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(54) APPARATUS FOR PACKAGING PRODUCTS IN BAGS WITH PREFORMED BAG FEED

(57) An apparatus (100) for packaging products in bags using preformed bags, comprises: a processing station (1) configured to fill the preformed bag with the product and to seal the open end of the bag; a feed station (2), configured to feed the preformed bags to the processing station (1) one by one; a conveying station (3) configured to receive the preformed bags from a store (4) and to make them available to the feed station (2) and including a container (334') configured to contain a group of preformed bags, and a conveyor (30) configured to receive the preformed bags and to transport them from respective loading positions to the pickup position (PP). The conveying station (3) includes an optical device (331), configured to capture a position signal representing the orientation of the preformed bag, and a plurality of pickup devices (33), each including a pickup robot (332), configured to pick up preformed bags one by one to modify their orientation as a function of the respective position signal and to position each preformed bag on the conveyor (30) at the respective loading position with a predetermined orientation.

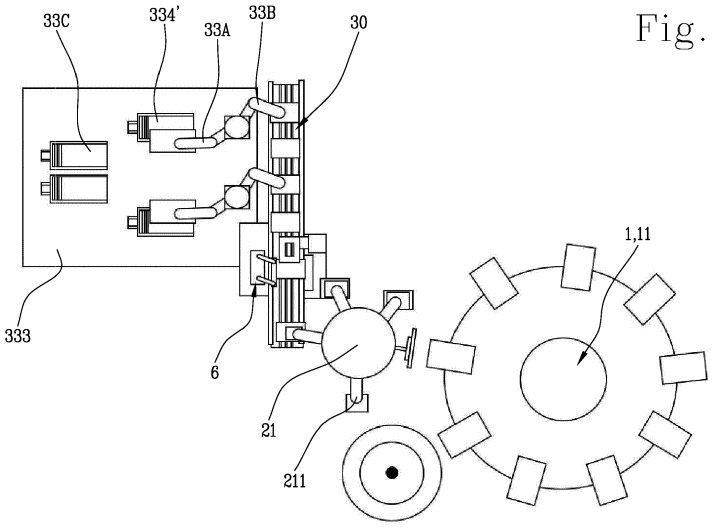

Fig.1

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Description

[0001] This invention relates to an apparatus for packaging products in bags using preformed bags.

[0002] This disclosure addresses the sector of apparatuses or lines for packaging products, be they in solid, liquid or granular form, in bags made of plastic or paper material.

[0003] Known in this sector are apparatuses in which the bags which are filled with the product and sealed are preformed or premade bags.

[0004] In solutions known in this sector, a pickup device picks up the preformed bags one by one from a store and feeds them to a carousel which is configured to fill and seal the preformed bags. These solutions are described in document EP2712727A2.

[0005] In that document, the pickup device includes a bag gripper element by which the bags are moved by translation and rotation in such a way that they are in the correct position when they reach the carousel where they are filled and sealed.

[0006] In these solutions, the carousels work continuously at very high speeds and with a high level of productivity. The pickup device, on the other hand, works intermittently, alternately picking up from the store and feeding to the carousel. The alternating motion of the pickup device sets strong limits on its speed. In effect, working at very high speeds involves considerable accelerations and, consequently, high inertia forces. To avoid overloading the pickup device, therefore, the carousels of many apparatuses are made to work at reduced speeds to allow the pickup devices to work at acceptable feed speeds.

[0007] This, however, means reducing machine productivity and, in turn, a lower level of machine efficiency.

[0008] Moreover, another drawback of these solutions is the need for constant human attention, which means a large amount of operator time to attend to the machine and, consequently, higher costs of labour. Human intervention is required, for example, to move the products from the store to the zone where the device picks them up and to set the bags in place with the correct orientation, which is often different from the orientation they have when they are inside the store.

[0009] This disclosure has for an aim to provide an apparatus and a method for packaging products in bags to overcome the above mentioned drawbacks of the prior art.

[0010] These aims are fully achieved by the apparatus and method for packaging products in bags according to this disclosure as characterized in the appended claims.

[0011] According to one aspect of it, this disclosure provides an apparatus for packaging products in bags using preformed (or premade) bags.

[0012] The apparatus comprises a processing station. The processing station is configured to fill the preformed bag with the product. The processing station is configured to seal an open end of the preformed bag. The processing station includes a carousel. The carousel rotates continuously at a working speed. The carousel is configured to receive the preformed bags at a receiving position. The apparatus comprises a feed station. The feed station is configured to feed the preformed bags to the processing station one by one. The feed station includes a feed carousel. The feed station rotates to pick up the preformed bags from a pickup position. The feed station is configured to feed the preformed bags to the processing station at the receiving station.

[0013] According to one aspect of this invention, the apparatus includes a conveying station. The conveying station is configured to receive the preformed bags from a store. The conveying station is configured to make the preformed bags available to the feed station at the pickup position.

[0014] In an embodiment, the conveying station includes a conveyor. The conveyor is configured to receive the preformed bags. The conveyor is configured to transport the preformed bags from respective loading positions to the pickup position.

[0015] In an embodiment, the apparatus comprises a pickup device. In an embodiment, the apparatus comprises a plurality of pickup devices. Using a plurality of pickup devices working in parallel makes it possible to considerably reduce the working speed of each pickup device. That way, the conveying station is able to equalize the share of production handled by the carousels downstream.

[0016] Each pickup device includes a sensor: for example, an optical device. The optical device is configured to capture a position signal representing the orientation of the preformed bag. In an embodiment, each pickup device comprises a pickup robot. The pickup robot is configured to pick up preformed bags one by one. The pickup robot is configured to change the orientation of the preformed bags as a function of the respective position signal. This allows positioning each preformed bag on the conveyor at the respective loading position with a predetermined orientation. That way, the step of orienting the preformed bags, which was previously carried out manually by an operator, is carried out automatically by the pickup device. In an embodiment, the conveying station includes a loading bay for each pickup device. The term "loading bay" is used to indicate a space, in proximity to the respective pickup device, where the preformed bags are kept before being picked up by the pickup robot. In an embodiment, the conveying station includes a container for each pickup device. The container is disposed in the corresponding loading bay. The container is configured to contain a respective group of preformed bags.

[0017] In an embodiment, the conveying station includes an automatic reloading system. The automatic reloading system is configured to transport groups of preformed bags from the store to the loading bays.

[0018] The automatic reloading system is very important because it allows considerably reducing human intervention in reloading the containers in the loading bays.

In effect, thanks to the automatic reloading system, only one operator might be needed, whose only job would be that of opening the packages in which the preformed bags are delivered and placing them on the automatic reloading system.

[0019] In an embodiment, the conveyor includes a linear conveyor.

[0020] The linear conveyor extends in a longitudinal direction. The linear conveyor includes a loading zone. The loading zone is configured to receive the preformed bags one by one from the plurality of pickup devices. The linear conveyor includes a release zone. The release zone is spaced from the loading zone. The release zone is configured to release the preformed bags to the feed station one by one. That way, the pickup devices can be disposed in a line, thus facilitating positioning operations.

[0021] In an embodiment, the conveyor comprises a pickup carousel. The pickup carousel is interposed between the linear conveyor and the feed station. The pickup carousel is configured to pick up the preformed bags one by one from the release zone of the linear conveyor. The pickup carousel is configured to position the preformed bags at the pickup position, where they can be picked up by the feed station.

[0022] In an embodiment, the pickup carousel comprises a plurality of grasping elements. Each grasping element is configured to pick up a respective preformed bag from the release zone. Each grasping element is movable to vary the orientation of the corresponding preformed bag. The pickup carousel allows further modifying the position and orientation of the preformed bags in such a way that they are ready to be picked up by the feed carousel.

[0023] In an embodiment, the linear conveyor comprises a first conveyor belt. The first conveyor belt is configured to receive the preformed bags one by one in the loading zone. In an embodiment, the linear conveyor comprises a second conveyor belt. The second conveyor belt is configured to release the preformed bags one by one in the release zone. In an embodiment, the linear conveyor comprises a positioner. The positioner is configured to transport the preformed bags one by one from the first conveyor belt to the second conveyor belt. The positioner allows positioning the preformed bags at a predetermined position on the second conveyor belt functional to their being picked up by the pickup carousel. Since the pickup robots work at very high speeds, they are unable to place the bags on the first conveyor belt precisely enough to ensure that they can be picked up correctly by the pickup carousel. Thus, to make up for the low level of precision due to the high working speeds, the positioner repositions the bags while they are being transported on the linear conveyor.

[0024] In an embodiment, the first conveyor belt is parallel to the second conveyor belt. In an embodiment, the first conveyor belt is inclined to the second conveyor belt at an angle less than or equal to 90 degrees. In an embodiment, the positioner is a third conveyor belt which is inclined to the first and second conveyor belts. The third conveyor belt extends from a first end, which is in contact with the first conveyor belt, to a second end, which is in contact with the second conveyor belt.

[0025] In an embodiment, the linear conveyor includes an additional positioner. The additional positioner is superposed on the second belt. The additional positioner is superposed on the second belt in proximity to the release zone. The additional positioner is configured to vary the position of the bags on the second conveyor belt. The additional positioner further enhances the precision.

[0026] In an embodiment, the conveying station includes, for each pickup device, an additional container to form a group of containers. In other words, in an embodiment, the apparatus includes a plurality of containers: one for each pickup device of the plurality. In other embodiments, the apparatus includes a plurality of containers, where the plurality is composed of a group of containers for each pickup device of the plurality. The groups of containers in the respective loading bays make it possible to have a buffer which can be used when automatic reloading operations are delayed.

[0027] In an embodiment, the conveying station includes an automatic recycling system for each group of containers. The recycling system is configured to vary the position of each container within the respective loading bay between a provisioning position and a delivery position. At the provisioning position, the container is configured to be interfaced with the automatic reloading system. At the delivery position, the container is configured to be interfaced with the corresponding pickup device.

[0028] In an embodiment, the pickup robots are disposed on the same side of the conveyor. The pickup robots are spaced from each other along a longitudinal direction of feed of the preformed bags. This arrangement makes it easier for the automatic reloading system to supply the loading bays.

[0029] In an embodiment, the conveyor comprises a pickup carousel interposed between the pickup devices and the feed station. The pickup carousel is configured to pick up the preformed bags one by one from each pickup device. The pickup carousel is configured to position the preformed bags at the pickup position, where they can be picked up by the feed station.

[0030] In an embodiment, the apparatus (the automatic reloading system) comprises a supply track. The supply track extends along a supply path, from the store, where the groups of preformed bags are kept, to the loading bays of the plurality of pickup devices.

[0031] In an embodiment, the automatic reloading system comprises at least one carriage, configured to transport the groups of preformed bags from the store to the loading bays of the pickup devices. In an embodiment, the automatic reloading system comprises a plurality of carriages in which one or more carriages are dedicated to a respective loading bay. The carriage is disposed on the track to move from the store to the loading bays.

[0032] In another embodiment, the plurality of contain-

ers are configured to move on the track of the automatic reloading system. In this embodiment, the automatic reloading system is configured to pick up a container from the respective loading bay. The automatic reloading system is configured to transport it to the store. The automatic reloading system is configured to fill a group of preformed bags, manually by an operator, or automatically. The automatic reloading system is configured to transport it again to the loading bays. In an embodiment, the automatic reloading system is configured to release a full container and to pick up an empty container. In this context, the recycling system is configured to move the containers within the respective loading bay from the delivery position to the provisioning position, where the empty container is picked up by the automatic reloading system and carried on the track to the store.

[0033] In an embodiment, the feed station (or the conveying station) comprises a rotary conveyor. The rotary conveyor is configured to receive the preformed bag from the pickup device at a loading position. The rotary conveyor is configured to deliver it to the first carousel at the receiving position.

[0034] In an embodiment, each pickup device of the plurality is configured to pick up the preformed bags one by one and to deliver them to the rotary conveyor at a corresponding loading position.

[0035] In an embodiment, the rotary conveyor comprises a plurality of arms. The plurality of arms includes at least a first arm and a second arm. The first and second arms are angularly spaced from each other by a spacing angle. In an embodiment, the first arm is configured to rotate independently of the second arm to vary the spacing angle.

[0036] In an embodiment, the plurality of arms includes a first set of arms. The arms of the first set of arms are interconnected to rotate as one. In an embodiment, the plurality of arms includes a second set of arms. The arms of the second set of arms are interconnected to rotate as one.

[0037] The first set of arms is configured to rotate independently of the second set of arms. In an embodiment, the number of arms of the first set of arms and of the second set of arms is less than or equal to the number of pickup devices of the plurality.

[0038] In an embodiment, each arm of the plurality of arms includes a gripper element. In an embodiment, the gripper element is configured to grasp the bags and to hold them on the rotary conveyor. In an embodiment, the gripper element is configured to rotate about an adjustment axis, perpendicular to the corresponding arm and belonging to a plane which is perpendicular to an axis of rotation (R2) of the rotary conveyor.

[0039] In an embodiment, the pickup device includes one or more of the following elements:

- a fixed frame (supporting post) with which the loading bay is associated;
- an articulated structure which is removably connected to the fixed frame;
- a pickup element, connected to the articulated structure to withdraw a preformed bag from the containers and to hold it;
- a beam, connected to the fixed frame and to the articulated structure;
- an actuator, connected to the articulated structure and/or to the pickup element and/or to the beam in order to drive them.

[0040] In an embodiment, the articulated structure is configured to rotate relative to the fixed frame about a first axis of rotation R1 belonging to a plane which is perpendicular to the direction of the weight force, from the pickup position to the feed position. In an embodiment, the beam is configured to rotate relative to the fixed frame about the first axis of rotation R1. In an embodiment, in which the articulated structure and the beam are two axisymmetric solids, the articulated structure and/or the beam are configured to rotate about a main axis of symmetry of the articulated structure or of the beam.

[0041] In an embodiment, the articulated structure is configured to move translationally from the pickup position to the feed position.

[0042] In an embodiment, the pickup element is a suction surface that is configured to rotate about a second axis of rotation perpendicular to the suction surface itself, in order to vary the orientation of the preformed bag.

[0043] In an embodiment, the apparatus comprises a compensation system configured to vary the minimum distance between the pickup element and the preformed bags inside the container.

[0044] In an embodiment, the apparatus comprises a control unit. In an embodiment, the optical device is configured to capture image data representing the orientation of the bag relative to the pickup element. The optical device is configured to send the image data to the control unit. The control unit is configured to generate drive signals as a function of the image data. The control unit is configured to send the drive signals to the actuator to instruct it to rotate the pickup element in order to modify the orientation of the preformed bag.

[0045] In an embodiment, the linear conveyor comprises a zeroing system. The zeroing system is configured to vary the position of the preformed bags on the linear conveyor.

[0046] The zeroing system comprises an abutment member. The zeroing system comprises a movable member. The movable member is configured to move the preformed bag into contact with the abutment member.

[0047] In an embodiment, the movable member is movable along a zeroing direction. In an embodiment, the zeroing direction is perpendicular to the longitudinal direction and to the direction of the weight force.

[0048] In an embodiment, the feed carousel comprises a plurality of arms, each configured to pick up a respective preformed bag at the pickup position. Each arm of the

plurality is movable to vary the orientation of the corresponding preformed bag.

[0049] In an embodiment, the apparatus comprises a first pickup device and a second pickup device. In an embodiment, the first pickup device and the second pickup device are configured to pick up the preformed bags from the same container. In an embodiment, the first pickup device and the second pickup device are disposed along a vertical direction parallel to the direction of the weight force, one above the other. In an embodiment, the first pickup device and the second pickup device are spaced from each other along the longitudinal direction.

[0050] According to one aspect of it, this disclosure also provides a method for packaging products in bags using preformed (or premade) bags.

[0051] The method comprises a step of filling the product into the preformed bag by means of a carousel which rotates continuously at a working speed and which receives the preformed bags at a receiving position. The method comprises a step of feeding the preformed bags to the carousel at the receiving position by means of a feed carousel which rotates to withdraw the preformed bags from a pickup position.

[0052] The method comprises a step of transporting the preformed bags from a store to the feed carousel at the pickup position.

