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(54) **WASTE COLLECTION VEHICLE**

(57) Waste collection vehicle (100) comprising a waste collection container (102), comprising:
- a first device (1) for moving and emptying waste-holding bins (200) which is mounted on a lateral side (104) of the vehicle (100) movable between at least a first loading position suitable to allow hooking with at least one waste-holding bin (200) moved manually towards the first device (1) by an operator, and a second raised position for emptying the hooked waste-holding bin (200) inside the collection container (102);
- a second device (20) for moving and emptying waste-holding bins (200) which comprises hooking means (40) for automatically hooking at least one

waste-holding bin (200), said second device (20) being mounted on the vehicle (100) movable among at least a first rest position in which said hooking means (40) are retracted in correspondence of the lateral side (104) of the vehicle (100), a second loading position in which said hooking means (40) are extended away from the lateral side (104) of the vehicle (100) to automatically hook at least one waste-holding bin (200), and a third raised position for emptying the waste-holding bin (200) automatically hooked inside the collection container (102);
- command and control means (50) configured for operating at least one of said first device (1) and second device (20).

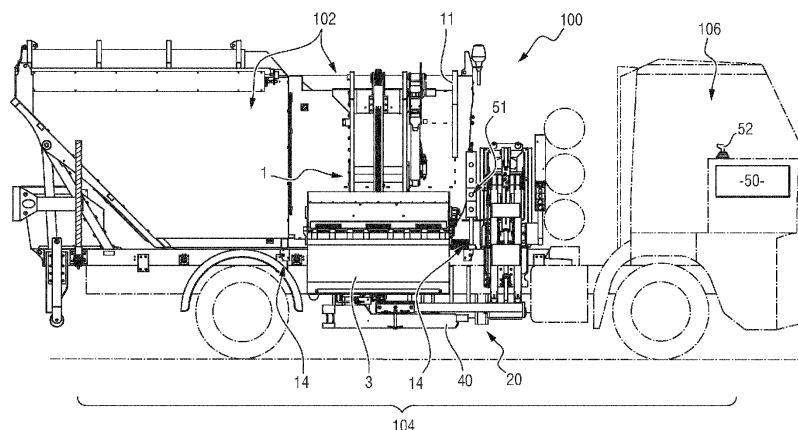


FIG.1

Description

[0001] The present invention relates to a vehicle for the collection of waste, in particular of the lateral loading type, and with a double loading system.

[0002] As is known in the art, one of the most widespread methods for waste collection nowadays is the use of vehicles, such as trucks or vans, which are equipped with a waste collection container inside which waste-holding bins are emptied.

[0003] In practice, during service, the waste collection vehicle stops wherever there are waste bins along its route, such as in residential areas, and one or more operators transport the bins full of waste to the collection vehicle and hook them manually to an emptying device installed on the vehicle which raises them and empties them inside the waste collection container.

[0004] Once this operation is completed, the operators get back on the vehicle, for example on special footboards located at the rear of the vehicle; then the vehicle moves off repeating the loading and emptying operations wherever it encounters waste bins to be emptied.

[0005] In some cases, the driver of the vehicle is the only operator and thus each time the driver has to stop the vehicle, get down from the driving cab, complete the emptying operations and then get back on board and move off again.

[0006] Such solutions, even if allowing an efficient waste collection, present some drawbacks in particular concerning the health and safety of the operators.

[0007] In particular, the frequent getting up and down from the footboards or driving cab, expose the operators to the risk of accidents, for example falling, and over the time can result in physical debilitation which could lead to the onset of occupational illnesses.

[0008] Furthermore, when the operators are standing on the footboards or manoeuvring the bins at the back of the vehicle where the loading and emptying device is normally located, the risk of being hit by other vehicles is significant, particularly in areas with reduced visibility, for example due to the presence of fog or to the configuration of the area itself.

[0009] Therefore, an object of the present invention is to provide a vehicle for waste collection which, compared to other solutions known in the art, makes it possible to mitigate one or more of the above-mentioned drawbacks, particularly reducing the possibility of accidents, casualties and debilitation of the operators.

[0010] This object, as well as others which will become more apparent from the following description, is achieved by means of a waste collection vehicle as defined in claim 1.

[0011] Particular embodiments of the vehicle according to the invention are object of the dependent claims, which are intended as an integral part of the present description.

[0012] Further characteristics and advantages of the invention will become more apparent from the following

detailed description of exemplary and non-limiting embodiments, and with reference to the attached drawings, where:

- 5 figure 1 is a lateral view illustrating a waste collection vehicle according to the invention on a side of which a first device and a second device for moving and emptying waste-holding bins are mounted, according to a lateral loading position;
- 10 figure 2 is a perspective view illustrating a first possible embodiment of the first device in figure 1, in a first loading position of a waste-holding bin;
- figure 3 is a perspective view illustrating the first device in figure 2 in a predefined stop position;
- 15 figure 4 is a perspective view illustrating the first device in figures 2 and 3 in a position of emptying the waste-holding bin;
- figure 5 is a perspective view illustrating a possible embodiment of the second device in figure 1, in an extracted position for automatic hooking of a waste-holding bin;
- 20 figure 6 is a perspective view illustrating the second device in figure 5 in the phase of raising a waste-holding bin;
- 25 figure 7 is a perspective view illustrating the second device in figures 5 and 6 in the phase of emptying a waste-holding bin;
- figure 8 is a perspective view illustrating a further possible embodiment where the first and the second devices form an integral part and are illustrated in a position suitable for hooking a waste-holding bin;
- 30 figure 9 is a perspective view illustrating the first and the second devices in figure 8 in the raising phase;
- figure 10 is a perspective view illustrating the first and the second devices in figures 8 and 9 in a position suitable for emptying a waste-holding bin.

[0013] It should be noted that in the following detailed description identical or similar components, from both structural and/or functional points of view, may be indicated with the same reference numbers, independently of the fact that they are shown in different embodiments or in components different from the present description; furthermore, it should be noted that, in order to illustrate this invention clearly and concisely, the drawings are not necessarily to scale and certain characteristics of the description may be shown in a rather schematic form.

[0014] Furthermore, when the term "suitable" or "organised" or "configured" or "shaped" or "set up", or a similar term is used in this document, with reference to any component whatsoever as a whole or to any part whatsoever of a component, or a combination of components, it must be understood as meaning and comprising correspondingly the structure and/or configuration and/or shape and/or position.

[0015] In particular, when said terms refer to hardware or software electronic means, they are understood to include circuits or parts of electronic circuits, as well as

software/firmware, such as for example algorithms, routines and programs in general, being executed and/or resident in any storage medium whatsoever.

[0016] Furthermore, when the terms "substantial" or "substantially" are used herein, they must be understood to comprise an actual variation of more or less 5% of what indicated as a reference value, axis or position, and when the terms "transversal" or "transversally" are used herein, they must be understood to comprise a direction not parallel to the reference part or parts or to the direction(s)/axis to which they refer, and the perpendicularity is to be considered as a specific case of transversal direction.

[0017] Finally, in the following description the ordinal numbers first, second, third, etc. will be used, whose sequence is intended only for the sake of better illustrative clarity; therefore, unless implicitly or clearly indicated to the contrary in the description, the definition for example of a second element does not necessarily imply the presence of a first element, and so on.

[0018] Figure 1 illustrates a vehicle for waste collection according to the invention, indicated with the reference number 100, comprising a collection container 102, per se known, suitable for temporarily receiving waste during operation of the vehicle 100.

[0019] The vehicle 100 according to the invention comprises at least:

- a first device, indicated with the overall reference number 1, for moving and emptying waste-holding bins 200 inside the container 102; in particular, the first device 1 is mounted on a lateral side 104 of the vehicle 100 movable between at least a first loading position, illustrated for example in figure 2, suitable to allow hooking with at least one waste-holding bin 200 moved manually towards the first device 1 by an operator, and a second raised position, illustrated in figure 4, suitable for emptying the hooked at least one waste-holding bin 200 inside the collection container 102; and
- a second device, indicated with reference number 20, also for moving and emptying waste-holding bins 200 inside the container 102 and which loads the bins laterally and on the same side 104 where the first device 1 is located.

[0020] In particular, the second device 20 comprises hooking means 40 for automatically hooking at least one waste-holding bin 200, and is mounted on the vehicle 100 movable between at least a first rest position, illustrated for example in figure 1, in which the hooking means 40 are retracted in correspondence of the lateral side 104 of the vehicle 100, a second loading position, illustrated for example in figure 5, in which the hooking means 40 are extended away from the lateral side 104 of the vehicle 100 so as to automatically hook at least one waste-holding bin 200, and a third raised position, illustrated for example in figure 7, for emptying the automatically hooked

at least one waste-holding bin 200 inside the collection container 102.

[0021] Furthermore, the vehicle 100 comprises command and control means, configured for appropriately operating said first device 1 and/or second device 20 so that, according to specific operation situations, alternatively to each other, one (device 1) is manually hooked to at least one waste-holding bin 200 to be emptied or the other (device 20) automatically hooks at least one waste-holding bin 200 to be emptied.

[0022] In practice, in the way that will result more in detail from the following description, the vehicle 100 according to the invention advantageously comprises two devices 1 and 20 both with side loading and operating on the same side of the vehicle, of which one enables loading and emptying of one or two bins which are manually put in the loading position by the operator, and the other is configured in such a way as to automatically hook one or two bins located along its route, under the guide of an operator who can remain in the vehicle, for example in the driving cab 106, and who uses the command and control means to operate said device 20.

