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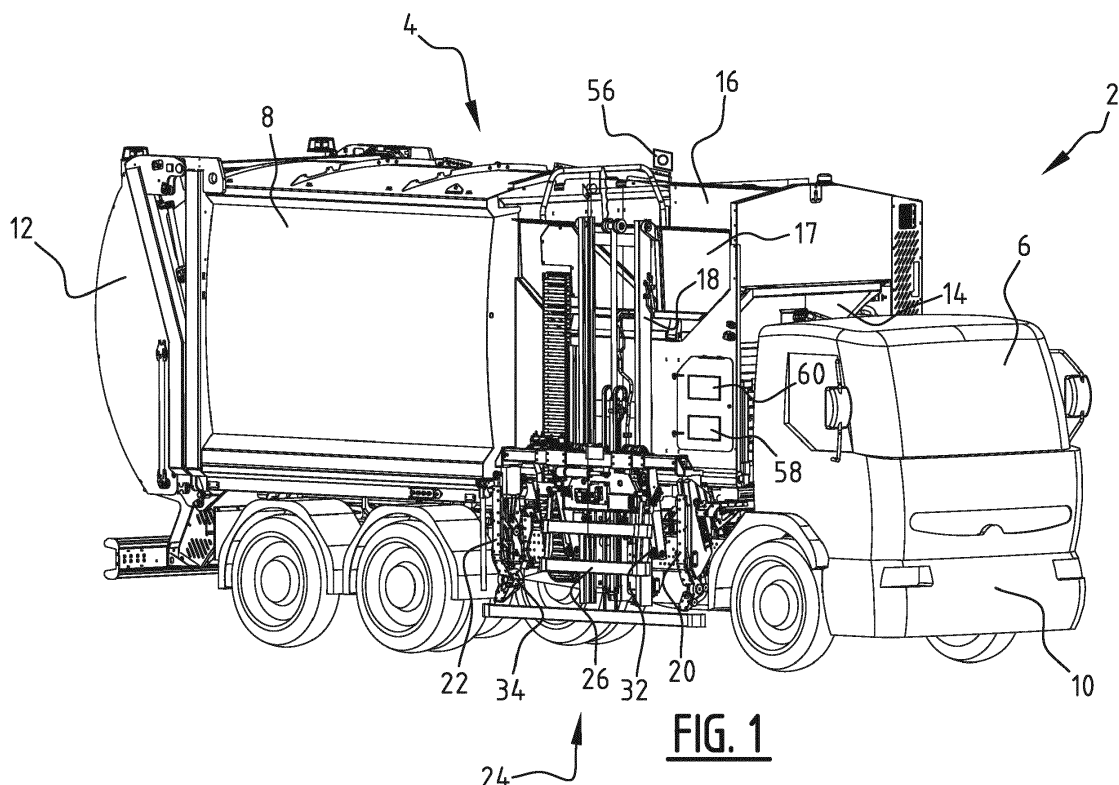
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(54) SIDEWARD LOADING SYSTEM AND METHOD FOR LIFTING AND EMPTYING A CONTAINER

(57) The invention relates to a side loader system (4) for lifting and emptying a bin (42), a refuse truck (2) provided therewith and method therefor. The side loader system according to the invention comprises:

- a loading frame attachable with coupling means to the collector;
- a lifting mechanism (18, 20, 22) arranged on the frame

and configured to pick up, lift and empty the bin; and
 - a lifting drive system (21, 28, 30, 32) operatively connected to the lifting mechanism and configured to drive the lifting mechanism,
 wherein the loading system is provided with a lateral positioning system (24) configured to position the lifting mechanism in lateral direction relative to the bin.

**FIG. 1****EP 3 862 295 A1**

Description

[0001] The present invention relates to a loading system and more particularly to a side loader system. Such a loading system is used particularly to empty bins, or other containers, which are filled for instance with waste, into a refuse truck or collection container. The side loader system here empties the bin or container at the side of the refuse truck or collection container.

[0002] Known in practice are diverse loading systems with which refuse bins are emptied into a refuse truck. These loading systems are usually provided on the rear side of the refuse truck, wherein the bins are raised using a so-called loading seat and are emptied into an opening of the collector. During emptying the bin is moved upward in a lifting movement and tilted by means of a tilting movement for the purpose of emptying. The lifting movement and tilting movement can be performed simultaneously and/or successively.

[0003] Refuse trucks provided with a side loader system which are known in practice make use of two lifting arms. The refuse truck is here placed at the correct position relative to the bin, after which the lifting arms are activated to pick up the bin and perform the desired lifting movement and tilting movement to empty the bin.

[0004] A problem which occurs with such known side loader systems is that the bin to be picked up is here usually displaced over the ground in order to be able to pick the bin up properly. This is also due to the vehicle not being positioned exactly at the desired position relative to the bin. In order to still pick up the bin, the picking up with the lifting arms is forced, whereby the bin may move, damage may be caused to the bin, damage may be caused to the area surrounding the bin, and damage may be caused to the loading system with the lifting arms.

[0005] The present invention has for its object to provide a side loader system wherein the above stated problems are obviated, or at least reduced.

[0006] This object is achieved with the side loader system for lifting and emptying a bin into a collector according to the invention, wherein the side loader system comprises:

- a loading frame attachable with coupling means to the collector;
- a lifting mechanism arranged on the frame and configured to pick up, lift and empty the bin; and
- a lifting drive system operatively connected to the lifting mechanism and configured to drive the lifting mechanism,

wherein the loading system is provided with a lateral positioning system configured to position the lifting mechanism in lateral direction relative to the bin.

