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(54) **A REFUSE COLLECTION VEHICLE, METHOD OF OPERATING A REFUSE COLLECTION VEHICLE AND METHOD OF DISCHARGING REFUSE FROM A REFUSE COLLECTION VEHICLE**

(57) The present invention is directed towards a refuse collection vehicle (200) comprising at least an upper refuse compartment (120) situated above a lower refuse compartment (201). The lower refuse compartment (201) partially houses a ram compaction assembly (216) such that a portion (220) of the ram compaction assembly (216) protrudes into the upper refuse compart-

ment (120) when the ram compaction assembly (216) is in normal use. The ram compaction assembly (216) is moveable so as to no longer protrude into the upper refuse compartment (120) when so desired; this may be as it is desired to discharge refuse from the upper refuse compartment (120). The ram compaction assembly (216) comprises a substantially vertically orientated ram (220).

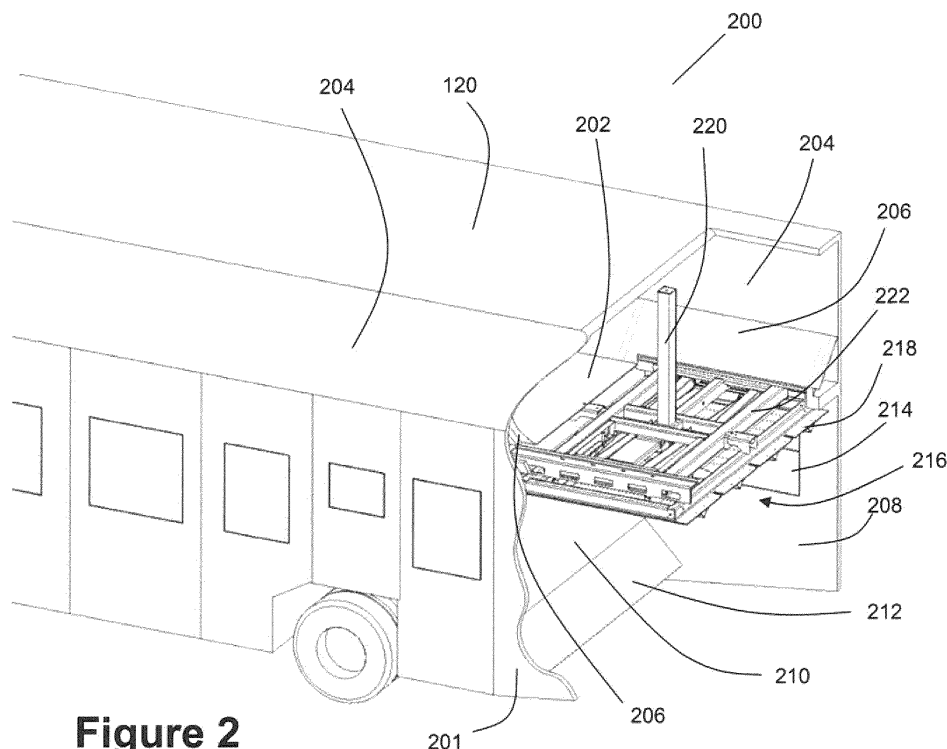


Figure 2

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Description

[0001] This invention relates to a refuse collection vehicle and method of collecting and discharging refuse from a refuse collection vehicle. The present invention is further directed towards a compactor assembly for use in a refuse collection vehicle.

[0002] Throughout this specification, the term "refuse" shall be understood to encompass any type of materials which have been disposed of for recycling and/or dumping. Particular reference has been made throughout this specification to the term "cardboard" as a specific type of refuse which the present compactor assembly invention is particularly adept at handling; however, it will be readily appreciated that various other types of papers, plastics and the like can also be handled by the compactor assembly and the scope of the invention is envisaged to cover many different refuse types and should not be seen to be limited to cardboard.

[0003] In this specification the term "wheeled chassis" includes not just simply a trailer mounted on wheels for towing behind a vehicle, but also a vehicle itself and any other form of transporting device or equipment. Indeed, one could well envisage situations where the chassis would not have wheels would simply be loaded on an off a transport vehicle while resting on skids. However, in general the chassis would be wheeled trailers or vehicles. Thus, the term "wheeled chassis" must be accorded the widest possible interpretation.

[0004] Additionally, in this specification, the terms "distal" and "proximal" are essentially used for convenience and do not, strictly speaking, in any way limit the invention in the sense that something should always be at one particular end of a vehicle or container.

[0005] The type of refuse collection vehicle which will be used in this invention shall be a multi-compartment refuse collection container which is mounted on a wheeled chassis. An example of such a refuse collection vehicle is shown in Figure 1 and furthermore European Patent Application Number EP11166128.6 discloses such a type of refuse collection vehicle.

[0006] Referring to Figure 1, such a vehicle is generally indicated by reference numeral 100 and the refuse collection vehicle typically comprises a plurality of side-by-side in-line refuse receiving compartments 102, 104, 106, 108, 110, 112 mounted along the wheeled chassis 114 from a proximal end 116 to a distal end 118 of the chassis 114. Such side-by-side in-line refuse receiving compartments 102, 104, 106, 108, 110, 112 are well known and will not be detailed further for the sake of brevity. An enclosed upper compartment 120 is provided and the upper compartment 120 extends over some or all of the side-by-side in-line refuse receiving compartments 102, 104, 106, 108, 110, 112 from adjacent the proximal end 116 to the distal end 118 of the chassis 114. A cardboard compartment 122 is also provided and is situated at a distal end 118 of the chassis 114.

[0007] The enclosed upper compartment comprises a

discharge door 124 at the distal end 118 of the chassis 114 of the refuse collection vehicle 100. European Patent Application Number EP11166128.6 discloses a specific scissors lift mechanism for moving refuse into the upper compartment. When the refuse in the upper compartment 120 is to be discharged, the discharge door 124 is opened and means (not shown) for forcing the refuse out through the discharge door 124 is employed. Such means may be a ram connected to an associated moveable discharge plate which pushes refuse along the upper compartment 120 towards the discharge door 124 and ultimately out through the discharge door 124.

[0008] The discharge door 124 of the upper compartment 120 is located above a discharge door 126 of the cardboard compartment 122.

[0009] The refuse collection vehicle 100 will comprise a number of compacting devices to facilitate crushing and compacting of refuse, which if not compacted would occupy too large a volume in one or more of the compartments 102, 104, 106, 108, 110, 112, 120, 122. This is particularly the case with cardboard as the cardboard is oftentimes not shredded and can contain a considerable amount of voids. An example of an article of cardboard refuse which suffers from this issue is cardboard boxes, which even when squashed down a bit will still contain large voids. Thorough and substantially complete compaction of such cardboard refuse is necessary in order to maximise the carrying capacity of the cardboard compartment 122.

