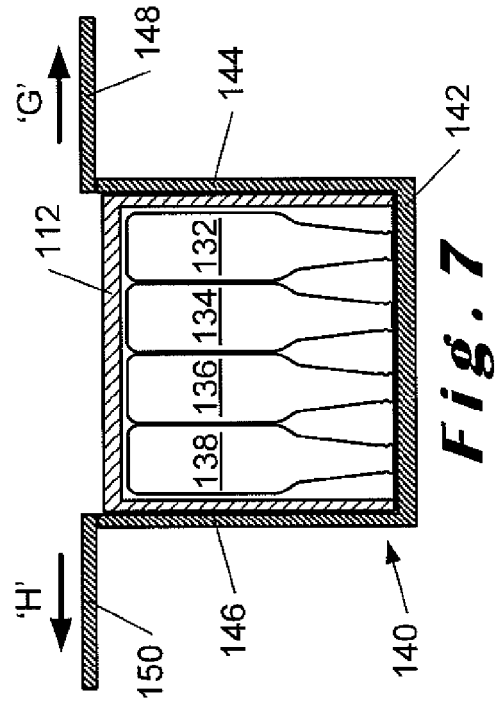


Fig. 7

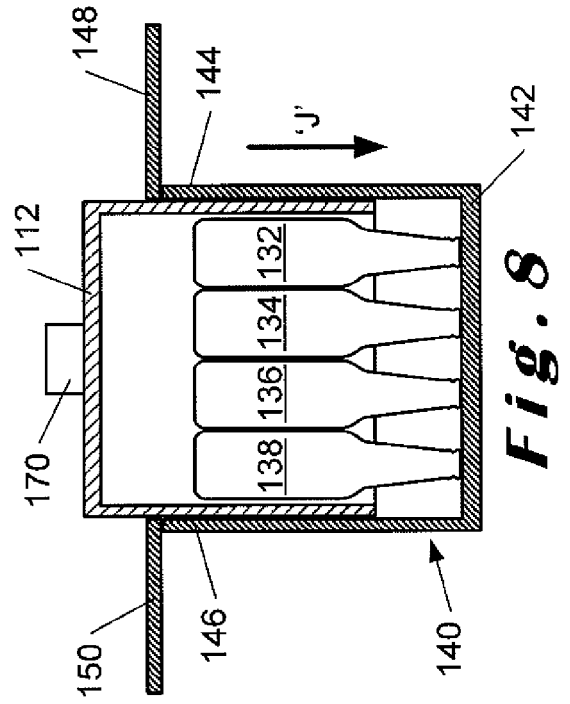