[0023] In a possible embodiment of the vehicle 100 according to the invention, said command and control means comprise at least one electronic control unit 50, installed for example in the driving cab 106, and a control device 52, for example a joystick, also installed in the driving cab 106, which enables the operator to remotely handle at least the second device 20 without having to get off from the driving cab 106.

[0024] Furthermore, the command and control means may comprise a push-button panel 51 installed outside the driving cab 106, for example in an appropriate position on the side 104 of the vehicle 100, which enables the operator to automatically handle at least the first device 1.

[0025] In another possible embodiment of the vehicle 100 according to the invention, and as illustrated in the figures 1-7, the first device 1 and the second device 20 are installed on the vehicle 100 structurally separated from each other and comprise first actuation means and second actuation means respectively, operationally driven by the command and control means, which are configured so as to move the first device 1 and respective second device 20 separately from each other.

[0026] In particular, in this first embodiment and according to the manner that will result more in detail in the following description, the first device is normally enabled to operate loading of the bins 200, while the second device 20 is disabled and the command and control means are configured so as to enable the second device 20 only when the first device 1 is in a predefined intermediate stop position, illustrated in figure 3.

[0027] More in detail, in this embodiment, the first device 1 comprises at least a loading basket 3 having an internal compartment 5 suitable for receiving waste for example from small bins for the collection of organic waste, and clamping means arranged externally to the

internal compartment 5 and configured to clamp at least one waste-holding bin 200 moved manually by an operator who places it in the loading position towards said basket 3.

[0028] Furthermore, the basket 3 is shaped at the bottom so as to form an external housing curved recess 4.

[0029] The clamping means of the basket comprise a plurality of hooking teeth 6 arranged on the front part of the basket 3 in correspondence with the upper edge of the internal compartment 5; in the embodiment here illustrated, two groups of hooking teeth 6 are provided, each group enabling hooking to a respective waste-holding bin 200, so as to simultaneously load, whenever possible, even two bins, one on the right side and the other on the left side of the basket 3.

[0030] Furthermore, in the embodiment here illustrated, the clamping means comprise a rod 7 which is fixed to the basket 3 so as to extend longitudinally in correspondence with the row of teeth 6 along a reference axis X, and a clamping flange 8, movable relatively to the rod 7, in particular rotating around the axis X, which is suitable to clamp, in collaboration with the plurality of teeth 6, an associated portion of at least one hooked bin 200.

[0031] In particular, the rotation of the flange 8 occurs thanks to an arm 9 placed laterally on the side of the basket 3 which is operatively connected to the flange 8 at one end and is equipped with a roller 10 at the other end. As will be seen in more detail in the following description, when the basket 3 is activated, the roller 10 is positioned at a certain point along the path sliding along a ramp or guide 11 which is fixed for example to an external wall of the container 104, and having a suitably profiled surface, represented only schematically in figure 2 for illustrative simplicity. The interaction between the roller 10 and the ramp 11 causes the displacement of the arm 9 and the consequent rotation of the flange 8 which, while the basket 3 moves upwards, rotates and clamps together with the teeth 6 the portion of the hooked bin 200 situated between them, whereas when the basket 3 moves downwards it rotates in the opposite direction interrupting clamping and leaving the basket simply hooked to the teeth 6.

[0032] Furthermore, in the embodiment illustrated in the figures 1-7, the first actuation means of the device 1 comprise a mounting frame, indicated with the overall number 12, on which the loading basket 3 is slidably mounted.

[0033] The mounting frame 12, which is fixedly installed on the vehicle 100 so as to extend vertically along the side 104, comprises for example two parallel guide tracks 12A and 12B along which the basket 3 slides, and an actuation mechanism 13 which is connected to the loading basket 3 so as to move it bidirectionally along the mounting frame 12, and in particular along the two sliding tracks 12A and 12B.

[0034] As illustrated in figures 1-7, the mechanism 13 is for example a motorised chain mechanism and comprises a chain 13A, which is movably mounted around a

vertical support 13B and is connected to the loading basket 3, and a motor 13C which activates the chain 13A which, in its turn, by rotating around the support 13B, moves the basket 3 hooked to at least one bin 200 from the loading position, illustrated in figure 2, towards the emptying position illustrated in figure 4, and vice versa.

[0035] Furthermore, the first actuation means comprise a tilting mechanism, indicated in figure 4 with the overall reference number 17, which is mounted externally to the frame 12 and is connected to it in a movable manner, for example along the track 12B; this tilting mechanism comprises for example a double-acting hydraulic cylinder 17A coupled to and suitable to rotate an associated oscillating arm 17B.

[0036] In this first embodiment, the command and control means comprise at least one sensor 14, for example an ultrasonic sensor, which is mounted on the side 104 of the vehicle 100, for example laterally with respect to the basket 3; said sensor 14 is configured so as to detect the presence of a bin 200 taken by an operator to the loading position close to the teeth 6 of the basket 3 and to send a corresponding signal indicating said position to the electronic control unit 50. In addition, or alternatively, said corresponding signal can be sent directly to the electronic control of the motor 13C.

[0037] In a possible embodiment, as illustrated in figure 1, two sensors 14 are provided and installed on the side 104 of the vehicle on opposite sides of the basket 3, so that one detects the hooking of a bin 200 on the right side of the basket 3 and the other detects the hooking of another bin 200 on the left side.

[0038] Furthermore, in this first embodiment, the command and control means also comprise at least one position detection device 15, comprising or constituted by a position sensor, which is located for example on the mounting frame 12, e.g. along the track 12A as illustrated in figure 2.

[0039] In particular, said device 15 is configured so as to detect when the loading basket 3 is in a predefined stop position, illustrated in figure 3, and to send to the driving cab, in particular to the electronic control unit 50, a corresponding signal indicating the fact that the basket 3 is effectively stationary in the stop position. Said predefined stop position is intermediate between the first loading position, illustrated in figure 2, and the second raised position suitable for emptying the bins 200, illustrated in figure 4.

[0040] Usefully, the electronic control unit 50 is configured so as to disable the first actuation means while maintaining the loading basket 3 stationary in said intermediate stop position and to enable the second actuation means to move the second device 20 only when it has received in input from the position detector device 15 said signal indicating that the loading basket 3 is effectively stationary in said predefined stop position.

[0041] In practice, in this embodiment, the command and control means, and in particular the electronic unit 50, are provided with an interlocking module which

makes it possible to enable/disable the device 20 with respect to the device 1. Should the basket 3 not be in the intermediate stop position, any attempt by the operator to activate the second device 20 would be prevented by said module; moreover, in said condition, the command and control means can be further configured to emit a corresponding warning signal to the operator, for example by causing a device in the cab 106 or a light on the vehicle 100 to flash.

[0042] In their turn, as can be seen in detail in figures 5-7, the second actuation means of the second actuation device 20 comprise at least:

- a first frame 30 which is fixedly mounted on the vehicle 100;
- a first arm 31 which is mounted on the first frame 30 slidably movable along a first longitudinal axis Y, transversal with respect to the direction of travel of the vehicle 100 and therefore also to the side 104, between a retracted position towards the inside of the vehicle gauge 100 and an extracted position in which the first arm 31 extends, at least partially, externally from the side 104;
- a second arm 33 on which said hooking means 40 are mounted and which extends longitudinally along the lateral side 104 of the vehicle 100, therefore transversally with respect to the first longitudinal axis Y; and
- a third arm 35 having a first end connected to the second arm 33, and a second opposite end connected to a second frame 37 fixed to and solidly movable with the first arm 31.

[0043] In the embodiment illustrated, the hooking means 40 comprise a gripping device, for example made up of two mobile arms 40A and 40B which, when activated by the command and control means, and in particular by an operator who moves the joystick 52 in the driving cab 106, grasp the body of the bin 200 solidly between them, as illustrated for example in figure 5.

[0044] In figures 5-7 only one gripping device is illustrated, while in the embodiment illustrated in figures 8-10 two distinct gripping devices are illustrated installed along the arm 33 so as to automatically hook two bins 200 to be emptied; it is evident that, also in the embodiment in figures 5-7, the hooking means 40 can comprise two gripping devices installed side by side along the second arm 33.

[0045] In particular, as can be seen in figure 1, the second device 20 is configured in such a way that when the basket 3 of the first device 1 is in the lowered loading position, the second arm 33 is positioned inside the curved recess 4 defined by the body of the basket 3 and substantially covered frontally by the body of the basket 3 itself. In said position, the hooking means 40 have for example their most external part retracted internally or substantially aligned with respect to the front surface of the basket 3, under the bottom wall of the latter.

