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(72) Inventeur/Inventor:
DELMONI, ALEX, AU

(73) Propriétaire/Owner:
SCHENCK PROCESS AUSTRALIA PTY LIMITED, AU

(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : GOULOTTE A AJUSTAGE
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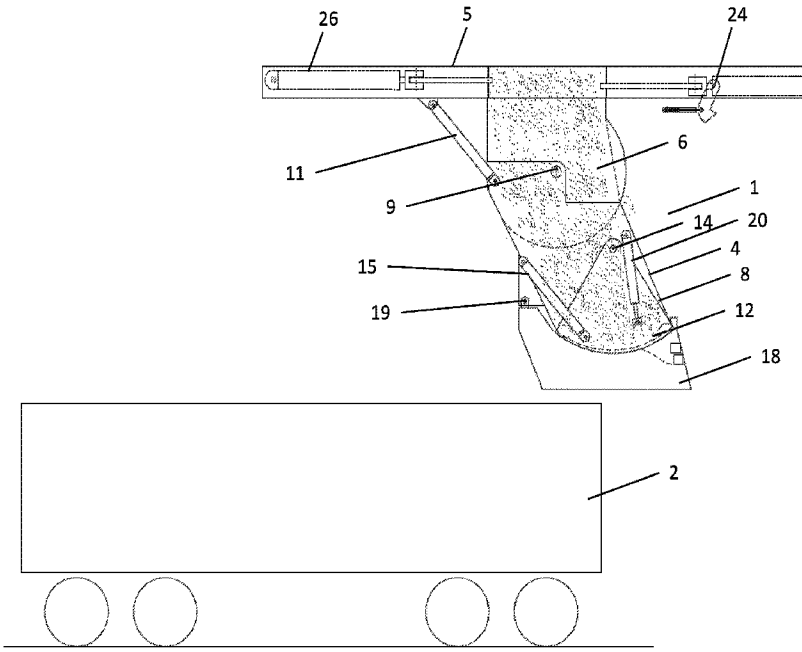

(57) Abrégé/Abstract:
A trim chute for a loading apparatus for loading particulate material into a container, the trim chute being configured to be engaged with the loading apparatus to direct particulate material into the container, the trim chute being moveable with respect to the loading apparatus during loading, movement of the trim chute effecting a change in flow of the particulate material into the container.

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(72) Inventor; and
(71) Applicant : **DELMONI, Alex** [AU/AU]; PO Box 17, Stockton, New South Wales 2295 (AU).

(74) Agent: **GRIFFITH HACK**; Level 29 Northpoint, 100 Miller Street, North Sydney, NSW 2060 (AU).

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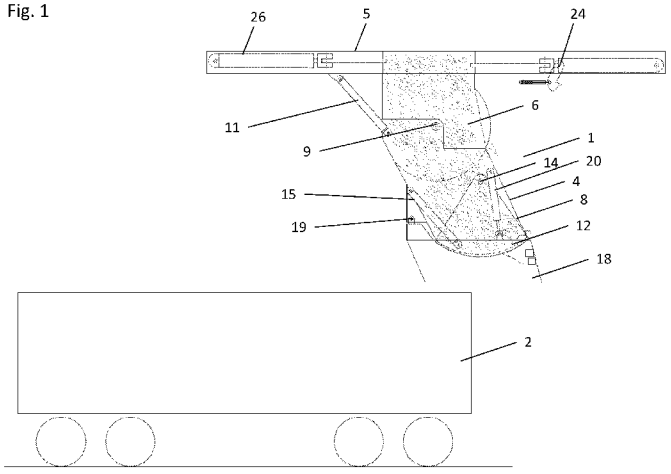
(54) **Title**: TRIM CHUTE

Fig. 1



(57) **Abstract**: A trim chute for a loading apparatus for loading particulate material into a container, the trim chute being configured to be engaged with the loading apparatus to direct particulate material into the container, the trim chute being moveable with respect to the loading apparatus during loading, movement of the trim chute effecting a change in flow of the particulate material into the container.

TRIM CHUTE

BACKGROUND

The disclosure relates to material handling, and more particularly to an apparatus and method for loading particulate matter into a transport container.

SUMMARY

Disclosed in some forms is a trim chute for a loading apparatus for loading particulate material into a container, the trim chute being configured to be engaged with the loading apparatus to direct particulate material into the container, the trim chute being moveable with respect to the loading apparatus during loading, movement of the trim chute effecting a change in flow of the particulate material into the container.

The adjustable trim chute allows for variation in desired levels and volumes of the particulate material to be brought about through adjustment of the trim chute while loading occurs. This allows for the wagon load profile height to be managed and the volume of material to be designed to suit certain specifications. Further, loading can be adapted to reduce initial spill.

In another aspect, disclosed is a method of loading a container, the method comprising depositing particulate material into the container through a loading apparatus, the loading apparatus having a chute body and a trim chute located at an outlet end of the chute body; and, adjusting the angle of the trim chute with respect to the chute body to adjust the flow of the particulate material.

The method allows for dynamic adjustment of load profiles and weight of material in the container.

BRIEF DESCRIPTION OF THE FIGURES

The embodiments will now be described in view of the Figures, in which,

Figure 1 shows a side plan view of a trim chute of one embodiment of the disclosure in use in a loading arrangement;

Figure 2 shows the loading arrangement of Figure 1, with the swing chute in a raised position;

Figure 3 shows a side plan view of the loading arrangement of Figure 1 in use with the trim chute in a lowered configuration;

Figure 4 shows a side plan view of the loading arrangement of Figure 1 in use with the trim chute in a raised configuration;

Figure 5 shows an end view of the loading arrangement of Figure 3, showing the container load profile height;

Figure 6 shows an end view of the loading arrangement of Figure 4, showing the container load profile height;

Figure 7 shows the container load profile of one trim chute setting;

Figure 8 shows the container load profile of another trim chute setting;

Figure 9 shows the container load profile of another trim chute setting;

Figure 10 shows the container load profile of another trim chute setting;

Figure 11 shows the container load profile of another trim chute setting;

Figure 12 shows a side plan view of a trim chute of another embodiment of the disclosure in use with a fixed chute system;

Figure 13 show the trim chute of Figure 12 in a raised configuration.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE DISCLOSURE

Disclosed in some forms is a trim chute for a loading apparatus for loading particulate material into a container, the trim chute being configured to be engaged with the loading apparatus to direct particulate material into the container, the trim chute being moveable with respect to the loading apparatus during loading, movement of the trim chute effecting a change in flow of the particulate material into the container.