[0007] The loading system according to the invention is configured to pick up and lift a bin and then empty it into a collector. Bin is understood to mean any type of container suitable for containing waste, including glass,

paper, biodegradable waste, other waste and other types of material. This is for instance a bin with a volume of about 1100 litres with wheels, and also larger bins with a volume of 2200-3200 litres which are not provided with wheels and are disposed at a fixed position. The frame of the loading system is preferably mounted on the collector using coupling means. The coupling means can take diverse forms, including using bolts, hooks, pin/hole connections and other suitable and preferably releasable connections.

[0008] The collector can be a collection container at a specific location or a housing for instance a refuse truck in which the waste can be placed. The collector is preferably operatively connected to a press or other press system whereby the material is placed in the collector in compressed form. An unloading opening into which the bin can be emptied is provided here.

[0009] The loading system is configured to perform a substantially vertical and lifting movement, and a tilting movement for emptying the bin. This can for instance be embodied in similar manner as described for a loading system on the rear side of a refuse truck in for instance EP 2 347 978 A1. Use can be made here of a single drive and of separate drives, for instance with separate hydraulic cylinders. Alternative embodiments for such a drive are also possible according to the invention. It is for instance possible to envisage here a wholly or partially electrical drive using a battery or for instance the refuse truck and/or a separate battery.

[0010] According to the invention, the lifting movement and the tilting movement can be performed (partially) simultaneously as well as be performed successively. In the context of the invention the described lifting mechanism and the described drive system is preferably able to perform both the lifting movement and the tilting movement, using separate cylinders. In a currently preferred embodiment the lifting movement, tilting movement and the lateral positioning movements, as well as the movement of the possible lifting arms, are realized using a number of cylinders which are preferably driven hydraulically and/or alternatively electrically.

[0011] According to the invention, the side loader system is provided with a lateral positioning system configured to position the lifting mechanism in lateral direction relative to the bin. This lateral direction preferably extends in a direction substantially parallel to the longitudinal direction of the vehicle and/or collector. The lateral positioning system enables the lifting mechanism to be positioned relative to the bin in this lateral direction. This achieves that the lifting mechanism can be positioned in this lateral direction, for instance also once the refuse truck with the side loader system has been parked adjacently of a bin, wherein the mutual distance between collector and bin is fixed. Following the parking, the lifting mechanism is positioned correctly relative to the bin using the lateral positioning system.

[0012] The lifting mechanism is preferably provided with two lifting arms. Using the lateral positioning system

these lifting arms are positioned relative to the bin, such that the bin can be picked up in correct manner. This results in an optimal alignment of the lifting mechanism relative to the bin to be emptied.

[0013] According to the invention, it is alternatively or additionally preferably likewise possible to activate the lifting arms and align them using the lateral positioning system when they approach or even when they come into contact with the bin. This is for instance possible by positioning the lifting mechanism relative to the bin as soon as one of the two lifting arms approaches the bin or has come into contact therewith.

[0014] By positioning the lifting mechanism relative to the bin prior to activation of the lifting arms and/or after activation of these lifting arms a correct alignment of the lifting mechanism relative to the bin is realized. This prevents the bin being pushed away as a result of an alignment which is incorrect or not optimal. This in turn results in damage being avoided to the bin and/or loading system and/or refuse truck provided with the collector and/or the immediate surroundings, such as parked cars. This applies to both freestanding bins and to bins that are fixed at a specific position using positioning elements such as ramps, bumpers, edges and so on. It further likewise applies to bins that are fixedly placed and to bins that are provided with wheels.

[0015] In an advantageous embodiment according to the invention a detection system is provided, such as a camera or reader, which is arranged on the loading system, collector and/or refuse truck in order to thereby detect the correct position of the loading system relative to the bin. Use can for instance be made here of a line, groove or other identifying mark arranged on the bin to be emptied.

[0016] In an advantageous embodiment the lateral positioning system is likewise suitable to position the bin relative to the unloading opening of the collector during emptying of the bin, i.e. preferably during the lifting movement. This prevents the possibility of the bin ending up wholly or partially next to the unloading opening. Such an adjustment can therefore be performed during the movement, if desired. This prevents part of the contents of a bin from being placed in the collector, or at least in the unloading opening thereof, in incorrect manner.

[0017] The lifting arms are preferably provided with a locking configured to engage on the bin, preferably such that the lifting arms remain in a safe engagement with the bin during the tilting movement and thereby bring about a safe emptying of the bin. Such a locking can for instance be performed using a hook or pin or other suitable locking element.

[0018] In an advantageous embodiment according to the invention the lifting mechanism is provided with at least one contact sensor and/or distance sensor configured to detect contact and/or distance in lateral direction of the lifting mechanism to the bin.

[0019] Providing a contact sensor and/or distance sensor enables the lateral positioning mechanism to be con-

trolled on the basis of an actual measurement of contact and/or distance of the engagement of the lifting mechanism on the bin, for instance in the form of an engagement with lifting arms. Such a correction of the position of the lifting mechanism relative to the bin enables a good alignment of the lifting mechanism relative to the bin. This further reduces the risk of damage.

[0020] Such a contact sensor and/or distance sensor is for instance embodied as a so-called Hall sensor, optical sensor and/or other suitable sensor for measuring contact and/or distance. It is optionally possible to additionally or alternatively provide in a cylinder of the lifting mechanism a sensor whereby it is possible to detect an increased resistance to displacement of the cylinder, for instance as a result of contact with the bin. Such a sensor is hereby provided in a (semi-)enclosed space so that contamination can thereby be prevented. The conditions, such as temperature and humidity, can additionally be controlled better in such a cylinder. This enhances the reliability of the measurement.

[0021] In an advantageous embodiment according to the invention the lifting mechanism further comprises a free-running mechanism.

