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(54)

FOLDABLE REAR-CAB EQUIPMENT FOR LIFTING AND HANDLING WASTE COLLECTION CONTAINERS

(57) Described is a crane (1) for lifting and moving stationary containers for waste collection, which comprises a column element (10) which extends perpendicularly to a base (11) designed to be associated with a vehicle (200) and a crosspiece (20) which extends in a direction substantially normal relative to the axis of symmetry (A1) and which is rotatably connected to the column element (10) about an axis of symmetry (A1) of the column element (10).

There are also a first arm (30) and a second arm (40).

The first arm (30) is connected rotatably to the crosspiece (20) about a first axis (A2) of rotation by means of a first joint (21). The first joint (21) is positioned at the vertex of a first angle (O1) drawn by the rotation of the first arm (30) relative to the crosspiece (20). The second telescopic arm (40) pivots at the end of the first arm (30) about a second axis of rotation (A3) by means of a second

joint (31). The second joint (31) is positioned at the vertex of a second angle (O2) drawn by the mutual rotation of the first arm (30) and of the second arm (40). Moreover, the second arm (40) has, at the end opposite the second joint (31), a gripping unit (50) for the stationary containers (C).

In this crane (1), the first arm (30) is configured to be rotated about the first axis (A2), by means of a first actuator (22), transporting with it the second arm (40) in a rotary movement and the second arm (40) is designed to also rotate about the second axis (A3) by means of a second actuator (32), in such a way that, by means of the rotation of the crosspiece (20) and of the first arm (30) about their respective axes (A2, A3), the gripping unit (50) can be adjusted and aligned with the container (C).

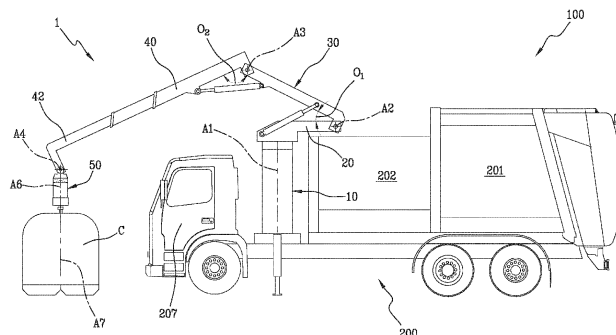


Fig. 5

Description

[0001] This invention relates to a foldable rear-cabin apparatus for lifting and moving waste collection containers, and to a machine on which the apparatus is mounted.

[0002] According to the prior art, there are apparatuses, such as cranes mounted on a respective truck, designed for lifting and moving stationary containers for collecting waste which can be lifted from above and emptied from below. For lifting these containers, which generally have a capacity of from approximately 1,000 litres to approximately 5,000 litres, traditional truck cranes are normally used, equipped with a suitable coupling and movement device or cranes specifically made for this use which differ from the former in terms of a greater operating speed and a system for command and control of the apparatus which is generally performed from the cabin of the vehicle. In the field of the apparatuses specifically constructed for this type of service, there are prior art apparatus with telescopic segments mounted on a truck suitable for lifting and moving containers. All the prior art machines are apparatuses characterised by a limited operating area which extends on the right and left side of the machine (two-sided cranes).

[0003] An example is given by the crane described in patent document EP1084069 where a first vertical telescopic element allows a variation in height of a second horizontal telescopic element at the end of which is anchored the unit for coupling and movement of the container. The entire lifting device is rotated through a rotary platform mounted at the base of the vertical telescopic element.

[0004] The geometries of this constructional solution limit the operating field of the apparatus only to a small lateral area to the right and left of the machine (two-sided cranes). The operator must perform a very accurate centring of the container relative to the arm of the crane, since the rotation of the horizontal arm for gripping the container is limited by the space present between the cabin of the truck and the skip.

[0005] In order to empty two adjacent containers, it is necessary, after the first emptying, to move the vehicle to perform the centring of the second container. Due to constructional features, this apparatus does not allow any correction of misalignment between the vertical axis of the crane and the vertical axis of the container. Any misalignments are only compensated for by the clearances and tolerances allowed by the gripping unit with all the mechanical stresses and operational limitations that this constructional solution entails.

[0006] Due to geometrical characteristics, with this crane it is not possible to lift underground waste collection containers. For this application it is necessary to apply a further lifting device (known as JIB), considerably complicating the construction of the machine and increasing the operating times. Patent document EP2614017 B1 shows another embodiment of a crane with a telescopic vertical column, where, in order to increase the operating

area and allow the gripping and emptying also of underground containers without the application of auxiliary devices (cranes with the extensible arm, also called "JIB crane"); the vertical telescopic column has a significant extension in height, greater than the solution described above.

[0007] According to this embodiment, too, the telescopic column is mounted on a rotary platform (rack) located at the base of the column. The top of this telescopic vertical element is hinged, with a suitable support, to a second telescopic element where, at the outer end, the device for gripping the containers is anchored.

[0008] This first telescopic arm, having a point of rotation at a height greater than the height of the skip and of the cabin of the truck increases the operating area of the apparatus allowing the movement also of two adjacent containers located laterally to the vehicle.

[0009] The mechanical complexity of this solution is evident, the same vertical column has three telescopic sliding members, with all the constructional complexities which derive from it and the weights which characterise it.

[0010] Patent document EP 2821360 B1 shows another embodiment of a telescopic apparatus which moves on Cartesian axes where, in order to improve the positioning of the crane relative to the container and allow the movement of underground containers without the aid of jib cranes, the two vertical and horizontal telescopic elements, characteristic of the crane described in patent document EP1084069, have been added with, at the end of the horizontal telescopic arm, a third vertical telescopic element for gripping containers as well as having inserted in the central column, in place of the jib crane, another two telescopic elements, necessary to reach a greater height, which is essential for moving and emptying the underground containers inside the skip since said containers are characterised by a height of almost 3.4 m, which is twice the height of the containers positioned above the ground which have a height of approximately 1.7 m.

[0011] Moreover, in order to correct any misalignment of the crane relative to the axis perpendicular to the ground, the support of the horizontal telescopic element and of the third vertical telescopic element, to which the gripping unit is anchored, are equipped with a joint which allows a partial rotation on the respective axes to perform the correction of the position of the axis of the gripping unit relative to the perpendicular to the ground. An automatic device for correcting the inclination repositions the axis of the gripping unit perpendicular to the ground also in the case of positioning the vehicle outside the plane. However, the correction crane does not take into account the need to correct the inclination of the gripping unit in relation to the actual position and inclination of the container. Correction is essential when using rigid type lifting couplings such as the F90 hooking system or the double mushroom system. The out-of-plane positioning of the container is a typical condition and very frequent when it is not positioned on a specific pad. The inclination is

caused by the normal slope of the roadbed formed for the runoff of water, a slope which, in the outer zone of the road, is generally greater than the central zone of the carriageway. The differences of inclination between the vehicle positioned on the carriageway and the container positioned outside the carriageway cannot be managed with the system indicated in patent document EP 2821360 B1 nor with the other apparatuses mentioned above.

[0012] The constructional complexity and the operating limits of all these apparatuses which represent the current state of the art are evident. These constructional complexities obviously lead to high construction costs and significantly affect machine maintenance costs and reliability.

[0013] These constructional choices also determine very long cycle times (gripping/emptying/repositioning), due to the complexity of the movements and the masses to be moved, with consequent high energy consumption levels. For example, just the movement of the telescopic vertical column requires an extremely high quantity of energy, both because of the weights which characterise it and due to the sliding friction.

[0014] Energy consumptions that are no longer negligible in vehicles with an internal combustion engine, due to the direct emissions of pollutants and due to the CO₂ emissions, with the consequent impact on the so-called "carbon footprint" and in vehicles with electric traction, due to an evident reduction in autonomy.

[0015] Other examples of apparatuses for lifting and moving waste collection containers are described in prior documents FR 2964648 A1, KR 2022 0068500 A and WO 9617750 A1.

[0016] These documents illustrate a crane, mounted on a truck, designed to lift and move waste collection containers, which has articulated arms on a column that can rotate about its axis. These arms allow, by means of pistons, the adjustment of the gripping means - mounted at the vertex of the arm furthest from the column - in order to allow the picking up of the container. However, due to the geometrical shape of the cranes described in the above-mentioned documents, the gripping means cannot move easily and entirely around the truck in an arc of 360°; thus, in order to pick up a skip positioned in front of the crane, the driver is forced to manoeuvre the vehicle in such a way as to make the skip available to the gripping unit.

[0017] In other words, these apparatuses are forced to operate on a limited operating area, forcing the vehicle to occupy a specific position to be able to pick up the skip.

[0018] This leads to more or less serious disadvantages depending on the traffic and space conditions of the skip gripping zone.

[0019] Amongst other things, some of these apparatuses cannot be folded in the rear-cabin.

[0020] The aim of the invention is to overcome the above-mentioned drawbacks of prior art types of foldable rear-cabin apparatus for lifting and moving waste collec-

tion containers which allows a skip to be picked up easily and quickly in any situation with the pick-up zone, irrespective of the traffic, how the parked cars are parked and the dimensions of the road.

[0021] In the context of the above-mentioned purpose, another aim of the invention is to improve the functionality of the foldable rear-cabin apparatus for lifting and moving containers for collecting waste, as well as their operational and constructional simplicity.

[0022] Another aim of the apparatus according to the invention is to reduce the cycle times and limit the maintenance costs and the energy consumption necessary for operation of the apparatus.

[0023] This purpose, as well as these and other aims, which are described in more detail below, are achieved by a foldable rear-cabin apparatus for lifting and moving waste collection containers, according to the invention, comprising the technical features described in one or more of the appended claims. The dependent claims correspond to possible different embodiments of the invention.

[0024] More specifically, according to a first aspect, this invention relates to a foldable rear-cabin apparatus for lifting and moving stationary containers for waste collection, which comprises a column element which extends perpendicularly to a base, which is designed to be associated with a vehicle. The column element is fixed on the base. According to a variant, it can rotate about its axis of symmetry by means of a rotatable support. This axis of symmetry is substantially normal relative to the ground. The column element is rotatably connected to a crosspiece which extends in a direction substantially normal relative to the axis of symmetry. If the column element can rotate, the crosspiece will be integral in rotation with the column element.

