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(54) **Lifting mechanism for a loading system for emptying containers**

(57) The invention relates to a lifting mechanism and a loading system (4) for a refuse truck (2). The invention also relates to a refuse truck (2) which is provided here-with and a method herefor. The lifting mechanism comprises:

- two lifting arms (14) mountable on uprights (12) of the loading system;
- a lifting shaft (18) which is placed between the lifting arms (14) and which extends over substantially the whole width of the loading system (4);
- an engaging mechanism (16) attached to the lifting shaft (18) for picking up a container (6); and
- at least two cylinders (46,52) placed on or close to the uprights (12) of the loading system (4) for the purpose of moving the lifting arms (14) mountable on the uprights (12).

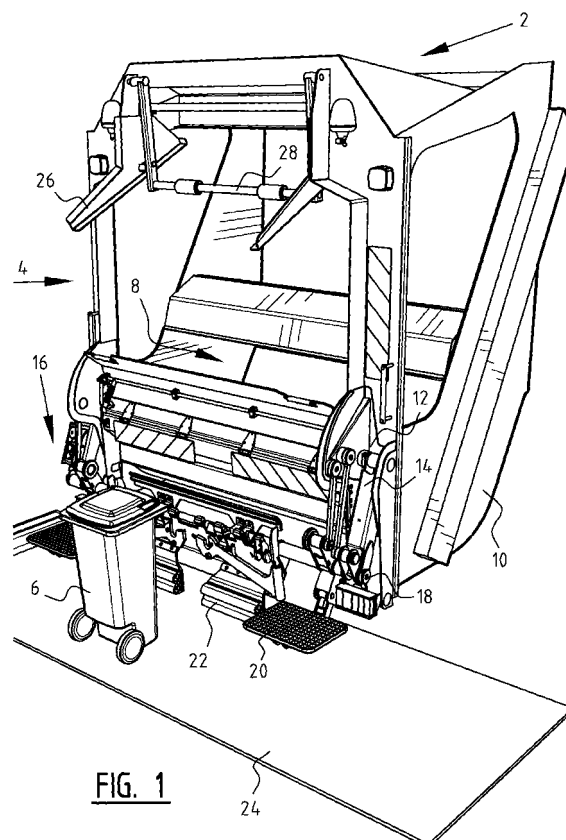


FIG. 1

Description

[0001] The present invention relates to a lifting mechanism for a loading system for the purpose of emptying containers. There are many types and dimensions of container. The lifting mechanism according to the invention is particularly suitable for containers with a volume varying from 70 to about 1,700 litres.

[0002] Containers such as refuse bins are usually emptied at the user location using a refuse truck. Such refuse trucks are provided at the rear with a loading system. This loading system comprises a lifting mechanism for engaging a container and picking up and rotating this container such that it is emptied into the refuse truck. The engaging mechanism of such a lifting mechanism can be provided with a comb or toothed edge which engages under an edge of the container. This edge is clamped on the other side by a plate. The lifting movement is realized by making use of cylinders. These cylinders are mounted at a first outer end on an additional lifting frame and at a second outer end on a lifting arm. A certain overall depth is required for the lifting mechanism with the additional lifting frame. This depth lengthens the refuse truck or reduces the loading capacity thereof. Since the lifting mechanism is situated at the rear of a refuse truck, i.e. behind the rear(most) axle thereof, the pressure on the front axle of the refuse truck is reduced due to the lifting mechanism. This front axle hereby tends to move upward such that in an extreme case the wheels of a refuse truck can leave the ground. The result hereof is that the loading capacity of a refuse truck is limited in order to prevent this. This therefore reduces the loading capacity of the refuse truck.

[0003] The present invention has for its object to provide a lifting mechanism for a loading system with which goods such as refuse can be collected in a more efficient manner.

[0004] This object is achieved with a lifting mechanism for a loading system for the purpose of emptying containers, comprising:

- two lifting arms mountable on uprights of the loading system;
- a lifting shaft which is placed between the lifting arms and which extends over substantially the whole width of the loading system;
- an engaging mechanism attached to the lifting shaft for picking up a container; and
- at least two cylinders placed on or close to the uprights of the loading system for the purpose of moving the lifting arms mountable on the uprights.

[0005] By providing the cylinders directly on or close to the uprights of the loading system it is possible to substantially dispense with an additional lifting frame on which these cylinders have to be mounted. By dispensing with this frame the mass of the overall lifting mechanism, and thereby the whole loading system, is reduced. This

