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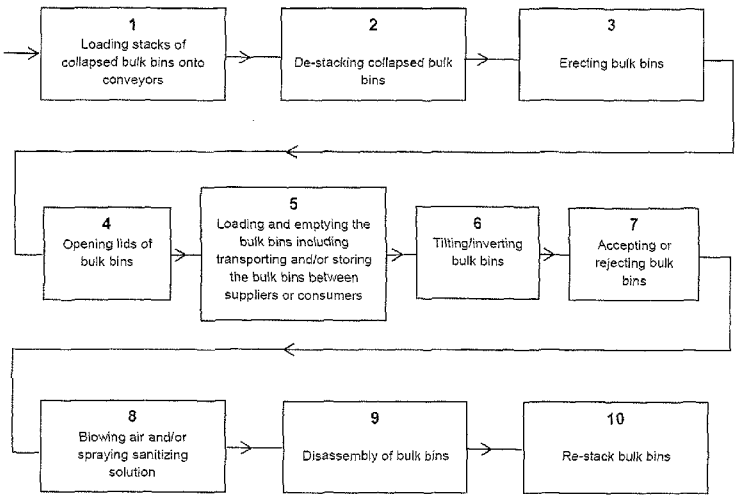
(54) **Title**: PROCESS AND APPARATUS FOR BULK BINS

FIGURE 1



(57) **Abstract**: The present invention relates to an automated process and apparatus for assembling bulk bins, having lids and a bag liner, from a collapsed orientation to an erected orientation. The process and apparatus is specifically adapted to allow the bulk bins to be assembled without the need for operating personnel to handle the bulk bins.

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PROCESS AND APPARATUS FOR BULK BINS

Field of the Invention

The present invention relates to a process and apparatus for handling stackable bulk bins. The present invention is particularly suited for preparing bulk bins that are moveable between an erect operative orientation and a collapsed orientation i.e., collapsible, and assemblable between collapsed and erect orientations. The bins also have a lid that can be opened and closed.

Background of the Invention

Bulk bins typically have a capacity in the range of 0.5 to 3 cubic metres and can be used for carrying a range of different materials including agricultural produce, mining materials and feedstock of manufacturing processes. The high value of bulk bins means that it is desirable on economic grounds to recycle the bulk bins between loading points and unloading points. One type of bulk bin that has gained wide acceptance is the knock-down bin which can be reused. A feature of the knock-down bin is that while in an erect orientation, the bin can be filled and transport items from a supplier to a consumer, and once the bin has been emptied by the consumer, the bin can be collapsed and transported back to the supplier in a space saving manner. The supplier is then responsible for erecting the bin and subsequent refilling. Knock-down bulk bins are generally of significant monetary value and may or may not include a bag liner that is discarded after each use, or on an as needs basis.

It is standard practice for bulk bins to be assembled and collapsed manually.

Summary of the Invention

The present invention relates to a process for handling stackable bulk bins that may be used for items including, but by no means limited to, plastic bottle preforms and bottle closures, wherein the bulk bins have at least one lid that can be opened and closed ,a bag liner having an entrance that is covered by the lid when closed, and the bulk bins are moveable (i.e. collapsible and assemblable) between an erected orientation and a collapsed orientation, and wherein the process includes the steps of:

a) de-stacking a stack of the bulk bins;

b) erecting the bulk bins from the collapsed orientation to an erect orientation after each respective bin has been de-stacked from the stack of bulk bins according to step a); and

c) opening a lid of the bulk bins to allow items to be loaded into the bag liner,

wherein steps a) to c) are carried out by automated machinery without personnel handling the bulk bins.

It is within the scope of the present invention that steps a) to c) may be carried out consecutively, simultaneously, or disjunctively. For example, the steps may be carried out consecutively on the same bin, or simultaneously on multiple bins.

In an embodiment, any one of more of steps a) to c) is carried out at any time on one bulk bin only i.e., different bins. For example, step a) may be carried out using automated de-stacking machinery that de-stacks one bulk bin at a time from a stack. Step b) may be carried out using automated erecting machinery that erects one bulk bin at a time, and step c) may be carried out using automated lid opening machinery that opens the lids of one bulk bin at a time.

Throughout this specification, the term "automated machinery" or components thereof such as automated de-stacking station and automated erecting station refers to machinery that can carried out a functional task with respect to the bulk bins without the steps being carried out manually or without the need for intervention or handling of the bin by personnel. For example, the automated de-stacking station and the automated erecting station can de-stack a stack of the bulk bins and erect bulk bins respectively without continuous monitoring, supervision or handling of the bins by operator personnel.

In an embodiment, the stack of bulk bins de-stacked in step a) are in a collapsed orientation.

In an embodiment, step a) includes separating the bulk bins from the bottom of the stack, and suitably separating the bottom bulk bin by lifting the second bottom bin (and any of the bulk bins stacked thereon) from the bottom bulk bin.

In an embodiment, the bulk bins include a base that is configured for receiving forktines of a forklift, a collapsible mechanism interconnecting the base and an upper assembly including the lid, and wherein step b) includes lifting the upper assembly by a lifting arm that engages the upper assembly and are driven upwardly and downwardly to operate the collapsible mechanism and, thereby move the bulk bins from the collapsed orientation to the erect orientation.

In an embodiment, step b) includes engaging the base using a retaining device that retains the base on a surface, such as a conveyor, while lifting the upper assembly. For example, the retaining device may engage sides of the base. In another example, the base may be configured with a sub-member and the retaining device passes over the sub-member which prevents the base from lifting upwardly. The sub-member may be an upper deck of the base of the bin, or part the lower deck of the base of the bin.

In an embodiment, the collapsible mechanism includes collapsible posts, each post having two or more members that move relative to each other. For example, the member may move telescopically relative to each other, or slidingly over one another.

In an embodiment, the collapsible mechanism of the bulk bins includes linkage members that are pivotally interconnected and collapse inwardly relative to an operative

position of the linkage members when the bulk bins are in an erect orientation and, step b) includes driving the linkage members toward the operative position by lifting the upper assembly to an extended position beyond the operative position, and thereafter lower the upper assembly so that the linkage members are positioned into an operative erect orientation. Suitably the bulk bins includes four pairs of linkage members, and the process includes driving each pair of linkage members toward, and into, the operative position by laterally moving members of the automated erecting station that move laterally to the direction of the movement of the linkage members. The process also includes preventing the linkage members from moving inwardly into a collapsing direction by the lateral moving member that can move laterally to the lifting arm.

In an embodiment, the collapsible mechanism includes a releasable lock for retaining the bulk bins in an erected orientation.

In an embodiment, the linkage members of the collapsible mechanism can be extended beyond their effective operative length and the releasable lock includes co-operating pairs of connector formations, and step b) includes lifting the upper assembly so as to space the co-operating pairs of connector formations one above the other when the collapsible mechanism is in the extended position and, thereafter lowering the upper assembly to the erected orientation in which the connector formations engage. Suitably, the pairs of connector formations include co-operating male and female formations such as pins received within an opening or slot.