[0010] In prior art refuse collection vehicles, where there is an upper compartment, the compaction mechanism, which is usually a ram, used in the cardboard compartment must be situated and arranged so as not to impede the discharge of refuse from the upper compartment. It will be appreciated that as the compaction mechanism for the cardboard compartment must sit above the collection area in the cardboard compartment, the compaction mechanism will usually protrude into the upper compartment area and if it is not situated appropriately, then the compaction mechanism will form an impediment to the discharge of refuse from the upper compartment.

[0011] In order to avoid causing an obstruction, a pair of rams are normally used, with each ram being positioned off to each side of the upper compartment adjacent the pair of side walls of the upper compartment. The rams may be angled to extend inwardly away from the side walls when operated. A pair of rams are used so as to create an even downward pressure on the compaction plate attached to the rams which is forced downward within the collection area of the cardboard compartment. It is undesirable for an uneven force to be applied, as this may cause the compaction plate to become slanted and this will cause the compaction plate to become less effective at providing a thorough and substantially complete compaction of the cardboard in the collection area of the cardboard compartment. By applying a force on each side of the compaction plate, an even force can be applied and the rams can be controlled to ensure the

compaction plate remains in a substantially horizontal position during lowering for compaction of the cardboard.

[0012] The use of two rams is undesirable as this increases the complexity of the construction of the compaction assembly. The build costs and maintenance costs are higher as a result of having to use two rams. It is generally desirable to use a single compaction ram in place of the pair of rams described above. However, the use of a single compaction ram is problematic as it must be situated substantially in the centre of the compaction plate to avoid an offset forces being applied to the compaction plate which would encourage slanting and skewing of the compaction plate. When situated in the a central location above the compaction plate, the single ram must also extend and retract along a substantially vertical plane, so the compaction ram housing for the compaction ram will depend upwardly into the upper compartment in a central location which will be substantially equidistant from the side walls of the upper compartment. This clearly causes an impediment to the discharge of refuse from the upper compartment through the upper compartment discharge door.

[0013] An alternative method of providing the compaction assembly but avoiding causing an obstruction in the upper compartment is to use a horizontally mounted ram which opens and closes a scissor mechanism. The horizontally mounted ram is connected between upper ends of the arms of the scissors mechanism such that by fully extending the ram, the upper ends of the cross-linked arms of the scissors mechanism are pushed away from each other and the scissors mechanism is folded. And, when the scissor mechanism is to be extended and cause a compaction plate to be pushed down, the ram is retracted and the upper ends of the arms are brought relatively close together and the scissor mechanism is opened up. This arrangement of a single horizontally mounted ram allows the compactor plate assembly to have a relatively low profile when closed. However, a disadvantage of this type of ram arrangement is that there is uneven compaction force throughout the stroke of the compactor due to the angle of the ram relative to the scissor arm mechanism. When the compactor is compacting from its closed state, the angle of the scissor arms relative to the horizontally mounted ram is small, which is to say that the cross-linked arms of the scissor mechanism are close to horizontal and this results in a relatively weak vertical compacting force being transferred through the compaction plate. When the scissor mechanism is more open, the angle of the ram relative to the scissor arms is larger, giving a larger vertical compacting force. The difference in compacting force from closed position to open position can be substantial, and a difference of up to 1000% has been observed. This inconsistent compaction force is undesirable.

[0014] Further alternative methods of providing a compaction arrangement, which does not cause an obstruction in an upper refuse compartment, include compaction plates which move horizontally but this is not ideal as the

cardboard will typically lie flat in the compartment under gravity and the stacked up in this manner. A horizontally moving compaction plate, or set of compaction plates, will move orthogonally to the natural position of the cardboard in the cardboard compartment.

[0015] It is a goal of the present invention to provide a method and apparatus that overcomes at least one of the above mentioned problems.

10 Summary of the Invention

[0016] The present invention is directed to a refuse collection vehicle comprising at least an upper refuse compartment situated above a lower refuse compartment, whereby the lower refuse compartment partially houses a ram assembly such that a portion of the ram assembly protrudes into the upper compartment when the ram assembly is in normal use; the ram assembly being moveable so as to no longer protrude into the upper compartment when so desired.

[0017] The advantage of providing the refuse collection vehicle of this type is that the ram can protrude into an upper refuse compartment during filling activities (for example), but can be lowered out of the way during discharging activities (for example). The ram is selectively allowed to protrude into the upper compartment, when this is suitable for the refuse vehicle operator's requirements and needs, but can also be moved to no longer protrude into the upper compartment when this is suitable for the refuse vehicle operator's requirements and needs.

[0018] In a further embodiment, the ram assembly is a compaction ram assembly. Better compaction can be achieved by a ram which extends into the upper compartment; however this may cause issue as the ram will become an obstacle in the upper compartment and therefore engineering the ram assembly so as to be moveable so as to no longer protrude into the upper compartment when so desired is very advantageous.

[0019] In a further embodiment, the ram assembly is moved so as to no longer protrude into the upper compartment when it is desired to discharge refuse from the upper compartment.

[0020] In a further embodiment, the ram compaction assembly comprises a substantially vertically orientated ram.

[0021] The advantage of providing the refuse collection vehicle of this type is that a vertically orientated ram can be used as this is best for evenly distributing pressure on a compaction plate; and, the vertically orientated/mounted ram can protrude into an upper refuse compartment during filling activities, but can be lowered out of the way during discharging activities, so as not to be an obstacle in the upper compartment during refuse discharge from the upper compartment.

[0022] In a further embodiment, the ram assembly comprises a ram housed in a ram housing, whereby the ram housing comprises a flanged end which engages against a flange lock such that the flange lock holds the

ram housing in place protruding into the upper compartment when the ram assembly is in normal use.

[0023] In a further embodiment, the flange lock is remotely actuatable.

[0024] In a further embodiment, the ram housing is slidably mounted within slides on a support framework which is situated intermediate the upper compartment and the lower compartment.

[0025] In a further embodiment, the ram assembly raises and lowers a compaction plate which is located within the lower refuse compartment.

[0026] The present invention is further directed towards a method of discharging refuse from an upper compartment of a collection vehicle, where the refuse collection vehicle comprises at least an upper refuse compartment situated above a lower refuse compartment and the lower refuse compartment partially houses a substantially vertically mounted ram compaction assembly which protrudes into the upper refuse compartment when in normal use, the method comprising the steps of: activating the ram compaction assembly so as to lower a compaction plate to its lowered position; opening a flange lock which holds the ram compaction assembly in its normal operating position which protrudes into the upper refuse compartment; with, the ram compaction assembly being lowered into the lower refuse compartment so as to leave the upper refuse compartment substantially clear of obstacles and allow refuse in the upper refuse compartment to be discharged.

[0027] The advantage of providing the above method is that the compaction ram can protrude into an upper refuse compartment during filling activities, but can be lowered out of the way during discharging activities. A vertically mounted ram can be used as this is best for evenly distributing pressure on the compaction plate.

[0028] The present invention is further directed towards a method of operating a refuse collection vehicle, where the refuse collection vehicle comprises at least an upper refuse compartment situated above a lower refuse compartment and the lower refuse compartment partially houses a ram assembly which protrudes into the upper refuse compartment when in normal use, the method comprising the steps of: activating the ram assembly to extend a piston rod of the ram assembly into a lowered position; and, lowering the ram assembly into the lower refuse compartment such that the ram assembly no longer protrudes into the upper refuse compartment.

