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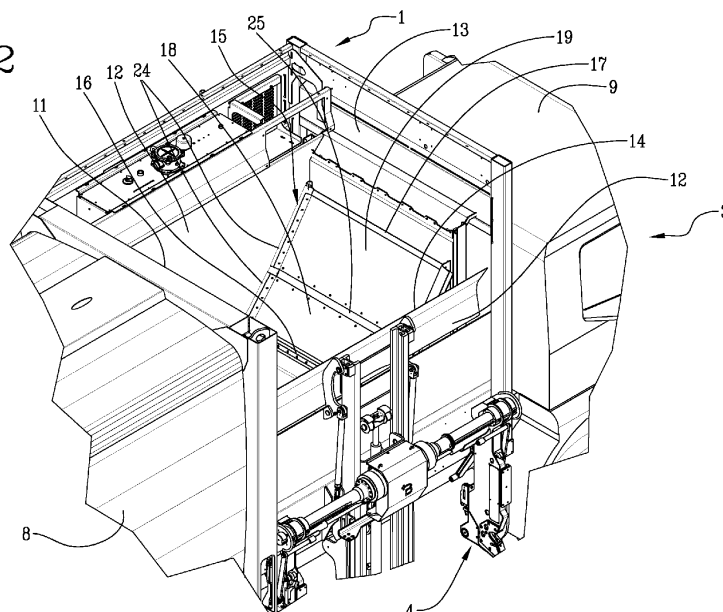
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(54) **LOADING HOPPER FOR COMPACTION EQUIPMENT OF REFUSE COLLECTION VEHICLES, AND METHOD FOR CONVEYING FEASIBLE WITH SAID HOPPER**

(57) A loading hopper for compaction equipment of refuse collection vehicles, comprising: containment walls (11, 12, 13) extending from an edge of the upper end (1a) of the loading hopper (1) towards a loading chamber (6) arranged below; and a conveying chute (15) having a lower end edge (16) confluent to the loading chamber (6) and an upper end edge (17) facing the edge of the upper end (1a) of the loading hopper (1). The conveying

chute (15) is selectively configurable between a first operating condition in which it extends obliquely, and a second operating condition in which it extends along a broken line having a lower section extending from the lower end edge (16) and an upper section carrying the upper end edge (17) and rising according to an angled orientation on the continuation of the lower section.

Fig.2



Description

[0001] The present invention relates to a loading hopper for compaction equipment of refuse collection vehicles, and a conveying method feasible with said hopper. The invention further relates to compaction equipment equipped with said hopper, as well as a refuse collection motor vehicle, equipped with the aforesaid equipment.

[0002] As is known, one of the common methods for actuating refuse collection in urban areas is that the refuse 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.

[0003] 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.

[0004] The loading hopper has a conveying chute therein which flows according to an appropriately inclined trend towards a loading chamber arranged below, in which the refuse poured inside the hopper is conveyed by gravity. At the loading chamber, a transfer unit operates on the action of which the refuse conveyed in the loading hopper is progressively transferred to the storage compartment of a containment bin.

[0005] The market demand is oriented towards solutions which allow to minimize the height reached by the bin in the emptying step, to minimize the impediments created by any branches of trees, balconies, power lines or other suspended obstacles on the usability of the equipment. At the same time, the loading hopper must be as compact as possible, in order to increase the availability of space in favour of the internal capacity of the bin.

[0006] To meet these demands, the current equipment is usually designed so as to at least partially introduce the bin inside the hopper, so as to limit the height thereof during the emptying step. However, this is not easy to implement with all types of bins. For example, there are bins with rather bulky lids which, when opened due to the overturning, would tend to hit the internal parts of the hopper, and in particular the higher parts of the conveying chute, with consequent damage to the mechanical parts and/or incomplete disposal of the refuse from the bin.

[0007] In these circumstances it is necessary to bring the bin to a higher height during the overturning, with the consequent risk of impacting against suspended obstacles, or increase the internal volume of the hopper, penalizing the internal capacity of the bin.

[0008] The object of the present invention is to overcome the limits of the prior art, creating compaction equipment whose hopper is suitable for receiving bins of different types and sizes, even large ones, allowing a lowering of the tilting axis without causing mechanical interference and/or obstructing the outflow of refuse from

the bin itself.

[0009] Another object of the invention is to increase the containment capacity of the hopper, without penalizing the internal capacity of the storage compartment of the bin.

[0010] A further object is to offer a structurally simple, reliable and low-cost technical solution.

[0011] In this respect, the Applicant has understood that the spaces below the conveying chute can be conveniently exploited to obtain an increase in the useful capacity of the hopper by means of a conveying chute of variable geometry.

[0012] More in particular, according to a first aspect, the invention relates to a loading hopper 1 for compaction equipment of refuse collection vehicles according to claim 1.

[0013] In a further aspect, the invention relates to a method for conveying refuse in a loading hopper, according to claim 9.

[0014] The invention further relates to compaction equipment for refuse collection vehicles, comprising: a containment bin; the aforesaid loading hopper; and a pressing unit operating in the loading chamber for transferring refuse from the loading hopper to a storage compartment defined inside the containment bin, through a transfer opening arranged in a delimitation wall between the loading hopper and the containment bin.

[0015] A further object of the invention relates to a refuse collection motor vehicle, equipped with said compaction equipment.