[0025] A first arm is mounted on the crosspiece in such a way that it can rotate about a first axis of rotation by means of a first joint; the first joint is positioned at the vertex of a first angle drawn by the rotation of the first arm relative to the crosspiece. The apparatus also comprises a second arm, preferably telescopic, which pivots at the end of the first arm, about a second axis of rotation by means of a second joint positioned at the vertex of a second angle drawn by the mutual rotation of the first and of the second arm. The second arm also has, at the end opposite the second joint, a gripping unit for the stationary containers.

[0026] The first arm is configured to be rotated about the first axis by means of a first actuator, transporting with it the second arm in a rotary movement; the second arm, for its part, is designed to rotate also about the second axis by means of a second actuator.

[0027] In this way, by rotating the crosspiece and the first arm about their respective axes, the gripping unit is adjustable and may be aligned on the basis of the position of the container.

[0028] This allows the apparatus according to this invention to have an articulation of the lifting system which

guarantees a large operating area on the right side, on the left side and also in the front area of the machine without the use of a central telescopic column or auxiliary lifting systems such as jibs.

[0029] Advantageously, the crosspiece is designed to perform an entire revolution about the relative axis of symmetry, in such a way as to also be able to pick up the skips positioned in front of the vehicle on which the apparatus is mounted, in the case, for example, of narrow roads or with obstacles (parked cars, trees, gazebos, etc.) which would otherwise limit the operation.

[0030] Operatively, the rotations of the first and of the second arm about the relative axes occur between an initial position and a succession of operating positions. In the initial position, the crosspiece and the first arm are substantially aligned whilst the first and the second arm are substantially perpendicular to each other; in the operating positions the crosspiece and the first arm are not substantially aligned with each other and/or the first and the second arm are not substantially perpendicular to each other.

[0031] The Applicant understood that by projecting the crosspiece from the axis of symmetry by a length such that, in the rest configuration, that is to say, when the crane is folded in the rear-cabin, the distance between the second axis and the axis of symmetry is less than or equal to the distance between the first axis and the axis of symmetry, a larger operating surface is reached. This increased operating area, achieved with the specific articulation of the arms and positioning of the centres of rotation, allows the apparatus to lift and move containers positioned above the ground or underground without requiring the movement of the vehicle to perform an accurate centring of several containers located in the operating area, with all the advantages in terms of operating times and energy consumption.

[0032] Advantageously, sensors have been provided for detecting the real position and inclination of the container relative to the position and inclination of the column element, in such a way as to detect the position and the inclination of the container relative to the position of the apparatus.

[0033] Preferably, the sensors are also for controlling the positioning of the gripping unit at the point calculated for coupling the container: the electronic control system of the apparatus acquires the specific data of the position and inclination of the container and, after detecting the real position and inclination of the apparatus with specific inclinometers and angular and position sensors, it manages and controls the necessary movements of the crane arms and of the gripping unit for positioning said gripping unit at the point required for coupling the container.

[0034] For this reason, another aspect of the invention relates to the use of an electronic control system, with reading of the position and inclination of the container, by means of systems for three-dimensional measurement and systems for measuring the inclination of the column element and of the gripping unit. This, thanks to

inclination sensors which allow the inclination of the gripping unit to be corrected, on the basis of the telemetric information processed by the electronic command and control system, allowing the central axis of the gripping unit to be positioned in such a way that it is coaxial with the axis of extension of the container.

[0035] The protection is also required for a machine for lifting and moving stationary containers for waste collection, which comprises, on a vehicle provided with a waste collection skip (and advantageously the relative unloading hopper), a crane according to this invention.

[0036] Another aspect of the invention relates to a process for gripping and moving a stationary waste collection container using the foldable rear-cabin apparatus for lifting and moving stationary waste collection containers described here.

[0037] Starting from the above-mentioned initial, rest position, the process comprises rotatably actuating the crosspiece, modifying the first angle, defined between the crosspiece and the first arm, using the first actuator means, modifying the second angle, defined between the first and the second arm using second actuator means, detecting the real position and inclination of the axis of extension of the container relative to the real position and inclination of the axis of symmetry, by means of the sensors, and therefore positioning the central axis of symmetry of the gripping unit, in such a way that it coincides with the axis of the container, in order to guarantee a perfect coupling of the container.

[0038] Advantageously, the first arm is rotated in such a way as to lift the container and, at the same time, withdraw the container towards the column element to allow the roto-translation of the second arm. Therefore, during unloading, the container is positioned in an area of the hopper adjacent to the column of the apparatus, in such a way as to avoid interference between the container and the second arm. In this way, the increase in the volume of the waste collection skip not occupied by the unloading hopper is allowed.

[0039] In order to reduce the lifting forces necessary to move the container, the first arm is rotated about the first axis, consequently moving the centres of mass of the first and of the second arms relative to the axis of symmetry. In effect, in this way, the centres of mass are moved between the step of gripping the container and the step of emptying. The direct consequence of this reduction of forces is a saving in energy consumption. Advantageously, the rotation of the first arm determines the vertical movement of the centre of rotation of the second axis, allowing an increase in the operating area of the apparatus, in such a way that it can also operate in the front part of the vehicle for lifting containers positioned in the operating area without moving the vehicle.

[0040] Further features and advantages of the invention are more apparent in the detailed description below, with reference to a preferred, non-limiting embodiment of the foldable rear-cabin apparatus for lifting and moving waste collection containers, illustrated by way of example

and without limiting the scope of the invention, with the aid of the accompanying drawings, in which:

Figure 1 is a schematic front view of the apparatus 1 according to the invention, suitable for mounting in the rear-cabin part of a truck 200, in a first operating position for gripping a first container C above the ground positioned laterally and in a second operating position for gripping a second container C, located parallel to the first, but at a distance greater than that of the apparatus 1;

Figure 2 is a schematic front view of the apparatus 1, suitable for mounting in the rear-cabin part of a truck 200, in an operating position for gripping a first underground container C, positioned laterally, and in a second operating position for gripping a second container C, which is also underground, positioned parallel to the first, but at a distance greater than that of the apparatus 1;

Figure 3 shows a side view of a machine 100 for lifting and moving stationary waste collection containers provided with a crane 1, mounted in the rear-cabin part of a truck 200, in an operating position, during emptying of the container C inside the unloading hopper 202 of a compactor mounted on the truck 200;

Figure 4 shows the machine 100 wherein the apparatus 1 is in the step of emptying the container C inside the unloading hopper 202;

Figure 5 is a schematic side view of the machine 100 wherein the apparatus 1 is mounted in the rear-cabin part of a truck 200, in the operating position, illustrated in the front area of the truck 200 for gripping a container C above ground positioned in front of the truck 200;

Figure 6 is a schematic front view of the apparatus 1, folded into the rear cabin in the rest configuration; Figures 7A and 7B show, respectively, a side view and an elevation view of the apparatus 1 in the step of gripping and lifting the container C showing the adjustment of the gripping unit;

Figures 8A and 8B show the apparatus 1 in the gripping step and in the step of emptying a container C (not shown), with indication of the centres of mass; Figure 9 shows an elevation view of the apparatus 1 with the detail of the electronic control unit and the respective three-dimensional video cameras 221 and the respective sensors 222 and 223.

Figure 10 is a plan view of the operating area of the apparatus 1 and the measurements of the angular rotation sensors 223.

[0041] The above-mentioned drawings show a preferred embodiment of a foldable rear-cabin apparatus for lifting and moving waste collection containers, according to the invention, which is identified in its entirety with the numeral 1 and which comprises a column element 10, vertical relative to the ground T, fixed to a fixed base 11

complete with stabilisers 12 suitable for mounting on a truck 200 or any other suitable vehicle. Installed in the upper part of the column element 10 is a rotatable support 13, for example a rack, where a crosspiece 20 is anchored. The crosspiece 20 rotates about the axis of symmetry A1 of the element 10 by means of a gear motor, not illustrated, and thanks to the rotatable support 13.

[0042] As mentioned above, the axis of symmetry A1 is therefore substantially normal relative to the ground T.

[0043] According to a variant embodiment, the rotatable support 13 may be installed in the lower part of the column 10 which at that point will be rotatable and integrally connected to the crosspiece 20.

[0044] As shown in Figures 3 to 5, the crosspiece 20 has a length comprised in the width of the bodywork of the truck 200 or less; it is positioned at a height greater than the height of the cabin 207 of the truck 200 and of the unloading hopper 202, in such a way as to allow a free rotation without interference with said elements.

[0045] The height of rotation of the crosspiece 20 is obtained with a specific length of the column element 10. The length of the column element 10 in the solution described here is purposely, but not necessarily, made with a single component without any telescopic or other movement, in such a way as to reduce the weights and the production costs.

[0046] Obviously, variants may comprise the possibility of telescopically modifying the height of the element 10.

[0047] A first arm 30, with a length included in the bodywork of the vehicle or less, or, if necessary, also telescopic, is anchored to the crosspiece 20 through a first joint 21 which, with the rotation of the element 30 about a first axis of rotation A2, allows a first angle O1, defined between the crosspiece 20 and the first arm 30, to be varied.

[0048] A second arm 40, in this case telescopic, is fixed to the end of the first arm 30 by a second joint 31. The joint 31 defines a first axis A2 of rotation, obviously allowing the rotation of the second arm 40 about the axis A2 so as to allow the variation of the second angle O2 defined between said two arms 30 and 40.

[0049] The other end of the telescopic arm 40, opposite the joint 31, is connected to a gripping unit 50, anchored by a first pin 41. The gripping unit 50 allows a container C to be coupled to the end of the second arm 40 for its lifting. The apparatus 1 is mounted on a vehicle 200 to form a machine 100 (Figures 3-5) for lifting and moving stationary containers for waste collection, which comprises the vehicle 200 equipped with a waste collection skip 201 and the respective unloading hopper 202, and the apparatus 1 according to the invention.