[0029] In a further embodiment, the method of the present invention further comprising the step of activating the ram compaction assembly to extend the piston rod of the ram assembly into the lowered position so as to lower a compaction plate to its lowered position.

[0030] In a further embodiment, the method further comprising the step of prior to lowering the ram assembly into the lower refuse compartment, opening a lock which holds the ram assembly in its normal operating position.

[0031] In a further embodiment, the method further comprising the step of prior to lowering the ram assembly

into the lower refuse compartment, opening a flange lock which is engaged against a flange plate of the ram assembly and holds the ram assembly in its normal operating position.

[0032] In a further embodiment, the method further comprising the step of lowering the ram assembly into the lower refuse compartment such that the ram assembly no longer protrudes into the upper refuse compartment so as to leave the upper refuse compartment substantially clear of obstacles and allow refuse in the upper refuse compartment to be discharged.

[0033] The present invention is further directed towards a compaction ram comprising a piston rod and associated ram cylinder housed within a ram compaction housing, whereby the ram compaction housing comprises a flanged end plate; the flanged end plate comprising a ram extension port and a ram retraction port which are both suitable to connecting to a fluid to actuate the extension and retraction of the piston rod within the ram cylinder, such that, a tube connects one of the ram extension port and the ram retraction port with an upper end of the ram cylinder which is distal to the flanged end plate.

[0034] The advantage of providing a compaction ram of this design is that the ram and associated tube(s) is contained within the housing and the entire compaction ram can be lowered as a component. In this manner, the compaction ram can protrude into an upper refuse compartment during filling activities, but can be lowered out of the way during discharging activities.

[0035] In a further embodiment, the tube connecting one of the ram extension port and the ram retraction port with an upper end of the ram cylinder is also housed within the ram compaction housing.

[0036] The present invention is further directed towards a method of activating the compaction ram in a refuse collection vehicle so as to hold and retain compacted cardboard in its compacted state when the refuse collection vehicle travels above a preset speed threshold. In a further embodiment, the preset speed threshold is 20 mph. Of course, it will be appreciated that this preset speed threshold may be set to any speed desired.

[0037] In a further embodiment, the compaction ram will be activated to lower the compaction plate for a period of time at a certain pressure, and, after the compaction ram has been activated for the period of time, it is then held in the lowered position to retain and hold the cardboard. It thus prevents vibrations from encouraging the compacted cardboard to return towards its original uncompacted shape. In a further embodiment, the compaction ram may be raised when the speed of the refuse collection vehicle drops below the preset speed threshold, or drops below the preset speed threshold for a period of time, and/or is based on when the operator of the refuse collection vehicle opens a door of the refuse collection vehicle, and/or is based on when the operator of the refuse collection vehicle opens a loading hatch of the refuse collection vehicle.

Detailed Description of Embodiments

[0038] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a refuse collection vehicle in accordance with the prior art;

Figure 2 is a perspective view of a distal end of a refuse collection vehicle in accordance with the present invention, whereby a cut-away section shows a compaction assembly in accordance with the present invention;

Figure 3a is a perspective view of a compaction ram in accordance with an embodiment of the present invention showing a ram housed within an outer compaction ram housing;

Figure 3b is a perspective view of the compaction ram of Figure 3a;

Figure 4a is a perspective view the refuse collection vehicle of Figure 2, whereby a compaction plate which forms part of the compaction assembly is fully extended;

Figure 4b is a perspective view the refuse collection vehicle of Figure 2, whereby a compaction ram housing which forms part of the compaction assembly is partially lowered;

Figure 4c is a perspective view the refuse collection vehicle of Figure 2, whereby the compaction ram housing is fully lowered;

Figure 5a is a rear view of the distal end of the refuse collection vehicle of Figure 2, whereby a cut-away section shows a compaction plate of the compaction assembly in a fully raised position;

Figure 5b is a rear view of the refuse collection vehicle of Figure 5a, with the compaction plate in a fully lowered position with the housing lock closed;

Figure 5c is a rear view of the refuse collection vehicle of Figure 5a, with the compaction plate in a fully lowered position with the housing lock opened;

Figure 5d is a rear view of the refuse collection vehicle of Figure 5a, with the compaction plate in a fully lowered position with the housing lock opened and the compaction ram housing partially lowered; and,

Figure 5e is a rear view of the refuse collection vehicle of Figure 5a, with the compaction plate in a fully

lowered position with the housing lock opened and the compaction ram housing fully lowered.

[0039] Referring to Figure 2, there is provided a refuse collection vehicle indicated generally by reference numeral 200. The refuse collection vehicle 200 is largely similar to the prior art refuse collection vehicle 100 shown in Figure 1 in terms of the side-by-side in-line refuse receiving compartments 102, 104, 106, 108, 110, 112 and the upper compartment 120. The cardboard compartment 201 of the present invention is different to the cardboard compartment 122 as is known from the prior art.

[0040] The refuse collection vehicle 200 comprises a cardboard compartment 201 which partly houses a compaction assembly indicated generally by reference numeral 216. The compaction assembly 216 is substantially vertically mounted so as to be substantially vertically orientated when protruding into the upper compartment 120. The cardboard compartment 201 comprises a floor (not shown), an inclined rear portion 212, a rear wall 210, a side wall 208 comprising a cardboard compartment access flap 214. The compaction assembly comprises a compacting plate 218 which is mounted to a support framework 222 by way of a support scissors mechanism (not shown) and is raised and lowered by an actuating compaction ram 220. It will be appreciated that alternative compacting plate 218 mounting means may be used; for example, the compacting plate 218 may run on guide rails which are located on side walls 208 of the cardboard compactor 201. Alternatively, the compacting plate 218 may float within the cardboard compactor 201 and not have any guiding or support frames connected to it. Other mounting means known in the art are also considered to form part of the present invention.

[0041] A cardboard compartment discharge door (reference 128 in Figure 1) is hingedly attached to the distal end of the refuse collection vehicle 200. The floor (not shown), or a portion of the floor, may form part of the hinge mounted discharge door so as to form a cantilevered L-shaped rear discharge door.

[0042] The upper compartment 120 comprises a floor 202, upright side walls 204 and inclined side walls 206. An upper compartment discharge door (reference 124 in Figure 1) is opened to allow refuse to be pushed along the floor 202 and become discharged from the refuse collection vehicle 200. As can be seen from Figure 2, the actuating compaction ram 220 of the compaction assembly 216 forms an obstacle to the discharge of refuse from the upper compartment 120.