[0022] Damage to the bin, lifting mechanism and/or loading system can be avoided or at least be limited by providing a free-running mechanism. If lifting arms are used, they can for instance be provided with a free-running mechanism in order to thereby run freely in the case that a lifting arm is in contact with or lies at a minimum distance to the bin. The lifting mechanism can hereby be positioned in lateral direction in effective manner with the lateral positioning system. It is therefore a correction of the positioning of the lifting mechanism relative to the bin while approaching the bin. The free-running mechanism preferably makes use here of one or more cylinders, for instance a hydraulic cylinder, which enables a corrective displacement of the lifting arms during the process of engaging on the bin. It will be apparent that a possible combination of positioning the lifting mechanism after parking adjacently of the bin, correcting the position of the lifting mechanism while approaching the bin with for instance the lifting arms, and/or correcting the position of the bin relative to the unloading opening during the lifting movement can bring about a very good alignment between lifting mechanism and bin/unloading opening.

[0023] One or more distance measuring means, such as a distance sensor as discussed above, are thus provided in a currently preferred embodiment according to the invention. Such sensors are optionally mounted on or in the lifting arms. During use the preferably two lifting arms are positioned adjacently of the bin to be emptied with clearance. The sensor/sensors measure the distance between the lifting arms and the bin and a lateral control of the lifting arms is performed. Such a control can be realized by a separate lifting controller and/or an integrated controller for the overall emptying process and/or for the whole vehicle. If necessary, a corrective correction can be performed with the free-running mech-

anism during the process of engaging with the lifting arms on the bin. Following the lateral positioning, the lifting arms pick up the bin and the emptying process can be performed, up to and including setting down of the emptied bin, without performing an undesired horizontal displacement or other displacement of the bin. Different position corrections, i.e. both a correction of the lateral positioning of the two lifting arms collectively prior to activation of the lifting arms and a corrective action of a single lifting arm during the process of the actual engagement on the bin, can be performed in an advantageous embodiment in order to further minimize the risk of damage. For an even better positioning of the bin relative to the unloading opening it is preferably possible to perform a lateral correction of the two lifting arms collectively also during the lifting movement.

[0024] In a further embodiment according to the invention it is provided with a locking system configured to lock the loading system.

[0025] In an advantageous embodiment the locking system is provided to keep the loading system locked, particularly during transport, relative to the collector, particularly the refuse truck provided with such a collector. This prevents objects and/or fellow road users from being able to come into contact with the loading system, or at least greatly reduces the risk thereof. This increases traffic safety.

[0026] Such a locking system is preferably provided with a locking configured to position the lifting mechanism relative to the locking. This can for instance be embodied in the form of a hook or recess, and a (positioning) cylinder which is configured to raise the mechanism and position it relative to this hook or recess or other suitable locking element. It is potentially also possible to move the hook relative to the lifting mechanism and thereby lock the lifting mechanism. In an alternative embodiment the locking element is embodied as an element which forms a cavity or space, or other container, wherein the (positioning) cylinder positions the mechanism in this container such that the lifting mechanism is prevented from being able to get (or slip) out of this locking in response to for instance driving over a speed bump or coming into contact with a kerb.

[0027] In a further advantageous embodiment according to the invention the lifting mechanism is provided on or close to a contact point during lifting of the bin with a weighing sensor.

[0028] By arranging a weighing sensor on or close to the contact point during lifting of the bin, i.e. on or close to the point of engagement of the lifting mechanism and the bin, a direct measurement of the weight of the bin and the contents thereof can be obtained. This particularly avoids the need to for instance take into consideration the lifting arm, which acts as weighing arm in the case of a weighing, whereby the measurement may become less accurate. A more reliable measurement therefore becomes possible by arranging the weighing sensor on or close to the contact point.

[0029] In a further advantageous embodiment according to the invention the side loader system comprises a support element configured to support the bin. By providing an (additional) support element a more stable lifting movement and/or tilting movement is realized. This increases the safety of the process for the purpose of emptying a bin, particularly if bins of different dimensions are being handled.

[0030] In a currently preferred embodiment such a support element is provided in extendable manner on the lifting mechanism. In such an embodiment the support element extends sideways, i.e. substantially in transverse direction to the lateral direction, and comes into contact with the bin. If two lifting arms are used on the lifting mechanism, this support element is preferably provided halfway between the two lifting arms so as to provide an optimal support.

[0031] In a further advantageous embodiment the side loader system according to the invention is further provided with a camera system configured to monitor a correct emptying of the bin into the collector.

[0032] By providing a camera system or other suitable sensor system the emptying of the bin into the unloading opening of the collector in particular can be monitored.

This is for instance important when emptying a bin for paper or cardboard wherein a so-called bridge formation can for instance occur, due to which the unloading opening can be wholly or partially blocked and/or the press system can become jammed. If such a blockage or jamming is detected, it is optionally possible to activate a vibrating or hammering element, also referred to as a bridge breaker. Such a blockage or jamming is then remedied hereby in effective manner.

[0033] In a further advantageous embodiment according to the invention the lifting drive system is operatively connected to a press drive of a press system.

[0034] The press or the press system compresses the waste emptied from the bin in order to thereby increase the capacity of the collector. The press or the press system makes use of a press drive to be able to realize the actual pressing. By operatively connecting the lifting drive system to the press drive the capacity of the drive system can be utilized for pressing the contents of an already emptied bin if it is not in use for emptying a bin. A higher pressing speed can hereby be realized, and thereby a greater compacting capacity, and/or a smaller press can alternatively be provided.

[0035] The invention also relates to a collection vehicle provided with the side loader system in an embodiment according to the present invention.

