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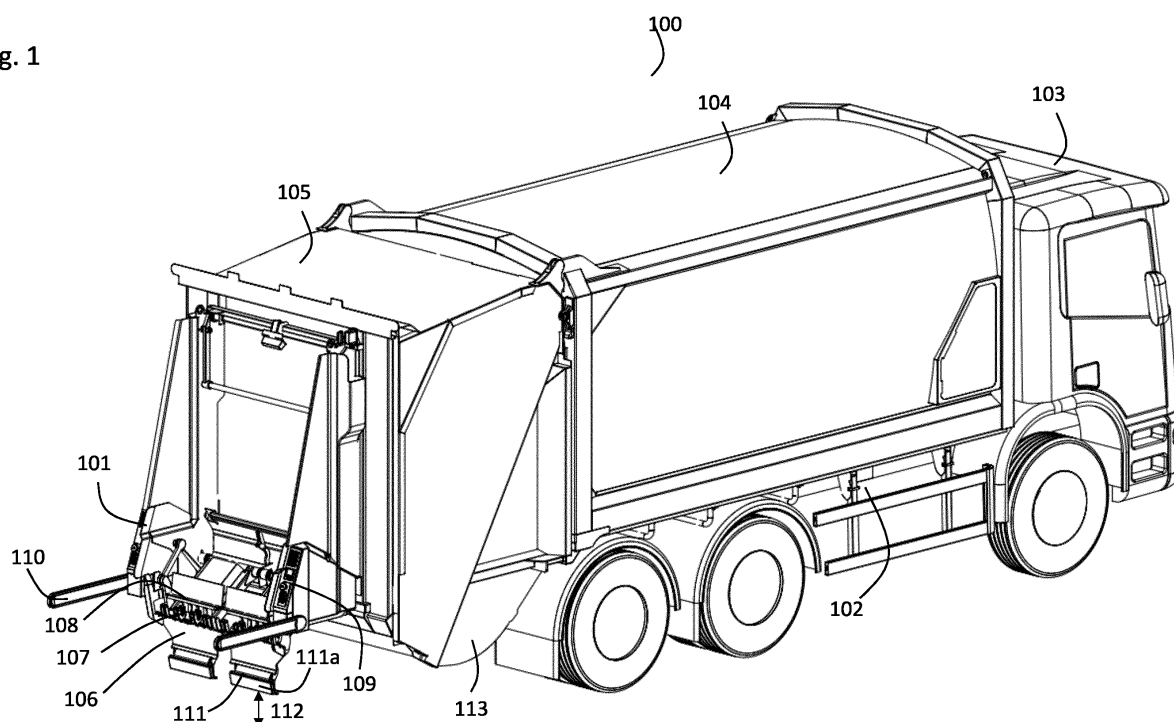
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(54) **LIFTING SYSTEM FOR A REFUSE COLLECTION VEHICLE**

(57) The invention relates to a lifting system (101) for a refuse collection vehicle (100). The lifting system comprises a lifting chair (106) with a gripper for the refuse bin. The lifting chair is moveable between a vertical receiving condition, in which the upper side of the bin is arranged higher than the lower side of the bin, and a tilted emptying condition, in which the upper side of the bin is arranged lower than the lower side of the bin. The lifting

system further comprises a lower support (111) at the bottom of the lifting chair for pushing and/or supporting the refuse bin when it is moved to its emptying condition. In the receiving condition, the lower support is allowed to move around a horizontal swing axis from a vertical position, in a backward direction opposite to a forward driving direction of the vehicle.

Fig. 1



Description

[0001] The present application relates to the field of refuse collection vehicles, in particular to a lifting system for a refuse collection vehicle.

[0002] Refuse collection vehicles are used to pick up refuse at different collection points. Usually the collection points, e.g. of households, of companies, etc., are located outside along the road. The refuse at the collection points can be deposited outside in different ways, e.g. in a refuse bag, in a refuse bin, which may be small one with two wheels or a large one with four wheels. In case of a refuse bin, an operator usually arranges the bin at a lifting system arranged at the rear end of the refuse collection vehicle. The lifting system lifts the bin up and tilts the bin such that the refuse is emptied in the hopper of the refuse collection vehicle. Once the collection body is full, the refuse collection vehicle drives to a refuse collection station to empty the collection body, after which the refuse collection vehicle is ready again for collecting refuse that is offered along the road.

[0003] The lifting system has a so-called lifting chair provided with a comb to grip the top edge of the bin in order to lift and tilt the bin. Because the bins are usually made of plastic material, the edge or one of more walls of the bin could break when it is tilted by the lifting system. Therefore, the lifting system is provided with a support, which supports a side of the bin. The lower support pushes the bin via a tilting movement upwards to tilt the bin relative to the point where it is gripped by the gripper and tilts the bin so far that its bottom faces upward for emptying the refuse. Usually, the support is provided at the bottom of the lifting chair, such that the support is, relative to the road, the lowest point of the lifting system of the refuse collection vehicle when the lifting system is in a low position.

[0004] During operation, the refuse collection vehicle drives from one collection point to another collection point. When travelling longer distances, for instance when the refuse collection vehicle is fully loaded wherein it travels back to the depot, the lifting system can be raised to a high position in order to create more ground clearance. When the travelling distance between the different collection points is rather short, e.g. in a densely populated residential street or area, the lifting system should also be raised during travelling, but the operators prefer to leave the lifting system in a low position or may forget to raise the lifting system. Leaving the lifting system in low position, makes the collection of refuse more efficient without wasting time with lowering and raising of the lifting system. When the refuse collection vehicles drives forward and the lifting system is still in a low position, the surface of the road, e.g. due to high speed humps, may hit the pushing support. This causes damage to the lifting system due to the impact against the ground/road. In most cases, this means that the refuse collection vehicle has to return to its base for repair, resulting in the refuse collection vehicle being out of order for some time.

[0005] It is known to mount the pushing support on a break plate. When the pushing support than collides with an obstacle on the road, the break plate with pushing support breaks off without damaging the lifting system. Although the damage is then less severe, the refuse collection vehicle still needs to return to base for repair and is temporarily out of order.

[0006] It is an object of the present invention to provide a lifting system that overcomes one or more of the above problems. It is a further object of the invention to provide a lifting system that prevents the lifting system from being damaged by obstacles without the need of repair of parts of the lifting system, or at least provide an alternative lifting system.

[0007] One or more of the above objects are achieved by providing a lifting system for a refuse collection vehicle, the lifting system being configured to be arranged at the rear of the vehicle, wherein the lifting system comprises:

- a lifting chair comprising a gripper, optionally comprising a comb, configured to grip a refuse bin, wherein the lifting chair is moveable relative to the vehicle between
 - a receiving condition, in which a height axis of the refuse bin is about vertical and an upper side of the bin is arranged higher than the lower side of the bin, and
 - an emptying condition, in which the refuse bin is tilted around a horizontal axis so that the height axis of the refuse bin slants with respect to a horizontal plane and the upper side of the bin is arranged lower than the lower side of the bin, and
- a lower support arranged at the bottom of the lifting chair, wherein the lower support is configured to push and/or support the refuse bin when the refuse bin is moved to the tilted emptying condition; and

wherein the lifting system is configured to allow the lower support, when in the receiving condition, to rotate, with respect to the lifting chair, around a horizontal swing axis from a vertical position, in a backward swing direction opposite to a forward driving direction of the vehicle, to a horizontal position.