[0043] Referring briefly to Figures 3a and 3b, the actuating compaction ram 220 is shown in greater detail and comprises a compaction ram 300 housed within a compaction ram housing 302. The compaction ram housing 302 comprises a top plate 303 and a flanged bottom end 304. The compaction ram comprises a connector 306 for connecting the actuating compaction ram 220 to the compaction plate (not shown). A hydraulic cylinder may be preferably used. A ram extension port 308 is pro-

vided alongside a ram retraction port 310 on the flanged bottom end 304 of the actuating compaction ram 220. The compaction ram 300 itself comprises a piston rod 312 mounted within a ram cylinder 314. A tube connects the ram extension port 308 to an upper portion, which is adjacent the top plate 303, of the ram cylinder 314. The ram retraction port 310 is connected to a lower portion of the ram cylinder 314. It will be appreciated that the ram extension port 308 and the ram retraction port 310 could be connected in reverse, such that the ram extension port 308 is connected to a lower portion of the ram cylinder 314 and the ram retraction port 310 is connected to an upper portion of the ram cylinder 314. It will be readily understood that the actuating compaction ram 220 would operate in the normal fashion such that fluid would be passed through the ram extension port 308 to apply pressure on the piston (not shown) in the compaction ram 300. The piston is connected to one end of the piston rod 312 and thus forces the piston rod 312 downward within the ram cylinder 314; as the opposing end of the piston rod 312 terminates in the form of the connector 306, this connector 306 is forced down. Passing fluid through the ram retraction port 310 causes the piston rod 312 to retract back into the ram cylinder 314. The ram extension port 308 and the ram retraction port 310 are connected to flexible hydraulic pipe (not shown). This flexible hydraulic pipe connects the ram extension port 308 and the ram retraction port 310 to controlled valves which operate the actuating compaction ram 220 in the normal fashion. A cable chain may also be used in a preferred embodiment to contain and restrict the movement of the flexible pipe to ensure that it does not become entangled in the support scissor mechanism and other equipment.

[0044] Turning now to Figures 4a through 4c inclusive, there is shown the refuse collection vehicle 200 with the compaction plate 218 in a fully lowered position. The support scissors mechanism 400 is used to spread the load on the compactor plate 218 and keep the compaction plate 218 substantially level as it is raised and lowered by the compaction ram which is within the compaction ram housing 302. As mentioned hereinbefore, the scissors mechanism 400 may be replaced with guide rails (not shown) or other types of guiding/supporting frameworks, or, the compaction plate 218 may be simply allowed to float in the refuse collection vehicle 200. The piston rod 312 of the compaction ram can be seen in a fully extended state with the connector 306 connecting the piston rod 312 to the compaction plate 218 and holding the compaction plate 218 down in a fully extended position within the cardboard compartment 122 of the refuse collection vehicle.

[0045] In order to discharge refuse from the upper compartment 120, the compaction cylinder within the compaction ram housing 302 and the compaction ram housing 302 itself must be moved out of the way.

[0046] The compaction ram housing 302 is slidably mounted within slides (not shown) in the support frame-

work 222. These slides are polymer slides or are made of an appropriate type of low friction, hard wearing material, in a preferred embodiment. When released from its operating position, the compaction ram housing 302 slides downwardly such that the ram cylinder slides over the exposed piston rod 312 to encompass the piston rod 312. In the fully lowered state, which is shown in Figure 4c, the compaction ram housing 302 has slid completely over the ram cylinder so that the top plate 303 is substantially in the same transverse plane as the support framework 222 and/or the floor 202 of the upper compartment 120. In this manner, the horizontally and centrally arranged compaction ram assembly can be used to apply a pressure on the compaction plate in a substantially central location so as to use only a single ram and still ensure a relatively even force on the compaction plate, and yet also remove the compaction ram assembly from being an obstacle for the discharge of refuse from the upper compartment.

[0047] Figures 5a to 5e show the various stages of the process.

[0048] Referring to Figure 5a, the compaction plate 218 is in its raised position adjacent the support framework 222 and cardboard can be accepted into the cardboard compartment 201.

[0049] Referring to Figure 5b, the compaction plate 218 is in its lowered position adjacent an inclined floor portion 212 of the cardboard compartment 201. The support scissors mechanism 400 is extended to assist with spreading the pressure applied on the compaction plate 218 by the piston rod 312. The actuating compaction ram 220 is in its operating position, protruding into the upper compartment 120. A flange lock 500 is in a closed position so as to engage with the flanged end 304 of the housing of the actuating compaction ram 220. This closed flange lock 500 holds the compaction ram housing in its operating position.

[0050] Referring to Figure 5c, the flange lock 500 is opened. It will be understood that an actuatable lock is preferably used and thus the lock can be opened as part of a preset process to clear the actuating compaction ram 220. Other steps in the process would include fully extending the compaction plate 218 to its fully lowered position, for example. Alternatively, the flange lock 500 could be opened on cue from an operator of the refuse collection vehicle. The opening of the flange lock 500 will allow the actuating compaction ram 220 to drop under the control of the ram by operating the ram retraction port. It will be understood that as the weight of the actuating compaction ram 220 is less than the weight of the compaction plate, the actuating compaction ram 220 will effectively pull itself down over the extended piston rod, such that the piston rod retracts back into the ram cylinder. In a further embodiment, it is envisaged to provide stops (not shown) mounted on rails of the support scissors mechanism 400 to prevent the compactor plate 218 from falling and impacting against the floor of the cardboard compartment, when the flange lock 500 is opened.

These stops are positioned so as to still allow the compaction plate 218 to operate with full stroke during normal use.

[0051] Referring to Figure 5d, the opening of the flange lock 500 has permitted the actuating compaction ram 220 to be lowered towards the compaction plate 218 and the flanged end 304 of the housing which forms part of the actuating compaction ram 220.

[0052] Referring to Figure 5e, shows the actuating compaction ram 220 fully lowered such that a top plate 303 on the housing of the actuating compaction ram 220 is substantially along the same transverse plane as the support framework 222 and/or the floor of the upper compartment 120. In one embodiment of the present invention, a proximity sensor (not shown) is used to inform an automatic control system in the refuse collection vehicle 200, that the compaction ram housing has reached its lowered position, leaving the upper compartment 120 substantially free from obstruction.

[0053] In order to raise the actuating compaction ram 220 back into an operating position, after the refuse from the upper compartment 120 has been discharged, the actuating compaction ram 220 is extended and this will raise the compaction ram housing 300 back to protrude into the upper compartment 120. Once the actuating compaction ram 220 has been raised to its operating position, the flange lock 500 is operated to engage the flanged end 304 of the housing 300 which forms part of the actuating compaction ram 220 and this will hold the actuating compaction ram 220 in the raised position. Once the flange lock 500 has been closed, the piston rod of the actuating compaction ram 220 can be retracted as this will lift the compaction plate 218 up into a raised position whereby cardboard can be placed into the cardboard compartment again.

[0054] In a preferred embodiment, the actuating compaction ram 220 is a hydraulic ram although other types of rams and/or actuators, such as a pneumatic ram or electric actuator, may be used in the place of the hydraulic ram.

[0055] The compaction ram housing 300 is preferably constructed on stainless steel. The refuse in the upper compartment is allowed to surround the compaction ram housing 300 in one embodiment of the present invention.