[0016] The geometric switchability of the conveying chute allows to increase the internal volume of the loading hopper during the bin overturning step, and to reconfigure the conveying chute according to a suitably inclined trend, so as to facilitate the correct outflow of refuse to the loading chamber after the bin has been moved away from the loading hopper. In fact, in the second operating condition the broken line configuration of the conveying chute is such as to increase the internal volume of the hopper.

[0017] In at least one of the above aspects, the invention can also comprise one or more of the preferred features listed below.

[0018] Preferably, the conveying chute delimits, together with the containment walls, at least one loading volume of the hopper.

[0019] Preferably, the conveying chute together with the containment walls delimits, inside the hopper, a first and a second load volume in the first and the second operating condition, respectively.

[0020] Preferably, the second load volume is greater than the first load volume.

[0021] Preferably, the upper end edge circumscribes a loading mouth.

[0022] Preferably, the conveying chute is entirely arranged in vertical alignment under the loading mouth.

[0023] Preferably, at least in the first and/or in the second operating condition, the conveying chute is entirely

arranged in vertical alignment under the loading mouth.

[0024] Preferably, the conveying chute comprises an upper portion and a lower portion respectively consecutive and mutually movable to selectively configure the conveying chute itself between the first operating condition and the second operating condition.

[0025] The creation of the conveying chute in two parts is a simple and cost-effective technical solution.

[0026] Preferably, the lower portion is hinged near an upper threshold of the loading chamber by means of said lower end edge.

[0027] A correct positioning of the conveying chute with respect to the loading chamber is thus favoured, regardless of the configuration assumed by the conveying chute itself.

[0028] Preferably, the lower portion carries, near the lower end edge, a hinging shaft whose ends rotatably cross two of said containment walls respectively opposite each other of the loading hopper.

[0029] Preferably, in the first operating condition the conveying chute has a substantially continuous, preferably straight, extension from the upper end edge to the lower end edge.

[0030] Preferably, the upper portion is engaged in sliding laying relationship at one of said side walls by means of the upper end edge.

[0031] A correct control of the position of the upper portion inside the loading hopper is thus favoured. Furthermore, the proximity of the upper edge to the containment wall of the loading hopper prevents an undesired bypassing of the conveying chute by the refuse accumulated in the loading hopper during the movement of the conveying chute itself.

[0032] Preferably, the upper portion carries, near the upper end edge, a pair of sliders slidingly engaged along respective sliding guides fixed at intersections between respectively contiguous containment walls of the loading hopper.

[0033] Preferably, the lower portion and the upper portion have peripheral seals acting elastically in dragging contact relationship against the containment walls.

[0034] The presence of the seals prevents the passage of refuse through any gaps present between the edges of the conveying chute and the internal surfaces of the loading hopper.

[0035] Preferably, the lower portion and the upper portion are mutually constrained along respective mutually juxtaposed edges.

[0036] Preferably, the upper portion and the lower portion are rotatably constrained to each other, substantially around a transverse constraint axis with respect to said side walls.

[0037] Preferably, the lower portion and the upper portion are mutually constrained by means of a flexible insert.

[0038] The use of a flexible insert represents an economical and effective solution for stably constraining the lower and upper portions, giving the conveying chute the

deformability required to switch its configuration.

[0039] Preferably, the flexible insert comprises a strip of elastomeric material extending according to a continuous extension along mutually juxtaposed edges of the lower portion and the upper portion.

[0040] Undesired infiltrations of material between the lower and upper portions is thus effectively hindered.

[0041] Preferably, at least one selectively actuatable control actuator is further included for switching the conveying chute between the first and the second operating condition.

[0042] Preferably, the control actuator is externally fixed to the loading hopper and operates on the conveying chute through one of the containment walls.

[0043] The actuator therefore remains protected from the entry of refuse inside the loading hopper, without necessarily invading the internal volume of the latter.

[0044] Preferably, the bin is at least partially introduced into the loading hopper during the emptying of the contents.

[0045] It is thus possible to reduce the maximum height reached by the bin in the overturning step.

[0046] Preferably, the action of expelling part of the refuse conveyed into the loading chamber from the loading hopper is envisaged, before switching the conveying chute from the second operating condition to the first operating condition.

[0047] It is thus possible to reduce the weight on the conveying chute and consequently the efforts required for switching to the first operating condition.

[0048] Further features and advantages will become more apparent from the detailed description of a preferred, but not exclusive, embodiment of a loading hopper for compaction equipment of refuse collection vehicles, and a conveying method feasible with said hopper, as well as of compaction equipment equipped with said hopper and a refuse collection motor vehicle, equipped with the aforesaid equipment, in accordance with the present invention.

[0049] 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 a refuse collection motor vehicle, equipped with compaction equipment having a loading hopper according to the present invention;
- figure 2 shows an enlarged detail of figure 1, highlighting a conveying chute of the loading hopper in a first operating condition;
- figure 3 shows a vertical section of figure 2 executed according to a plane longitudinal to the motor vehicle;
- figure 4 shows the detail of figure 2 with the conveying chute in a second operating condition;
- figure 5 shows a vertical section of figure 4 executed according to a plane longitudinal to the motor vehicle;
- figure 6 is a detail highlighting a control actuator in

perspective view from the opposite side with respect to figure 4.

[0050] In the figures cited, the number 1 globally indicates a loading hopper for compaction equipment for refuse collection motor vehicles. The loading hopper 1 equips a compaction equipment 2 installed on a motor vehicle indicated overall with 3, and is suitable for receiving the refuse emptied from a bin (not shown) picked up from the ground and inverted in the hopper itself on the action of gripping and tilting equipment 4, not described in detail as not relevant for the purposes of the present invention, placed laterally with respect to the hopper itself along one of the sides of the motor vehicle 3.