In some forms the trim chute is engaged with the loading apparatus by means of at least one extendable arm, movement of the extendable arm effecting movement of the trim chute with respect to the loading apparatus.

In some forms the extendable arm is configured to move the trim chute while material is flowing through the trim chute.

In some forms movement of the trim chute with respect to the loading apparatus is angular.

In some forms the loading apparatus comprises a chute and the trim chute is adapted to engage with the chute to allow flow of material through the chute and out the trim chute.

In another aspect, disclosed is a method of loading a container, the method comprising depositing particulate material into the container through a loading apparatus, the loading apparatus having a chute body and a trim chute located at an outlet end of the chute body; and, adjusting the angle of the trim chute with respect to the chute body to adjust the flow of the particulate material.

In some forms, the step of adjusting the angle of the

trim chute is performed during loading.

In some forms, the step of adjusting the angle of the trim chute is performed by at least one extendable arm.

In some forms, the hydraulic arm is configured to attach the trim chute to the chute body.

In some forms, the angle of the trim chute is adjusted to provide a desired container load profile.

In some forms the container is a rail wagon.

In another aspect, disclosed is an apparatus for loading particulate material into a container, the apparatus comprising a primary chute having an outlet, a trim chute engaged with the primary chute and moveable with respect to the primary chute wherein movement of the trim chute with respect to the primary chute adjusts flow of material into the container.

In some forms, the trim chute is engaged with the primary chute by at least one trim chute extendable arm, the trim chute extendable arm effecting movement of the trim chute with respect to the primary chute.

In some forms, the movement of the trim chute with respect to the primary chute is an angular movement, adjusting the angle of the trim chute.

In some forms the trim chute includes an outlet that feeds directly into the container.

In some forms the container comprises a rail wagon.

In some forms the primary chute comprises a fixed chute through which particulate material is received in

use, and a swing chute adapted to extend from the fixed chute.

In some forms the swing chute is angularly moveable with respect to the fixed chute.

In some forms the swing chute is moveable to adopt a raised position when not in use.

In some forms the apparatus further comprises a moveable barrier engaged with the primary chute and moveable to adopt a closed configuration wherein the outlet is obstructed and an open configuration.

In some forms, the barrier comprises a single clamshell bucket.

In some forms, the bucket is engaged with the primary chute by means of at least one barrier hydraulic arm which effects movement of the bucket between its closed and open configurations.

In some forms, extension of the barrier hydraulic arm causes the bucket to adopt the open configuration.

Referring to Figure 1, disclosed is a chute assembly 1 for loading particulate material into a container 2. In the illustrated form the container is a rail wagon.

In the illustrated form, the chute assembly 1 comprises a chute body 4 extending from a gateframe 5. The chute body 4 comprises a fixed chute 6 located proximal the gateframe 5 and into which material initially flows. A swing chute 8 is engaged with the fixed chute 6 by means of a pin 9. A swing chute hydraulic arm 11 engages the swing chute 8 and the gateframe 5.

The swing chute 8 is moveable from the lowered position illustrated in Figure 1 into a raised position which is best shown in Figure 2. Movement of the hydraulic arm 11 moves the swing chute from the lowered position into the raised position through rotation about pin 9.

In the illustrated form, a barrier in the form of a single clamshell bucket 12 is located in and engaged with the swing chute 8. The bucket is rotatable about axis 14 to move the bucket between the closed configuration shown in Figure 1 and an open configuration. A bucket hydraulic arm 15 effects movement of the bucket 12 between its closed and open positions.

In the illustrated form, guillotine gates 26 block particulate material from the chute in a closed position and open to allow material through.

In its closed position, as shown in Figure 1, the clamshell bucket blocks flow of particulate material from the swing chute 8.

A trim chute 18 is engaged with the swing chute 8 at pin 19. A trim chute hydraulic arm 20 also engages the trim chute 18 and attaches it with the swing chute 8. The trim chute 18 is moveable with respect to the swing chute 8 about pin 19 by movement of an extendable arm in the form of trim chute hydraulic arm 20.

While the illustrated form shows the adjustable trim chute in use with a fixed chute and swing chute system, the trim chute can be utilized with other chutes such as fixed chutes and lowering telescopic chutes with either single or twin guillotine gates. Most coal loaders are a guillotine style with a lowering telescopic or cross traversing chute which floods and empties with each wagon. The chutes either side traverse or raise to clear the

locomotives.

Adjustment of the trim chute is performed using a data system into which weight data is fed from scales on outgoing rails which measure the bogie, axle, wheel and front/rear wagon masses.

Referring now to Figure 2, the swing chute 8 is rotatable with respect to the fixed chute 6 in order to move the swing chute 8 into its raised position that is shown in Figure 2. In its raised position the chute assembly 1 is out of the way of a wagon 2 moving through when loaded. A lock hook or latch 24 is attached to the gateframe 5 and secures the swing chute 8 in the raised position when the system is not in use. The lock hook or latch 24 can be either a single latch or a double latch in which case one is located on each side of the gateframe 5. This is operated by spring extended cylinders. The lock is required as when the system is left unused for long periods, the latch prevents the chute creeping down which could cause an interaction with a locomotive or loaded wagons or rail maintenance equipment travelling through.

Referring now to Figures 3 and 4, the trim chute 18 is angularly moveable with respect to the swing chute 8 and fixed chute 6. In the illustrated form, movement of the trim chute 18 is effected by movement of the trim chute hydraulic arm 20, however alternative dynamic configurations would allow similar movement of the trim chute 18. For example, telescoping arms such as electric or alternatively powered linear actuators or other extendable arms could be utilised.

As shown in Figure 3, in the lowered position the trim chute provides a container load profile 22 of the particulate material 23 that has a specified height above

the container 2. As shown in Figure 4, in the raised position the height of the container load profile 22 above the container 2 is greater.

Figures 5 and 6 show end views of the container load profiles of Figures 3 and 4.

The variable trim system allows for full flow through the vertical areas (y axis) of the chutes and controls the load level (trim) along the horizontal plane (x axis). The adjustable trim system has been designed to provide a variable y axis load height profile.