[0056] In a further embodiment, it is envisaged to utilise the compaction assembly 216 as a cardboard retention apparatus. It has been observed that when the refuse collection vehicle 200 travels at speeds above walking pace, the vibrations caused by travelling over the roadway can encourage the compacted cardboard back towards its uncompacted state, as the memory for shape is quite strong in cardboard. In this further embodiment, when the refuse collection vehicle 200 is driven above a threshold, say 20 mph, the actuating compaction ram 220 will be activated to lower the compaction plate 218 for a period of time, say 20 seconds. This would be enough time for the compaction plate 218 to be lowered to the floor of the cardboard compartment. If the card-

board compartment is half full, then the compaction plate (after approximately 10 seconds) will stop lowering itself as the force applied will be met with an equal but opposite force from the compacted cardboard in the half filled cardboard compartment. After the actuating compaction ram 220 has been activated for the period of time, it is then held in the lowered position to retain and hold the cardboard and prevent vibrations from encouraging the compacted cardboard to return towards its original uncompacted shape. A pressure spike may alternatively be used to assess when the compaction plate has reached the compacted cardboard, however the above time-based option is seen to be an easier and less complex solution. Typical safety features would be used, such as locking access to the cardboard compartment during utilisation of the compaction assembly 216. A particularly advantageous feature is envisaged to concern how the compaction assembly 216 would know to raise itself again. This could be based on when the speed of the refuse collection vehicle 200 drops below the threshold, or drops below the threshold for a period of time, or preferably is based on when the operator of the refuse collection vehicle 200 opens a door of the refuse collection vehicle 200. The compaction plate 218 would then begin to be raised to its' home position when the door is opened by the operator and by the time the operator would wish to access the cardboard compartment, it is foreseen that in the majority of cases, the compaction plate would have fully raised itself to its home position.

[0057] The terms "comprise" and "include", and any variations thereof required for grammatical reasons, are to be considered as interchangeable and accorded the widest possible interpretation.

[0058] It will be understood that the components shown in any of the drawings are not necessarily drawn to scale, and, like parts shown in several drawings are designated the same reference numerals.

[0059] It will be further understood that features from any of the embodiments may be combined with alternative described embodiments, even if such a combination is not explicitly recited hereinbefore but would be understood to be technically feasible by the person skilled in the art.

[0060] The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail.

Claims

1. A refuse collection vehicle comprising at least an upper refuse compartment situated above a lower refuse compartment, whereby the lower refuse compartment partially houses a ram assembly such that a portion of the ram assembly protrudes into the upper compartment when the ram assembly is in normal use; the ram assembly being moveable so as to no longer

protrude into the upper compartment when so desired.

2. A refuse collection vehicle as claimed in claim 1, wherein, the ram assembly comprises a ram compaction assembly. 5
3. A refuse collection vehicle as claimed in claims 1 or 2, wherein, the ram assembly comprises a substantially vertically orientated ram. 10
4. A refuse collection vehicle as claimed in any of claims 1 to 3, wherein, the ram assembly comprises a ram housed in a ram housing, whereby the ram housing comprises a flanged end which engages against a flange lock such that the flange lock holds the ram housing in place protruding into the upper compartment when the ram assembly is in normal use. 15
5. A refuse collection vehicle as claimed in any of claims 1 to 4, wherein, the flange lock is remotely actuable. 20
6. A refuse collection vehicle as claimed in any preceding claims, wherein, the ram housing is slidably mounted within slides on a support framework which is situated intermediate the upper compartment and the lower compartment. 25
7. A refuse collection vehicle as claimed in any preceding claims, wherein, the ram assembly raises and lowers a refuse compaction plate which is located within the lower refuse compartment. 30
8. A refuse collection vehicle as claimed in any preceding claims, wherein, the ram assembly is moved so as to no longer protrude into the upper compartment when it is desired to discharge refuse from the upper compartment. 35
9. A method of operating a refuse collection vehicle, where the refuse collection vehicle comprises at least an upper refuse compartment situated above a lower refuse compartment and the lower refuse compartment partially houses a ram assembly which protrudes into the upper refuse compartment when in normal use, the method comprising the steps of: 40
 - i) activating the ram assembly to extend a piston rod of the ram assembly into a lowered position;
 - ii) lowering the ram assembly into the lower refuse compartment such that the ram assembly no longer protrudes into the upper refuse compartment. 45
10. A method of operating a refuse collection vehicle, as claimed in claim 9, the method further comprising the step of: 50
 - iii) activating the ram compaction assembly to extend the piston rod of the ram assembly into the lowered position so as to lower a compaction plate to its lowered position. 55

11. A method of operating a refuse collection vehicle, as claimed in claims 9 or 10, the method further comprising the step of:
 - iv) prior to lowering the ram assembly into the lower refuse compartment, opening a lock which holds the ram assembly in its normal operating position.
12. A method of operating a refuse collection vehicle, as claimed in any of claims 9 to 11, the method further comprising the step of:
 - v) prior to lowering the ram assembly into the lower refuse compartment, opening a flange lock which is engaged against a flange plate of the ram assembly and holds the ram assembly in its normal operating position.
13. A method of operating a refuse collection vehicle, as claimed in any of claims 9 to 12, the method further comprising the step of:
 - vi) lowering the ram assembly into the lower refuse compartment such that the ram assembly no longer protrudes into the upper refuse compartment so as to leave the upper refuse compartment substantially clear of obstacles and allow refuse in the upper refuse compartment to be discharged.
14. A method of discharging refuse from an upper compartment of a collection vehicle, where the refuse collection vehicle comprises at least an upper refuse compartment situated above a lower refuse compartment and the lower refuse compartment partially houses a substantially vertically mounted ram compaction assembly which protrudes into the upper refuse compartment when in normal use, the method comprising the steps of:
 - vii) activating the ram compaction assembly so as to lower a compaction plate to its lowered position;
 - viii) opening a flange lock which holds the ram compaction assembly in its normal operating position which protrudes into the upper refuse compartment;
 - ix) the ram compaction assembly being lowered into the lower refuse compartment so as to leave the upper refuse compartment substantially clear of obstacles and allow refuse in the upper refuse compartment to be discharged.