[0046] As can be better seen in figures 5-7, the second actuation means also comprise:

- a first double-acting hydraulic cylinder 32 which is operationally connected to the first arm 31 and is configured so as to translate the first arm 31 bidirectionally along the first longitudinal axis Y;
- a second double-acting hydraulic cylinder 34 which is operationally connected to one end of a third articulated arm 35 and at the other end is hinged to a further anchoring frame 38, rotating around it. In its turn, the anchoring frame 38 is fixed to and solidly movable with the first arm 31. In particular, during the stage when the bin 200 is raised towards the emptying position, the second hydraulic cylinder 34 causes rotation of the third arm 35 around the rotation axis 105 which, in its turn, moves the second arm 33 together with the bin 200 lifting it towards the collection container 102; and
- a third double-acting hydraulic cylinder 36 which is connected at one end to the second frame 37, in particular hinged and rotating around the rotation axis 110, and at the opposite end to the second arm 33. The third hydraulic cylinder 36 is configured so as to rotate around the rotating axis 110 by means of the action of the third arm 35 during the lifting stage until the suitable emptying position is reached. In said position, the third cylinder 36 is activated and rotates the arm 33 around a rotation axis 115 so causing emptying of the bin 200 inside the collection container 102.

[0047] The various cylinders are activated for example by means of a hydraulic circuit according to known embodiments or that can be easily implemented by a person skilled in the art and therefore not described in detail. Similarly, the connection of the cylinders and/or arms between them and/or with the parts connected to them takes place according to well known embodiments or that can be easily implemented by a person skilled in the art and therefore not described here in detail.

[0048] In a possible embodiment, the command and control means further comprise a plurality of sensors 21, for example magnetoresistive sensors, suitable to send to the electronic control unit 50 signals indicating the starting position of at least one bin 200 with respect to the vehicle 100 when it is automatically hooked by the extended hooking means 40 moving away from the lateral side 104 to the relative loading position illustrated in figure 5; in its turn, the electronic control unit 50 is further configured to calculate and memorise, on the basis of said signals received in input, said starting position of at least one bin 200.

[0049] In this way, once the bin has been emptied, the second device 20, controlled by the command and control means, replaces the empty bin 200 substantially in the same initial position it had before being hooked by the hooking means 40.

[0050] In a possible embodiment, for example three magnetoresistive sensors 21 are provided, each associated to one of the respective first second and third double-acting cylinders 32, 34, 36.

[0051] In a second embodiment of the vehicle 100 according to the invention, of which an exemplary embodiment is illustrated in figures 8-10, the first device 1 and the second device 20 are installed on the vehicle 100 structurally integral with each other, and only one actuation mechanism is provided, configured so as to jointly move both devices 1 and 20 together.

[0052] In particular, in this second embodiment, said only one actuation mechanism coincides preferably with the second actuation means described above in relation to the second device 20 and which, therefore, also act as actuation means of the first device 1.

[0053] Therefore, in this embodiment the first actuation means described above, i.e. the mounting frame 12 with relative motorised chain mechanism 13 and the tilting mechanism 17, are not utilised. Furthermore, the device 15 for detection of the position of the basket 3 in the stop position is also unnecessary.

[0054] However, in this case too, even if the two devices 1 and 20 are moved jointly together for the purpose of emptying the bins, the two devices 1 and 20 operate alternatively to each other, so that one bin 200 is positioned manually by an operator in a position suitable for hooking by the first device 1, or that the bin 200 is hooked directly and automatically in its initial position by the second device 20 guided by an operator who, moving the joystick 52, activates the hooking means 40.

[0055] Preferably, in this second embodiment, the second device 20 generally replicates constructively and functionally the second device 20 described above with reference to figures 1-7.

[0056] In its turn, the device 1 essentially comprises a loading basket 3 which comprises only some of the components/parts described above with reference to the exemplary embodiment in figures 2-4, i.e. the internal compartment 5, the teeth 6, the rod 7, the clamping flange 8. In this case when, during lifting, the basket 3 hooked to a bin 200 reaches a pre-established height, the clamping flange 8 is activated by the cylinder 9A fitted with a movable part, for example a double-acting hydraulic type cylinder (schematically illustrated only in figure 9 for clarity), which causes its rotation around the axis X, which then triggers clamping of the bin 200 between the flange 8 and the teeth 6. As illustrated in figure 9, the hydraulic cylinder 9A can substitute the lateral arm 9 in the embodiment previously described, therefore acting directly on the flange 8 or on the arm 9 itself acting as actuator and therefore functionally substituting the action obtained by the surface coupling of the roller 10-ramp 11 previously described.

[0057] In this case, the basket 3 is fixed to and solidly movable with a component of the second device 20, in particular to the upper part of the second arm 33, on the opposite side of the hooking means 40 and is not shaped

so as to present the external housing curved recess 4; the hooking means 40 are installed along the second arm 33 so as not to protrude from the front surface of the basket 3 when it is stationary, and so that the arms 40A and 40B, when activated, protrude sufficiently from the basket 3 to hook the bin 200 without causing the surface of this to interact against the basket 3 itself.

[0058] The functioning of the vehicle 100 according to the invention will be now described by referring initially to the first embodiment in figures 1-7.

[0059] Starting from the position illustrated in figure 1, where the vehicle 100 can be considered stationary along its route near an area for manually loading the bins 200, the device 1 should be in such a condition that its basket 3 is already in a lowered loading position illustrated in figure 2, or the basket 3 is put into that position by an operator who, using the push-button panel 51, activates the chain mechanism 13; in this way, the basket 3 is lowered towards the ground taking it, for example, from the position in figure 1 to the position in figure 2. The device 20 is disabled in the retracted rest position, with the second arm 33 positioned within the curved recess 4 and the first arm retracted along the axis Y inside the vehicle gauge 100.

[0060] In said position, an operator moves at least one bin 200 to be emptied near the teeth 6 of the basket 3; at least one of the sensors 14 detects the presence of the bin 200 and sends a corresponding signal to the electronic control unit 50 which intervenes by briefly activating the motor 13C and causing a brief lifting of the basket 3 with the teeth 6 which abut against a portion of the bin 200 firmly hooking it. Depending on the applications, it is possible to set up the commands so that said initial brief lifting of the basket 3 is caused by a manual command for example carried out by an operator using the push-button panel 51, and/or also by an operator in the driving cab 106. Once this brief lifting is completed, the operator then intervenes with the push-button panel 51 which activates the motor 13C. In its turn, the motor 13C sets in motion the chain 13B which, rotating, moves the basket 3 upwards. During the lifting stage, at a certain point the roller 10 slides along the ramp or guide 11 which, due to its suitably profiled surface, for example pushes the arm 9 forwards and causes rotation of the flange 8. In this way, the flange 8 clamps together with the teeth 6 the portion of the hooked bin 200 situated between them.

[0061] When the basket 3 reaches the tilting position, the tilting mechanism 17 is activated, for example by means of the push-button panel 51, and the rotating arm 17C moved by the cylinder 17B pushes the basket 3 tilting it together with the hooked bin 200 and therefore emptying the contents into the container 102. Once the emptying operation is completed, the operator inverts the operations using the push-button panel 51, the chain 13A moves in the opposite direction and the basket is replaced on the ground; during this operation, at a certain point the roller 10 detaches itself from the ramp 11, and

the arm 9, for example activated by a return spring, causes rotation in the opposite direction of the flange 8 which unlocks the clamping action. During the last descending stage, the bin 200 remains hooked to the teeth 6 until it reaches the ground where an operator moves it away from the vehicle 100. Said operations can then be repeated in the same loading area (and in others similar along the route) for other bins 200. Furthermore, as previously indicated, it is possible to load two bins 200 to be moved and emptied on the basket 3 simultaneously.

[0062] In the case it is possible to use the device 20 in a loading area along the route, then the basket 3 must be in the predefined stop position illustrated in figure 3, leaving uncovered the second arm 33 with relative hooking means 40. As previously described, the position detection device 15 detects the basket 3 in said position and sends a corresponding signal to the electronic control unit 50 which disables the first device 1 enabling the second device 20. The basket 3 can be taken to said stop position for example when the emptying operations in a loading area by means of the device 1 are completed and then the operator using the push-button panel 51 moves the basket 3 upwards until it reaches said position, or by means of a command sent by an operator in the driving cab 106.

[0063] In said condition, while the device 1 is blocked, the device 20 is enabled and an operator in the cab 106 can activate it and move it for example by using the joystick 52. In practice, the first cylinder 32 is activated which moves the arm 31 along the axis Y, taking with it the rest of the components directly or indirectly connected to it. When the second arm 33 reaches the position suitable to hook a bin 200, the operator himself activates the arms 40A and 40B which surround and hook the bin 200, as illustrated in figure 5. The position sensors 21 send signals to the electronic control unit 50 indicating the initial position of the bin 200, and this then calculates the starting coordinates. Once the bin 200 has been hooked, it is raised slightly from the ground for example by means of the second cylinder 34 and subsequently the first arm 31 is returned back to its starting position again by means of the first cylinder 32. The second cylinder 34 is then activated again, which causes rotation of the third arm 35 around the rotation axis 105. In its turn, as illustrated in figure 6, during its rotation, the third arm 35 moves the second arm 33 together with the hooked bin 200, raising it towards the collection container 102. In correspondence with the emptying position, activation of the third cylinder 36 causes rotation of the second arm 33 around the rotation axis 115 together with the bin 200, so that its contents are emptied inside the collection container 102. In this case too, the operations described are substantially inverted and the empty bin 200 is taken back to its initial position on the ground thanks to the coordinates calculated on the basis of the signals sent to the electronic control unit 50 by the plurality of sensors 21.