Referring now to Figures 7 through 11, variations in load height throughout the full profile of the container are enabled by the adjustable trim chute 18. This dynamic adjustment provides loaded volume and subsequent mass variations from front to rear of the wagon while the wagon loads through feedback provided without needing to alter the opening distances.

In Figure 7, the container load profile 22 is level and relatively low. In Figure 8, the container load profile 22 is level and is high. This variation is produced by adjusting the trim chute 18 from a lowered setting to a raised setting.

Higher wagon load profiles result in an increase of transported particulate material. This results in cost and efficiency savings.

In Figures 9 through 11, the container load profile varies across the load. This variation is produced by varying the angle of the trim chute while the loading is occurring.

In Figure 9, the load profile 22 is tapered from

front to rear, as the trim chute 18 is lowered during filling. This is useful when a wagon weighs in with the rear bogies as being underweight with the bulk load longitudinal profile being flat and the front bogies weigh in as correct. The PLC records the wagon weight disparity input data and calculates the correction requirement. Trim height and opening distance for the front of the subsequent wagon remains "as is", while the load will taper up from front to rear.

In Figure 10, the load profile 22 is raised from front to rear. In circumstances wherein the wagon weighs in with the front bogies as being underweight with the bulk load longitudinal profile being flat this profile would be desirable and the system can correct for it.

In Figure 11, the container load profile 22 peaks in the centre.

The flat, tapered or peaked load over length of the wagon correct for weight imbalances from track scale data input received from previous wagons. The load can be automatically adjusted from the plc and corrected from track scale data input received from previous wagons.

Referring now to Figures 12 and 13, the trim chute 18 can be utilised with a fixed chute system.

Figure 12 shows the trim chute 18 in a lowered configuration. The trim chute 18 is engaged with the gateframe 5 by means of at least one hydraulic arm 25. The hydraulic arm engages the trim chute and extends to move the trim chute 18 into the lowered configuration. In this embodiment guillotine gates 26 are also shown in the open position.

Figure 13 shows the trim chute 18 in a raised

configuration. The trim chute 18 is engaged with the gateframe 5 by means of at least one hydraulic arm 25. The hydraulic arm engages the trim chute and is retracted to move the trim chute 18 into the lowered configuration.

The adjustment of the trim chute can be adapted to reduce and prevent initial front overspill of the wagons by lowering the trim chute upon wagon presentation and then raising it to the required level once the initial surge/flood has completed. Dependent upon requirements this can be integrated into the PLC program to operate with each wagon.

The hydraulic supply for the adjustable or dynamic trim chute is generally sourced from the original system chute pressure supply, main return and drain lines tee connections. The small volume and power required to operate the adjustable trim system is minimal and has minimal or no effect on the functioning of the OEM designed main system

Control valving and components are incorporated in a purpose designed stand alone manifold assembly mounted to the underside of or near the gateframe

The trim system is able to be isolated from the main hydraulic system by lockable isolation valves. Dynamic trim system operating maximum speed is controlled by a flow control valve. In most systems a failsafe (emergency shutdown) valve is energized throughout the loading process (for the train duration) unless an emergency shutdown occurs.

The failsafe valve is identical to the main hydraulic system failsafe emergency shutdown valve and energisation operates in parallel.

A double solenoid valve raises, lowers or maintains the chute in the desired position upon being energized or de-energised.

The system is designed so that irrespective of whatever signal at the time is for raise, lower or maintain position, the failsafe operation will be prioritized for the emergency shutdown and the normal control signal will be negated.

While the disclosure is directed toward filling rail wagon containers with particulate material, such as iron ore, it will be clear that alternative materials and alternative container settings may be utilised in line with the disclosure of the application. The chute system can also be utilised in typical truck loader operation and in coal chute train loading among other particulate material loading arrangements.

In other alternative arrangements, the trim chute can be applied to a fixed chute system and installed in a blade shape rotating on a mounted hinge at the rear of the chute. The trim arrangement can be either a single or twin actuator operated. Existing designs that are not hydraulically operated can be installed with electric linear actuators for trim adjustment. To provide sufficient clearance from the clamshell bucket, trim chute width can be altered either as a modification to the existing system or a new trim chute designed allowing for additional clearance.

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or any other country.

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word “comprise” or variations such as “comprises” or “comprising” is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

CLAIMS

1. A loading apparatus for loading particulate material into a container, the apparatus comprising:

a primary chute comprising a fixed chute positioned, in use to receive particulate material, a swing chute positioned, in use, to extend from the fixed chute to receive the particulate material from the fixed chute and pass the particulate material to a swing chute outlet, the swing chute being angularly moveable with respect to the fixed chute;

a movable barrier member engaged with the primary chute and being selectably movable between a closing position where the movable barrier member closes the swing chute outlet, and an open position where flow of the particulate material through the swing chute outlet is possible; and

a trim chute engaged with the primary chute, in use, to receive flow of the particulate material from the swing chute outlet and to pass the flow of particulate material flow through the trim chute into the container, the trim chute having a trim chute portion engageable with deposited the particulate material in the container whereby movement of the trim chute with respect to the primary chute adjusts a particulate material load profile on the deposited particulate material in the container.

2. The loading apparatus according to claim 1, wherein at least one trim chute movement actuator is provided to operationally adjust positioning of the trim chute to enable the trim chute portion to adjust the particulate material load profile.

3. The loading apparatus according to claim 1 or claim 2, wherein the trim chute is angularly adjustable relative to the primary chute thereby enabling the trim chute portion to adjust the particulate material load profile.

4. The loading apparatus according to claim 3, wherein the trim chute is pivotally connected to the primary chute for pivotal movement relative to the primary chute.

5. The loading apparatus according to claim 4, wherein the trim chute is pivotally connected to the swing chute.

6. The loading apparatus according to any one of claims 1 to 5, wherein the trim chute

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includes a trim chute outlet arranged, in use, to feed the particulate material into the container, the trim chute outlet being positioned adjacent to the trim chute portion.

7. The loading apparatus according to any one of claims 1 to 6, wherein the angular movement of the swing chute enables movement of the swing chute between a first lowered in use position, and a second raised position when not in use.

8 The loading apparatus according to claim 7, further comprising independent latch means to hold the swing chute in the second raised position when not in use.