The bulk bin may have bag liner that is supported or attached to either one or a combination of: i) the upper assembly, ii) the collapsible mechanism, or iii) the base of the bin. By way of example, a suitably bulk bin is described in the Australian provisional applications 2010903949 and 2011900160, the contents of which are hereby incorporated by express reference. The bulk bag is suitably attached to the upper assembly, and remains attached to the upper assembly while the bin is moved from an erect orientation to a collapsed orientation, and vice versa.

In an embodiment, the bulk bins include two lids having oppositely disposed hinges and step c) includes pivoting the lids in opposite directions from a closed position to an open position.

In an embodiment, a lid opening station for opening the lids includes mechanical arms that are pivotally mounted so as to move in an arc and the lids are opened by the arms engaging the lids and moving over an arc which causes the lids to open. Suitably, the arms include suction cups that communicate with a pneumatic suction line and step c) includes attaching the suction cups onto the lids by suction.

In an embodiment, the process includes as step d), excluding the bulk bins from loading with items when a fault condition of the bulk bin has occurred. Suitably, when the fault condition has occurred, step d) includes sending a signal to personnel so as to notify

that a condition has occurred. The fault condition of the bulk bin may relate to an error in the erection of the bulk bins or may relate to the structural worthiness of the bulk bins. In any event, examples of the conditions that may result in the bin being excluded from loading include:

- the bulk bin is not full erected,
- the bulk bin has been damaged, or
- the lid has not opened.

In an embodiment, step d) may be carried out by an optical instrument including an emitter and sensor, and the condition has been sensed when the sensor senses or does not sense a signal, such as a light emitted from the emitter.

In an embodiment, the automated erecting machinery includes an optical emitter and an optical sensor for optically scanning at least part of the bulk bin.

In an embodiment, the process includes loading the bulk bin with items. Once loaded, the bulk bin can be subjected to a number of different operations including transportation between sites, placed in storage and so forth. In all situations, loaded bulk bins may be stacked on one top of the other as desired.

The bulk bins may be unloaded into a tipping mechanism, such as a tipper hopper that inverts the bulk bin, and suitably inverts two or more bulk bins simultaneously. To attempt to empty all of the items from the bag liner of the bulk bin, suitably the tipping mechanism includes means for deforming or tension the bag liner to ensuring that the bag liner, and particularly the walls of the bag liner is free of pockets or overlapping sections that can trap items in the bag when being inverted by the tipped mechanism.

In an embodiment, the process includes a step of removing any residual items from the bulk bin once erected, for example, by inverting the bulk bin. Suitably, removing any residual items from the bag liner includes blowing a stream of gas at, or into, the bag liner to dislodge any residual items. Even more suitably, the stream of gas includes injecting one or more jets of air into the bag liner to dislodge any residual items. Removing any residual items from the bag liner may be carried out while the bulk bin is in the inverted position.

In an embodiment, the process includes spraying into the bulk bin a sanitising solution, such as chlorine containing solution. Spraying the sanitizing solution into the bulk bin may also help dislodge any residual items in the bulk bin, particularly while the bulk bin is in an inverted orientation.

When the bulk bin has been emptied, the process may also include closing the lids. The bulk bin may then be disassembled by being transformed into a collapsed orientation for stacking the collapsed bins one on top of the other. Collapsing the bulk bins may include lifting the upper assembly so as disengage connector formations of the collapsible mechanism, which may occur with or without holding the base, and moving the upper assembly toward the base. Suitably, the linkage members of the collapsing assembly are

moved inwardly in order to lower the upper assembly toward the base. During disassembly, the bag liner can be removed, but suitably remains attached to the upper assembly, and the entrance of the bag remain closed by the lid(s).

Once in a collapsed orientation, a fork lift or stacking device may be used to stack the bulk bins. For example, stacking the bulk bins may include lifting a bulk bin in a lifting station into a raised position, a conveyor conveying another bulk bin into the lifting station, lower the bulk bin from the raised position onto the other bulk bin, and thereafter raising the two bulk bins and repeating this sequence until a stack of the bulk bins has been formed. In this context, a stack of bulk bins may comprise any number of bins, and is suitably a stack of 4, 5, 6, 7 or more bins. The stack of bulk bins may then be conveyer away from the stacking device and returned to a production facility or sent to storage.

In an embodiment, the bulk bins are conveyed on a conveyor, such as a belt conveyor or a conveyor including a series of rollers during the process. Suitably, the conveyor transports the bulk bins between the stations that carry out the steps of the process.

The present invention also relates to an automated apparatus for preparing stackable bulk bins for loading with items, the bulk bins have at least one lid that can be opened and closed, a bag liner having an opening that is covered when the lid is closed, and the bulk bin is moveable (i.e., collapsible and can be assembled) between a collapsed orientation for stacking and an assembled operative orientation, and wherein the apparatus includes:

a de-stacking station that de-stacks a stack of bulk bins;

an erecting station that erects the bulk bins from the collapsed orientation to an erected orientation after each has been de-stacked in the de-stacking station; and

an opening station for opening the lid of the bulk bins in readiness for loading the bulk bins.

In an embodiment, the apparatus includes a tilting station for tilting the bin to emptying any items contained in the bulk bin. The tilting station may also have means for deforming or tension the bag liner to prevent pockets or overlapping sections being formed in the liner that could trap items in the bag when being tilted.

In an embodiment the de-stacking station includes:

a first lifting mechanism

that can engage the base of a second to the bottom bulk bin in a stack of bulk bins, and lift the stack of the bulk bins clear of the bottom bulk bin to separate the bottom bulk bin, and lower the stack of bulk bins, release the stack and re-engage the second from the bottom bulk bin.

In an embodiment the bulk bins include a base, an upper assembly to which the lids are mounted and a collapsible mechanism interconnecting the base and the upper assembly, and the erecting station includes:

a retainer for holding the base of the bulk bin,

a second lifting mechanism that is operable to lift the upper assembly of the bulk bins to an extended position beyond the normal operating position of the collapsible mechanism and lowering the collapsible mechanism into the operating position, and

a lateral moving member that moves laterally to the lifting arm to stabilise the collapsible mechanism while the collapsible mechanism is being lowered from the extended position to the operating position.

In an embodiment the lid opening station for opening the lids includes mechanical arms have suction cups connected to a pneumatic suction line for attaching the cups to the lids and the arms are operable to move in arc to open the lids.

In an embodiment the apparatus includes an optical instrument and an output of the optical instrument is used to assess the condition of the bulk bins in terms of whether the bulk bins are in the workable state or in state unfit for use.

In an embodiment the apparatus includes a tilting station for tilting the bins to emptying items contained in the bulk bin.

In an embodiment the tilting station includes nozzles supplying a gas stream at or into the bag liner of the bulk line to dislodge any residual items in the bulk bin.

In an embodiment the apparatus includes nozzles that the spray a sanitising solution onto the inside or outside of the bag liner.

In an embodiment, the apparatus includes a conveyor for conveying the bulk bins between at least the de-stacking station, the erecting station and the lid opening station, and convey a stack of the bulk bins to the first lifting mechanism and conveying separated bulk bins away from the first lifting mechanism.