[0064] In the case where the vehicle 100 is configured with the first and second devices 1 and 20 structurally

integrated with each other, as in the embodiment illustrated in figures 8-10, the loading and emptying operations of the bins 200 carried out using the automatic hooking device 20 activated remotely by an operator in the driving cab 106, substantially coincide with that previously described for the device 20 in the first embodiment of figures 1-7.

[0065] For the loading and emptying operations of the bins 200 using the device 1 with manual hooking, as previously described, movement between the various positions takes place thanks to the actuation means of the second device 20. In this case, starting from the position illustrated in figure 8, an operator moves at least one bin 200 near the teeth 6 of the basket 3 (not illustrated for greater illustrative clarity of the components of the devices 1 and 20), and then activates the actuation means, for example using the push-button panel. In particular, as illustrated in figure 8 (where the bin near the teeth 6 of the basket 3 has also not been illustrated to favour better visibility of the components of the devices 1 and 20), the first arm 31 remains in the initial retracted position inside the vehicle gauge 100, and the second cylinder 34 is activated directly which rotates the third arm 35 around the rotation axis 105. In its turn, as can be seen in figure 9, the third arm 35 during its rotation moves the second arm 33 together with the basket 3 and the bin 200 hooked to it (not illustrated in the figure), lifting it towards the collection container 102. During the lifting stage, at a predefined position, the hydraulic cylinder associated to the flange 8 intervenes making it rotate and causing clamping of the bin 200 between the flange 8 and the teeth 6. When the emptying position is reached, activation of the third cylinder 36 makes the second arm 33 rotate around the rotation axis 115 together with the bin 200 so causing emptying inside the collection container 102, as illustrated in figure 10 (where the bin is not illustrated for better visibility of the components of the devices 1 and 20). In this case too, the operations described are then substantially inverted and the empty bin is replaced in its initial position on the ground thanks to the coordinates calculated on the basis of signals sent to the electronic control unit 50 by the plurality of sensors 21. Furthermore, as previously described, it is possible to load and empty two bins simultaneously by using the device 1 with manual hooking means or alternatively by using the device 20 with automatic hooking means. In this embodiment, evidently there is no interlocking between the two devices 1 and 20 which maintains one device enabled while movement of the other is temporarily disabled.

[0066] In practice it has been demonstrated how the vehicle 100 for waste collection according to the present invention makes it possible to reach the intended object. In fact, thanks to the fact that the bins are loaded laterally, compared to solutions known in the art which use rear loading systems, the possibility that the operators get hit by other vehicles is reduced since they operate on the side of the vehicle 100 and therefore in areas that present

fewer risks compared to the rear part where other vehicles may arrive. Furthermore, thanks to the use of manual hooking means together with automatic hooking means, the number of times an operator on board the vehicle is obliged to get up and down from the cab can be considerably reduced, thus contributing to a reduction in possible physical debilitation and occupational illnesses.

[0067] Naturally, without prejudice to the principles of the invention, many variations and implementation details thereof may be applied to the above-described exemplary and non-limiting embodiments, without departing from the scope of protection of the invention as defined in the accompanying claims, including also any combination, even partial, of the embodiments illustrated. For example, some of the above-described components/parts could be configured and/or positioned and/or reciprocally connected differently from that described, while still remaining capable of carrying out the functions and objects for which they were designed within the scope of the present invention.

Claims

1. Waste collection vehicle (100) comprising a waste collection container (102), **characterized in that it** further comprises at least:
 - a first device (1) for moving and emptying waste-holding bins (200) which is mounted on a lateral side (104) of the vehicle (100) movable between at least a first loading position suitable to allow hooking with at least one waste-holding bin (200) moved manually towards the first device (1) by an operator, and a second raised position for emptying the hooked at least one waste-holding bin (200) inside the collection container (102);
 - a second device (20) for moving and emptying waste-holding bins (200) which comprises hooking means (40) for automatically hooking at least one waste-holding bin (200), said second device (20) being mounted on the vehicle (100) movable among at least a first rest position in which said hooking means (40) are retracted in correspondence of the lateral side (104) of the vehicle (100), a second loading position in which said hooking means (40) are extended away from the lateral side (104) of the vehicle (100) to automatically hook at least one waste-holding bin (200), and a third raised position for emptying the at least one waste-holding bin (200) automatically hooked inside the collection container (102);
 - command and control means (50, 51, 52) configured for operating at least one of said first device (1) and second device (20).
2. Vehicle (100) according to claim 1, wherein said first device (1) and said second device (20) are installed on the vehicle (100) structurally separated from each other and comprise respective first actuation means and second actuation means configured to move said first device (1) and respectively said second device (20) separately from each other.
3. Vehicle (100) according to claim 1, wherein said first device (1) and said second device (20) are installed on the vehicle (100) structurally integrated with each other and comprise actuation means configured to move together said first and second devices (1, 20).
4. Vehicle (100) according to claim 1, wherein said first device (1) comprises a loading basket (3) having an internal compartment (5) suitable for receiving waste, and clamping means (6, 7, 8, 9, 9A) arranged externally to the internal compartment (5) and configured to clamp said at least one waste-holding bin (200).
5. Vehicle (100) according to claims 2 and 4, wherein said first actuation means comprise a mounting frame (12) which is fixedly installed on the vehicle (100) and extends in a substantially vertical direction along said lateral side (104), and an actuation mechanism (13) which is connected to the loading basket (3) and is configured to move the loading basket (3) bidirectionally along said mounting frame (12).
6. Vehicle (100) according to claims 2 and 4, wherein said command and control means comprise at least one device (15) configured to detect when the loading basket (3) is in a predefined stop position intermediate between said first loading position and said second raised position, and an electronic control unit (50) which is configured to disable said first actuation means while maintaining the loading basket (3) in said intermediate stop position and enable said second actuation means to move said second device (20) only when it has received in input from said at least one device (15) a signal indicating that the loading basket (3) is in said predefined stop position.
7. Vehicle (100) according to one or more of the preceding claims, wherein said command and control means comprise a plurality of sensors (21) adapted to send, to an electronic control unit (50), signals indicative of the starting position on the ground of the at least one waste-holding bin (200) when automatically hooked by said hooking means (40) extended away from the lateral side (104) of the vehicle (100) in said second loading position, said electronic control unit (50) being configured to calculate and memorize said starting position on the ground of the at least one waste-holding bin (200) on the basis of the signals received by said plurality of sensors (21).

8. Vehicle (100) according to claim 2 or 3, wherein said second actuation means or said actuating means comprise a first frame (30) fixedly mounted on the vehicle (100), a first arm (31) mounted on said fixed frame (30) slidably movable along a first longitudinal axis (Y) transversal with respect to the direction of travel of the vehicle (100) between a retracted position towards the inside of the vehicle shape (100) and an extracted position in which the first arm (31) extends at least for a portion thereof externally from the lateral side (104), a second arm (33) on which said hooking means (40) are mounted and which extends, along the lateral side (104) of the vehicle (100), transversely with respect to the first longitudinal axis (Y), and a third arm (35) having a first end connected to said second arm (33) and a second end connected to a second frame (37) fixed to and solidly movable with said first arm (31). 5 10 15
9. Vehicle (100) according to claim 8 wherein said second actuation means further comprise a first hydraulic cylinder (32) connected to said first arm (31) and configured to translate said first arm (31) along said first axis longitudinal (Y), a second hydraulic cylinder (34) which is connected to said third arm (35) and to a further frame (38) solidly mounted on said first arm (31) and is configured to rotate said third arm (35) around an axis (105) hinged on said second frame (37) lifting said second arm (33) towards the collection container (102), and a third hydraulic cylinder (36) connected to said second frame (37) and to said second arm (33) to rotate the second arm (33) about an axis (115) hinged on said third arm (35) and cause the emptying of the waste-holding bin (200) hooked by the hooking means (40) inside the collection container (102). 20 25 30 35
10. Vehicle according to claims 3 and 4, wherein said loading basket (3) is mounted on and solidly movable with a component of the second device (20). 40