9. The loading apparatus according to any one of claims 1 to 8, wherein the moveable barrier member is pivotally mounted to the primary chute enabling pivotal movement of the movable barrier member relative to the primary chute with at least one extendable/retractable actuator operating between the primary chute and the moveable barrier to effect movement of the moveable barrier member.

10. The loading apparatus according to any one of claims 1 to 9, wherein the trim chute is engaged with the primary chute by at least one trim chute hydraulic arm or linear actuator, the trim chute hydraulic arm effecting movement of the trim chute with respect to the primary chute.

11. The loading apparatus according to any one of claims 1 to 10, wherein the container comprises a rail wagon.

12. A method of loading a container with a particulate material and adjusting a load profile of deposited particulate material, the method comprising:

depositing the particulate material into the container through a loading apparatus, the loading apparatus having a primary chute including a fixed chute and a swing chute angularly movable relative to the fixed chute, with the primary being positioned, in use, to receive the particulate material to pass the particulate material to a swing chute outlet, and a trim chute positioned at swing chute outlet being connected to the primary chute, the loading apparatus further including a movable barrier member engaged with the primary chute and being selectably movable between a closing position where the movable barrier member closes the swing chute outlet, and an open position where flow of the particulate material through the swing chute outlet is possible, and a trim chute positioned at the swing chute outlet being

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connected to the primary chute, the trim chute having a trim chute portion engageable with deposited the particulate material in the container; and

operably moving the trim chute portion relative to the primary chute to thereby adjust positioning of the particulate material to establish a desired particulate material load profile in the container.

13. The method of loading the container according to claim 12, wherein adjusting positioning of the trim chute portion occurs during loading of the container.

14. The method of loading the container according to claim 12, wherein adjusting positioning of the trim chute portion occurs prior to commencing loading of the container.

15. The method of loading the container according to any one of the claims 12 to 14, wherein adjusting movement of the trim chute portion occurs in response to adjusting angular position of the trim chute relative to the primary chute.

16. The method of loading the container according to any one of claims 12 to 15, wherein the particulate material load profile in the container is adjusted to provide either a uniform height or a non-uniform height of the particulate material load profile substantially along a full length of the container.

17. The method of loading the container according to any one of claims 12 to 16, wherein relative translational movement is provided between the loading apparatus and the container during loading of the container with the particulate material.

18. The method of loading the container according to claim 17, wherein the container is translationally moveable relative to a stationary the loading apparatus.

19. The method of loading the container according to any one of claims 12 to 18, wherein the container is a rail wagon supported by front and rear wheel/axles rolling on outgoing rails.

20. The method of loading the container according to any one of claims 12 to 19, wherein the moving of the trim chute relative to the primary chute is performed during loading the particulate material into the container.

21. The method of loading the container according to any one of claims 12 to 20, wherein

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the container is carried by a truck loader vehicle.

22. The method of loading the container according to claim 19, wherein operably moving the trim chute relative to the primary chute occurs using a data control system into which weight data is introduced from weight measuring means assessing front and rear rail wagon masses.

23. The method of loading the container according to claim 22, wherein the data control system includes a programmable logic controller (PLC).

24. The method of loading the container according to claim 22 or claim 23, wherein the load profile of the particulate material load profile from front to rear of the container, or from a relatively forward to a relatively rearward location of the container occurs solely by adjusting movement of the trim chute relative to the primary chute using the data control system.

25. The method of loading the container according to any one of claims 12 to 24, wherein the adjusting movement of the position of the trim chute relative to the primary chute occurs by extension or retraction of at least one actuator operable between the primary chute and the trim chute.

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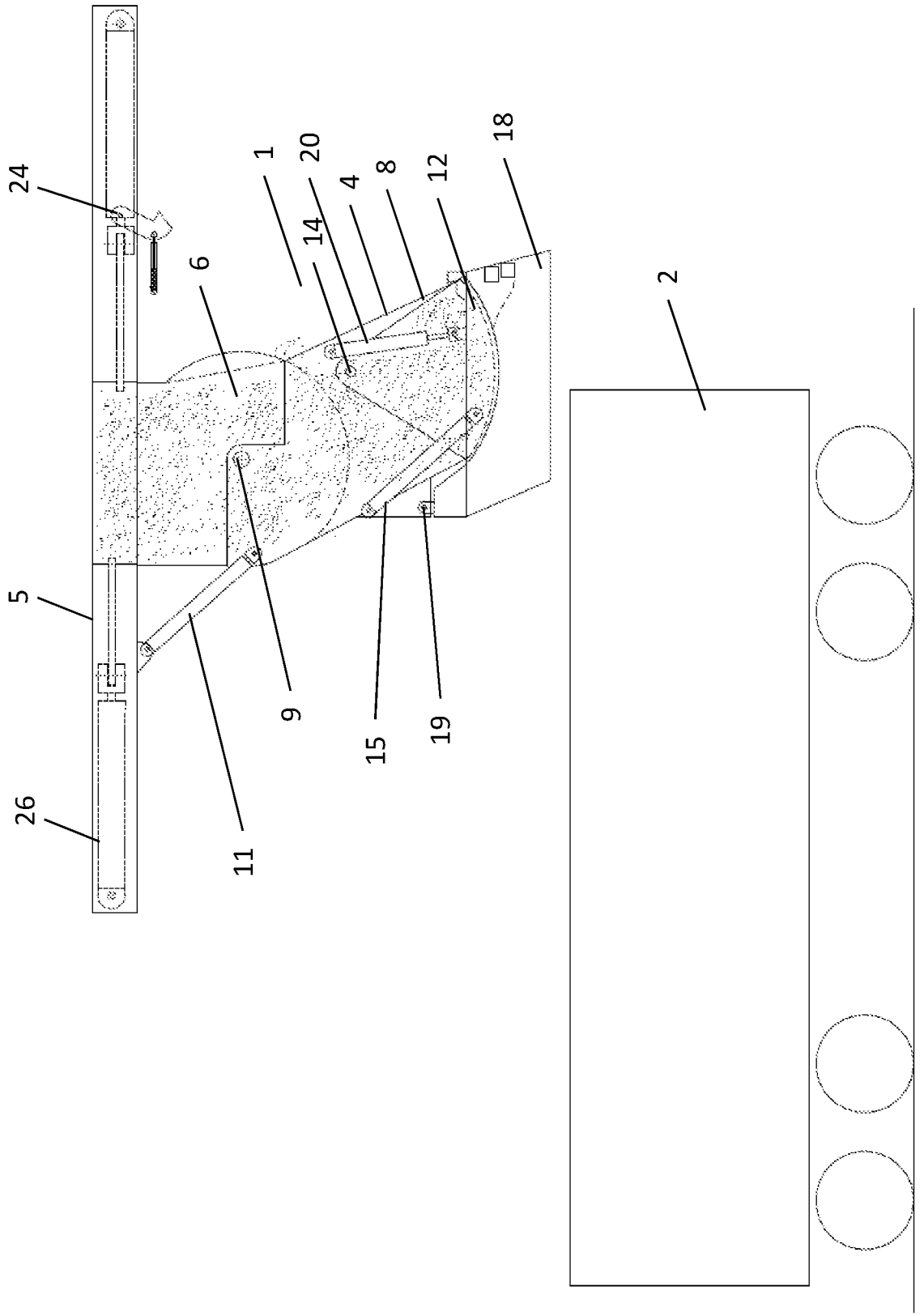