[0008] The invention thus relates to a lifting system for a refuse collection vehicle, which further in the description is also referred to as vehicle. The refuse collection vehicle is configured to collect refuse. The lifting system may in practice be arranged at the rear of the vehicle. The lifting system comprises a lifting chair. The lifting chair comprises a gripper, such, as a comb, which is configured to grip a refuse bin. Generally, the gripper is arranged at the top end of the lifting chair. In case of a comb, the comb is arranged under the flange of the bin in order to grip the bin. The invention is not limited to one

type of refuse bin. Also, other types of refuse bins are applicable, e.g. with different dimensions and/or volume. In this respect it is mentioned that refuse bins - in practise also called 'bins' - up to about 400 litres - such as a 60 litres, a 80 litres, a 140 litres, a 240 litres, and a 360 litres refuse bin - have in general two wheels, two corners of the bottom each having one wheel, and that refuse bins - in practise in general called 'containers' - from about 500 litres to about 1300 litres - such as 660 litres, 770 litres, and 1100 litres refuse bins - have in general 4 wheels, one at each corner of the bottom. These bins are in practise standardized, at least per region, and the refuse collection vehicles in a region are provided with handling adapters in correspondence with the 'standardized' bins used in that region. These handling adapters especially concern the so-called lifting chair and locking system. The invention may be used with all these types of bins as well other types of bins, like bins without wheels.

[0009] Referring to the above paragraph, it is noted that that the term 'bin' as used in this application comprises containers as well, in other words the term 'bin' as used in this application comprises the term 'bin' as used in practise as well as the term 'container' as used in practise.

[0010] The lifting chair is moveable relative to the vehicle between a receiving condition and an emptying condition. In the receiving condition, the lifting chair is intended to be used to grip the refuse bin. In the receiving condition, a height axis of the refuse bin is about vertical and an upper side of the bin is arranged higher than the lower side of the bin. Note that throughout the description, with the use of the terms as 'vertical' or 'horizontal' it is assumed that the vehicle is defined relative to a flat, horizontal road. The upper side of the bin may e.g. comprise a hinged cover for the top of the bin. Optionally, at the lower side of the bin, at least a pair of wheels are provided to move the bin. In the emptying condition, the lifting chair is intended to be used to tilt the refuse bin. In the emptying condition, the refuse bin is tilted around a horizontal axis so that the height axis of the refuse bin slants with respect to a horizontal plane and the upper side of the bin is arranged lower than the lower side of the bin. Generally, the horizontal plane is parallel with the road surface. Due to the gravitational force, the content of the bin falls into a feeding device, also called hopper, feeding the refuse to the collection body of the vehicle. Optionally, the lifting chair which grips the bin can be shaken a couple of times in the emptying condition to ensure that the bin is completely emptied.

[0011] The lifting system further comprises a lower support, also called pushing support. The lower support is arranged at the bottom of the lifting chair. The lower support is configured to push and/or support the refuse bin when the refuse bin is moved to the tilted emptying condition. In case the lifting chair grips the bin in the receiving condition, the lower support is configured to make contact with a side surface of the bin, e.g. the front side

surface. The position of the lower support relative to the bin is defined by ISO or EN standards. The lower support pushes and/or supports the bin at the side surface during its tilting movement and pushes and/or supports it so far that the refuse bin gets into its tilted emptying condition. The lower support may e.g. be provided with a pad. This pad serves to distribute the supporting and/or pushing force of the lower support on the refuse bin. In case the sides of the refuse bin are convex, e.g. due to the content inside the refuse bin, the pad on the lower support ensures that the executed supporting and/or pushing force is about equally distributed over the contact surface at the refuse bin to prevent cracks in the refuse bin. Preferably, the pad is made of or comprises an elastomeric material, such as a rubber.

[0012] In case the lifting system is in the receiving condition, the lifting system is configured to allow the lower support to move around a horizontal swing axis from a vertical position, in a backward swing direction opposite to a forward driving direction of the vehicle, to a horizontal position. The lifting system according to the invention is thus configured to allow the lower support to swing aside in the backward direction, when the vehicle drives in forward direction and the lower support hits an obstacle on the road, e.g. a road bump. When the lower support hits an obstacle on the road, it folds up and creates more ground clearance. This ensures that damage of the lifting system is prevented and that collection of refuse may continue without the refuse collection vehicle needing to return to its base for any repair.

[0013] In a further embodiment, the lifting system is further configured to restrain the lower support from returning to the vertical position after the lower support has rotated from the vertical position, in the backward swing direction, around the horizontal swing axis. Restraining the lower support from returning prevents uncontrolled returning, which may cause damage to the lifting device or injuries to persons adjacent the lifting device. Restraining the lower support from returning may for example be achieved by means of a releasable ratchet. The ratchet - being a mechanism having a bar or wheel with inclined teeth into which a pawl drops so that motion of the bar or wheel is allowed in one direction and prevented in the other direction - allows rotation of the lower support in the backward swing direction and prevents the lower support from returning in a direction opposite to the backward swing direction. By retracting the pawl, the ratchet is released which allows the lower support to return. Alternatively or in addition, restraining the lower support from returning may be achieved by means of friction. In order to return the lower support, this friction then has to be overcome by a force larger than the friction or a friction member causing the friction has to be released with respect to the lower support.

[0014] In another further embodiment, the lifting system comprises a friction system configured to arrest rotation of the lower support with respect to the lifting chair such that the lower support is kept motionless, with re-

spect to the lifting chair, in its position once the lower support has been rotated around the horizontal swing axis. A friction system arresting rotation of the lower support prevents so to say the lower support from any swinging except swinging due to a large force caused by hitting an obstacle. This reduces the risk of people getting injured and ensures that the lower support is - as long as no obstacle has been hit - always in vertical position when the lifting chair is in receiving condition. Such a friction system will allow the lower support to rotate in the backward swing direction in case it hits an obstacle, but prevents it from a) returning in a forward swing direction, and from b) swinging - such as swinging to-and-fro - due to for example shocks or vibrations caused by the road or vehicle. In case the lower support has hit an obstacle and is to be returned, an operator may do so hands or feet by exerting a force onto the lower support which is sufficient to overcome the friction of the friction system. Expressed in different wording, one could say that the friction system is configured to allow a hampered movement of the lower support between the vertical and horizontal position to prevent the lower support from:

- leaving its vertical position due to vibrations and shocks caused by the road and/or refuse collection vehicle; and
- returning to its vertical position under influence of gravity, after the lower support has rotated from the vertical position, in the backward swing direction, around the horizontal swing axis.

[0015] In another further embodiment, the lifting system is configured to prevent the lower support, when in the receiving condition and with the lower support in the vertical position, from moving around the horizontal swing axis in a direction opposite to the backward swing direction. The lower support thus can only swing in one direction. By preventing the lower support from swinging in the direction opposite to the backward swing direction, it is ensured that rattling of the lower support is prevented during the forward movement of the vehicle.

[0016] For example, the lower support may be provided with a plate at the top, which extends upwards behind the lifting chair relatively seen from the receiving side. Since the plate of the lower support contacts the back of the lifting chair when the lower support is in the vertical position, it is for the lower support not possible to swing in the direction opposite to the backward swing direction.

[0017] In another further embodiment, the lifting system is configured to prevent the lower support, when moving a bin from the receiving condition to the emptying condition, from moving around the swing axis in a direction opposite to the backward swing direction. For example, when the lifting system is moved to the emptying condition, the lower support could swing down, e.g. due to the gravitational force. By preventing the movement around the swing axis in the direction opposite to the backward swing direction, this ensures that the lower

support continuously supports and/or pushes the refuse bin during the movement from the receiving condition to the emptying condition. This can also be achieved by providing the lower support with a plate at the top, which extends behind the lifting chair. The back of the lifting chair then serves as a stop against which the plate, provided at the top of the lower support, may rest.