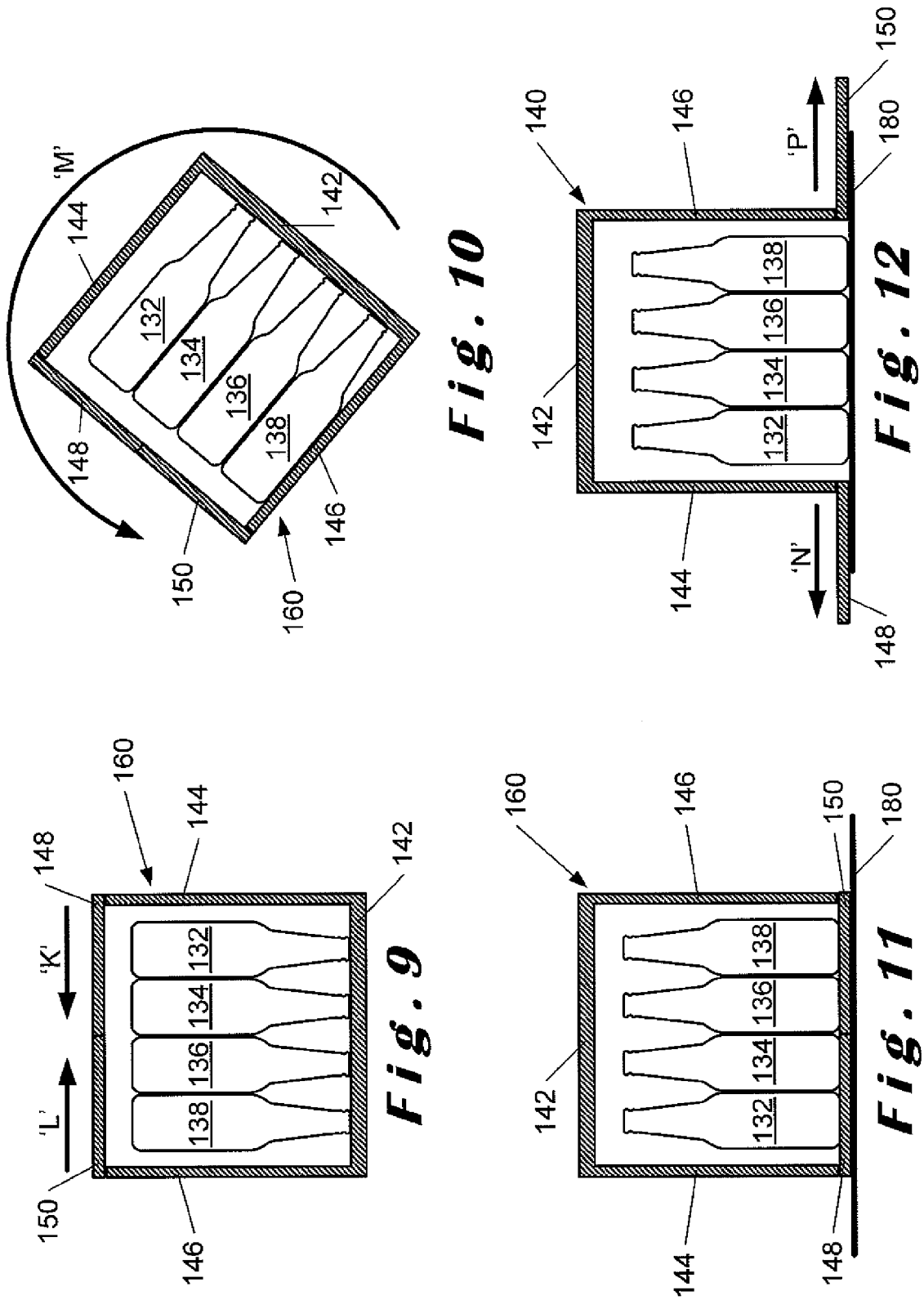
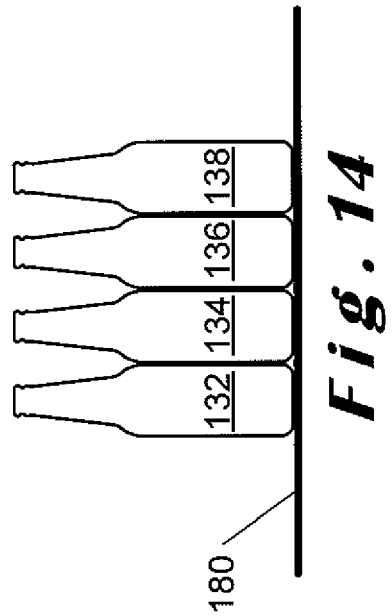
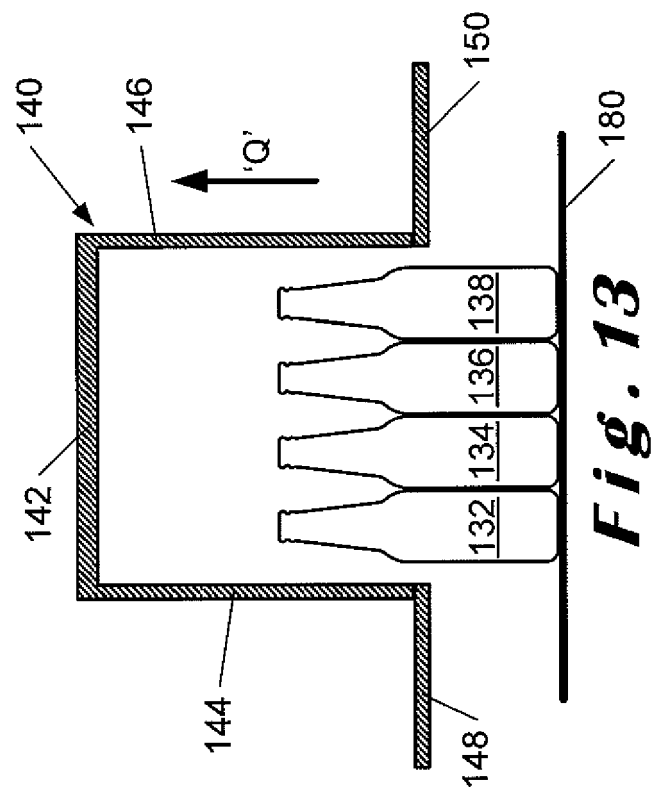