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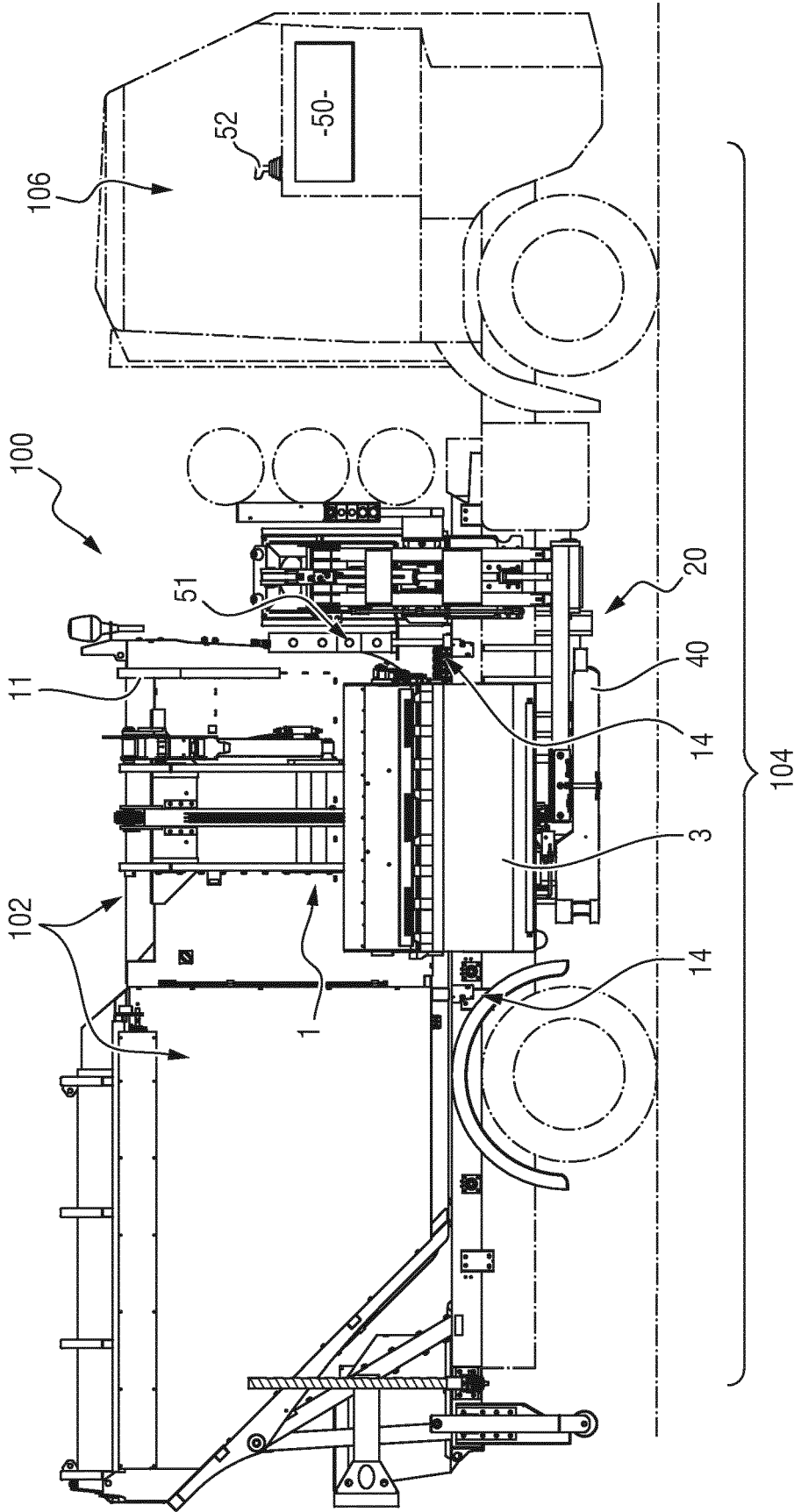