achieves that a greater loading capacity of the refuse truck is realized. By reducing the mass behind the rear-most axle of a refuse truck as a result of dispensing with this frame, more load can instead be placed in the space behind this axle without the pressure on the front axle of the refuse truck falling below the limit value. In addition, placing of the cylinders preferably directly on or at least in the immediate vicinity of the uprights of the loading system achieves that the lifting shaft extends over substantially the whole width of the loading system. This is realized in that the uprights of the loading system are placed substantially in the line of the sides of a refuse truck. A loading system is hereby provided over the whole width of the refuse truck. Through placing of the cylinders on the uprights of the loading system, which are thus situated substantially in line with the side of the refuse truck, the lifting shaft can extend over substantially the whole width of the refuse truck. This achieves that a maximum opening is obtained in which containers can be emptied using the lifting mechanism according to the invention. An additional advantage of the lifting mechanism according to the present invention is that, by dispensing with the additional lifting frame, the opening for emptying of the containers is greater in vertical direction. One significance hereof is that the containers have to be lifted less high with the lifting mechanism. An additional advantage hereof is that refuse bags can also be placed more easily in the opening since they need lifting or throwing less high in order to be deposited in the refuse truck. It is also the case that due to the lifting mechanism according to the invention such refuse bags have to be thrown less far owing to the smaller overall depth which is realized by the lifting mechanism according to the invention. An additional advantage of the lifting mechanism according to the present invention is that a container for emptying is tilted inward at a comparatively high position relative to other known mechanisms. The enlarged loading opening provided with the lifting mechanism according to the invention is hereby utilized optimally. A refuse slide-off plate provided in or on the lifting mechanism can advantageously be opened, thereby realizing a low and also wide insertion opening. This increases the user-friendliness and efficiency of the lifting mechanism according to invention.

[0006] In a preferred embodiment according to the present invention the at least two cylinders are operatively connected in a master-slave configuration for the purpose of preventing torsional forces.

[0007] By providing the cylinders preferably directly on an upright, or at least in the vicinity thereof, of the loading system a greater moment effect will be exerted on the lifting mechanism during lifting of a container compared to a known loading system in which the cylinder is situated very closely to the container for lifting and is mounted on the lifting frame. The lifting shaft in the lifting mechanism according to the invention is therefore under relatively great strain of torsion and of bending. Providing the cylinders in a master-slave configuration prevents the

lifting shaft as it were becoming asymmetrically suspended and the container for emptying not remaining sufficiently horizontal. This achieves that the lifting mechanism does not need to be given an unnecessarily stiff form. One of the advantages of such a master-slave configuration is that the lifting shaft can be given a relatively light form. This reduction in weight can then be utilized for a greater loading capacity as described above. By connecting the hydraulic drive cylinders in series in a master-slave configuration, and herein selecting the volume dimensions such that the desired ratio is achieved, the cylinders move substantially synchronously. This prevents the lifting shaft and/or the lifting mechanism twisting and/or bending. Compared to other systems, such as hydraulic synchronizing valves or electronic synchronizing controls, the master-slave configuration has the advantage that it can be embodied more cheaply and is less susceptible to malfunction. It is additionally the case that during performing of a lifting movement the outer end of the cylinders will be fully extended, whereby both cylinders, for instance in the case of a leakage or fouling, can be placed in synchronized position (reset) in the unlikely event a deviation occurs.

[0008] In a further advantageous preferred embodiment according to the invention the at least two cylinders are operatively connected to a valve with which the lifting mechanism can be placed a greater distance from a ground surface for the purpose of protection thereof in the case of obstacles and/or a road surface.

[0009] Owing to the provision of additional valves the cylinders can be moved such that a great distance can be realized between these cylinders and the ground surface. This is realized in that, in the case an obstacle exerts a determined force, the hydraulic pressure in the cylinders will rise. The additional valve is then opened so that the lifting mechanism moves upward without damage occurring to the system. It is possible here to have the valves, which provide for a correction in the case of a possibly occurring synchronization difference between two cylinders, likewise perform this protective function. This is particularly advantageous in the case obstacles such as a kerb or speed bumps are provided on or in the ground surface. Damage to the cylinders and the mechanism can hereby be prevented or reduced. In addition, this also reduces the risk of something or someone being caught between the lifting mechanism with the cylinders and the ground surface. The use of the valves according to the invention hereby increases the safety of the mechanism and also reduces maintenance costs resulting from damage. This safety mechanism can otherwise be combined in advantageous manner with a plastic part which can be arranged on the underside of the loading seats. This part can deform in the case it comes into contact with an obstacle such as a speed bump. Particularly in the case of small obstacles the safety mechanism with the additional valves need hereby not be activated, while damage is nevertheless prevented.

[0010] For safety purposes one or more springs are

preferably provided on or close to the lifting shaft in order to protect the lifting mechanism. While the lifting mechanism tilts or rotates a container, this latter exerts a force on, among other parts, the lifting shaft. Partly depending on the mass in such a container, this load may be not inconsiderable. The springs are therefore provided to damp this peak load. Other spring members and/or damping members can be provided instead of these springs.

[0011] A cover or refuse slide-off plate rotatable relative to the engaging mechanism is preferably also provided for the purpose of covering the engaging mechanism. This cover is rotatable and covers the comb or teeth of the engaging mechanism. This increases the safety of the lifting mechanism. An additional advantage hereby is that, when refuse bags are for instance being placed in the refuse truck, they cannot hook behind a comb. This prevents the possibility of these bags tearing and the content thereof ending up in the wrong place. It is also a possibility to provide the cylinders with a length measuring system for the purpose of determining the position of the lifting mechanism. This increases the controllability of the whole lifting mechanism, which further enhances the safety of the system.

[0012] The invention further relates to a loading system provided with a lifting construction as described above. Such a loading system provides the same effects and advantages as those stated in respect of the lifting mechanism.

