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(54) METHOD AND DEVICE FOR HANDLING AND EMPTYING WASTE CONTAINERS

(57) The present invention relates to a device and method for handling and emptying waste collection containers comprises a coupling head (40) integrating a head structure (41) attached to the end of a crane arm integrated in a vehicle, bearing a first holding member (10) intended for holding a handle (1) of a container (3), and a second holding member (20) intended for holding a gate operator (2a, 2b) of a container, the second holding member being movable with respect to the first holding member, and the operators of the coupling head being controllable by means of a programmable control unit provided with at least a first and a second handling configuration, which are adapted, respectively, for handling a container with a gate operator of a first type (2a) and for handling a container with a gate operator of a second type (2b).

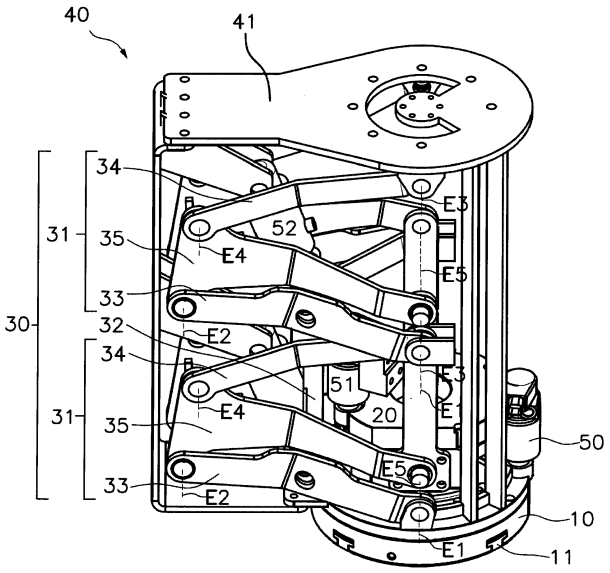

Fig. 1

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Description

Field of the Art

[0001] The present invention relates to the field of devices for handling and emptying waste collection containers, and to methods for performing said operations, by means of a coupling head attached to a crane arm integrated in a waste collection vehicle, said coupling head allowing holding a container, lifting it and emptying it into said vehicle.

State of the Art

[0002] Devices for handling and emptying waste collection containers capable of being coupled to a handle of the container and capable of interacting with a gate operator of the container for causing the opening or closing of the gates of the container are known in the state of the art.

[0003] For example, patent document DE29905551U1 describes a mechanism of this type, but in which the holding members are laterally fixed to the handle of the container with a fork configuration, which makes coupling thereof difficult and limits the capacities. Furthermore, the proposed solution is envisaged for vertically pulling on the gate operator of the container, but it would not be suitable for pushing said gate operator downwards.

[0004] Patent document EP1916218A1 also describes a similar mechanism which is not capable of adapting the holding members to different configurations.

[0005] In patent document US5014870A it is proposed that the first and second holding members consist of moving hooks which allow gripping the handle and the gate operator, but it does not envisage that said moving hooks can be adapted to different handles or gate operators, or that said moving hooks can adopt a position in which they can act as a pushing stop for pushing the gate operator of the container.

[0006] Patent document EP1172308B1 which describes a device for handling and emptying containers is also known, but it lacks movable elements in the second holding member, which in this device is limited to a simple piston capable of pushing the gate operator. Therefore, this device is not capable of adapting to containers of another type which require the gate operator to be pulled upwards for operation.

[0007] None of the known prior art documents has sufficient adaptability to enable operating interchangeably with different types of containers provided with a handle and with a gate operator concentric to the handle, which is interchangeably operated by means of pulling or by means of pushing.

Brief Description of the Invention

[0008] The present invention relates to a device for handling and emptying waste collection containers.

[0009] Containers of a first type and of a second type which are common in the sector of waste collection are surface or underground containers having lower gates mechanically connected to a gate operating element which allows operating the opening and closing of said gates. Said gate operator is usually located in the upper half of the container in a position adjacent or concentric to a mushroom-shaped handle intended for allowing the gripping and lifting of the container. Said function leads to the handle being typically located on an upper face of the container and in a position centered with its center of gravity. Therefore, the movement of the gate operator with respect to the rest of the container and the handle causes the opening or closing of the gates as a result of the mechanical connection between them.

[0010] Therefore, the device intended for handling and emptying said container must be capable of gripping the container by the mentioned handle, lifting it, and simultaneously interacting with the gate operator for causing or allowing its movement and the subsequent opening or closing of the gates.

[0011] Therefore, the proposed device for handling and emptying waste collection containers comprises a coupling head which integrates a head structure and is attached to the distal end of a crane arm integrated in a waste collection vehicle, said head structure bearing:

- a first holding member having first movable elements operated by means of first operating means, movable between a handle gripping position and a handle release position for being coupled to a mushroom-shaped handle fixed on an outer surface of a container holding up said container through said handle;
- a second holding member having second movable elements operated by means of second operating means, movable between an operator release position and a position of interaction with the operator allowing, since the first holding member is attached to the handle and the second holding members are arranged in the position of interaction, said movable elements to come into geometric interference with a gate operator preventing its free movement, the gate operator being arranged in the container in a position adjacent and/or concentric to said handle and being mechanically linked to the lower gates of the container for controlling their opening and closing;
- a displacing mechanism operated by means of third operating means envisaged for axially moving said second holding member with respect to said first holding member between gate closing and gate opening positions, by means of the resulting relative axial movement between the handle and the gate operator of the mentioned container linked to the first and second holding members, causing the closing and/or opening of said lower gates of the container mechanically linked to the gate operator.

[0012] The mentioned first and second holding mem-

bers can be, by way of example, any one of the following members, or another similar member, as will be obvious for a person skilled in the art:

> a claw or clamp configuration, a lug with retractable fins, a screw, a retractable pin, a fork, etc, the first and second movable elements being the moving parts of said claw, clamp, lug configurations, etc, the moving parts thereof being the so-called first and second movable elements. Said movable elements will be operated by means of the mentioned operating means which could be, by way of non-limiting example, a motor, servomotor, linear motor, electromagnet, solenoid, hydraulic or pneumatic piston, or the like.

[0013] The mentioned displacing mechanism is a mechanism envisaged for producing a vertical axial movement of the second holding member with respect to the first holding member. This mechanism can adopt many different configurations, such as for example, a non-sliding and non-guided pantograph- or scissors-type mechanism, or it could also be a sliding mechanism which is moved in a guided path, such as for example, a nut and spindle mechanism or a piston mechanism. This mechanism is operated by the third operating means which can be, by way of example, any one of the following mechanisms or another similar mechanism, as it would be obvious for a person skilled in the art: a motor, servomotor, solenoid, electromagnet, linear motor, piston, etc.

[0014] It is understood that said operating means require an external power source and can be electrically or electronically controlled or can be controlled by means of hydraulic or pneumatic controls.

[0015] Therefore, said coupling head integrates a first holding member which can grip a handle fixed on a container by means of the movement of its movable elements, for example, closing said first movable elements around said claw-like handle, providing a firm enough attachment to the container to allow lifting the entire container and its content, the load being supported by the crane arm.

[0016] A second holding member, also integrated in the coupling head, can interact with a gate operator, envisaged in a position concentric or adjacent to the handle of the container, by means of the movement of its second movable elements. Said gate operator is mechanically linked to gates arranged in the lower part of the container, such that the operation of said gate operator causes the closing or opening thereof. Typically, the mentioned mechanical link with the lower gates of the container is made by means of cables or chains although it can also be made by means of connected bars or straps forming kinematic chains.

[0017] When lifting said container, the weight of the waste deposited inside the container is supported on the lower gates, and said load is transmitted through the mechanical link to the gate operator. Depending on the configuration of the mechanical link, said loads can be transmitted in the form of an upward vertical load or a downward vertical load. The second movable elements interacting with the gate operator are responsible for supporting said load, preventing the weight of the waste from causing the opening of the gates.

[0018] The second holding member is connected to a displacing mechanism moving it axially away or closer to the first holding member. During the travel thereof, and since the first holding member is gripping the handle of the container, the second holding member interacts with the gate operator moving it or allowing its movement between the gate closing position and the gate opening position, causing the gates to open giving way to the weight of the waste accumulated thereon, or causing the gates to close.

[0019] In a novel manner, it is proposed that:

- the second movable elements are movable between the operator release position and the position of interaction with the operator regardless of the relative position between the first and second holding members;
- the first, second and third operating means are controlled by means of a programmable control unit provided with at least a first and a second handling configuration, which are adapted, respectively, for handling a container containing a gate operator of a first type and for handling a container containing a gate operator of a second type, the first and second configurations differing at least in the predetermined handle gripping and release positions and/or in the operator release and interaction positions and/or in the gate opening and closing positions; and in that
- the programmable control unit is prepared for implementing the first configuration or the second configuration depending on the information obtained by means of sensors or by means of information entered by an operator through an interface.