Fig. 1

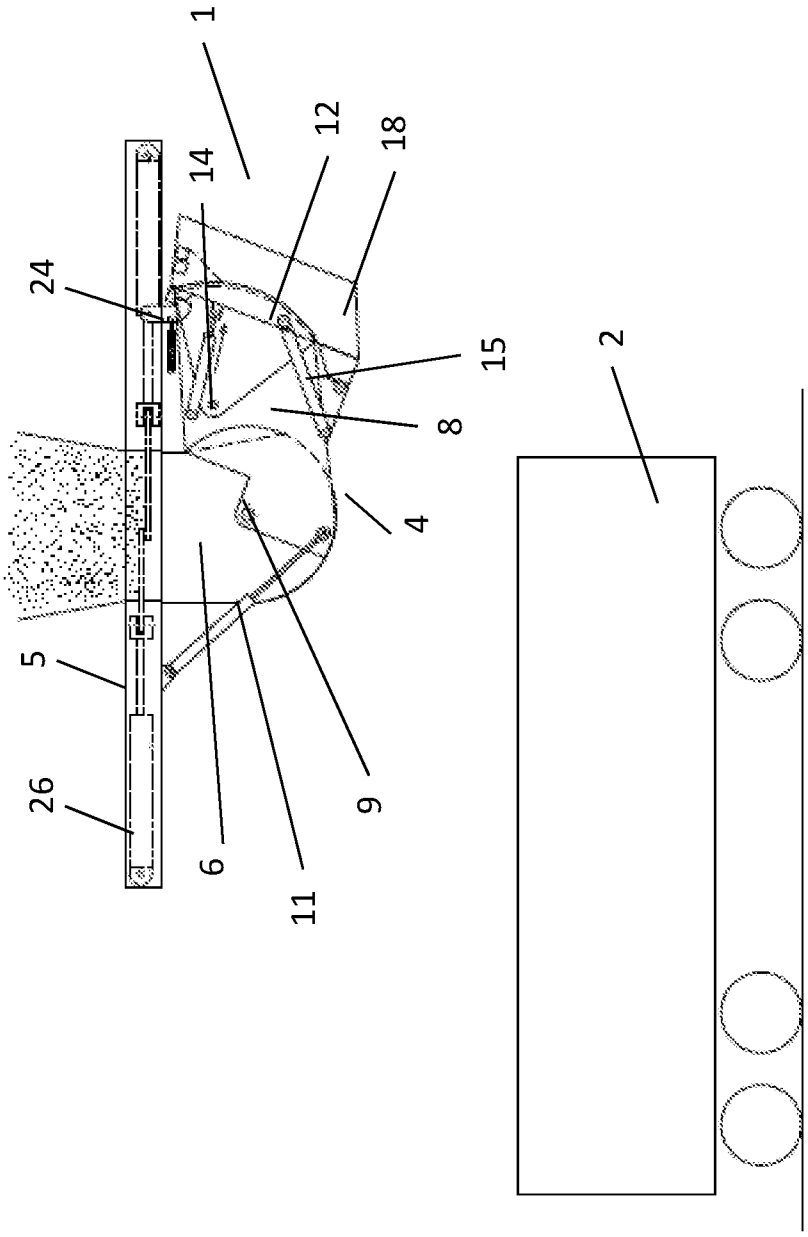


Fig. 2

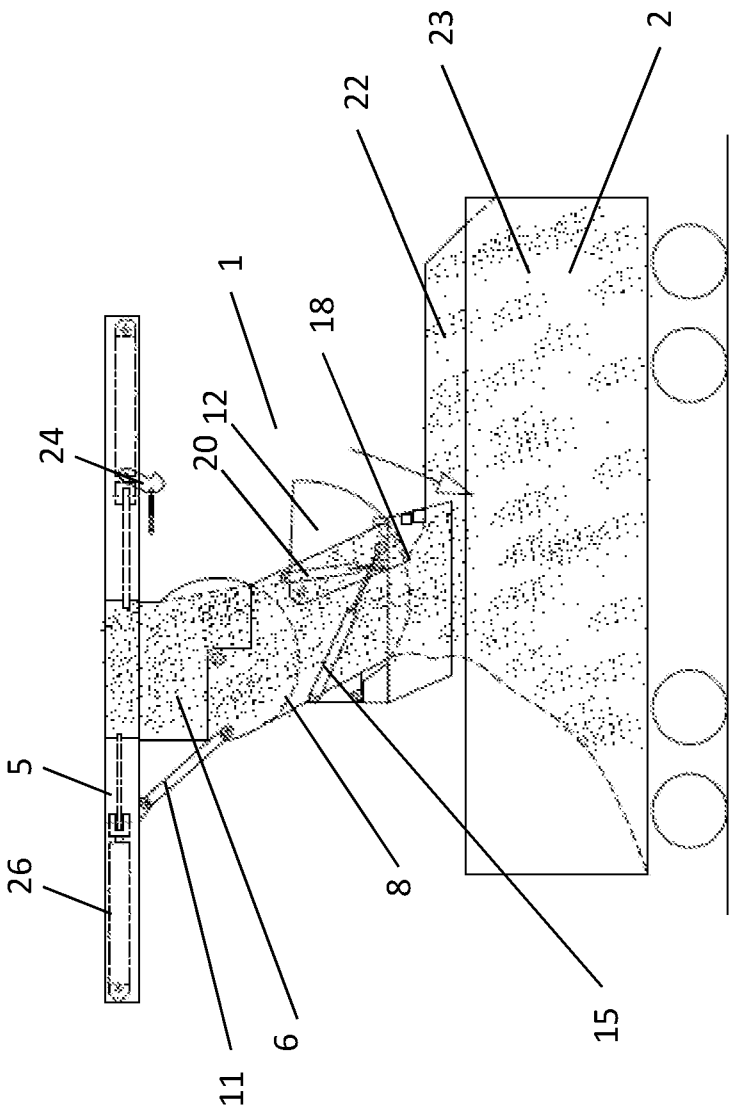


Fig. 3

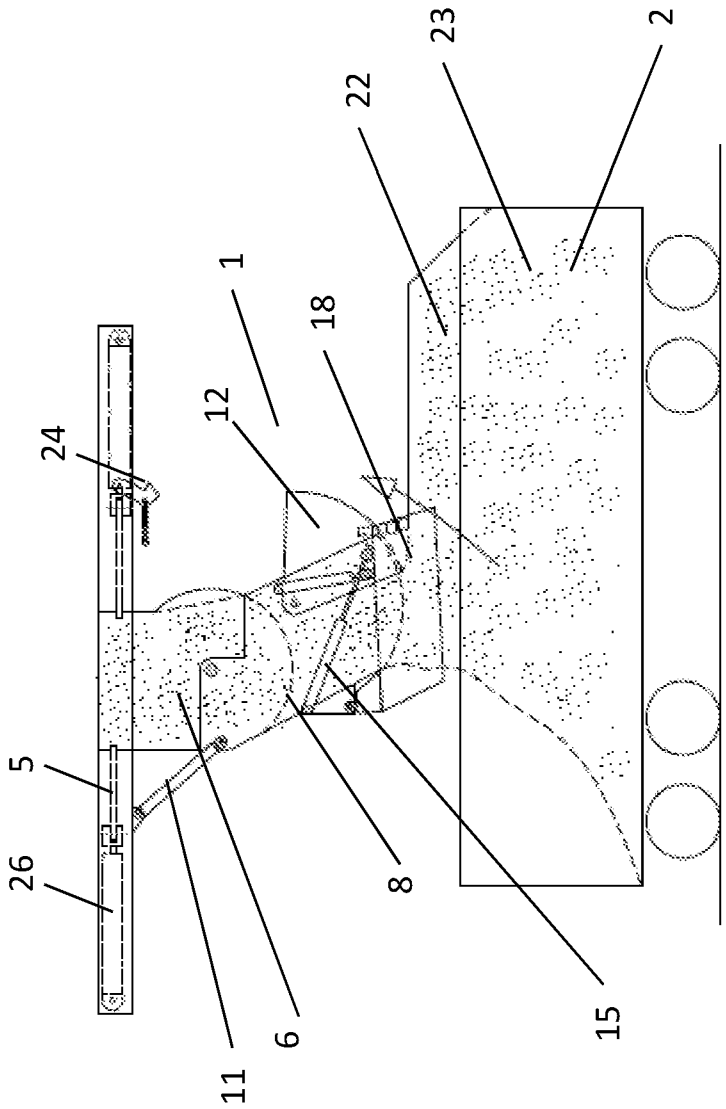


Fig. 4