[0050] As shown in the above-mentioned drawings, the point of rotation of the arm 30 moves through the crosspiece 20, which has a length within the width of the truck 200, allowing all the geometries of movement of the apparatuses shown to be made.

[0051] More specifically, the crosspiece 20 projects

from the axis of symmetry A1 by a length such that, in the rest configuration, the distance between the second axis A3 and the axis of symmetry A1 is less than or equal to the distance between the first axis A2 and the axis of symmetry A1.

[0052] In practice, the crosspiece 20 projects from the axis of symmetry A1 of the column element 10 by a length at least equal to the diameter of the column element 10.

[0053] With reference to Figure 6, advantageously the distance between the axis of symmetry A1 and the first axis A2 is equal to the distance between the axis of symmetry A1 and the second axis A3, so as to have maximum compactness at rest and excellent possibility of manoeuvring the gripping unit 50.

[0054] First actuation means, hydraulic, electrical or other type 22, which may consist of one or more actuators, allows the arm 30 to be rotated relative to the first axis of rotation A2 of the pin 21 varying the angle between the element 20 and 30.

[0055] Second actuation means, hydraulic, electrical or other type of 32, which may consist of one or more actuators, allows the arm 40 to be rotated relative to the second axis A3 of the pin 31 varying the angle between the arms 30 and 40.

[0056] The rotation around the axes A2 and A3 may also be performed with rotary actuators or other actuation systems.

[0057] From the rest configuration (Figure 6), a simple rotation of the two arms 30 and 40 allows the operational positioning of the apparatus which is completed with the positioning of the gripping unit 50 obtained with the rotation relative to the third axis of rotation A4 of the pin 41 until moving the relative central axis A6 of symmetry for the gripping unit 50 to a position perpendicular to the ground T.

[0058] The rotation of the gripping unit 50 is performed by a hydraulic, electrical or other type of actuator, inserted in the arm of the sliding member 42 of the second arm 40.

[0059] The elongation of the telescopic arm 40 and the rotation of the movable parts (arms 30 and 40 and their connected members) of the apparatus 1 relative to the axis of symmetry A1 allows the gripping unit 50 to centre the container C positioning itself at the desired distance for the coupling. With regard to the crane model, the telescopic arm 40 may have one or more telescopic sliding members which allow the operating area of the apparatus to be varied. The lifting capacity of the apparatus 1 may also vary in relation to the type and weight of the containers to be moved.

[0060] By way of an example embodiment, it is possible to have a model of crane 1 with an operating distance for gripping containers of 5000 mm and a lifting capacity of 1600 kg at 5000 mm, or a model of crane with an operating distance greater than, for example, 7500 mm with a lifting capacity of 2000 kg, or different.

[0061] With regard to the type of coupling of the container C to be lifted, rings, mushroom, etc. the characteristics of the gripping unit 50 vary, which may have and

require specific shapes and movements.

[0062] According to the embodiment described here, the gripping unit 50 is suitable for moving containers C with rigid mushroom-shaped coupling. The movements indicated guarantee a perfect centring and coupling of the container C, avoiding forces in the gripping of the container C which may adversely affect and cause damage to the gripping unit 50 or the lifting device of the container C, also adversely affecting safety.

[0063] The gripping unit 50 is completed by a further joint inserted in the support 51 which makes it possible to correct the inclination, by means of a specific actuator (not shown), with a rotation of the gripping unit 50 on the axis of rotation A5, perpendicular with respect to the third axis A4 and a rotatable support 53, provided with a relative actuator (not shown) which makes it possible to rotate the container C with respect to the central axis A6.

[0064] The rotatable support 53 allows the container C to be positioned correctly inside the unloading hopper 202 of the skip 201 so as to avoid possible interference of the closing lids C1 of the container C with the walls of the unloading hopper 202.

[0065] The rotatable support 53, in the step of coupling the container, allows the gripping unit 50 to be oriented in the correct position required by the coupling devices of the container C (Figure 10), whilst in the step for repositioning on the ground, if necessary, it allows the container to be rotated to change or correct the orientation or the positioning.

[0066] There are also detection sensors, such as three-dimensional video cameras 221 or other means of per se known type (inclination 222 and angular 223 sensors), for detecting the real position and inclination (angle O5) of the container C with the axis of extension A7 relative to the position and inclination of the column element 10 relative to the ground T and for detecting the position of the container relative to the transversal axis A8 of the apparatus (Figure 9 and Figure 10).

[0067] The inclination of the column element 10 (with measurement of the angle O4 defined between the axis A1 and the ground T) and of the gripping unit 50 (with measurement of the angle O3 between the axis A6 and the perpendicular to the ground T) is detected by specific inclination sensors 222. In the same way, the position of rotation of the rotatable support 13 of the column element 10 (with the measurement of the angle O7) and of the rotatable support of the gripping unit 50 (with the measurement of the angle O6) is detected by specific sensors of the angular position 223.

[0068] The three-dimensional video cameras 221 and the sensors 222 and 223 are connected to an electronic command and control unit (not illustrated). This unit allows the gripping unit 50 to be positioned at the point exactly calculated for coupling the container C, orienting the gripping unit with the same inclination as the container.

[0069] The correction of the inclination of the gripping unit 50 with the rotation on the axes A4 and A5 is per-

formed by means of specific actuators.

[0070] This correction allows the central axis A6 of the gripping unit 50 to be positioned coinciding perfectly with the axis of extension A7 of the container C, once the real position and inclination of the container C has been detected with its axis of extension A7 relative to the real position and inclination of the axis A1 of the machine 100.

[0071] This makes a perfect coupling of the container C possible.

[0072] In practice, an electronic control system is provided with a reading of the position and inclination of the container C using three-dimensional measuring systems and detection of the inclination both of the column element 10 and of the gripping unit 50, using inclination sensors 222; in such a way as to correct the inclination of the gripping unit 50, on the basis of the telemetric information processed by the electronic command and control system, thus allowing the axis A6 of the gripping unit 50 to be positioned coaxial with the axis A7 of the container C.

[0073] The correction of the above-mentioned inclination is fundamental for the optimum coupling and lifting of all the containers with rigid lifting hooks, such as the mushroom type.

[0074] After coupling the container C, in the first lifting step, during detaching from the ground, only the force of gravity causes the gripping unit 50 to rotate on the axes A4 and A5, moving the axis of extension A7 of the container C to a barycentre position perpendicular to the ground. The barycentric position is maintained during all the lifting and emptying steps irrespective of the positioning outside the plane of the apparatus 1, without generating abnormal stress on the gripping unit 50 or on the lifting device of the container C.

[0075] The devices for correcting the inclination of the gripping unit, hydraulic, electrical or other types, during all the lifting steps, dampen any oscillations of the container C, increasing the operating safety.

[0076] It should be noted that only in the lifting of underground or above-ground containers C, positioned on pads specifically made, is it possible to find containers C positioned perfectly flat, therefore with its axis of extension A7 perpendicular to the ground, and with the operating position of the vehicle perfectly flat in such a way as to also have the axis A1 of the apparatus perpendicular to the ground.

[0077] Since the crosspiece 20 is positioned at a height greater than the height of the cabin 207 of the truck 200 and of the hopper 202 of the skip 201, the apparatus 1 can rotate the arms 30 and 40 about the axis of symmetry A1 freely to 360°; this implies that the apparatus 1 has a large operating radius (R) which is no longer limited by the gap between the cabin 207 and the skip 201 (Figure 10).

[0078] The partial rotation of the first arm 30 on the first axis A2 allows the centre of rotation of the telescopic arm 40, which coincides with the second axis A3, to be raised from the rest configuration to an operating position. The

vertical movement of the centre of rotation corresponding to the axis A3 makes it possible to increase the operating area covered by the second arm 40, eliminating the interference with the cabin 207 or with the skip 201 of the vehicle 200. A radius of action which may also extend to the front part of the vehicle 200 as it is no longer limited by the space between the cabin 207 and the skip 201.

[0079] The number of sliding members of the telescopic arm 40 determines the depth of the operating area given by the distance between the axis A1 of the crane column 10 and the central axis A6 of the gripping unit 50.

[0080] Once the container C has been gripped, the simple rotation of the arm 30 allows the container C to be lifted and moved towards the vehicle 200. This movement, thanks to the movement of the masses, the geometrical reduction of the reach and the increase in the lever of the actuator of the crosspiece 20 relative to the first axis of rotation A2 of the arm 30 reduces the force necessary for lifting and the relative energy consumption.

[0081] As illustrated in Figures 8A and 8B, which schematically show the variation of the forces and the movement of the centres of mass between the gripping step and the step of emptying the container C, the movement of the centres of mass of the arms 30 and 40 relative to the axis of rotation A1 of the column 10 of the apparatus, by means of the natural balancing of the forces relative to the respective centres of rotation, determines a reduction in the lifting forces necessary to move the container C.

[0082] Figures 3 and 4 show the unloading of the container C, respectively, of the type above ground and underground, in a skip 201 provided with an unloading hopper 202, positioned in the front part of the skip 201, and of the press 203. Thanks to the vertical rotation of the arm 30 performed with the actuator 22, the telescopic arm 40 is also rotated with consequent lifting and translation of the container C towards the hopper 202. This articulation of the arms makes it possible to not have interferences, both for the containers above ground and for the underground containers, between the lifting arm 40 and the container C both during lifting and unloading.

[0083] During the unloading step, with the verticalization of the arm 30, the centre of rotation A3 is withdrawn, towards the front part of the vehicle 200. This withdrawal allows the unloading of the containers C in the front part of the hopper 202 without having interferences between the container C and the arm 40 and allows the depth of the unloading hopper 202 to be limited, with obvious advantages in terms of the volume of the skip 201 not occupied by a hopper with larger dimensions required for all those apparatuses which do not have this feature.

[0084] The geometries of the apparatus 1 allow operation to be easily performed also for unloading in containers C open at the top, without the hopper 202.

[0085] Thanks to the sliding of the apparatus it is possible to control the unloading of the containers C in different zones of the skip 201, thus optimising the filling.