[0020] The first and second configurations adapted to the gate operators of the first type and of the second type are different because the gate operators of the first and of the second type are also different from one another. They can differ in size and/or shape and/or position, and can also differ in the travel that they must make to cause the opening and closing of their respective gates. All these differences are differences that must be contemplated by the device for handling and emptying containers, adapting to same for correctly handling the container by means of the mentioned configurations.

[0021] The mentioned programmable control unit will be, by way of non-limiting example, a programmable logic controller, a computer, a printed circuit, or another similar device provided with a data input, a memory, computing capacity and a control order output, furthermore having an interface allowing a user to known and change the configuration of the programmable control unit. Addition-

ally, said programmable control unit may be connected to a network of sensors that will provide it with precise information about the position of some or all the main elements making up the device for handling containers, as well as the position of the handle, the gate operator, and optionally also the rest of the container or its gates.

[0022] By means of said information obtained by means of the sensors, or by means of the information entered by a user through the mentioned interface, the programmable control unit determines if the container to be handled has a gate operator of the first type or of the second type, and proceeds to apply a first configuration envisaged for the correct handling of containers with gate operators of the first type, or a second configuration envisaged for the correct handling of containers with gate operators of the second type.

[0023] Said first and second configurations change operation parameters, such as for example, which position must be the relative position between the first and second holding members when they are coupled to the container, or regulating a higher or lower degree of closing of the first and second movable elements for adapting to different handle sizes and to different modes of interaction with the gate operator. It can also regulate which position is the gate opening position and which position is the closing position, etc.

[0024] This feature turns the proposed head into a head compatible with several container formats, allowing one and the same truck provided with this head to collect waste from different types of containers, by simply adapting its configuration, and as a result of the versatility allowed by its makeup.

[0025] Additionally, it is proposed that:

- the second movable elements, in the position of interaction with an gate operator of a first type of a container, surround and secure said gate operator of the first type, and support downward vertical loads produced by the stored waste on the gates of the container and transmitted by the gate operator of the first type; and
- the second movable elements, in the position of interaction with the gate operator of the second type of a container, are superposed with respect to the gate operator of the second type performing the functions of a stop preventing its vertical movement, and support upward vertical loads produced by the stored waste on the gates of the container and transmitted by the gate operator of the second type;
- the displacing mechanism supports and transmits to the crane arm upward and downward vertical loads.

[0026] These proposed features allow the second movable elements to interact with the gate operator in two different ways, by resisting downward vertical loads or by resisting upward vertical loads, which allows the same head to be able to interchangeably interact with containers provided with a gate operator of a first type and of a second type.

[0027] According to this embodiment, the gate operators of a first type differ from the gate operators of a second type in that, in gate operators of the first type the weight of the waste accumulated inside the container, on the lower gates produces loads which are transmitted to the gate operator as a downward vertical load by means of the mechanical link thereof. In contrast, in the gate operators of the second type said load is transmitted to the gate operator in the form of an upward vertical load, due to the action of the mechanical link existing between the operator and the gates.

[0028] This difference means that the gate operator of the first type must be gripped by means of the second movable elements or retained by means of pins or flanges of any type to prevent its downward movement, allowing the second movable elements to support the mentioned downward vertical loads. Typically, said gate operator of the first type will have a type of flange at its end, such as a mushroom-shaped configuration, above a thinner neck, allowing the second movable elements to close around said neck, the flange being retained, preventing it from sliding downwards.

[0029] In contrast, the gate operator of the second type of containers requires the second movable elements to be interposed in the upward path of the gate operator and to prevent its movement, performing the functions of a stop. Since said second movable elements are interposed in the mentioned upward path, the vertical movement of the second holding member allows said second movable elements to push the gate operator downwards. Therefore, the second movable elements can be sufficiently closed to at least partially block the travel that the gate operator of the container of the second type must make in order to go from the gate closing position to the gate opening position or vice versa, preventing the forward movement thereof, and they are furthermore envisaged for supporting said upward load and transmitting the loads to the head.

[0030] According to one embodiment in which it interacts with a container provided with a gate operator of the first type, the gate closing position is the position in which the first and second holding members are spaced apart and the second movable elements support a downward vertical load, and the gate opening position is the position in which said first and second holding members are adjacent.

[0031] In contrast, according to another embodiment in which it interacts with a container provided with gate operators of the second type, the gate opening position is the position in which the first and second holding members are spaced apart, and the gate closing position is the position in which the first and second holding members are adjacent and the second movable elements support an upward vertical load.

[0032] Therefore, in order to handle the operator of the first type the second holding member must grip the gate operator and pull on it, partially removing it from the con-

tainer to close the gates, whereas on the contrary, with the gate operators of the second type the second holding member must push the gate operator downwards, keeping it inside the container, to cause the closing of said gates.

[0033] The proposed coupling head allows interchangeably performing both operations, both for the first and for the second type of gate operators, therefore allowing said coupling head to be versatile and to be able to handle containers of different type.

[0034] According to an optional feature, the first movable elements and/or the second movable elements are integrated in a jaw chuck mechanism grouping said movable elements in a radial arrangement around a hollow center, and coupled to an annular mechanism arranged around said hollow center allowing the coordinated radial movement of said movable elements.

[0035] According to another additional feature, the displacing mechanism moving the second holding member is operated by third operating means, and consists of two identical Roberts swinging mechanisms having coordinated movement with respect to one another by means of a connecting bar, each Roberts mechanism being formed by:

- a first pair of rockers and a second pair of rockers, all having the same length;
- the first pair of rockers being articulated with respect to the head structure at a first end around a first shaft, and articulated with respect to a swinging body at a second end around a second shaft;
- the second pair of rockers being articulated with respect to the head structure at a first end around a third shaft, and articulated with respect to a swinging body at a second end around a fourth shaft;
- the swinging body having a protruding end articulated with respect to the second holding member around a fifth shaft;
- all the shafts being parallel to one another, and the distances between the first and second shafts, between the third and fourth shafts, between the fourth and fifth shafts, and between the second and fifth shafts being the same;

said two Roberts mechanisms having coordinated movement determining a considerably axial rectilinear movement of the second holding member with respect to the first holding member.

[0036] The Roberts mechanism is known in the scientific literature as it is a swinging mechanism providing a rectilinear movement in a part of travel thereof. Said movement actually includes a slight deviation with respect to a completely rectilinear movement, but it is considered an insignificant deviation which is within the range of mechanical device tolerances, for example, of tenths of millimeter.

[0037] In this case, the two Roberts mechanisms are located on the side of the coupling head, superposed such that the first shaft, the third shaft, and the fifth shaft of both Roberts mechanisms are coplanar to one another (except the mentioned insignificant deviation) with respect to a plane parallel to the direction of the axial movement of the second holding member.

[0038] Said two Roberts mechanisms are operated by means of third operating means, which can be several types, for example, it is contemplated that said third operating means are one or more hydraulic pistons or linear motors, pushing or pulling on a first or second pair of rockers, for example, causing the swinging thereof and thereby the linear (or almost linear) movement of the second holding member.

[0039] This mechanism has the advantage of being able to be operated very quickly and being able to apply great forces as a result of the lever effect which can be achieved depending on the position in which the mentioned pistons or linear motors are attached to the mechanism, the rockers being able to act as lever arms.

[0040] Another additional advantage is that said mechanism is located on one side. This allows, according to another alternative embodiment, also proposing that the first holding member and the second holding member are each configured around a hollow center intended for the insertion of the handle and the gate operator, the hollow centers of both holding members being aligned.

[0041] A camera and/or visual sensor is integrated in the coupling head and envisaged for receiving visual information through said hollow center, which allows detecting the relative position of the handle and the gate operator with respect to the head. Said camera will be connected to the programmable control unit and will transmit the obtained thereto, thereby allowing, by means of any type of processing of the obtained images, the programmable control unit to be capable of detecting the relative position and of sending automatic control orders to the different operators which allow moving the head until it is coupled to the handle of the container.

