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(54) **Device and method for automatically cutting and emptying bags**

(57) The present invention relates to a device (1) for automatically cutting and emptying bags, comprising:
- a feed device (2) designed to take one or more bags to a take-up position (a);
- a gripper unit (3) designed to grip the one or more bags at the take-up position (a) and move it/them to a delivery

position (b);
- a cutting and emptying device (4) designed to cut open and empty the one or more moved bags;

in which the gripper unit (3) can be rotated between the take-up position (a) and delivery position (b).

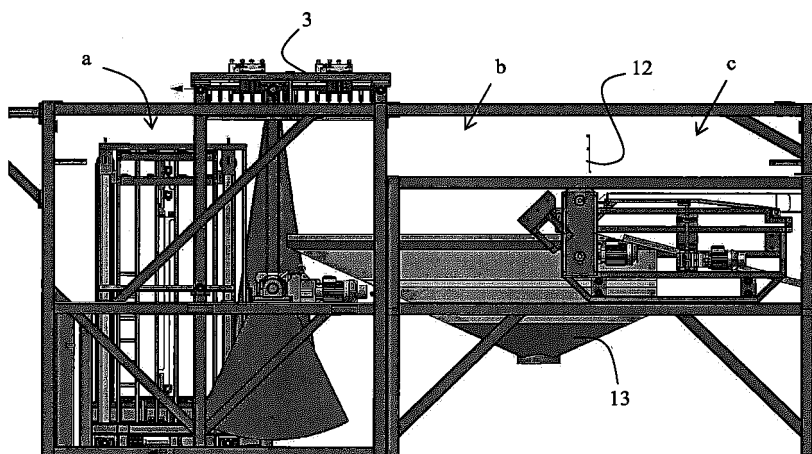


Fig. 2



Description

[0001] The present invention relates, on the one hand, to a device for automatically cutting and emptying bags, comprising:

- a feed device designed to take one or more bags to a take-up position;
- a gripper unit designed to grip the one or more bags at the take-up position and move it/them to a delivery position;
- a cutting and emptying device designed to cut open and empty the one or more moved bags.

[0002] On the other hand, the present invention relates to a method for automatically cutting and emptying bags.

[0003] Bags (of 25 kg or different weights) are commonly used for packaging crushed or granular goods, such as for example corn, coal, ore, gravel, sand, raw materials for the plastics industry, etc. For transportation purposes, these bags are often stacked on pallets in layers (e.g. 5 bags per layer and 11 layers per pallet).

[0004] Once the products have reached their final destination, the customer very often wants to use the packaged products in bulk form (e.g. in big bags or 25 ton silo trucks). To this end, the bags are cut open and emptied into a discharge hopper. The cutting of the bags may be carried out manually or automatically.

[0005] So-called single-track cutting machines are known for automatically opening bags. With such a machine, the bags are taken off the pallet manually and placed on a conveyor track one by one. The conveyor track then moves the bags past a fixed blade which cuts the bag open and as a result of which the contents of the cut-open bag drops into a collecting hopper. Vibrating elements or eccentric gear wheels ensure that the bag is emptied in an optimum manner. At the rear of the machine, the bag is taken off the track by means of a guide plate and discharged into a container. However, the capacity of this machine is too low. In addition, one or two operatives are required to remove the bags from a pallet and place them on the conveyor track.

[0006] In order to partially solve the abovementioned problems, the international patent application WO 2006/043261 discloses a device for automatically emptying bags. To this end, a complete pallet (any outer packaging having previously been removed) is introduced into the device by means of, for example, a fork-lift truck. The device comprises a gripper unit which is designed to grip one complete layer of bags and move them across a number of rotating blades, thus cutting the bags open, as a result of which the contents can drop into a collecting hopper. The bags are subsequently laid on a vibrating frame which serves to ensure that the bags are emptied further. The bags which have been laid down are pushed into a collecting container by means of a rake which is provided on the underside of the gripper unit. Depending on the position of the collecting container, this can take

place when the gripper unit returns in order to pick up the next layer of bags, or during the next cycle, when the gripper unit moves across the rotating blades with the next layer of bags.