Fig. 8





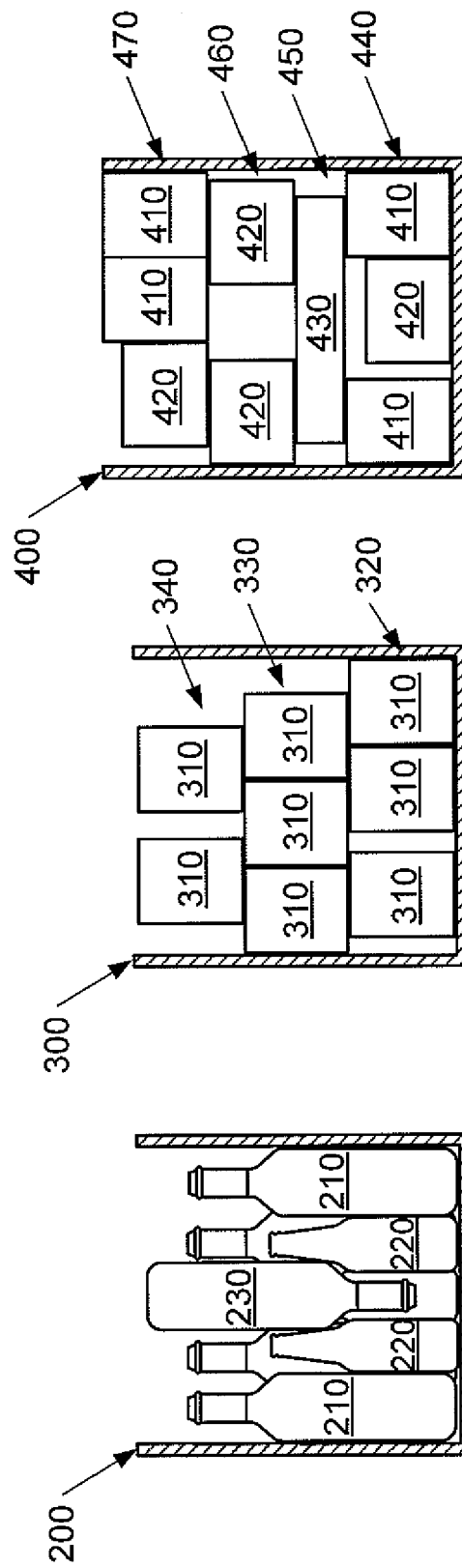


Fig. 17

Fig. 16

Fig. 15



EUROPEAN SEARCH REPORT

Application Number
EP 12 16 1362

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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