[0086] With the separate management of the move-

ments of the lifting arms 30 and 40 it is possible to perfectly control the desired lifting path of the container C so much so that it is very easy to also control manually all the movements of the apparatus 1.

[0087] From the above description it may be seen how the invention achieves the preset purpose and aims and in particular the fact that a foldable rear-cabin apparatus is made for lifting and moving waste collection containers which allows a skip to be gripped quickly and easily lifted in any situation of the picking up zone.

[0088] In effect, in this regard, thanks to the rotation of the gripping unit, but especially the correction of the inclination of the unit itself, which may be performed on two planes perpendicular to each other, the gripping unit may be positioned in such a way that the actual inclination and position of the machine, that is to say, of the vehicle and of the apparatus, are perfectly coaxial relative to the inclination and to the position of the container.

[0089] This correction is essential to ensure an optimum coupling and a safe lifting of all the containers provided with a rigid lifting hook such as, for example, all the containers with a mushroom lifting hook.

[0090] Another advantage of the invention is that it improves the functionality of the foldable rear-cabin apparatus for lifting and moving containers for collecting waste, as well as their operating and production simplicity, thanks to the particular geometry of the foldable apparatus which, with the specific articulation of the arms and the respective centres of rotation, allows a reduction in the movements necessary for gripping and emptying the container, consequently reducing the cycle times and the energy consumption compared with prior art devices.

[0091] Another advantage of the apparatus according to the invention is to allow a perfect coupling of the container in all the operating conditions, increasing the operating area and also reducing the movements necessary for gripping and emptying the container, with advantages in terms of operating speed and energy consumption.

[0092] Lastly, the use of means which are easily available on the market and the use of common materials makes the device economically competitive. The invention can be modified and adapted in several ways without thereby departing from the scope of the inventive concept.

[0093] Moreover, all the details of the invention may be substituted by other technically equivalent elements.

[0094] In practice, the materials used, as well as the dimensions, may be of any type, depending on requirements, provided that they are consistent with their production purposes.

Claims

1. A foldable rear-cabin crane (1) for lifting and moving stationary waste collection containers, comprising:

a column element (10) extending perpendicularly to a base (11) designed to be associated with a vehicle (200);

a crosspiece (20) extending in a direction substantially normal relative to the axis of symmetry (A1) and rotatably connected to the column element (10) about an axis of symmetry (A1) of the column element (10);

a first arm (30) rotatably connected to the crosspiece (20) about a first axis (A2) of rotation by means of a first joint (21), the first joint (21) being positioned at the vertex of a first angle (O1) drawn by the rotation of the first arm (30) relative to the crosspiece (20);

a second telescopic arm (40), pivoting at the end of the first arm (30) about a second axis (A3) of rotation by means of a second joint (31), said second joint (31) being positioned at the vertex of a second angle (O2) drawn by the mutual rotation of the first (30) and the second arm (40); the second arm (40) having, at the end opposite the second joint (31), a gripping unit (50) for the stationary containers (C);

wherein the first arm (30) is configured to be rotated about the first axis (A2), by means of a first actuator (22), transporting with it the second arm (40) in a rotary movement; and

the second arm (40) is designed to also rotate about the second axis (A3) by means of a second actuator (32);

in such a way that, by means of the rotation of the crosspiece (20) and of the first arm (30) about their respective axes (A2, A3), the gripping unit (50) can be adjusted and aligned with the container (C).

2. The apparatus (1) according to claim 1, wherein the crosspiece (20) is designed to perform an entire revolution about its own axis of symmetry (A1).

3. The apparatus (1) according to claim 2, wherein the rotation of the first arm (30) about the first axis (A2) and of the second arm (40) about the second axis (A3) occurs between an initial position and a succession of operating positions;

the initial position being such that the crosspiece (20) and the first arm (30) are substantially aligned with each other and the first arm (30) and the second arm (40) are substantially perpendicular to each other;

the operating positions being such that the crosspiece (20) and the first arm (30) are not substantially aligned with each other and/or the first arm (30) and the second arm (40) are not substantially perpendicular to each other.

4. The apparatus (1) according to claim 2 or 3, wherein

the second axis (A3) is positioned on the opposite side of the joint (21) with respect to the axis of symmetry (A1).

5. The apparatus (1) according to claim 2, wherein the crosspiece (20) projects from the axis of symmetry (A1) by a length such that, in the rest configuration, the distance between the second axis (A3) and the axis of symmetry (A1) is less than or equal to the distance between the first axis (A2) and the axis of symmetry (A1). 5
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6. The apparatus (1) according to claim 5, wherein the crosspiece (20) projects from the axis of symmetry (A1) of the column element (10) by a length at least equal to the diameter of the column element (10). 15
7. The apparatus (1) according to any one of claims 1 to 6, wherein the gripping unit (50) is connected to the end of the second arm (40) by a first pin (41) defining at least a third axis of rotation (A4) substantially normal to its central axis (A6). 20
8. The apparatus (1) according to claim 7, wherein the gripping unit (50) is connected to the end of the second arm (40) by means of a second pin (51) defining an axis of rotation (A5) substantially normal to the third axis (A4) and to the central axis (A6). 25
9. The apparatus (1) according to claim 7 or 8, comprising a rotatable support (53) interposed between the end of the second arm (40) and the gripping unit (50) for the rotation of the container (C) relative to the central axis (A6). 30
10. The apparatus (1) according to any one of claims 1 to 9, comprising sensors (221, 222, 223) for detecting the real position and inclination of the container (C) relative to the position and inclination of the column element (10) and for controlling the positioning of the gripping unit (50) in the point calculated for coupling the container (C). 35
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11. A machine (100) for lifting and moving stationary containers for waste collection, comprising, on a vehicle (200) equipped with a waste collection skip (201) and also including a crane (1) according to any one of claims 1 to 10. 45
12. A process for gripping and moving a stationary container (C) for collecting waste using a foldable rear-cabin crane (1) for lifting and moving stationary waste collection containers according to any one of claims 1 to 10, comprising the step of: 50

- rotatably actuating the crosspiece (20) about the axis of symmetry starting from a rest configuration,

- modifying a first angle (O1) defined between the crosspiece (20) and the first arm (30) by means of first actuator means (22), modifying a second angle (O2) defined between the first arm (30) and the second arm (40) by means of second actuator means (32), detecting, by means of sensors (221, 222, 223) for detecting the real position and inclination of the container relative to the position and inclination of the column element, the position and inclination of the axis of extension (A7) of the container (C) relative to the position and inclination of the axis of symmetry (A1),
- positioning the central axis (A6) of symmetry of the gripping unit (50), in such a way that it coincides with the axis (A7) of the container (C), so as to guarantee a perfect coupling of the container;

wherein the rest configuration coincides with an initial position of the apparatus (1) wherein the initial position being such that the crosspiece (20) and the first arm (30) are substantially aligned with each other and the first arm (30) and the second arm (40) are substantially perpendicular to each other.

13. The method according to claim 12, comprising the steps of:
 - rotating the first arm (30) in such a way as to lift the container (C) and, at the same time, withdraw the container (C) towards the column element (10) to allow the roto-translation of the second arm (40),
 - positioning the container (C) during unloading in an area of the unloading hopper (202) adjacent to the column of the apparatus (1), in such a way as to avoid interference between the container (C) and the second arm (40).
14. The process according to claim 12 or 13, wherein the rotation of the first arm (30) about the first axis (A2) allows the movement of the centres of mass of the first arm (30) and of the second arm (40) relative to the axis of symmetry (A1), reducing at the same time, for the movement of the centres of mass between the step of gripping the container (C) and the step of emptying, the lifting forces necessary for moving the container (C) and consequently also the energy consumption.
15. The process according to any one of claims 11 to 14, wherein the rotation of the first arm (30) causes the vertical movement of the centre of rotation of the second axis (A3), allowing an increase in the operating area of the apparatus (1), in such a way that said crane (1) is also able to operate in the front part of the vehicle (200) for lifting containers (C) posi-

tioned in the operating area without moving the vehicle (200).