[0007] However, the device described in WO 2006/043261 has a large number of moving parts, resulting in considerable energy consumption (inertia) and wear. Therefore, it is an object of the present invention to provide a device which attempts to limit the number of movements for automatically cutting and emptying one or more bags.

[0008] The object of the invention is achieved by providing a device for automatically cutting and emptying bags, comprising:

- a feed device designed to take one or more bags to a take-up position;
- a gripper unit designed to grip the one or more bags at the take-up position and move it/them to a delivery position;
- a cutting and emptying device designed to cut open and empty the one or more moved bags;

in which the gripper unit can be rotated between the take-up position and delivery position and in which the cutting and emptying device can be moved between a rest position and said delivery position, in which the cutting and emptying device is designed to cut open and empty the one or more moved bags at the delivery position. By arranging the gripper unit in such a manner that it can rotate between a take-up and delivery position, the gripper unit will have to perform far fewer movements compared to the known device. Since fewer movements have to be carried out, there is less wear, less inertia, and less energy is used and it is possible to work more quickly. In addition, such a rotatable gripper unit, at rest, takes up far less space, as a result of which such a device can be transported much more easily. Since cutting is carried out at the delivery position, the device offers the following advantages:

- the bags to be cut are suspended, the packaging is under tension, which improves the cutting and emptying of the cut bags;
- as a result of the cutting and emptying device being movable, the cutting and emptying device is completely removed following cutting, thus making the collecting hopper readily accessible for cleaning or maintenance.

[0009] In a preferred embodiment of the device according to the invention, the gripper unit comprises a fixed frame having at least two rotatable arms, with each arm being rotatable about a point of rotation. In particular, said frame comprises four, in particular six, rotatable arms, with each arm being rotatable about a point of rotation.

[0010] In a particular embodiment of the device ac-

cording to the invention, the cutting and emptying device comprises a movable carriage provided with cutting means and a vibratable collecting frame for the emptied bags. Said cutting means are preferably rotatable. By means of the vibratable frame, any material which may still be present in the cut-open bags can be removed in a simple manner.

[0011] In a more particular embodiment of the device according to the invention, said collecting frame can be made to vibrate by means of a vibration motor or a cam-shaft system. A collecting frame which is designed in such a manner improves the emptying of the bags which have already been cut open.

[0012] According to a particularly preferred embodiment of the device according to the invention, the device comprises a collecting unit designed to collect the emptied bags. Said collecting unit is preferably a pressing container in which the emptied bags are compacted.

[0013] Another object of this application relates to a method for automatically cutting and emptying bags, with the method comprising the following steps:

- taking one or more bags to a take-up position by means of a feed device;
- gripping the one or more bags by means of a gripper unit at the take-up position and rotating it/them to a delivery position;
- cutting open and emptying the one or more moved bags at the delivery position by means of a cutting and emptying device which is movable between a rest position and said delivery position.

[0014] According to a preferred method according to the invention, the one or more moved bags are held by the gripper unit while being cut open and emptied. The time period during which the bags are held can be adjusted.

[0015] According to a more particular method of the present invention, the one or more moved bags, after being cut open and emptied, are passed onto a vibratable collecting frame provided on the cutting and emptying device, with this collecting frame vibrating when the cutting and emptying device returns to its rest position.

[0016] In order to illustrate the characteristics of the present invention further and to indicate the additional advantages and features thereof, a more detailed description of the device and method for automatically cutting and emptying bags according to the present invention is given below. It will be clear that nothing in the following description can be interpreted as a limitation of the protection sought in the claims for the present invention.

[0017] In the following description, reference numerals are used to refer to the attached drawings, in which:

- *Fig. 1 shows a perspective view of the device according to the invention;*
- *Fig. 2 shows a front view of the device according to*

the invention in which the gripper unit is situated between the take-up and delivery position and the cutting and emptying device is in its rest position;