The present invention also relates to an automated apparatus for preparing stackable bulk bins for loading with items, the bulk bins have at least one lid that can be moved between opened and closed positions, and are collapsible between an erect operative orientation and a collapsed orientation for stacking, and wherein the apparatus includes:

a stacking station for stacking a stack of bulk bins;

a de-erecting station for transforming the bulk bins from the collapsed orientation to an erected orientation; and

an closing station for closing the lid of the bulk bin in readiness for loading the bulk bin.

The apparatuses of the present invention may also include any one or a combination of the features of the process described above.

Brief Description of the Drawings

The present invention will now be described in more detail with reference to the accompanying drawings, of which:

Figure 1 is a block diagram of a process and apparatus for handling stackable bulk bins without the need for personnel handling the bulk bins according to an embodiment of the present invention;

Figure 2 is perspective view of an apparatus for carrying out some of the process steps shown in Figure 1;

Figure 3 is a perspective view of a stackable bulk bin without a bag liner in a collapsed orientation, and wherein the bulk bin is suitable for use process and apparatus shown in Figures 1 and 2;

Figure 4 is a perspective view of the stackable bulk bin shown in Figure 3 including a bag liner;

Figure 5 is a perspective view of the bulk bin shown in Figures 3 and 4 in an erected orientation, and the bulk bin has been fitted with a bag liner.

Detailed Description

Figures 1 and 2 illustrate a preferred embodiment of a process 40 and an apparatus 41 for preparing bulk bins for loading with items without the need for personnel handling the bulk bins. The process and apparatus 40, 41 are suitable for handling bulk bins that can be moved between an erected orientation for carrying items to be consumer, and a collapsed orientation in which the bulk bin can be stacked one on top of the other in a space saving manner, and returned to a supplier for filling with items. An example of a suitable bulk bin that can be used in the process and apparatus of a preferred embodiment of the invention is shown in Figures 3 to 5. However, it will be appreciated that a number of different types of collapsible bulk bins may be used by the process and apparatus of the present invention.

In the following text, reference numerals have been used to identify particular features shown in the Figures. In order to maintain clarity of the Figures, not all of the reference numerals have been included in each Figure as this could compromise the clarity of the Figure.

When the bulk bins are received by a supplier for refilling with items, the bins are usually received in a collapsed orientation and stacked, one on top of the other, in a stack 42 of 3 or more, and typically 5 or more. As shown in Figures 1 and 2, a number of steps are carried out on the stack of bulk bins in readiness for filling. Firstly, a stack of the bulk bins is loaded onto a conveyor 43 (step 1), typically comprising a conveyor belt, a series of horizontal rollers, or combination thereof. The bulk bins suitably have a base 12 that is

adapted for receiving forktines of a forklift and can be moved onto the conveyor by a forklift including a driverless forklift, or an overhead crane.

Once on the conveyor 43, the process involves de-stacking the stack of collapsed bulk bins in a de-stacking station 44 (step 2). Suitably, the de-stack station includes a first lifting mechanism that can engage the base 12 of the bulk bins. In operation, the first lifting mechanism engages the base 12 of the bulk bin that is second from the bottom of the stack of bulk bins. The first lifting mechanism then lifts the stack of bins free of the bottom bulk bin that is left on the conveyor 43. The separated bulk bin is then conveyed out of the de-stacking station 44, and suitably to an erecting station 45 by the conveyor 43. The first lifting mechanism then lowers the remaining stack of bulk bins onto the conveyor and disengages. The first lifting mechanism is then repositioned to engage what is now the second to the bottom bulk bin of the stack 42 of bins. The de-stacking sequence is then repeated by engaging the second from the bottom bulk bin, lifting the stack clear to separate the bottom bulk bin, conveying the separated bottom bulk bin out of the de-stacking station, lowering the remaining stack of the bins, and repositioning to engage the second to the bottom bulk bin in the remaining stack of bulk bins. In other words, the de-stacking step involves de-stacking the bulk bins, sequentially one after the other until the stack has been de-stacked, at which point, a new stack of bulk bins is conveyed into the de-stacking station.

Erecting the collapsed bulk bins (step 3) is carried out in the erecting station 45 that receives collapsed bulk bins from the de-stacking station 44 one after the other on a singular consecutive basis. The erecting station 45 suitably includes a retainer that holds a base 12 of the collapsed bulk bin and a second lifting mechanism that engages an upper assembly 10 of the bulk bin 9. The retainer may engage sides of the base of the bulk bin 9, or alternatively, in the situation in which base 12 of the bulk bin includes a upper and lower decks, the retainer may engage the lower deck to hold the base relative to the second lifting mechanism. The second lifting mechanism includes a pair of mechanical arms that engage the upper assembly 10 and that are driven upward and downward by a suitable actuator, such as a pneumatic or hydraulic piston and cylinder arrangement, or a gear and rack arrangement. By holding the base 12 and lifting an upper assembly 10 of the bulk bin 9 by the second lifting mechanism, a collapsible mechanism 13 of the bulk bin is operated and the bulk bin moves from the collapsed orientation to the erect orientation. Suitably, the second lifting mechanism lifts the upper assembly to an extended position beyond the normal erected position so as to locate connector formations for retaining the collapsible mechanism spatially apart, and suitably one above the other. Lowering the upper assembly by the second lifting mechanism then enables the connector formations to engage. For example, as can be seen in the case of the bulk bin in Figures 2 to 4, the connector formations may include pins 20 that are received by cut outs 21 when the upper assembly is

lowered from an extended position that is beyond the operative position to an operative position in which the pins 20 are received by the cut outs 21.

During or after lifting of the upper assembly 10, the erecting step may also include holding the collapsible mechanism by lateral bracing members that move laterally to the arms of the second lifting mechanism. The bracing members help to maintain the correct orientation of the collapsible mechanism of the bulk bin when the upper assembly is being lowered from beyond the operative position while the connector formation are inter-fitted.

The components of the erecting station, namely the retainer, second lifting mechanism and lateral moving members may then be disengaged from the erected bulk bin. Once erected, the bulk bin can then be conveyed to the next step of the process, namely an opening station 46 for opening the lids 11 of the bulk bin 9, and the next collapsed bulk bin is conveyed from the de-stacking station to the erecting station 45.

The lids 11 of the bulk bin 9 are then opened in the opening station 46 (in step 4). Suitably, the opening station 46 includes two pneumatic suction pads connected to suction lines that are mounted to two arms that move through an arc (or any other non-liner path) extending at least 270 degrees. The suctions pads form a temporary air seal on the lids 11 and are driven over the arc which causes the lids 11 to open.

Once opened, items can be loaded into the bin 9 as desired and the either transported from a supplier to a consumer, or held on site for use of the items on site at a later time. In any event, the process may include emptying the bins (step 5) using any suitable means including opening a lower flap in the bag to allow the items to flow out of the bin under gravity, or even tilting or inverting the bin, for example by means of an overhead crane, fork lift or alike. In one embodiment, a purposely constructed bin hopper having forks that are received between upper and lower and decks of the base of the bulk bin can be used for inverting or tilting the bulk bin. It is also possible that the items may be manually removed from the bin.