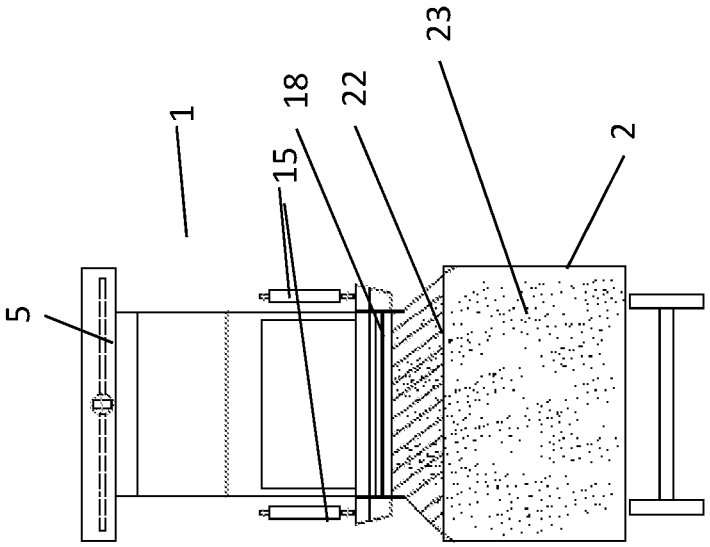


Fig. 6

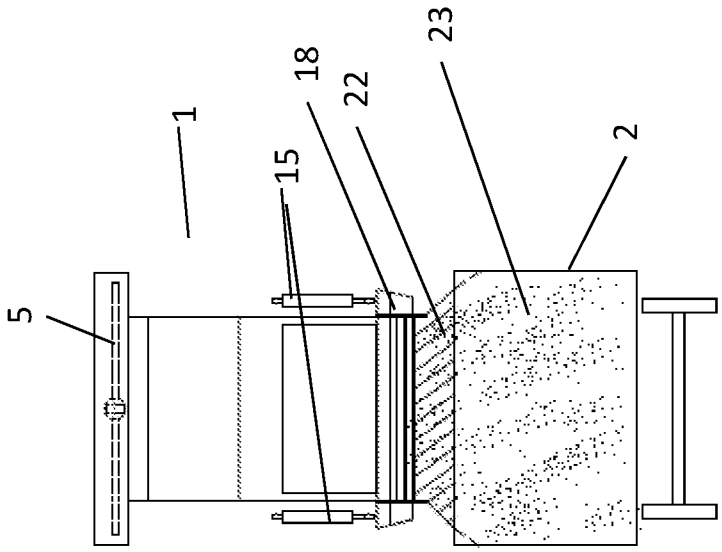


Fig. 5

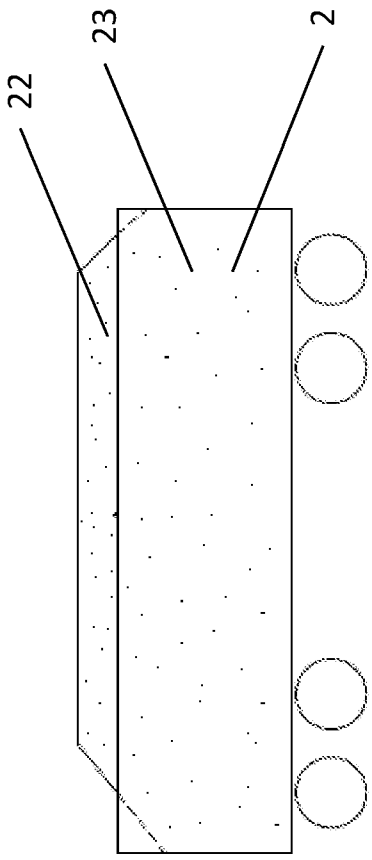


Fig. 7

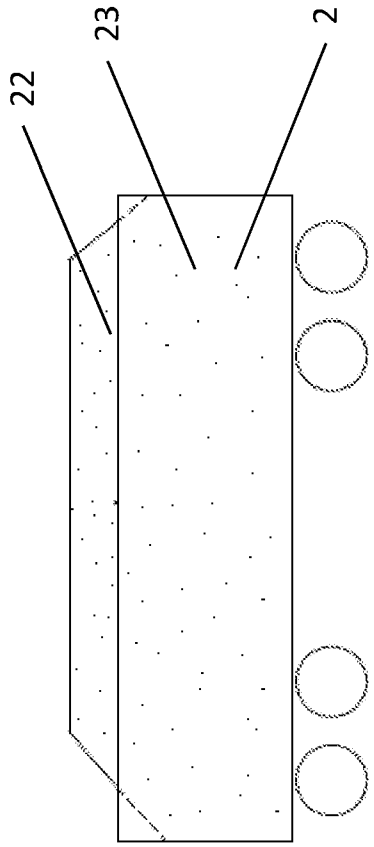