[0013] In an advantageous preferred embodiment according to the present invention the loading system is provided with a weighing system for weighing a container to be emptied.

[0014] Providing a weighing system achieves that the content of an individual container can be measured. The overall load on the system can for instance hereby be monitored. It is also possible to track how much a user discards by means of the container. Such a container can be provided for this purpose with an identification, for instance in the form of an RFID chip, which is read during the operation. This weighing system can be used manually, semi-automatically or fully automatically. This is also the case for the loading system itself.

[0015] In a further preferred embodiment according to the present invention the loading system comprises a guide for opening a lid of a container.

[0016] By providing the loading system with a guide at the correct position a lid of a container to be emptied can be opened in automatic manner. This is important in the case of, among others, so-called EN-840 type containers. This reduces the manual operations which have to be performed, whereby the containers can be emptied in more efficient manner.

[0017] In a further advantageous preferred embodiment according to the present invention a loading system comprises a stop member for stopping a container during emptying thereof.

[0018] Placing a stop member in the form of a rod in

width direction in the loading opening of for instance the refuse truck prevents the container being as it were catapulted into the interior of for instance the refuse truck during the lifting movement, and particularly the rotation of the container during this movement. This catapulting movement of the container causes damage to the interior of for instance the refuse truck. The stop member will in that case stop the container for emptying and prevents the container disappearing, with its possible content, into for instance the refuse truck.

[0019] The invention also relates to a refuse truck provided with a loading system as described above, and to a method for emptying a container, comprising of:

- engaging a container to be emptied using a loading system as described above;
- emptying a container with the loading system; and
- setting down the emptied container.

[0020] The same effects and advantages are hereby realized as stated in respect of the lifting mechanism and the loading system.

[0021] Further advantages, features and details of the invention are elucidated on the basis of preferred embodiments thereof, wherein reference is made to the accompanying drawings, in which:

- Figure 1 shows a rear view of a refuse truck with loading system according to the invention;
- Figure 2 shows a view of the loading system of figure 1;
- Figure 3 shows a detail of the outer end of the lifting shaft;
- Figure 4 shows a view of the mounting of the clamping plate on the lifting shaft;
- Figure 5 shows a detail of figure 4 without resilient elements;
- Figure 6 shows of view of the engaging mechanism;
- Figures 7A and B show tilting of a container in the loading system of figure 1; and
- Figure 8 shows a schematic representation of the coaxing cylinders for the lifting arms.

[0022] A refuse collection truck 2 (figure 1) provided with a loading system 4 is used to empty containers 6. Containers 6 are, among others, containers of the type EN 840-1, -2, -3 and -4 with respective volumes of 80-360 litres, 500-1200 litres, 770, 1100 and 1300 litres, and 750-1700 litres. In addition, it is also possible using loading system 4 to place refuse bags in refuse truck 2. Refuse truck 2 is provided for this purpose with a large loading opening 8. This loading opening 8 is bounded on the sides by side walls 10 of refuse truck 2. Loading system 4 is provided for this purpose with the same width as refuse truck 2, whereby uprights 12 of loading system 4 are situated substantially in line with side wall 10 of refuse truck 2. Mounted on uprights 12 are lifting arms 14 with which engaging mechanism 16 can be moved

for the purpose of lifting a container 6. When a container 6 is emptied, engaging mechanism 16 makes a pivoting movement with lifting shaft 18, wherein container 6 is carried upside down into loading opening 8. Refuse truck 2 is provided with two footboards 20 on which for instance a dustman can take up position during movement of refuse truck 2. Refuse truck 2 is also provided with two rubber buffers 22 on which a container 6 rests during the pivoting movement. These cushions 22, with the plate on which they are mounted, are also embodied such that they can yield to some extent when they come into contact with obstacles on ground surface 24. Loading system 4 is also provided with two guides 26 attached to the top part of loading system 4. The lid of a container can be pushed open with these guides 26 during the pivoting movement such that the content of container 6 disappears into loading opening 8. Likewise arranged on the top part of loading system 4 is a stop member 28, substantially along the whole width of the loading opening 8. This stop member 28 prevents container 6 continuing to rotate during the pivoting movement. In the case of such a continued rotation container 6 would, without stop member 28, disappear completely into loading opening 8, and thereby into the interior of refuse truck 2.

[0023] Engaging mechanism 16 (figure 2) engages using a comb 30 under the edge of container 6. During lifting of container 6 with comb 30 the clamping plate or enclosing plate 32 closes, whereby the container edge is clamped between comb 30 and clamping plate 32. Container 6 cannot detach from comb 32 due to clamping plate 32. Lifting shaft 18 extends along the whole width of loading opening 8, and therefore over the whole width of refuse truck 2. Lifting shaft 18 is connected at an outer end to an outer end 34 (figure 3) of lifting arm 14. Lifting shaft 18 is provided at the outer end with an end stop 36. Clamping plate 32 is mechanically connected close to a first outer end with two fixing brackets 38 (figure 4) to lifting shaft 18. Situated in this bracket 38 is a spring element 40 so that shocks can be partially absorbed without the whole lifting shaft 18 having to be unnecessarily heavily loaded. The resilient elements 40 ensure that container 6 and loading system 4 are not damaged if an obstacle, such as wood, refuse etc., comes between them. Resilient elements 40 also make it possible for container 6 to be shaken without the container edge being unnecessarily heavily loaded. Container 6 herein continues to rotate in the tilting movement and is braked by the resilient action of resilient elements 40. Lifting shaft 18 is provided with a number of contact surfaces 42 (figure 5) to which resilient elements 40 are connected. Lifting arm 14 (figure 2) is mounted at a first outer end on upright 12 via shaft 44. Lifting shaft 18 is mounted on the other outer end of lifting arm 14. The pivoting movement of lifting arm 14 is realized using a first cylinder 46. Cylinder 46 is mounted at one outer end for rotation around shaft 48 and connected on the other extendable part to lifting arm 14 via shaft 50. When first cylinder 46 is extended lifting arm 14 will make a pivoting movement, whereby it