Any residual items in the bin can be emptied by tilting or inverting the bulk bin (step 6) at a tilting station. This step may be omitted if the bulk bins are used repeatedly for the same items on each return cycle. However, when the bulk bins are used for different items on different return cycles, for example, plastic bottle performs on one cycle and bottle closures on another, it can be important to ensure that the bins are empty to avoid contamination of the bins between cycles.

The process may include assessing the erected bulk bin (step 7) in checking station 47 and excluding the bin 9 from further use when a condition of the bulk bin 9 is detected, suitably a preselected faulty condition. Examples of faulty conditions of the bulk bin that may be detected include:

- the bulk bin is not full erected,
- the bulk bin has been damaged,

- the lid has not opened, or
- the bulk bin contains items after the bin should be completely emptied.

Suitably, an optical instrument including either one or a combination of a light emitter, light sensor, digital camera, or processor for conducting image analysis can be used to sense the condition of the bulk bin based on outputs of the emitter, sensor and digital camera. The failure in the condition of the bin may be the result of a failure in the process of erecting the bin, or failure in the physical construction of the bin. For example, the condition may be sensed, depending on the arrangement, when the sensor senses, or does not sense light emitted from the emitter.

The process may also include blowing air into the bulk bin (step 8), and bag liner of the bulk bin if present, so as to dislodge any residual items trapped in the bulk bin. In the situation in which the bulk bin includes a bag liner, the bag liner may also be deformed or tensioned to avoid the formation of pockets and alike that trap items.

Step 8 may also include spraying the inside of the bulk bin, or bag liner if present, with a suitable sanitizing solution.

Once the bulk bins have been loaded with items, the process also includes disassembling (de-erecting) the bulk bins (step 9). The disassembling step may essentially be a reverse of the erecting step described above. In the case of the bulk bin shown in Figures 3 to 5, the disassembly step may comprise, initially holding the base of the bulk bin and lifting the upper assembly of the bin so as to disengage the locking formations that hold the corner posts in a locked position. The posts can then be folded inwardly in to the position shown in Figures 3 and 4.

Finally, the process may include re-stacking the collapsed bulk bins (step 10) for returning or storage. The bins may stacked by a re-stacking station that includes the conveyor on which the bulk bins are fed consecutively into the stacker, and a lifting device that lifts and lowers a bulk bin that has previously entered the stacking station. When the lifting device has lowered the bins in the stacking device onto the bin in the station, the lifting device can then lift from the bottom bulk bin, so as to allow another bulk bin to enter into the station, following which the stack can be lowered to increase the stack by adding the lowest bulk bin to the stack. When the stack has reached the necessary height (or number of bins), the stack can be conveyed out of the stacker by the conveyor.

The present invention requires the steps 2, 3 and 4 of the process be carried out using automated machinery without the need for direct personnel handling the bulk bins. In the event of a malfunction of the processing line, it may be necessary for operator personnel to handle the bins. In addition, it also possible that any one or a combination of steps 1 and 5 to 10 be carried out using automated machinery, and that at least part of each of the steps 1 to 10 be carried using automated machinery. However, it will be appreciated that

components of step 5 of unloading the bulk bin could include an element of the personnel handling, for example, items contained in the bulk bin.

It will also be appreciated that operation of the process and apparatus can be controlled using any suitable controllers, computer processors, and alike.

An example of a collapsible bulk bin 9 suitable for use in the process or apparatus of the present invention is shown in Figures 2 to 4. Figure 3 illustrates the bulk bin 9 in a collapsed orientation and without a bag liner. Figures 4 and 5 illustrate the bulk bin 9 of Figure 3 fitted with a bag liner 50 and located in collapsed and erected orientations respectively.

The bulk bin 9 includes an upper assembly 10 having a pair of lids 11 that can be pivoted to open and close an entrance to a bag liner 50 of the bulk bin 9, a base 12, and a collapsible mechanism 13 that enables the bulk bin 9 to be moved between collapsed and erected orientations. The upper assembly 10 includes a square top frame 26 to which the lids 11 are mounted so as to pivot over approximately 270 degrees in the direction of the arrows A.

The base 12 includes an upper deck 14, lower deck 15 and pillars 16 between the upper and lower decks 14, 15. Forktines of a fork lift can be position between the upper and lower decks 14, 15 for lifting the bulk bins when empty or fully loaded.

The collapsible mechanism 13 includes four pairs of linkage members 17, wherein each pair forms a corner post when in the erected orientation. The pairs of linkage members 17 are pivotally interconnected, and pivotally connected to the base 12 and the upper assembly 10 The linkage members 13 fold inwardly to lower the upper assembly 10 toward the base 12, as shown in Figures 3 and 4, and when in this condition the bulk bins can be stacked one on top of the other. The pivot interconnection between the linkage members 17 includes a pin 18 and slot 19 arrangement, whereby the pin 18 slides in the slot 19 to facilitate extension of the corner posts beyond the normal operating length, and the operating length.

In addition, the collapsible mechanism includes a releasable retaining mechanism for retaining the bulk bins in an erected orientation. Specifically, the releasable retaining mechanism include co-operating pairs of lugs 20 and cut-outs 21 that inter-fit when the linkage members are in an operative upright orientation. During the erecting step, the upper assembly is lifted so as to extend the linkage members 17, beyond their effective operative length by pins 18 sliding to the lower end of the slots 19, and then the upper assembly is lowered so that the lugs 20 and cut-outs 21 inter-fit (as shown in Figure 5). Weight supported by the upper assembly helps to hold the lugs 20 within the cut-outs 21. During the erecting step, the erecting station includes bracing members that move laterally to the second lifting mechanism and prevent the linkage members 17 from pivoting inwardly during the lowering of the upper assembly 10 and inter-fitting of the lugs 20 and cut-outs 21.

The upper assembly 10 also includes cleats 22 projecting upwardly therefrom that are received by co-operation openings (not show in the Figures) in a bottom face of the base frame 22 when bulk bins are stacked one on top of the other.

The bulk bag liner 50 includes a base panel, four side wall panels extending upward from the base panel, and an annular portion or lip that extends about the top of the side wall panels. The annular portion is sandwiched between a rectangular top frame and orthogonal sections to secure the top of the bag liner to the top frame.

The bulk liner 50 bag may also include elastic straps, including a first elastic strap 51 that extends about the perimeter of the bulk bag at a height of approximately two thirds of the height of the side walls. A second elastic strap 52 is configured in a U-shape and extends down the side walls and underneath the base panel of the bag. The purpose of the elastic straps is that the first elastic strap 51 pulls the side walls of the bag liner inwardly and the second strap 52 pulls the base panel upwardly when emptied and when the bulk bin is lowered into a collapsed position.

The bag liner 50 is secured to the upper assembly 10 while the bilk bin 9 is moved between the collapsed and erected orientations and vice versa. Moreover, there is no need to detached the bag liner 50 from the bulk bin 9 while the bag liner 50 is in a working condition.