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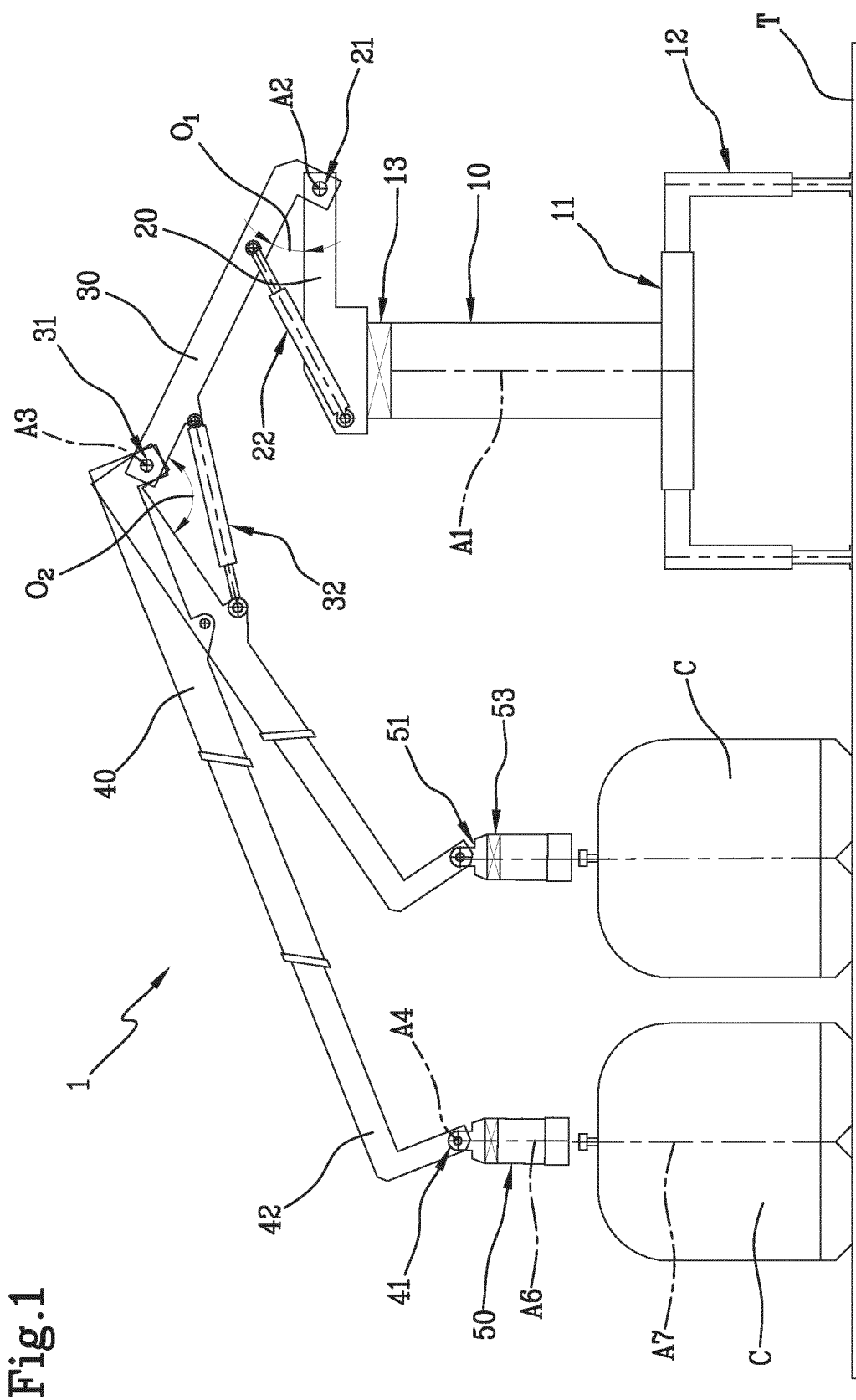
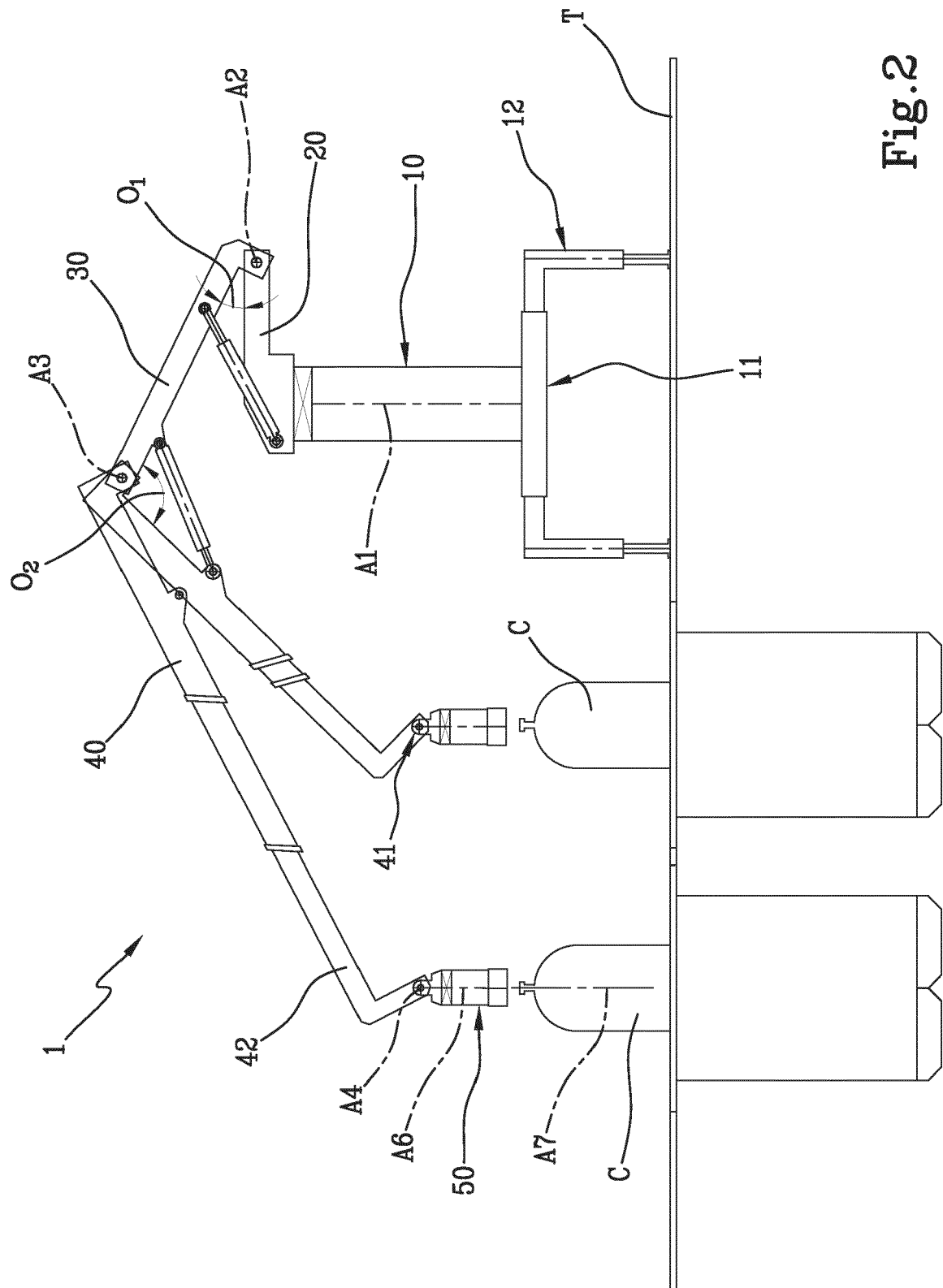
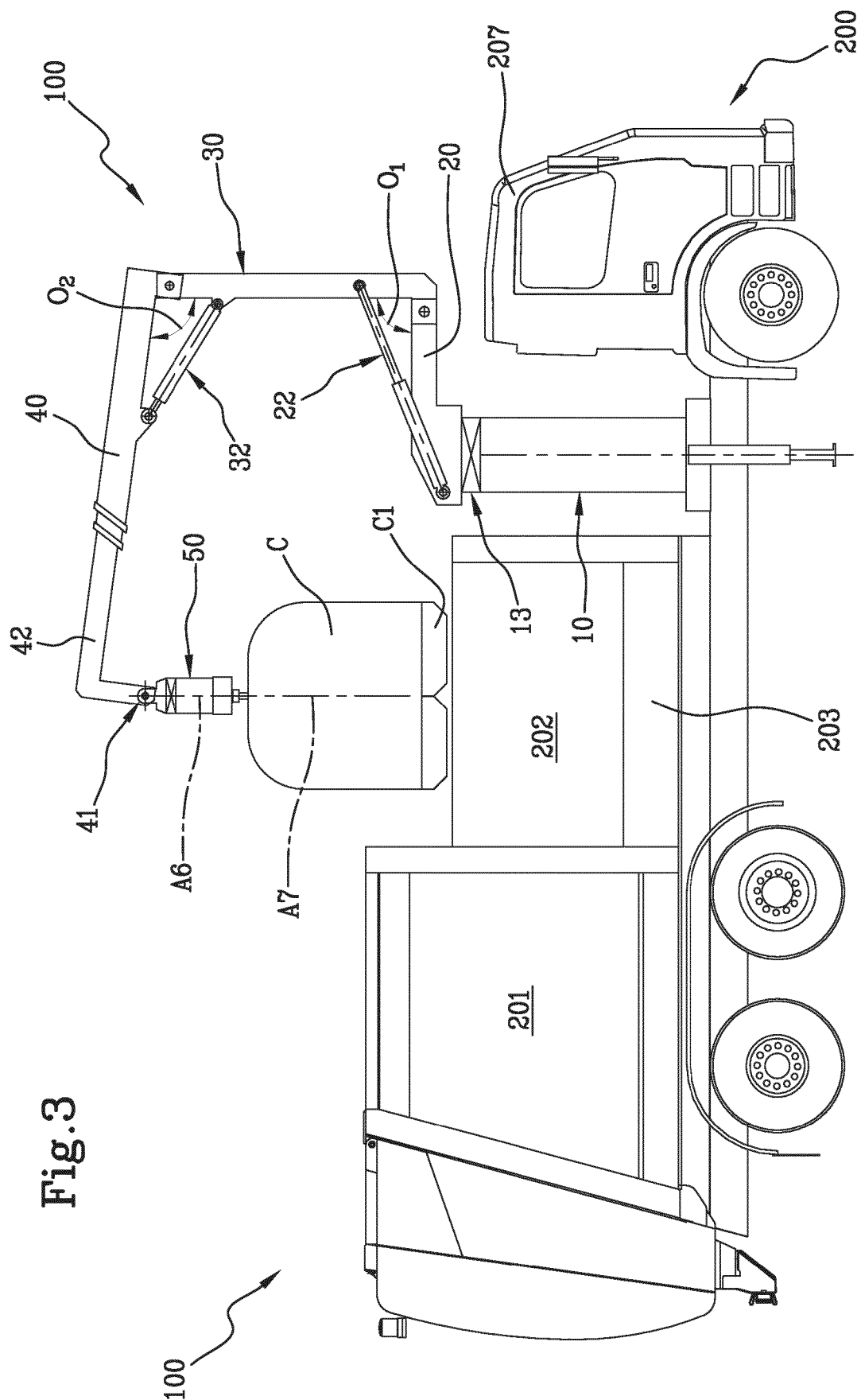
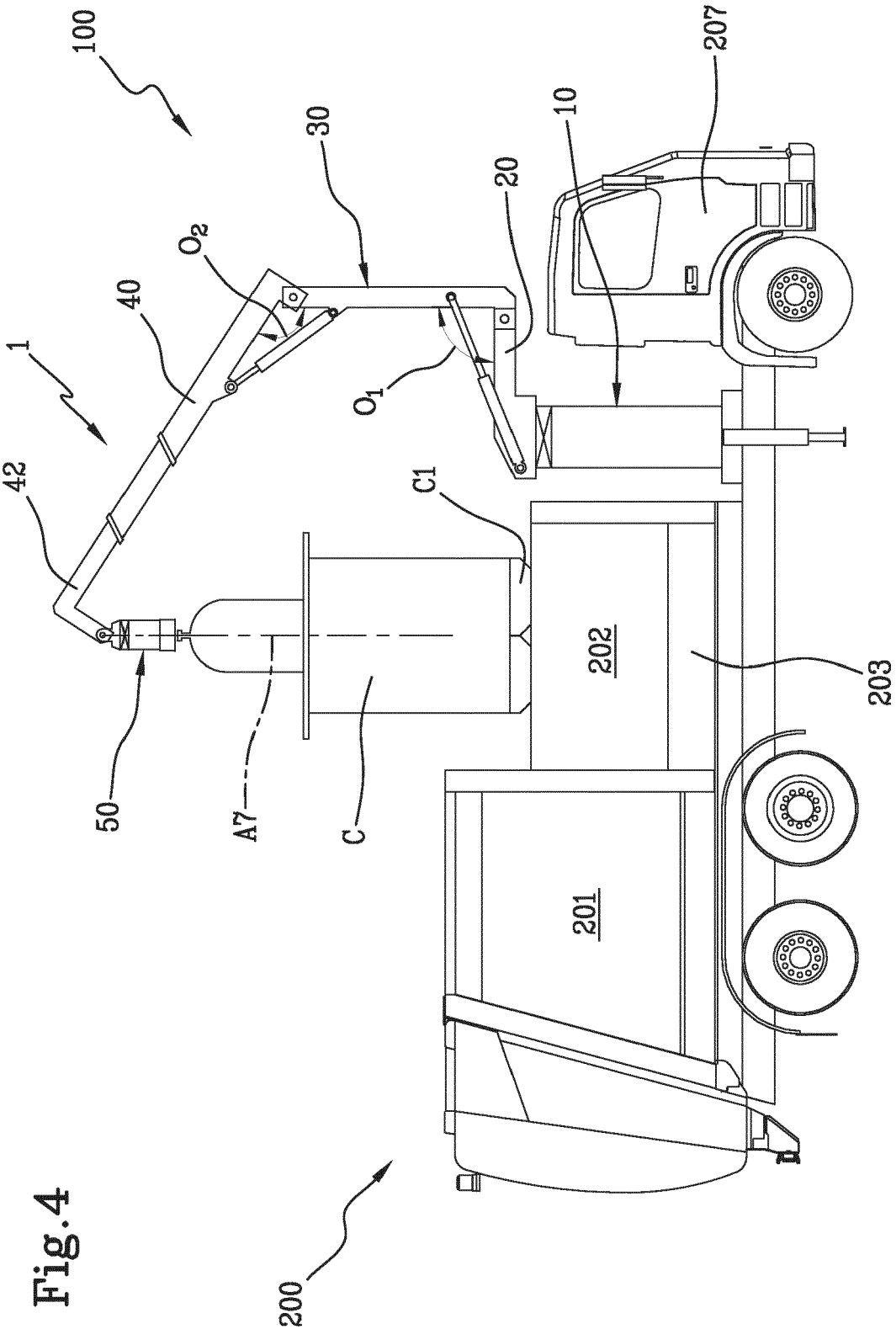