is possible to empty a container 6. Provided on the other side of loading system 4 is a second cylinder 52 which is mounted in the same manner on lifting arm 14 on this side of loading system 4.

[0024] Engaging mechanism 16 (figure 6) has a cover or refuse slide-off plate 54 which in a rest position lies over clamping plate 32 and comb 30 such that these are covered. This increases safety. It is likewise possible to place refuse bags in loading opening 8 of refuse truck 2 when cover 54 is closed. Mechanism 56 controls the relative movements of comb 30 and clamping plate 32 in a per se known manner. This relative movement between comb 30 and clamping plate 32 (figures 7A and 7B) takes place during the pivoting movement of container 6.

[0025] The configuration of first cylinder 46 and second cylinder 52 (figure 8) is shown schematically. These cylinders 46, 52 are not placed in the loading system according to the invention at the location of the greatest load resulting from the pivoting movement with containers 6. Cylinders 46, 52 are on the contrary placed at the outer end of lifting shaft 18, substantially in line with side wall 10 of refuse truck 2. Although the lifting shaft is in principle under greater strain of torsion and bending as a result, the hydraulic drive cylinders 46, 52 according to the invention are connected in series. By correctly selecting the volume dimensions of cylinders 46, 52 in known manner cylinders 46, 52 always move synchronously. Torsion of the frame, and bending thereof, are hereby prevented. Using this relatively inexpensive configuration a robust system is obtained compared to known drive systems for loading systems 4 of refuse trucks 2. Using the master-slave configuration with first cylinder 46 as master and second cylinder 52 as slave, the movement of these cylinders 46, 52 are controlled using valve 58. The hydraulic fluid is transported through conduits 60 to and from cylinders 46, 52 by means of this valve 58. The desired pivoting movement of loading system 4 can hereby be realized in synchronous manner. Valve 58 can be operated manually as well as electrically via a central control. First cylinder 46 is also provided with a valve 62. Second cylinder 52 is also provided with a valve 64. Valves 62, 64 are operated mechanically when cylinders are fully retracted or extended. In the unlikely event of a synchronization difference a correction can be made by means of valves 62, 64. By means of pressure-relief valve 66 the loading system or beam lift 4 can move upward as soon as it makes contact with an obstacle in ground surface 24 in order to prevent damage to loading system 4. Valve 66 limits the downward force of the lifting mechanism. Valve 68 limits the lifting force and can be operated electrically by a central control. Hydraulic pump 70 is mounted on refuse truck 2. The oil is in communication with a central reservoir 72 mounted on refuse truck 2. The shut-off valve 74 ensures that the mechanism does not descend in the case of insufficient pump pressure, and also serves as safety in the case of a broken conduit.

[0026] The present invention is by no means limited to

the above described preferred embodiment. The rights sought are defined by the following claims, within the scope of which many modifications can be envisaged.

Claims

1. Lifting mechanism for a loading system for the purpose of emptying containers, comprising:
 - two lifting arms mountable on uprights of the loading system;
 - a lifting shaft which is placed between the lifting arms and which extends over substantially the whole width of the loading system;
 - an engaging mechanism attached to the lifting shaft for picking up a container; and
 - at least two cylinders placed on or close to the uprights of the loading system for the purpose of moving the lifting arms mountable on the uprights.
2. Lifting mechanism as claimed in claim 1, wherein the at least two cylinders are operatively connected in a master-slave configuration.
3. Lifting mechanism as claimed in claim 1 or 2, wherein the at least two cylinders are operatively connected to a valve such that the cylinders can be placed a greater distance from a ground surface for the purpose of protecting the cylinders in the case of obstacles and/or a road surface.
4. Lifting mechanism as claimed in claim 1, 2 or 3, wherein one or more springs are provided on or close to the lifting shaft in order to protect the lifting mechanism.
5. Lifting mechanism as claimed in one or more of the claims 1-4, wherein a cover rotatable relative to the engaging mechanism is provided on the lifting shaft for the purpose of covering the engaging mechanism.
6. Loading system provided with a lifting mechanism as claimed in one or more of the claims 1-5.
7. Loading system as claimed in claim 6, further comprising a weighing system for weighing a container to be emptied.
8. Loading system as claimed in claim 6 or 7, further comprising a guide for opening a lid of a container to be emptied.
9. Loading system as claimed in claim 6, 7 or 8, further comprising a stop member for stopping a container during emptying thereof.