[0053] In an embodiment, the method comprises a step of conveying the preformed bags from respective loading positions to the pickup position. In an embodiment, the method comprises a step of picking up the preformed bags by means of a plurality of pickup devices to position each preformed bag on the conveyor at the respective loading position with a predetermined orientation. The step of picking up may include, for each pickup device, a step of capturing a position signal through an optical device. The position signal represents the orientation of the preformed bag. The step of picking up may comprise a step of modifying the orientation of the preformed bag by means of a pickup robot as a function of the respective position signal. In an embodiment, the method comprises a step of containing a group of bags in a container disposed in loading bay associated with a respective pickup device.

[0054] In an embodiment, the method comprises a step of automatically reloading the loading bays, where an automatic reloading system transports groups of preformed bags from the store to the loading bays.

[0055] In an embodiment, the step of automatic reloading comprises a step of provisioning, in which a carriage disposed on a track transports a group of preformed bags from the store to a corresponding loading bay where the corresponding container is disposed at the provisioning position. The step of automatic reloading comprises a step of transferring, in which the carriage transfers its contents into the corresponding container and then returns to the store for refilling.

[0056] In an embodiment, in the step of provisioning, the container associated with each pickup device is picked up from the loading bay and placed on the track. In an embodiment, in the step of provisioning, the container is transported on the track up to the store. When the container is in the store, the step of transferring is carried out between the container and the package in which the preformed bags are kept in the store.

[0057] In an embodiment, the method comprises a step of linear conveying by means of a linear conveyor. The step of linear conveying includes a step of receiving the preformed bags one by one from the plurality of pickup devices in a loading zone of the linear conveyor. The step of linear conveying includes a step of transporting the preformed bags along a longitudinal direction up to a release zone of the linear conveyor, spaced from the loading zone.

[0058] The step of linear conveying comprises a step of releasing the preformed bags one by one to the feed station.

[0059] In an embodiment, the step of conveying comprises a step of rotary conveying by means of a pickup carousel. The step of rotary conveying comprises a step of picking up the preformed bags one by one from the release zone of the linear conveyor. The step of rotary conveying comprises a step of transporting the preformed bags to the pickup position where they are picked up by the feed carousel.

[0060] In an embodiment, the step of conveying comprises a step of repositioning the bags. In the step of repositioning the bags, a positioner modifies the position of each of the preformed bags on the conveyor.

[0061] In an embodiment, in which the linear conveyor includes a first conveyor belt and a second conveyor belt, which are parallel to each other, the positioner moves the preformed bags from the first to the second conveyor belt. In an embodiment, in which the positioner is a third conveyor belt, the bags are picked up from the first conveyor belt and transported to the second conveyor belt by way of the third conveyor belt, which is inclined relative to the first and second conveyor belts. The inclination of the third conveyor belt relative to the first and second conveyor belts depends on the feed speed of the bags on the first conveyor belt.

[0062] In an embodiment, each pickup device comprises an additional container to form a respective group of containers in the corresponding loading bay. In an embodiment, the method comprises a step of recycling. In the step of recycling, a recycling system varies the position of the containers of the group of containers between a provisioning position and a delivery position. In an embodiment, at the provisioning position, the container is interfaced with the automatic reloading system to receive the group of preformed bags from the carriage. In an embodiment, at the provisioning position, the container is interfaced with the store to receive a group of preformed bags previously contained in the packages they were stored in. At the delivery position, the container is interfaced with the corresponding pickup device so the bags contained therein can be picked up.

[0063] In an embodiment, the method comprises a step of sealing the open end of the bag that was filled in the processing station.

[0064] In an embodiment, the method comprises a step of a pickup device withdrawing a single preformed bag from a container in which the preformed bags were stored.

[0065] In an embodiment, the method comprises a step of (rotary) conveying, in which the single bag picked up is transferred form the pickup device to a rotary conveyor. The rotary conveyor feeds the single bag from the processing station at the receiving position.

[0066] In an embodiment, the step of picking up a single preformed bag includes a plurality of steps of picking up a single preformed bag, carried out in parallel by a plurality of pickup devices, to transfer a plurality of single preformed bags to the rotary conveyor.

[0067] In an embodiment, in the step of conveying, a first arm of the rotary conveyor rotates at a first rotation speed. In an embodiment, a second arm of the rotary conveyor rotates at a second rotation speed. In an embodiment, when the first or the second arm rotates at the first or the second rotation speed to feed the bags to the first carousel, the other arm is stationary and receives the single bag from the pickup device.

[0068] In the step of capturing, the optical device captures image data representing the orientation of the bag relative to the rotary conveyor. The optical device sends the image data to a control unit. In an embodiment, the method comprises a step of controlling, in which the control unit generates drive signals as a function of the image data. In the step of controlling, the control unit sends the drive signals to the actuator to instruct it to rotate the pickup device to adapt the orientation of the preformed bag to the position of the rotary conveyor.

[0069] This and other features of the invention will become more apparent from the following description of a preferred embodiment of it, illustrated purely by way of non-limiting example in the accompanying drawings, in which:

- Figure 1 is a plan view of an embodiment of an apparatus for packaging products in bags;
- Figure 2 is a perspective view of a detail of the apparatus of Figure 1;
- Figure 3 is a plan view of a detail of the apparatus of Figure 1;
- Figure 4 is a plan view of an embodiment of an apparatus for packaging products in bags;
- Figure 4A is a schematic representation of the plan view of Figure 4;
- Figure 5 is a perspective view of a part of the apparatus of Figure 4;
- Figure 6 is a plan view of a detail of the apparatus of Figure 4;
- Figure 7 is a plan view of a detail of the apparatus of Figure 4;
- Figure 8 is a perspective view of a conveying system of the apparatus of Figure 4;
- Figure 9 is a perspective view of an embodiment of an apparatus for packaging products in bags;
- Figure 10 is a plan view of the apparatus of Figure 9;
- Figures 11A, 11B, 11C and 11D are perspective views of a pickup device of the apparatus of Figure 1 in four different configurations;
- Figure 12 schematically illustrates an embodiment of an apparatus for packaging products in bags;
- Figure 13 is a plan view of a rotary conveyor of the apparatus of Figure 9;
- Figures 14A and 14B are, respectively, a first and a second embodiment of the rotary conveyor of Figure 13.

[0070] With reference to the accompanying drawings, the numeral 100 denotes an apparatus for packaging products in bags using preformed bags. The packaging apparatus comprises a processing station 1 configured to fill the preformed bag with the product and to seal the open end of the bag. The processing station 1 comprises a carousel 11, configured to rotate about a vertical axis. The carousel 11 is configured to receive the preformed bags at a receiving position (PR). The apparatus comprises a feed station 2. The feed station 2 is configured to feed the preformed bags to the processing station 1 one by one. The feed station 2 includes a feed carousel 21. The feed carousel 21 rotates about a vertical axis to pick up the preformed bags from a pickup position PP and to feed the preformed bags to the processing station 1 at the receiving position PR. In an embodiment, the pickup position PP and the receiving position PR are diametrically opposite positions around the feed carousel 21.

[0071] The apparatus 1 comprises a conveying station 3. The conveying station 3 is configured to transport the preformed bags from a store 4 to the feed carousel 21 at the pickup position PP.

[0072] The conveying station 3 comprises a conveyor 30. The conveyor 30 is configured to receive the preformed bags and to make them available to the feed station 2 at the pickup position PP.

[0073] In an embodiment, the conveyor 30 comprises a linear conveyor, configured to move the preformed bags from a loading zone C to a release zone R.

[0074] In an embodiment, the feed carousel 21 comprises a plurality of arms 211, each configured to pick up a respective preformed bag from the pickup position PP. In an embodiment, each arm of the plurality of arms 211 comprises a first appendage 211Aand/or a second appendage 211B and/or a suction element 211C. The suction element 211C comprises a suction surface. The first appendage 211A is disposed higher up than the second appendage 211B, along a vertical direction. The first appendage 211A is configured to vary its length. The second appendage 211B comprises a first hinge 211B'. The suction element 211C is connected to the first appendage 211A by a second hinge 211A' and to the second ap-

pendage 211B by the first hinge 211B'. In an embodiment, the first appendage 211A is made to be extended so it pushes an upper portion of the suction element 211C. In an embodiment, the suction element 211C is configured to rotate about the first hinge 211B'. Thus, by rotating about the first hinge 211B', the suction element 211C varies its orientation and brings its suction surface to be coplanar with the preformed bag so as to pick up the bag. In an embodiment, the conveyor (or the linear conveyor) 30 comprises a linear conveyor 31. In an embodiment, the conveyor 30 (or the linear conveyor 31) comprises a first conveyor belt 311.

[0075] In an embodiment, the first conveyor belt 311 is configured to transport the preformed bags from the store 4 to the feed carousel 21.

[0076] In an embodiment, the first conveyor belt 311 comprises a zeroing system 6. The zeroing system 6 allows placing at a predetermined position each of the preformed bags in transit on the first conveyor belt 311. This ensures the feed carousel 21 can grip them more precisely.

[0077] In an embodiment, the zeroing system 6 comprises a first abutment member 61. The first abutment member 61 is configured to contact the preformed bag along a direction perpendicular to the longitudinal direction L of the first conveyor belt 311. In an embodiment, the first abutment member 61 is a first bar parallel to the longitudinal direction L of the first conveyor belt 311. In an embodiment, the zeroing system 6 comprises a second abutment member 62. The second abutment member 62 is configured to keep the bag substantially coplanar with the first conveyor belt 311 to prevent the bag from being lifted off the first conveyor belt 311.

[0078] In an embodiment, the second abutment member 62 is a plate which is coplanar with the first conveyor belt 311 and disposed above the first conveyor belt 311 to allow the preformed bags to pass through a gap between the second abutment member 62 and the first conveyor belt 311. In an embodiment, the zeroing system 6 comprises a third abutment member 63. The third abutment member 63 may be parallel to the first abutment member 61.

[0079] In an embodiment, the third abutment member 63 is movable along a direction perpendicular to the longitudinal direction L of the first conveyor belt 311. The third abutment member 63 is movable between a pushing position in which it is configured to push a preformed bag in the direction of the first abutment member 61 and a rest position in which it is spaced from the preformed bag.

[0080] In an embodiment, the third abutment member 63 is a four-bar linkage whose second bar 63' is parallel to the longitudinal direction L of the first conveyor belt 311. The four-bar linkage comprises a pair of articulated arms 63", each hinged to the second bar 63' and to the first conveyor belt 311. Thus, when the preformed bag passes by in front of the third abutment member 63, the latter adopts the pushing position and pushes the preformed bag against the first abutment member 61.

[0081] In an embodiment, the zeroing system 6 (the first conveyor belt 311) comprises a fourth abutment member 64. The fourth abutment member 64 is configured to contact the bag along the longitudinal direction L. In an embodiment, the fourth abutment member 64 is a step rising from a conveyor surface of the first conveyor belt 311 on which the preformed bags rest.

[0082] In an embodiment, the conveyor 30 comprises a second conveyor belt 312. In an embodiment, the conveyor 30 comprises a third conveyor belt 313. The loading zone C is located on the first conveyor belt 311. The release zone is located on the second conveyor belt 312. In an embodiment, the first conveyor belt 311 and the second conveyor belt 312 are parallel to each other and both extend along a longitudinal direction L. In an embodiment, the third conveyor belt 313 is configured to transfer the preformed bags from the first conveyor belt 311 to the second conveyor belt 312 in order to improve the positioning precision of the preformed bags on the conveyor 30.

[0083] In an embodiment, the first conveyor belt 311, second conveyor belt 312 and third conveyor belt comprise a respective entraining roller driven by a respective actuator or, in other embodiments, by a single actuator and suitable motion transmission means known to one skilled in the art.

[0084] The third conveyor belt 313 is inclined to the longitudinal direction L. More specifically, the sliding speed component of the third conveyor belt 313 along the longitudinal direction L is equal to the sliding speed of the first conveyor belt 311. This allows moving the bags along a transverse direction T, perpendicular to the longitudinal direction L and to the vertical direction, without reducing the feed speed along the longitudinal direction L. In an embodiment, the first conveyor belt 311 is longer than the second conveyor belt 312, which runs alongside the first conveyor belt 311 only at one of its two ends.

[0085] In an embodiment, the linear conveyor comprises a fourth conveyor belt 314. The fourth conveyor belt 314 is at least partly superposed on the second conveyor belt 312 and is configured to come into contact with a top face of the preformed bags disposed on the second conveyor belt 312. That way, the fourth conveyor belt 314 is configured to improve the precision with which the preformed bags are positioned on the second conveyor belt 312. In an embodiment, the conveyor 30 comprises a pickup carousel 32. The pickup carousel 32 rotates about an axis which is included in a plane perpendicular to the vertical direction. In a preferred embodiment, the pickup carousel 32 rotates about a transverse axis parallel to the transverse direction T. The pickup carousel 32 is interposed between the linear conveyor 31 and the feed station 2. The pickup carousel 32 is configured to pick up the preformed bags from the release zone R of the linear conveyor 31 or of the second conveyor belt 312. The pickup carousel 32 is configured to transport the preformed bags to the pickup position PP. In an embodiment,

the pickup carousel 32 comprises a plurality of arms 321. Each arm 321 of the plurality is configured to grasp a corresponding preformed bag disposed on the linear conveyor 31. Each arm 321 of the plurality comprises an extension 322 and a grasping element 323. Each extension 322 allows the corresponding arm 321 to extend towards the pickup position PP. Each grasping element 323 is configured to grasp a corresponding preformed bag as the pickup carousel 32 rotates. Each grasping element 323 is configured to rotate relative to the extension 322. That way, it is possible to vary the orientation of the preformed bags. In an embodiment, the conveyor 30 comprises a pickup device 33. In an embodiment, the conveyor 30 comprises a plurality of pickup devices 33. In an embodiment, the pickup devices 33 are robots. The pickup devices 33 are configured to receive the preformed bags and to place them on the linear conveyor 31 at the loading zone C.

[0086] Each pickup device 33 comprises an optical device 331. The optical device 331 is configured to capture a position signal representing the orientation of the preformed bags. The optical device 331 may be a camera or a scanner. In an embodiment, the optical device 331 is configured to detect the position of a spout on the preformed bag in order to determine how much to rotate the bag, and/or an intersection between the diagonals of the preformed bag in order to define an optimum pickup point.

[0087] Each pickup device 33 comprises a pickup robot 332 configured to grasp the preformed bags and to transport them. The pickup robot 332 comprises an articulated arm 332', configured to rotate about a vertical axis and/or a longitudinal axis and/or a transverse axis in such a way that it can extend towards the first conveyor belt 311.

[0088] The pickup robot 332 comprises a gripper element 332", configured to hold the preformed bags as they move along the path to the loading zone C on the linear conveyor 31.

[0089] In an embodiment, the pickup element 332" is configured to rotate about the articulated arm 332' to vary the orientation of the preformed bag and place it on the first conveyor belt 311 with a predetermined orientation.

[0090] In an embodiment, the apparatus comprises a control unit. The control unit can control two more components of the apparatus. In other embodiments, the apparatus comprises two or more dedicated control units.

[0091] In an embodiment, each pickup device 33 comprises a respective control unit configured to control it.

[0092] The control unit is configured to receive the position signal from the optical device 331. The control unit is configured to process the position signal and to generate a corresponding control signal. The control unit is configured to send the control signal to the corresponding pickup device 33 to instruct it to move. The control device is configured to move the articulated arm 332' and/or the pickup element 332" as a function of the control signal sent to it by the control unit.

[0093] In an embodiment, the articulated arm 332' comprises a first and a second segment which allow varying the distance between the body of the pickup device 33 and the pickup element 332" without having to raise the articulated arm 332'.

[0094] Each pickup device 33 of the plurality of pickup devices is disposed on the same side of the first conveyor belt 311 (or of the linear conveyor 31).

[0095] The apparatus 1 comprises a loading bay 333 for each pickup device 33. The loading bay 333 is a space near the respective pickup device 33 for keeping groups of preformed bags in the process of being withdrawn or waiting to be withdrawn.

[0096] For each pickup device 33 (or for each loading bay 333), the apparatus 1 comprises a container 334' configured to contain a group of preformed bags. In an embodiment, each loading bay comprises an additional container to form a group of containers 334.