[0051] The compaction equipment 2 comprises a pressing unit 5 operating at a loading chamber 6 located at the base of the loading hopper 1, to transfer the refuse from the hopper itself to a storage compartment 7 defined inside a containment bin 8. The loading hopper 1 is located at one end of the containment bin 8, between the latter and a driving cabin 9 of the motor vehicle 3.

[0052] The pressing unit 5 comprises, for example, a pusher 10 driven with alternating motion in the loading chamber 6, to push the refuse through a transfer opening 11a arranged in a delimitation wall 11 between the loading hopper 1 and the containment bin 8.

[0053] The loading hopper 1 is delimited between containment walls 11, 12, 13, typically four, which extend in an almost vertical direction towards the loading chamber 6, starting from an upper end edge of the hopper itself, circumscribing a loading mouth 1a. More in particular, between the containment walls 11, 12, 13, two side walls 12 are identifiable, which are located near the respective sides of the motor vehicle 3, a rear wall defined by the aforesaid delimitation wall 11, and a front wall 13 opposite the delimitation wall 11, near the driving cabin 9. At least one of the side walls 12, arranged for example along the side carrying the gripping and tilting equipment 4, can end with a lowered load threshold 14 with respect to the upper end edge identifiable on one or more of the other containment walls 11, 12.

[0054] At least one conveying chute 15 is installed inside the loading hopper 1, which extends transversely between the side walls 12 arranged along the opposite sides of the motor vehicle 3, and having a lower end edge 16 confluent to the loading chamber 6, and an upper end edge 17 facing the upper end edge and/or the loading mouth of the loading hopper 1. The conveying chute 15 is preferably made in at least two distinct parts, namely a lower portion 18 and an upper portion 19. The lower portion 18 is hinged by means of the aforesaid lower end edge 16 near an upper threshold 6a of the loading chamber 6. As can be seen from the accompanying drawings and from the following description, the lower portion 18 is rotatably hinged. More in particular, for this purpose a hinging shaft 20 can be fixed near the lower end edge 16 whose ends rotatably cross, at respective support bushings 21, the opposite side walls 12 arranged at the

respective sides of the motor vehicle 3. The upper portion 19 in turn carries the upper end edge 17 of the conveying chute 15, engaged in sliding laying relationship against one of the containment walls 11, 12, 13, more specifically the front wall 13. To this end, a pair of sliders 22, for example in the form of a skid, can be slidably engaged along respective sliding guides 23 fixed at the intersections between the front wall 13 and the side walls 12, included in the upper portion 19 near the upper end edge 17.

[0055] It can also be conveniently included that the lower portion 18 and the upper portion 19 are associated with peripheral seals 24, for example in the form of elastomeric material strips, acting elastically in dragging contact relationship against the containment walls 11, 12, 13.

[0056] The upper portion 19 and the lower portion 18 are mutually constrained along respective mutually juxtaposed edges, preferably by means of a flexible insert 25 made for example in the form of a strip in elastomeric material extending according to a continuous extension along the entire extension of the same mutually juxtaposed edges. As clearly visible from figures 3 and 5, the upper portion 19 and the lower portion 18 are rotatably constrained to each other, substantially around a transverse constraint axis with respect to the side walls 12.

[0057] The mutual mobility of the lower portions 18 and upper portions 19 causes the conveying chute 15 to be selectively configurable between a first operating condition depicted in figures 2 and 3, and a second operating condition, depicted in figures 4 to 6. In the first operating condition, the conveying chute 15 extends obliquely inside the loading hopper 1, preferably according to a straight or otherwise substantially continuous extension, from the upper end edge 17 to the lower end edge 16, above the pusher when moved away from the delimitation wall 11.

[0058] In the second operating condition, the conveying chute 15 instead extends according to a broken line, where the lower portion 18 and the upper portion 19 respectively define a lower section extending from the lower end edge 16, and an upper section carrying the upper end edge 17 and rising according to an angled orientation in continuation from the lower section. As clearly seen from the accompanying drawings, in the second operating condition the broken line configuration of the conveying chute is such as to increase the internal volume of the hopper.

[0059] The switching of the conveying chute 15 between the first and the second operating condition is for example achievable by at least one control actuator 26 operating between the loading hopper 1 and the conveying chute 15. More in particular, the control actuator 26 is preferably externally fixed to the loading hopper 1, to one of its containment walls 11, 12, 13, and operates on the conveying chute 15, for example at the lower portion 18, through the same conveying wall on which the actuator is fixed. More in particular, the control actuator 26 can for example be made in the form of a double-acting

fluid-dynamic cylinder, fixed to one of the side walls 12 and operating on an arm 27 protruding radially at one of the ends of the hinging shaft 20 crossing the side wall itself.

[0060] The loading hopper 1 in question is suitable for operating according to an innovative method of conveying refuse, described below.

[0061] Before emptying a bin inside the loading hopper 1, the control actuator 26 is driven to switch the conveying chute 15 from the first operating condition to the second operating condition. By means of the gripping and tilting equipment 4, a refuse bin is lifted beyond the loading threshold 14 of the loading hopper 1 and emptied inside the latter with a tilting action. In this step, the lower portion 18 and upper portion 19 of the conveying chute 15 are respectively juxtaposed to the pusher 10 of the pressing unit 5 and to the front wall 13 of the loading hopper 1, so as to release the volume available inside the latter to receive the overturned bin and the refuse falling therefrom towards the loading chamber 6. The bin in the overturning step can conveniently be at least partially introduced into the loading hopper 1 and kept relatively close to the loading chamber 6, without risking that parts of the bin itself, for example the lids which open by gravity, can undesirably collide with the internal parts of the loading hopper 1. The use of the overall internal volume of the loading hopper 1 is also optimized, making a dimensional containment thereof possible in favour of the capacity of the containment bin 8.