- *Fig. 3 shows a front view of the device according to the invention, in which the gripper unit is in the take-up position and the cutting and emptying device in its rest position;*
- *Fig. 4 shows a front view of the device according to the invention, in which the gripper unit is in the delivery position and the cutting and emptying device in its rest position;*
- *Fig. 5 shows a front view of the device according to the invention, in which the gripper unit is in the delivery position and the cutting and emptying device is also at the delivery position;*
- *Fig. 6 shows a front view of the device according to the invention, in which the cutting and emptying device returns with the emptied bag in its rest position;*
- *Fig. 7 shows a front view of an alternative embodiment of the device according to the invention in which the gripper unit is in the take-up position;*
- *Fig. 8 shows a front view of the device illustrated in Fig. 7 in which the gripper unit is situated between the take-up and delivery position;*
- *Fig. 9 shows a front view of the device illustrated in Fig. 7, in which the gripper unit is situated in the delivery position;*
- *Fig. 10 shows a perspective view of a mobile container in which the device is placed in order to be transported;*
- *Fig. 11 shows a view of the container illustrated in Fig. 10 with the doors open;*
- *Fig. 12 shows a view of the container illustrated in Fig. 10 without side walls.*

[0018] The present invention describes a device (1) for automatically, preferably layer by layer, cutting and emptying bags (25 kg or different weight) which are stacked on pallets. Generally, a pallet will comprise at least one or more adjacent bags per layer.

[0019] The device (1) for automatically cutting and emptying bags according to the invention and as illustrated in Figs. 1 to 6 to this end comprises:

- a feed device (2) provided for taking one or more bags to a take-up position (a);
- a gripper unit (3) provided for gripping the one or more bags at the take-up position (a) and moving it/them to a delivery position (b);
- a cutting and emptying device (4) provided for cutting open and emptying the one or more moved bags.

[0020] The feed device (2) comprises a hydraulically or electrically driven lifting platform which can be moved up and down. The pallet with the bags is placed on this lifting platform by means of a fork-lift truck. For safety reasons, the lifting platform is protected by railings. These railings also ensure that no bags can fall off the

stack.

[0021] In use, the gripper unit (3) will in each case take a layer of bags from the stack at the take-up position (a) (Fig. 3). When a layer of bags has been removed from the stack, the lifting platform will move upwards to take a new layer to the take-up position (a). To this end, detectors are fitted at various levels in the railings to detect the height of the stack of bags and to bring the lifting platform (and consequently the pallet) to the correct height for optimum removal.

[0022] Using the gripper unit (3), one or more bags are gripped layer by layer. In order to grip the bags, the gripper unit (3) comprises a number of telescopic, preferably pin-shaped, gripping elements. When the one or more bags are gripped and moved, the gripping elements are in their extended position. The gripping elements may be driven pneumatically and/or electrically.

[0023] As the gripper unit (3) can be rotated between the take-up position (a) and the delivery position (b), the gripper unit (3) will, after the bags have been lifted up at the take-up position (a), rotate (in a reciprocating way) (Fig. 2) to the delivery position (b) where they will be held for a certain period by the gripping elements (Fig. 4). When the one or more bags are at the delivery position (b), the cutting and emptying device (4) moves from its rest position (c) to the delivery position (b) in order to cut open and empty the supplied one or more bags at the delivery position (b) (Fig. 5).

[0024] The cutting and emptying device (4) comprises a movable carriage which is provided with cutting means (11) and a vibratable collecting frame (10) for the emptied bags. The cutting means (11) are preferably situated at the end of the movable carriage and are preferably rotatable.

[0025] On account of the force of gravity, the material present in the bag drops into a collecting hopper (13) situated underneath after the supplied one or more bags have been cut open. Subsequently, the latter are passed on to the vibratable collecting frame (10) by the gripping elements being retracted. In order to remove any material which has possibly remained behind, it is possible to cause the collecting frame (10) to vibrate by means of a shaft on eccentric guide wheels or a guide shaft or by means of a vibration system. Preferably, the collecting frame (10) is caused to vibrate when it returns to its rest position (c) (Fig. 6).

[0026] In order to subsequently remove the emptied bag from the collecting frame (10), the device is provided with a rake (12) which can fold out and can be moved between a folded-in and a folded-out position. When the collecting frame (10) is in its rest position (c), the rake (12) folds out downwards, so that when the movable carriage moves towards the delivery position (b) during the next cycle, it will pass the folded-out rake (12), as a result of which the emptied bag(s) will be pushed off the collecting frame (10). The removed bag is received in a collecting unit, preferably a pressing container. After the bag has been removed, the rake (12) will fold back into its

folded-in position.