[0097] The container 334' comprises a lifting actuator, configured to keep the bag level constant so that the pickup point is always at the same height. In an embodiment, the container 334' comprises a containing element 33C in contact with the bag C that is about to be withdrawn so as to keep it at the correct height. The containing element 33C is configured to be deformed to allow the preformed bag to be withdrawn from the corresponding pickup device 33.

[0098] In an embodiment, the plurality of pickup devices 33 and the corresponding loading bays 333 are aligned along the longitudinal direction L of extension of the first conveyor belt 311.

[0099] In an embodiment, the pickup devices 33 of the plurality of pickup devices are disposed along the longitudinal direction L and aligned vertically in pairs. In other words, at least two pickup devices of the plurality of pickup devices 33 are disposed one above the other.

[0100] In an embodiment, at least two pickup devices of the plurality of pickup devices 33 are coaxial with each other: that is to say, the articulated arm 332' of the at least two pickup devices rotates about the same axis of rotation, preferably vertical. In an embodiment, the at least two pickup devices are configured to withdraw preformed bags from the same container 334'. In an embodiment, the at least two pickup devices are configured to pick up preformed bags from two adjacent containers positioned in the same loading bay 333. Thus, in an embodiment, the apparatus comprises one loading bay 333 for a pair of pickup devices 33.

[0101] In an embodiment, each pickup device 33 of the plurality comprises an independent motor. That way, each pickup device 33 of the plurality is configured to be driven independently of the other pickup devices 33. Moreover, the at least two independently driven pickup devices 33 can adjust their rotation speeds so as to pick up and release the bags at different rotation speeds.

[0102] In an embodiment, the apparatus comprises an automatic reloading system 5.

[0103] The automatic reloading system 5 is configured to provide a constant supply of preformed bags from a store 4 to the loading bays 333 of the pickup devices 33.

[0104] The automatic reloading system comprises a track 51. The track 51 may be a guide on which containers or carriages can slide: for example, but not necessarily, a pair of rails. In an embodiment, the track 51 defines a closed path which starts and ends in the store 4 and passes through a provisioning zone inside or in proximity to the loading bays 333.

[0105] According to one aspect of this disclosure, the automatic reloading system 5 is configured to carry the containers 334, 334' to be released in the loading bays 333 of the pickup devices 33. In an embodiment, each container 334' is disposed on the track 51 and is movable along the track 51 from the store 4 to the respective loading bay 333. The automatic reloading system 5 is configured to supply each loading bay 333 with a full container 334' from the store 4 and to pick up from the loading bay 333 an empty container 334' to be carried back to the store 4 for refilling.

[0106] In the store 4, the container 334' is configured to be filled by transferring the preformed bags into it manually or automatically from the packages in which the preformed bags are stored.

[0107] In an embodiment, the automatic reloading system 5 comprises one or more carriages 52. The one or more carriages 52 are configured to move along the track 51 from the store 4 to the provisioning zones. In an embodiment, the carriages 52 are configured to be automatically tipped, thereby transferring the preformed bags they contain. More specifically, the carriages 52 are configured to reach the provisioning zones and to transfer the preformed bags to a respective container 334'.

[0108] In an embodiment, the apparatus comprises a recycling system 335 for each pickup device 33. The recycling system 335 is configured to move the containers 334 of the group of containers of the respective loading bay 333. More specifically, the containers 334 of the group of containers are configured to move within the respective loading bay 333 from a delivery position, where they are interfaced with the respective pickup device 33. to a provisioning position, where they are interfaced with the automatic reloading system 5.

[0109] The carriages 52 are configured to transfer the preformed bags with the respective container 334' at the provisioning position. On completion of transfer, the carriage 52 returns to the store for to be filled once again.

[0110] In an embodiment, the apparatus comprises an unpacking device. The unpacking device is configured to unwrap the packages in which the preformed bags are stored. The unpacking device is configured to make the storage packages ready for their contents to be transferred into the carriages 52 and/or into the containers 334. In an embodiment, the unpacking process can be carried out by a machine operator.

[0111] According to one aspect of it, this disclosure provides a method for packaging products in bags using preformed (or premade) bags.

[0112] The method comprises a step of filling the product into the preformed bag by means of a carousel 11 which rotates continuously at a working speed and which receives the preformed bags at a receiving position PR. The method comprises a step of feeding the preformed bags to the carousel 11 at the receiving position PR by means of a feed carousel 21 which rotates to withdraw the preformed bags from a pickup position PP.

[0113] The method comprises a step of transporting the preformed bags from a store 4 to the feed carousel 21 at the pickup position PP.

[0114] In an embodiment, the method comprises a step of conveying the preformed bags from respective loading positions to the pickup position PP. In an embodiment, the method comprises a step of picking up the preformed bags by means of a plurality of pickup devices 33 to position each preformed bag on the conveyor at the respective loading position with a predetermined orientation. In other words, the preformed bags have a first orientation when they are picked up and are placed at a loading position of the conveyor with a predetermined orientation which makes it easier for them to be picked up by the feed station 2. The step of picking up may include, for each pickup device 33, a step of capturing a position signal through an optical device 331. The position signal represents the orientation of the preformed bag. The step of picking up may comprise a step of modifying the orientation of the preformed bag by means of a pickup robot 332 as a function of the respective position signal.

[0115] In an embodiment, in the step of modifying the orientation, a grasping element 332" of the pickup robot rotates to modify the orientation of the preformed bag. The step of modifying the orientation comprises a step of controlling. In the step of controlling, a control unit receives the position signal. In the step of controlling, the control unit processes the position signal and generates a control signal as a function of the position signal. In the step of controlling, the control unit sends the control signal to the pickup device 33 to drive the pickup robot 332 and/or to instruct the grasping element 332" to rotate. In the step of picking up, an articulated arm 332' of the pickup robot 32 moves from a pickup position, where the grasping element 332" picks up a preformed bag, to a release position, where the grasping element 332" releases the preformed bag at the loading position of the conveyor.

[0116] In an embodiment, the method comprises a step of containing, in which a group of bags is contained in a container 334 disposed in loading bay 333 associated with a respective pickup device 33. The preformed bags are disposed in the container 334 with a variable orientation along the stack of bags.

[0117] In an embodiment, the method comprises a step of automatically reloading the loading bays 333, where an automatic reloading system 5 transports groups of preformed bags from the store 4 to the loading bays 333.

[0118] In an embodiment, the step of automatic reloading comprises a step of provisioning, in which a carriage 52 disposed on a track 51 transports a group of preformed bags from the store 4 to a corresponding loading bay 333

where the corresponding container 334 is disposed at the provisioning position. The step of automatic reloading comprises a step of transferring, in which the carriage 52 transfers its contents into the corresponding container 334 and then returns to the store 4 for refilling. In short, the carriage 52 contains a group of preformed bags when it leaves the store, and it then reaches a provisioning zone, near the respective loading bay 333, and transfers its contents into a corresponding container 334. The carriage 52 then continues along its path on the track 51 of the automatic reloading system 5 to return to the store 4 where it can be filled once again. In an embodiment, in the step of provisioning, the container 334 associated with each pickup device 33 is picked up from the loading bay 333 and placed on the track 51. In an embodiment, in the step of provisioning, the container 334 is transported to the store 4 on the track 51. When the container 334 is in the store 4, the step of transferring from the package in which the preformed bags are kept in the store 4 to the container 334 is carried out. In short, in this embodiment, the containers 334 themselves represent a set of carriages in transit on the track 51 to be supplied with the preformed bags directly from the store. This embodiment could avoid having to transfer the products again and thus could improve the efficiency of the process.

[0119] In an embodiment, the method comprises a step of linear conveying by means of a linear conveyor 31. The step of linear conveying includes a step of receiving the preformed bags one by one from the plurality of pickup devices 33 in a loading zone C of the linear conveyor 31. The step of linear conveying includes a step of transporting the preformed bags along a longitudinal direction L up to a release zone R of the linear conveyor, spaced from the loading zone C.

[0120] The step of linear conveying comprises a step of releasing the preformed bags one by one to the feed station 2.

[0121] In the step of linear conveying, a first conveyor belt 311 receives the preformed bags from the plurality of pickup devices 33. The first conveyor belt 311 conveys the preformed bags to a second conveyor belt 312, parallel to the first conveyor belt 311. In an embodiment, the step of conveying comprises a step of repositioning the bags. In the step of repositioning the bags, a positioner modifies the position of each of the preformed bags on the conveyor 30. In an embodiment, in the step of repositioning, the positioner is a third conveyor belt 313. The third conveyor belt 313 picks up the preformed bags from the first conveyor belt 311 and transfers them to the second conveyor belt 312. This step allows enhancing the precision with which the preformed bags are positioned on the linear conveyor. The positioning precision is very important for the subsequent step of picking up carried out by the feed station 2.

[0122] In an embodiment, the step of conveying comprises a step of rotary conveying by means of a pickup carousel 32. The step of rotary conveying comprises a step of picking up the preformed bags one by one from the release zone R of the linear conveyor 31. The step of rotary conveying comprises a step of transporting the preformed bags to the pickup position PP where they are picked up by the feed carousel 21. In the step of rotary conveying, the pickup carousel 32 picks up the preformed bags from the second conveyor belt 312 by means of a plurality of arms 321. The plurality of arms 321 grasp the preformed bags and rotate them so they are suitably placed at the pickup position PP. In an embodiment, the pickup carousel 32 places the preformed bags at the pickup position PP with their two main faces parallel to the vertical direction. In an embodiment, each arm 321 of the plurality rotates on the carousel at a rotation speed that is independent of the rotation speed of the other arms 321.

[0123] Thus, in an embodiment, the process of conveying the preformed bags comprises the following steps: automatically reloading the preformed bags from the store 4 to the containers 334 disposed in the loading bays 333 of the pickup devices 33; picking up the preformed bags from the containers 334 one by one and placing the preformed bags on the first conveyor belt 311; repositioning the preformed bags on the second conveyor belt 312 by means of the third conveyor belt 313; withdrawing the preformed bags one by one from the second conveyor belt 312 by means of the pickup carousel 32; placing the preformed bags at the pickup position PP by means of the pickup carousel 32.

[0124] In an embodiment, each pickup device 33 comprises an additional container to form a respective group of containers 334 in the corresponding loading bay 333. In an embodiment, the method comprises a step of recycling. In the step of recycling, a recycling system 335 varies the position of the containers 334 of the group of containers between a provisioning position and a delivery position. In an embodiment, at the provisioning position, the container 334 is interfaced with the automatic reloading system to receive the group of preformed bags from the carriage 52. In an embodiment, at the provisioning position, the container 334 is interfaced with the store 4 to receive a group of preformed bags previously contained in the packages they were stored in. At the delivery position, the container 334 is interfaced with the corresponding pickup device 33 so the bags contained therein can be picked up.

[0125] In an embodiment, the apparatus 100 is configured to package products in bags using preformed (or premade) bags. In other embodiments, the apparatus 100 is located downstream of a line for processing a web from which preformed bags are made.

[0126] The processing station 1 is configured to perform a series of processes or operations on the preformed bags in order to obtain bags that are filled with products. The processing station 1 is configured to fill the preformed bag with the respective product. The processing station 1 is configured to seal the open end of the preformed bag.

[0127] In an embodiment, the processing station 1 in-

cludes a first carousel 21. In an embodiment, the first carousel 21 is configured to place a spout on each preformed bag. In other embodiments, the first carousel 21 is configured to fill the bags with the product. In an embodiment, the first carousel 21 is configured to receive the preformed bags at a receiving position PR. The first carousel defines the feed carousel 21.

[0128] In an embodiment, the processing station 1 includes a provisioning carousel 12. The provisioning carousel 12 is configured to feed to the first carousel 21 the spouts to be placed on the preformed bags.

[0129] In an embodiment, the processing station 1 includes a second carousel 11. In an embodiment, the second carousel 11 is configured to fill the preformed bags (preferably but not necessarily provided with spouts) with the product. In an embodiment, the second carousel 11 is configured to fill the preformed bags (preferably but not necessarily provided with spouts) with the product. In an embodiment in which the first carousel 21 is configured to fill the bags with the product, the second carousel 11 is configured to place the spout on each preformed bag and to seal the open end of the bag.

[0130] In an embodiment, the first carousel 21 rotates at a first working speed, corresponding to a first peripheral speed. In an embodiment, the second carousel 11 rotates at a second working speed, corresponding to a second peripheral speed. The first and second peripheral speeds are the same in modulus so that they can exchange the preformed bags. In an embodiment, the first carousel 21 and the second carousel 11 operate continuously.

[0131] In an embodiment, the apparatus 100 comprises a control unit 7. The control unit 7 is configured to control and/or drive the apparatus 100.

[0132] The conveying station 30 is configured to feed the preformed bags to the feed station 2. In an embodiment, the conveying station 30 is configured to feed the preformed bags to the first carousel 21.

[0133] The store 4 is configured to hold a plurality of preformed bags at a storage position in which the bags are disposed horizontally and stacked on top of one another along a vertical direction V, parallel to the direction of the weight force. In other embodiments, at the storage position, the bags are disposed vertically and placed side by side along a horizontal direction (or having at least one horizontal component) perpendicular to the direction of the weight force.

[0134] In an embodiment, the container 334' comprises a bracket 101A that supports the plurality of bags. In an embodiment, the bracket 101A is movable along the vertical direction V to compensate for the withdrawal of bags causing a reduction in the height of the plurality of bags.

[0135] In an embodiment, the container 334' comprises a compensating element 101B. In an embodiment, the compensating element 101B is a spring. In such a case, when the weight of the plurality of bags is reduced due to bags being withdrawn, the spring responds with a force which lifts the plurality of bags. In an embodiment, the compensating element 101B is compressed air kept at a predetermined pressure. In such a case, the pressure is kept constant and the compressed air is configured to push the bracket 101A when the weight of the bags on the bracket 101A is reduced as a result of bags being withdrawn.

[0136] In an embodiment, the control unit 7 is configured to vary the position of the bracket 101A (by operating on the spring, on the air pressure or on a dedicated actuator) as a function of the number (and/or weight) of the bags it supports. In this embodiment, the container 334' comprises a detecting sensor (for example, a weight sensor) configured to capture weight signals representing the number of bags on the bracket 101A.

[0137] In an embodiment, the conveying station 301 includes a pickup device 33. The pickup device 33 is configured to withdraw the preformed bags one by one from the container 334'. The pickup device 33 is movable from a first operating position P1, where it is configured to withdraw the preformed bags one by one from the container 334' at a pickup position, to a second operating position P2, where it is configured to release the preformed bag at a loading position. In an embodiment, the pickup device 33 is configured to move from the first operating position P1 to the second operating position P2 by rotation. In an embodiment, the pickup device 33 is configured to move from the first operating position P1 to the second operating position P2 by translation.

[0138] In an embodiment, the pickup device 33 includes a supporting post 105. The supporting post 105 is connected to a frame of the apparatus 100 and is fixed to the floor on which the apparatus 100 is placed. The supporting post 105 may comprise a portion that is oriented along the vertical direction V.

[0139] In an embodiment, the pickup device 33 comprises a beam 106. The beam 106 is oriented perpendicularly to the vertical direction V. In an embodiment, the beam 106 is movable. In an embodiment, the beam 106 is configured to rotate. In an embodiment, the beam 106 has an axisymmetric shape: for example, a cylinder or a cone. The beam 106, having the shape of a cylinder, is configured to rotate about its axis of symmetry R1.

[0140] In an embodiment, the pickup device 33 includes a pickup element 104. The pickup element 104 is configured to grasp the bags from the container 334' and to hold them as the pickup device 33 moves. In an embodiment, the pickup element 104 is a suction plate. In an embodiment, the pickup element 104 is a plate provided with suction cups which hold the preformed bag in place.

[0141] In an embodiment, the pickup device comprises an articulated structure 103. The articulated structure 103 is connected to the supporting post 105 and to the pickup element 103. The articulated structure 103 is movable. The articulated structure 103 is configured to vary its position during the movement of the pickup device 33 from the first operating configuration P1 to the second oper-

ating configuration P2. In an embodiment, the articulated structure 103 is configured to move by rotation. In an embodiment, the articulated structure is configured to move by translation.