FIG. 1

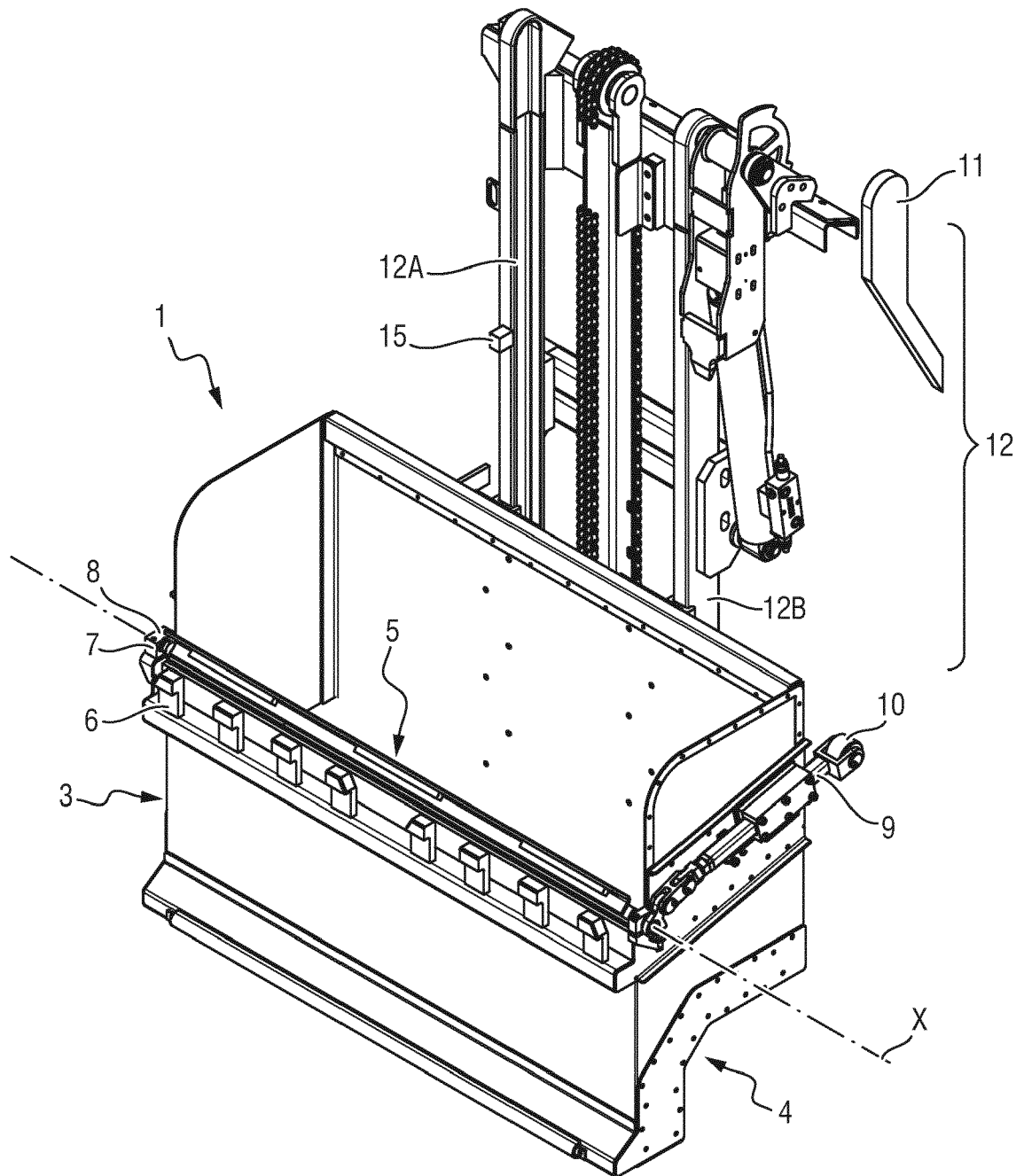


FIG.2

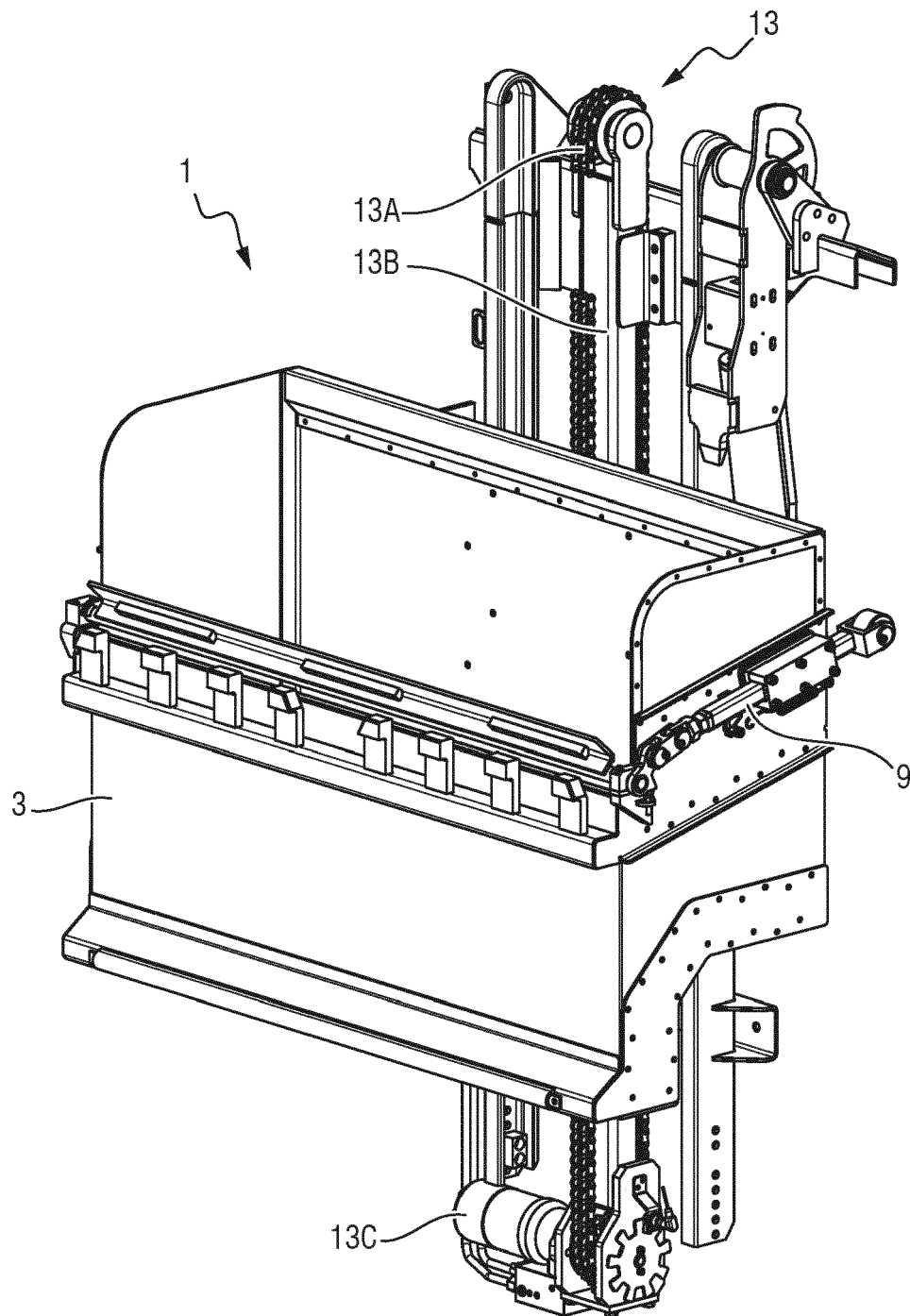


FIG.3

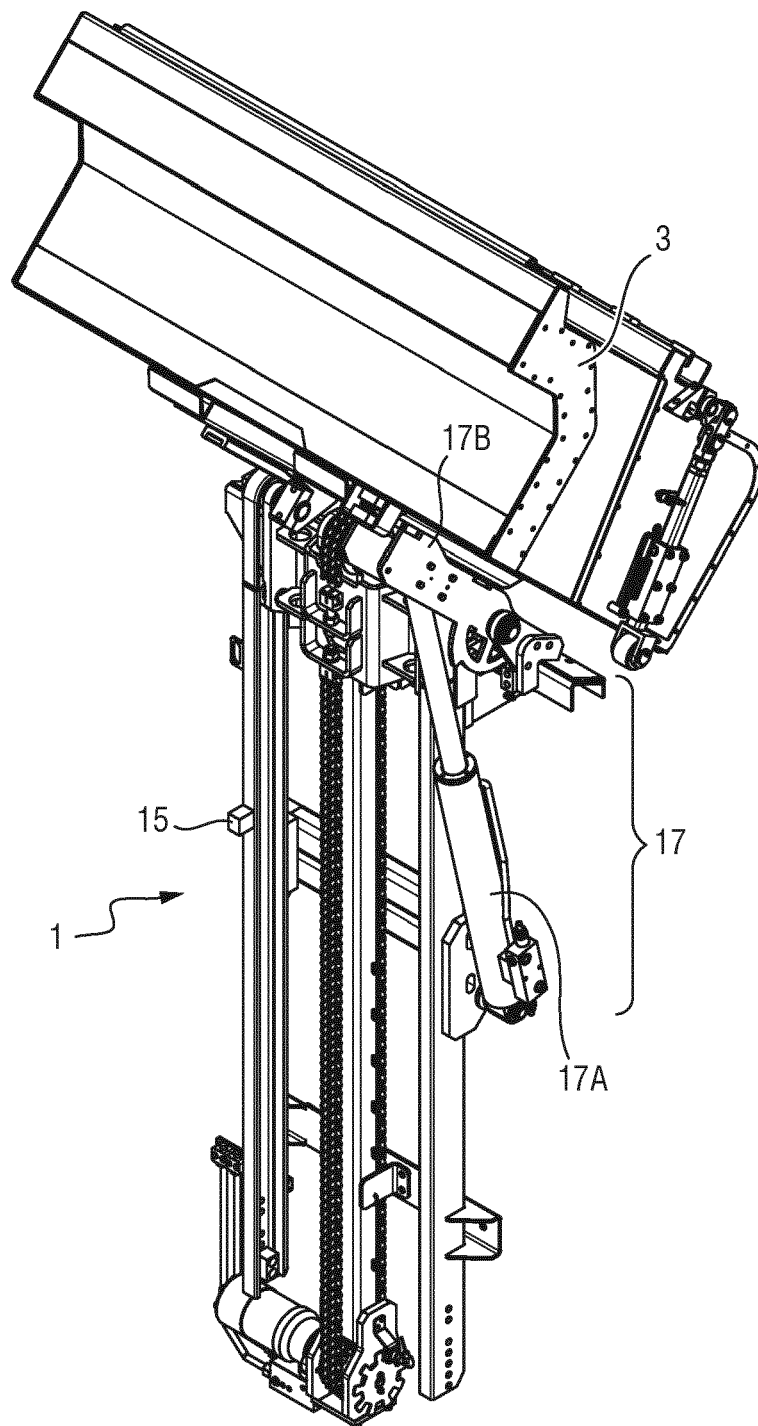
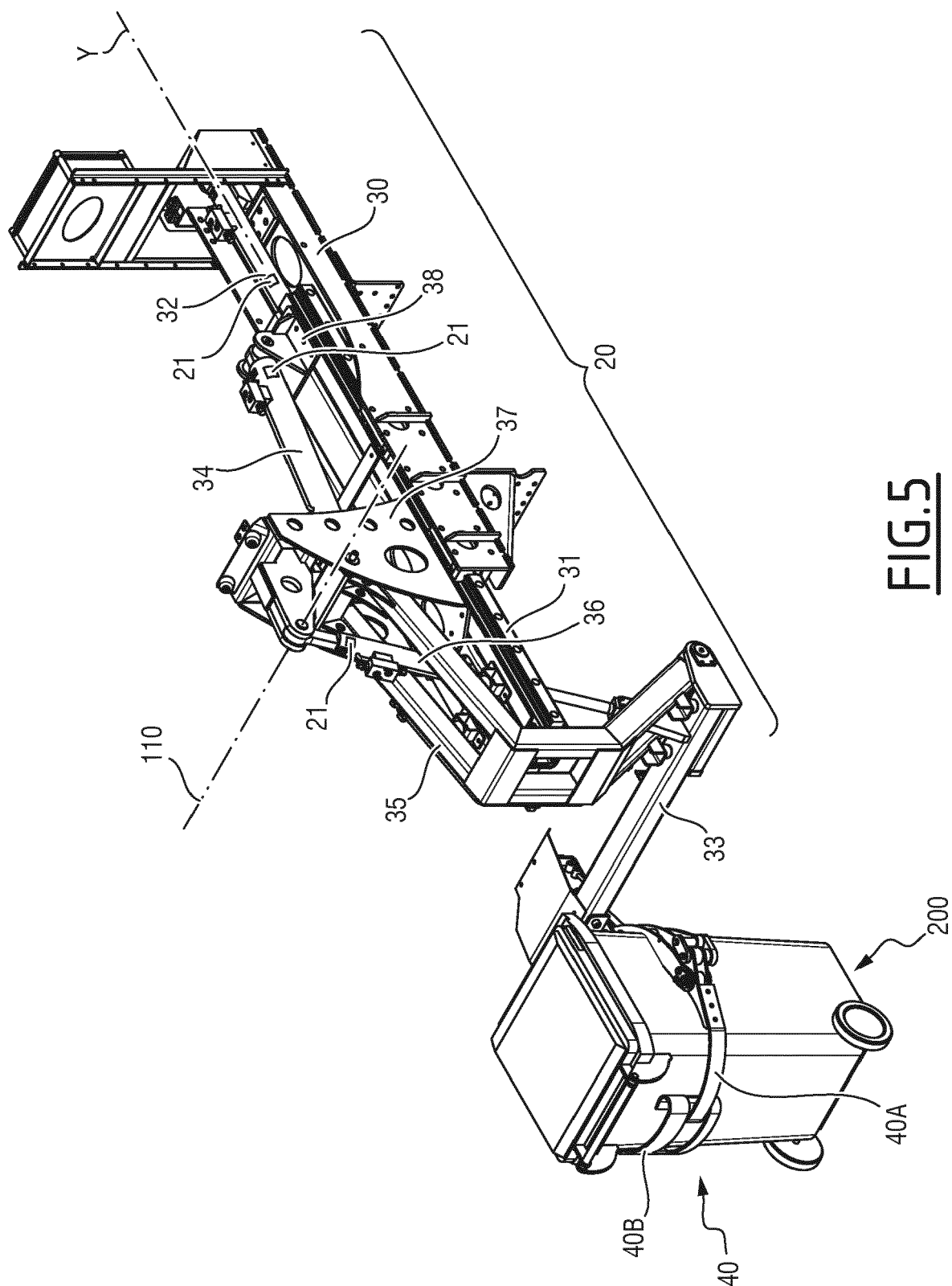