[0036] Such a collection vehicle provides similar effects and advantages as described for the side loader system. Such a collection vehicle is preferably a so-called refuse truck.

[0037] The invention also relates to a method for emptying a bin, wherein the method comprises the steps of:

- providing a loading system and/or collection vehicle

provided therewith according to the present invention;

- picking up the bin to be emptied with the loading system;
- lifting and emptying the bin; and
- setting down the emptied bin.

[0038] Such a method provides similar advantages and effects as described for the side loader system and/or collection vehicle.

[0039] Picking up the bin to be emptied is performed particularly by the lifting mechanism of the loading system. The lifting mechanism is preferably positioned in lateral direction relative to the bin using a lateral positioning system. This lateral positioning can be carried out prior to activation of the lifting mechanism and/or while the lifting mechanism approaches the bin and/or during the actual lifting of the bin with the lifting mechanism.

[0040] The method preferably further comprises the step of fixing and/or locking the loading system for transport. This makes transport safer.

[0041] Further advantages, features and details of the invention are elucidated on the basis of preferred embodiments thereof, wherein reference is made to the accompanying drawings, in which:

- Figure 1 shows a view of a refuse truck provided with a side loader system according to the invention;
- Figure 2 shows a cross-section from the rear side of the refuse truck of figure 1;
- Figure 3 shows a top view of the loading system applied in the refuse truck of figure 1;
- Figure 4 shows a perspective view of the loading system of figure 3; and
- Figure 5 shows a perspective view of the emptying of the bin after the tilting movement was performed following the picking up and lifting with the loading system of figures 3 and 4.

[0042] Refuse truck 2 (Figure 1) is provided with loading system 4, vehicle cab 6 and collector 8 in which goods, such as waste, can be placed. Refuse truck 2 is further provided with chassis 10 and tailgate 12 for emptying collector 8. In addition, refuse truck 2 is provided in the shown embodiment with press 14 and hopper 16 with an unloading opening. Hopper 16 is further provided with waste slide-off plate 17.

[0043] Loading system 4 is provided with lifting mast 18 over which lifting carriage 19 can move in an at least partially vertical direction in order to perform the lifting movement. Lifting arms 20, 22 are provided on loading system 4 and configured to pick up bin 42 (Figure 3). Tilting cylinder 21 (Figure 5) is provided in the shown embodiment for the purpose of tilting bin 42.

[0044] Lateral positioning mechanism 24 is provided with side guard 26 (Figure 1) and lateral correction cylinder 28 (Figure 3). Sideways correction 30 (Figure 3) enables lateral positioning. Lifting arm cylinder 32 ena-

bles the height movement for the bin. Lifting arms 20, 22 are further provided with so-called trunnion pick-up point 34 (Figure 2) which can engage on trunnion 44 (Figure 4) of bin 42. Bin 42 is provided with emptying lid 43.

[0045] Lifting arm positioning adjustment 36, 38 enables a lateral positioning of lifting arms 20, 22. Lifting arm width adjustment cylinder 40 enables the width adjustment of lifting arm(s) 20, 22. Telescopic extendable arm 46 enables a substantially horizontal movement of a lower outer end of lifting mast 18 around a rotation axis close to an upper outer end of lifting mast 18 (Figure 4). Transport hook 48 (Figure 2) fixes the lifting mechanism particularly in a transport position using transport hook suspension point 50 (Figures 2, 4). A transport hook position sensor 52 is preferably provided here to monitor the correct fixation, particularly during transport. Load cell 54 (Figure 5) is provided in the shown embodiment in lifting arms 20, 22 for an accurate measurement of the weight of bin 42. Free-running system 39 (Figure 3) for lifting arms 20, 22 is further provided in the shown embodiment. Free-running system 39 is controlled by an integrated lifting controller and/or by a controller integrated with the loading system or vehicle whereby the preferably hydraulic cylinder(s) 40 are controlled.

[0046] In the shown embodiment camera 56 (Figure 1) is optionally provided for the purpose of monitoring the unloading opening of hopper 16. Refuse truck 2 and/or loading system 4 are further provided with lifting drive 58 for loading system 4 and press drive 60 for press 14 (Figure 1). In the shown embodiment these are for instance operatively connected such that lifting drive 58 can add power to press drive 60 if no bin needs to be emptied. Detector 62 (Figure 3) is provided on or close to the outer end of lifting arms 20, 22 in order to detect contact or a certain minimum distance from lifting arms 20, 22 to bin 42.

[0047] In the shown embodiment bin 42 is provided with a first positioning groove 64 and second positioning groove 66 whereby bin 42 can be fixed at a fixed position in the street (Figure 5).

[0048] In the shown embodiment refuse truck 2 is moved to bin 42 for the purpose of emptying bin 42. Vehicle 2 is stopped at the position of bin 42 such that loading system 4 can be activated. The lifting mechanism is preferably positioned in lateral direction using lateral correction 30. Following activation of lifting arms 20, 22 they are moved in transverse direction of the lateral direction (of travel) of refuse truck 2, such that they can engage on bin 42. After detection using detector 62, one of the lifting arms 20, 22 is here optionally stopped, as it were, using the free-running mechanism 39, and with a lateral displacement of the lifting mechanism the other lifting arm can likewise approach bin 42. Loading system 4 can hereby engage on bin 42 without bin 42 for instance being displaced. Different position corrections, i.e. both lateral positioning prior to activation of the lifting arms and a corrective action during the engagement, can be performed in combination for an even better positioning of

bin 42 relative to the unloading opening of hopper 16.