10. Refuse truck provided with a loading system as claimed in one or more of the claims 6-9.

11. Method for emptying a container, comprising of:

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- engaging a container to be emptied using a loading system as claimed in one or more of the claims 6-9.

- emptying the container with the loading system; and

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- setting down the emptied container.

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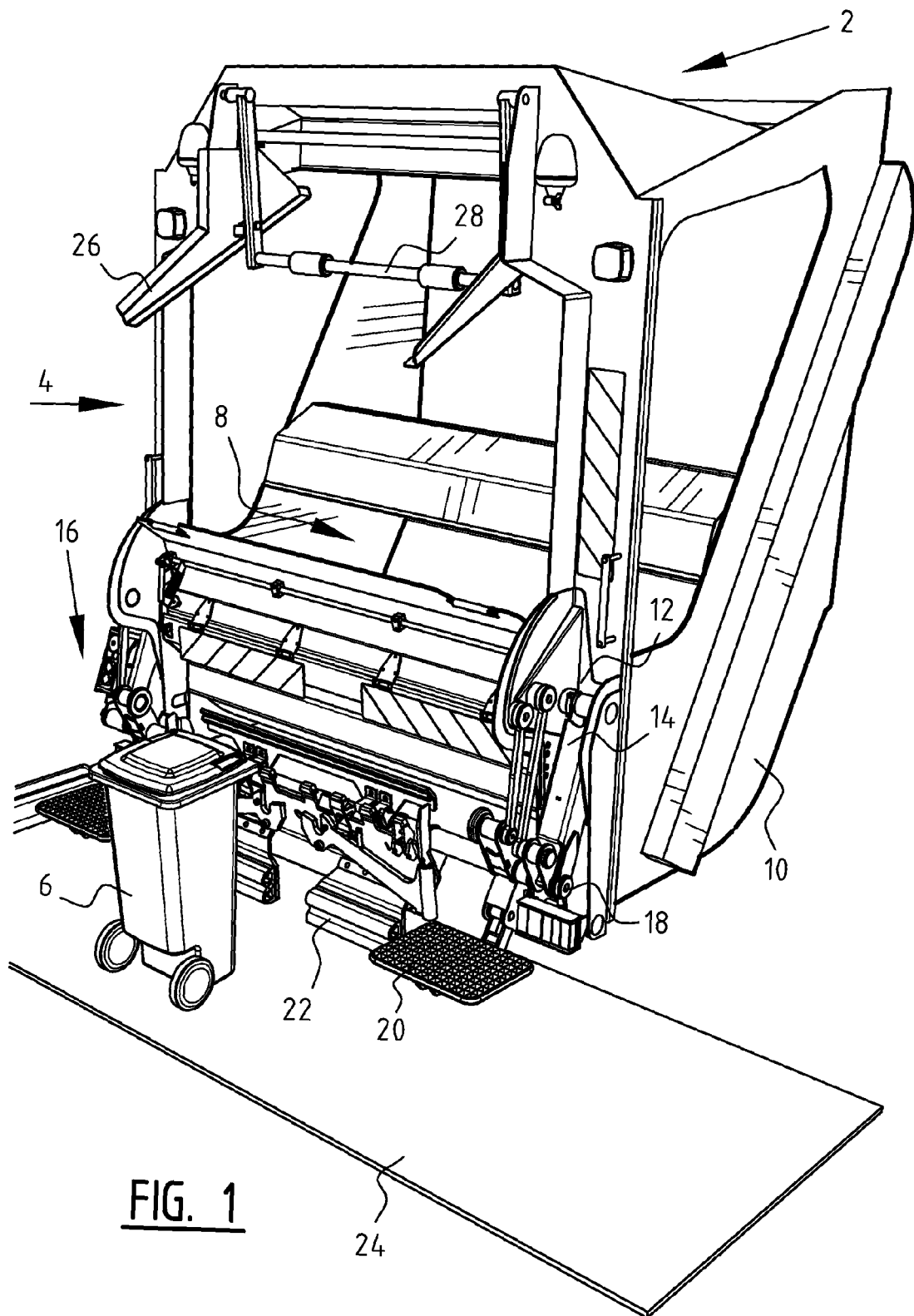
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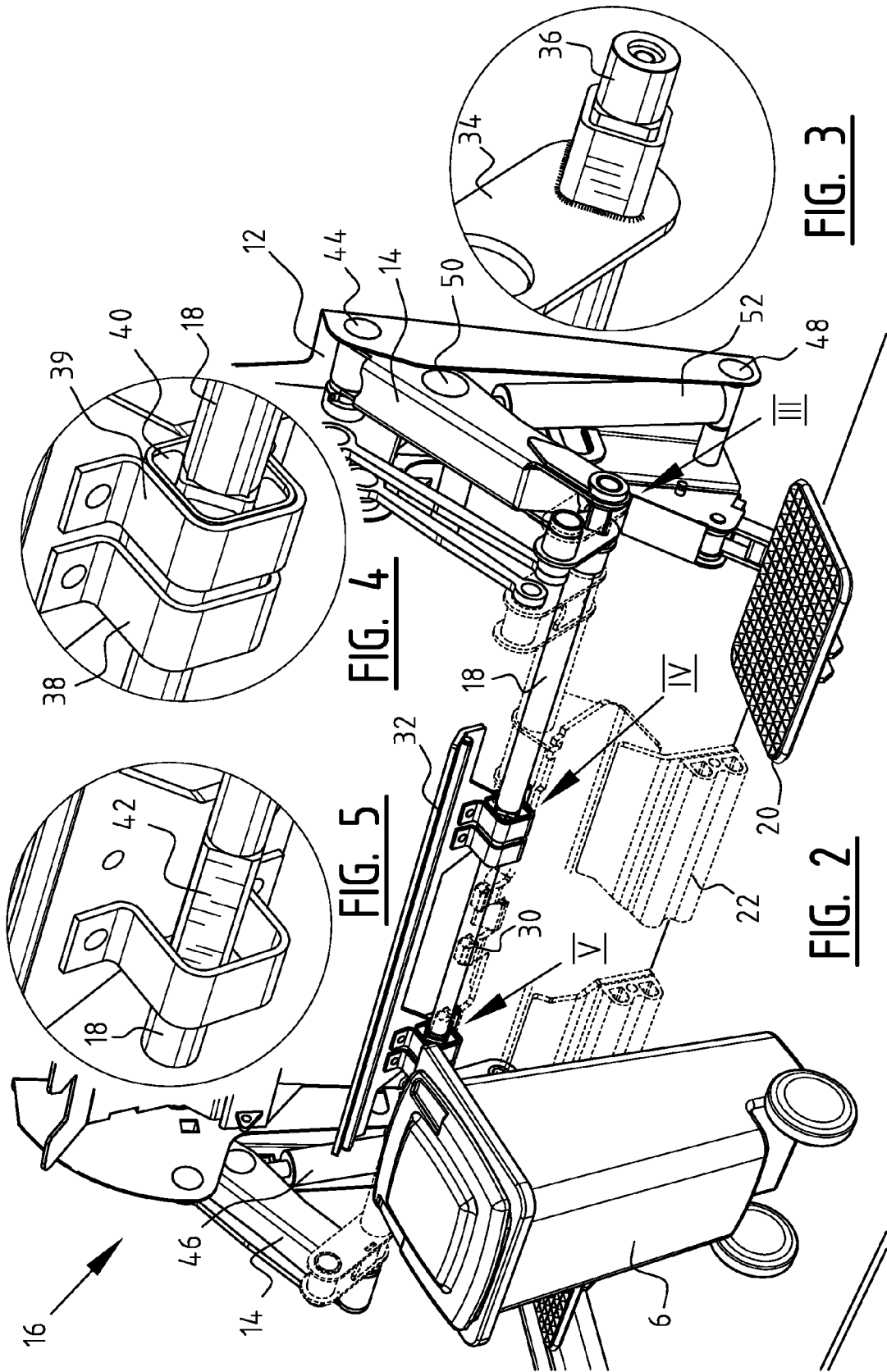
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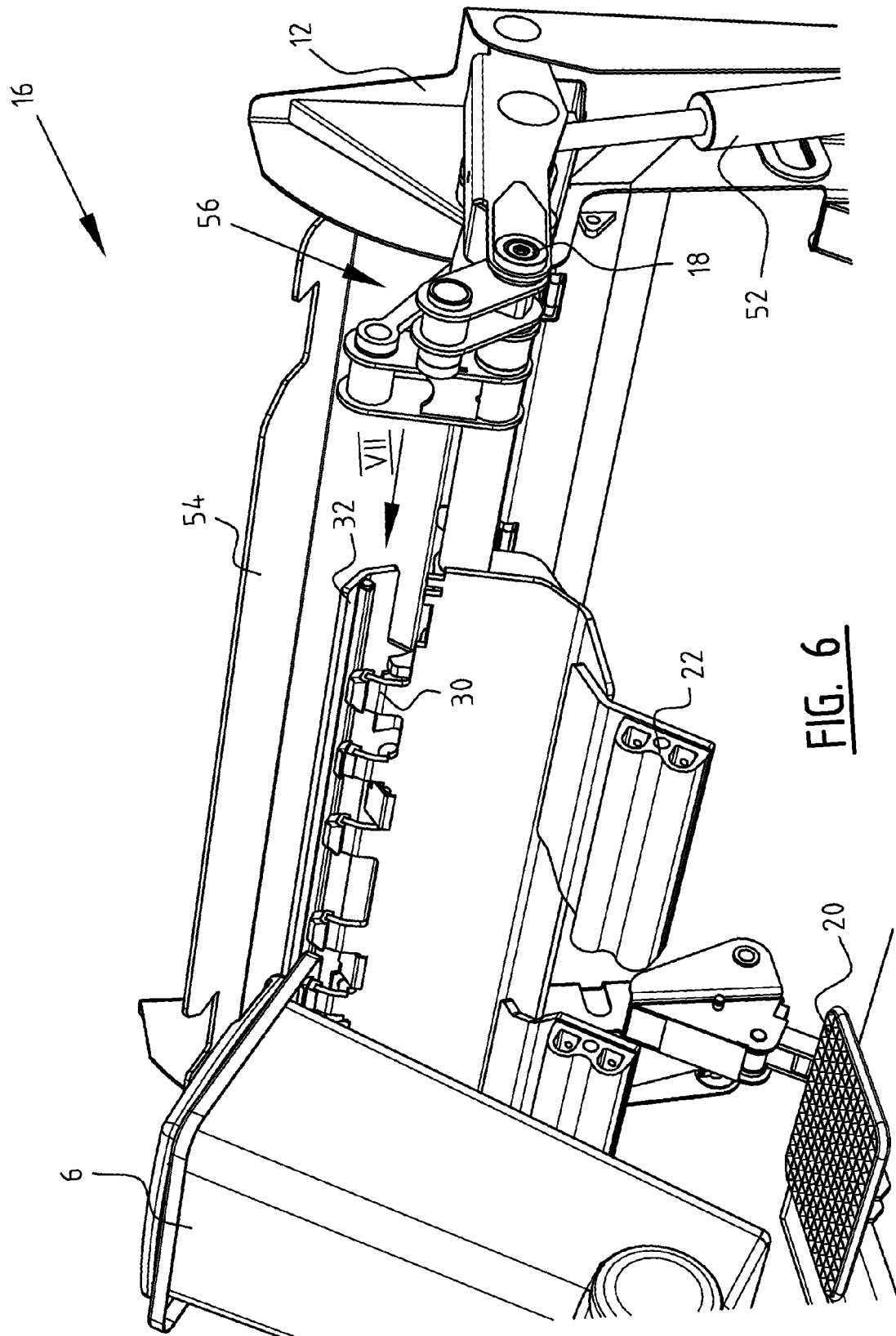