[0062] When the emptying is completed, the container is repositioned on the ground and the motor vehicle 3 can resume operation, while the pusher 10 is driven with alternating motion to progressively expel the refuse from the loading chamber 6 and transfer it to the storage compartment 7.

[0063] After the refuse, or a sufficient part thereof, has been transferred to the storage compartment 7, a new drive of the control actuator 26 can be commanded, to switch the conveying chute 15 again from the second operating condition to the first operating condition. Once the first operating condition has been reached, the inclination of the conveying chute 15 causes the refuse still possibly present in the loading hopper 1, in particular that accumulated on the lower portion 18, to be forced to fall into the loading chamber 6 to also be transferred to the storage compartment 7 by the pusher 10.

[0064] Once the transfer is complete, the conveying chute 15 can be switched again from the first operating condition to the second operating condition, to prepare the loading hopper 1 for emptying the next bin.

Claims

1. Loading hopper for compaction equipment of refuse collection vehicles, comprising:

containment walls (11, 12, 13) extending from

an upper end edge of the loading hopper (1) towards a loading chamber (6) arranged below; a conveying chute (15) having a lower end edge (16) confluent to the loading chamber (6) and an upper end edge (17) facing the upper end edge of the loading hopper (1); wherein said conveying chute (15) is selectively configurable between a first operating condition in which it extends obliquely, and a second operating condition in which it extends along a broken line having a lower section extending from the lower end edge (16) and an upper section carrying the upper end edge (17) and rising according to an angled orientation on the continuation of the lower section.

2. Hopper according to claim 1, wherein the conveying chute (15) comprises an upper portion (19) and a lower portion (18) respectively consecutive and mutually movable to selectively configure the conveying chute (15) itself between the first operating condition and the second operating condition.
3. Hopper according to claim 2, wherein the lower portion (18) is hinged near an upper threshold (6a) of the loading chamber (6) by means of said lower end edge (16).
4. Hopper according to claim 2 or 3, wherein the lower portion (18) carries, near the lower end edge (16), a hinging shaft (20) whose ends rotatably cross two of said containment walls (11, 12, 13) respectively opposite each other of the loading hopper (1).
5. Hopper according to one or more of the preceding claims, wherein in the first operating condition the conveying chute (15) has a substantially continuous extension, preferably straight, from the upper end edge (17) to the lower end edge (16).
6. Hopper according to one or more of claims 2 to 5, wherein the upper portion (19) is engaged in sliding laying relationship at one of said side walls (12) by means of the upper end edge (17).
7. Hopper according to one or more of claims 2 to 6, wherein the upper portion (19) carries, near the upper end edge (17), a pair of sliders (22) slidably engaged along respective sliding guides (23) fixed at the intersections between respectively contiguous containment walls (11, 12, 13) of the loading hopper (1).
8. Hopper according to one or more of claims 2 to 7, wherein the lower portion (18) and the upper portion (19) are mutually constrained by means of a flexible insert (25).

9. Method for conveying refuse into a loading hopper (1) according to one or more of the preceding claims, comprising the actions of:

arranging the conveying chute (15) in the second operating condition; 5
emptying the contents of a bin into the loading hopper (1) with the conveying chute (15) in the second operating condition;
switching the conveying chute (15) from the second operating condition to the first operating condition. 10

10. Method according to claim 9, further comprising the action of expelling part of the refuse conveyed into the loading chamber (6) from the loading hopper (1), before switching the conveying chute (15) from the second operating condition to the first operating condition. 15