[0042] The present invention also proposes a method for handling and emptying waste collection containers by means of a coupling head which integrates a head structure and is attached to the distal end of a crane arm integrated in a waste collection vehicle, said head structure bearing the same elements described above in relation to the device, namely:

- a first holding member having first movable elements operated by means of first operating means, movable between a handle gripping position and a handle release position for being coupled to a mushroom-shaped handle fixed on an outer surface of a container holding up said container through said handle;
- a second holding member having second movable elements operated by means of second operating means, movable between an operator release position and a position of interaction with the operator allowing, since the first holding member is attached to the handle and the second holding members are

arranged in the position of interaction, said movable elements to come into geometric interference with a gate operator preventing its free movement, the gate operator being arranged in the container in a position adjacent and/or concentric to said handle and being mechanically linked to the lower gates of the container for controlling their opening and closing;

- a displacing mechanism operated by means of third operating means, envisaged for axially moving said second holding member with respect to said first holding member between gate closing and gate opening positions, by means of the resulting relative axial movement between the handle and the gate operator of the mentioned container linked to the first and second holding members, causing the closing and/or opening of said lower gates of the container mechanically linked to the gate operator;

[0043] In a novel manner, the present method contemplates that:

- the first, second and third operating means are controlled by means of a programmable control unit provided with at least a first and a second handling configuration, which are adapted, respectively, for handling a container containing a gate operator of a first type and for handling a container containing a gate operator of a second type, the first and second configurations differing at least in the predetermined handle gripping and release positions, and/or in the operator release and interaction positions, and/or in the gate opening and closing positions; and in that the programmable control unit implementing the following steps:
- determining if the container to be handled integrates a gate operator of a first type or a gate operator of the second type based on the information obtained by means of sensors or by means of information entered by an operator through an interface;
- applying a first handling configuration if the container to be handled integrates a gate operator of the first type 2a or a second handling configuration if the container to be handled integrates a gate operator of the second type, by means of a programmable control unit;

wherein the first configuration and the second configuration modify the handle gripping and release positions, and/or the gate operator interaction and release positions, and/or the gate opening and closing positions.

[0044] Therefore, according to the proposed method the operating means controlling the holding members and the displacing mechanism are controlled by means of a programmable control unit, as described above in relation to the device. Said programmable control unit can modify the operation parameters of the head, changing, for example, the position in which the interaction between the second member and the gate operator occurs, or the relative position between the first and second members determining the container opening and closing positions, by means of applying a first configuration or a second configuration.

[0045] This allows one and the same head to be able to operate on different types of containers provided with different types of gate operators, for example, gate operators of a first type and of a second type.

[0046] Whether the gate operator is of the first type or of the second type can be automatically determined by means of the information obtained by means of sensors included in the head and after the analysis thereof by means of the programmable control unit, or it can be indicated by an operator by means of an interface of the programmable control unit.

[0047] Additionally, the method can contemplate that the gate operator of the first type is that which transmits downward vertical loads caused by the stored waste on the lower gates of the container and transmitted through the mechanical link of the gates with the gate operator of the first type, and that the gate operator of the second type is that which transmits upward vertical loads caused by the stored waste on the lower gates of the container and transmitted to the gate operator of the second type through the mechanical link between them.

[0048] The method for handling the container according to another embodiment furthermore includes the following steps:

- placing the coupling head in a position such that the first holding member is located adjacent to, aligned with and at least partially around the handle of a container, the second holding member being adjacent to and aligned with the gate operator;
- operating the movement of the first movable elements to the handle gripping position, according to the first or second configuration, firmly securing the handle;
- operating the movement of the second movable elements to the position of interaction with the operator, according to the first or second configuration;
- moving the second holding member to the gate closing position by means of the displacing mechanism, according to the first or second configuration, allowing the second movable elements to support a vertical load produced by the weight of the waste located on the gates of the container and transmitted through the gate operator;
- lifting the container, placing it such that it is superposed on a discharge area and operating the displacing mechanism until placing the second holding member in the gate opening position, according to the first or second configuration, causing the movement of the second holding member and the gate operator, causing the opening of the gates mechanically linked to said gate operator;
- operating the displacing mechanism again until placing the second holding member in the gate closing

position, according to the first or second configuration, causing the closing of said gates, putting the container back in its original location and releasing the first and second holding members.

[0049] According to another complementary embodiment it is proposed that, since the head is in interaction with a gate operator of a first type and in application of the mentioned first configuration, the gate opening position is the position in which the first and second holding members are adjacent, and the gate closing position is the position in which the first and second holding members are spaced apart and the gate operator of the first type is surrounded and held by the second movable elements supporting a downward vertical load produced by the stored waste on the gates of the container.

[0050] According to another embodiment of the proposed method, since the head is in interaction with a gate operator of a second type and in application of the mentioned second configuration, the gate opening position is the position in which the first and second holding members are spaced apart, and the gate closing position is the position in which the first and second holding members are adjacent and the second movable elements are superposed and in geometric interference with the gate operator of the second type, performing the functions of a stop and preventing its vertical movement, supporting an upward vertical load produced by the stored waste on the gates of the container.

[0051] Additionally, it is proposed that the first and second configurations differ in the length of travel of the second holding member between the gate opening and closing positions, and/or in the opening left by the first movable elements in the handle gripping position, and/or in the opening left by the second movable elements in the position of interaction with the gate operator.

[0052] It is also proposed that a camera and/or visual sensor is integrated in the coupling head and is envisaged for receiving visual information through a central hole envisaged in the first and second holding members, and said programmable control unit uses said visual information to guide the coupling head to the handle and the gate operator and/or to determine if the gate operator is of the first type or of the second type.

Brief Description of the Drawings

[0053] The foregoing and other advantages and features will be more clearly understood based on the following detailed description of an embodiment in reference to the attached drawings which must be interpreted in an illustrative and non-limiting manner, in which:

Figure 1 shows a perspective view of the proposed coupling head without casing, the inside thereof being visible, according to a preferred embodiment, the first holding member and the second holding member being adjacent;

Figure 2 shows a side view of the proposed coupling head without casing, the inside thereof being visible, according to a preferred embodiment, the first holding member and the second holding member being adjacent, and the head being superposed on a container with a gate operator of a first type, and also showing on its side a fragment of another container containing a gate operator of a second type;

Figure 3 shows the same head shown in Figure 2 but the first holding member and the second holding member being spaced apart;

Figure 4 shows a cross-section of the coupling head of Figure 2, the latter being coupled to a container containing a gate operator of a first type, and the first holding member and the second holding member being adjacent;

Figure 5 shows a cross-section of the coupling head shown in Figure 4 but the first and second holding members being spaced apart.

Detailed Description of an Embodiment

[0054] According to an illustrative, non-limiting embodiment shown in Figure 1, the present invention relates to a device for handling and emptying waste collection containers made up of a coupling head 40 which integrates a head structure 41 and is attached to the distal end of a crane arm of a waste collection vehicle.

[0055] Said head structure 41 bears a first holding member 10 responsible for fixing to a handle 1 of a container 3, a second holding member 20 responsible for interacting with a gate operator 2 of a container 3, and a displacing mechanism 30 responsible for moving the second holding member 20 with respect to the first holding member 10, likewise achieving a relative movement of the gate operator 2 with respect to the handle 1, all of them being attached to the mentioned head.

[0056] The present device is envisaged for handling containers 3 having gates on its lower face, filling openings in its upper half, a handle 1 firmly attached to the container 3 on its upper face, which allows holding the entire container 3 and its waste load through said handle 1, and a gate operator 2 arranged in a position adjacent or concentric to said handle 1, which is mechanically linked to said gates, for example, by means of an articulated bar mechanism or a cable and pulley mechanism. Said mechanical link allows the vertical axial movement of the gate operator 2 to cause the opening and closing of said gates and to cause at least a part of the weight of the waste deposited on the lower gates of the container 3 to be transmitted through the mentioned mechanical link to the gate operator 2 while lifting the container. These transmitted loads must be supported by the second holding member 20 interacting with the gate operator 2, in order to keep the gates closed.

[0057] The first holding member 10 of the coupling head 40 has first movable elements 11 operated by means of first operating means 50 which allow moving

said first movable elements between the handle gripping and handle release positions. In this embodiment, said movable elements are jaws of a motor-operated jaw chuck. The first holding member 10 is thereby circular and has a central opening in which the handle 1 is inserted, after which the first operating means 50 are operated, causing the radial and coordinated closing of the jaws around the mentioned handle, which will typically have a mushroom shape, the handle therefore being retained by said jaws which can support the downward vertical load produced by the weight of the container and its load.

[0058] A jaw chuck mechanism is typically operated by means of rotating a chuck provided with a helical thread on one of its faces interacting with a toothed area envisaged in each of the jaws. In the present invention it is also contemplated that said chuck has a cam and the jaws have a cam follower. This can allow the closing and opening of the jaws to be achieved by means of a smaller angle of rotation of the chuck, speeding up the process, in addition to allowing making the manufacture less expensive and allowing, depending on the geometry of the cam, with a constant rotational speed of the chuck, obtaining an inconstant jaw closing/opening speed, for example, quicker at the beginning and slower at the end.

[0059] Similarly, the second holding member 20 has second movable elements 21 operated by means of second operating means 51, and which in the present embodiment are also jaws of a jaw chuck operated by means of a motor, which are radially arranged around a central hole in which the gate operator 2 can be inserted.