Fig. 8

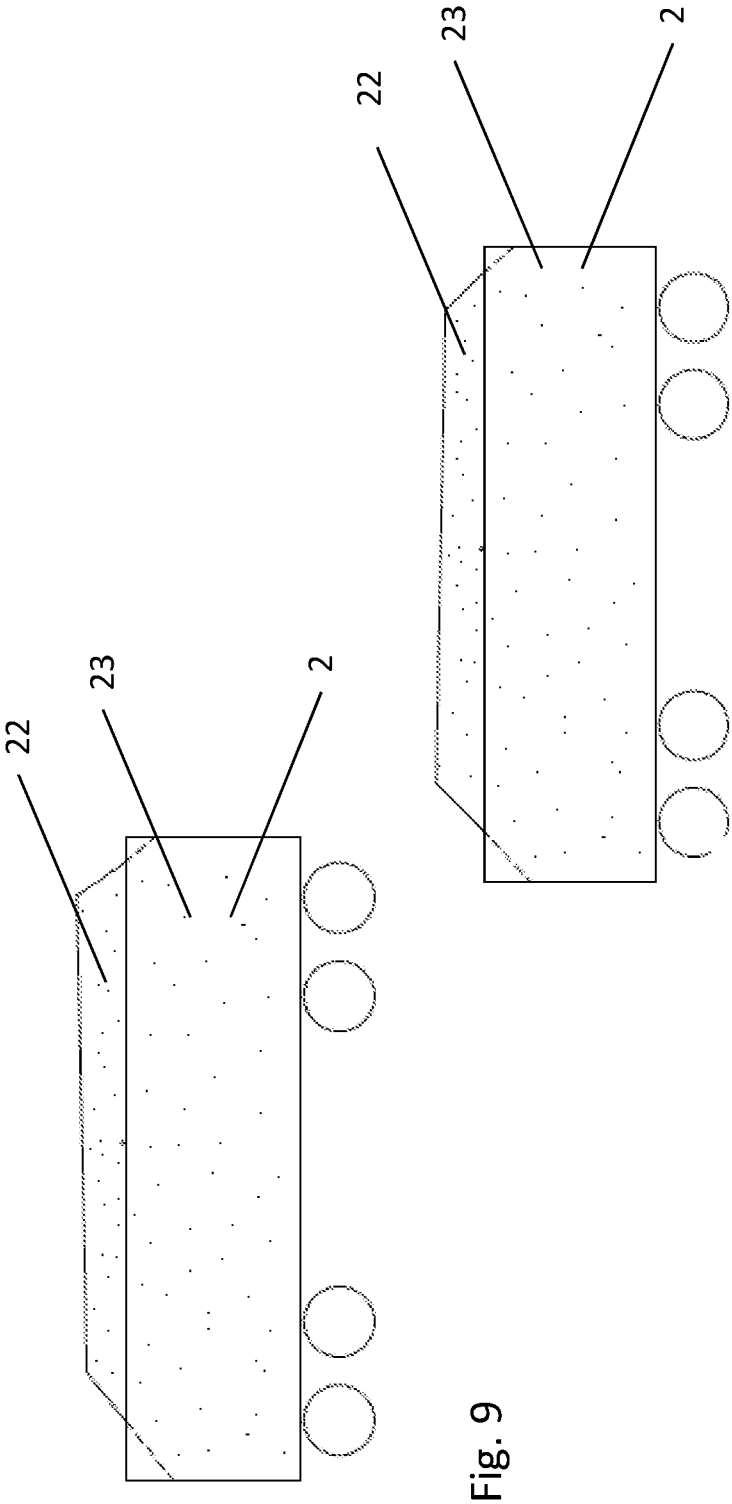


Fig. 9

Fig. 10

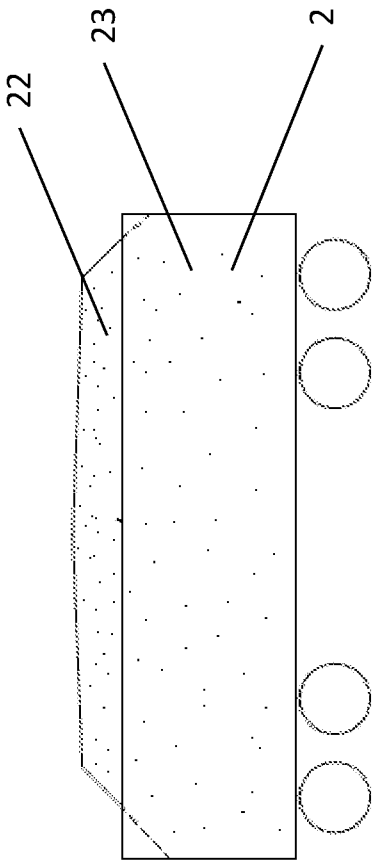


Fig. 11

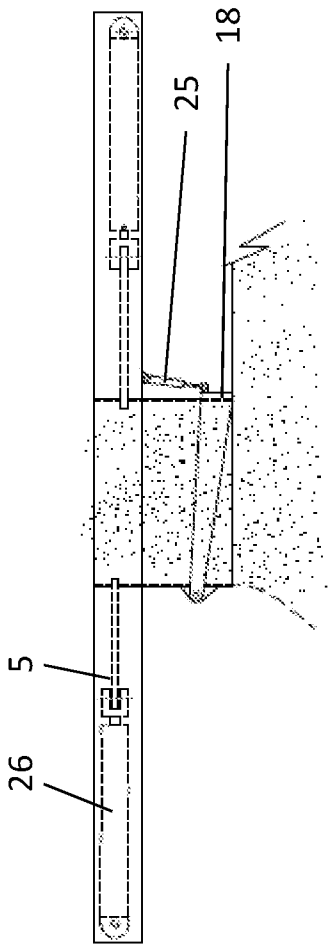