The liner bag 50 may be made of any suitable material including polymeric materials and in particular polypropylene. The inside and/or outside of the bag may be coating with a softer layer for product protection. The bulk bag may also be liquid impermeable to prevent leakage.

Although not shown in detail on the Figures, the bulk bin 9 may also include a latching device for releasably securing the lids in a closed position and an opened position. The latching device may include mechanical devices or co-operating pairs of magnets for securing the lids 27 in an opened or closed position. For example in one construction, a magnet may be mounted to the lid and a co-operating magnet to the top frame of the upper assembly for magnetically securing the lids in a closed position. A co-operating magnet may also be mounted to a part of the upper assembly between the top frame and the sub-structure so as to magnetically secure the lid when the lid is fully opened.

The upper assembly 10, base 12 and collapsible mechanism 13 of the bulk bin may be made of any suitable materials including plastics and composite materials. However, preferably, the framework is made from metallic materials such as aluminium or aluminium alloys and steel including food grade stainless steel. Each of the components of the framework may be made of the flat, tubular or even solid steel components and may be constructed using welding or suitable fasteners. Although not shown in detail in the Figures, suitably all welds are finished smooth and where possible, any gaps or holes in which material can be trapped are filled to reduce possible contamination risks.

It will be understood to persons skilled in the art of the invention that many modifications may be made without departing from the spirit and scope of the invention.

CLAIMS

1. A process for handling stackable bulk bins that can be used for items including, but by no means limited to, plastic bottle performs and bottle closures, wherein the bulk bins have at least one lid that can opened and closed, a bag liner having an entrance that is covered by the lid when closed, and the bulk bins are movable between an erected orientation and a collapsed orientation, and wherein the process includes the steps of:

a) de-stacking a stack of the bulk bins;

b) erecting the bulk bins from the collapsed orientation to an erect orientation after each respective bin has been de-stacked from the stack of bulk bins according to step a); and

c) opening a lid of the bulk bins to allow items to be loaded into the bag liner,

wherein steps a) to c) are carried out by automated machinery without personnel handling the bulk bins.

2. The process according to claim 1, wherein the stack of bulk bins de-stacked in step a) are in a collapsed orientation.

3. The process according to claim 1 or 2, wherein step a) includes separating the bulk bins from the bottom of the stack, and separating the bottom bulk bin by lifting the second from the bottom bulk bin.

4. The process according to any one of claims 1 to 3, wherein the bulk bins include a base that is configured for receiving forktines of a forklift, an upper assembly including the lid, and a collapsible mechanism interconnecting the base and the upper assembly, and wherein step b) includes lifting the upper assembly by a lifting arm that engages the upper assembly and is able to be driven upwardly and downwardly to operate the collapsible mechanism and, thereby move the bulk bins from the collapsed orientation to the erect orientation.

5. The process according to claim 4, wherein step b) includes engaging the base using a retaining device that holds the base on a surface while lifting the upper assembly.

6. The process according to claim 4 or 5, wherein the collapsible mechanism of the bulk bin includes collapsible posts, each post having two or more members that move relative to each other.

7. The process according to any one of claims 4 to 6, wherein the collapsible mechanism of the bulk bins include linkage members that are pivotally interconnected and

collapse inwardly relative to an operative position of the linkage members when the bulk bins are in an erect orientation and, step b) includes driving the linkage members toward the operative position by lifting the upper assembly to an extended position beyond an operative position, and thereafter lowering the upper assembly so that the linkage members are positioned into an operative erect orientation.

8. The process according to claim 7, wherein the linkage members are prevented from moving inwardly in a collapsing direction when the upper assembly is lowered from the extended position to the erected orientation.

9. The process according to claim 7 or 8, wherein the linkage members include a releasable lock having co-operating pairs of connector formations, and step b) includes lifting the upper assembly so as to space the co-operating pairs of connector formations one over the other when the collapsible mechanism is extended position, and thereafter lowering the upper assembly to the erected orientation in which the connector formations engage.

10. The process according to claim 9, wherein the connector formations includes a pin on one of the linkage members and an opening on the other pivotally connected linkage member, and the opening receives the pin when lowered which prevents the linkage members from pivoting into the collapsed position.

11. The process according to any one of claims 4 to 10, wherein the bulk bag is attached to the upper assembly while the bin is moved from an erect orientation to a collapsed orientation, and vice versa.

12. The process according to any one of claims 1 to 11, wherein the bulk bins include two lids having oppositely disposed hinges and step c) includes pivoting the lids in opposite directions from a closed position to an open position.

13. The process according to any one of claims 1 to 12, wherein the lids are opened according to step c) by mechanical arms that are pivotally mounted so as to move in an arc and the mechanical arms have suction cups that communicate with a pneumatic suction line and step c) includes attaching the suction cups onto the lids by suction and moving the arms once the suction cups are attached to open the lids.

14. The process according to any one of claims 1 to 13, wherein the process includes as step d), excluding the bulk bins from further use in the process when a preselected fault condition of the bulk bin has occurred.

15. The process according to claim 14, wherein the preselected fault condition of the bulk bins relates to an error in the erection of the bulk bins, or the structural worthiness of the bulk bins.

16. The process according to any one of claims 1 to 15, wherein the process includes unloading items from the bulk bin by tilting the bin or opening an openable flap in a lower section of the bag liner.

17. The process according to claim 16, wherein the process includes a step of removing any residual items from the bulk bin, once erected, by inverting the bulk bin.

18. The process according to claim 17, wherein the process includes blowing a stream of gas at, or into, the bag liner to dislodge any residual items.

19. The process according to any one of claims 1 to 18, wherein the process includes spraying a sanitizing solution onto, or into, the bag liner.

20. The process according to any one of claims 1 to 19, wherein the process includes disassembling the bulk bins, once emptied, by extending the collapsible mechanism beyond the normal operating position to disengage the connector formations, and thereafter collapsing the collapsible mechanism.

21. The process according to claim 20, wherein the disassembled bulk bins are stacked by lifting a collapsed bulk bin into a raised position, conveying another bulk bin beneath the raised bulk bin, lowering the bulk bin from the raised position onto the other bulk bin, and thereafter raising the two bulk bins and repeating this sequence until a stack of the bulk bins has been formed.

22. An automated apparatus that prepares stackable bulk bins for loading with items without the need for personnel handling the bulk bin, the bulk bins having at least one lid that can be opened and closed, a bag liner having an opening that is covered when the lid is closed, and the bulk bins are moveable (i.e., collapsible and assemblable) between a collapsed orientation for stacking and an assembled operative orientation, and wherein the apparatus includes:

a de-stacking station that de-stacks a stack of the bulk bins;

an erecting station that erects the bulk bins from the collapsed orientation to an erected orientation after each has been de-stacked in the de-stacking station; and

an opening station for opening the lids of the bulk bins in readiness for loading the bulk bins.

23. The apparatus according to claim 22, wherein the de-stacking station includes:

a first lifting mechanism that can engage a second to the bottom bulk bin in a stack of bulk bins, and lift the stack of the bulk bins clear of the bottom bulk bin to separate the bottom bulk bin, a conveyor to convey the separate bottom bulk bin, after which the first lifting mechanism can lower the stack of bulk bins, release the stack and re-engage the new second bulk bin from the bottom bulk bin.