[0049] Following engagement of bin 42 lifting carriage 19 is moved upward along lifting mast 18 using lifting cylinder 32. In the shown embodiment a tilting movement is performed close to the outer end of this wholly or partially vertical movement by activation of tilting cylinder 21, whereby bin 42 is tilted above the unloading opening of hopper 16. During this partially upward movement it is possible to perform an additional lateral correction in order to position bin 42 relative to the unloading opening of hopper 16.

[0050] After bin 42 is emptied, the tilting movement and lifting movement are performed in reverse direction and bin 42 is set back down at the desired position. Refuse truck 2 can then be moved to subsequent bin 42. The material in hopper 16 can be compressed using press 14. Use is optionally made here of lifting drive 58 in addition to press drive 60 in order to further increase the pressing capacity.

[0051] It has been found that damage to bin 42, loading system 4, refuse truck 2 and the surrounding area, such as parked vehicles, can be reduced considerably with such a method for emptying bins 42.

[0052] The present invention is by no means limited to the above described preferred embodiments thereof. The rights sought are defined by the following claims, within the scope of which many modifications can be envisaged.

Claims

1. Side loader system for lifting and emptying a bin into a collector, the loading system comprising:

- a loading frame attachable with coupling means to the collector;
- a lifting mechanism arranged on the frame and configured to pick up, lift and empty the bin; and
- a lifting drive system operatively connected to the lifting mechanism and configured to drive the lifting mechanism,

wherein the lifting mechanism is provided with two lifting arms, and
wherein the loading system is provided with a lateral positioning system configured to position the lifting mechanism in lateral direction relative to the bin.

2. Side loader system according to claim 1, wherein the lifting arms are provided with a locking configured to engage on the container.

3. Side loader system according to claim 1 or 2, wherein the lifting mechanism is provided with at least one contact sensor and/or distance sensor configured to detect contact and/or distance in lateral direction of the lifting mechanism to the bin.

4. Side loader system according to any one of the foregoing claims, wherein the lifting mechanism further comprises a free-running mechanism.

5. Side loader system according to any one of the foregoing claims, further comprising a locking system configured to lock the loading system.

6. Side loader system according to claim 5, wherein the locking system is provided with a locking configured to position the lifting mechanism relative to the locking.

7. Side loader system according to any one of the foregoing claims, wherein the lifting mechanism is provided on or close to a contact point during lifting of the bin with a weighing sensor.

8. Side loader system according to any one of the foregoing claims, further comprising a support element configured to support a bin.

9. Side loader system according to claim 8, wherein the support element is provided in extendable manner on the lifting mechanism.

10. Side loader system according to any one of the foregoing claims, further comprising a camera system configured to monitor a correct emptying of the bin into the collector.

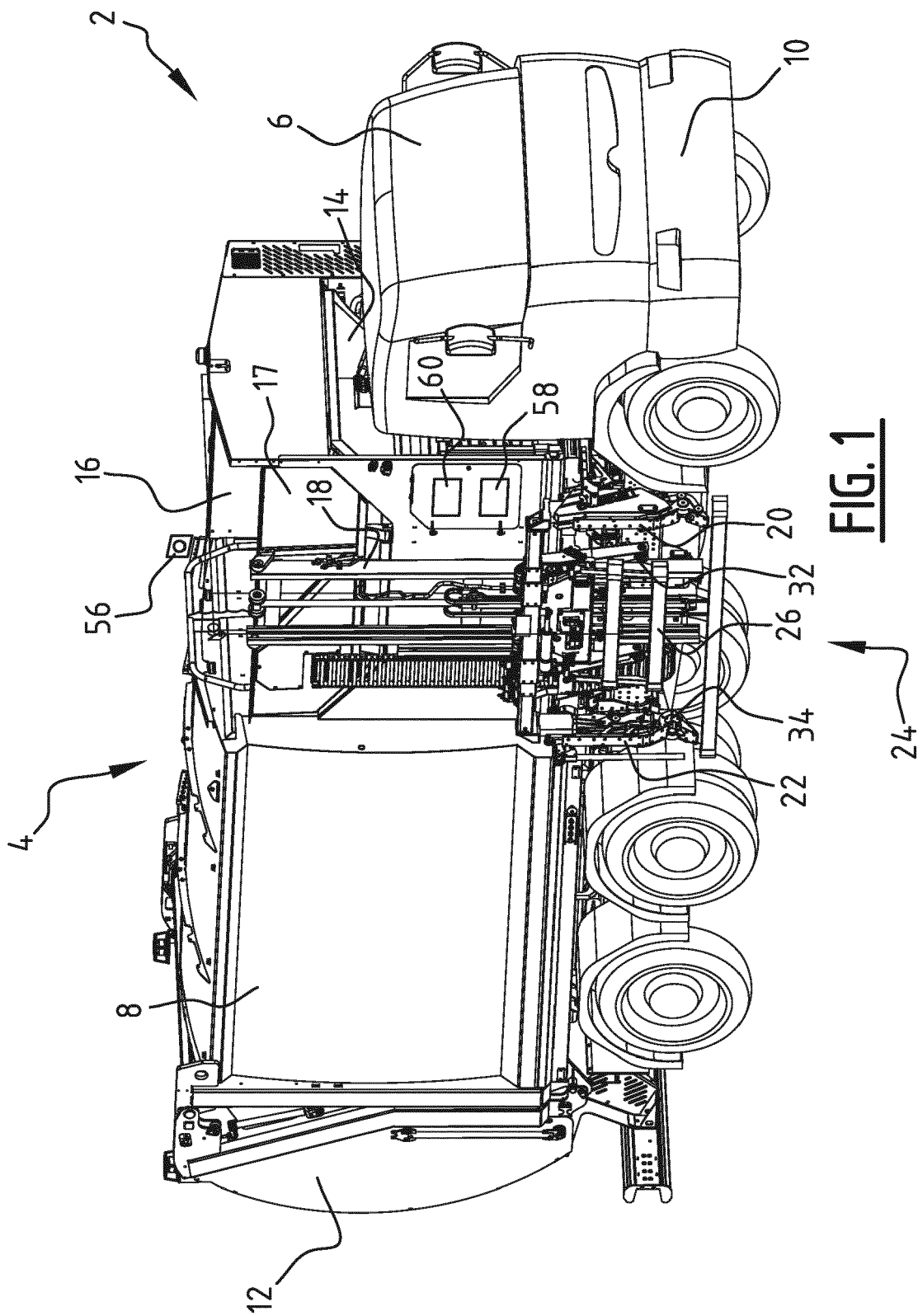
11. Side loader system according to any one of the foregoing claims, wherein the lifting drive system is operatively connected to a press drive of a press system.