[0018] In another further embodiment, the lower support is mounted to the lifting chair by at least one hinge. The hinge provides the horizontal swing axis. The hinge allows the swing of the lower support relative to the lifting chair in backward swing direction. Preferably, the hinge has at least one hinge pin or bendable section providing the horizontal swing axis. In an embodiment, the bendable section is made of or comprises an elastomeric material, such as a rubber. The hinge allows that the lower support folds upwards from the vertical position to the horizontal position. Preferably, the hinge ensures that the lower support in the horizontal position automatically, e.g. due to gravitational force, falls back to the vertical position. For example, the hinge may be made of or may comprise a return spring, which may be adapted to lock, temporary, the lower support in the horizontal position.

[0019] In another further embodiment with at least one hinge, the at least one hinge is a friction hinge. As the skilled man knows, a friction hinge is a hinge that offers resistance to the pivoting motion of the hinge. That resistance can be such that it slows the movement or that it actually arrests movement to the extent that the pivoting object is held motionless in the position it has been brought in. As explained above in relation to the friction system, a friction hinge reduces the risk of people getting injured and assists the lower support being in vertical position when the lifting chair is in receiving condition. According to a further embodiment with at least one friction hinge, the friction hinge is configured to arrest rotation of the lower support with respect to the lifting chair such that the lower support is kept motionless in its position once the lower support has been rotated around the horizontal swing axis.

[0020] In an embodiment, the horizontal swing axis is arranged at the lower end of the lifting chair. The lower support mounted at the bottom of the lifting chair in the vertical position defines the ground clearance between bottom of the lower support and the road. In order to create more ground clearance between the lifting chair and the ground by swinging the lower support in the backward direction to the horizontal position, it is advantageous to arrange the horizontal swing axis at the lowest point of the lifting chair.

[0021] In an embodiment, the horizontal swing axis is arranged, when the lifting chair is in receiving condition, at about 35 cm to about 70 cm, such as about 40 cm to about 50 cm or about 40 cm to about 60 cm, above a road surface spanned by the location where wheels of the vehicle contact the road.

[0022] The invention further relates to a refuse collection vehicle, wherein the vehicle comprises:

- a chassis,
- a driver's cab provided on the chassis, at the front of the chassis,
- a collection body for collecting refuse, provided on the chassis, behind the driver's cab, and
- a tailgate provided at the back of the chassis with the collection body arranged between the tailgate and the driver's cab;
- a lifting system according to the invention provided at the rear of the vehicle with the tailgate arranged between the lifting system and the collection body.

[0023] For collecting refuse in the collection body, the lifting system tilts a refuse bin in an emptying condition. In the emptying condition, the refuse bin is tilted around a horizontal axis so that the height axis of the refuse bin slants with respect to a horizontal plane, wherein the refuse bin is upside down and the refuse falls down into a hopper of the tailgate. The hopper feeds or guides the refuse to the collection body. Once the refuse bin is emptied in the hopper, the refuse is pressed, e.g. under hydraulic pressure, from the hopper towards the collection body.

[0024] The lifting system may still be configured to be raised from a low position for accepting bins to be emptied to a high transport position for traveling over longer distances, and to be lowered from the high position to the low position. But, with the lifting device according to this invention, this raising and lowering of the lifting device can be omitted.

[0025] In an embodiment, the lifting system exclusive the lower support defines a main part of the lifting system, and the horizontal swing axis is arranged at the lower end of the main part.

[0026] The invention will be described in more detail below with reference to the figures, in which in a non-limiting manner exemplary an embodiment of the invention will be shown. The same reference numerals in different figures indicate the same characteristics in different figures.

In the figures:

Fig. 1: Schematically illustrates a lifting system according to the invention for a refuse collection vehicle, wherein the lifting system is in the receiving condition;

Fig. 2: Schematically illustrates a lifting system for a refuse collection vehicle as illustrated in Fig. 1 in more detail, wherein the lifting system grips a refuse bin in the receiving condition;

Fig. 3: Schematically illustrates a lifting system for a refuse collection vehicle as illustrated in Fig. 2, wherein the lifting chair is moved to an emptying condition;

Fig. 4a: Schematically illustrates a lower support according to the invention in more detail, wherein the lower support is in a vertical position;

Fig. 4b: Schematically illustrates the lower support

of Fig. 4a in a vertical cross-sectional view;

Fig. 5a: Schematically illustrates a lower support according to the invention in more detail, wherein the lower support is in the horizontal position;

Fig. 5b: Schematically illustrates the lower support of Fig. 5a in a vertical cross-sectional view.

[0027] Fig. 1 schematically illustrates a lifting system 101 according to the invention for a refuse collection vehicle 100. The refuse collection vehicle 100 comprises a chassis 102, a driver's cab 103, a collection body 104 for collecting refuse and a tailgate 105. The driver's cab 103 is provided on the chassis 102, at the front of the chassis 102. The collection body 104 is provided on the chassis 102, behind the driver's cab 103. The tailgate 105 is provided at the rear side of the chassis 102 with the collection body 104 arranged between the tailgate 105 and the driver's cab 103.

[0028] The tailgate 105 comprises the lifting system 101. The lifting system comprises a lifting chair 106. The lifting chair comprises a gripper at the top end of the lifting chair. The gripper is configured to grip a refuse bin. The gripper comprises a comb 107 and locking system 108. The comb 107 grips under the flanged edge of the bin and the locking system 108 locks on top of this flanged edge to cooperate in locking action with the comb 107. The lifting chair 106 is moveable relative to the vehicle 100 between a receiving condition and an emptying condition. In Fig. 1, the lifting chair 106 is in the receiving condition. In the receiving condition, the lifting chair 106 is intended to be used to grip the refuse bin (see Fig. 2). During the receiving condition, a height axis of the refuse bin is about vertical and an upper side of the bin is arranged higher than the lower side of the bin (see Fig. 3).

[0029] The lifting system 101 further comprises a control panel 109 to control the movement of the lifting chair. At the sides of the lifting system safety barriers 110 are provided. The safety barriers are provided to avoid a person to walk into the area where refuse bins are tilted.

[0030] The lifting system 101 further comprises a lower support 111. The lower support is arranged at the bottom of the lifting chair 106. The distance between the lower support 111 and the ground surface defines the ground clearance 112. The lower support is configured to push and/or support the refuse bin when the refuse bin is moved to the tilted emptying condition. The lower support is provided with a pad 111a. This pad 111a serves to distribute the supporting and/or pushing force of the lower support on the refuse bin. In case the sides of the refuse bin are convex, e.g. due to the content inside the refuse bin, the pad on the lower support ensures that the executed supporting and/or pushing force is about equally distributed over the contact surface at the refuse bin to prevent cracks in the refuse bin. Preferably, the pad is made of or comprises an elastomeric material, such as a rubber.

[0031] Fig. 2 schematically illustrates the lifting system in the receiving condition as illustrated in Fig. 1, wherein

the lifting system grips a refuse bin 200. The lifting chair comprises a comb at the top end of the lifting chair. The gripper may be a comb with a plurality of teeth (not clearly visible in Fig. 2), which are at a distance from each other arranged along the top end of the lifting chair. The comb grips under the flange of the refuse bin. Subsequently the locking system 108 locks the upper side of the flange to lock the flange between the comb and the locking system 108. In the receiving condition, a height axis of the refuse bin is about vertical and an upper side of the bin is arranged higher than the lower side of the bin. The upper side of the refuse bin is a hinged cover for the top of the bin. At the lower side of the refuse bin, a pair of wheels are provided to move the bin, e.g. to move the bin towards the gripper. The invention is not limited to one type of refuse bin. Also, other types of refuse bins are applicable, e.g. with different dimensions and/or volume. The lower support is configured to make contact with the front side surface of the refuse bin. The position of the lower support relative to the bin is defined by ISO or EN standards.