24. The apparatus according to claim 22 or 23, wherein the bulk bins include a base, an upper assembly to which the or each lid is mounted and a collapsible mechanism interconnecting the base and the upper assembly, and the erecting station includes:

a retainer for holding the base of the bulk bin,

a second lifting mechanism that is operable to lift the upper assembly of the bulk bins to an extended position beyond the normal operating position of the collapsible mechanism and lowering the collapsible mechanism into the operating position, and

a lateral moving member that moves laterally to the lifting arm to stabilise the collapsible mechanism while the collapsible mechanism is being lowered from the extended position to the operating position.

25. The apparatus according to any one of claims 22 to 24, wherein the lid opening station includes a mechanical arm have suction cups connected to a pneumatic suction line for attaching the cups to the or each lid and the arms are operable to move in arc to open the or each lid.

26. The apparatus according to any one of claims 22 to 25, wherein the apparatus includes an optical instrument and an output of the optical instrument is used to assess the condition of the bulk bins in terms of whether the bulk bins are in the workable state or in state unfit for use.

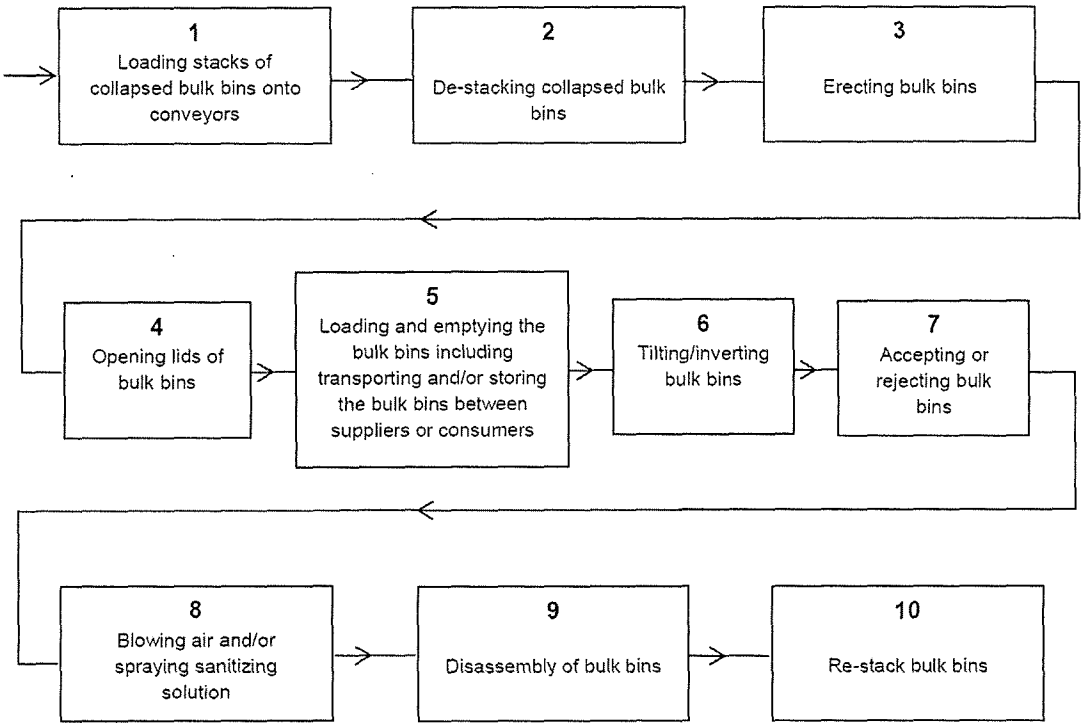
27. The apparatus according to any one of claims 22 to 26, wherein the apparatus includes a tilting station for tilting the bins to emptying items contained in the bulk bin.

28. The apparatus according to claim 27, wherein the tilting station includes nozzles supplying a gas stream at, or into, the bag liner of the bulk line to dislodge any residual items in the bulk bin.

29. The apparatus according to any one of claims 22 to 28, wherein the apparatus includes nozzles that spray a sanitising solution onto the inside or outside of the bag liner.

30. The apparatus according to any one of claims 22 to 29, wherein the apparatus includes a conveyor for conveying the bulk bins between at least the de-stacking station, the erecting station and the lid opening station, and convey a stack of the bulk bins to the first lifting mechanism and conveying separated bulk bins away from the first lifting mechanism.

FIGURE 1


1
Loading stacks of collapsed bulk bins onto conveyors
2
De-stacking collapsed bulk bins
3
Erecting bulk bins
4
Opening lids of bulk bins
5
Loading and emptying the bulk bins including transporting and/or storing the bulk bins between suppliers or consumers
6
Tilting/inverting bulk bins
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Accepting or rejecting bulk bins
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Blowing air and/or spraying sanitizing solution
9
Disassembly of bulk bins
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Re-stack bulk bins