Fig. 1



2. **Fig**





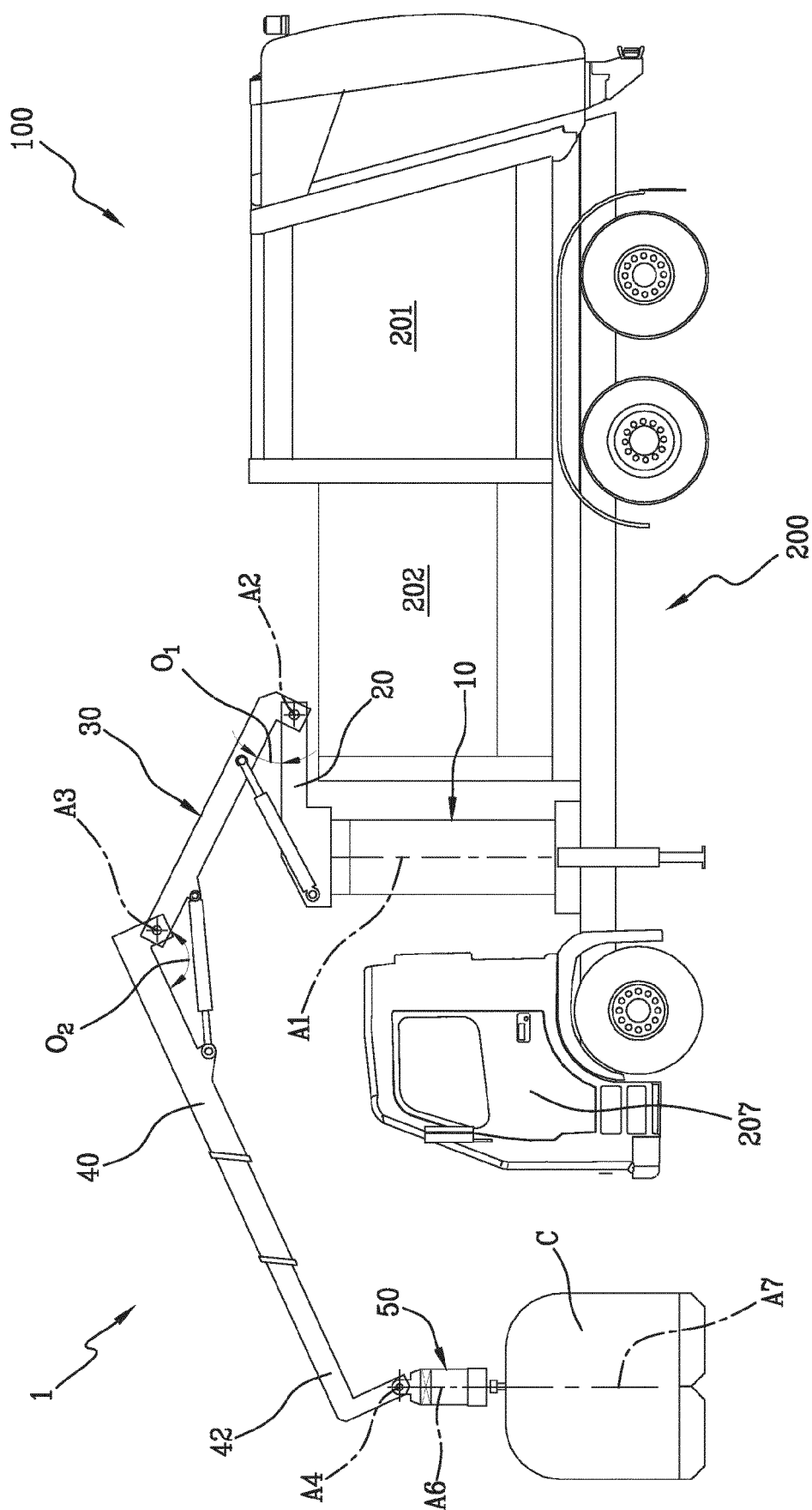


Fig. 5

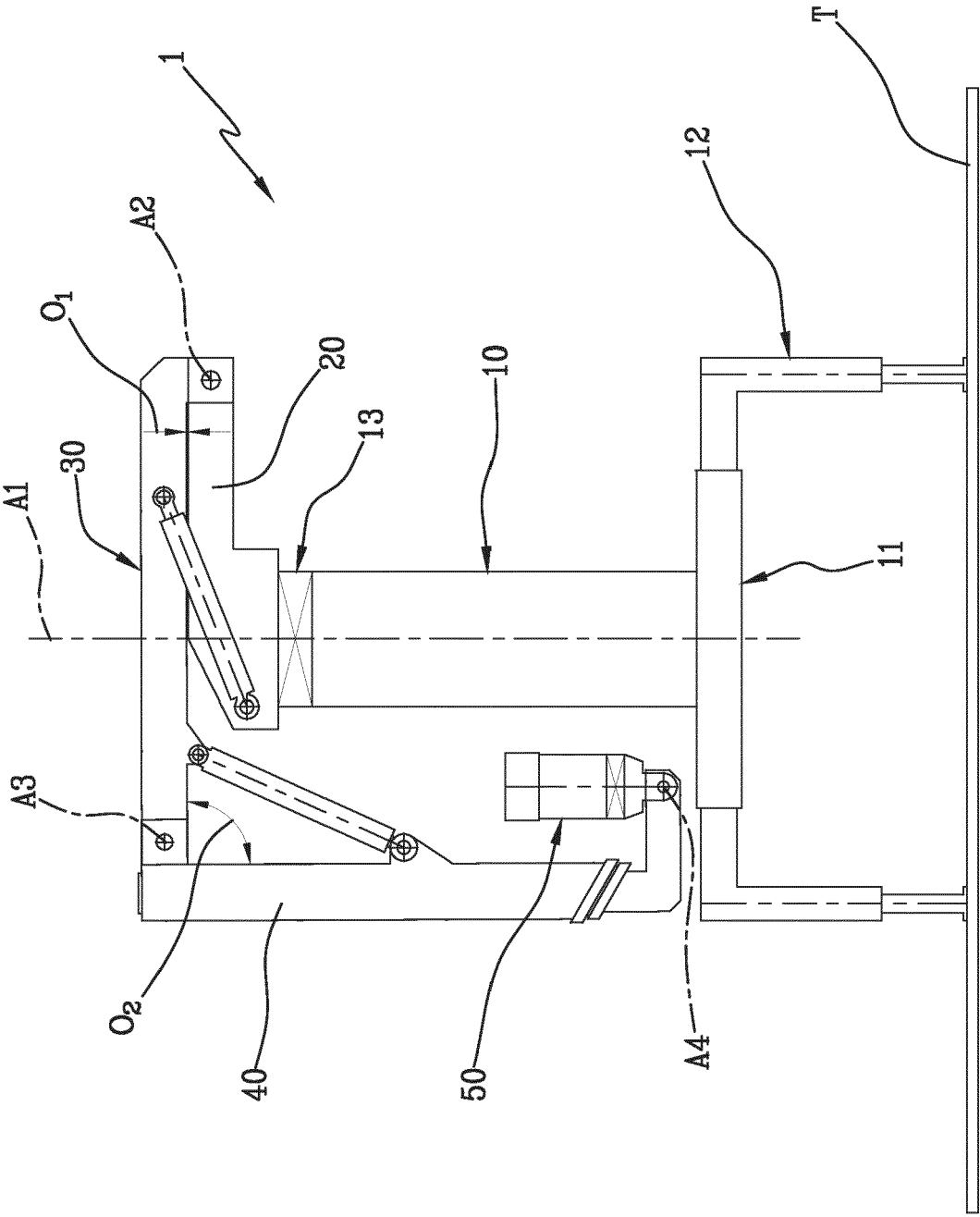


Fig.6

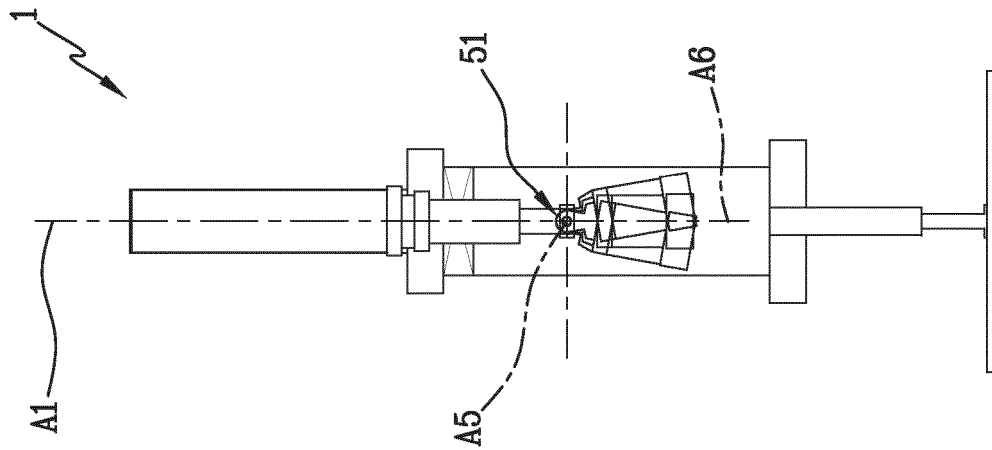


Fig. 7B

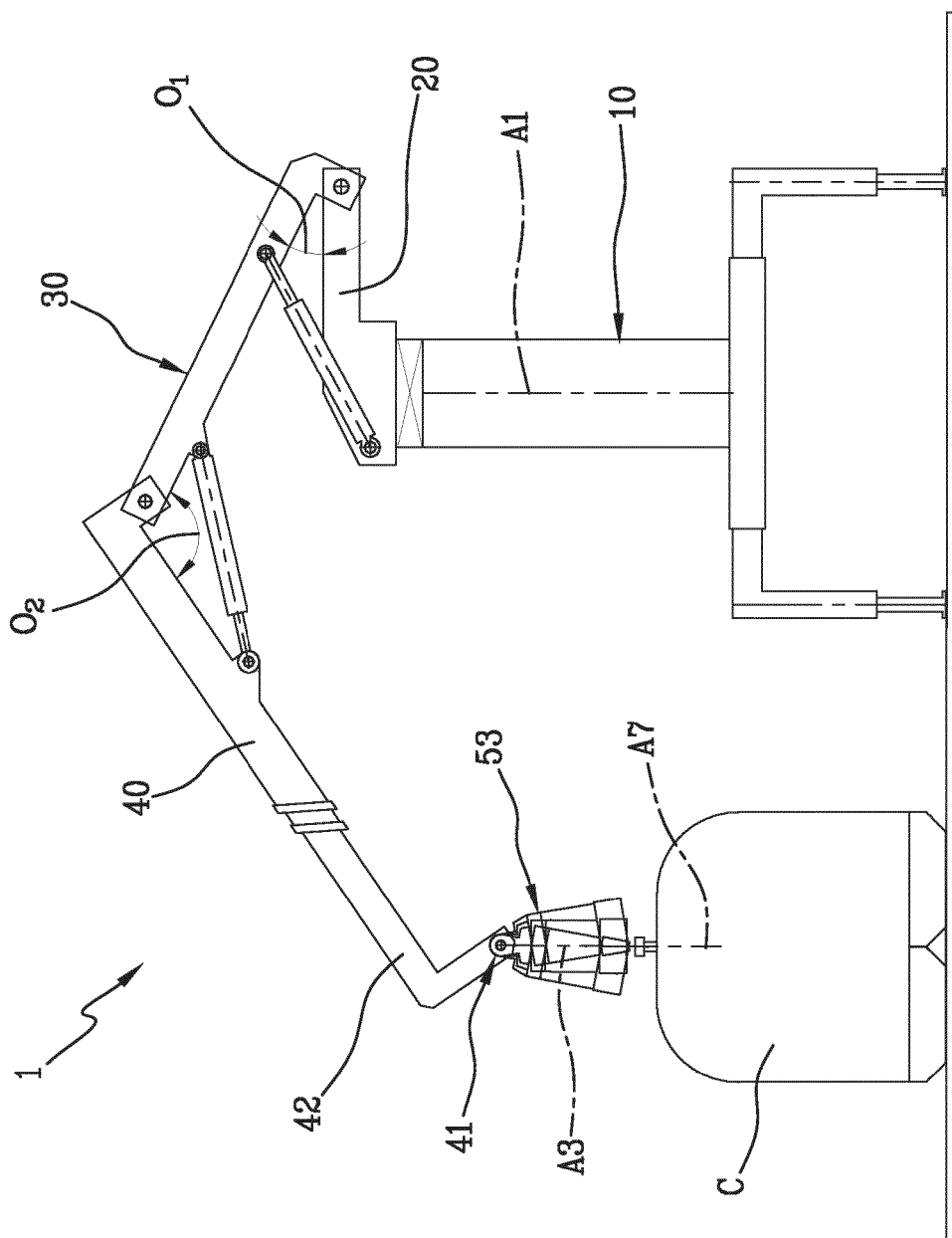


Fig. 7A

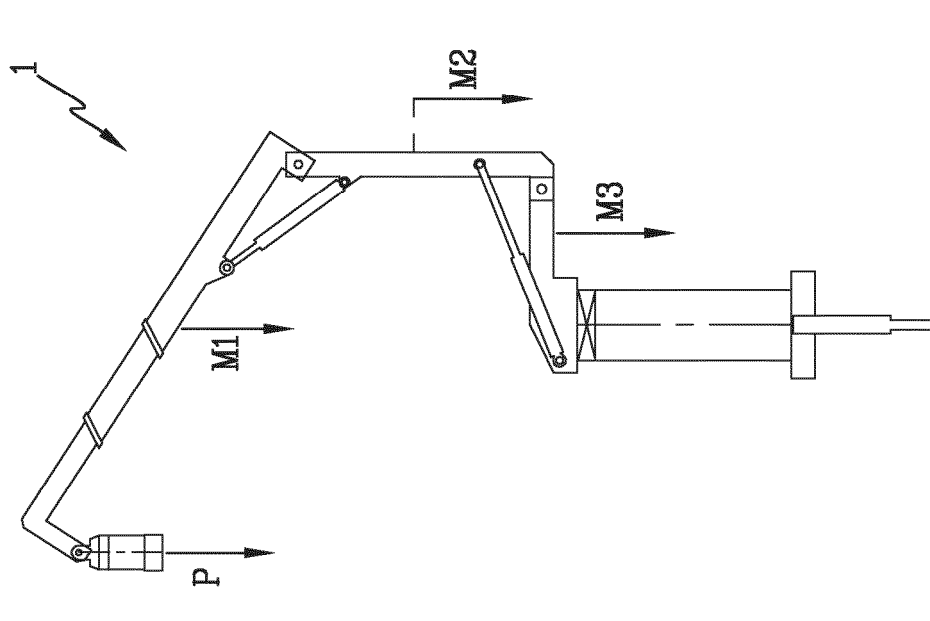


Fig. 8B

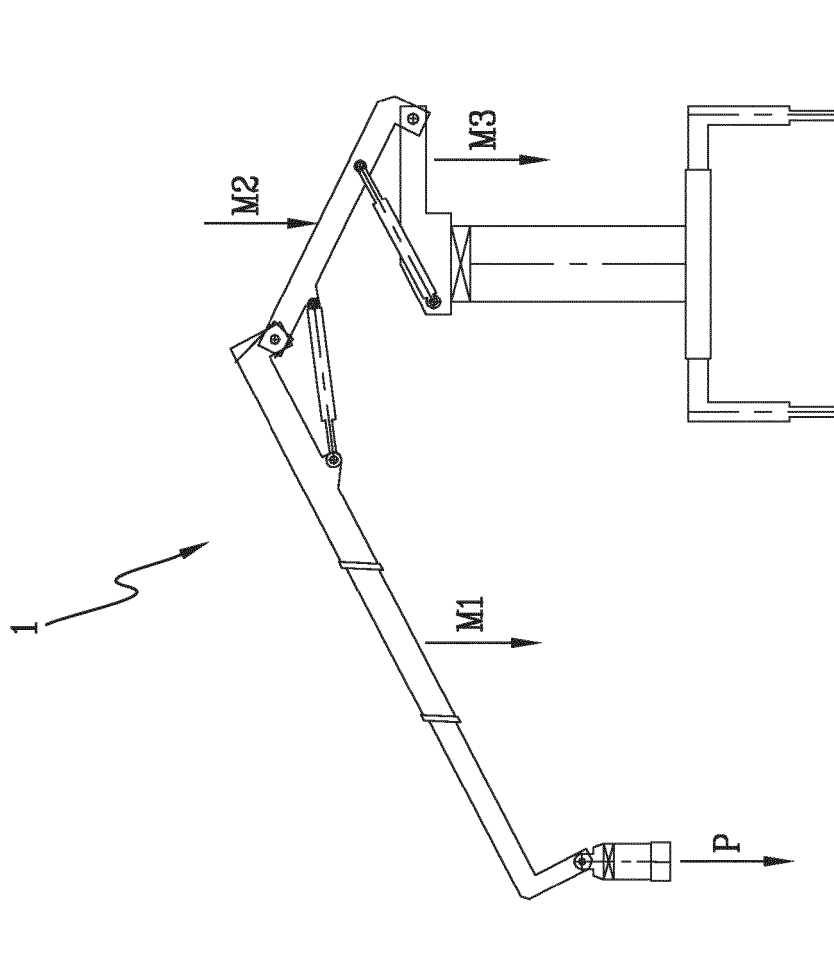
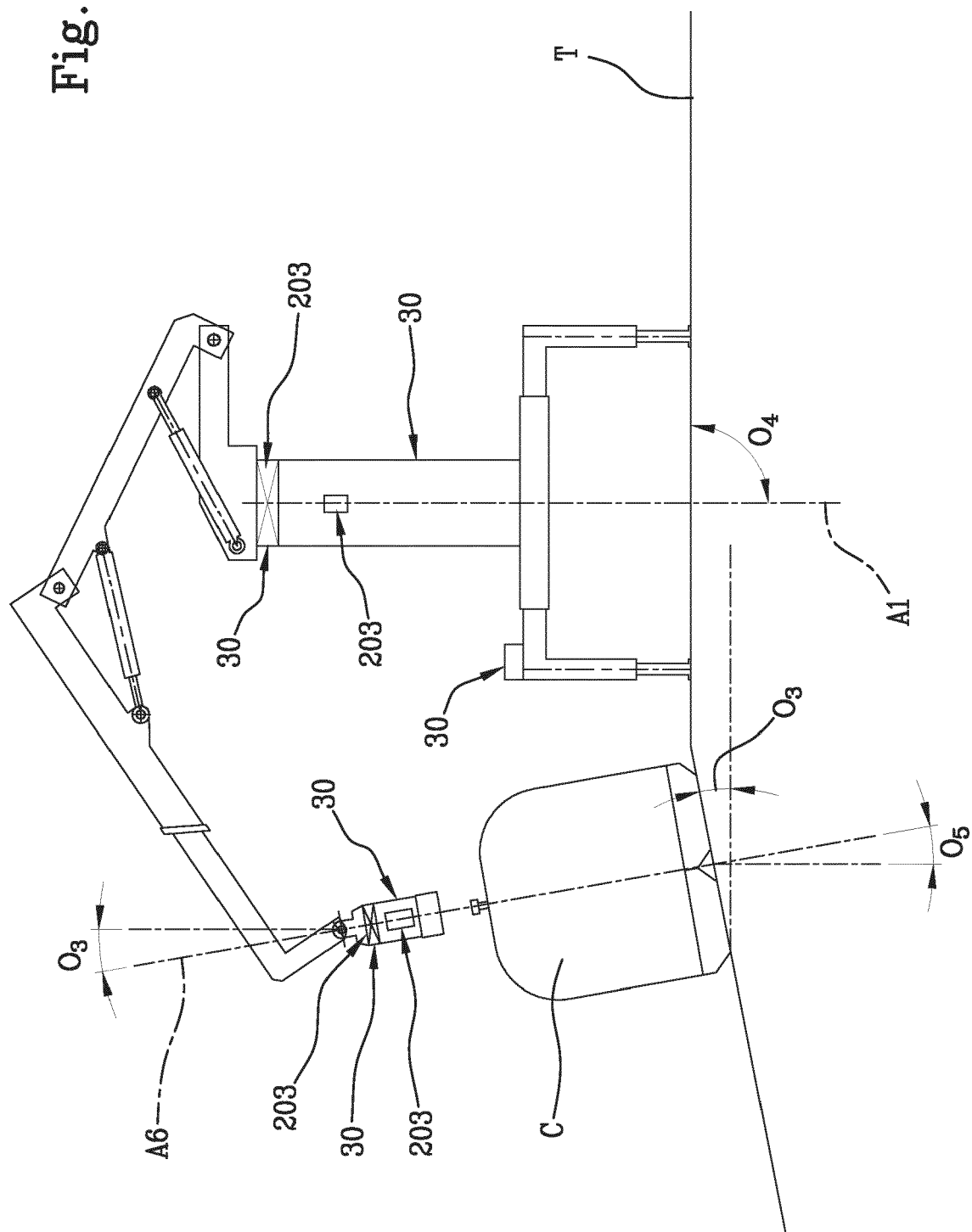
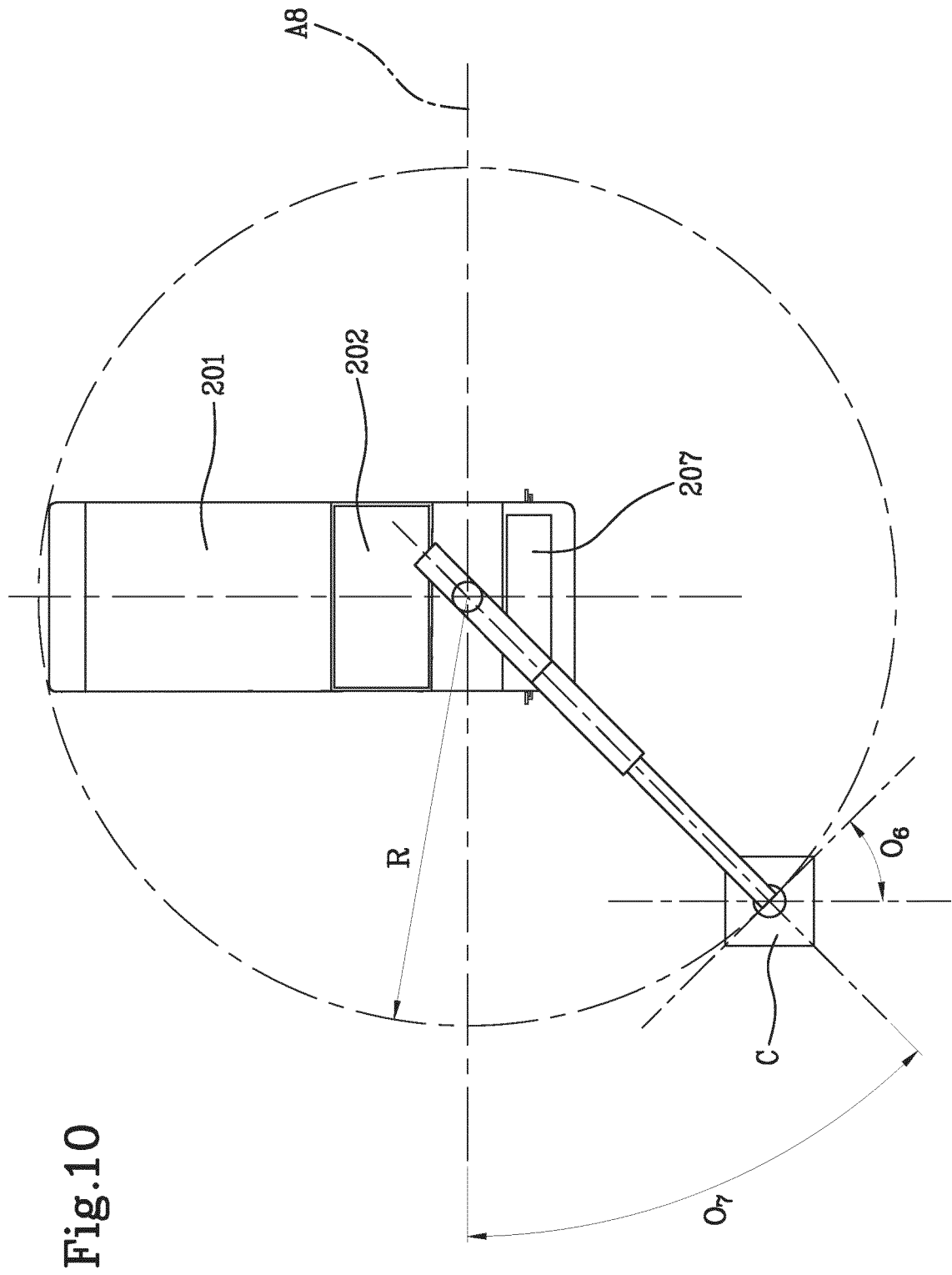


Fig. 8A

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EUROPEAN SEARCH REPORT

Application Number

EP 24 15 8563

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D Y	WO 96/17750 A1 (DAUMER JOSEPH [FR]) 13 June 1996 (1996-06-13) * figures 1,2 * * claims 1-6 * * page 6, line 13 - page 8, line 31 * -----	1,2,4,6, 7,11 8-10, 12-15	INV. B65F3/02