[0032] Fig. 3 schematically illustrates the lifting system as illustrated in Fig. 2, wherein the lifting chair is moved to an emptying condition. In the emptying condition, the refuse bin is tilted around a horizontal axis so that the height axis of the refuse bin slants with respect to a horizontal plane and the upper side of the bin is arranged lower than the lower side 301 of the bin. Generally, the horizontal plane is parallel with the road surface. Due to the gravitational force, the content of the bin falls down into a hopper 113 of the tailgate (see also Fig. 1). The hopper 113 is a refuse collector area. Once the refuse bin is emptied in the hopper, the refuse is pressed, e.g. under hydraulic pressure, from the hopper towards the collection body. Optionally, the lifting chair which grips the bin can be moved a couple of times from the receiving condition to the emptying condition to ensure that the bin is completely emptied. When moving the lifting chair from the receiving condition to the emptying condition, the lower support pushes and/or supports the bin at the front side surface 302 via a tilting movement upwards (see figure 3). The lower support pushes and/or supports the refuse bin up to in its emptying condition.

[0033] The lifting system prevents the lower support, when moving the bin from the receiving condition to the emptying condition, from moving around a horizontal swing axis 300 in a direction opposite to a backward swing direction 201 (see also Fig. 2). The backward swing direction is opposite to the forward driving direction of the vehicle. The lifting system 101 exclusive the lower support 111 defines a main part of the lifting system 101. The horizontal swing axis 300 is, when the lifting chair is in receiving condition, arranged at the lower end of the main part. The swing axis 300 is, when the lifting chair is in receiving condition, arranged at about 35 cm to about 70 cm, for example about 40-50 cm or about 40-60 cm, above a road spanned by the location where wheels of the vehicle contact the road.

[0034] When the lifting system is moved to the emptying condition like in Fig. 3, the lower support could swing down, e.g. due to the gravitational force. By preventing the movement around the horizontal swing axis in the direction opposite to the backward swing direction 201, it ensures that the lower support continuously supports and/or pushes the refuse bin during the movement from the receiving condition to the emptying condition.

[0035] Fig. 4a schematically illustrates a lower support 400 according to the invention in more detail, wherein the lower support 400 is in a vertical position (see also Fig. 4b). The lower support 400 is mounted to the bottom of the lifting chair 401 by a hinge 402. The lifting chair 401 includes a comb having a plurality of teeth 403, which are at a distance from each other arranged along the top end of the lifting chair 401. The hinge 402 provides a horizontal swing axis 404, i.e. along the y-axis (see the indicated xyz coordinate system). The hinge 402 allows the swing of the lower support 400 relative to the lifting chair 401 in backward swing direction 405, i.e. in the x-direction, around the horizontal swing axis 404. The swing axis 404 is arranged at the lower end of the lifting chair 401. The hinge 402 has a hinge pin providing the horizontal swing axis 404. In an embodiment, the hinge 402 may have no hinge pin but a different member allowing hinging. The hinge allows that the lower support folds upwards from the vertical position to the horizontal position (see Figs. 5a-5b).

[0036] Fig. 4b shows the lower support 400 of Fig. 4a in a vertical cross-sectional view. The lower support 400 is provided with a pad 406. This pad 406 serves to distribute the supporting and/or pushing force of the lower support 400 on a refuse bin. In case the sides of the refuse bin are convex, e.g. due to the content inside the refuse bin, the pad 406 on the lower support 400 ensures that the executed supporting and/or pushing force is about equally distributed over the contact surface at the refuse bin to prevent cracks in the refuse bin. Preferably, the pad 406 is made of or comprises an elastomeric material, such as a rubber.

[0037] The lifting system is configured to prevent the lower support in the vertical position, from moving around the horizontal swing axis 404 in a direction opposite to the backward swing direction 405. The lower support 400 is provided with a plate 407 at the top, which extends upwards behind the lifting chair 401. Since the plate 407 of the lower support 400 contacts the back of the lifting chair 401 when the lower support is in the vertical position, it is for the lower support not possible to swing in the direction opposite to the backward swing direction 405. The lower support 400 thus can only swing in one direction. By preventing the lower support 400 from swinging in the direction opposite to the backward swing direction 405, it is ensured that rattling of the lower support 400 is prevented during the forward movement of the vehicle.

[0038] Fig. 5a schematically illustrates the lower support 400 according to the invention in more detail, wherein

the lower support 400 is in a horizontal position (see also Fig. 5b). As illustrated in Fig. 4a-4b, the lifting chair 401 is in the receiving condition. The lower support 400 has moved around the horizontal swing axis 404 from a vertical position, in the backward swing direction 405 opposite to a forward driving direction of the vehicle, to the horizontal position. For example, when the vehicle drives in forward direction and the lower support hits an obstacle on the road, e.g. a road bump, it folds up and creates more ground clearance. This ensures that damage of the lifting system is prevented and that collection of refuse may continue.

[0039] Fig. 5b shows the lower support 400 of Fig. 5a in a vertical cross-sectional view. The hinge 402 ensures that the lower support 400 in the horizontal position automatically, e.g. due to gravitational force, falls back to the vertical position.

[0040] Referring to figures 4 and 5, there may be provided one hinge with one hinge or two hinges 402 as shown, one hinge on the left and one hinge on the right side. Also more than two hinges are possible. Further, the hinge 402 can be configured as a friction hinge by tightening the bolts - forming the hinge pins - sufficiently and/or by providing the hinge with friction members, such as friction rings.

[0041] As required, this document describes detailed embodiments of the present invention. However, it must be understood that the disclosed embodiments serve exclusively as examples, and that the invention may also be implemented in other forms. Therefore, specific constructional aspects which are disclosed herein should not be regarded as restrictive for the invention, but merely as a basis for the claims and as a basis for rendering the invention implementable by the average skilled person.

[0042] Furthermore, the various terms used in the description should not be interpreted as restrictive but rather as a comprehensive explanation of the invention.

[0043] The word "a" used herein means one or more than one, unless specified otherwise. The phrase "a plurality of" means two or more than two. The words "comprising" and "having" are constitute open language and do not exclude the presence of more elements.

[0044] Reference figures in the claims should not be interpreted as restrictive of the invention. Particular embodiments need not achieve all objects described.

[0045] The mere fact that certain technical measures are specified in different dependent claims still allows the possibility that a combination of these technical measures may advantageously be applied.

[0046] Embodiments and further embodiments of the present invention may be expressed in words as set out in the following clauses:

Clause 1: Lifting system for a refuse collection vehicle, the lifting system being configured to be arranged at the rear side of the vehicle, wherein the lifting system comprises:

- a lifting chair comprising a gripper configured to grip a refuse bin, wherein the lifting chair is moveable relative to the vehicle between
 - a receiving condition, in which a height axis of the refuse bin is about vertical and an upper side of the bin is arranged higher than the lower side of the bin, and
 - an emptying condition, in which the refuse bin is tilted around a horizontal axis so that the height axis of the refuse bin slants with respect to a horizontal plane and the upper side of the bin is arranged lower than the lower side of the bin, and
- a lower support arranged at the bottom of the lifting chair, wherein the lower support is configured to push and/or support the refuse bin when the refuse bin is moved to the tilted emptying condition; and

wherein the lifting system is configured to allow the lower support, when in the receiving condition, to rotate, with respect to the lifting chair, around a horizontal swing axis from a vertical position, in a backward swing direction opposite to a forward driving direction of the vehicle, to a horizontal position.