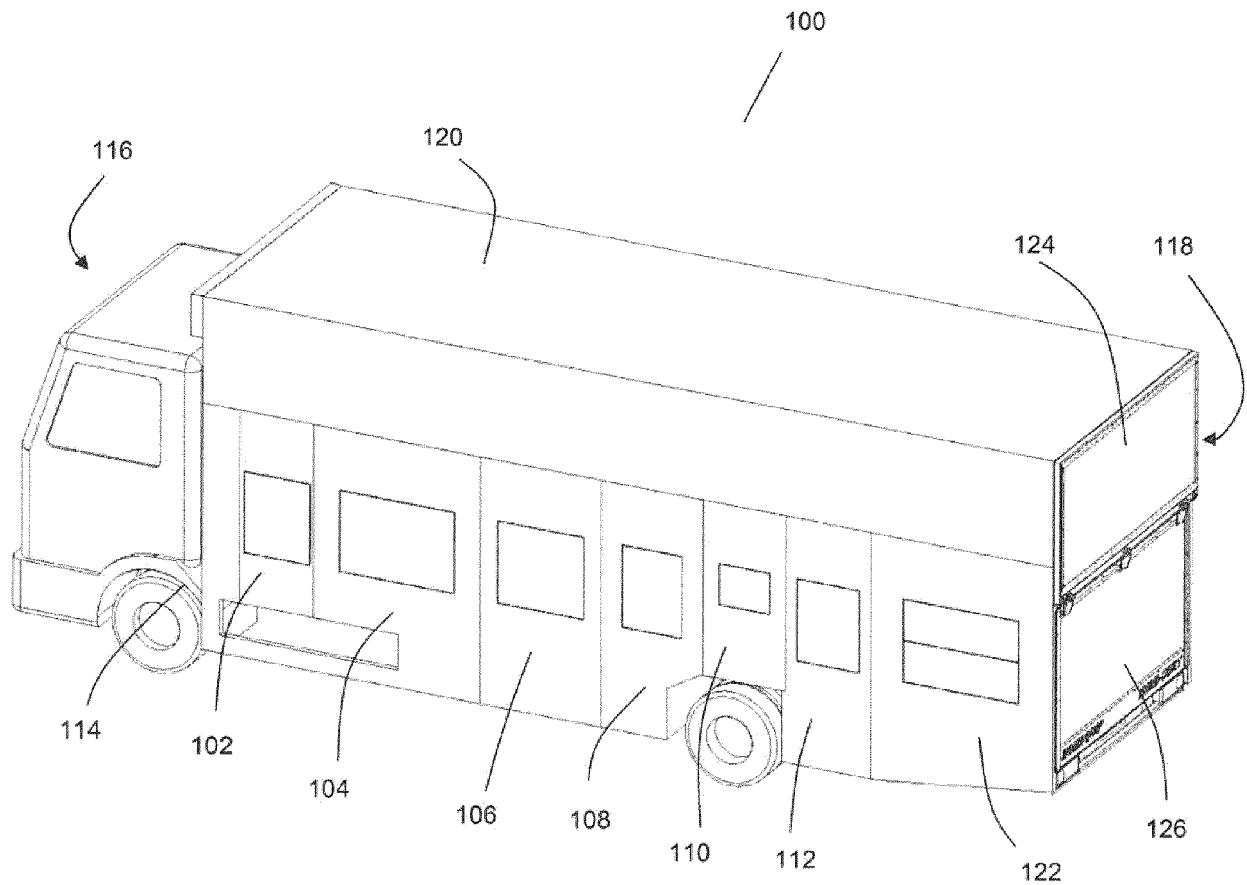


Figure 1 (Prior Art)