[0060] The central hole of the first and second holding members 10 and 20 are concentric, both holding members 10 and 20 being aligned and superposed.

[0061] The second holding member 20 is attached to the head structure 41 by means of the displacing mechanism 30 which, according to the present embodiment, is made up of a non-sliding mechanism consisting of two identical Roberts swinging mechanisms 31 having coordinated movement with respect to one another by means of a connecting bar 32, each Roberts mechanism 31 being formed by:

- a first pair of rockers 33 and a second pair of rockers 34, all having the same length;
- the first pair of rockers 33 being articulated with respect to the head structure 41 at a first end around a first shaft E1, and articulated with respect to a swinging body 35 at a second end around a second shaft E2;
- the second pair of rockers 34 being articulated with respect to the head structure 41 at a first end around a third shaft E3, and articulated with respect to a swinging body 35 at a second end around a fourth shaft E4;
- the swinging body 35 having a protruding end articulated with respect to the second holding member 20 around a fifth shaft E5;
- all the shafts E1, E2, E3, E4 and E5 being parallel to one another, and the distances between the first and second shafts E1 and E2, between the third and fourth shafts E3 and E4, between the fourth and fifth shafts E4 and E5, and between the second and fifth shafts E2 and E5 being the same;

said two Roberts mechanisms 31 having a coordinated movement determining a considerably axial rectilinear movement of the second holding member 20 with respect to the first holding member 10.

[0062] In the embodiment shown in the attached drawings, the third shaft E3 of a Roberts mechanism coincides with the first shaft E1 of the other Roberts mechanism.

[0063] The Roberts mechanism 31 is known in the scientific literature as it is a swinging mechanism providing a rectilinear movement in a part of travel thereof. Said movement actually includes a slight deviation with respect to a completely rectilinear movement, but it is considered an insignificant deviation which is within the range of mechanical device tolerances, for example, of tenths of millimeter.

[0064] In this case, the two Roberts mechanisms 31 are located on the side of the coupling head 40, superposed such that the first shaft E1, the third shaft E3, and the fifth shaft E5 of both Roberts mechanisms 31 are coplanar with respect to one another (except the mentioned insignificant deviation) and with a plane parallel to the direction of the axial movement of the second holding member 20.

[0065] In the present embodiment, said two Roberts mechanisms 31 are operated by means of third operating means 52, which in this case, it is proposed that they are two hydraulic pistons 36, each operating one of the two Roberts mechanisms 31 and with an end attached to the head structure 41 and another end attached to a central portion of the first pair of rockers 33.

[0066] This displacing mechanism 30 has the advantage of being able to be operated very quickly and being able to apply great forces as a result of the lever effect which can be achieved depending on the position in which the mentioned hydraulic pistons 36 are attached to the Roberts mechanism 31, the rockers 33 and 34 being able to act as lever arms.

[0067] The first, second and third operating means 50, 51 and 52 are preferably controlled by means of a programmable control unit (not shown) made up of a programmable logic controller and receiving information from several sensors envisaged in the device which allow controlling the position of the main elements of the invention, as well as the position of the handle 1 and the gate operator 2, at all times.

[0068] Said programmable control unit determines if the gate operator to be handled 2 is of a first type 2a or of a second type 2b by means of the information received from the sensors, by means of communication with the container or by means of information entered by an operator.

[0069] The type of gate operator can be detected, for

example, by means of detecting RFID tags integrated in the container, by means of detecting the size or position of some of the elements making up the container to be handled, either by means of contact sensors or by means of optical sensors. In the event that an operator is responsible for recognizing the type of container and the type of gate operator to be handled, the work will communicate said information to the programmable control unit by means of an interface, such as a touch screen, a push-button, a configuration switch, etc. The worker will preferably be the collection vehicle driver himself, and the interface will be arranged inside the driver's cab.

[0070] After determining the type of gate operator, the programmable control unit implements a first configuration or a second configuration, or even other additional configurations, each of said control configurations determining the handle gripping and release positions, the gate operator interaction or release positions, the gate opening and closing positions, among others. By means of controlling the operating means 50, 51 and 52 through the programmable control unit depending on the different configurations, they allow handling containers of different type with handles of different size and with gate operators that require a different movement to cause the opening and closing of the gates of the container 3.

[0071] Therefore, according to the present embodiment the head will implement different configurations adapted to different gate operators and to different handles, wherein each configuration will modify the predetermined operating positions, which thereby allows adapting to the operating requirements of each type of gate operator and handle.

[0072] For example, two different configurations are proposed in which the first configuration is adapted for handling gate operators of a first type which project from the handle and have a flange at its end, a thin neck being arranged between the flange and the handle, and in which the weight of the waste accumulated inside the container rests on the lower gates of the container and is transmitted through the mentioned mechanical link to the gate operator of the first type, transmitting a downward vertical load thereto.

[0073] In said gate operator of the first type 2a, the gate opening position will be the position in which it is in the lower point of its vertical travel, the mentioned flange being close to and superposed on the handle 1. That will also be the resting position of the gate operator of the first type 2a, the container 3 being supported on the ground, and the opening of the lower gates therefore being prevented as they are supported on said ground. In this case, although the gate operator of the first type 2a is in the gate opening position, the gates will remain closed, which means that the mechanical link between the gate operator of the first type 2a and the gates must allow that position, for example, by integrating cables or chains that can stay loose in that resting position.

[0074] The gate closing position of the gate operator of the first type 2a will be the position in which the flange of the gate operator of the first type 2a is arranged at a predetermined distance from the handle 1 greater than the distance existing in the gate opening position, in the upper limit of its vertical travel.

[0075] So by knowing said distances separating the flange and the handle 1 in the different positions and also knowing the dimensions of the handle 1 and the gate operator of the first type 2a, the programmable control unit can handle the container 3 by regulating the distance between the first and second holding members 10 and 20, both for determining the gate closing and gate opening positions, and also by regulating the closing of the first and second movable elements 11 and 21 for adapting to the sizes of the mentioned handle 1 and the gate operator of the first type 2a. In this case, for handling the container the second movable elements 21 will be closed around the neck of the gate operator of the first type 2a located below the flange, said flange being retained preventing its vertical downward movement, and therefore allowing the transmission of downward vertical loads between the gate operator of the first type 2a and the second movable elements 21.

[0076] The second configuration will be adapted for handling gate operators of the second type 2b having a rod shape inserted into the handle, allowing its vertical guided movement towards the outside of the container. Said gate operator of the second type 2b will be driven upwards due to the forces transmitted through the mechanical link with the lower gates of the container 3, caused by the weight of the stored waste on said closed gates.

[0077] In said gate operator of the second type 2b, the gate closing position will be the position in which said operator is completely inserted into the handle 1, without projecting above same, whereas the gate opening position will be the position in which said gate operator of the second type 2b projects a predetermined distance from the handle 1.

[0078] So by knowing said gate closing and opening positions and also knowing the dimensions of the handle 1 and the gate operator of the second type 2b, the programmable control unit can handle the container 3 by regulating the distance between the first and second holding members 10 and 20, both for determining the gate closing and gate opening positions, and also by regulating the closing of the first and second movable elements 11 and 21 for adapting to the sizes of the mentioned handle 1 and the gate operator of the second type 2b. In this case, the second movable elements 21 will be closed, the second member 20 being located above the gate operator of the second type 2a, such that the mentioned second movable elements 21 will not cause the gripping of the gate operator of the second type 2b, but rather they will be closed interfering in the movement range thereof by coming into geometric interference with them and preventing and regulating the upward vertical movement thereof in relation to the relative position between the first and second holding members 10 and 20.

This allows the vertical movement of the second holding member 20 with respect to the first holding member 10 driven by the displacing mechanism 30, allows the movement of the gate operator of the second type 2b between the gate closing and opening positions.

[0079] Therefore, many different types of containers provided with different types of gate operators and handles can be handled by means of the proposed device without requiring modifications of the head other than the modification of its operation parameters, which will preferably be performed automatically by means of a programmable control unit.

[0080] The present invention also relates to a method for handling containers implementing by means of the device described above the following steps:

- determining if the container to be handled integrates a gate operator of a first type 2a or a gate operator of the second type 2b;
- applying a first configuration if the container to be handled 3 integrates a gate operator of the first type 2a or the second configuration if the container to be handled 3 integrates a gate operator of the second type 2b, by means of a programmable control unit controlling the first, second and third operating means 50, 51 and 52;

wherein the first configuration and the second configuration modify the handle gripping and release positions, and/or the gate operator interaction and release positions, and/or the gate opening and closing positions.