Clause 2: Lifting system for a refuse collection vehicle, the lifting system being configured to be arranged at the rear side of the vehicle, wherein the lifting system comprises:

- a lifting chair comprising a gripper configured to grip a refuse bin, wherein the lifting chair is moveable relative to the vehicle between
 - a receiving condition, in which a height axis of the refuse bin is about vertical and an upper side of the bin is arranged higher than the lower side of the bin, and
 - an emptying condition, in which the refuse bin is tilted around a horizontal axis so that the height axis of the refuse bin slants with respect to a horizontal plane and the upper side of the bin is arranged lower than the lower side of the bin, and
- a lower support arranged at the bottom of the lifting chair, wherein the lower support is configured to push and/or support the refuse bin when the refuse bin is moved to the tilted emptying condition; and

wherein the lower support is mounted to the lifting chair by at least one hinge providing a horizontal swing axis;

wherein the at least one hinge is configured to allow the lower support, when in the receiving

condition, to rotate, with respect to the lifting chair, around the horizontal swing axis from a vertical position, in a backward swing direction opposite to a forward driving direction of the vehicle, to a horizontal position, and
 wherein the lifting system is further configured to restrain the lower support from returning to the vertical position after the lower support has rotated from the vertical position, in the backward swing direction, around the horizontal swing axis.

Clause 3: Lifting system according to clause 1, wherein the lifting system is further configured to restrain the lower support from returning to the vertical position after the lower support has rotated from the vertical position, in the backward swing direction, around the horizontal swing axis.

Clause 4: Lifting system according to one of the preceding clauses, wherein the lifting system comprises a friction system configured to arrest rotation of the lower support with respect to the lifting chair such that the lower support is kept motionless, with respect to the lifting chair, in its position once the lower support has been rotated around the horizontal swing axis.

Clause 5: Lifting system according to one of the preceding clauses, wherein the lifting system is configured to prevent the lower support, when in the receiving condition and with the lower support in the vertical position, from moving around the swing axis in a direction opposite to the backward swing direction.

Clause 6: Lifting system according to one of the preceding clauses, wherein the lifting system is configured to prevent the lower support, when moving a bin from the receiving condition to the emptying condition, from moving around the swing axis in a direction opposite to the backward swing direction.

Clause 7: Lifting system according to one of the preceding clauses, wherein the lower support is mounted to the lifting chair by at least one hinge providing the swing axis and allowing the swing in backward swing direction.

Clause 8: Lifting system according to clause 7 or according to one of the clauses 3-6 dependent from clause 2, wherein the hinge has at least one hinge pin or bendable section providing the swing axis.

Clause 9: Lifting system according to one of the clauses 7-8 or according to one of the clauses 3-6 dependent from clause 2, wherein the at least one hinge is a friction hinge.

Clause 10: Lifting system according to clause 9, wherein the friction hinge is configured to arrest rotation of the lower support with respect to the lifting chair such that the lower support is kept motionless, with respect to the lifting chair, in its position once the lower support has been rotated around the hor-

izontal swing axis.

Clause 11: Lifting system according to one or more of the preceding clauses, wherein the lower support is provided with a pad.

Clause 12: Lifting system according to clause 11, wherein the pad is made of or comprises an elastomeric material, such as a rubber.

Clause 13: Lifting system according to one or more of the preceding clauses, wherein the swing axis is arranged at the lowest point of the refuse collection vehicle.

Clause 14: Lifting system according to one or more of the preceding clauses, wherein the swing axis is arranged at the lower end of the lifting chair.

Clause 15: Lifting system according to one or more of the preceding clauses, wherein the lifting system exclusive the lower support defines a main part of the lifting system, and wherein the swing axis is arranged at the lower end of the main part.

Clause 16: Refuse collection vehicle, wherein the vehicle comprises:

- a chassis,
- a driver's cab provided on the chassis, at the front of the chassis,
- a collection body for collecting refuse, provided on the chassis, behind the driver's cab, and
- a tailgate provided at the rear side of the chassis with the collection body arranged between the tailgate and the driver's cab; and
- a lifting system according to one of the preceding clauses, wherein lifting system is provided at the rear of the vehicle with the tailgate arranged between the lifting system and the collection body.

Clause 17: Refuse collection vehicle according to clause 16, wherein the swing axis is, when the lifting chair is in receiving condition, arranged at about 35-70 cm, such as at about 40-50 cm or at about 40-60 cm, above a surface spanned by the location where wheels of the vehicle contact the road.

Claims

1. Lifting system for a refuse collection vehicle, the lifting system being configured to be arranged at the rear side of the vehicle, wherein the lifting system comprises:

- a lifting chair comprising a gripper configured to grip a refuse bin, wherein the lifting chair is moveable relative to the vehicle between

- a receiving condition, in which a height axis of the refuse bin is about vertical and an upper side of the bin is arranged higher than the lower side of the bin, and

- an emptying condition, in which the refuse bin is tilted around a horizontal axis so that the height axis of the refuse bin slants with respect to a horizontal plane and the upper side of the bin is arranged lower than the lower side of the bin, and

- a lower support arranged at the bottom of the lifting chair, wherein the lower support is configured to push and/or support the refuse bin when the refuse bin is moved to the tilted emptying condition; and

wherein the lifting system is configured to allow the lower support, when in the receiving condition, to rotate, with respect to the lifting chair, around a horizontal swing axis from a vertical position, in a backward swing direction opposite to a forward driving direction of the vehicle, to a horizontal position.

2. Lifting system according to claim 1, wherein the lifting system is further configured to restrain the lower support from returning to the vertical position after the lower support has rotated from the vertical position, in the backward swing direction, around the horizontal swing axis.
3. Lifting system according to one of the preceding claims, wherein the lifting system comprises a friction system configured to arrest rotation of the lower support with respect to the lifting chair such that the lower support is kept motionless, with respect to the lifting chair, in its position once the lower support has been rotated around the horizontal swing axis.
4. Lifting system according to one of the preceding claims, wherein the lifting system is configured to prevent the lower support, when in the receiving condition and with the lower support in the vertical position, from moving around the swing axis in a direction opposite to the backward swing direction.
5. Lifting system according to one of the preceding claims, wherein the lifting system is configured to prevent the lower support, when moving a bin from the receiving condition to the emptying condition, from moving around the swing axis in a direction opposite to the backward swing direction.
6. Lifting system according to one of the preceding claims, wherein the lower support is mounted to the lifting chair by at least one hinge providing the swing axis and allowing the swing in backward swing direction.
7. Lifting system according to claim 6, wherein the hinge has at least one hinge pin or bendable section providing the swing axis.

8. Lifting system according to one of the claims 6-7, wherein the at least one hinge is a friction hinge.
9. Lifting system according to claim 8, wherein the friction hinge is configured to arrest rotation of the lower support with respect to the lifting chair such that the lower support is kept motionless, with respect to the lifting chair, in its position once the lower support has been rotated around the horizontal swing axis.
10. Lifting system according to one or more of the preceding claims, wherein the lower support is provided with a pad, which pad may optionally be made of or comprise an elastomeric material, such as a rubber.
11. Lifting system according to one or more of the preceding claims, wherein the swing axis is arranged at the lowest point of the refuse collection vehicle.
12. Lifting system according to one or more of the preceding claims, wherein the swing axis is arranged at the lower end of the lifting chair.
13. Lifting system according to one or more of the preceding claims, wherein the lifting system exclusive the lower support defines a main part of the lifting system, and wherein the swing axis is arranged at the lower end of the main part.
14. Refuse collection vehicle, wherein the vehicle comprises:
 - a chassis,
 - a driver's cab provided on the chassis, at the front of the chassis,
 - a collection body for collecting refuse, provided on the chassis, behind the driver's cab, and
 - a tailgate provided at the rear side of the chassis with the collection body arranged between the tailgate and the driver's cab; and
 - a lifting system according to one of the preceding claims, wherein lifting system is provided at the rear of the vehicle with the tailgate arranged between the lifting system and the collection body.
15. Refuse collection vehicle according to claim 14, wherein the swing axis is, when the lifting chair is in receiving condition, arranged at about 35-70 cm, such as at about 40-50 cm or at about 40-60 cm, above a surface spanned by the location where wheels of the vehicle contact the road.