[0027] In an alternative embodiment, illustrated in Figs. 7 to 9, the gripped and moved one or more bags are passed onto a conveyor (5) by retracting the gripping elements.

[0028] Preferably, the alternative device (1) comprises two or more parallel conveyors (5). In order to prevent the bags from slipping and to ensure improved grip, the conveyors comprise a number of (triangular) projections. The projections have a pointed end, as a result of which they can pierce through the material of the bags.

[0029] The conveyor (5) will move the bags in the direction of the cutting and emptying device (4). In order to cut the supplied bags open, the cutting and emptying device (4) may comprise a shaft with rotating blades or one or more adjacent chains provided with blades or a set of blades which are arranged in a fixed position.

[0030] On account of the force of gravity, the material present in the bag drops into a collecting hopper situated underneath after the bags have been cut open. In order to assist emptying of the opened bags, the conveyor can be made to vibrate by means of a shaft on eccentric guide wheels or by means of a vibration system. The device furthermore also comprises a collecting unit in which the emptied bags land.

[0031] In order to be able to rotate, the gripper unit (3) (in both embodiments of the device according to the invention), comprises a fixed frame (6) having at least two and preferably four or more rotatable (7,8) arms, with each arm (7,8) being rotatable about a point of rotation. The rotating (reciprocating) movement may be effected by either a hydraulic drive or a motor drive. In this case, use can be made of a lever (with or without counterweight) or of another known drive mechanism.

[0032] In the take-up position (a), the gripper unit (3), as illustrated for example in Fig. 7, will press the frame (6), in which the gripping elements are situated, horizontally onto the supplied layer. Subsequently, the gripping elements are (pneumatically or electrically) actuated to grip the supplied layer. This 'gripped' layer is rotated (reciprocated) into the delivery position (b) where the layer is placed on driven conveyors (5) by retracting the gripping elements (see for example Fig. 9).

[0033] In addition to its high capacity, the device (1) according to the invention has the significant advantage that, due to its compact dimensions, it can be placed in a container, so that the device can readily be transported. In this case, the chassis of the device is incorporated into the bottom of the container (9). This container (9) is designed such that it can quickly be converted into a fully operational mobile station (see Fig. 10) with wheels, towing hook, access doors, covering roof, maintenance steps, control unit, etc.

Claims

1. Device (1) for automatically cutting and emptying

bags, comprising:

- a feed device (2) designed to take one or more bags to a take-up position (a);
- a gripper unit (3) designed to grip the one or more bags at the take-up position (a) and move it/them to a delivery position (b);
- a cutting and emptying device (4) designed to cut open and empty the one or more moved bags,

characterized in that the gripper unit (3) can be rotated between the take-up position (a) and the delivery position (b) and **in that** the cutting and emptying device (4) can be moved between a rest position (c) and said delivery position (b), in which the cutting and emptying device (4) is designed to cut open and empty the one or more moved bags at the delivery position (b).

2. Device (1) according to Claim 1, **characterized in that** the gripper unit (3) comprises a fixed frame (6) having at least two rotatable (7,8) arms, with each arm (7,8) being rotatable about a point of rotation.

3. Device (1) according to Claim 2, **characterized in that** said frame (6) comprises four rotatable arms, with each arm being rotatable about a point of rotation.

4. Device (1) according to one of the preceding claims, **characterized in that** the cutting and emptying device (4) comprises a movable carriage provided with cutting means (11) and a vibratable collecting frame (10) for the emptied bags.

5. Device (1) according to Claim 4, **characterized in that** said collecting frame (10) can be made to vibrate by means of a vibration motor or a camshaft system.

6. Device (1) according to one of the preceding claims, **characterized in that** said device comprises a collecting unit which is designed to collect the emptied bags.