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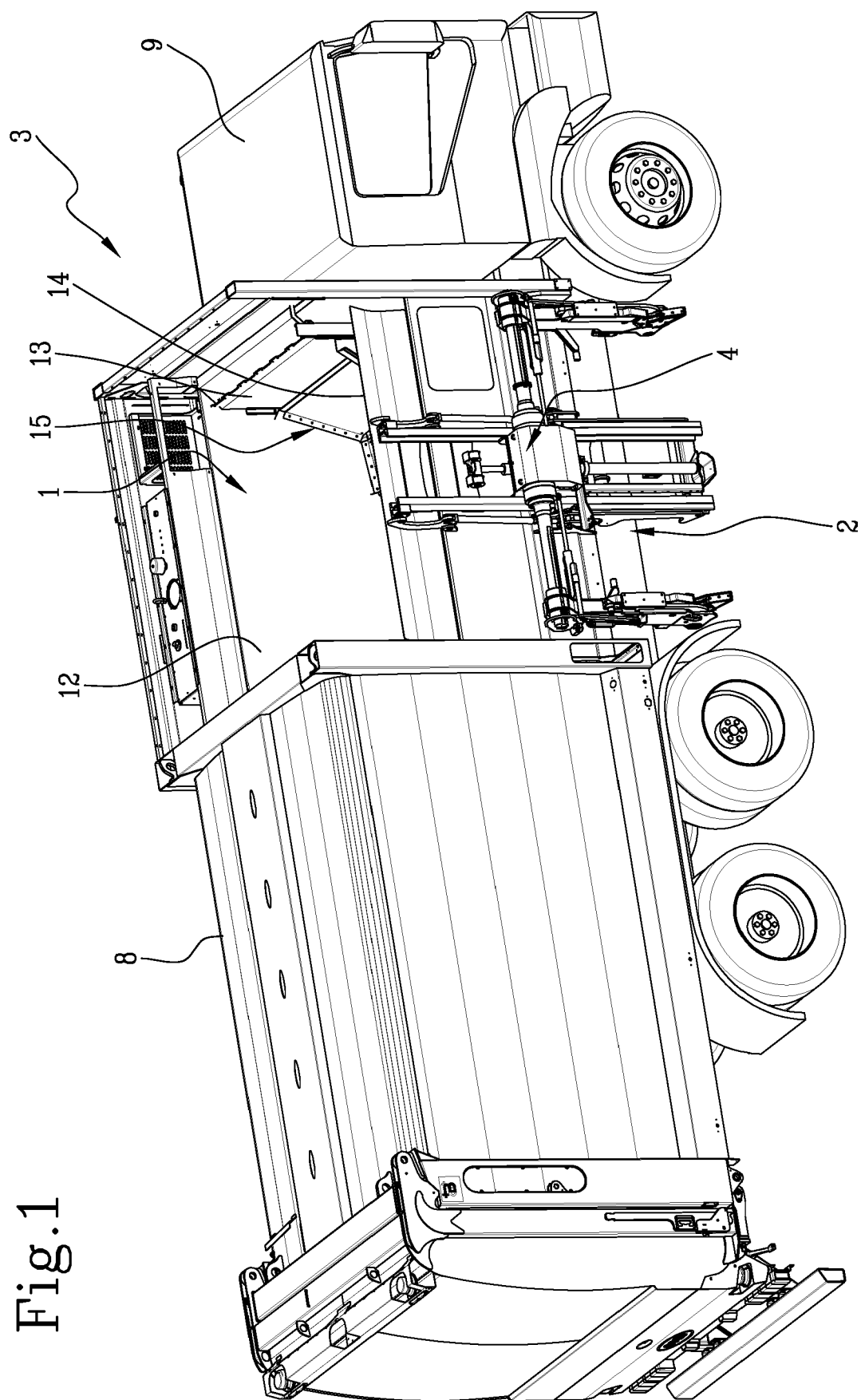