[0142] In an embodiment, the pickup device comprises an actuator 107. The actuator 107 is configured to actuate the pickup device 33. More specifically, the actuator 107 is configured to vary the operating configuration of the pickup device 33. In an embodiment, the actuator 107 is connected to the articulated structure 103 in order to drive it. In an embodiment, the actuator 107 is connected to the pickup element 104 to vary its orientation relative to the preformed bag and/or relative to the articulated structure 103 and/or relative to the supporting post 105.

[0143] In an embodiment, the actuator 107 is connected to the control unit 7. The control unit 7 is configured to control and/or drive the actuator 107 in its actuation of the articulated structure 103 and/or of the pickup device 33 and/or of the pickup element 104.

[0144] In an embodiment, the articulated structure 103 is configured to vary its length along its direction of maximum extension. In an embodiment in which the direction of maximum extension of the articulated structure 103 is the vertical direction V, the articulated structure 103 is configured to vary its distance from the container 334' along the vertical direction V.

[0145] In an embodiment, the articulated structure 103 comprises a cylinder 103A and a piston 103B. The piston 103B is configured to slide inside the cylinder 103A in such a way as to vary the length of the articulated structure 103. That way, when the distance of the articulated structure 103 of the container 334' increases on account of preformed bags being withdrawn, the piston slides and extends the length of the articulated structure 103 to allow it to fulfil its function of picking up the bags. In an embodiment, the pressure inside the cylinder is controlled by the control unit 7 as a function of the weight detected on the bracket 101A of the container 334'.

[0146] In an embodiment, the beam 106 is connected to the articulated structure 103. In an embodiment, the beam 106 is configured to allow the articulated structure 103 to move by translation. More specifically, in an embodiment, the beam 106 comprises a lead screw 106A. In an embodiment, the beam 106 comprises a slide 106B provided with internal threading which meshes with the threading of the lead screw 106A. The lead screw 106A is configured to rotate relative to the supporting post 105, thereby moving the slide 106B that is coupled therewith. The lead screw is driven by the actuator 107.

[0147] It should be noted that the actuator 107 might also be a system of actuators, each dedicated to a component of the pickup device 33. In other terms, the intention of this disclosure is to describe an actuating system designed to drive the pickup device.

[0148] In an embodiment, the articulated structure 103 is an axisymmetric body having a main axis of symmetry. In an embodiment, the articulated structure 103 is configured to rotate about its main axis of symmetry and to entrain in rotation with it the pickup element 104 it is connected to. In an embodiment, the pickup element 104 is configured to rotate about the main axis of symmetry of the articulated structure 103 to vary the orientation of the bag relative to the articulated structure 103. In other terms, keeping the articulated structure 103 stationary and rotating the pickup element 104 about the main axis of symmetry of the articulated structure 103 allows varying the mutual angular position between the preformed bag and the articulated structure 103.

[0149] In an embodiment, the pickup element 104 is configured to move along a circumferential trajectory whose radius is equal to the length of the articulated structure 103 because of the rotation of the beam 106 about its axis of symmetry R1.

[0150] In an embodiment, the pickup element 104 is tiltable about a tilting axis B belonging to a plane perpendicular to the main axis of symmetry of the articulated structure 103. This rotation of the pickup element 104 allows it to adapt to non-planar positions which the bags might adopt and thus to improve its hold on the bag.

[0151] In an embodiment, the articulated structure 103 is integral with the beam 106. In an embodiment, the articulated structure 103 is configured to move by rotation and/or translation relative to the beam 106.

[0152] In an embodiment, the pickup device 33 comprises an optical device 108. The optical device 108 is configured to capture image data 108' representing the orientation of the bag relative to the pickup element 104. The optical device 108 is configured to send the image data 108' to the control unit 7. The control unit 7 is configured to generate drive signals as a function of the image data 108'. The control unit 7 is configured to send the drive signals to the actuator to instruct it to rotate the pickup element 104 in order to modify the orientation of the preformed bag. In an embodiment, the optical device 108 is a camera or a scanner. This allows controlling the movement of the pickup device 33 as a function of the position of the preformed bags in the container 334'. It also allows the preformed bags to be positioned in the container 334' non-uniformly but in such a way as to maximize their storage density.

[0153] Each pickup device of the plurality of pickup devices 33 comprises a respective container 334' from which it is configured to withdraw the preformed bags one by one. Each pickup device is configured to withdraw the preformed bags one by one from a respective pickup position and to release them at a respective loading position, thus defining a plurality of pickup positions and a plurality of loading positions.

[0154] In an embodiment, the pickup devices 33 of the plurality are disposed along a circumferential trajectory (at least partly surrounding the rotary conveyor 315) and spaced from each other preferably at regular intervals.

[0155] In an embodiment, the apparatus 100 comprises a rotary conveyor 315. In an embodiment, the conveying system 30 comprises the rotary conveyor 315.

[0156] In an embodiment, the rotary conveyor 315 is

configured to receive the preformed bag from the pickup device at a loading position. The rotary conveyor 315 is configured to deliver the preformed bag to the first carousel 2 at the receiving position PR.

[0157] In an embodiment, the rotary conveyor allows bringing the bags one by one to the first carousel 2 at the correct peripheral speed, which corresponds to the first working speed.

[0158] The rotary conveyor comprises a plurality of arms 201.

[0159] Each arm 201 of the plurality of arms comprises a respective spoke 201A. Each arm 201 of the plurality of arms comprises a respective gripper element 201B.

[0160] The gripper element 201B is located at one end of the spoke 201A, distal from the centre of the rotary conveyor 315.

[0161] The gripper element 201B is configured to hold the preformed bags that the rotary conveyor receives from the pickup device 33 at the loading position. The gripper element 201B may be a suction plate or a plate provided with suction cups for holding the preformed bag.

[0162] In an embodiment, the plurality di arms 201 includes at least three arms which are connected to each other to rotate as one. In this embodiment, the apparatus includes at least two pickup devices 33. This allows halving the bag feed speed of each feed device for the same first working speed of the first carousel 2.

[0163] In an embodiment, the rotary conveyor comprises a first arm 202. In an embodiment, the rotary conveyor comprises a second arm 203.

[0164] In an embodiment, the first arm 202 and the second arm 203 are angularly spaced. In an embodiment, the first arm 202 and the second arm 203 are configured to rotate independently of each other. In an embodiment, the first arm 202 is configured to position the respective gripper element 201 B at the loading position while the gripper element 201B of the second arm 203 is positioned at the receiving position PR. This feature allows making the first working speed of the first carousel 2 (at least partly) independent of the feed speed of the pickup device because the length of time the first arm can stop at the loading position is longer than the time taken by the second arm 203 to release the bag to the first carousel 2.

[0165] In an embodiment, the rotary conveyor comprises a first plurality of arms 202'. In an embodiment, the rotary conveyor comprises a second plurality of arms 203'.

[0166] The arms of the first plurality of arms 202' are interconnected to rotate as one. The arms of the second plurality of arms 203' are interconnected to rotate as one. In the embodiment with the first plurality of arms 202' and the second plurality of arms 203', the apparatus 100 comprises the plurality of pickup devices 33. Preferably, the number of pickup devices 33 of the plurality is equal to the number of arms of the plurality (between the first 202' and the second 203') of arms which has the higher number of arms. In an embodiment, the first plurality 202' and the second plurality 203' have the same number of arms. In this embodiment, the number of pickup devices 33 is greater than or equal to the number of arms of the first plurality 202' and the second plurality 203'.

[0167] In an embodiment, the first plurality 202' and the second plurality 203' are configured to rotate independently of each other.

[0168] The first plurality of arms 202' is configured to feed the preformed bags to the first carousel 2 at the receiving position PR when each arm of the second plurality of arms 203' is disposed with the respective gripper element 201 B at the respective loading position. The first plurality of arms 202' is configured to rotate when the second plurality of arms 203' stops to receive the preformed bags from the respective pickup devices 33.

[0169] The first plurality of arms 202' is angularly spaced by a spacing angle A from the second plurality of arms 203'. In an embodiment, the spacing angle A is variable because the first plurality of arms 202' and the second plurality of arms 203' rotate independently of each other.

[0170] According to one aspect of it, this disclosure provides a method for packaging products in bags using preformed (or premade) bags.

[0171] In an embodiment, the method comprises a step of processing in which the preformed bags undergo a series of processes or operations in order to obtain bags that are filled with products.

[0172] In an embodiment, the step of processing comprises a step of filling in which the preformed bag is filled with the respective product. The step of processing comprises a step of sealing in which the open end of the preformed bag is sealed. In an embodiment, the step of processing is performed at least partly by a first carousel 2. In an embodiment, in the step of processing, the first carousel places a spout on each preformed bag. In other embodiments, in the step of processing, the first carousel 2 fills the preformed bags.

[0173] The first carousel 2 receives the preformed bags at a receiving position PR. In an embodiment, the step of processing is performed at least partly by a provisioning carousel 12 in which the spouts are fed to the first carousel 2. In an embodiment, the step of processing is performed at least partly by a second carousel 11 which can fill the preformed bags (preferably but not necessarily provided with spouts) with the product and/or which can seal the open end of each preformed bag.

[0174] The first carousel 2 rotates at a first working speed, corresponding to a first peripheral speed. The second carousel 11 rotates at a second working speed, corresponding to a second peripheral speed. The first and second peripheral speeds are the same in modulus so that the first carousel 2 and the second carousel 11 can exchange the preformed bags. The first carousel 2 and the second carousel 11 work continuously.

[0175] In an embodiment, the method comprises a step of controlling, in which a control unit 7 controls and/or drives the apparatus 100.

[0176] In an embodiment, the method comprises a step of feeding, in which a feed station 2 feeds the preformed bags to the processing station 1.

[0177] In an embodiment, the feed station 2 feeds the preformed bags to the first carousel 2.

[0178] In an embodiment, the method comprises a step of storing in which a store 4 holds a plurality of preformed bags at a storage position in which the bags are disposed horizontally and stacked on top of one another along a vertical direction V, parallel to the direction of the weight force.

[0179] In other embodiments, at the storage position, the bags are disposed vertically and placed side by side along a horizontal direction (or having at least one horizontal component) perpendicular to the direction of the weight force.

[0180] In an embodiment, the step of storing comprises a step of moving a bracket 101A that supports the plurality of bags. This movement is a movement along the vertical direction V to compensate for the withdrawal of bags causing a reduction in the height of the plurality of bags.

[0181] The step of storing comprises a step of compensating in which a compensating element 101B responds with a force which lifts the plurality of bags when the weight of the plurality of bags is reduced due to bags being withdrawn.

[0182] In an embodiment, the step of controlling comprises a step of controlling the container 334' in which the control unit 7 causes the position of the bracket 101A to be varied (by operating on the spring, on the air pressure or on a dedicated actuator) as a function of the number (and/or weight) of the bags supported by the bracket.

[0183] In an embodiment, the step of feeding comprises a step of picking up. In the step of picking up, a pickup device 33 is configured to withdraw the preformed bags one by one from the container 334'. The step of feeding comprises a step of moving the pickup device 33, in which the pickup device moves from a first operating position P1, where it withdraws the preformed bags one by one from the container 334' at a pickup position, to a second operating position P2, where it releases the preformed bag at a loading position. In the step of picking up, the pickup device 33 moves by rotation from the first operating position P1 to the second operating position P2. In the step of picking up, the pickup device 33 moves by translation from the first operating position P1 to the second operating position P2.

[0184] In an embodiment, the method comprises a step of gripping. In the step of gripping, a pickup element 104 grasps the bags from the container 334' and holds them as the pickup device 33 moves.

[0185] In an embodiment, in the step of moving the pickup device 33, an articulated structure 103 of the pickup device 33 moves by rotation and/or translation relative to a supporting post 105 of the pickup device 33.

[0186] In an embodiment, the step of moving the pickup device comprises a step of actuating. In the step of actuating, the actuator 107 varies the operating configuration of the pickup device 33. In the step of actuating, the actuator 107 drives the articulated structure 103. In an embodiment, the actuator 107 drives the pickup element 104 and varies its orientation relative to the preformed bag and/or relative to the articulated structure 103 and/or relative to the supporting post 105.

[0187] In an embodiment, the step of controlling comprises a step of controlling the actuator 107, in which the actuator receives drive signals from the control unit 7.

[0188] In an embodiment, the step of picking up comprises a step of lengthening/shortening the articulated structure 103, in which the articulated structure changes its length along its direction of maximum extension. In an embodiment, the step of lengthening is accomplished by sliding a piston 103B inside a cylinder 103A.

[0189] In an embodiment, the step of moving the pickup device 33 comprises a step of moving the articulated structure 103 by rotation and/or translation relative to a beam 106 connected to the supporting post 105.

[0190] In an embodiment in which the articulated structure 103 is an axisymmetric body, the step of moving the pickup device comprises rotating the articulated structure 103 about its main axis of symmetry and entraining in rotation with it the pickup element 104 it is connected to. In an embodiment, the pickup element 104 rotates about the main axis of symmetry of the articulated structure 103 to vary the orientation of the bag relative to the articulated structure 103.

[0191] In an embodiment, the pickup element 104 moves along a circumferential trajectory whose radius is equal to the length of the articulated structure 103 because of the rotation of the beam 106 about its axis of symmetry R1.

[0192] In an embodiment, the step of moving the pickup device 33 comprises a step of tilting the pickup element 104. In the step of tilting, the pickup element 104 is tilted about a tilting axis B belonging to a plane perpendicular to the main axis of symmetry of the articulated structure 103. This rotation of the pickup element 104 allows it to adapt to non-planar positions which the bags might adopt and thus to improve its hold on the bag.

[0193] In an embodiment, the method comprises a step of optical detection. In the step of optical detection, an optical device 108 captures image data 108' representing the orientation of the bag relative to the pickup element 104. The optical device 108 sends the image data 108' to the control unit 7. The control unit 7 generates drive signals as a function of the image data 108'. The control unit 7 sends the drive signals to the actuator to instruct it to rotate the pickup element 104 in order to modify the orientation of the preformed bag.

[0194] This allows controlling the movement of the pickup device 33 as a function of the position of the preformed bags in the container 334'. It also allows the preformed bags to be positioned in the container 334' non-uniformly but in such a way as to maximize their storage density.

[0195] In an embodiment, the step of picking up includes a plurality of steps of picking up performed in parallel.

[0196] In an embodiment, the step of feeding comprises a step of rotary conveying. In the step of rotary conveying, a rotary conveyor 315 receives the preformed bag from the pickup device 33 at a loading position. In the step of rotary conveying, the rotary conveyor delivers the preformed bag to the first carousel 2 at the receiving position PR.

[0197] In an embodiment, the rotary conveyor allows bringing the bags one by one to the first carousel 2 at the correct peripheral speed, which corresponds to the first working speed.

[0198] In an embodiment, the step of rotary conveying comprises a step of grasping. In the step of grasping, a gripper element 201B of an arm 201 of the rotary conveyor 315 holds the preformed bags that the rotary conveyor receives from the pickup device 33 at the loading position.

[0199] In an embodiment, in the step of rotary conveying, a plurality of arms 201 (three arms) are interconnected and rotate as one.

[0200] In this embodiment, the apparatus includes at least two pickup devices 33. This allows halving the bag feed speed of each feed device for the same first working speed of the first carousel 2.

[0201] In an embodiment, in the step of rotary conveying, a first arm 202 of the rotary conveyor rotates independently of a second arm 203. In an embodiment, in the step of rotary conveying, the first arm 202 positions the respective gripper element 201B at the loading position while the gripper element 201B of the second arm 203 releases the bags to the first carousel 2 at the receiving position PR. This feature allows making the first working speed of the first carousel 2 (at least partly) independent of the feed speed of the pickup device because the length of time the first arm 202 can stop at the loading position is longer than the time taken by the second arm 203 to release the bag to the first carousel 2.

[0202] In an embodiment, in the step of conveying, a first plurality of arms 202', whose arms are connected to each other as one, rotates independently of a second plurality of arms 203', whose arms are connected to each other as one. In the embodiment with the first plurality of arms 202' and the second plurality of arms 203', the apparatus 100 comprises the plurality of pickup devices 33.

[0203] In an embodiment, the first plurality of arms 202' feeds the preformed bags to the first carousel 2 at the receiving position PR when each arm of the second plurality of arms 203' receives the preformed bags from the pickup device at the respective loading position. The first plurality of arms 202' rotates when the second plurality of arms 203' stops to receive the preformed bags from the respective pickup devices 33.