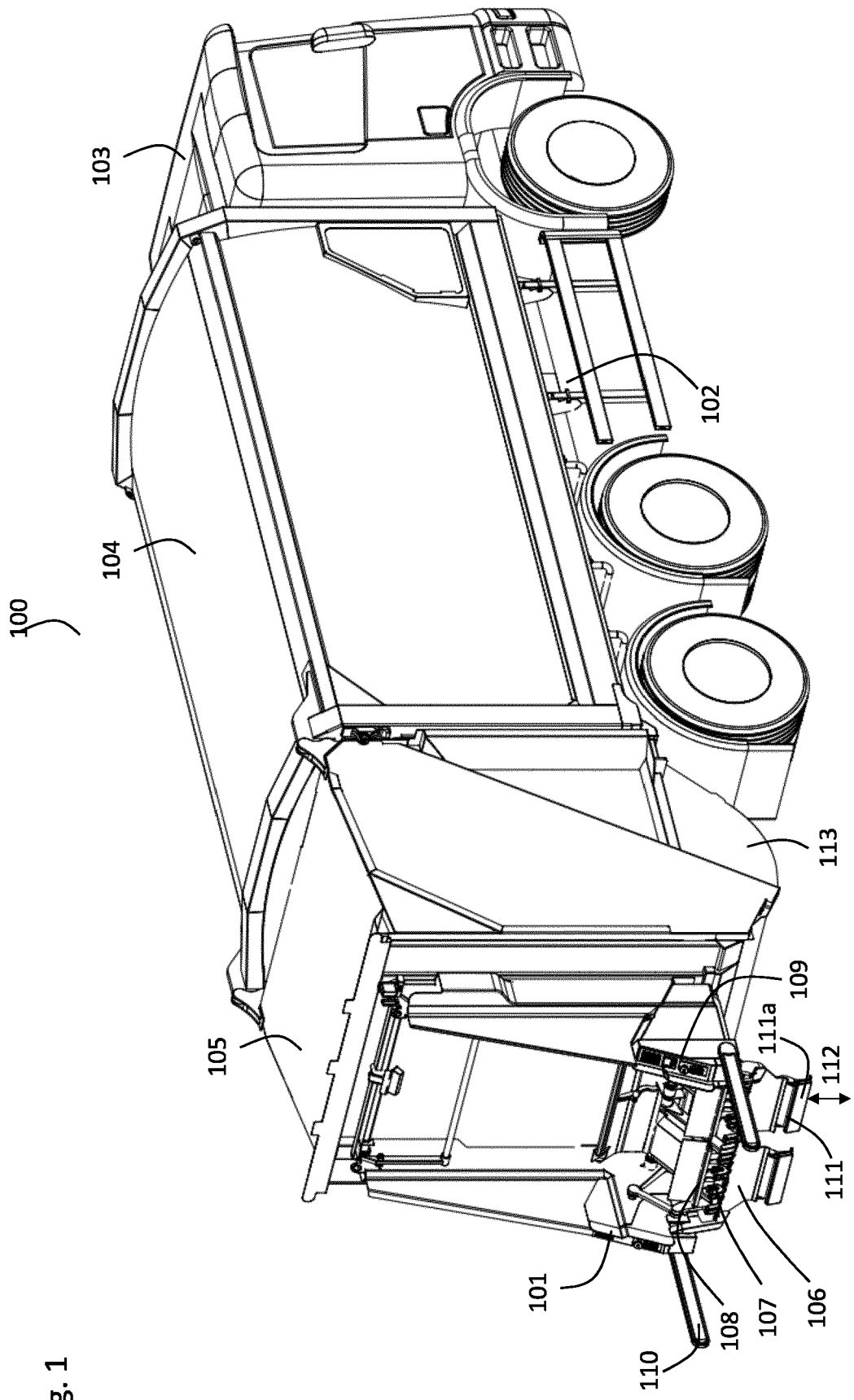


Fig. 1

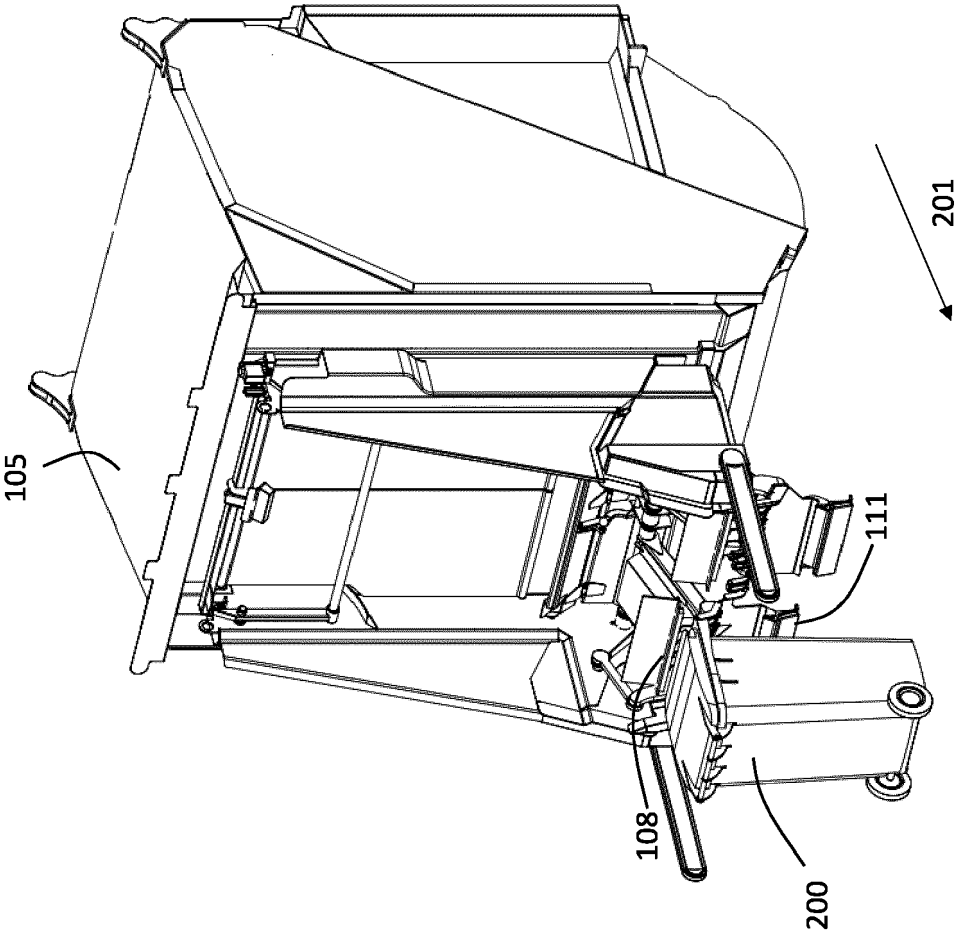


Fig. 2

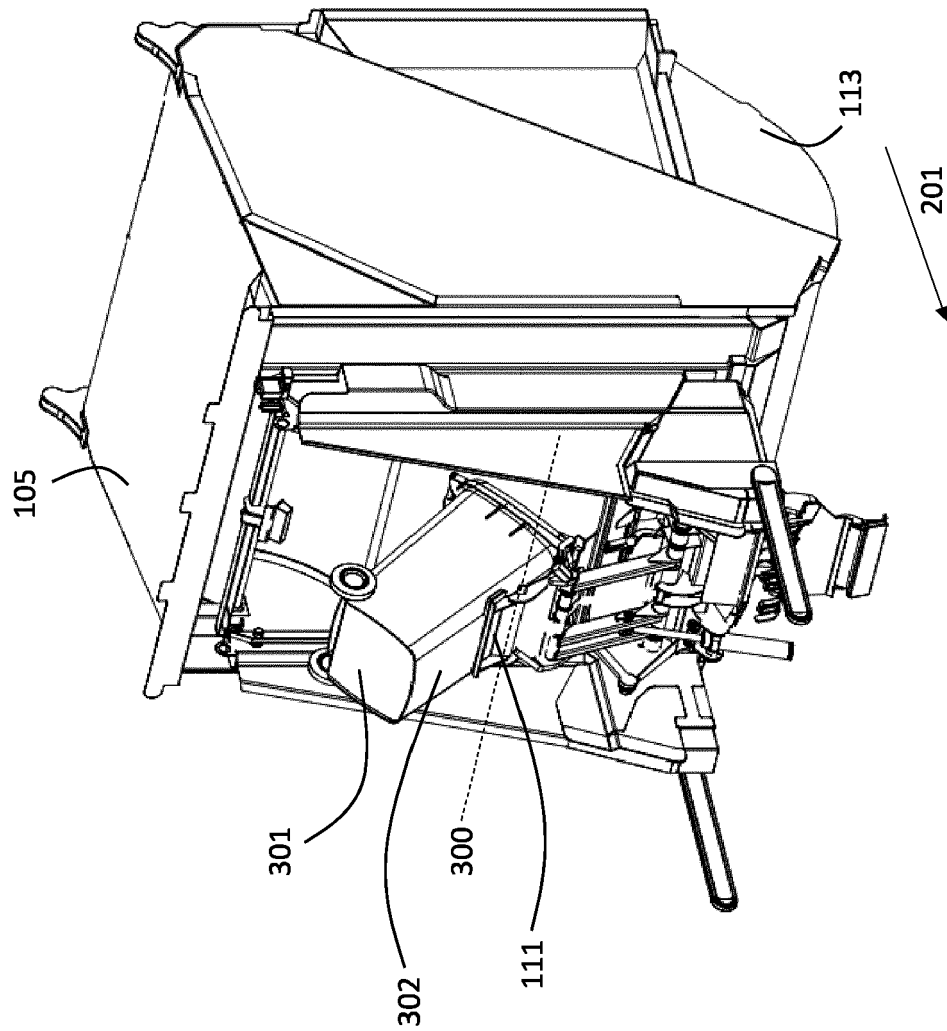