FIG. 6

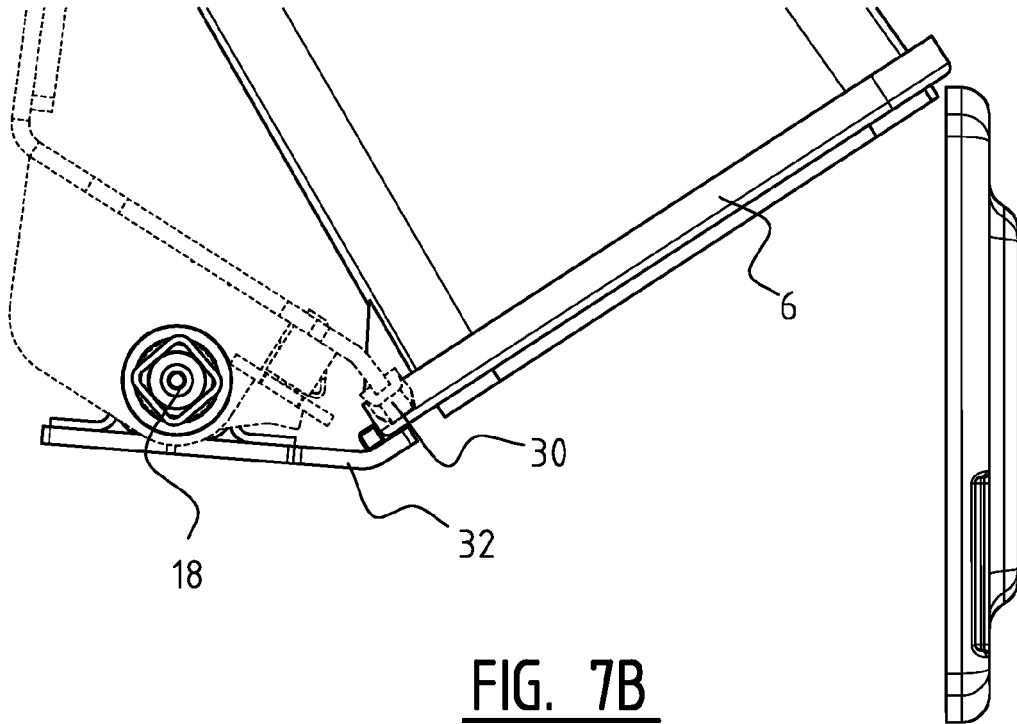


FIG. 7B

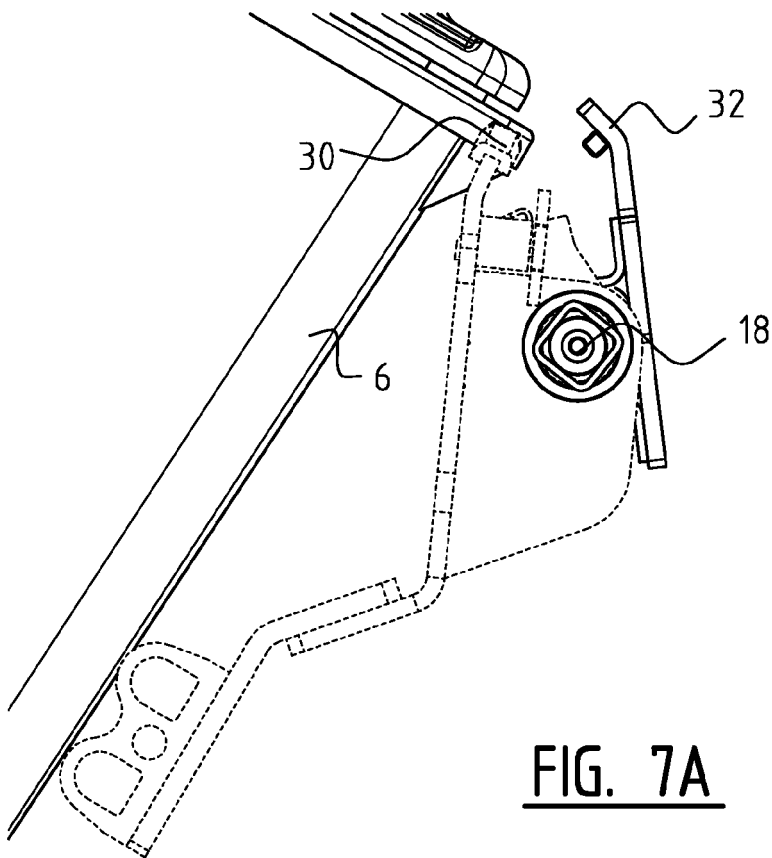


FIG. 7A

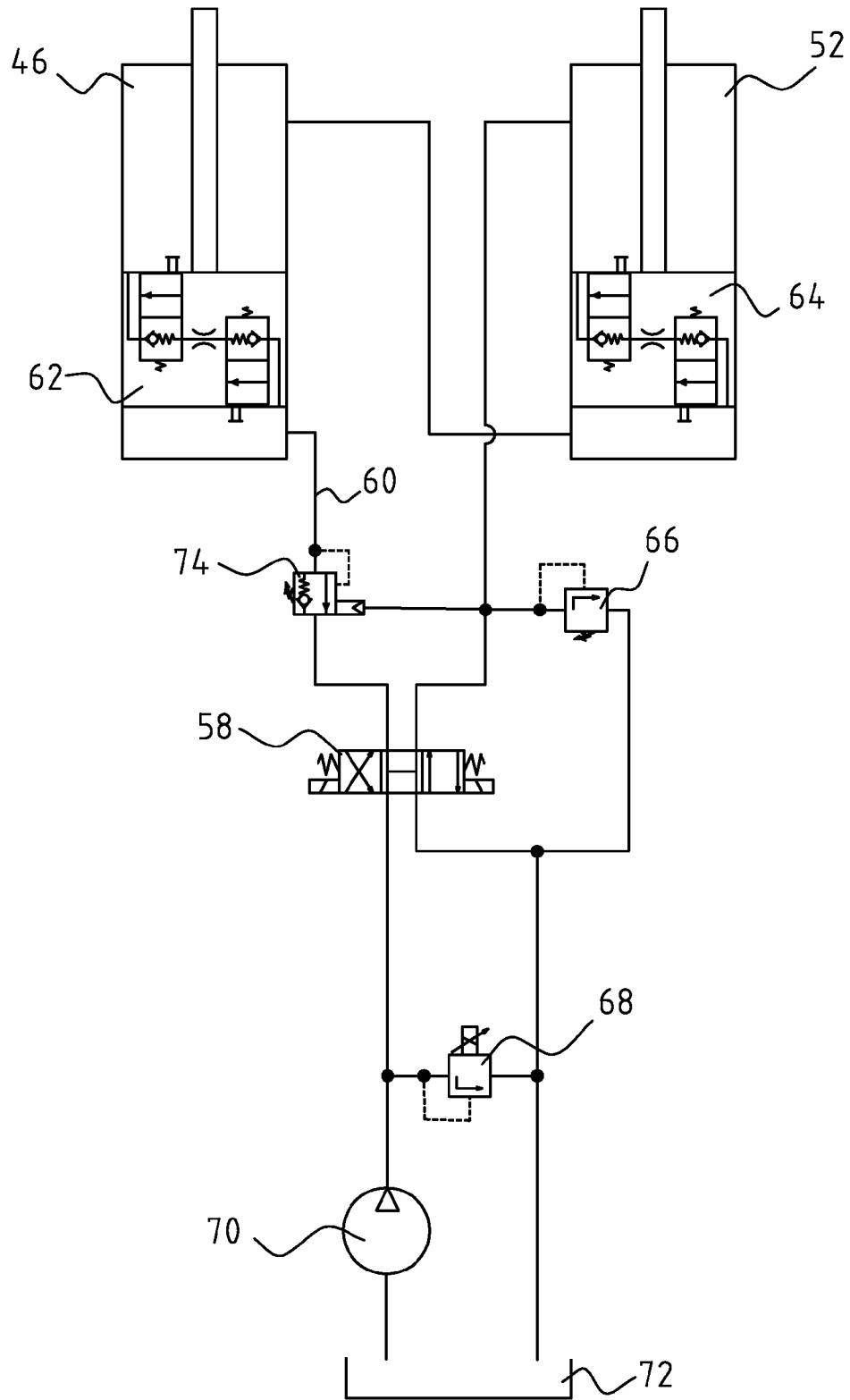


FIG. 8



EUROPEAN SEARCH REPORT

Application Number
EP 09 16 2192

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search The Hague		Date of completion of the search 21 August 2009	Examiner Smolders, Rob
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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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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