[0204] The following paragraphs, listed in alphanumeric order for reference, are non-limiting example modes of describing this invention.

A00. An apparatus (100) for packaging products in bags using preformed bags, comprising: a processing station (1) configured to fill the preformed bag with the product and to seal the open end of the bag, the processing station including a carousel (11) which rotates continuously at a working speed and being configured to receive the preformed bags at a receiving position (PR); a feed station (2) configured to feed the preformed bags one by one to the processing station (1) and including a feed carousel (21) which rotates to withdraw the preformed bags from a pickup position (PP) and to feed the preformed bags to the processing station (1) at the receiving position (PR); a conveying station (3) configured to receive the preformed bags from a store (4) and to make them available to the feed station (2) at the pickup position (PP), and including a container (334') configured to contain a group of preformed bags, and a conveyor (30) configured to receive the preformed bags and to transport them from respective loading positions to the pickup position (PP).

A0. The apparatus according to paragraph A00, comprising an optical device (331) configured to capture a position signal representing the orientation of the preformed bag.

A1. The apparatus according to paragraph A00 or A0, comprising a plurality of pickup devices (33).

A1.1. The apparatus (100) according to paragraph A1, wherein each pickup device includes a pickup robot (332) configured to pick up the preformed bags one by one.

A1.1.1. The apparatus (100) according to paragraph A1.1, wherein the pickup robot is configured to modify the orientation of the preformed bags as a function of a position signal representing the orientation of the preformed bag and to position each preformed bag on the conveyor (30) at the respective loading position with a predetermined orientation.

A2. The apparatus (100) according to any one of paragraphs A00 to A1.1.1, wherein the conveyor (30) includes a linear conveyor (31) extending along a longitudinal direction (L) and including a loading zone (C), configured to receive the preformed bags one by one from the plurality of pickup devices (33), and a release zone (R), spaced from the loading zone (C) along the longitudinal direction, downstream of the pickup devices, to allow the feed station (2) to withdraw the preformed bags one by one.

A2.1 The apparatus (100) according to any one of paragraphs A00 to A2, wherein the linear conveyor (31) comprises a zeroing system (6).

A2.1.1 The apparatus (100) according to paragraph A2.1, wherein the zeroing system (6) includes an abutment member (61) and a movable member (63) to move the preformed bag into contact with the abutment member (61).

A2.1.2 The apparatus (100) according to para-

graph A2.1.1, wherein the movable member (63) is movable along a zeroing direction (Z) perpendicular to the longitudinal direction (L) and to the direction of the weight force.

A3. The apparatus (100) according to any one of paragraphs A00 to A2.1.2, wherein the feed carousel (21) comprises a plurality of arms (211), each configured to pick up a respective preformed bag at the pickup position (PP).

A3.1 The apparatus (100) according to paragraph A3, wherein each arm (211) of the plurality is movable to vary the orientation of the corresponding preformed bag.

A4 The apparatus (100) according to any one of paragraphs A00 to A2.1.2, wherein the conveying station (3) includes a plurality of containers.

A4.1 The apparatus according to any one of paragraphs A00 to A4, comprising one or more loading bays.

A4.2 The apparatus (100) according to paragraph A4.1, wherein each loading bay includes a respective container.

A4.3 The apparatus (100) according to paragraph A4.1 or A4.2, wherein each loading bay of the plurality includes a respective pickup device configured to withdraw the bags from the container disposed in the corresponding loading bay.

A5. The apparatus (100) according to any one of paragraphs A00 to A4.3, comprising a first pickup device (33A) and a second pickup device (33B) included in the plurality of pickup devices (33), which are configured to withdraw the preformed bags from the same container (334').

A5.1 The apparatus (100) according to paragraph A5, wherein the first pickup device (33A) and the second pickup device (33B) are disposed along a vertical direction parallel to the direction of the weight force, one above the other.

A5.2 The apparatus (100) according to paragraph A5 or A5.1, wherein the first pickup device (33A) and the second pickup device (33B) are spaced from each other along the longitudinal direction.

A5.3 The apparatus (100) according to paragraph A5.2, wherein the first pickup device (33A) and the second pickup device (33B) are each disposed in a corresponding loading bay (333), the corresponding loading bays being spaced from each other along the longitudinal direction.

A5.4 The apparatus (100) according to paragraph A5.3, wherein the loading bay (333) of the first pickup device (33A) comprises a first plurality of containers (334) and wherein the loading bay (333) of the second pickup device (33B) comprises a second plurality of containers (334).

A6. The apparatus (100) according to paragraph A00, comprising a loading bay (333) and an additional container to form a plurality of containers (334) disposed in the loading bay (333).

A6.1 The apparatus (100) according to paragraph A6, wherein the loading bay comprises a recycling system (335), configured to vary the position of a container (334) of the plurality of containers (334) in the loading bay (333).

A6.1.1 The apparatus (100) according to paragraph A6.1, wherein the recycling system is configured to vary the position of a container of the plurality (334) between a provisioning position, where the container (334) is outside the range of action of the corresponding pickup device (33), and a delivery position, where the container (334) interacts with the corresponding pickup device (33).

A6.2 The apparatus (100) according to any one of paragraphs A6 to A6.1.1, wherein the conveying station (3) includes an automatic reloading system (5), configured to transport groups of preformed bags from the store (4) to the loading bay (333).

A6.2.1 The apparatus (100) according to paragraph A6.2, comprising a tipper, movable between a rest position, where the bags are kept on the automatic reloading system, and a tipped position, where the bags are transferred into a container (334) of the loading bay (333).

A7. The apparatus (100) according to any one of paragraphs A00 to A6.2.1, comprising a control unit.

A7.1 The apparatus (100) according to paragraph A7, wherein each pickup device (33) comprises a respective motor, connected to the control unit which drives it independently.

A8. The apparatus according to any one of paragraphs A00 to A7.1, wherein the conveyor (30) comprises a pickup carousel (32), interposed between the plurality of pickup devices (33) and the feed station (2) and configured to pick up the preformed bags one by one from each pickup device (33) and to position the preformed bags at the pickup position (PP) to be picked up by the feed station (2).

A9. The apparatus according to paragraph A2, wherein the linear conveyor comprises a first conveyor belt configured to receive the preformed bags one by one at the loading zone.

A10. The apparatus according to paragraph A2 or A9, wherein the linear conveyor comprises a second conveyor belt configured to release the preformed

bags one by one at the release zone.

A11. The apparatus according to paragraph A2, A9 or A10, wherein the linear conveyor comprises a positioner, configured to transport the preformed bags one by one from the first conveyor belt to the second conveyor belt.

A12. The apparatus according to paragraph A11, wherein the positioner is a third conveyor belt which is inclined to the first and second conveyor belts.

A13. The apparatus according to paragraph A2, A9, A10, A11 or A12, wherein the linear conveyor includes an additional positioner, superposed on the second conveyor belt in proximity to the release zone, to vary the position of the preformed bags on the second conveyor belt.

A14. The apparatus according to paragraph A10, wherein the first conveyor belt is parallel to the second conveyor belt.

A15. The apparatus according to paragraph A13, wherein the first conveyor belt is inclined to the second conveyor belt at an angle less than or equal to 90 degrees.

B00. An apparatus (100) for packaging products in bags using preformed bags, comprising: a processing station (1) configured to fill the preformed bag with the product and to seal the open end of the bag; a feed station (2) including a feed carousel (21) which rotates continuously at a working speed and being configured to receive the preformed bags at a receiving position (PR); a conveying station (30), configured to feed the preformed bags to the feed station (2) one by one and including a pickup device (33) which is movable from a pickup position (P1) to a feed position (P2) to withdraw the preformed bags one by one from a container (334') of bags.

B0. The apparatus (100) according to paragraph B00, wherein the conveying station (30) comprises a rotary conveyor (315).

B1. The apparatus (100) according to paragraph B0, wherein the rotary conveyor (315) comprises a plurality of gripper elements (201B) and is configured to receive the preformed bags from the pickup device (33) at a loading position and to deliver the preformed bags to the carousel (31) of the feed station (2) at the receiving position (PR).

B2. The apparatus (100) according to any one of paragraphs B00 to B1, wherein the conveying station (30) includes an additional pickup device (102) to form a plurality of pickup devices, each of which is configured to pick up the preformed bags one by one and to deliver them to the rotary conveyor (2).

B3. The apparatus (100) according to any one of paragraphs B00 to B2, wherein the rotary conveyor (315) of the feed station (1) comprises a plurality of arms (201), each of which is provided with a corresponding gripper element of the plurality of gripper elements (201B).

B3.1. The apparatus (100) according to paragraph B3, wherein the plurality of arms includes a first arm (202) and a second arm (203) which are angularly spaced from each other by a spacing angle (A).

B3.2 The apparatus (100) according to paragraph B3.1, wherein the first arm (202) is configured to rotate independently of the second arm (203) to vary the spacing angle (A).

B4. The apparatus (100) according to paragraph B3, wherein the plurality of arms includes a first set of arms (202') which are interconnected to rotate as one, and a second set of arms (203') which are interconnected to rotate as one.

B4.1 The apparatus (100) according to paragraph B4, wherein the second set of arms is configured to rotate independently of the first set of arms (202').

B4.2 The apparatus (100) according to paragraph B4 or B4.1, wherein the number of arms of the first set of arms (202') and of the second set of arms (203') is less than or equal to the number of pickup devices (33) of the plurality.

B5. The apparatus (100) according to any one of paragraphs B00 to B4.2, wherein the pickup device (33) includes one or more of the following features:

- a frame (105);
- an articulated structure (103) which is removably connected to the frame (105);
- a pickup element (104), connected to the articulated structure (103) to withdraw a preformed bag from the store (4) and to hold it;
- an actuator (107), connected to the articulated structure (103) in order to drive it.

B5.1 The apparatus (100) according to paragraph B5, wherein the articulated structure (103) is configured to rotate relative to the frame (105) from the pickup position (P1) to the feed position (P2) about a first axis of rotation (R1) belonging to a plane which is perpendicular to the direction of the weight force.

B5.2 The apparatus (100) according to paragraph B5 or B5.1, wherein the articulated structure (103) is configured to move by translation from the pickup position (P1) to the feed position (P2).

B5.3 The apparatus (100) according to any one of paragraphs B5 to B5.2, wherein the pickup element (104) is configured to rotate about a second axis of rotation (V) to vary the orientation of the preformed bag.

B5.4 The apparatus (100) according to any one of paragraphs B5 to B5.3, wherein the pickup

element (104) includes a suction surface and wherein each gripper element (201B) of the plurality of gripper elements (201B) includes a respective suction surface configured to act in conjunction with the suction surface of the pickup element (104) to transfer the preformed bags from the pickup element (104) to a respective gripper element (201B).

B6. The apparatus (100) according to any one of paragraphs B00 to B5.4, wherein each gripper element (201B) of the plurality of gripper elements (201 B) is movable along a predetermined trajectory about an axis of rotation (R2) of the rotary conveyor.
B6.1 The apparatus (100) according to any one of paragraphs B00 to B6, wherein each gripper element (201B) of the plurality of gripper elements (201B) is movable by rotation about an adjustment axis which is tangent to the predetermined trajectory at the gripper element.
B7. The apparatus (100) according to any one of paragraphs B00 to B6.1, comprising a control unit (7) and an optical device (331) configured to capture image data (108') representing the orientation of the bag relative to the pickup device (33).

B7.1 The apparatus (100) according to paragraph B7, wherein the control device is configured to send the image data (108') to the control unit (7).
B7.2 The apparatus according to paragraph B7 or B7.1, wherein the control unit (7) is configured to generate drive signals as a function of the image data (108') and to send them to the pickup device (33) to instruct the pickup device (33) to rotate its pickup element (104) in order to modify the orientation of the preformed bag.

Claims

1. An apparatus (100) for packaging products in bags using preformed bags, comprising:

- a processing station (1) configured to fill the preformed bag with the product and to seal the open end of the bag, the processing station including a carousel (11) which rotates continuously at a working speed and being configured to receive the preformed bags at a receiving position (PR);
- a feed station (2) configured to feed the preformed bags one by one to the processing station (1) and including a feed carousel (21) which rotates to withdraw the preformed bags from a pickup position (PP) and to feed the preformed bags to the processing station (1) at the receiving position (PR);
- a conveying station (3) configured to receive the preformed bags from a store (4) and to make them available to the feed station (2) at the pickup position (PP), and including a container (334') configured to contain a group of preformed bags, and a conveyor (30) configured to receive the preformed bags and to transport them from respective loading positions to the pickup position (PP),

characterized in that the conveying station (3) includes:

- an optical device (331) configured to capture a position signal representing the orientation of the preformed bag;
- a plurality of pickup devices (33), each pickup device including a pickup robot (332) configured to pick up preformed bags one by one to modify their orientation as a function of the respective position signal and to position each preformed bag on the conveyor (30) at the respective loading position with a predetermined orientation.

2. The apparatus (100) according to claim 1, wherein the conveyor (30) includes a linear conveyor (31) extending along a longitudinal direction (L) and including a loading zone (C), configured to receive the preformed bags one by one from the plurality of pickup devices (33), and a release zone (R), spaced from the loading zone (C) along the longitudinal direction, downstream of the pickup devices, to allow the feed station (2) to withdraw the preformed bags one by one.

3. The apparatus (100) according to claim 2, wherein the linear conveyor (31) comprises a zeroing system (6) including an abutment member (61) and a movable member (63) to move the preformed bag into contact with the abutment member (61).

4. The apparatus according to claim 3, wherein the movable member (63) is movable along a zeroing direction (Z) perpendicular to the longitudinal direction (L) and to the direction of the weight force.

5. The apparatus (100) according to any one of the preceding claims, wherein the feed carousel (21) comprises a plurality of arms (211), each configured to pick up a respective preformed bag at the pickup position (PP), and wherein each arm (211) of the plurality is movable to vary the orientation of the corresponding preformed bag.

6. The apparatus (100) according to any one of the preceding claims, wherein the conveying station (3) includes a plurality of containers.

7. The apparatus according to claim 6, comprising a plurality of loading bays (333), each including at least one respective container of the plurality, and wherein each loading bay (333) of the plurality includes a respective pickup device configured to withdraw the bags from the at least one container disposed in the corresponding loading bay (333).

8. The apparatus according to any one of the preceding claims, comprising a first pickup device (33A) and a second pickup device (33B) which are configured to withdraw the preformed bags from the same container (334').

9. The apparatus (100) according to claim 8, wherein the first pickup device (33A) and the second pickup device (33B) are disposed along a vertical direction parallel to the direction of the weight force, one above the other.

10. The apparatus (100) according to any one of the preceding claims, comprising a loading bay (333) and an additional container to form a plurality of containers (334) disposed in the loading bay (333), and wherein the recycling system (335), configured to vary the position of a container (334) of the plurality of containers (334) inside the loading bay (333), between a provisioning position, wherein the container (334) is outside the range of action of the corresponding pickup device (33), and a delivery position, wherein the container (334) interacts with the corresponding pickup device (33).

11. The apparatus (100) according to claim 10, wherein the conveying station (3) includes an automatic reloading system (5), configured to transport groups of preformed bags from the store (4) to the loading bay (333).

12. The apparatus (100) according to claim 11, comprising a tipper, movable between a rest position, where the bags are kept on the automatic reloading system, and a tipped position, where the bags are transferred into a container (334) of the loading bay (333).

13. The apparatus (100) according to any one of the preceding claims, comprising a control unit and wherein each pickup device (33) comprises a respective motor, connected to the control unit which drives it independently.

14. The apparatus (100) according to any one of the preceding claims, wherein the conveyor (30) comprises a pickup carousel (32), interposed between the plurality of pickup devices (33) and the feed station (2) and configured to pick up the preformed bags one by one from each pickup device (33) and to position the preformed bags at the pickup position (PP) to be picked up by the feed station (2).