[0081] It is proposed that determining whether the gate operator is of a first type 2a or of a second type 2b is carried out by means of communication between the head and the container, for example, by means of RFID technology or by means of the optical reading of signals included on the outside of the container and detected by means of an optical sensor, such as for example, a camera, or by means of a container or handle or gate operator shape optical recognition system, a set of sensors integrated in the head which allow, as the interaction thereof with the handle and/or with the gate operator starts, detecting the relative position or size thereof, therefore allowing identification, is also proposed. All of these proposed methods involves transmitting information relating to the container to be handled, received by sensors, to the programmable control unit so that it evaluates the received information and determines the type of gate operator 2.

[0082] According to another proposed embodiment, said determination is performed by means of an operator identifying the container and informing to the programmable control unit through an interface.

[0083] Additionally, the method can contemplate that the gate operator of the first type 2a transmits downward vertical loads caused by the stored waste on the lower gates of the container and transmitted through the mechanical link of the gates with the gate operator of the first type 2a and that the gate operator of the second type 2b transmits upward vertical loads caused by the stored waste on the lower gates of the container and transmitted to the gate operator of the second type 2b through the mechanical link between them.

[0084] The method for handling the container according to another embodiment furthermore includes the following steps:

- placing the coupling head 40 in a position such that the first holding member 10 is located adjacent to, aligned with and at least partially around the handle 1 of a container 3, the second holding member 20 being adjacent to and aligned with the gate operator 2;
- operating the movement of the first movable elements 11 to the handle gripping position, according to the first or second configuration, firmly securing the handle 1;
- operating the movement of the second movable elements 21 to the position of interaction with the operator, according to the first or second configuration;
- moving the second holding member 20 to the gate closing position by means of the displacing mechanism 30, according to the first or second configuration, allowing the second movable elements 21 to support a vertical load produced by the weight of the waste located on the gates of the container and transmitted through the gate operator 2;
- lifting the container, placing it such that it is superposed on a discharge area and operating the displacing mechanism 30 until placing the second holding member 20 in the gate opening position, according to the first or second configuration, causing the movement of the second holding member 20 and the gate operator 2, causing the opening of the gates mechanically linked to said gate operator 2;
- operating the displacing mechanism again 30 until placing the second holding member 20 in the gate closing position, according to the first or second configuration, causing the closing of said gates, putting the container back 3 in its original location and releasing the first and second holding members 10 and 20.

[0085] Therefore, the gate opening and closing positions of the gate operator 2 will be different depending on whether it is a gate operator of the first type 2a or of the second type 2b.

[0086] According to a preferred example, since the head is in interaction with a gate operator of a first type 2a and in application of the mentioned first configuration, the gate opening position is the position in which the first and second holding members 10 and 20 are adjacent, and the gate closing position is the position in which the first and second holding members 10 and 20 are spaced apart and the gate operator of the first type 2a is surrounded and held by the second movable elements 21

supporting a downward vertical load produced by the stored waste on the gates of the container, and since the head is in interaction with a gate operator of a second type 2b and in application of the mentioned second configuration, the gate opening position is the position in which the first and second holding members 10 and 20 are spaced apart, and the gate closing position is the position in which the first and second holding members 10 and 20 are adjacent and the second movable elements 21 are superposed and in geometric interference with the gate operator of the second type 2b, performing the functions of a stop and preventing its vertical movement, supporting an upward vertical load produced by the stored waste on the gates of the container.

Claims

1. A device for handling and emptying waste collection containers, comprises a coupling head (40) which integrates a head structure (41) attached to the distal end of a crane arm integrated in a waste collection vehicle, said head structure (41) bearing:

    • a first holding member (10) having first movable elements (11) operated by means of first operating means (50), being said first movable elements (11) movables between a handle gripping position and a handle release position for being coupled to a mushroom-shaped handle (1) fixed on an outer surface of a container (3) holding up said container (3) through said handle (1);
    • a second holding member (20) having second movable elements (21) operated by means of second operating means (51), being said second movable elements (21) movables between an operator release position and a position of interaction with the operator and allowing, said movable elements (21) to come into geometric interference with a gate operator (2) preventing its free movement, being the first holding member (10) attached to the handle (1) and the second holding members (20) arranged in the position of interaction, and being the gate operator (2) arranged in the container in a position adjacent and/or concentric to said handle (1) and mechanically linked to the lower gates of the container for controlling their opening and closing;
    • a displacing mechanism (30) operated by a third operating means (52) envisaged for axially moving said second holding member (20) with respect to said first holding member (10) between gate closing and gate opening positions, by means of the relative axial movement between the handle (1) and the gate operator (2) of the mentioned container (3) linked to the first and second holding members (10 and 20), causing the closing and/or opening of said lower gates of the container (3) mechanically linked to the gate operator (2);

    characterized in that

    • the second movable elements (21) are movable between the operator release position and the position of interaction with the operator regardless of the relative position between the first and second holding members (10 and 20);
    • the first, second and third operating means (50, 51 and 52) are controlled by means of a programmable control unit provided with at least a first and a second handling configuration, which are adapted, respectively, for handling a container containing a gate operator of a first type (2a) and for handling a container containing a gate operator of a second type (2b), the first and second configurations differing at least in the predetermined handle gripping and release positions, and/or in the operator release and interaction positions, and/or in the gate opening and closing positions; and **in that**
    • the programmable control unit is prepared for implementing the first configuration or the second configuration depending on the information obtained by means of sensors or by means of information entered by an operator through an interface.

2. The device according to claim 1, **characterized in that**:

    • the second movable elements (21), in the position of interaction with an gate operator of a first type (2a) of a container, surround and secure said gate operator of the first type (2a), and support downward vertical loads produced by the stored waste on the gates of the container and transmitted by the gate operator of the first type (2a); and
    • the second movable elements (21), in the position of interaction with the gate operator of the second type (2b) of a container, are superposed with respect to the gate operator of the second type (2b) performing the functions of a stop preventing its vertical movement, and support upward vertical loads produced by the stored waste on the gates of the container and transmitted by the gate operator of the second type (2b);
    • the displacing mechanism (30) supports and transmits to the crane arm upward and downward vertical loads.

3. The device according to claim 1 or 2, **characterized in that** in interaction with a gate operator of a first type (2a) and in application of the mentioned first configuration, the gate opening position is the posi-

tion in which the first and second holding members (10 and 20) are adjacent, and the gate closing position is the position in which the first and second holding members (10 and 20) are spaced apart and the gate operator is surrounded and held by the second movable elements (21) supporting a downward vertical load produced by the stored waste on the gates of the container.

4. The device according to claim 1 or 2, **characterized in that** in interaction with a gate operator of the second type (2b) and in application of the mentioned second configuration, the gate opening position is the position in which the first and second holding members (10 and 20) are spaced apart, and the gate closing position is the position in which the first and second holding members (10 and 20) are adjacent and the second movable elements (21) are superposed and in geometric interference with the gate operator of the second type (2b), performing the functions of a stop and preventing its vertical movement, supporting an upward vertical load produced by the stored waste on the gates of the container.

5. The device according to any one of preceding claims 1 to 4, **characterized in that** the first and second configurations differ in the length of travel of the second holding member (20) between the gate opening and closing positions, and/or in the opening left by the first movable elements (11) in the handle gripping position, and/or in the opening left by the second movable elements (21) in the position of interaction with the gate operator.

6. The device according to any one of the preceding claims, **characterized in that** the first movable elements (11) and/or the second movable elements (21) are integrated in a jaw chuck mechanism grouping said movable elements (11, 21) in a radial arrangement around a hollow center, and coupled to an annular mechanism arranged around said hollow center allowing the coordinated radial movement of said movable elements (11, 21).

7. The device according to any one of the preceding claims, **characterized in that** the displacing mechanism (30), responsible of moving the second holding member (20), consists of two identical Roberts swinging mechanisms having coordinated movement with respect to one another by means of a connecting bar, each Roberts mechanism being formed by:

- a first pair of rockers and a second pair of rockers, all having the same length;
- the first pair of rockers being articulated with respect to the head structure at a first end around a first shaft, and articulated with respect to a swinging body at a second end around a second shaft;
- the second pair of rockers being articulated with respect to the head structure at a first end around a third shaft, and articulated with respect to a swinging body at a second end around a fourth shaft;
- the swinging body having a protruding end articulated with respect to the second holding member around a fifth shaft;
- all the shafts being parallel to one another, and the distances between the first and second shafts, between the third and fourth shafts, between the fourth and fifth shafts, and between the second and fifth shafts being the same;

said two Roberts coordinated displacing mechanisms determining a considerably axial rectilinear movement of the second holding member with respect to the first holding member.

8. The device according to any one of the preceding claims, **characterized in that** the first holding member (10) and the second holding member (20) are each configured around a hollow center intended for the insertion of the handle (1) and the gate operator (2), both hollow centers being aligned.