FIG.4



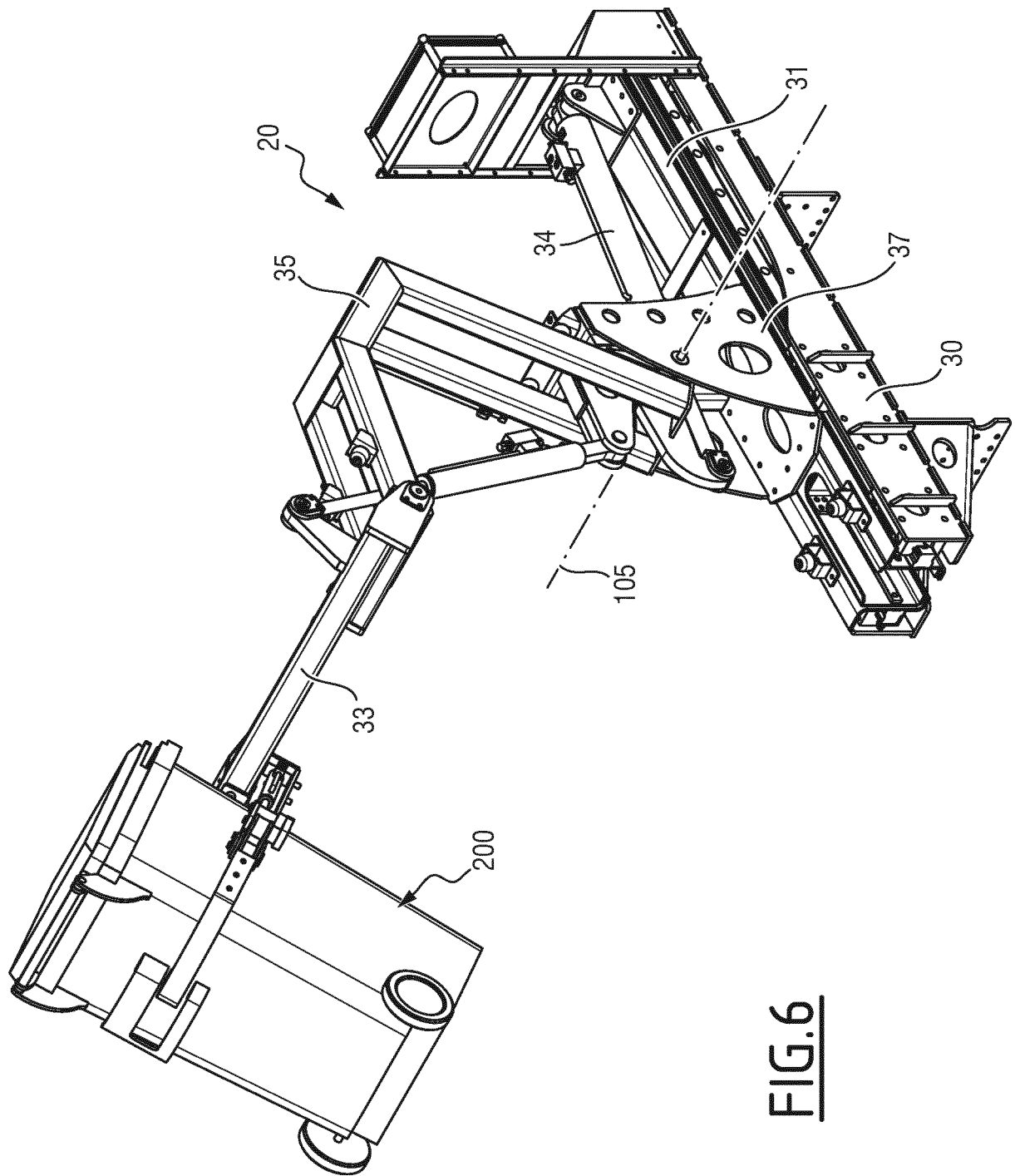


FIG. 6

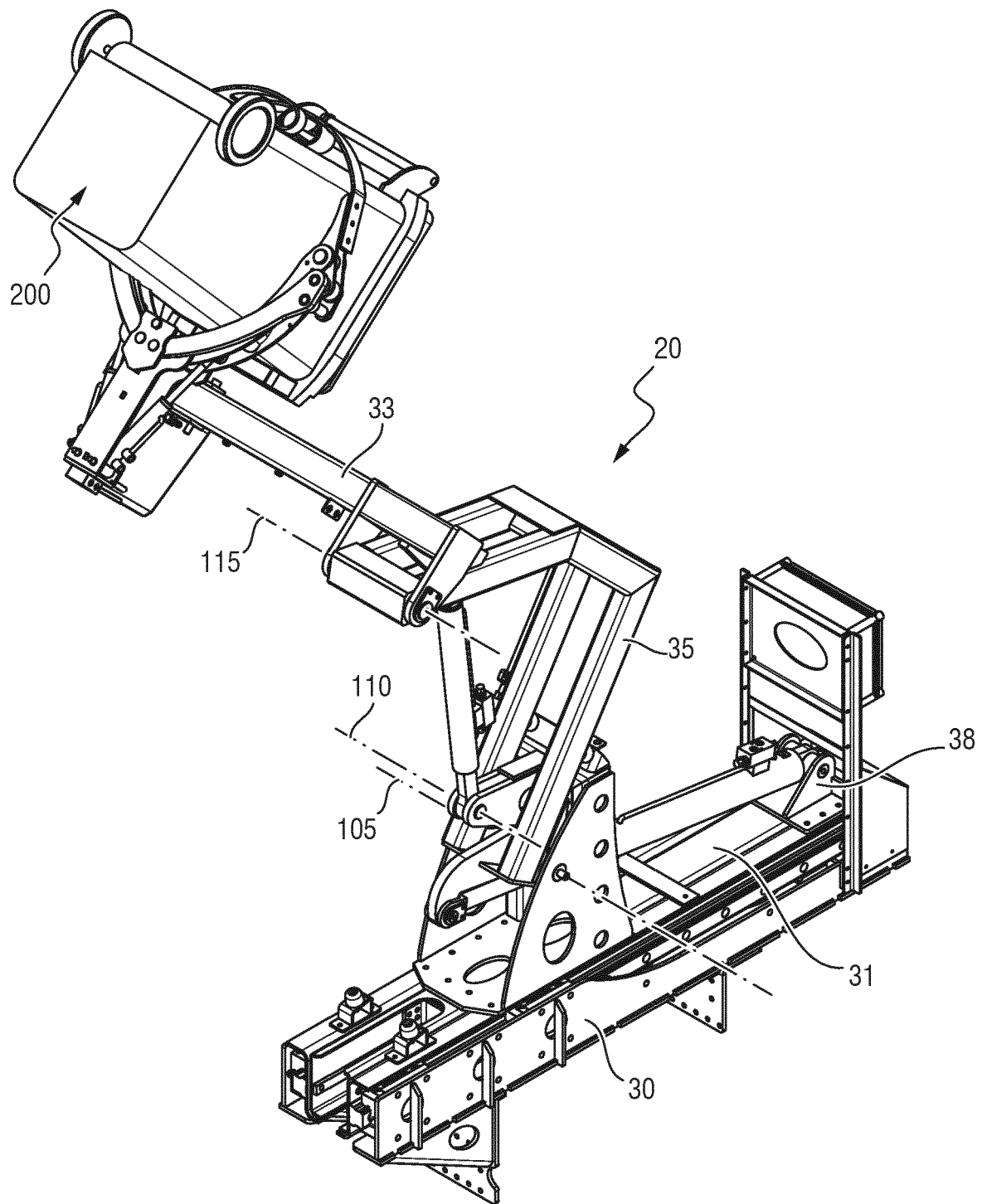
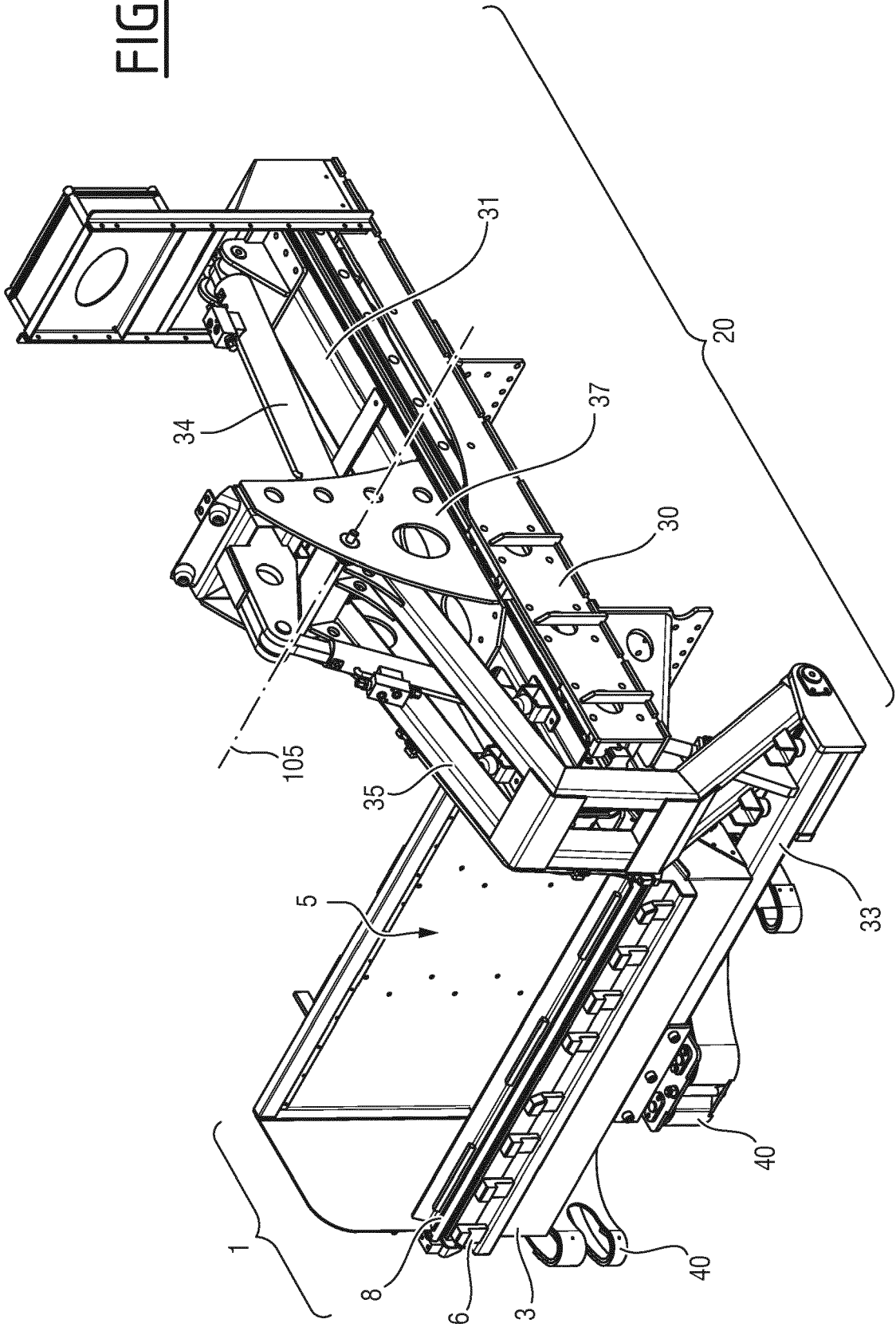