15. A method for packaging products in bags using preformed bags, comprising the following steps:

- transporting the preformed bags from a store (4) of preformed bags to a feed carousel (21) at a pickup position (PP);
- feeding the preformed bags to a filling carousel (11) at a receiving position (PR) by means of the feed carousel (21), which rotates to withdraw the preformed bags from the pickup position (PP);
- filling the product into the preformed bags by means of the filling carousel (11) which rotates continuously at a working speed and which receives the preformed bags at the receiving position (PR);
- containing a group of bags in a container (334') associated with the plurality of pickup devices (33);
- conveying the preformed bags from respective loading positions to the pickup position (PP);

the method being **characterized in that** the step of transporting comprises the following steps:

- picking up the preformed bags by means of a plurality of pickup devices (33) to position each preformed bag on the conveyor (30) at the respective loading position with a predetermined orientation; the step of picking up including a step of capturing a position signal representing the orientation of the preformed bag in the container (334') and a step of modifying the orientation of the preformed bag by means of a pickup robot (332) as a function of the respective position signal.

16. The method according to claim 15, wherein the step of conveying comprises a step of linear conveying including the following steps:

- receiving the preformed bags one by one from the plurality of pickup devices (33) in a loading zone (C) of a linear conveyor (31);
- transporting the preformed bags by means of the linear conveyor (31) along a longitudinal direction (L) up to a release zone (R) of the linear conveyor (31), spaced from the loading zone (C);
- releasing the preformed bags one by one to the feed station (2).

17. The method according to claim 15 or 16, wherein the step of feeding comprises a step of orienting the bags, in which a plurality of arms (211) of the feed carousel (21) holds the preformed bags and modifies

their orientation while the preformed bags are being transported from the pickup position (PP) to the receiving position (PR).

18. The method according to any one of claims 15 to 17, wherein the step of conveying comprises a step of zeroing in which a zeroing system (6) modifies the orientation of each of the preformed bags disposed on the conveyor (30).

19. The method according to any one of claims 15 to 18, wherein each pickup device (33) comprises an additional container to form a plurality of containers (334) disposed in a loading bay (333), the method comprising a step of recycling, including a step of moving the containers of the plurality (334) within the loading bay (333), between a provisioning position, where the container (334) interacts with an automatic reloading system (5) transporting the preformed bags from a store (4) to the loading bay (333), and a delivery position, where the container (334) interacts with the corresponding pickup device (33).