X,D	KR 2022 0068500 A (TAPS INT CO LTD [KR]) 26 May 2022 (2022-05-26) * paragraphs [0001], [0003], [0028] - [0066]; figures 1-5 * -----	1-15	
Y,D	FR 2 964 648 A1 (MONDINI ENGINEERING SA [CH]) 16 March 2012 (2012-03-16) * figures 1-5 * * page 8, line 8 - page 17, line 14 * -----	8-10, 12-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 11 June 2024	Examiner Pardo Torre, Ignacio
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	

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 24 15 8563

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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11-06-2024

10	Patent document cited in search report		Publication date	Patent family member(s)		Publication date
	WO 9617750	A1	13-06-1996	FR 2727658 A1		07-06-1996
				WO 9617750 A1		13-06-1996
15	-----					
	KR 20220068500	A	26-05-2022	NONE		

	FR 2964648	A1	16-03-2012	CH 703732 A2		15-03-2012
				ES 2399498 A2		01-04-2013
20				FR 2964648 A1		16-03-2012

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EPO FORM P0459

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1084069 A [0003] [0010]
- EP 2614017 B1 [0006]
- EP 2821360 B1 [0010] [0011]
- FR 2964648 A1 [0015]
- KR 20220068500 A [0015]
- WO 9617750 A1 [0015]