FIG.7

FIG. 8



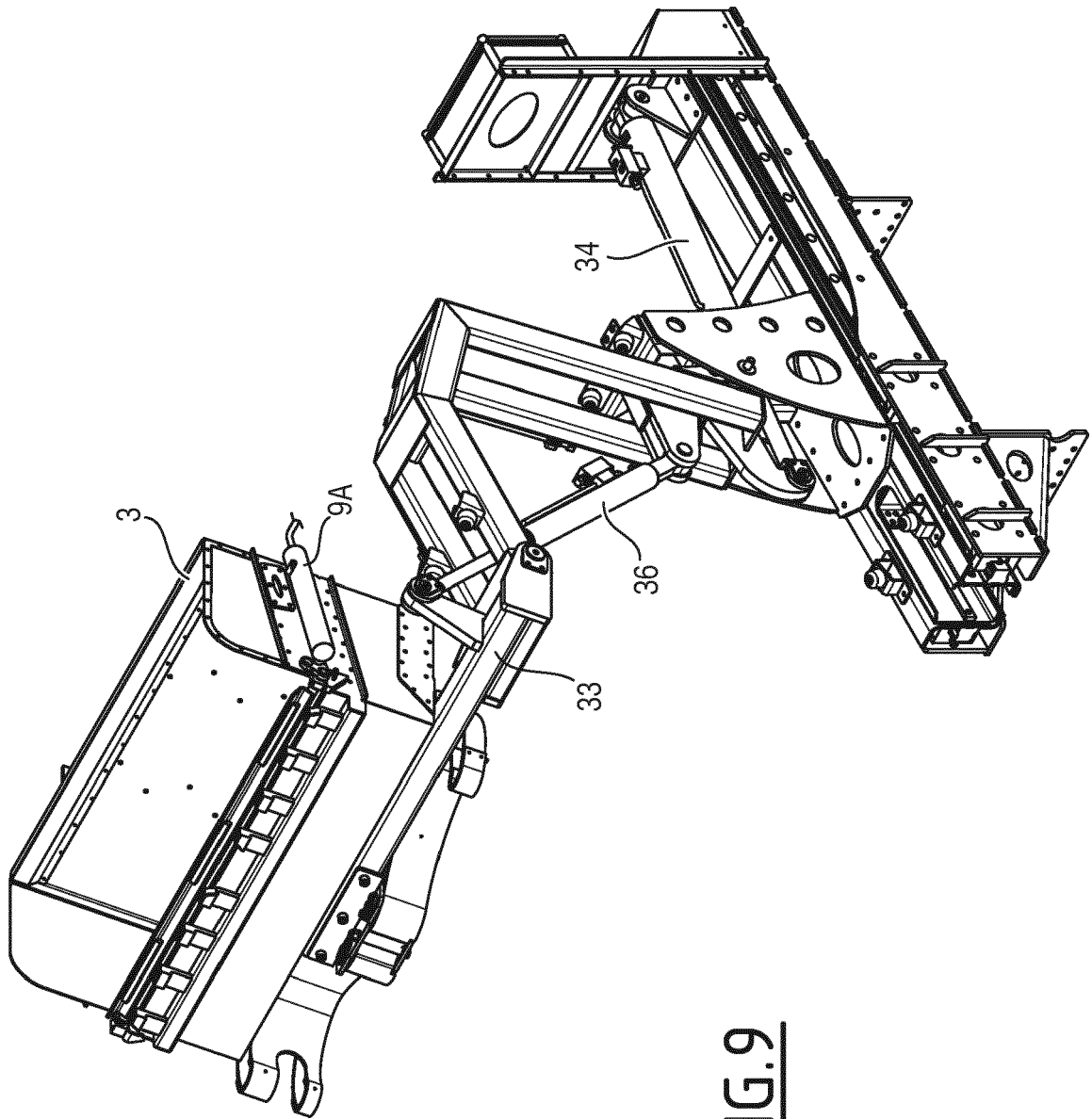
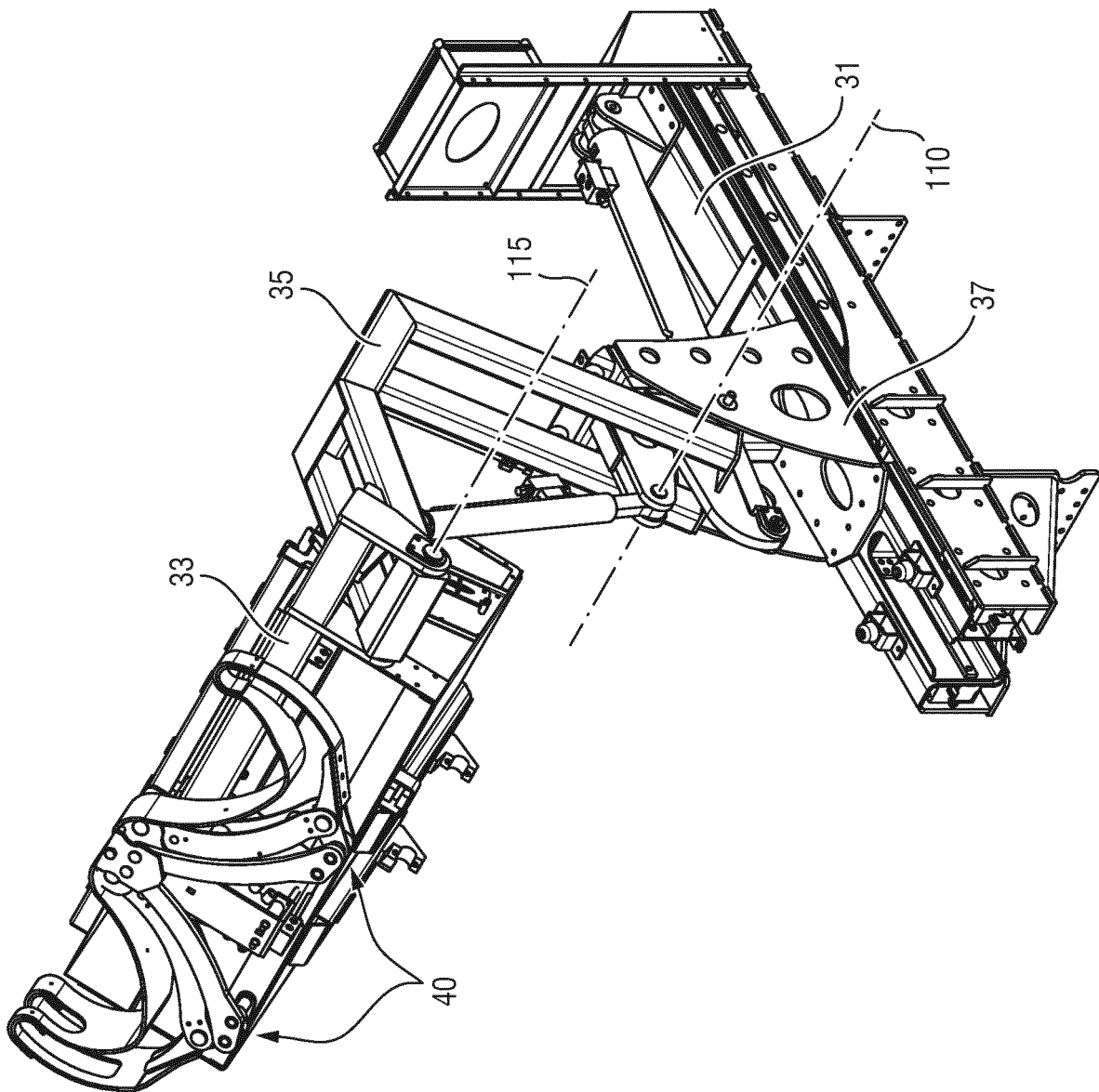


FIG. 9

FIG.10





EUROPEAN SEARCH REPORT

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Y	* paragraph [0042]; figures 1, 5, 6, 7 *	7	
A	-----	4-6, 8-10	
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A	* paragraphs [0043], [0054] *	1	

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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 30 June 2022	Examiner de Miscault, Xavier
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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30-06-2022

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