Fig. 1

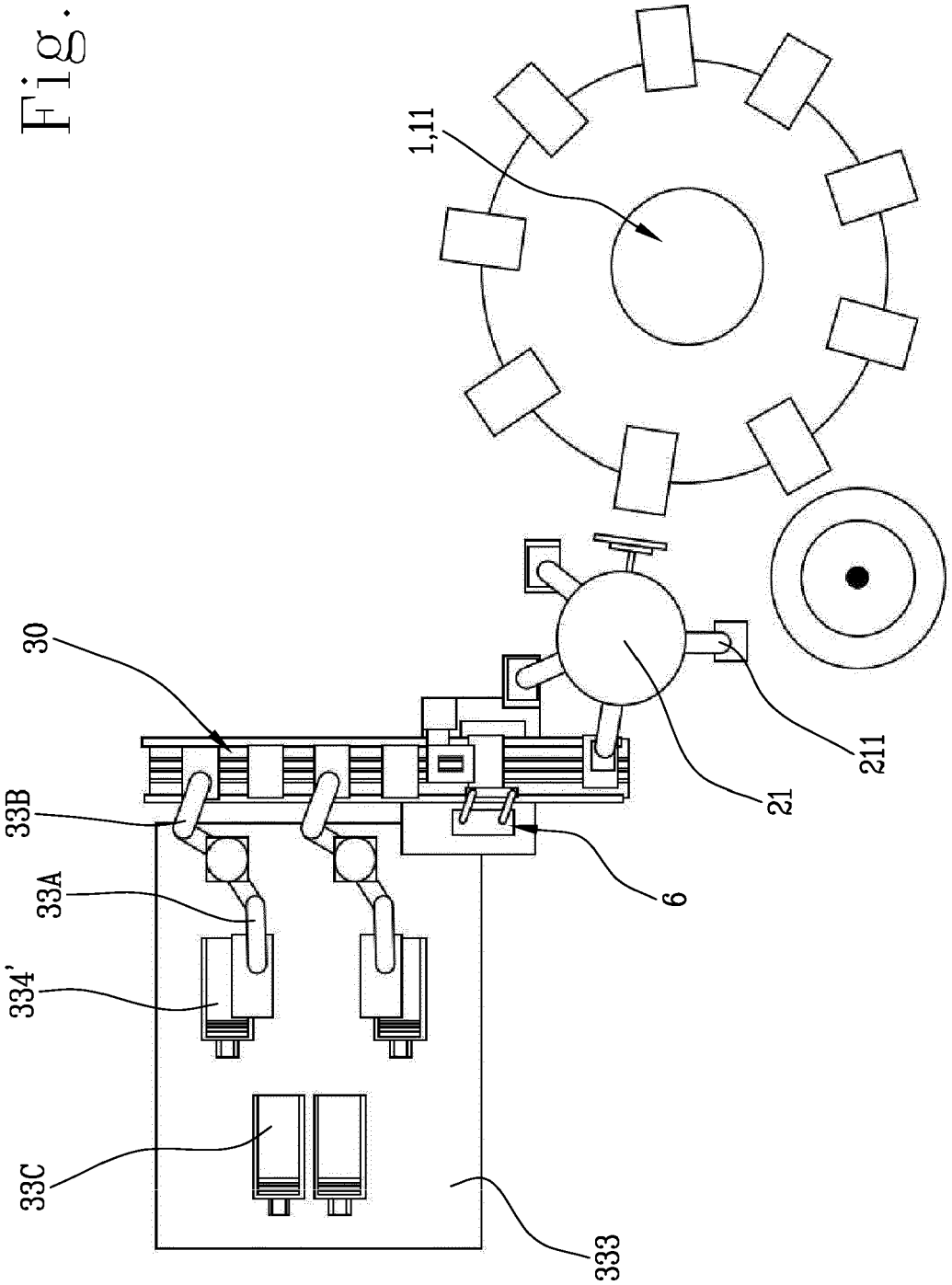


Fig.2

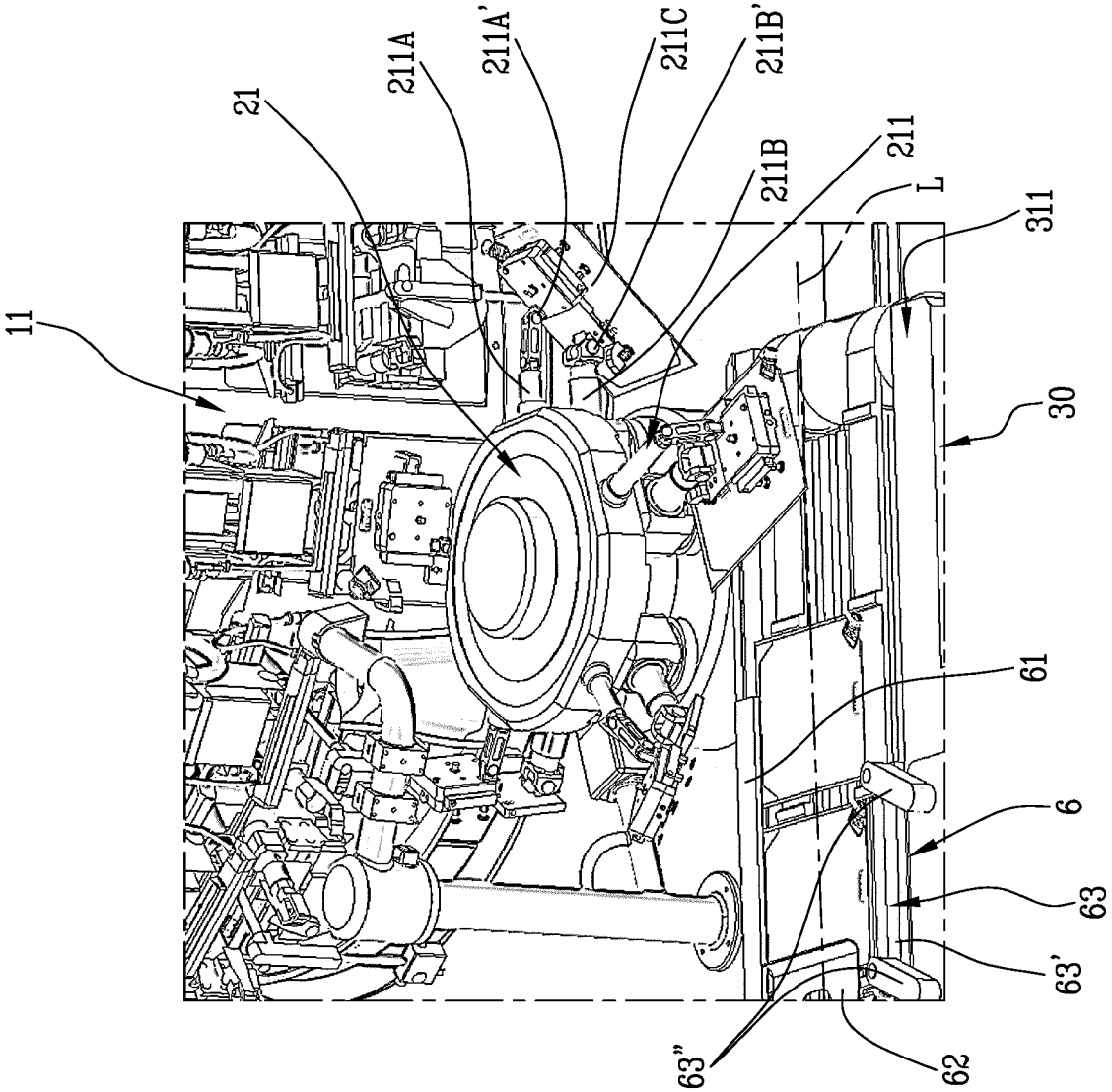


Fig.3

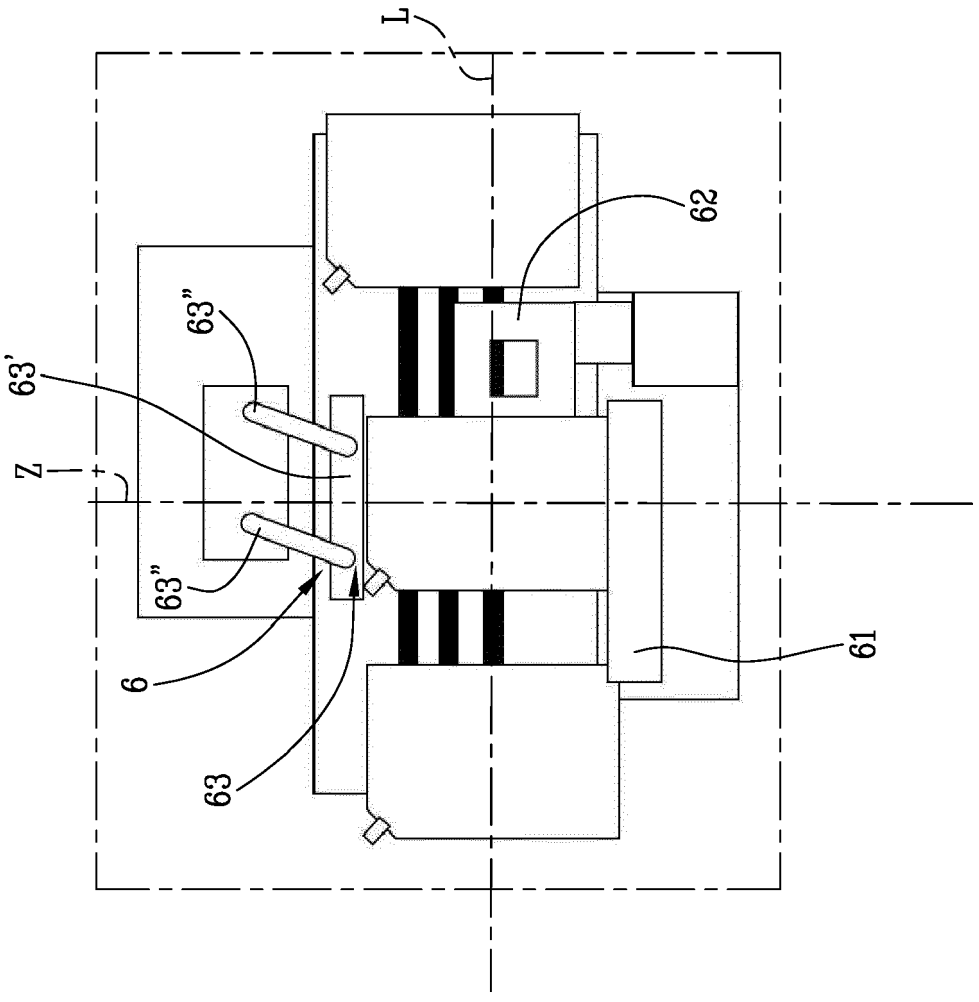


Fig.4

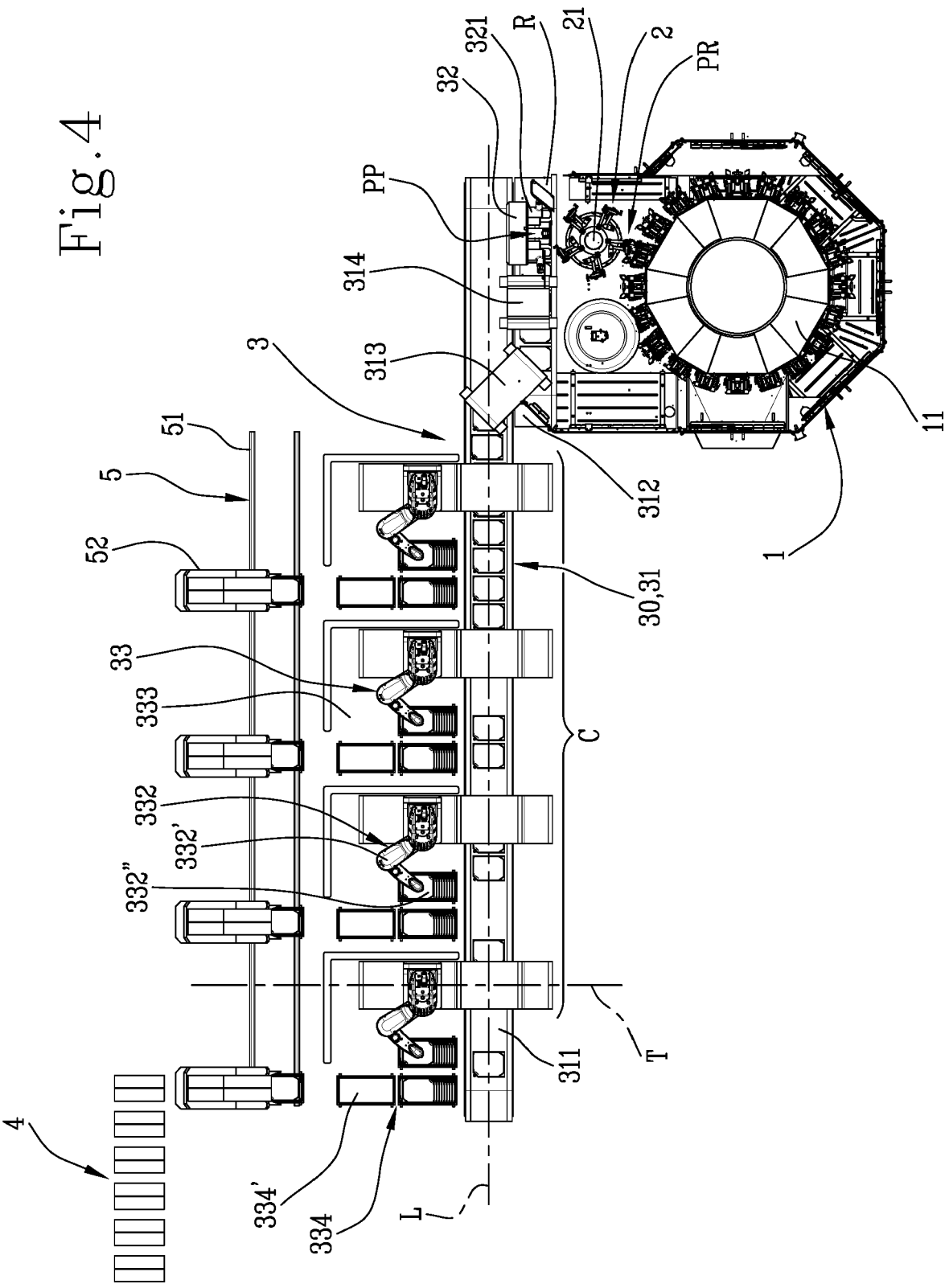

321
R
21
2
PR
32
PP
314
313
3
51
5
52
33
333
332
332'
332"
4
334'
334
L
311
T
C
30,31
312
1
11

Fig.4A

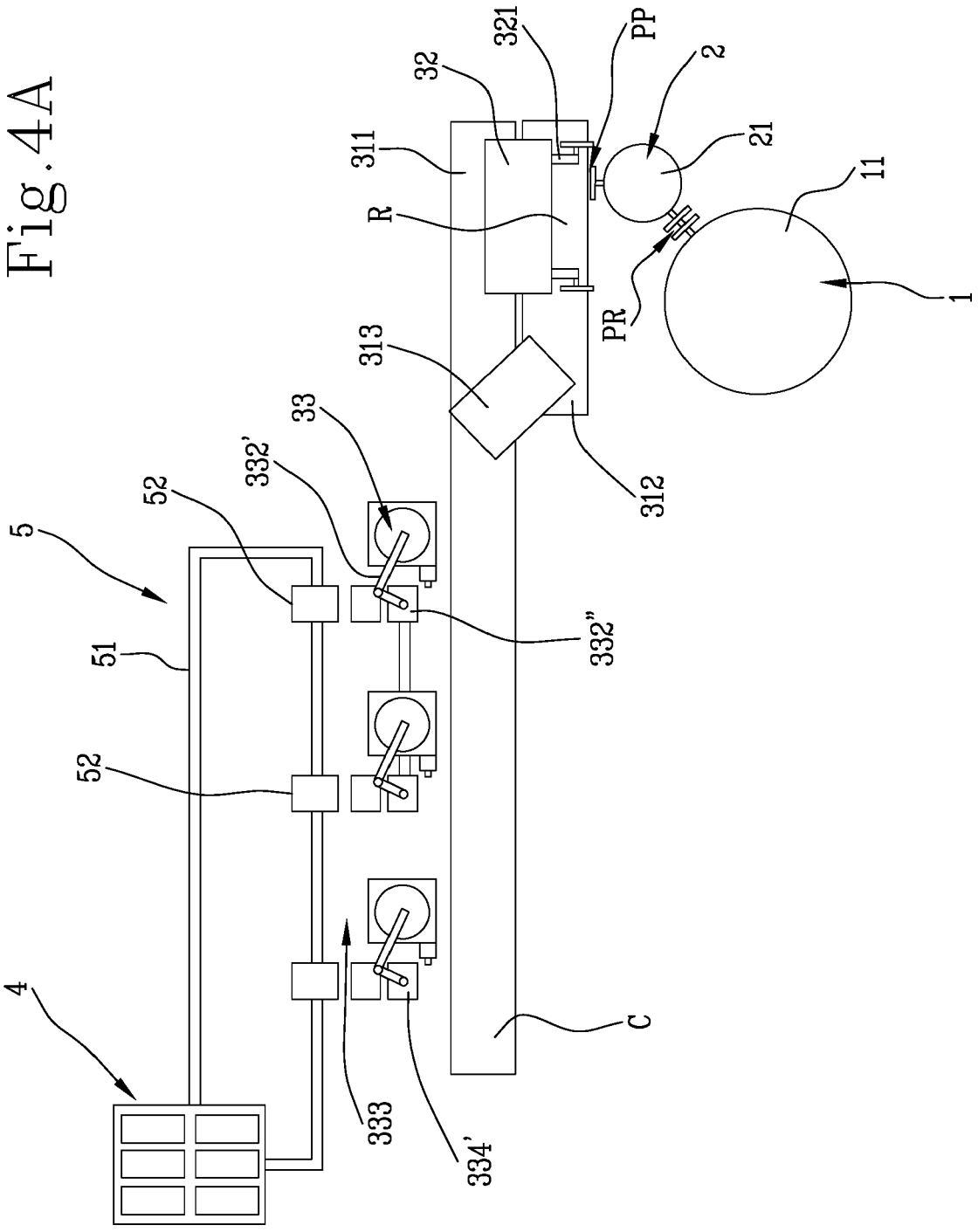


Fig.5

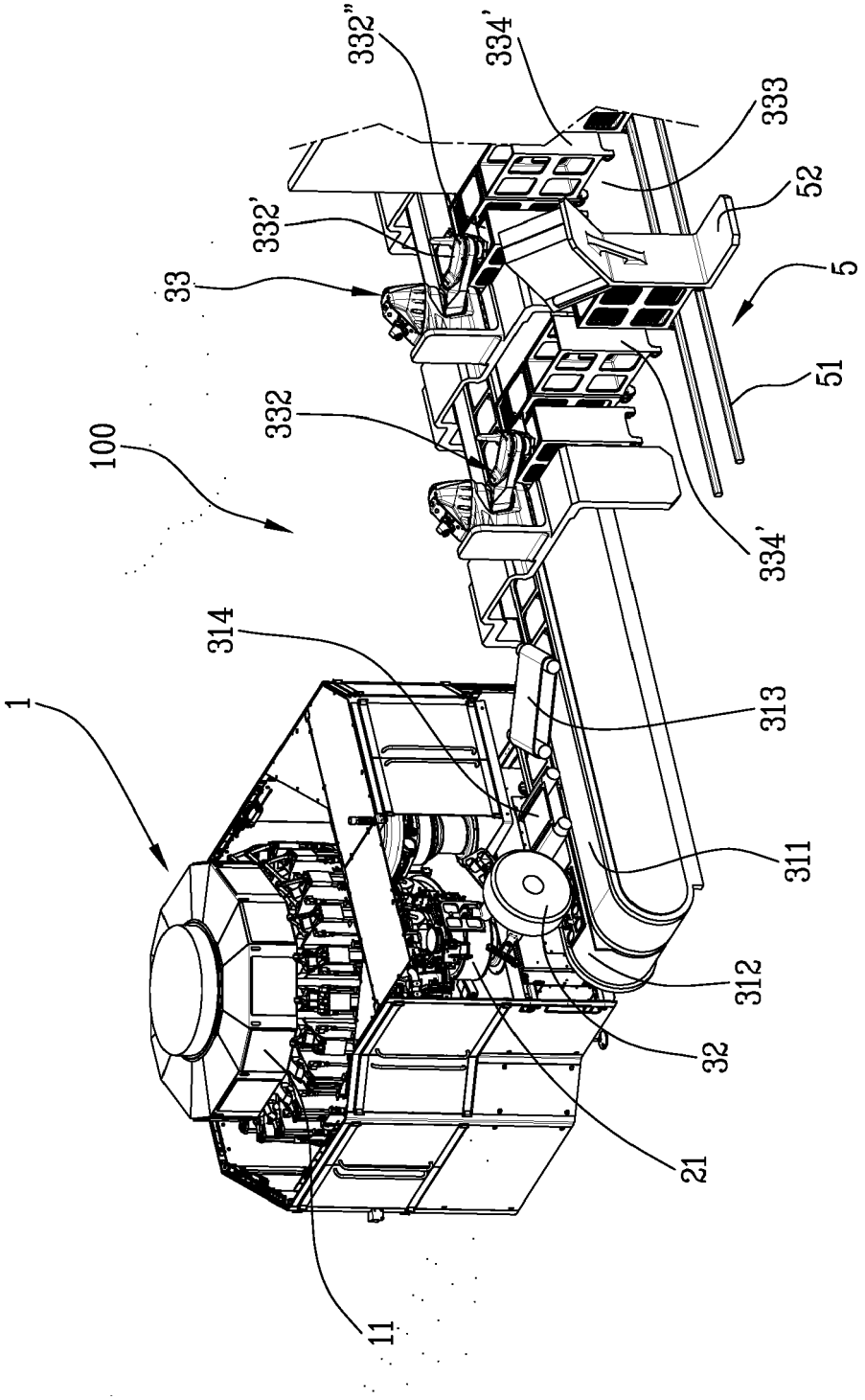


Fig.6

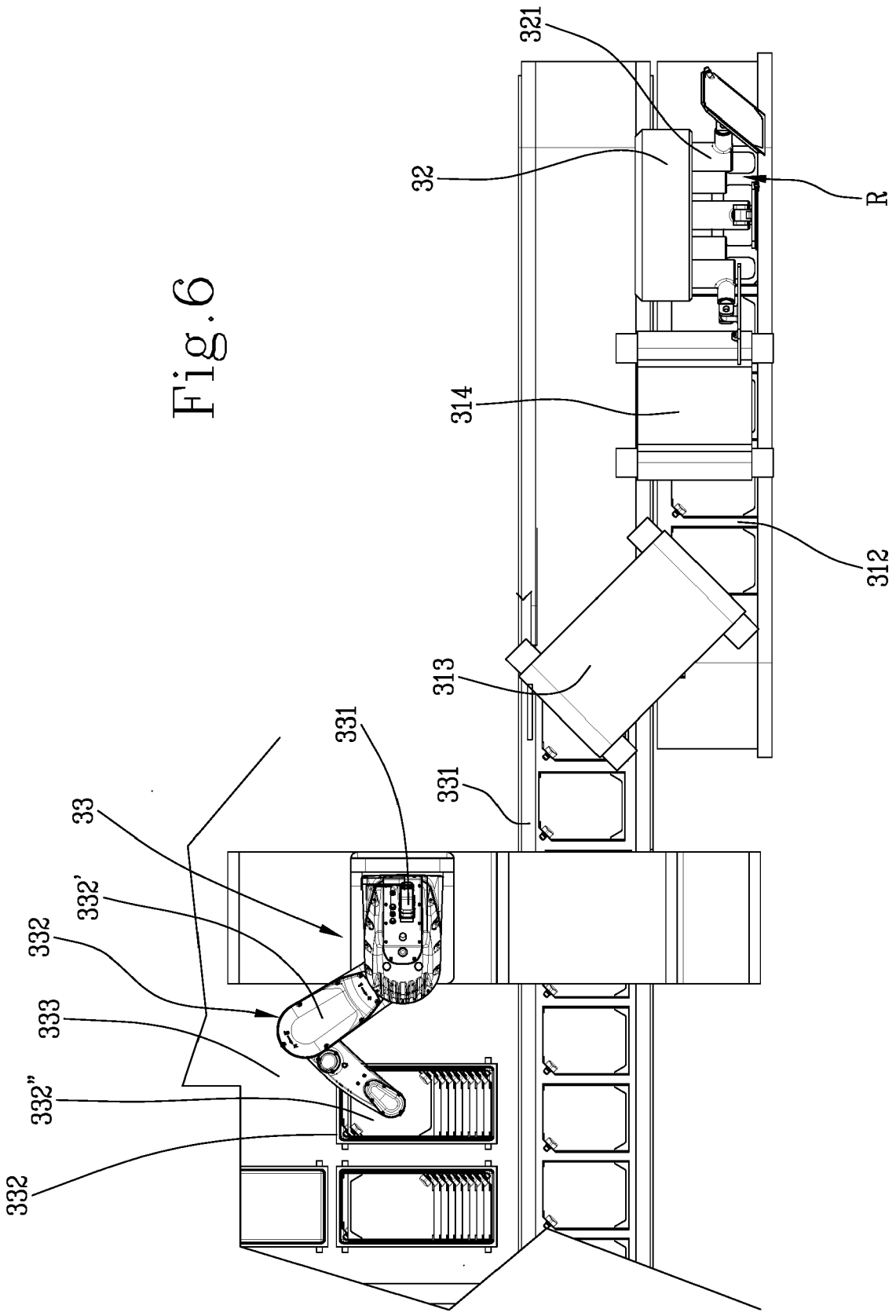
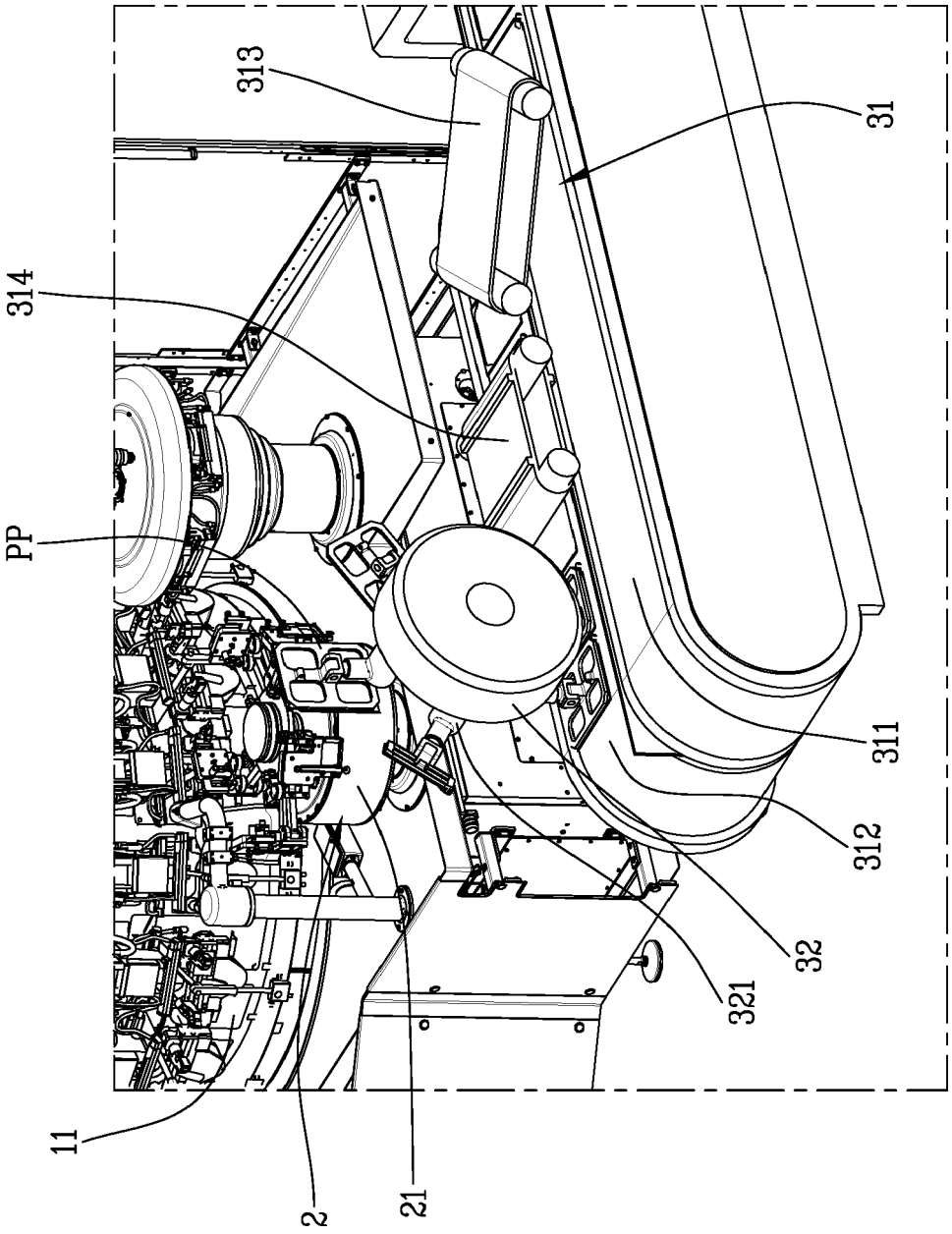