9. A method for handling and emptying waste collection containers by means of a coupling head which integrates a head structure (41) and is attached to the distal end of a crane arm integrated in a waste collection vehicle, said head structure (41) bearing:

- a first holding member (10) having first movable elements (11) operated by means of first operating means (50), movable between a handle gripping position and a handle release position for being coupled to a mushroom-shaped handle (1) fixed on an outer surface of a container (3) holding up said container (3) through said handle (1);
- a second holding member (20) having second movable elements (21) operated by means of second operating means (51), movable between an operator release position and a position of interaction with the operator allowing said movable elements (21) to come into geometric interference with a gate operator (2) preventing its free movement, being the first holding member (10) is attached to the handle (1) and the second holding members (20) are arranged in the position of interaction, the gate operator (2) being arranged in the container in a position adjacent and/or concentric to said handle (1) and being mechanically linked to the lower gates of the container for controlling their opening and closing;
- a displacing mechanism (30) operated by

means of third operating means (52), envisaged for axially moving said second holding member (20) with respect to said first holding member (10) between gate closing and gate opening positions, by means of the resulting relative axial movement between the handle (1) and the gate operator (2) of the mentioned container (3) linked to the first and second holding members (10 and 20), causing the closing and/or opening of said lower gates of the container (3) mechanically linked to the gate operator (2);
characterized in that:
• the first, second and third operating means (50, 51 and 52) are controlled by means of a programmable control unit provided with at least a first and a second handling configuration, which are adapted, respectively, for handling a container containing a gate operator of a first type (2a) and for handling a container containing a gate operator of a second type (2b), the first and second configurations differing at least in the predetermined handle gripping and release positions, and/or in the operator release and interaction positions, and/or in the gate opening and closing positions; and **in that** the programmable control unit implementing the following steps:
• determining if the container to be handled integrates a gate operator of a first type (2a) or a gate operator of the second type (2b) based on the information obtained by means of sensors or by means of information entered by an operator through an interface;
• applying a first handling configuration if the container to be handled (3) integrates a gate operator of the first type (2a) or a second handling configuration if the container to be handled (3) integrates a gate operator of the second type (2b), by means of a programmable control unit; wherein the first configuration and the second configuration modify one or more of the following positions: the handle gripping and release positions and/or the gate operator interaction and release positions and/or the gate opening and closing positions.

10. The method according to claim 9, **characterized in that** the gate operator of the first type (2a) transmits downward vertical loads caused by the stored waste on the lower gates of the container and transmitted through the mechanical link of the gates with the gate operator of the first type (2a); and the gate operator of the second type (2b) transmits upward vertical loads caused by the stored waste on the lower gates of the container and transmitted to the gate operator of the second type (2b) through the mechanical link between them.

11. The method according to claim 9 or 10, **characterized in that** it includes the following steps:

• placing the coupling head (40) in a position such that the first holding member (10) is located adjacent to, aligned with and at least partially around the handle (1) of a container (3), the second holding member (20) being adjacent to and aligned with the gate operator (2);
• operating the movement of the first movable elements (11) to the handle gripping position, according to the first or second configuration, firmly securing the handle (1);
• operating the movement of the second movable elements (21) to the position of interaction with the operator, according to the first or second configuration;
• moving the second holding member (20) to the gate closing position by means of the displacing mechanism (30), according to the first or second configuration, allowing the second movable elements (21) to support a vertical load produced by the weight of the waste located on the gates of the container and transmitted through the gate operator (2);
• lifting the container, placing it such that it is superposed on a discharge area and operating the displacing mechanism (30) until placing the second holding member (20) in the gate opening position, according to the first or second configuration, causing the movement of the second holding member (20) and the gate operator (2), causing the opening of the gates mechanically linked to said gate operator (2);
• operating the displacing mechanism (30) again until placing the second holding member (20) in the gate closing position, according to the first or second configuration, causing the closing of said gates, putting the container (3) back in its original location and releasing the first and second holding members (10 and 20).

12. The method according to claim 9, 10 or 11, **characterized in that** in interaction with a gate operator of a first type (2a) and in application of the mentioned first configuration, the gate opening position is the position in which the first and second holding members (10 and 20) are adjacent, and the gate closing position is the position in which the first and second holding members (10 and 20) are spaced apart and the gate operator of the first type (2a) is surrounded and held by the second movable elements (21) supporting a downward vertical load produced by the stored waste on the gates of the container.

13. The method according to claim 9, 10 or 11, **characterized in that** in interaction with a gate operator of a second type (2b) and in application of the mentioned second configuration, the gate opening posi-

tion is the position in which the first and second holding members (10 and 20) are spaced apart, and the gate closing position is the position in which the first and second holding members (10 and 20) are adjacent and the second movable elements (21) are superposed and in geometric interference with the gate operator of the second type (2b), performing the functions of a stop and preventing its vertical movement, supporting an upward vertical load produced by the stored waste on the gates of the container.

14. The method according to any one of claims 9 to 13, **characterized in that** the first and second configurations differ in the length of travel of the second holding member (20) between the gate opening and closing positions, and/or in the opening left by the first movable elements (11) in the handle gripping position, and/or in the opening left by the second movable elements (21) in the position of interaction with the gate operator.

15. The method according to any one of preceding claims 8 to 14, **characterized in that** a camera and/or visual sensor is integrated in the coupling head (40) and envisaged for receiving visual information through a central hole envisaged in the first and second holding members (10 and 20), and said programmable control unit uses said visual information to guide the coupling head (40) to the handle (1) and the gate operator (2) and/or to determine if the gate operator is of the first type (2a) or of the second type (2b).