Fig. 3

Fig. 4a

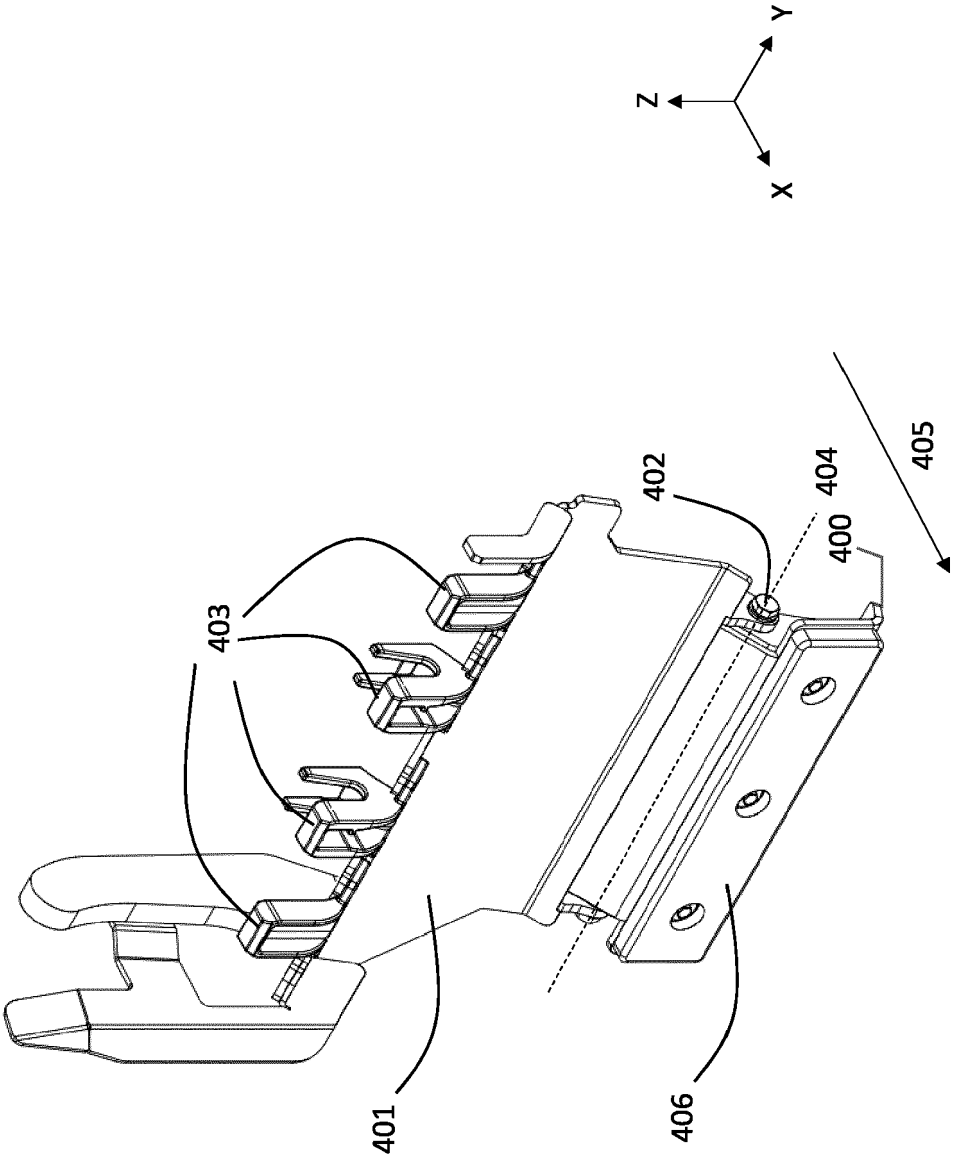
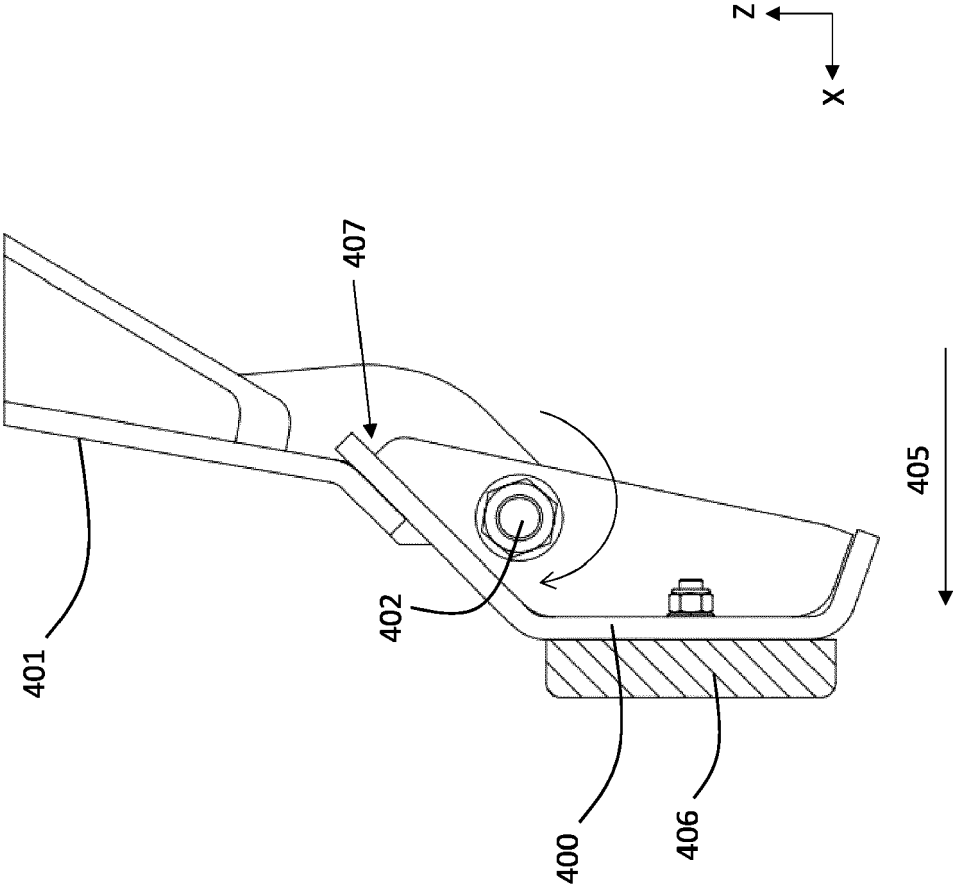