Fig. 12

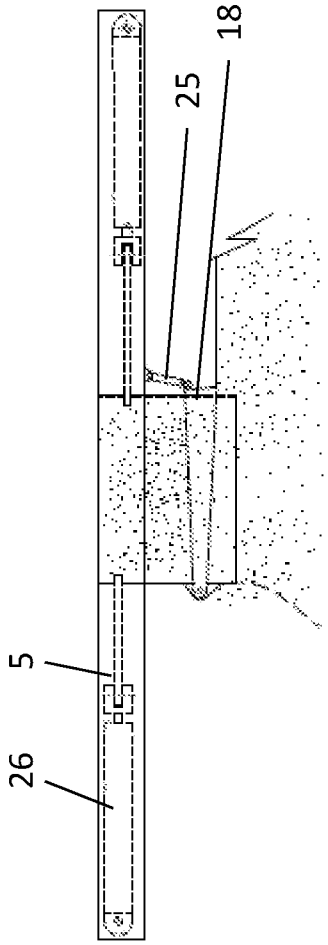
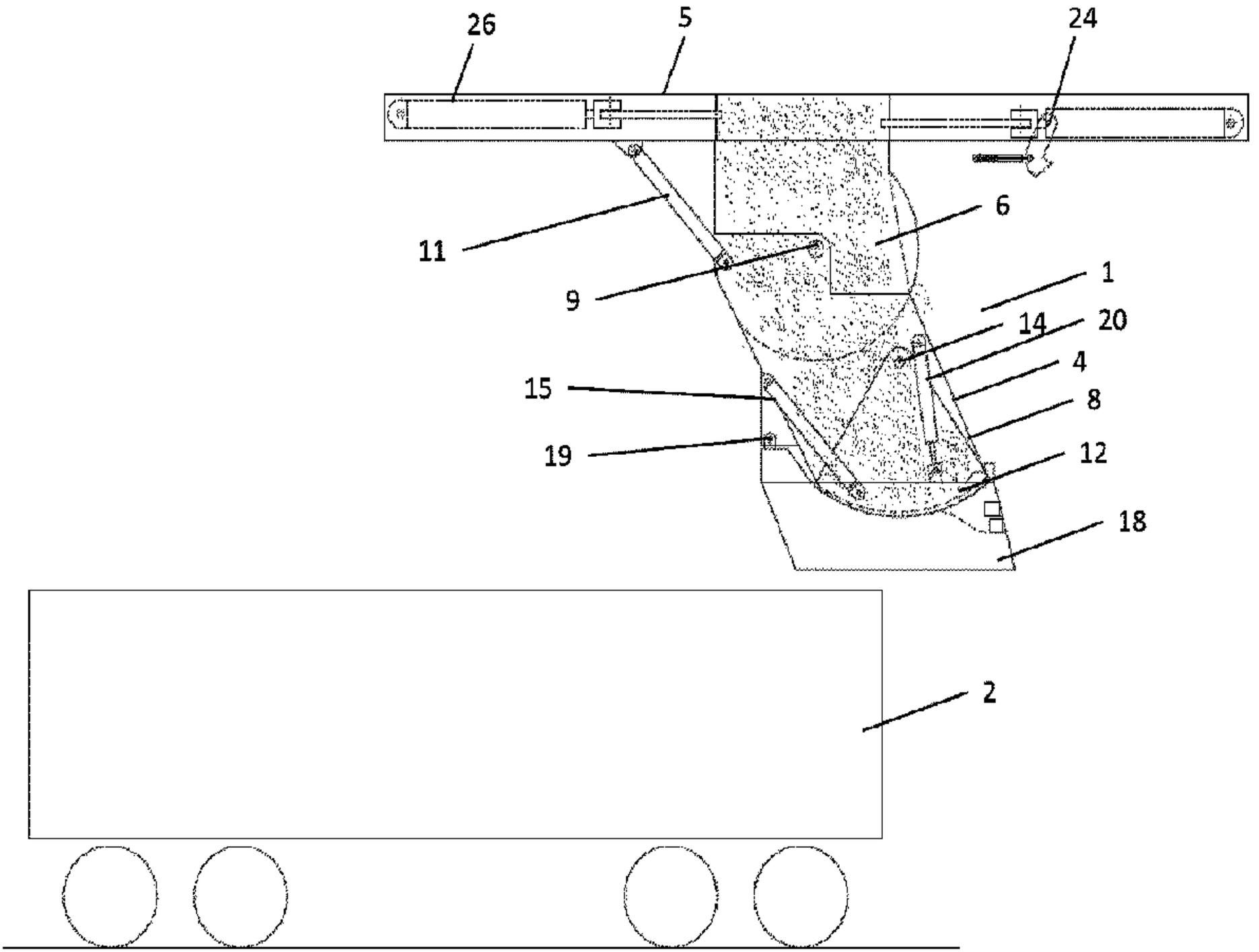


Fig. 13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