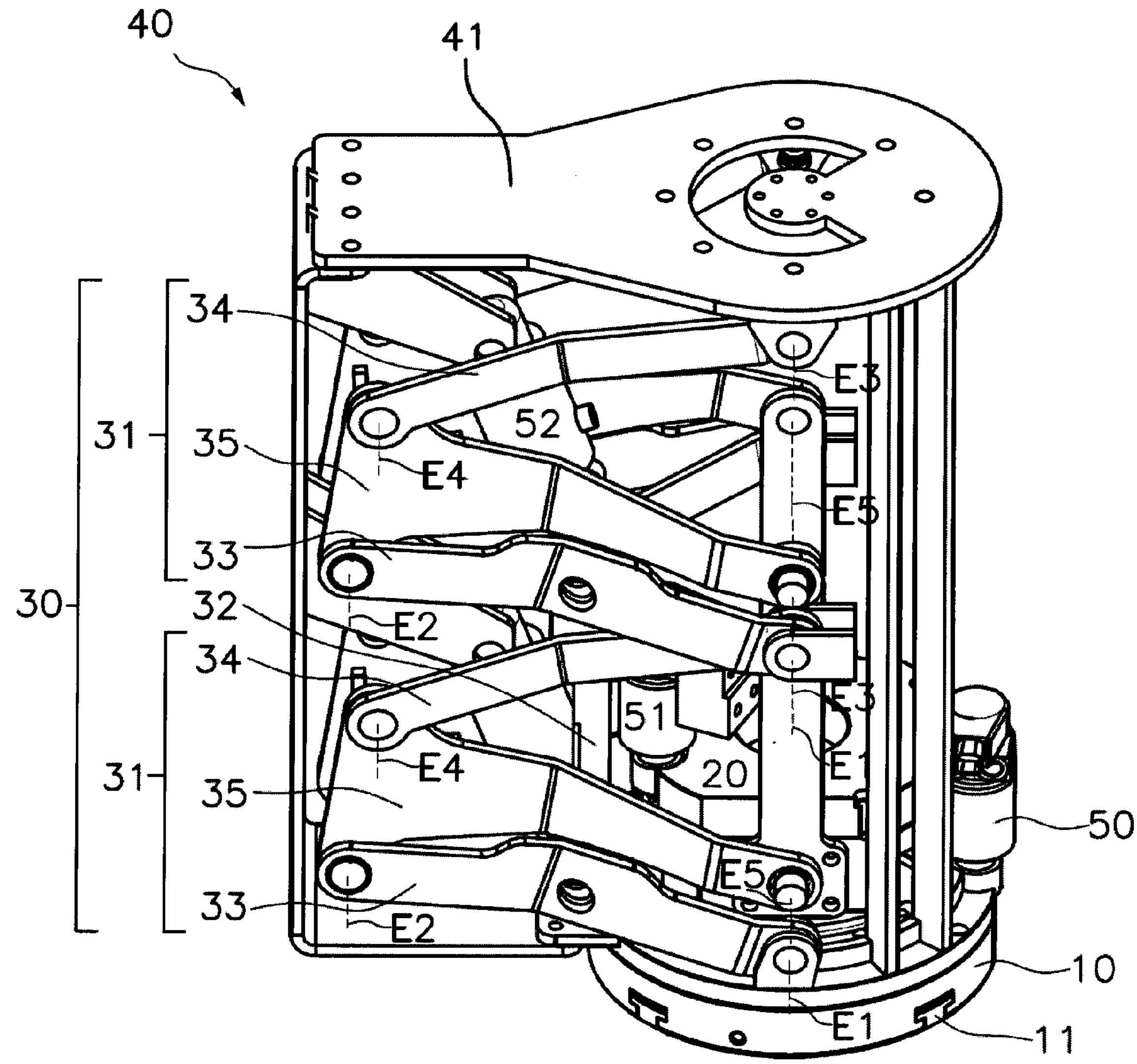
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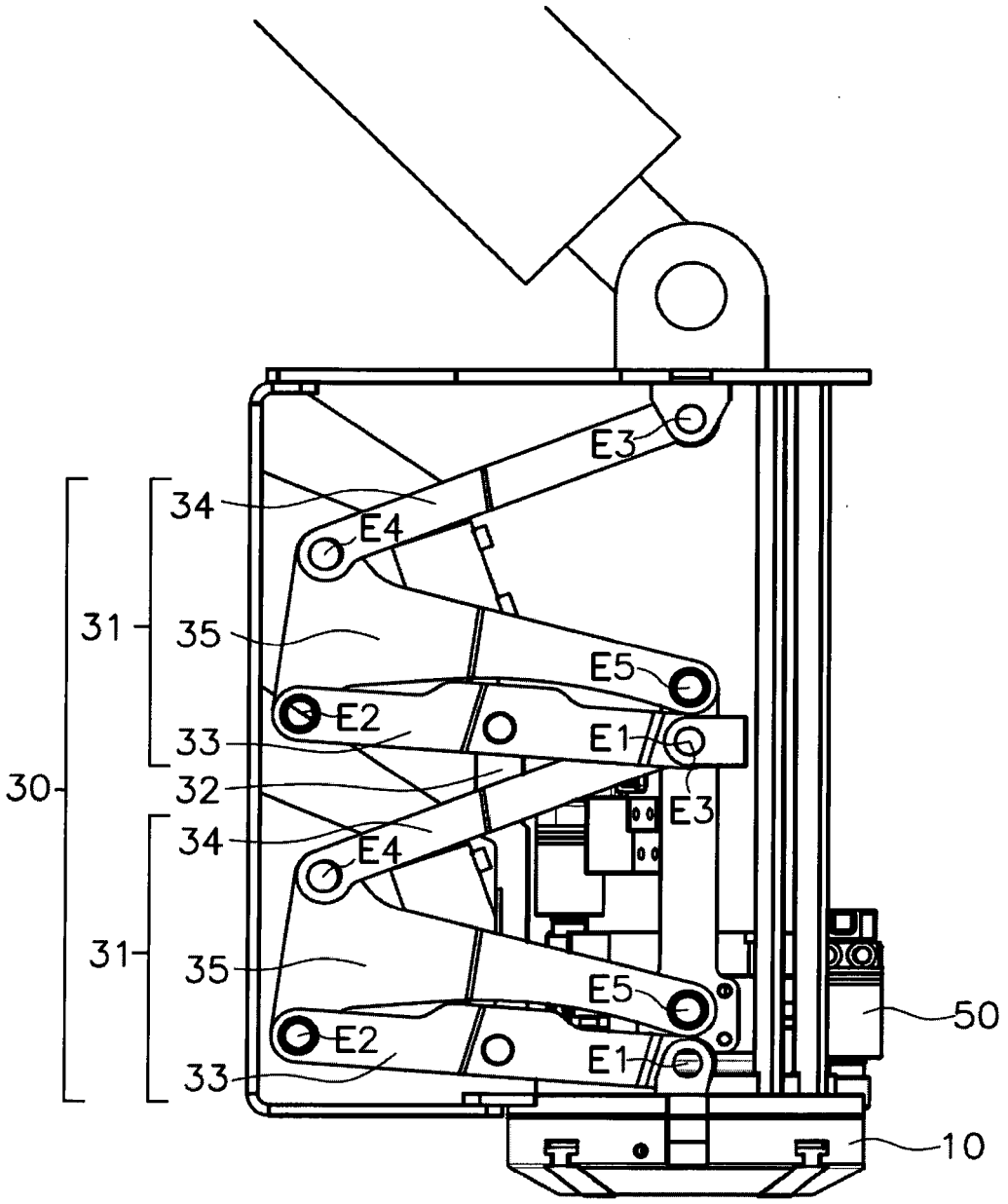
Fig. 1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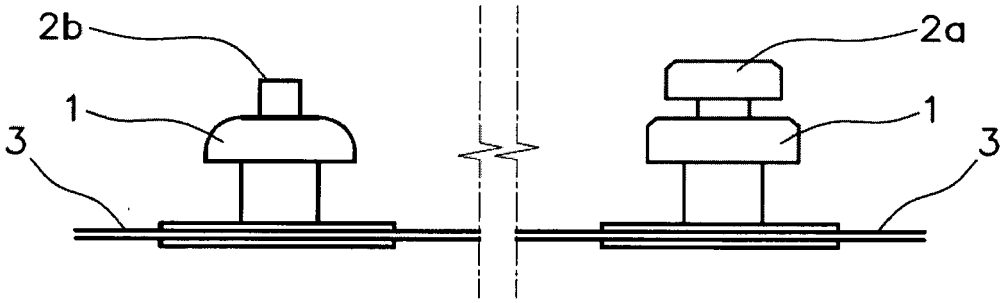
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Fig.2

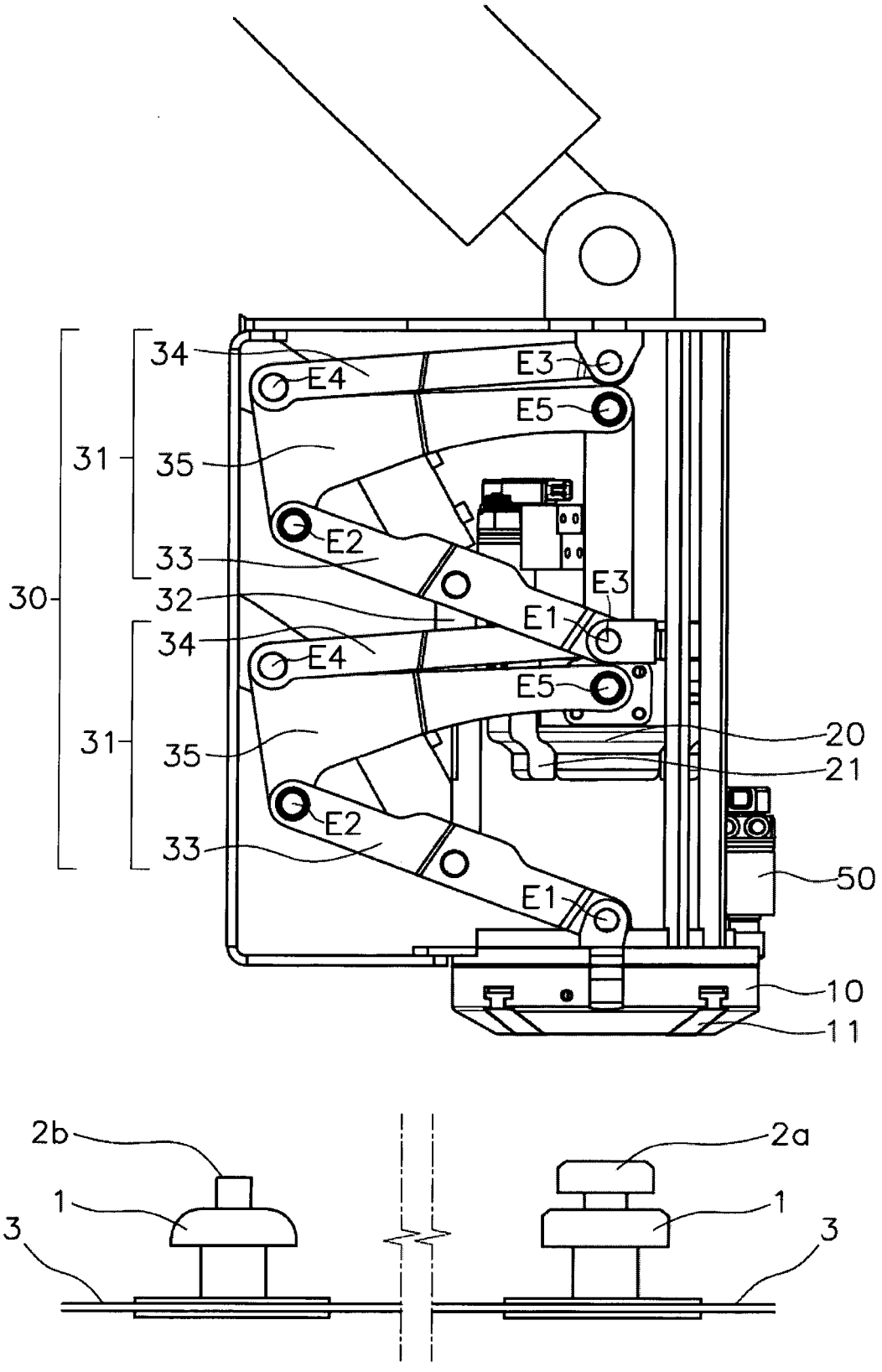
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Fig.3