7. Method for automatically cutting and emptying bags, **characterized in that** the method comprises the following steps:

- taking one or more bags to a take-up position (a) by means of a feed device (2);
- gripping the one or more bags by means of a gripper unit (3) at the take-up position (a) and rotating it/them to a delivery position (b);
- cutting open and emptying the one or more moved bags at the delivery position (b) by means of a cutting and emptying device (4) which is movable between a rest position (c) and

said delivery position (b).

8. Method according to Claim 7, **characterized in that** the one or more moved bags are held by the gripper unit (3) while being cut open and emptied.

9. Method according to Claim 7 or 8, **characterized in that** the one or more moved bags, after being cut open and emptied, are passed onto a vibratable collecting frame (10) provided on the cutting and emptying device (4), with this collecting frame (10) vibrating when the cutting and emptying device (4) returns to its rest position (c).

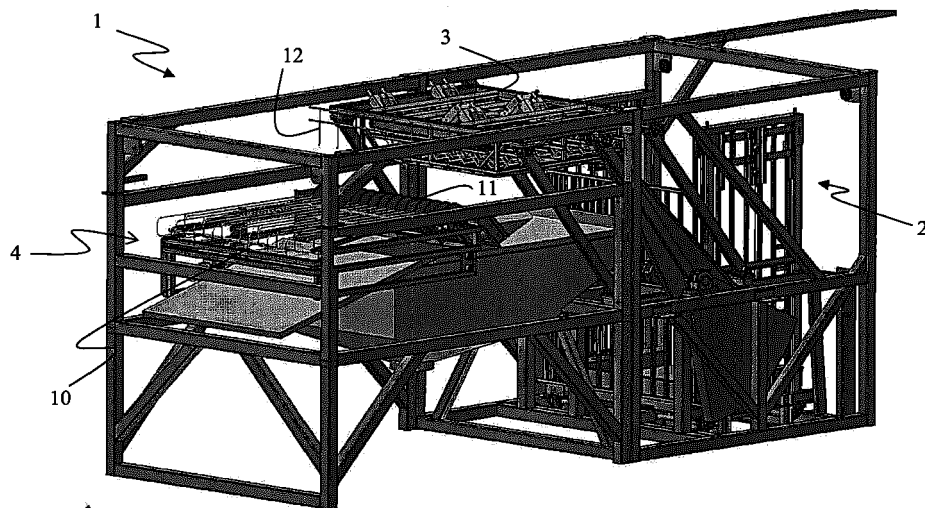


Fig. 1

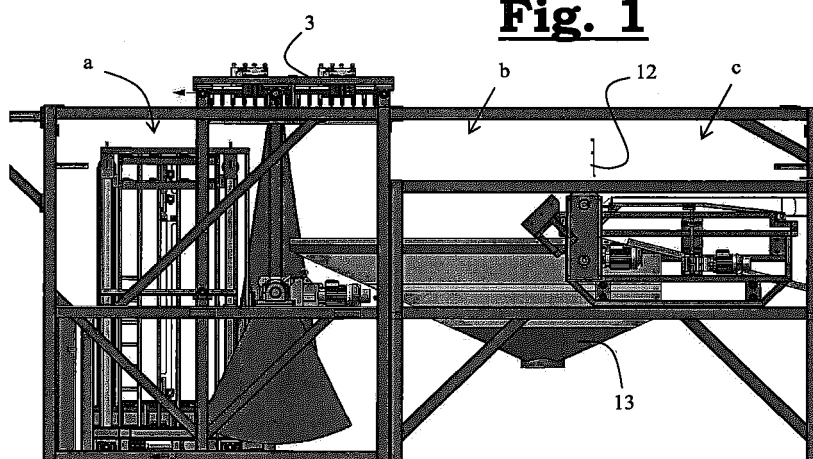


Fig. 2

1

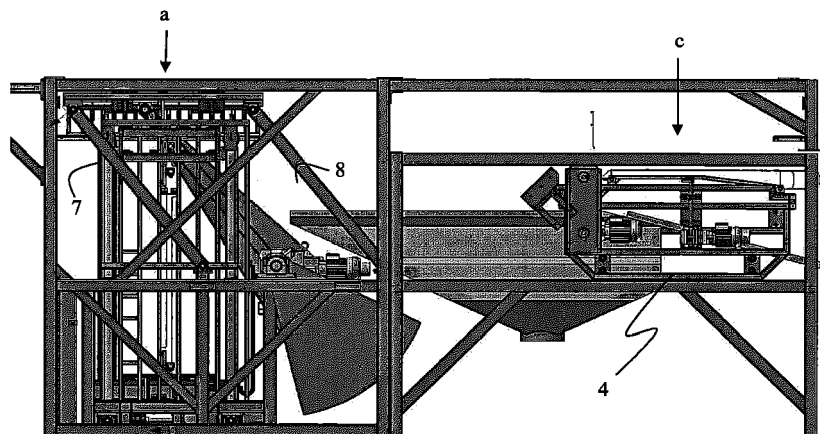


Fig. 3

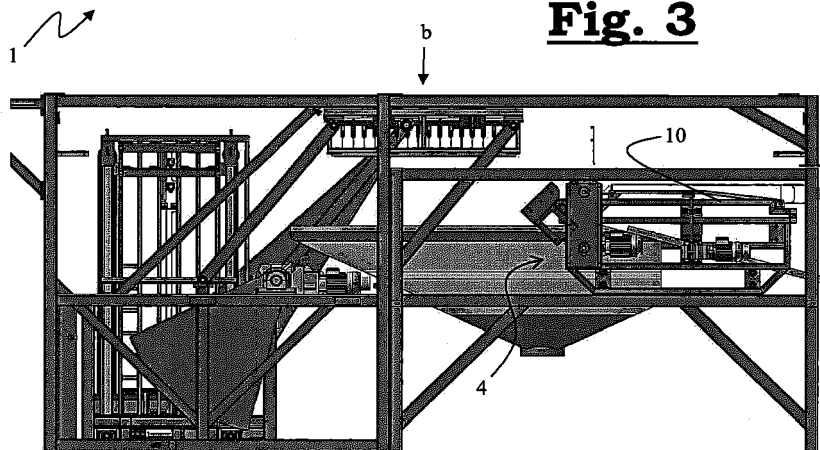


Fig. 4

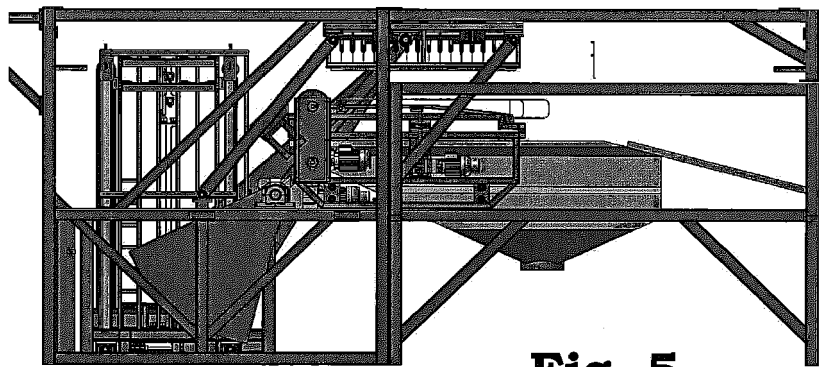


Fig. 5

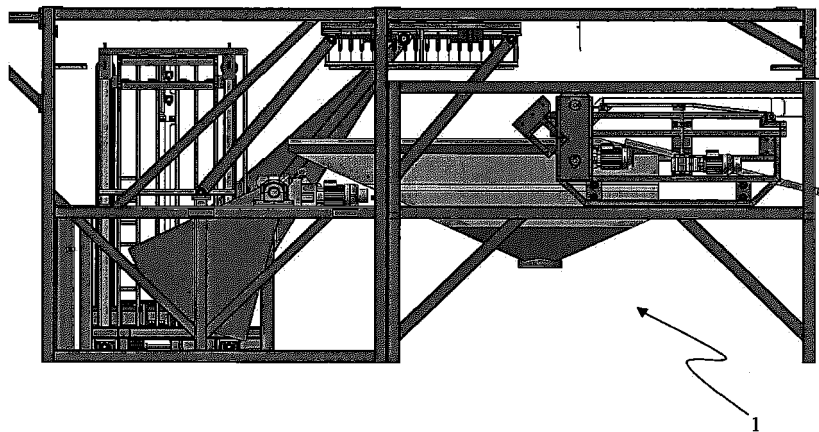
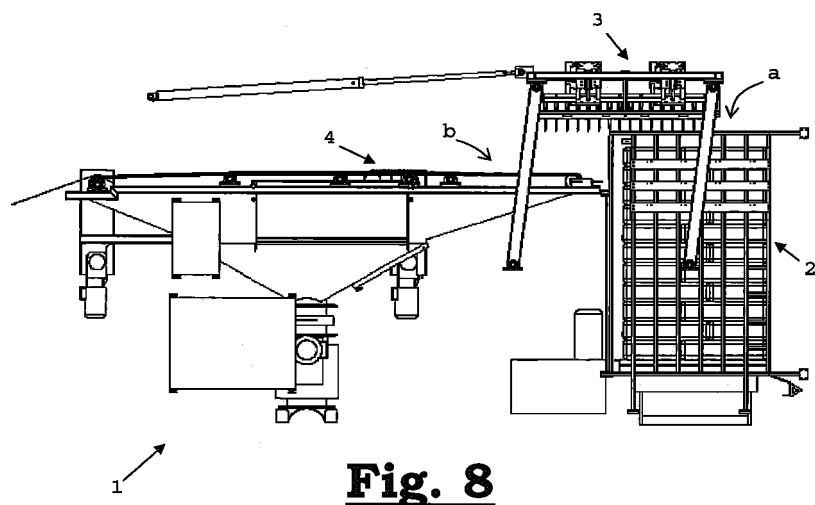
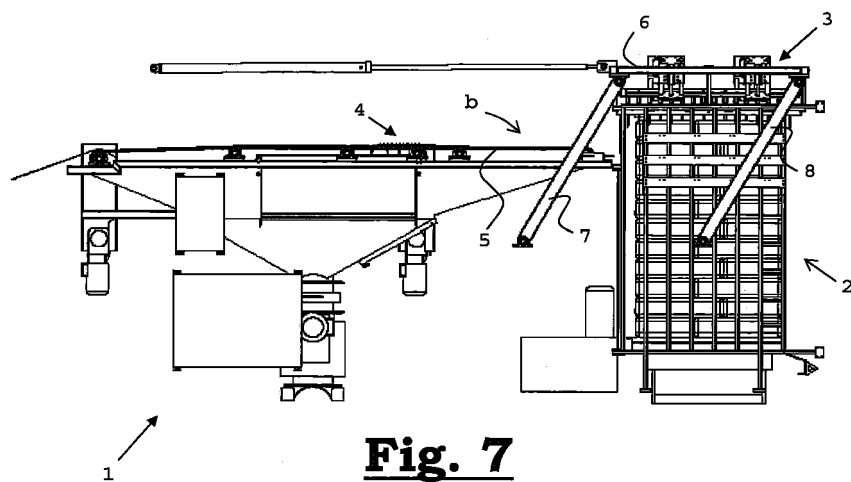