12. Collection vehicle provided with a side loader system according to any one of the foregoing claims.

13. Method for emptying a bin, the method comprising the steps of:

- providing a loading system and/or collection vehicle according to any one of the foregoing claims;
- positioning the lifting mechanism with the lateral positioning system;
- picking up the bin to be emptied with the lifting mechanism;
- lifting and emptying the bin; and
- setting down the emptied bin.

14. Method according to claim 13, further comprising the step of fixing and/or locking the loading system for transport.



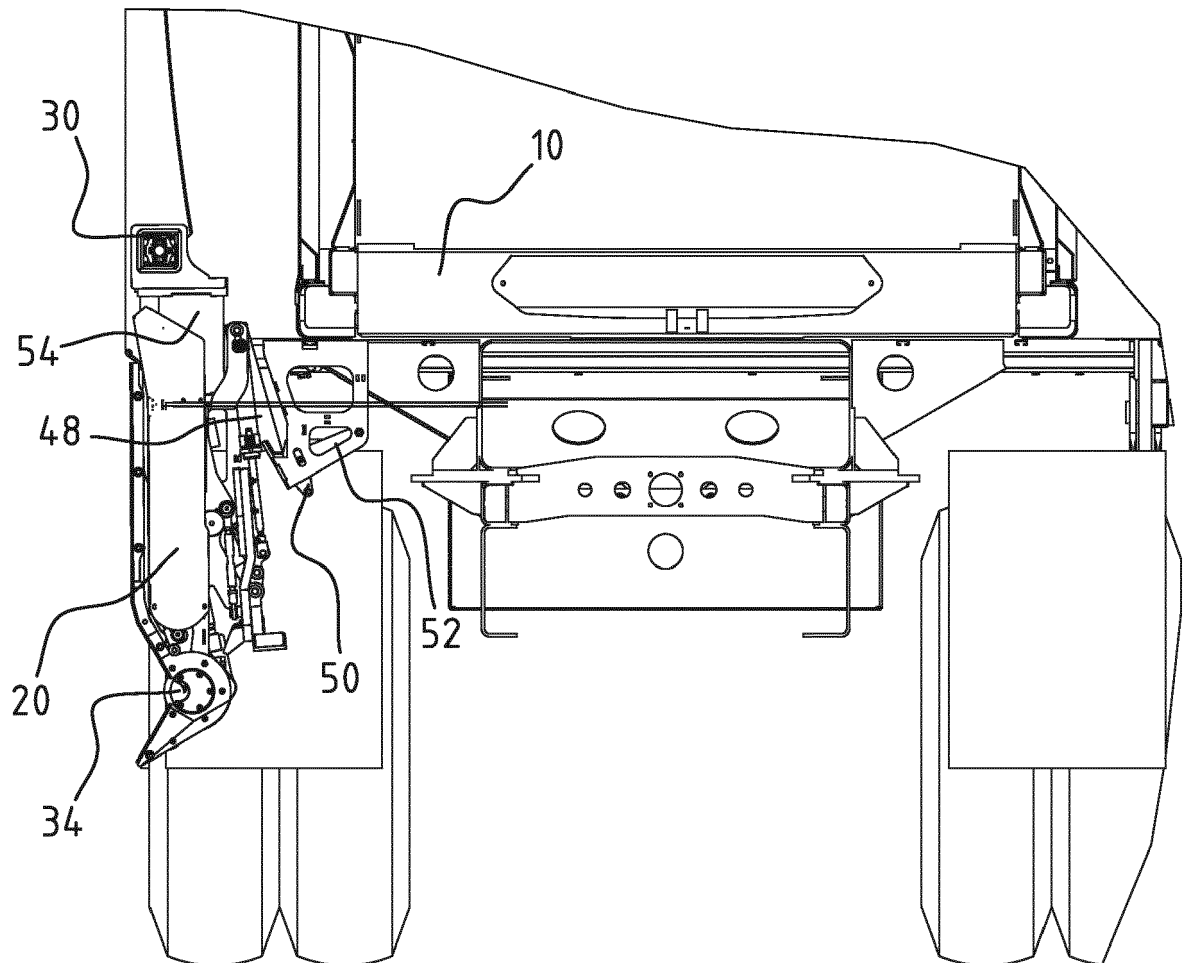
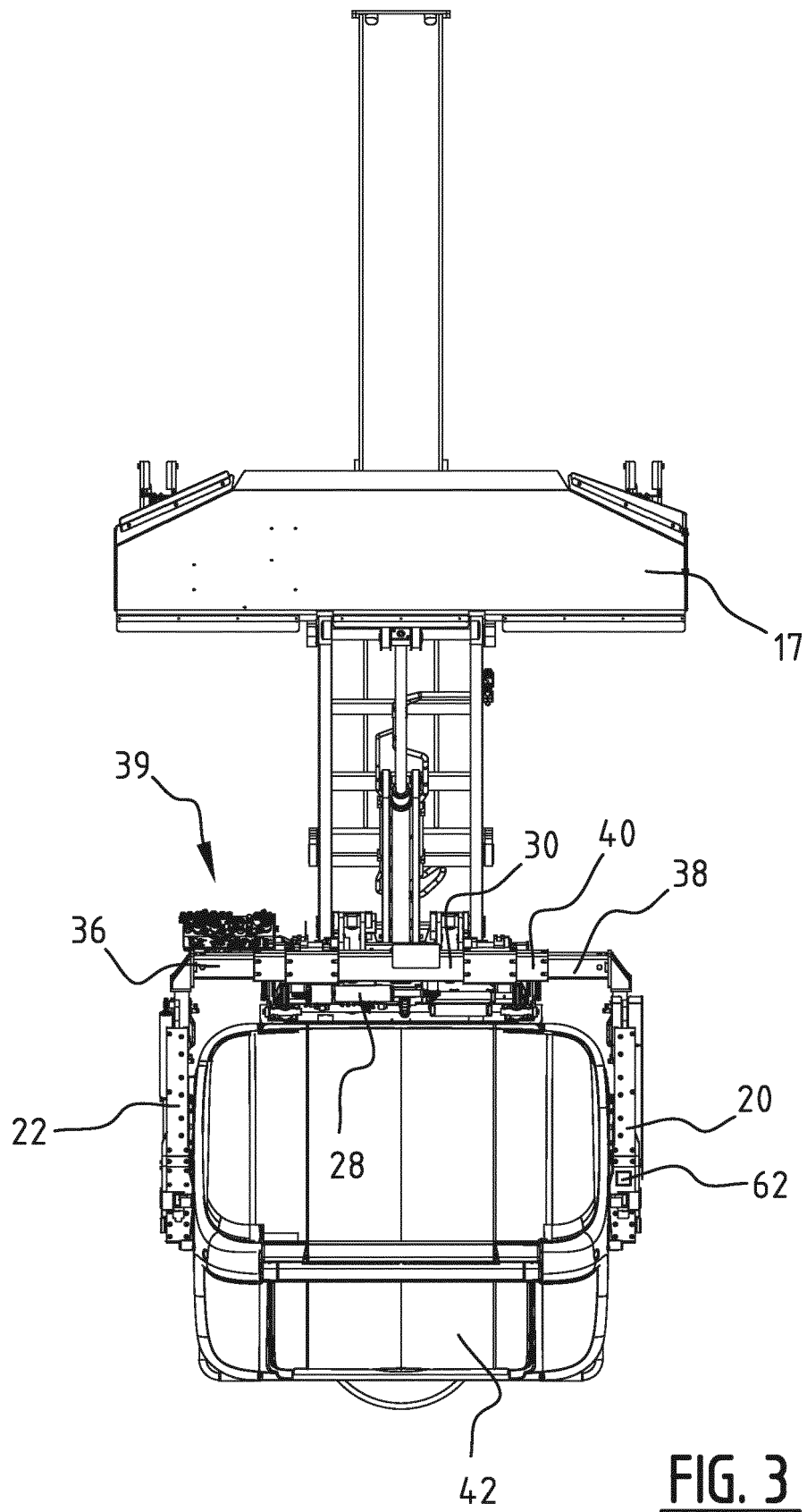