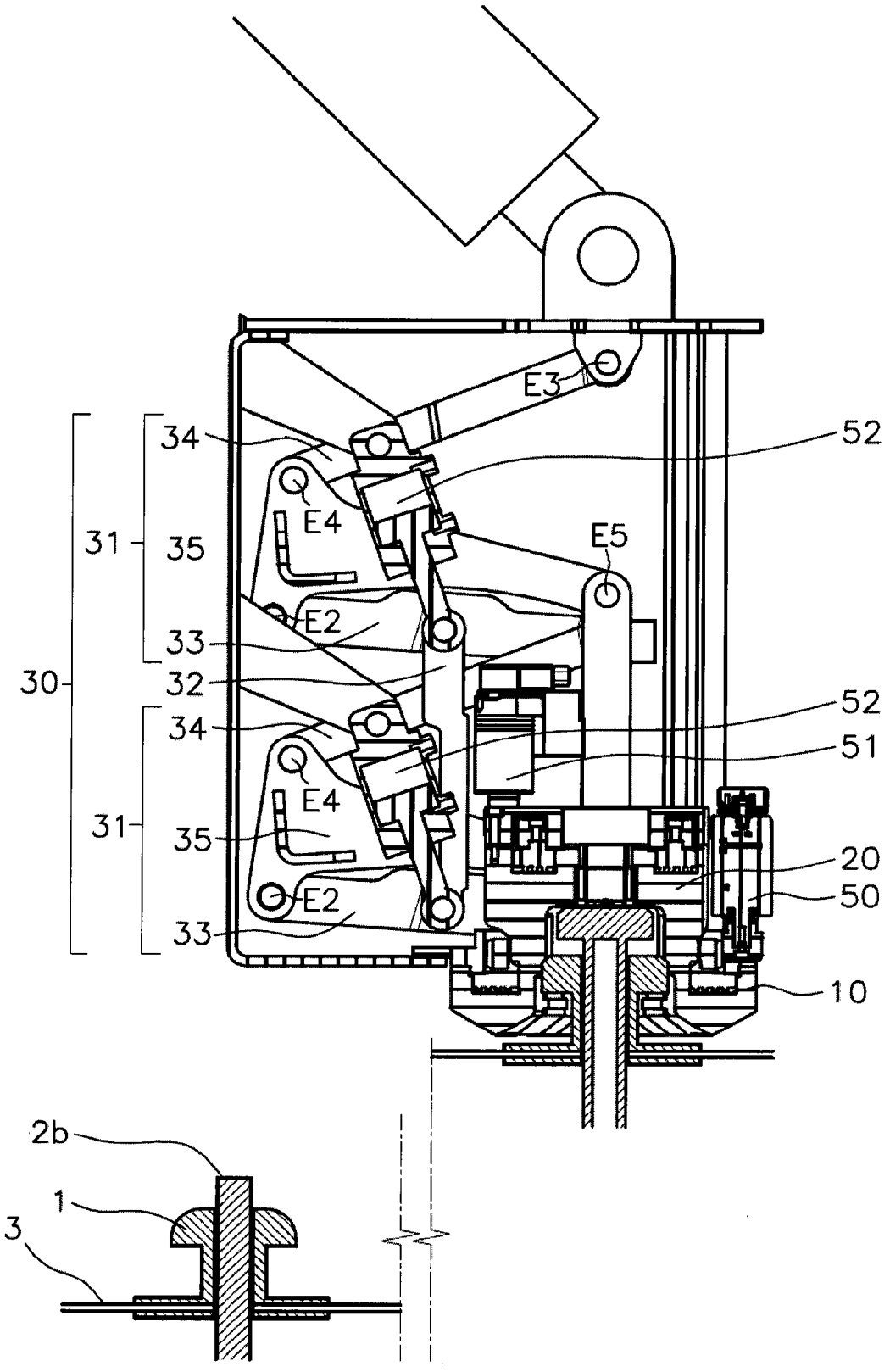

Fig. 4

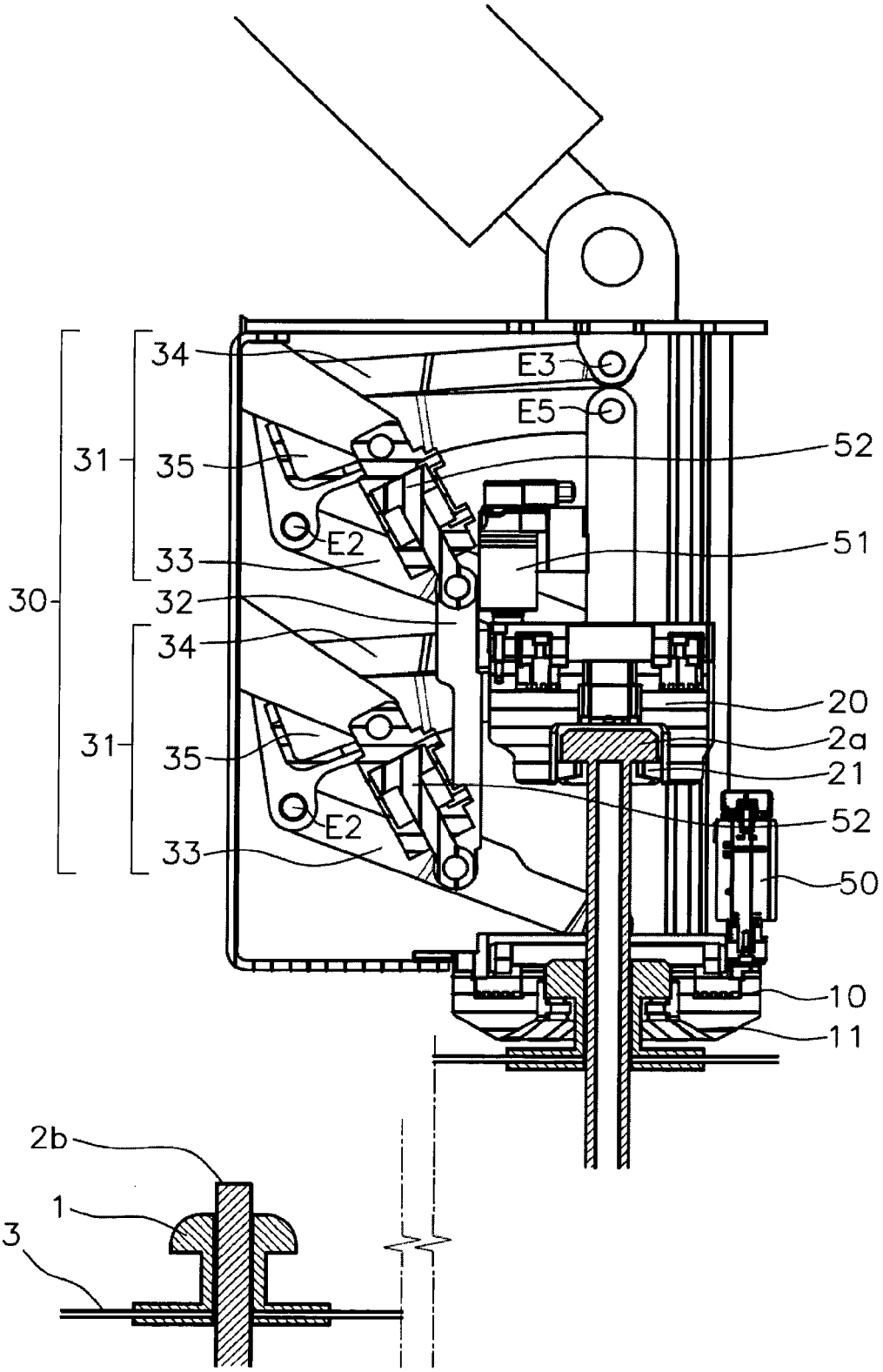
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Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 15 38 0026

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 December 2015	Pardo Torre, Ignacio

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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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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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 38 0026

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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