Fig. 6



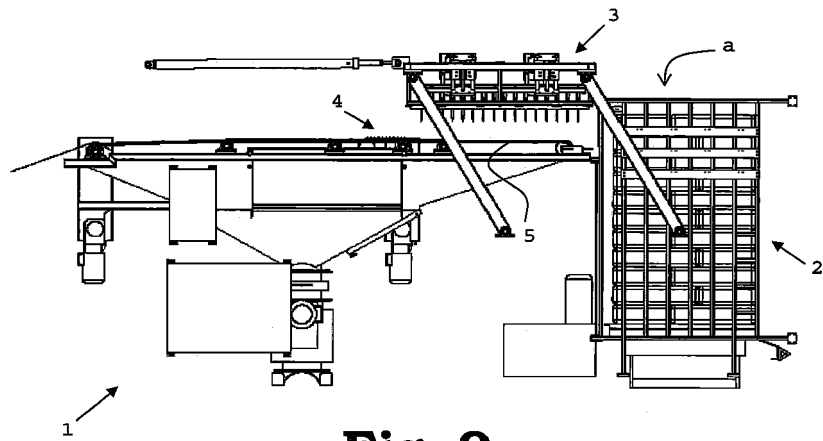


Fig. 9

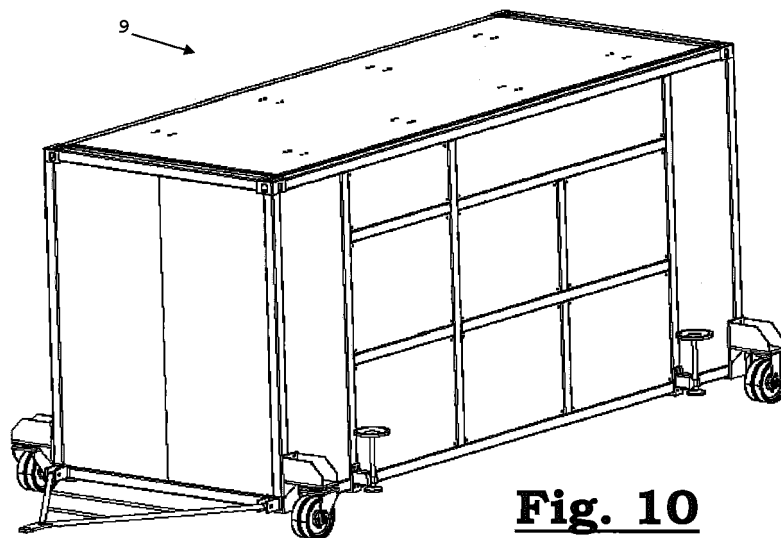


Fig. 10

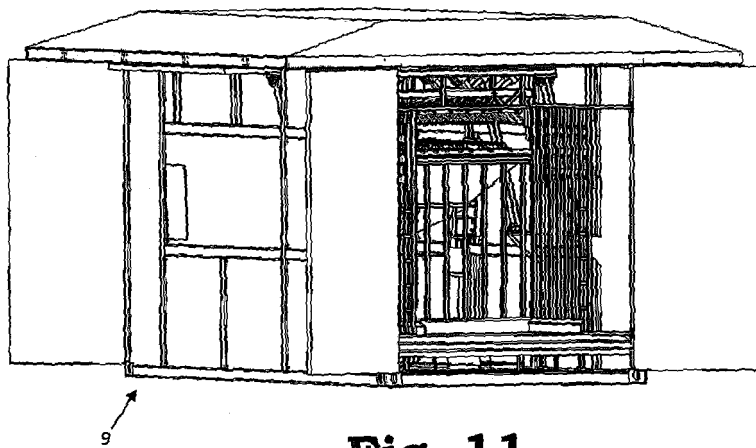


Fig. 11

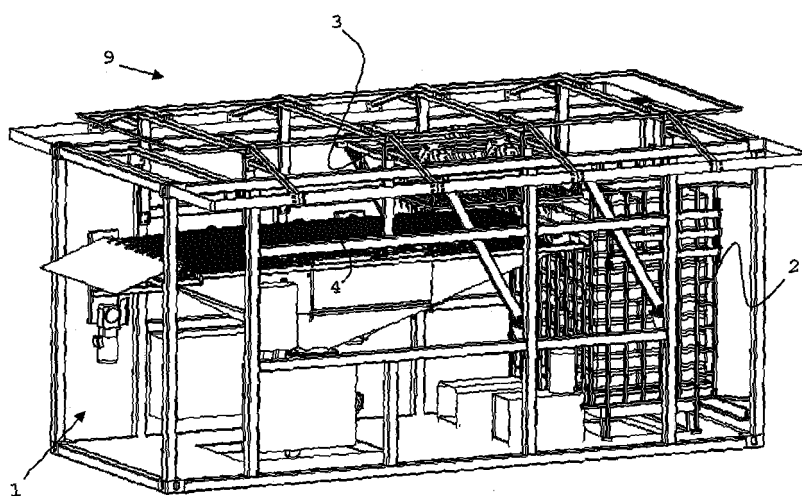


Fig. 12



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Place of search Munich		Date of completion of the search 21 September 2009	Examiner Schelle, Joseph
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EUROPEAN SEARCH REPORT

Application Number
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