Fig. 1

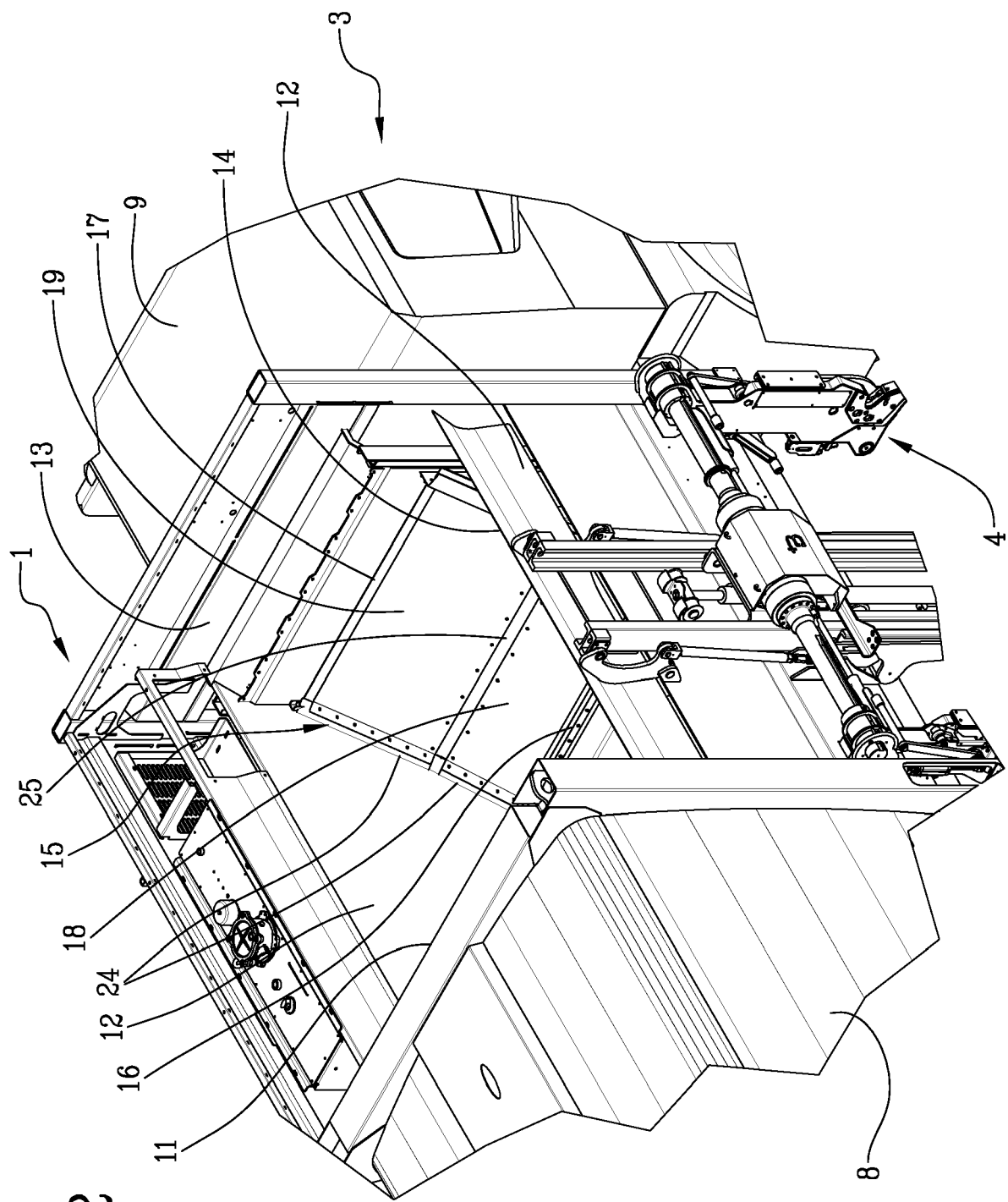


Fig.2

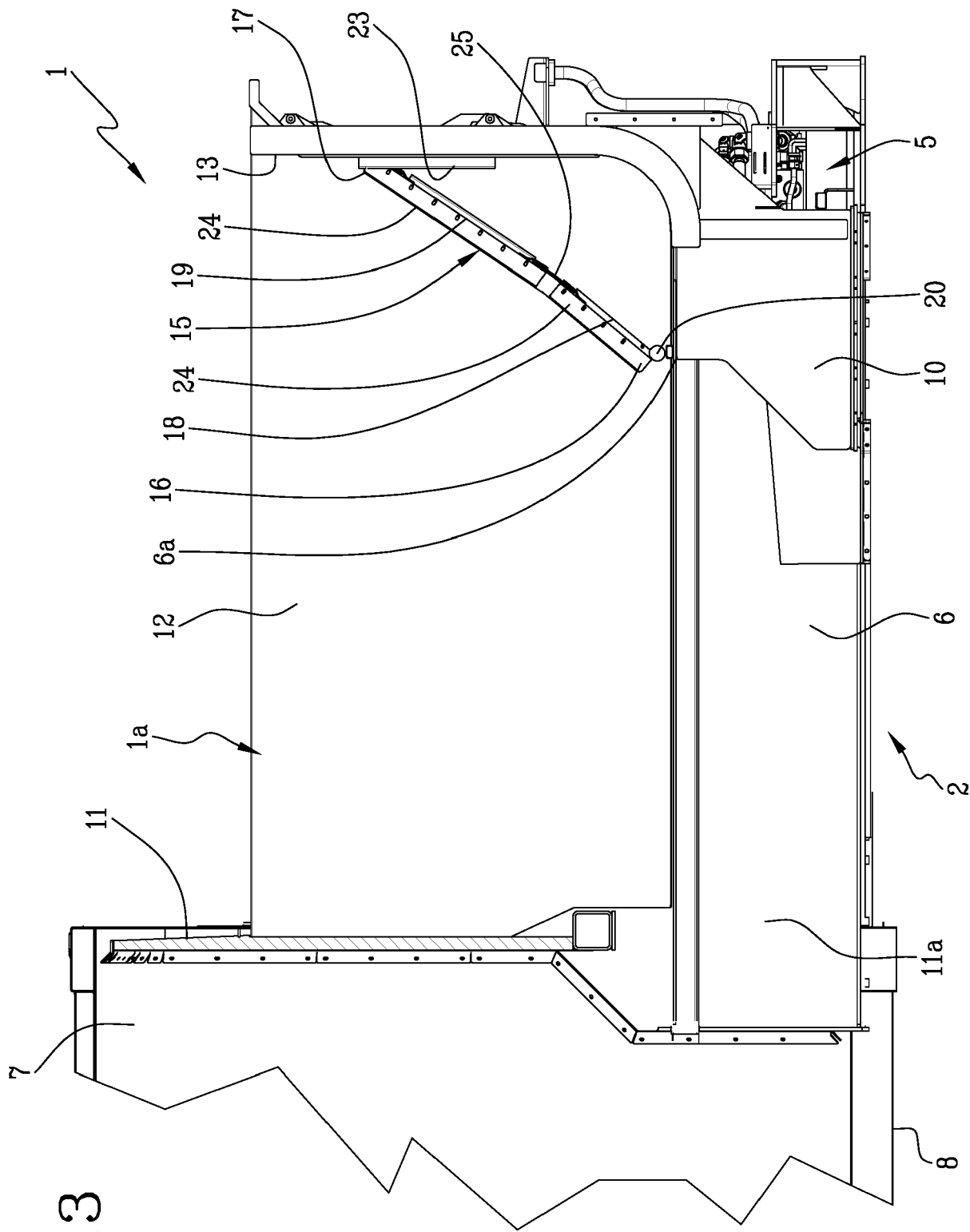


Fig. 3

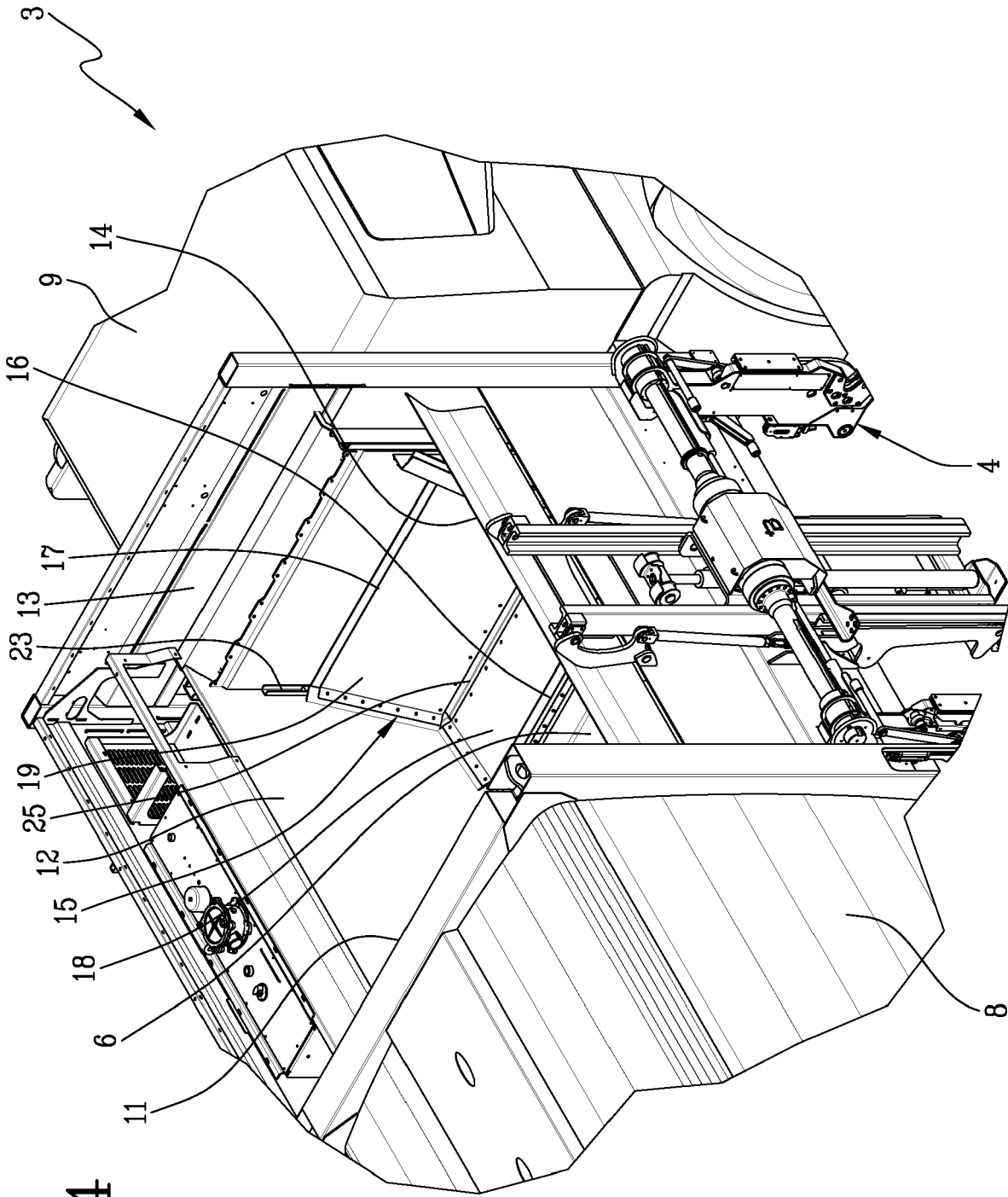


Fig.4

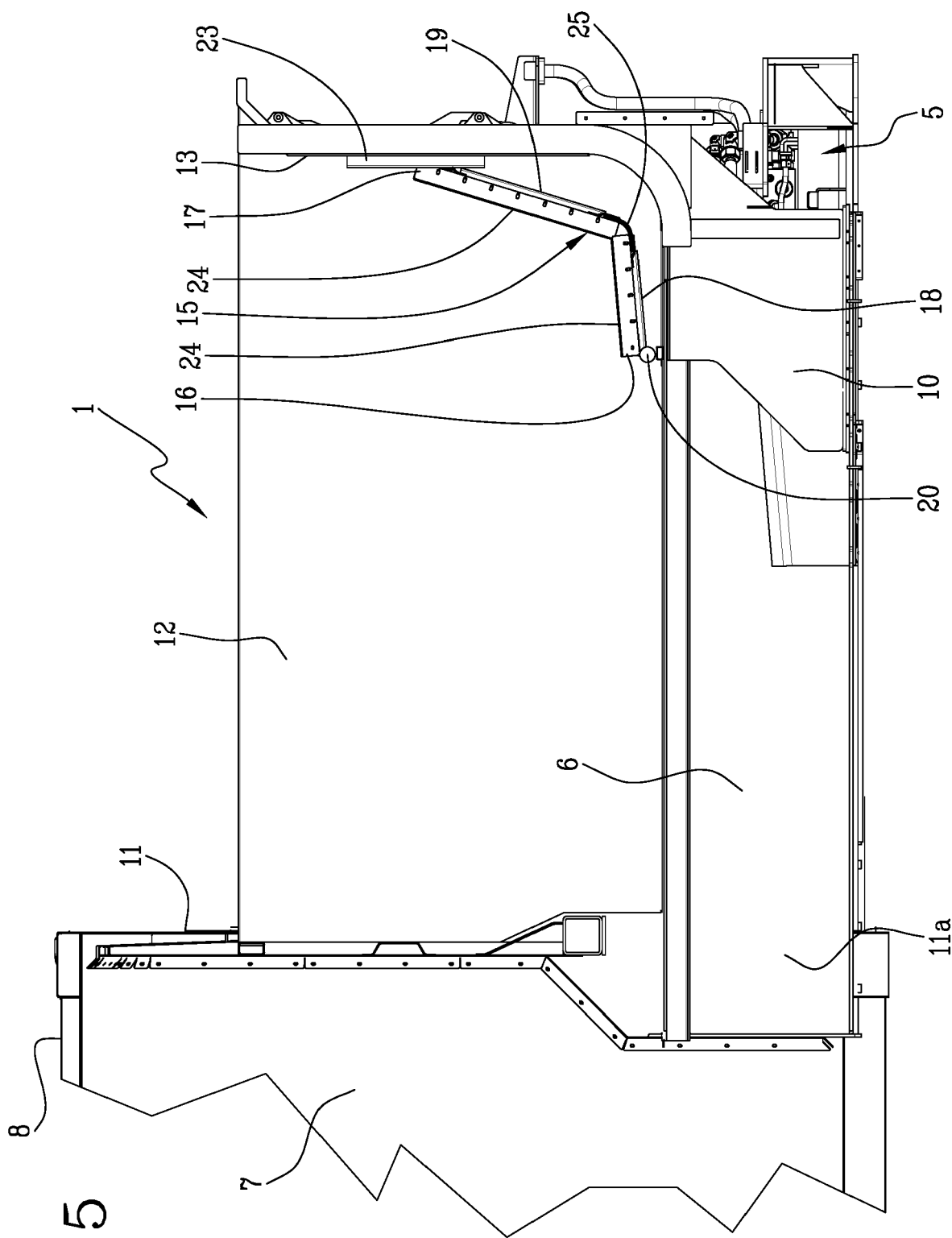


Fig. 5

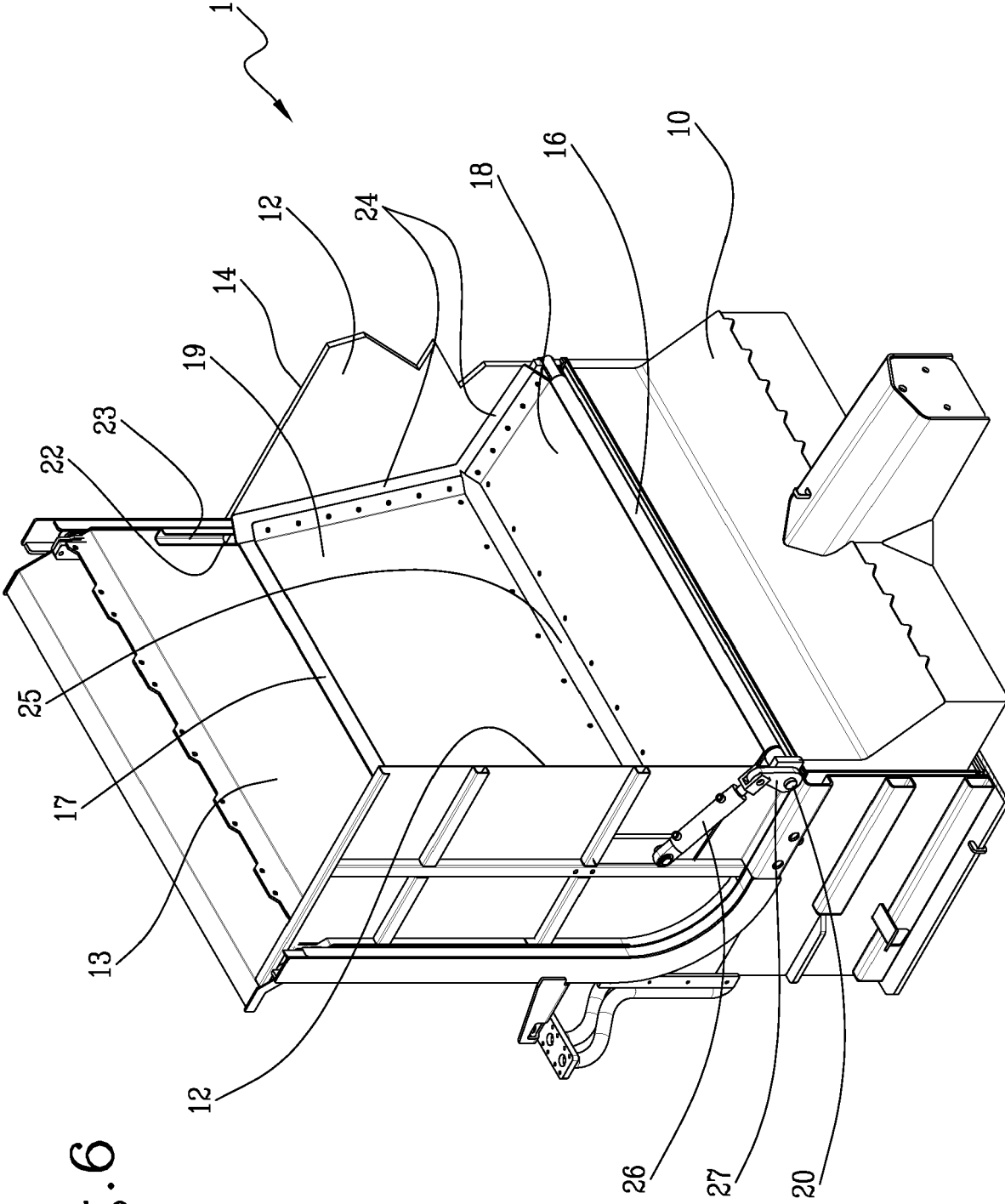


Fig.6



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Application Number

EP 22 19 7461

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B65F
Place of search		Date of completion of the search	Examiner
The Hague		27 March 2023	de Miscault, Xavier
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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

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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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