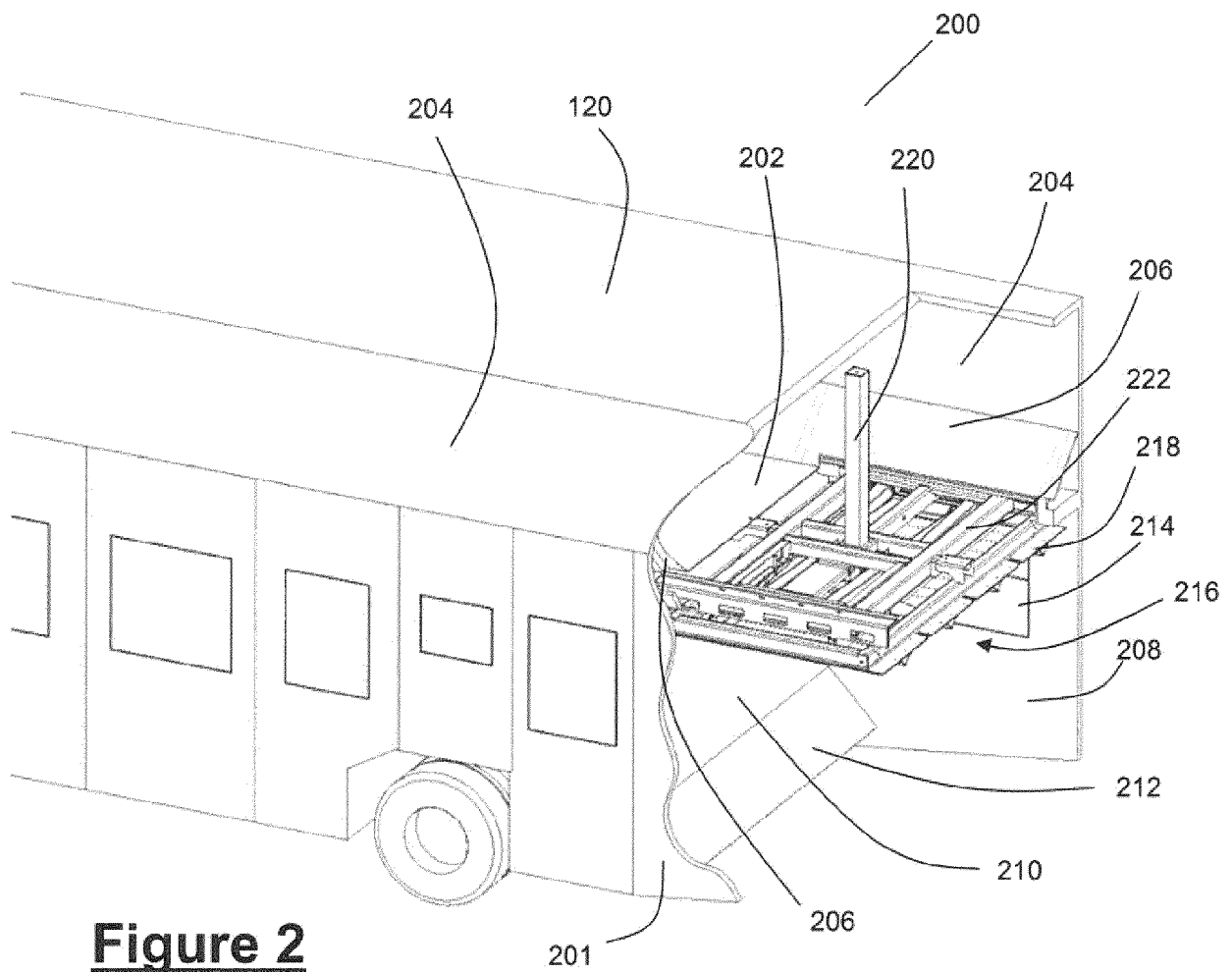


Figure 2

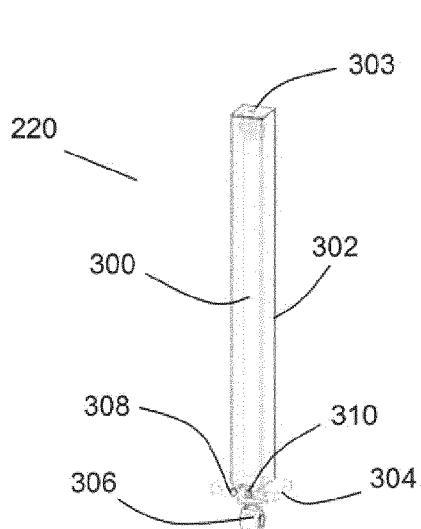


Figure 3a

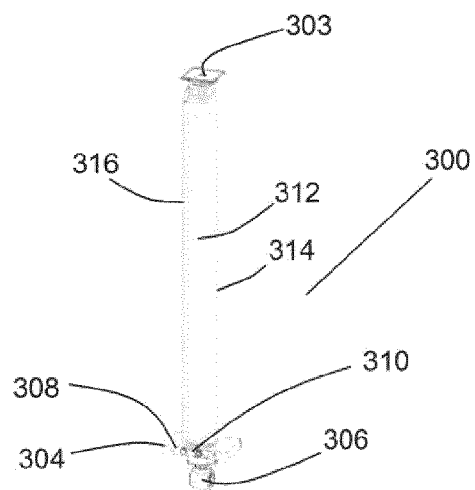


Figure 3b

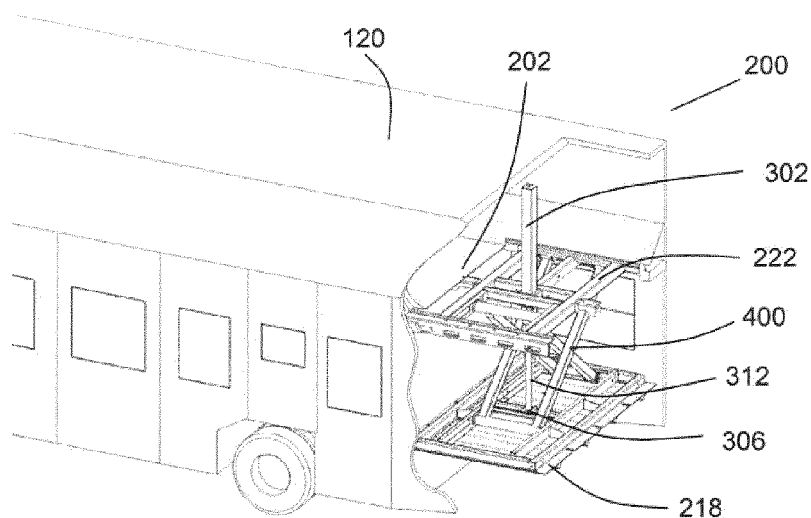


Figure 4a

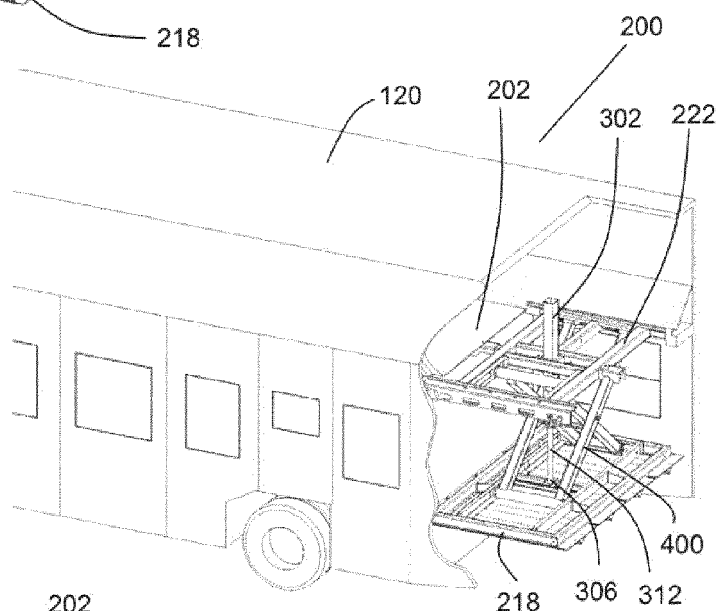


Figure 4b

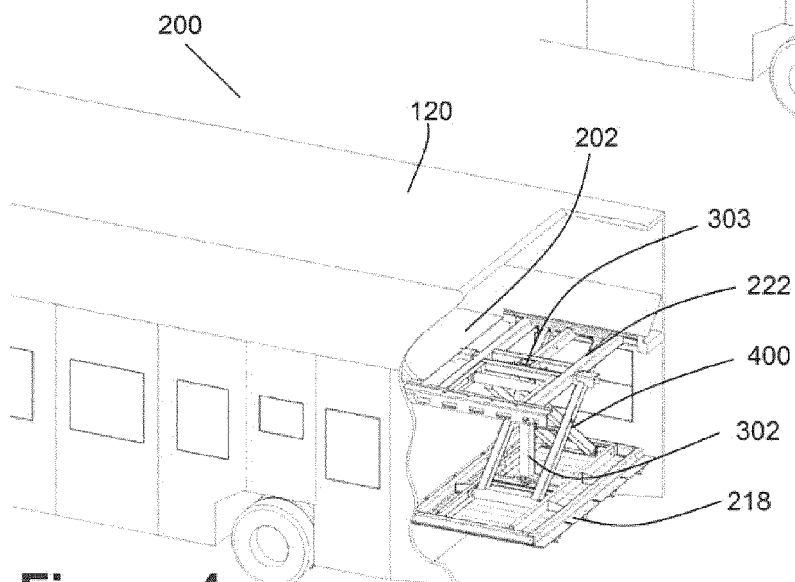


Figure 4c

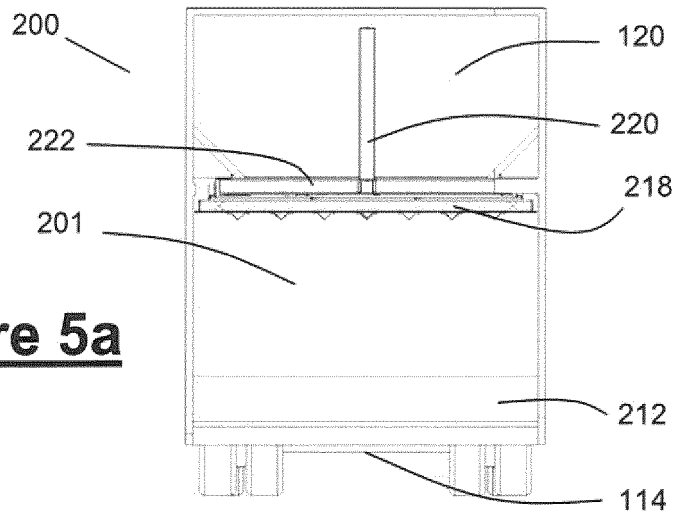


Figure 5a

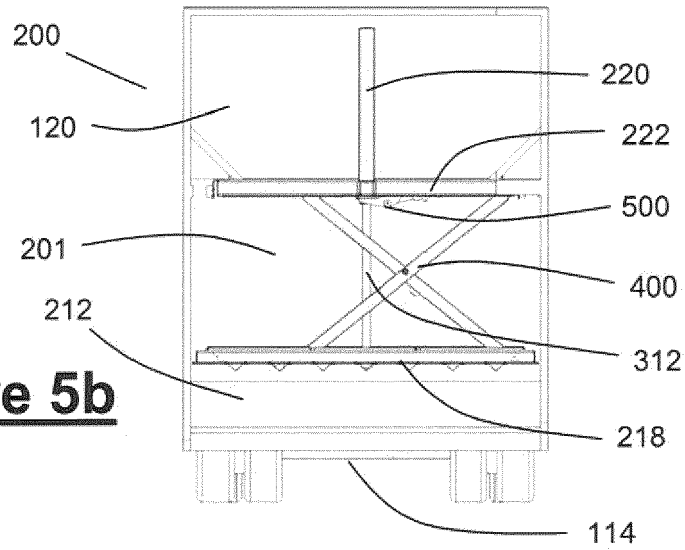


Figure 5b

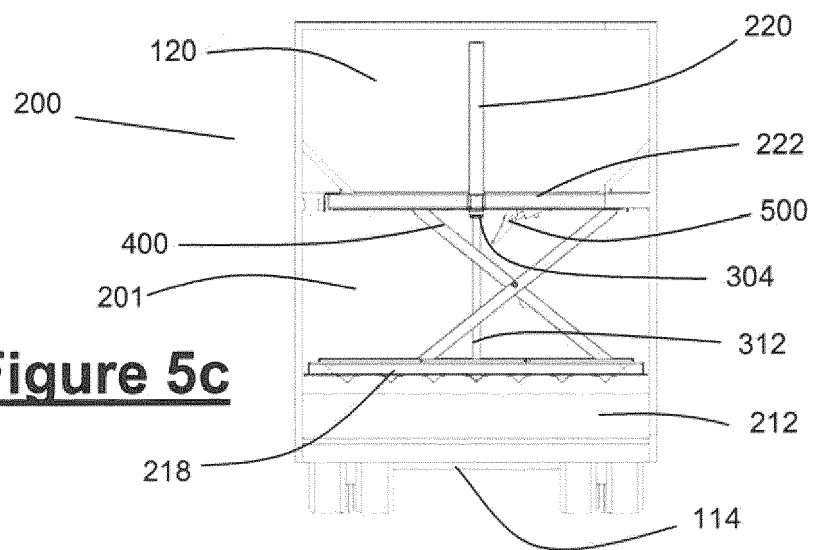
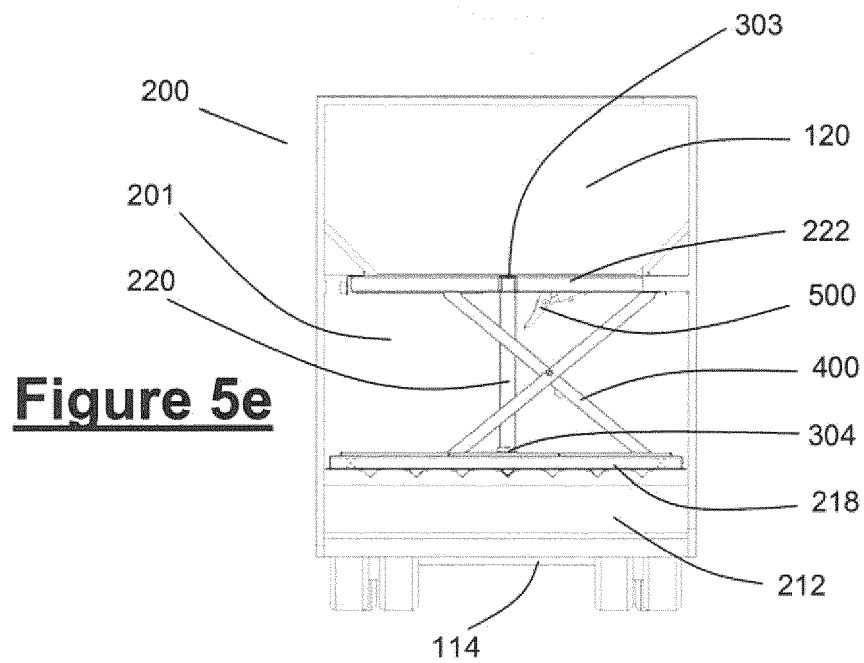
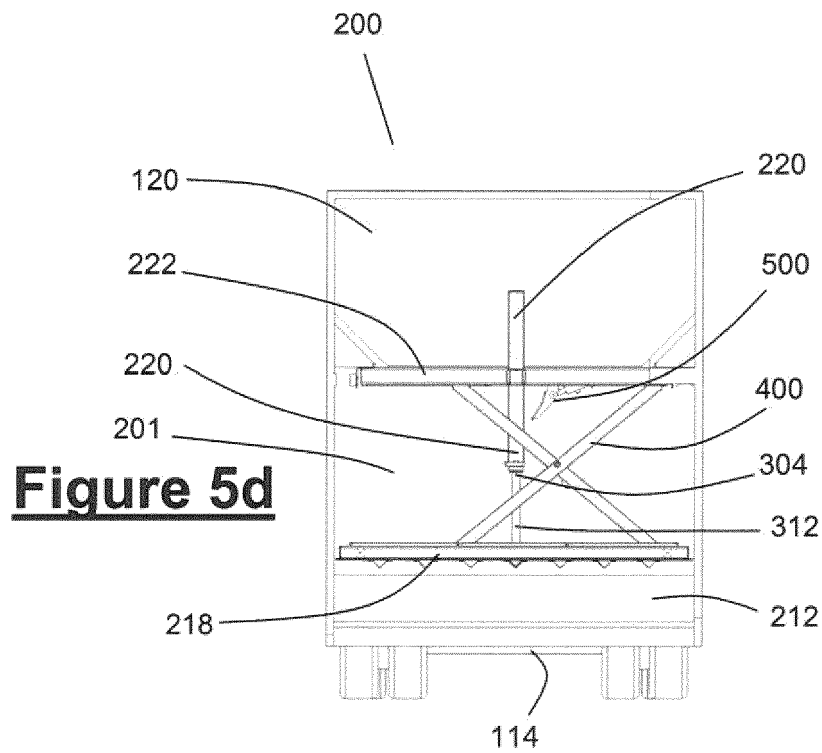


Figure 5c





EUROPEAN SEARCH REPORT

Application Number
EP 17 16 0202

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	EP 2 386 504 A1 (J. MCKEOWN) 16 November 2011 (2011-11-16)	1-3,7,8	INV. B65F3/00
A	* paragraph [0065]; figures 5-12 * -----	9-14	B65F3/20
X	WO 99/33718 A1 (MACDONALD JOHNSTON ENGINEERING CO. PTY. LTD.) 8 July 1999 (1999-07-08) * page 9, line 30 - page 10, line 3 * * figures 4,5A * -----	1,2	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65F B30B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 June 2017	Examiner Smolders, Rob
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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- EP 11166128 A [0005] [0007]