FIGURE 2

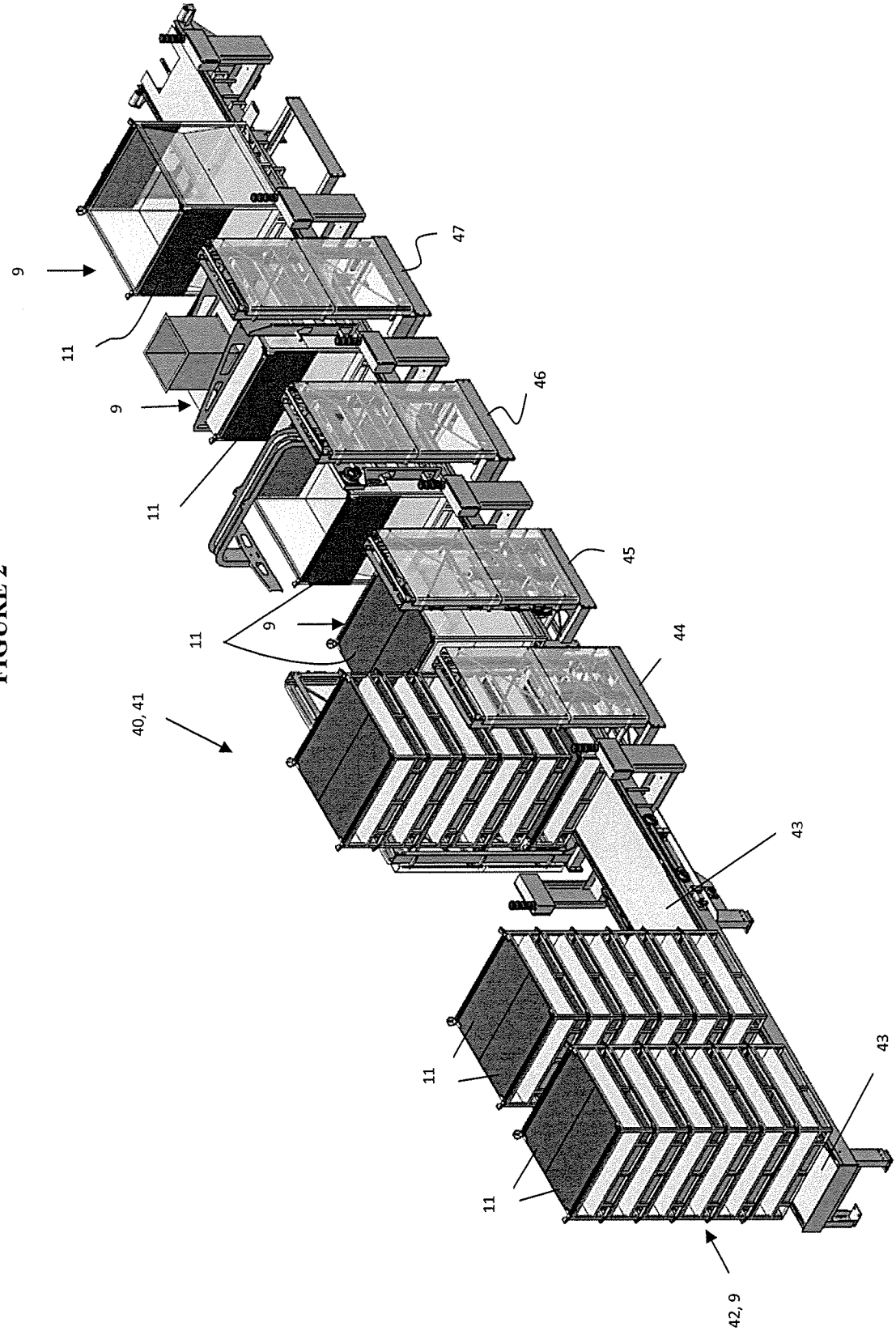


FIGURE 3

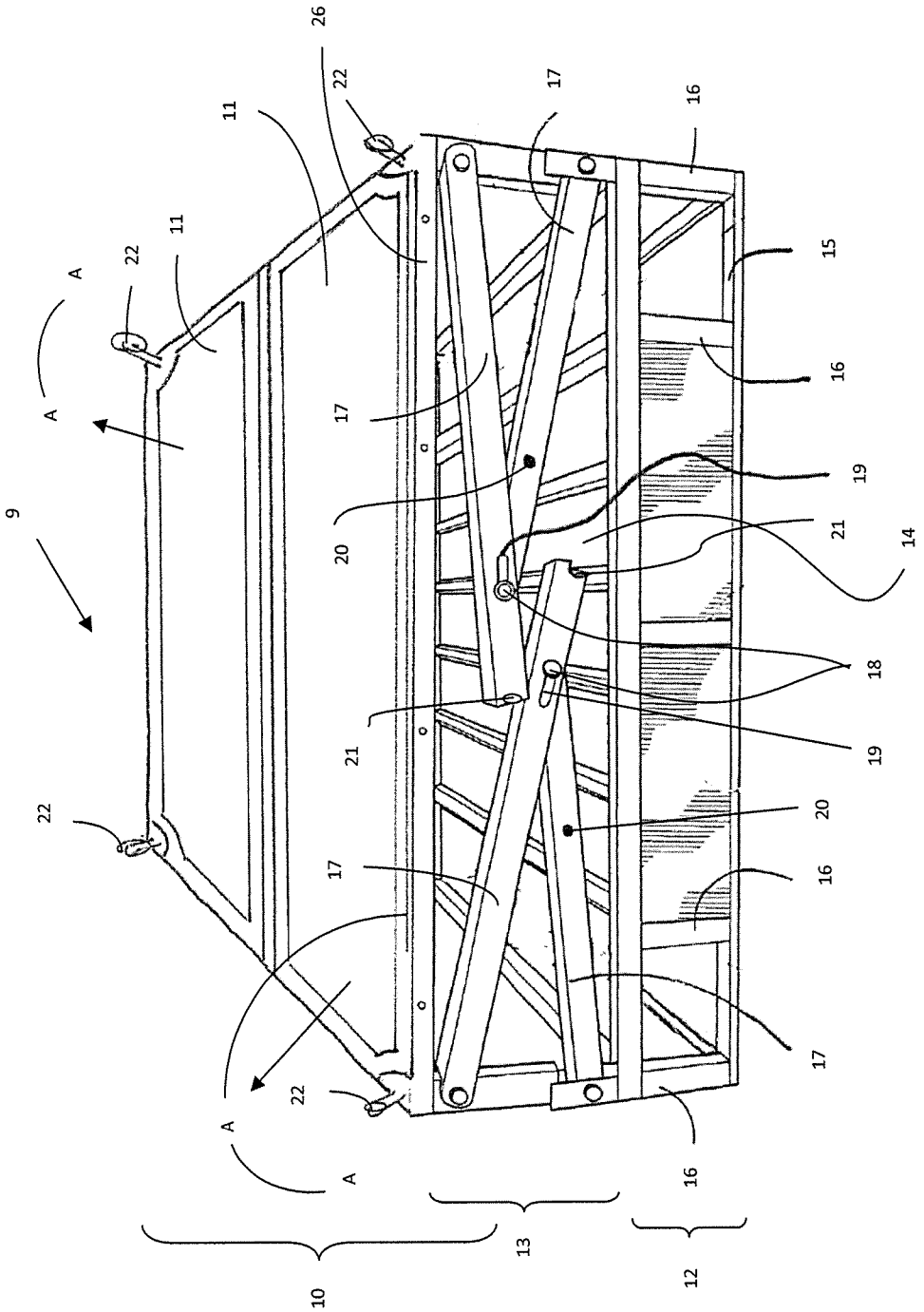


FIGURE 4

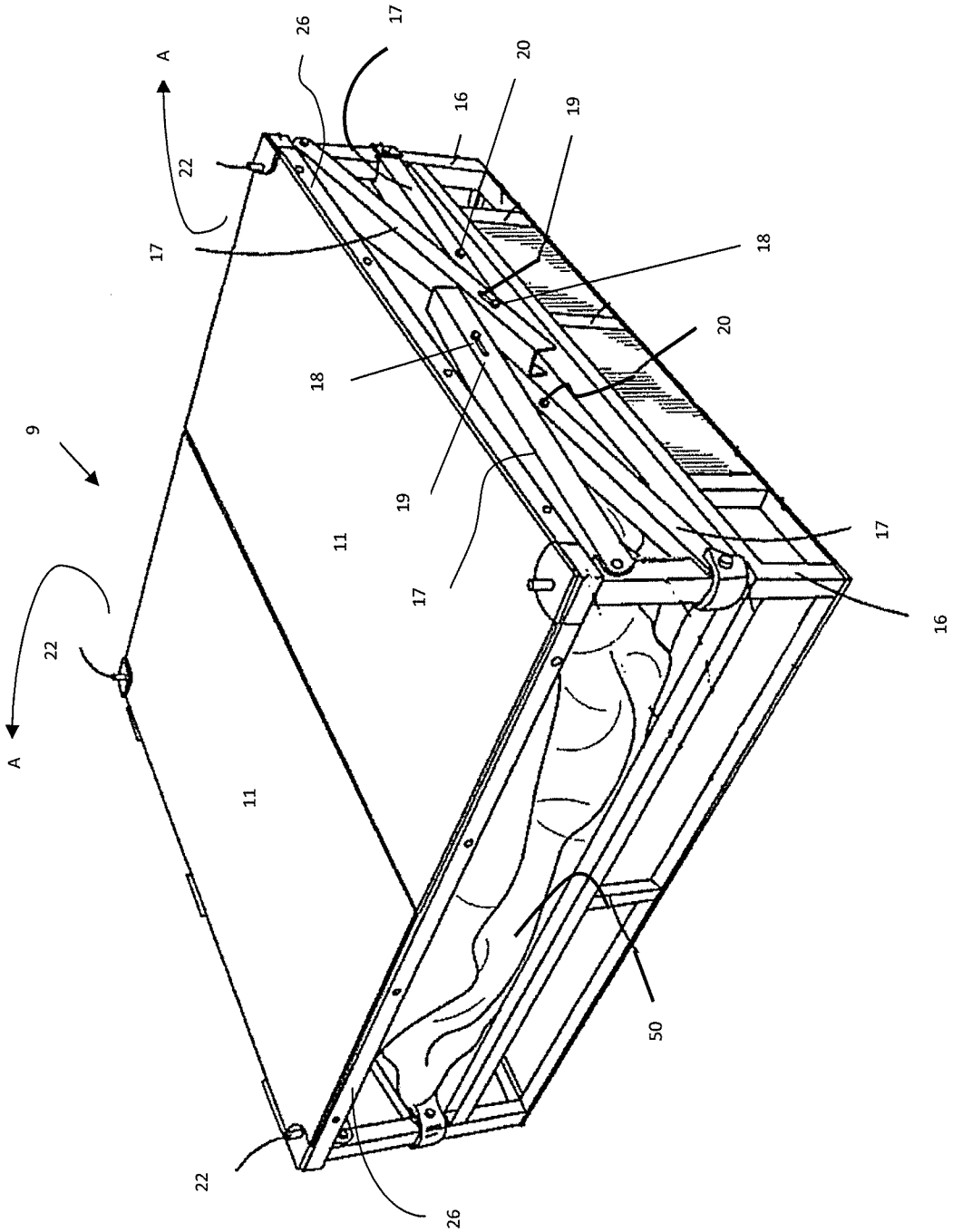
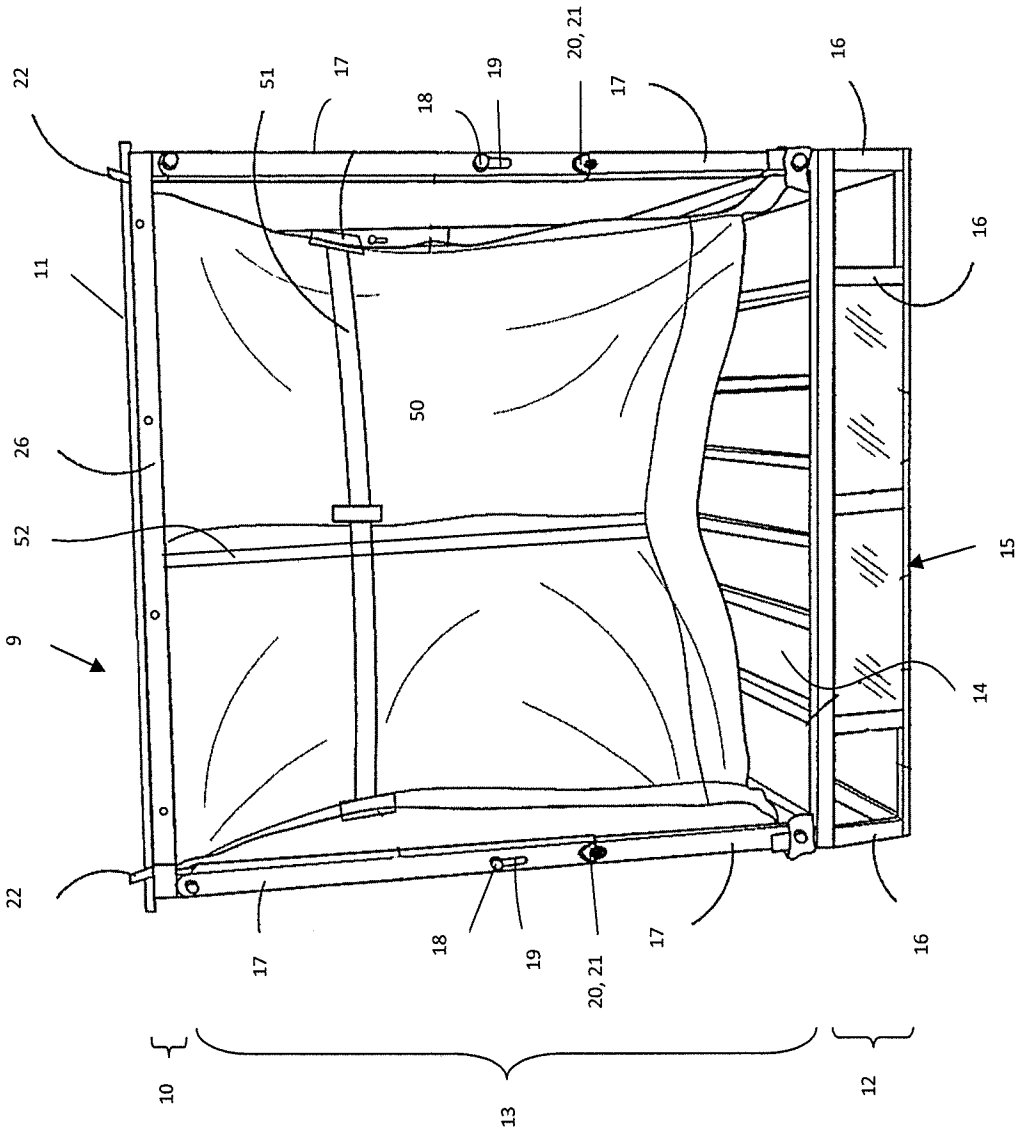


FIGURE 5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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2012/000165

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

B65D 21/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC & WPI: B65D 21/00 and key words: liner, collapse and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	US 2012/0012492 A1 (DARDEN) 19 January 2012-04-21 Whole document particularly abstract; all claims; all figures	1-12, 14-17, 20-24, 27
X	US 3921897 A (NOYES ET AL) 25 November 1975 Whole document particularly abstract; Figures 1-13; all claims	1-6, 11-21
A	GB 1314148 A (AB AKERLUND & RAUSING) 18 April 1973 Whole document	

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 May 2012	11 May 2012
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **SANTOSH GUPTA** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 7947

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/AU2012/000165**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	2012012492	WO	2011159979				
US	3921897	NONE					
GB	1314148	BE	781937	CH	550701	DE	2212213
		FR	2133727	NL	7204835		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX