(19) Europäisches Patentamt
European Patent Office
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(11) **EP 4 186 818 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.05.2023 Bulletin 2023/22

(21) Application number: **22189191.4**

(22) Date of filing: **08.08.2022**

(51) International Patent Classification (IPC):
B65F 3/04 *(2006.01)* ***B65F 3/08*** *(2006.01)*
B65F 3/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B65F 3/08; B65F 3/041; B65F 2003/0243;
B65F 2003/0276

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **25.11.2021 IT 202100029840**

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(54) EQUIPMENT FOR EMPTYING BINS ON A REFUSE COLLECTION VEHICLE, AND VEHICLE COMPRISING SAID EQUIPMENT

(57) A kinematic group (20) is constrained to a support assembly (10) secured to the side (3) of the motor vehicle (2), which supports a guide frame (7), along which a trolley (13) slides carrying lifting arms (14) operatively engageable with a box (15). The kinematic group (20) comprises two support arms (21) each having a proximal end (21a) constrained to the support assembly (10) and a distal end (21b) constrained to an upper end (7a) of the guide frame (7), two push arms (23) each having a proximal end (23a) constrained to the support assembly (10) and a distal end (23b) guided along a lower portion (7b) of the guide frame (7), and two struts (28) each having a lower end (28b) constrained near the proximal end (23a) of the push arm (23), and an upper end (28a) constrained near the proximal end (21a) of the support arm (21).

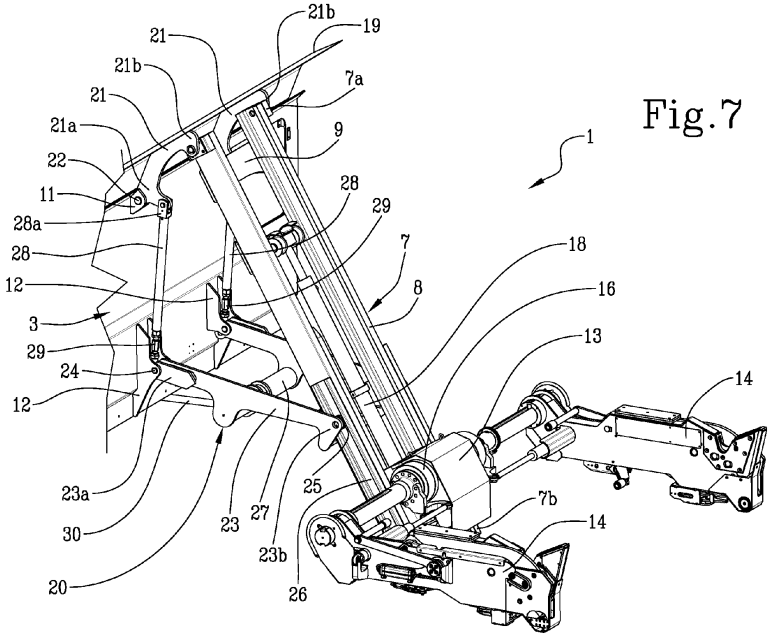

Fig.7

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Description

[0001] The present invention relates to equipment for emptying bins on a refuse collection motor vehicle.

[0002] A further object of the invention is a refuse collection vehicle, equipped with the aforesaid equipment.

[0003] More specifically, the equipment in question lends itself to be mounted next to a motor vehicle to perform in a fully automated manner the emptying cycle of bins used for refuse collection.

[0004] As is known, one of the common methods for actuating refuse collection in urban areas is that the waste is delivered in special bins appropriately distributed along the pavement or at the sides of the roads. The bins are suitable to be periodically emptied on properly equipped motor vehicles, which provide for the transport of the refuse to the places of disposal or recovery.

[0005] Such motor vehicles are normally equipped with equipment suitable for picking up the bin from the ground to hoist it above a loading hopper and overturn it to empty the refuse on the motor vehicle. When the emptying is complete, the equipment also repositions the bin on the ground.

[0006] A known type of equipment, described for example in EP 1454848, comprises a pair of lifting arms rotatably carried by a movable trolley along an extensible guide frame structure. The guide frame is formed by a first framework having an upper end hinged horizontally near the access threshold of the hopper and a second framework longitudinally sliding with respect to the first framework. In a rest condition, the structure of the guide frame is longitudinally retracted and vertically juxtaposed against the side wall of the hopper, with the lifting arms extending vertically downwards with respect to the trolley, positioned about halfway along the extension of the frame.

[0007] The operating cycle envisages that the gripping arms are angularly rotated to assume a horizontal orientation and, by extending the extendable structure and sliding the trolley along the second portion thereof, lowered to the level of the bin to engage the same at the respective gripping elements. An actuator operating on the first framework of the extensible guide frame is adapted to be activated to tilt the latter with respect to the side of the vehicle in order to reach the box, located at a certain distance from the vehicle itself. Such a distance varies from time to time as a function of the stopping position of the vehicle.

[0008] Upon engagement, the extendable guide frame is contracted by retracting the first framework into the second framework, and the trolley returns the gripping arms to the raised position up to the upper end of the guide frame. A rotation of the gripping arms around their horizontal hinging axis determines the overturning of the bin and the emptying of the content in the hopper.

[0009] With a reverse operating cycle with respect to that described, the bin is repositioned on the ground, and the equipment is returned to the rest condition.

[0010] EP 1389591 proposes equipment conceptually similar to that described above in which, unlike the latter, the overturning of the bin is actuated by the overturning of the extendable guide frame around its hinging axis near the access threshold of the hopper. A pair of simultaneously operable fluid-dynamic actuators operates between the side of the motor vehicle and the guide frame to tilt it until the bin is reached by gripping arms. The bin engaged by the gripping arms is lifted following the contraction of the extendable guide frame and the translation of the trolley towards the upper part thereof.

[0011] When the bin has overcome the access threshold of the hopper, a new operation of the aforesaid fluid-dynamic actuators is commanded to determine the overturning thereof following an overturning action of the guide frame extendable about its hinging axis.

[0012] An apparatus is disclosed in EP 2530033 comprising an extendable structure hinged near the access threshold of the loading hopper of a motor vehicle, and rotatably carrying a pair of lifting arms operatively engageable to a bin. An auxiliary structure rotatably constrained near the access threshold operates on the extendable structure to rotate the latter from an approach position with respect to a side wall of the hopper to a gripping position in which the lifting arms are distanced from the side wall. Tilting actuators operate between the auxiliary structure and the extendable structure to rotate the latter between a rest position in which it extends below with respect to the access threshold and a tilting position in which it rises with respect to the access threshold itself.

[0013] Document EP1142803 proposes a system in which the upper part of a guide frame is constrained with respect to the side of the motor vehicle by an articulated parallelogram system formed by an oscillating bulkhead arranged at the top of the frame, and a pair of articulated rods slightly lower with respect to the oscillating bulkhead. The extraction and re-entry movement of the guide frame is controlled by a hydraulic actuator articulated to the vehicle framework and operating at an intermediate point of the extension in height of the guide frame. The main object of the present invention is substantially to propose a new arrangement and cooperation of the constituent parts of the equipment, by virtue of which a structural simplification and a reduction in weights and dimensions can be achieved.

[0014] In particular, new gripping equipment is to be proposed which is designed so as to optimize the distribution of loads on the individual components involved in the gripping and movement of the bin during the lifting and tipping action, so as to allow a dimensional containment of the same in favour of the construction costs and the usability of the spaces, for example to increase the load capacity of the hopper and/or the storage box associated therewith.

[0015] A further object of the invention is to propose equipment in which the constraints between the parts are geometrically combined so as to improve the mechanical stability of the system both during the lifting and tilting

operations of the bin, and in the position of approaching the side of the vehicle during the movements thereof.

[0016] Another object of the invention is to provide equipment which is designed to be adaptable to different operating needs, for example in terms of the gripping distance of the bin from the side of the motor vehicle and/or the manoeuvring spaces required at the top of the equipment to move the bin during the lifting and tipping steps.

[0017] These and other objects, which will become apparent in the course of the present disclosure, are substantially achieved by equipment for emptying bins on a refuse collection vehicle, according to claim 1.

[0018] In accordance with a further aspect, an object of the invention is a refuse collection vehicle according to claim 10.

[0019] In at least one of the above aspects, the invention can also comprise one or more of the following preferential characteristics.

[0020] Preferably, the lower end of said at least one strut is constrained around a lower hinging axis near a constraint axis of the proximal end of the push arm.

[0021] Preferably, the upper end of said at least one strut is constrained around an upper hinging axis near a constraint axis of the proximal end of the support arm.

[0022] Preferably, the lower hinging axis of the strut is spaced towards the side of the vehicle, with respect to an alignment direction which joins the constraint axis of the proximal end of the push arm with the constraint axis of the proximal end of the support arm.

[0023] Preferably, the upper hinging axis of the strut is spaced away from the side of the vehicle, with respect to an alignment direction which joins the constraint axis of the proximal end of the push arm to the constraint axis of the proximal end of the support arm.

[0024] Preferably, the lower and upper hinging axes of the strut are located on opposite sides with respect to a plane containing the constraint axes of the proximal ends of the support arm and the push arm.

[0025] Preferably, said at least one strut has at least one adjustment device for changing the distance between its upper and lower ends.

[0026] Preferably, the push arm rotatably carries at least one cursor along a sliding guide carried by the guide frame. Preferably, said control actuator has a first end hinged to a fixed point with respect to the support assembly, and a second end hinged with respect to the push arm, at a point between the proximal end and the distal end of the push arm itself.

[0027] Preferably, the kinematic group comprises a pair of said push arms and a pair of said support arms, operating on respective opposite sides of the guide frame and mutually interconnected by means of a pair of said struts.

[0028] Preferably, the kinematic group comprises at least one pair of said push arms and at least one transverse stiffening and synchronization element which mutually connects the push arms.

[0029] Preferably, the second end of the control actuator operates on said at least one transverse stiffening element.

[0030] Preferably, in the approach position said push arm and support arm are joined to the guide frame according to an orientation substantially parallel thereto.

[0031] Preferably, said at least one support arm has an arcuate extension in a vertical plane.

[0032] Preferably, a distance between attachment points of the proximal and distal ends of the push arm is greater than a distance between attachment points of the proximal and distal ends of the support arm. Preferably, said kinematic group, in the movement between the approach position and the maximum distance position, moves an upper end of the guide frame away from the side according to a lower measure with respect to a distance imposed on a lower portion of the guide frame from the side.

[0033] Preferably, the support assembly comprises at least one upper articulation bracket and one lower articulation bracket, integral with the side of the vehicle and projecting externally therefrom.

[0034] Preferably, the proximal end of the push arm is constrained to said at least one lower articulation bracket.

[0035] Preferably, the proximal end of the support arm is constrained to said at least one upper articulation bracket.

[0036] Preferably, said support assembly is fixed to a side of the motor vehicle itself.

[0037] Preferably, the support assembly is fixed at a loading hopper having at the top an access threshold positioned near an upper end of the guide frame.

[0038] Further characteristics and advantages will become more apparent from the detailed description of a preferred, yet not limiting, embodiment of equipment for gripping and emptying bins on a refuse collection vehicle, according to the present invention.

[0039] Such a description will be set forth hereinafter with reference to the accompanying drawings given only for illustrative and, therefore, nonlimiting purpose, in which:

figure 1 shows a perspective view of equipment according to the present invention, arranged in the approach condition on the side of a refuse collection vehicle;

figure 2 shows the equipment of figure 1 in a side view in the approach position at the side of the partially sectioned motor vehicle, during an emptying cycle of a refuse collection bin;

figure 3 is an illustration similar to figure 2, showing the equipment during the execution of the emptying cycle in a maximum distance position from the side of the motor vehicle;

figure 4 is an enlarged detail of figure 3,

figure 5 shows the detail of figure 4 in perspective view;

figure 6 is an enlarged detail of figure 4,

figure 7 shows a perspective view of the apparatus in a maximum distance position from the side of the motor vehicle.

[0040] In the figures cited, the number 1 globally indicates an apparatus for emptying bins on a refuse collection vehicle, according to the present invention.

[0041] The equipment 1 is suitable to be installed on a motor vehicle 2 used for collecting refuse, for example along a side 3 thereof, at a loading hopper 4 operatively arranged between a driver's cab 5 and a box 6 for conveying and/or compacting the waste itself.

[0042] In a manner known per se, a pressing assembly 4a operating at the bottom of the loading hopper 4 transfers the refuse emptied into the hopper itself to the box 6 by means of the equipment 1.

[0043] The equipment 1 comprises a guide frame 7, having for example a pair of guide uprights 8 mutually parallel and interconnected with each other by respective crosspieces 9.

[0044] The guide frame 7 is engaged to a support assembly 10 which is suitable to be installed on the side 3 of the motor vehicle 2, at the loading hopper 4. In the illustrated example, the support assembly 10 is made by means of a pair of upper articulation brackets 11 and a pair of lower articulation brackets 12, integral with a side wall of the loading hopper 4 and projecting externally therefrom. In the illustrated example, each of the upper and lower articulation brackets 11 and 12 comprises a pair of plates protruding side by side from the side 3 of the motor vehicle 2, near the loading hopper 4.

[0045] A trolley 13 is slidably engaged between the guide uprights 8 rotatably carrying, on respectively opposite sides of the guide frame 7, a pair of lifting arms 14 respectively parallel, operatively engageable with a box 15 for refuse, to be emptied inside the loading hopper 4.

[0046] In particular, by means of one or more suitable actuators 16 associated with the trolley 13 and not described in detail since they can be made in a manner known per se, the lifting arms 14 are preferably movable in mutual approaching and distancing, as well as simultaneously rotatable around a horizontal axis to engage with respective gripping elements 17 in the form of a pin, protruding from opposite side walls of the box 15, respectively, possibly causing the detachment from the ground of the box itself.

[0047] A lifting actuator 18, also not described in detail as it can be made in a known manner, operates on the trolley 13 to control its movement along the guide frame 7, so as to hoist the box 15 up to an upper end 7a of the frame itself, located at an access threshold 19 of the loading hopper 4.

[0048] Once it has reached the upper end 7a of the guide frame 7, the box 15 is overturned by means of a further rotation of the lifting arms 14, to determine the emptying of the refuse inside the loading hopper 4. Suitable mechanisms, known per se and therefore not described in detail, can be associated with the lifting arms 14 to determine the opening of the lid of the box 15, in conjunction with the overturning action. When the emptying is complete, the box 15 is re-positioned on the ground, with a movement cycle which is inverse to that previously described.

[0049] The guide frame 7 is constrained to the support assembly 10 by means of a kinematic group 20 which allows its movement between an approach position with respect to the side 3, represented in figures 2, 4 and 5 and a maximum distance position from the side 3 itself, represented in figures 3, 6 and 7.

[0050] Thereby, an effective engagement of the box 15 is allowed regardless, within certain limits, of the distance between the latter and the side 3 of the motor vehicle 2.

[0051] The kinematic group 20 comprises two control levers 21, 23, 28 which are substantially identical to each other, each operating on one of the respectively opposite sides of the guide frame 7, i.e., on one of the guide uprights 8.

[0052] Each control lever 21, 23, 28 comprises at least one support arm 21 operating between the side 3 of the motor vehicle 2, near the access threshold 19, and the guide frame 7. More in particular, each support arm 21 has a respective proximal end 21a rotatably constrained to the support assembly 10 by a first pin 22 engaged at one of the upper articulation brackets 11, and a distal end 21b rotatably constrained to the upper end 7a of the guide frame 7. The support arms 21, arranged side by side in positions laterally opposite the guide frame 7, can conveniently have an arcuate development in a vertical plane, so as not to interfere with the movements of the lifting arms 14 and/or the trolley 13 when the latter reaches the upper end 7a of the guide frame itself.

[0053] Each control lever 21, 23, 28 further comprises at least one push arm 23 operating between the side 3 of the vehicle and the guide frame 7. More in particular, it is preferably envisaged that each push arm 23 has a proximal end 23a rotatably constrained to the support assembly 10 by a second pin 24 engaged at one of the lower articulation brackets 12. A distal end 23b of the push arm 23 is in turn rotatably constrained and slidably guided along a lower portion 7b of the guide frame 7, spaced from the upper end 7a. To this end, it is preferably envisaged that the distal end 23b of the push arm 23 rotatably carries at least one cursor, for example in the form of a slide roller 25, or other type slidably engaged along a sliding guide 26 fixed on one side of the respective guide upright 8 facing outside the guide frame 7.

[0054] The push arms 23 of both control levers 21, 23, 28 can be mutually interconnected by one or more transverse stiffening and synchronizing elements 27.

[0055] For each control lever 21, 23, 28 there is also at least one strut 28 operating between the support arm 21 and the push arm 23.

[0056] More in particular, each strut 28 has an upper end 28a rotatably constrained near the proximal end 21a of the support arm 21, around an upper hinging axis X1

parallel to and proximal to the constraint axis represented by the first pin 22. With respect to an alignment direction T passing through the constraint axes defined by the first and second pin 22, d124, the upper hinging axis X1 of the strut 28 is preferably spaced therefrom, away from the side 3 of the motor vehicle 2.

[0057] A lower end of the strut 28 is in turn rotatably constrained near the proximal end 23a of the push arm 23, around a lower hinging axis X2, parallel and proximal to the constraint axis represented by the second pin 24. With respect to the aforesaid alignment direction T, the lower hinging axis X2 of the strut 28 is preferably spaced therefrom, towards the side 3 of the motor vehicle 2.

[0058] In other words, the lower hinging axes X1 and upper hinging axes X2 are located on opposite sides with respect to a plane containing the constraint axes of the proximal ends of the support arm 21 and the push arm 23.

[0059] At least one adjustment device 29, for example of the threaded type, is conveniently associated with each strut 28 to change the distance between its upper and lower ends 28a and 28b. By intervening on the adjustment device 29 it is therefore possible to make appropriate adjustments, for example to adjust and/or stabilize the orientation of the guide frame 7 with respect to the side 3 in the approach position, and/or to recover mechanical clearance caused by wear or other factors.

[0060] At least one control actuator 30 operates on the kinematic group 20, on the action of which the movement of the guide frame 7 between the approach position and the maximum distance position from the side 3 of the motor vehicle is determined.

[0061] A single control actuator 30, for example a hydraulic cylinder, operating on the push arms 23 can be conveniently included. More in particular, in the illustrated example, the control actuator 30 is provided with a first end 30a hinged to a fixed point with respect to the support assembly 10, for example on the motor vehicle framework or under the loading hopper. A second end 30b of the control actuator 30 is in turn hinged to the transverse stiffening element 27 located in an intermediate zone between the proximal end 21a and the distal end 21b of each of the push arms 23.

[0062] During the operation of the motor vehicle 2, the control actuator 30 maintains the equipment in a rest condition with the guide frame 7 in the approach position to the side 3. In this situation, it is advantageously envisaged that in each control lever 21, 23, 28 the push arm 23, as well as the support arm 21, are substantially adjacent to the guide frame 7 according to an orientation substantially parallel thereto. The same guide frame 7 in turn maintains a substantially vertical and/or parallel orientation to the side 3 of the motor vehicle 2 as shown in figure 2.

[0063] A minimum footprint condition of the equipment 1, contained in the footprint outline of the motor vehicle 2, is therefore achieved. The possibility of adjusting the length of the struts 28 by means of the adjustment devices 29 allows to optimize the orientation of the guide frame 7 and the stability thereof thanks to the registration of any mechanical clearance, favouring safety during operation.

[0064] If the motor vehicle 2 stops at a minimum distance from the box 15 which must be emptied, the rotation of the lifting arms 14 can be directly controlled starting from the rest condition in which they face downwards, to determine the engagement of the box 15 without the need to activate the control actuator 30. In this case, as illustrated in figure 2, the entire cycle of emptying and repositioning the box 15 can be carried out keeping the guide frame 7 in the approach position. When, on the other hand, the motor vehicle 2 stops at a certain distance from the box 15 which must be emptied, it is possible to determine, by activating the control actuator 30, the distancing of the guide frame 7 from the side 3 according to a measure suitable to bring the lifting arms 14 into engagement with the respective gripping elements 17 of the box 15. The guide frame 7 can be stopped in any position between the approach position and the maximum distance position, depending on the distance between the side 3 of the motor vehicle 2 and the box 15.

[0065] The distance D2 between the attachment points of the proximal end 23a and distal end 23b of the push arm 23 is conveniently greater than a distance D1 between the attachment points of the proximal end 21a and the distal end 21b of the support arm 21.

[0066] The constraints imposed by the kinematic group 20 ensure that, in the movement between the approach position and the maximum distance position, the upper end 7a of the guide frame 7 moves away from the side 3 according to a relatively small measure, however lower with respect to the distance imposed on a lower end of the guide frame 7 itself.

[0067] Consequently, the guide frame 7 in the distancing condition assumes a tilted orientation, so that its lower end approaches the box to be picked up, while its upper end 7a moves only slightly with respect to the vertical plane containing the access threshold 19 of the loading hopper 4.

[0068] After the box 15 has been engaged by the lifting arms 14 14, the emptying and repositioning cycle of the box 15 can be advantageously completed by keeping the guide frame 7 stationary in the position assumed for the purpose of engaging the box 15 itself.

[0069] The absence of movement of the guide frame 7 with respect to the side 3 of the motor vehicle 2 as long as the box 15 remains engaged with the lifting arms 14, favours a precise repositioning of the box 15 itself in the same position from which it was picked up.

[0070] Furthermore, since the movement of the lifting arms 14 occurs autonomously and independently from that of the guide frame 7, it is advantageously possible to carry out the entire emptying and repositioning cycle keeping the box 15 oriented in a way suitable to limit the spaces required for the movement of the box 15.

Claims

1. Equipment for emptying bins on a refuse collection vehicle, comprising:

   a guide frame (7);
   a trolley (13) movable along the guide frame (7) and carrying a pair of lifting arms (14) operatively engageable to respective gripping elements (17) carried by respectively opposite side walls of a box (15);
   a support assembly (10) securable to a side (3) of a motor vehicle (2);
   a kinematic group (20) binding the guide frame (7) to the support assembly (10);
   at least one control actuator (30) operating on the kinematic group (20) to move the guide frame (7) between an approached position with respect to said side (3) and a position of maximum distance from said side (3);
   wherein said kinematic group (20) comprises:

      at least support arm (21) having a respective proximal end (21a) rotatably constrained to the support assembly (10) and a distal end (21b) rotatably constrained to an upper end (7a) of the guide frame (7); and
      at least one push arm (23) having a proximal end (23a) rotatably constrained to the support assembly (10), and a distal end (23b) slidably guided along a lower portion (7b) of the guide frame (7), spaced from said upper end (7a);
      at least one strut (28) having a lower end (28b) constrained near the proximal end (23a) of the push arm (23), and an upper end (28a) constrained near the proximal end (21a) of the support arm (21).

2. Equipment according to claim 1, wherein the upper end (7a) of said at least one strut (28) is constrained around an upper hinging axis (X1) close to a constraint axis of the proximal end (21a) of the support arm (21), and the lower end (28b) of said at least one strut (28) is preferably constrained around a lower hinging axis (X2) close to a constraint axis of the proximal end (21a) of the push arm (23).

3. Equipment according to claim 1 or 2, wherein the upper (X1) and lower (X2) hinging axes of the strut (28) are located on opposite sides with respect to a plane containing the constraint axes of the proximal ends (21a, 23a) of the support arm (21) and of the push arm (23).

4. Equipment according to one or more of the preceding claims, wherein said at least one strut (28) has at least one adjustment device (29) for modifying the distance between its upper (28a) and lower (28b) ends.

5. Equipment according to one or more of the preceding claims, wherein the push arm (23) rotatably carries at least one cursor (25) sliding along a sliding guide (26) carried by the guide frame (7).

6. Equipment according to one or more of the preceding claims, wherein said control actuator (30) has a first end (30a) hinged to a fixed point with respect to the support assembly (10), and a second end (30b) hinged with respect to the push arm (23), preferably at a point between the proximal end (23a) and the distal end (23b) of the pushing arm itself.

7. Equipment according to one or more of the preceding claims, wherein said at least one support arm (21) has an arcuate development in a vertical plane.

8. Equipment according to one or more of the preceding claims, wherein a distance (D2) between the attachment points of the proximal (23a) and distal (23b) ends of the push arm (23) is greater than a distance (D1) between attachment points of the proximal (21a) and distal (21b) ends of the support arm (21).

9. Equipment according to one or more of the preceding claims, wherein the support assembly (10) comprises at least one upper articulation bracket (11) and a lower articulation bracket (12), integral with the side (3) of the motor vehicle (2) and protruding externally from it, in which the proximal end (23a) of the push arm (23) is constrained to said at least one lower articulation bracket (12), and wherein the proximal end (21a) of the arm support (21) is constrained to said at least one upper articulation bracket (11).

10. Motor vehicle for the collection of waste, comprising equipment (1) according to one or more of the preceding claims.

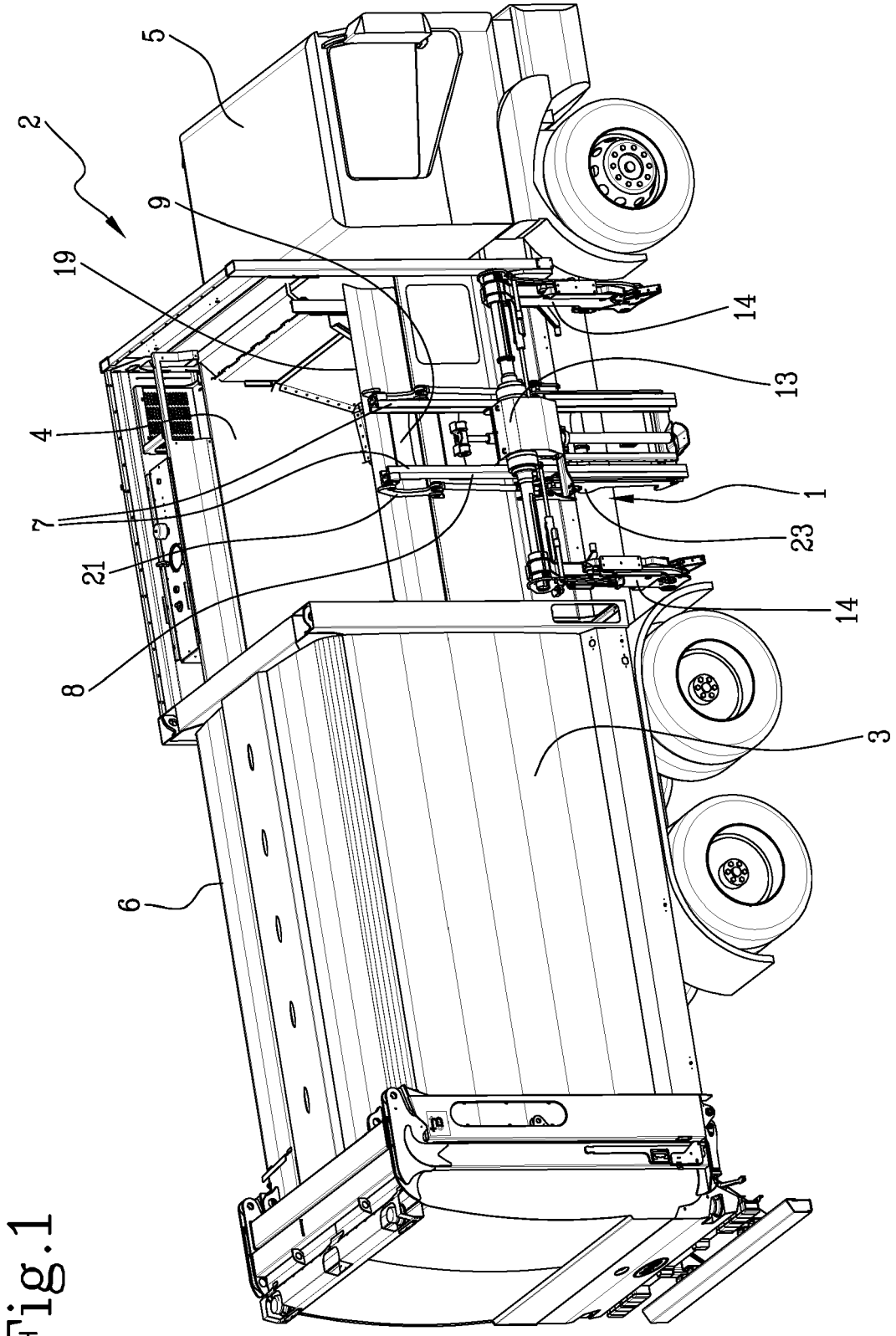

Fig.1

Fig.2

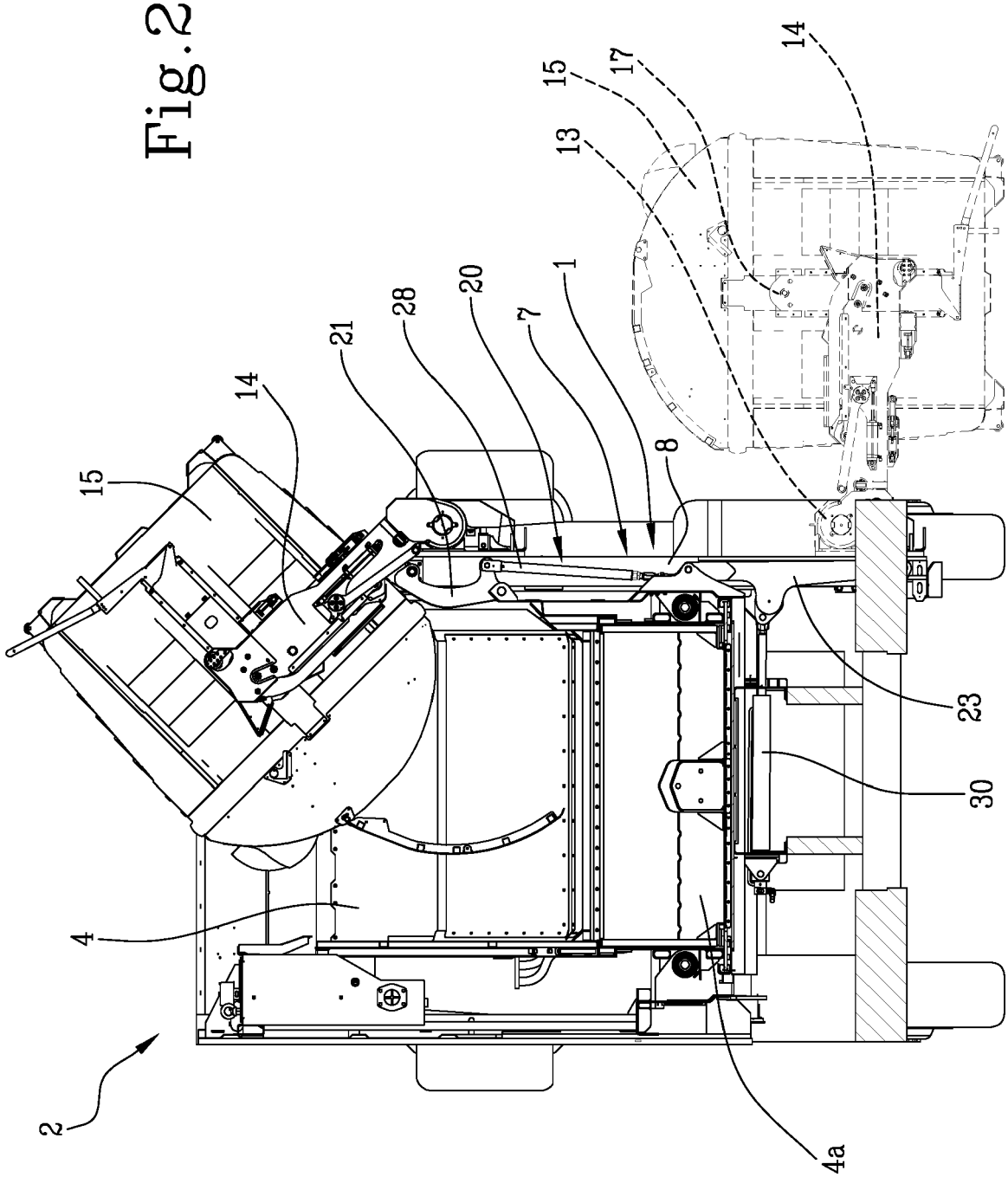

Fig.3

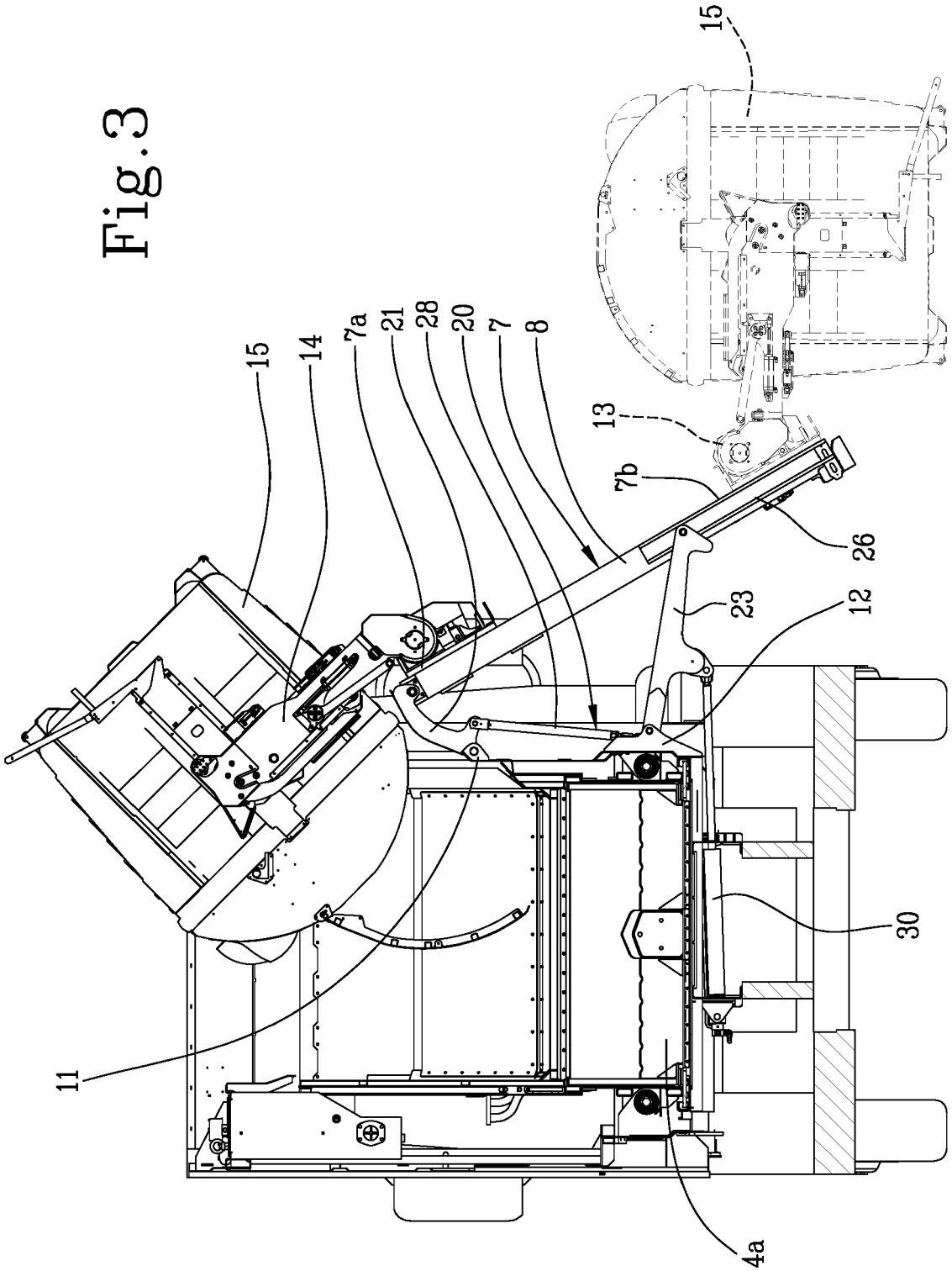

Fig.5

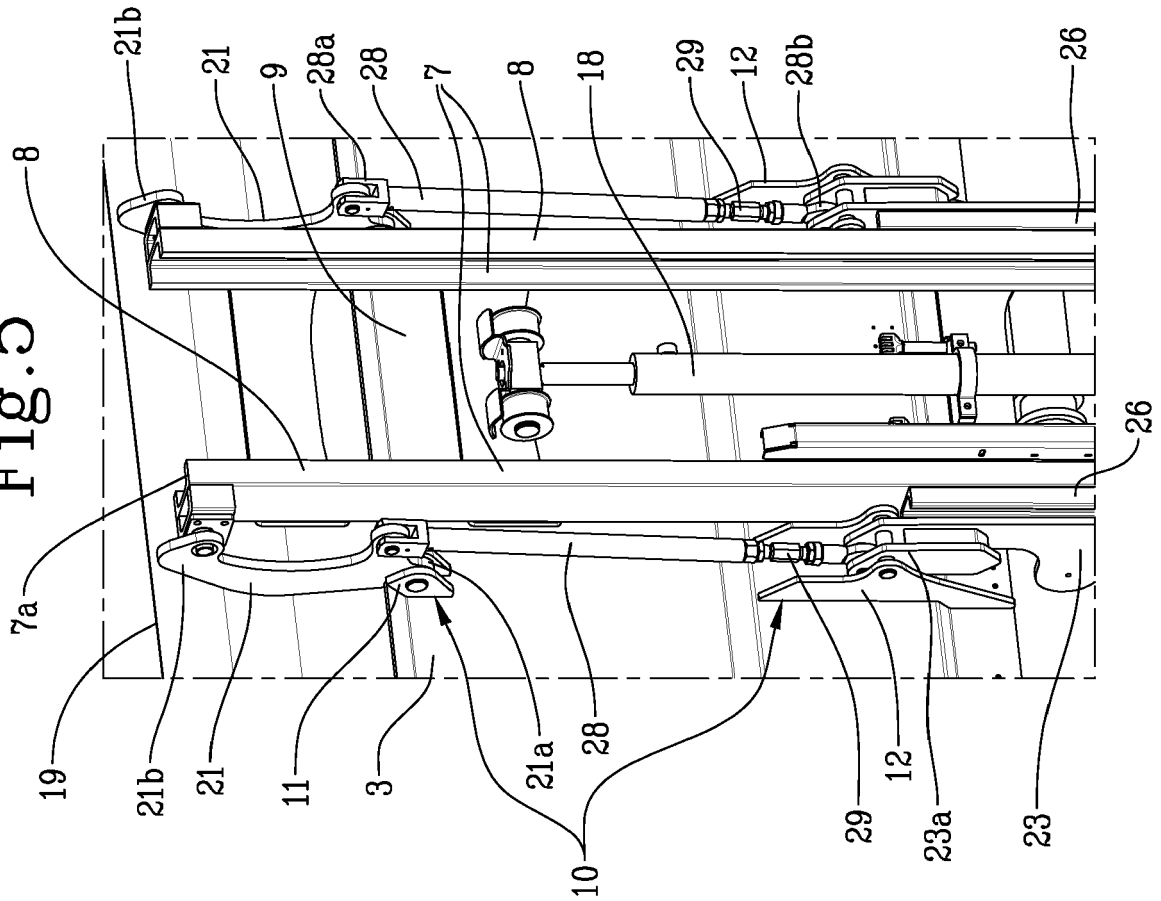
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Fig.4

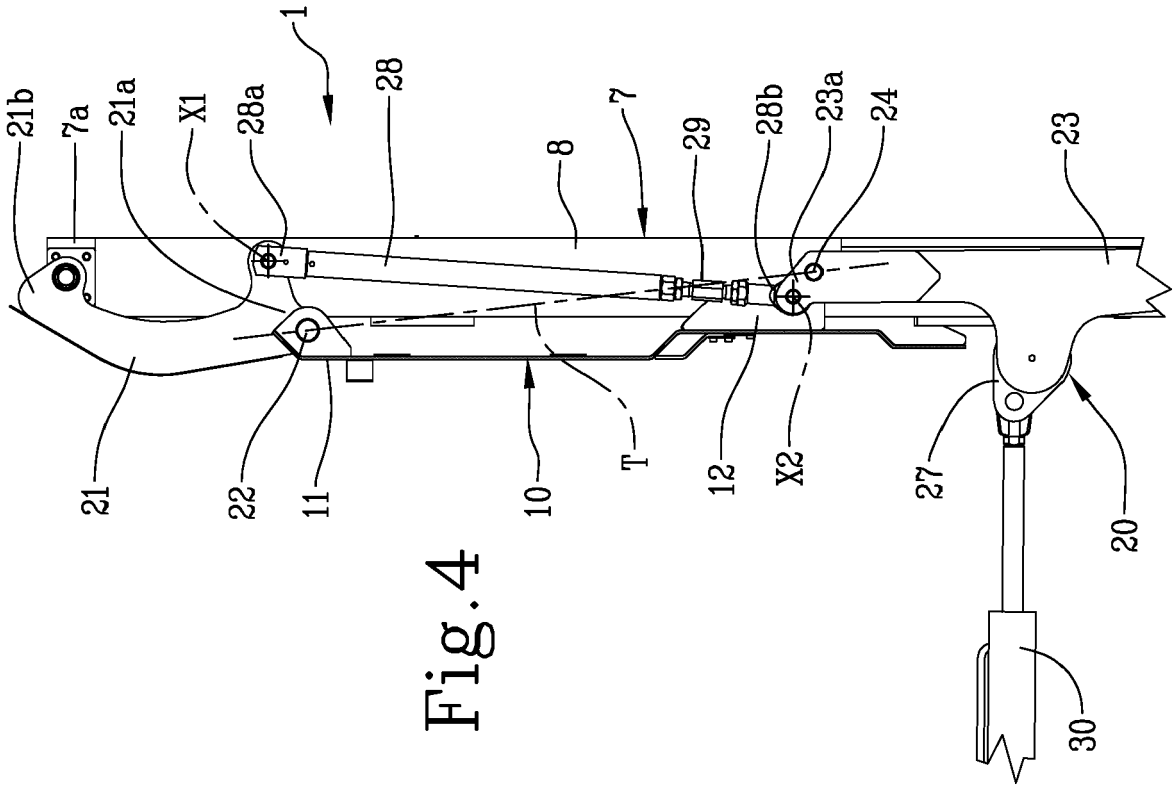
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Fig.6

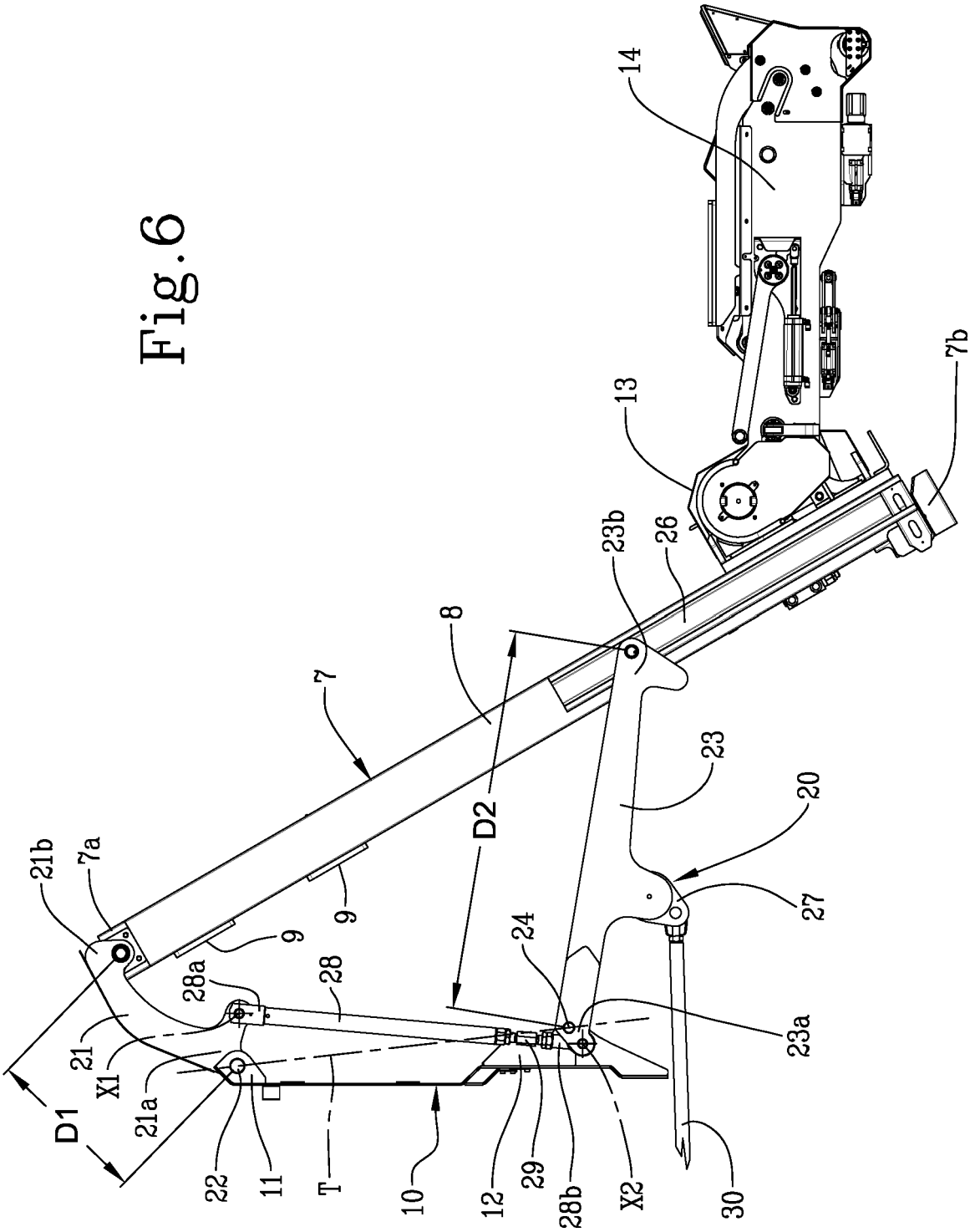
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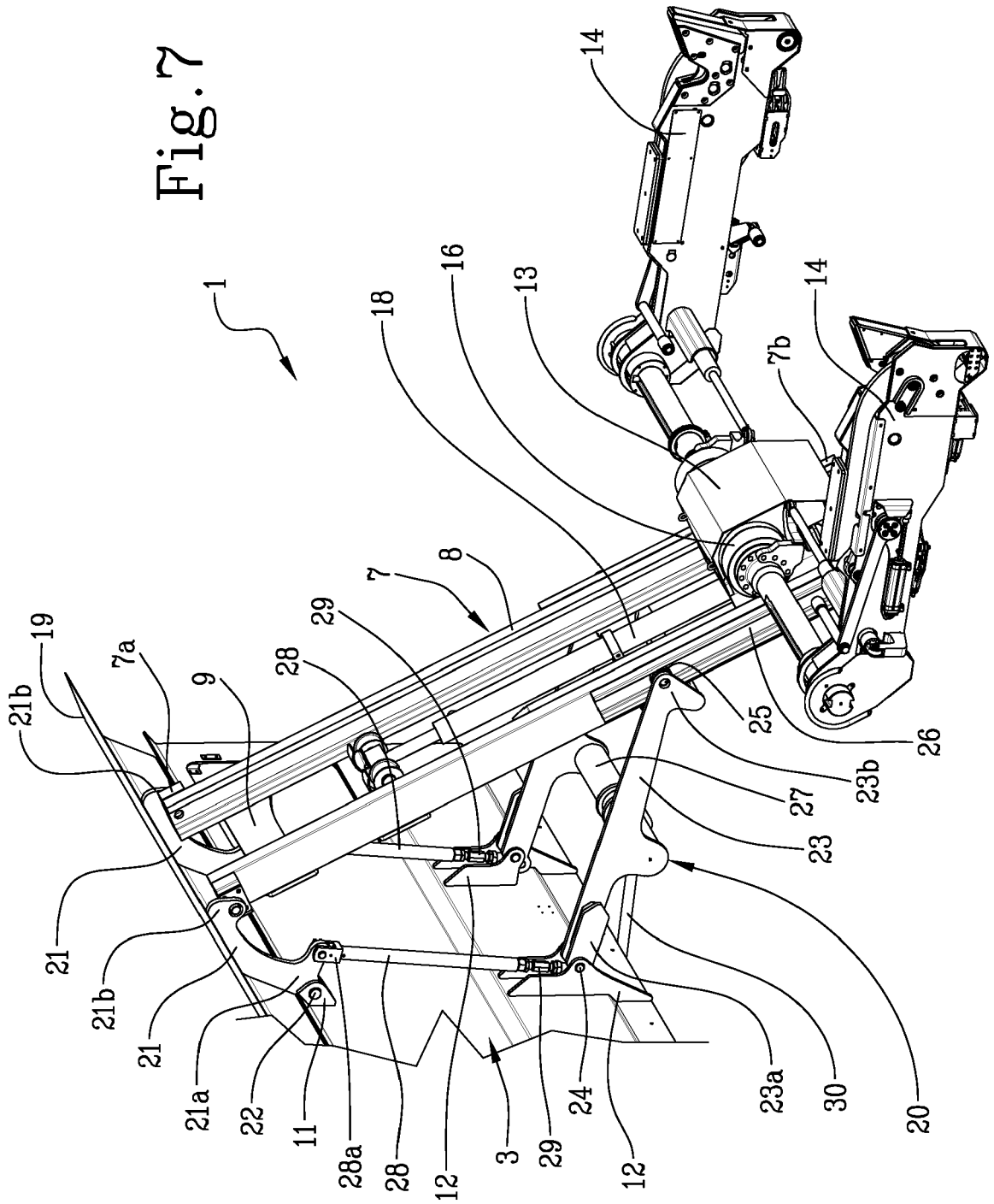
Fig.7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EUROPEAN SEARCH REPORT

Application Number
EP 22 18 9191

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 109 748 015 A (YANTAI HAIDE SPECIAL VEHICLE CO LTD) 14 May 2019 (2019-05-14) * translation provided by the EPO; figure 2 *	1-10	INV. B65F3/04 B65F3/08 B65F3/02
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TECHNICAL FIELDS SEARCHED (IPC)

B65F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 December 2022	de Miscault, Xavier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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REFERENCES CITED IN THE DESCRIPTION

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