FIG. 2



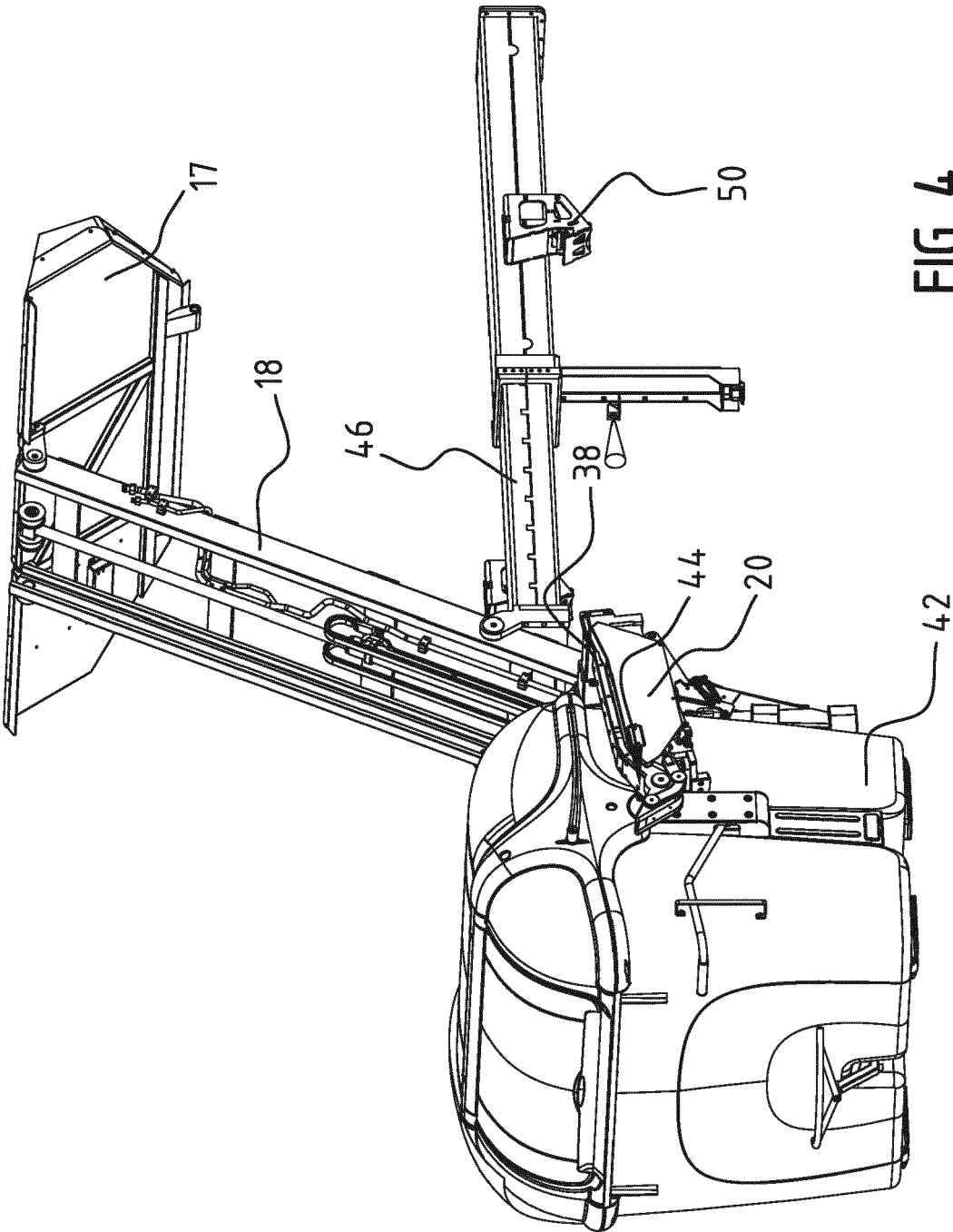


FIG. 4

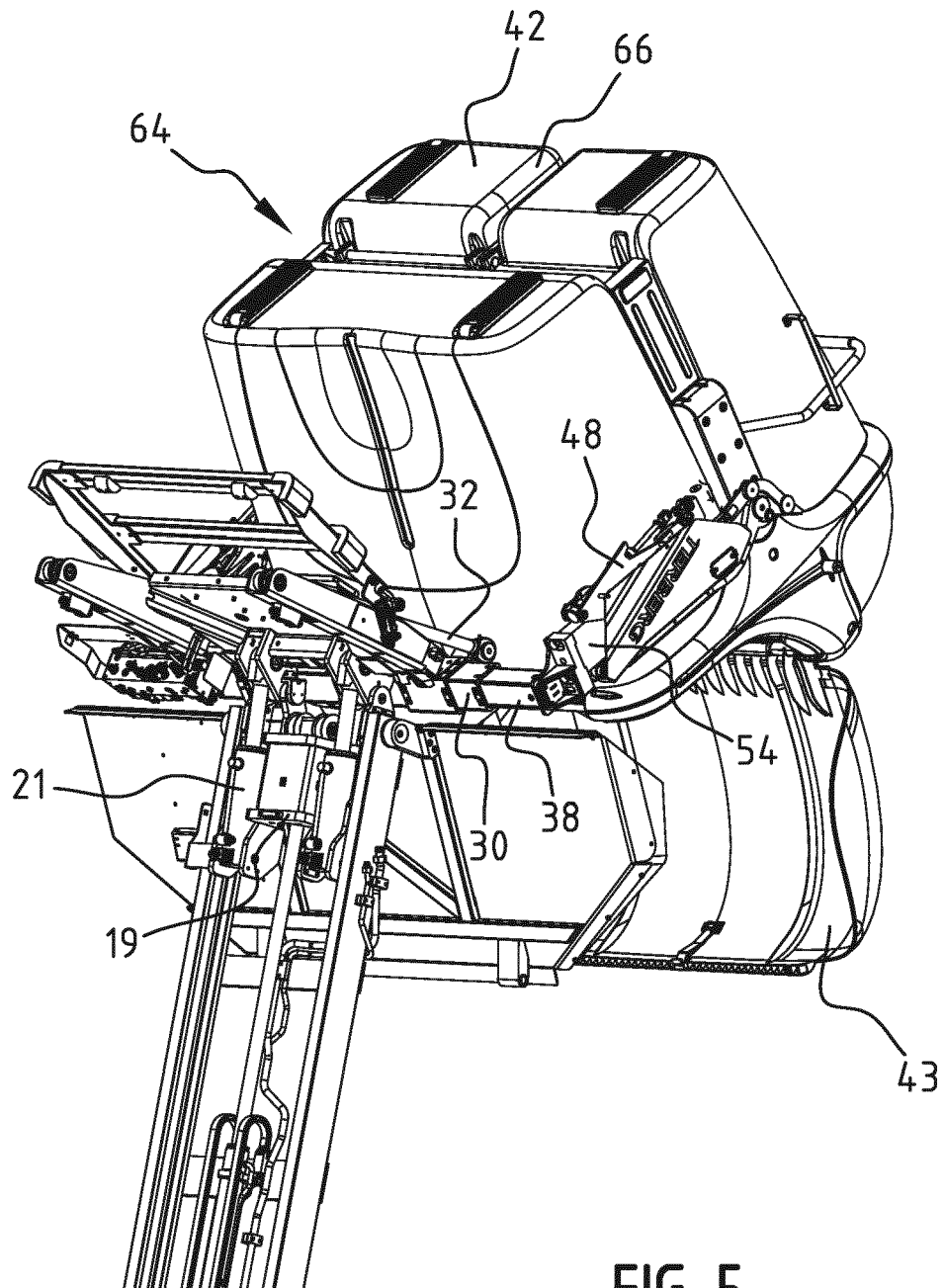


FIG. 5



EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 June 2021	Examiner Wartenhorst, Frank
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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REFERENCES CITED IN THE DESCRIPTION

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