Fig. 4b



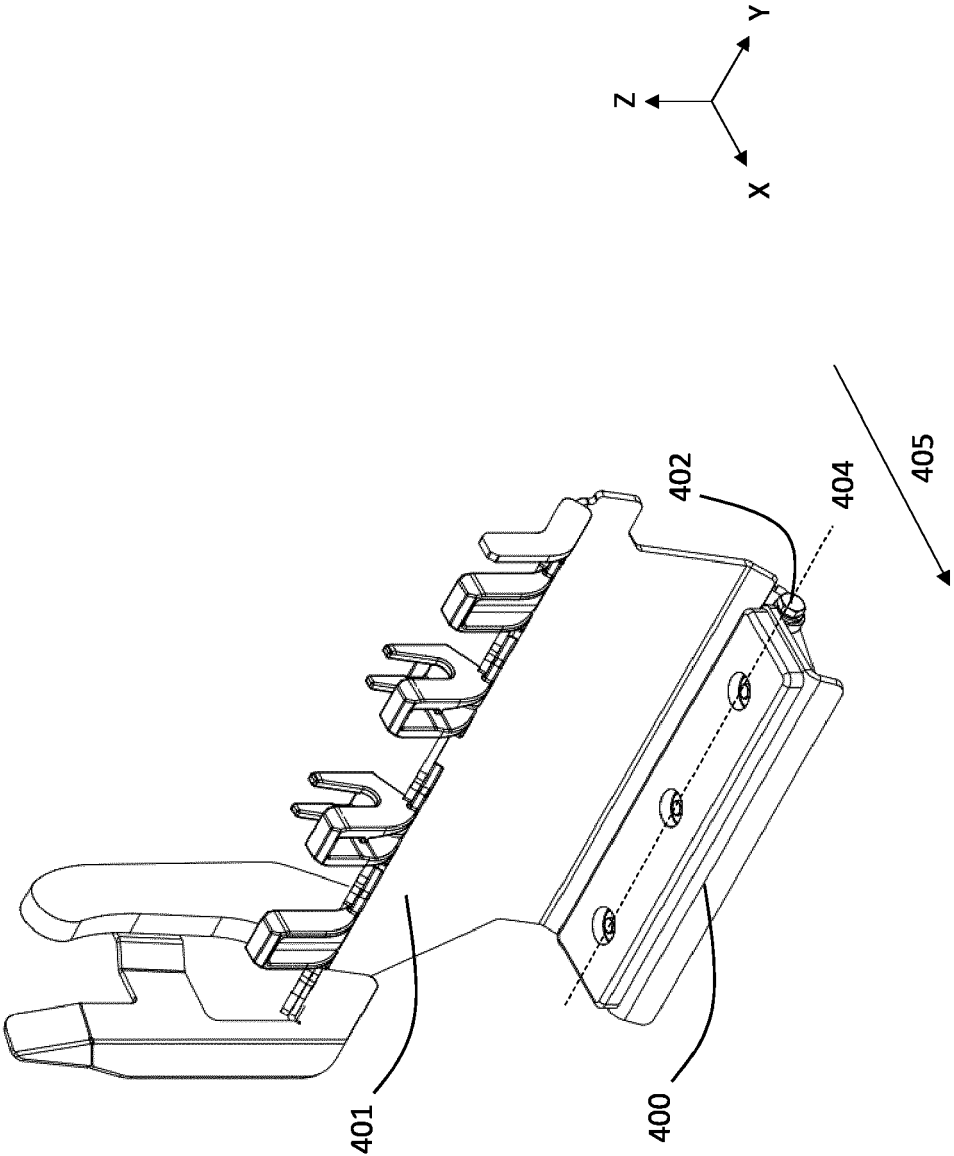


Fig. 5a

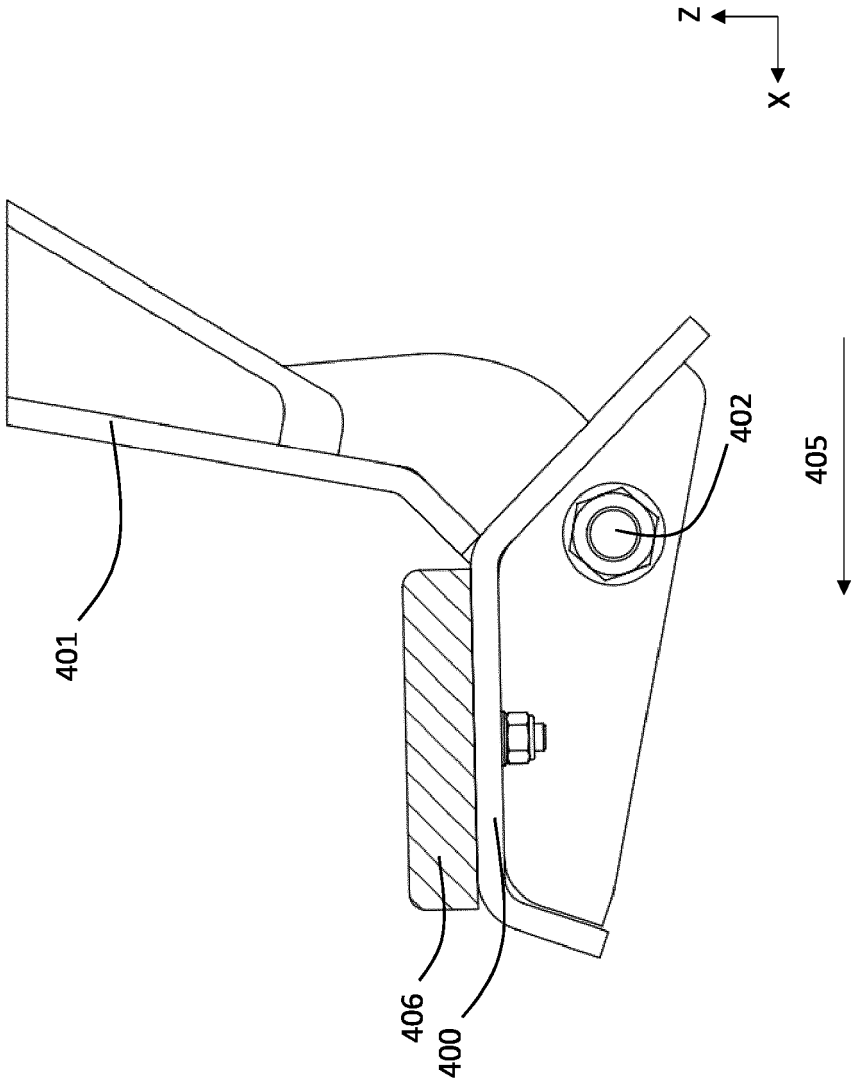


Fig. 5b



EUROPEAN SEARCH REPORT

Application Number

EP 21 21 0225

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			B65F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 March 2022	Examiner Luepke, Erik
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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