Fig.7



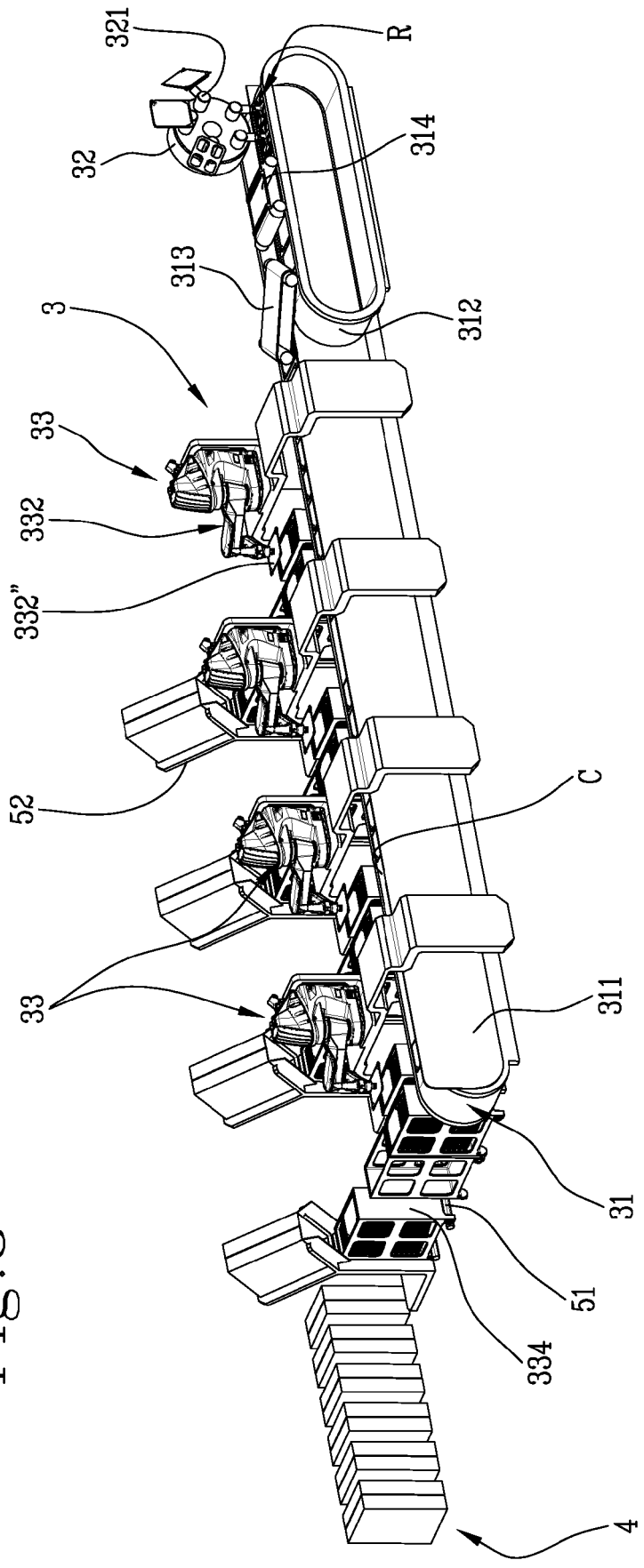


Fig.8

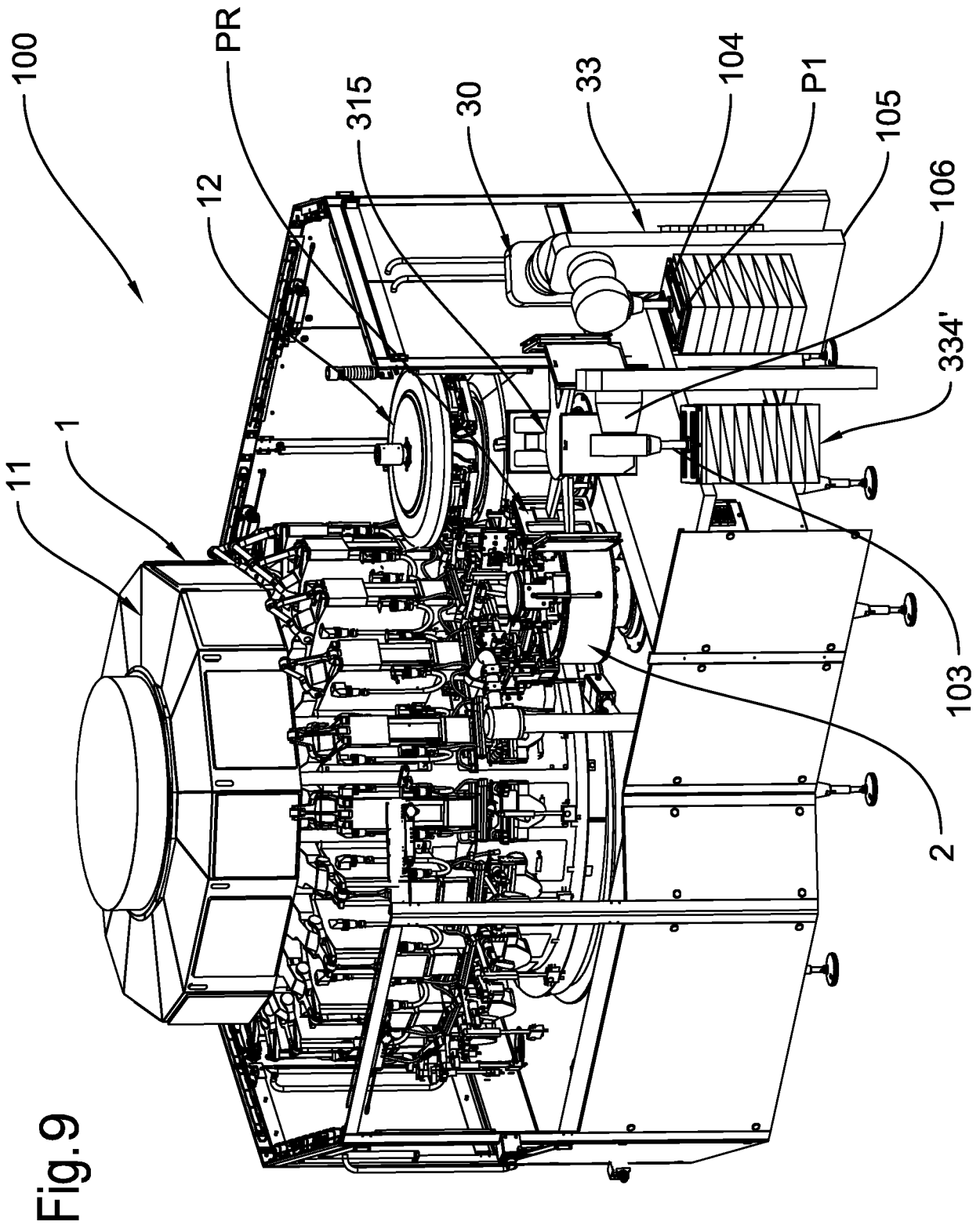


Fig.9

Fig. 10

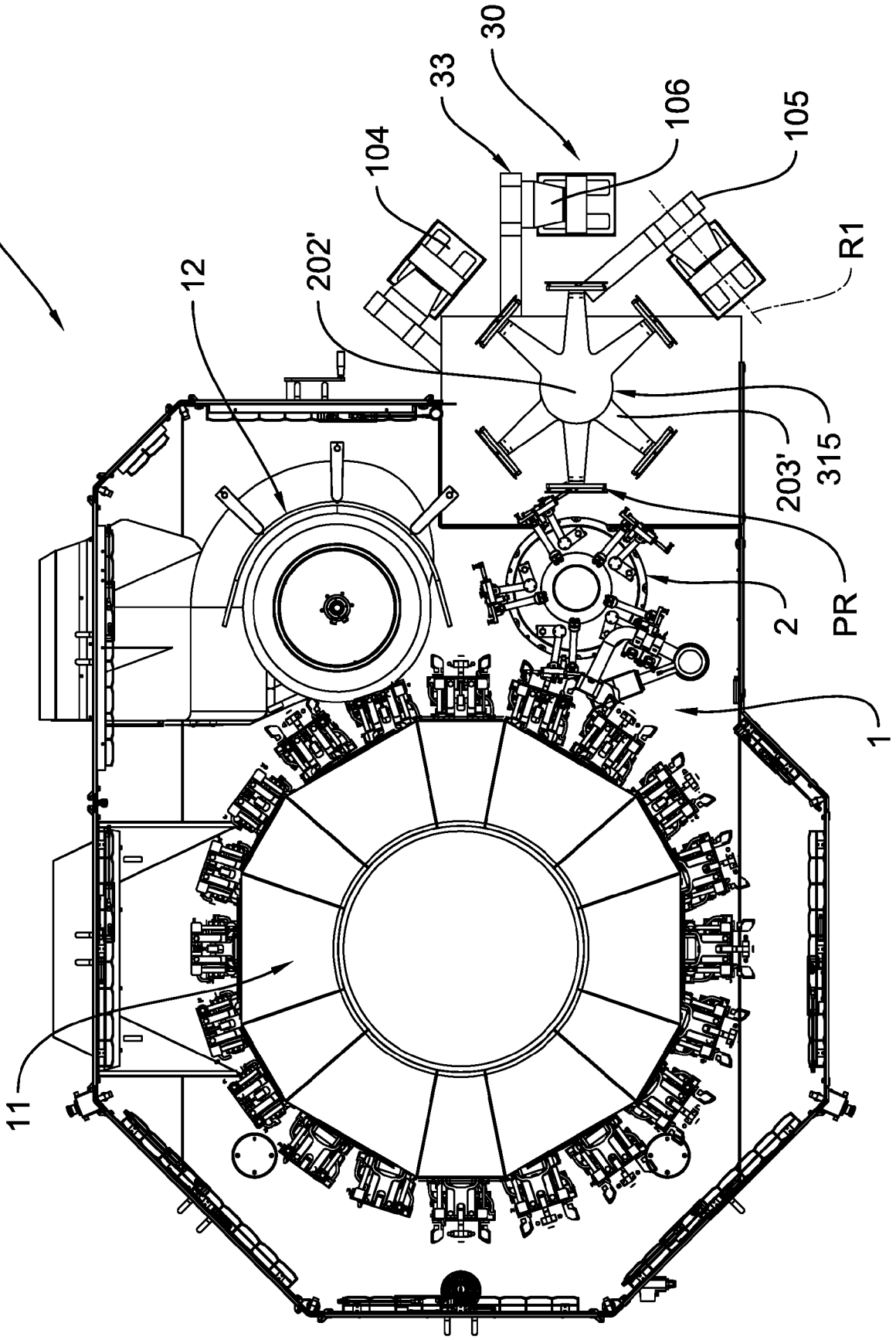


Fig.11B

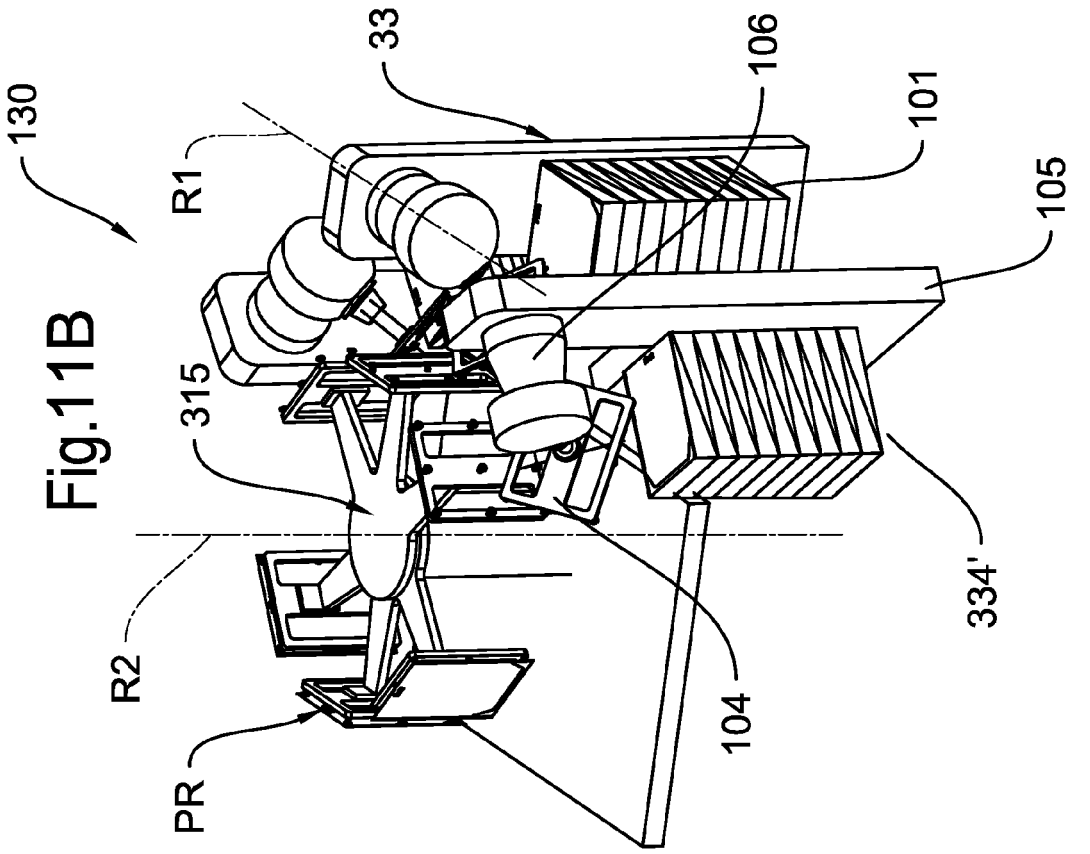


Fig.11A

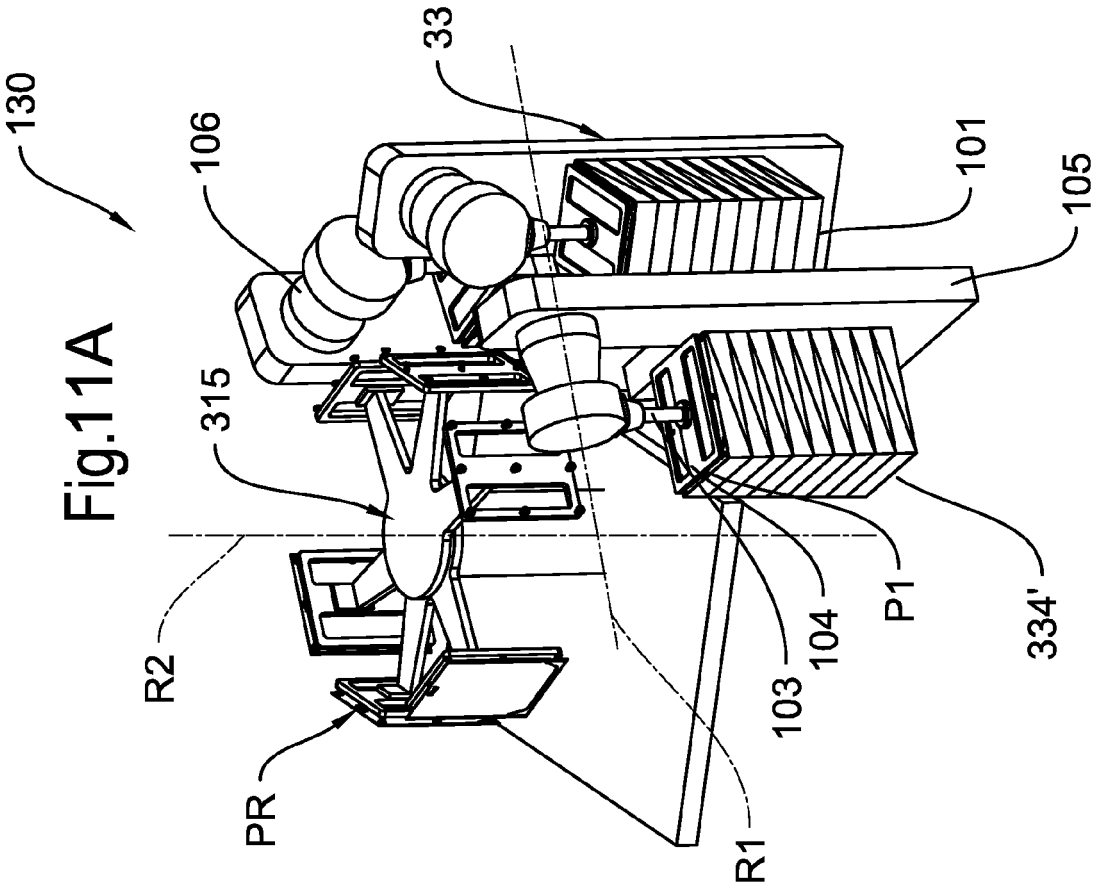


Fig.11D

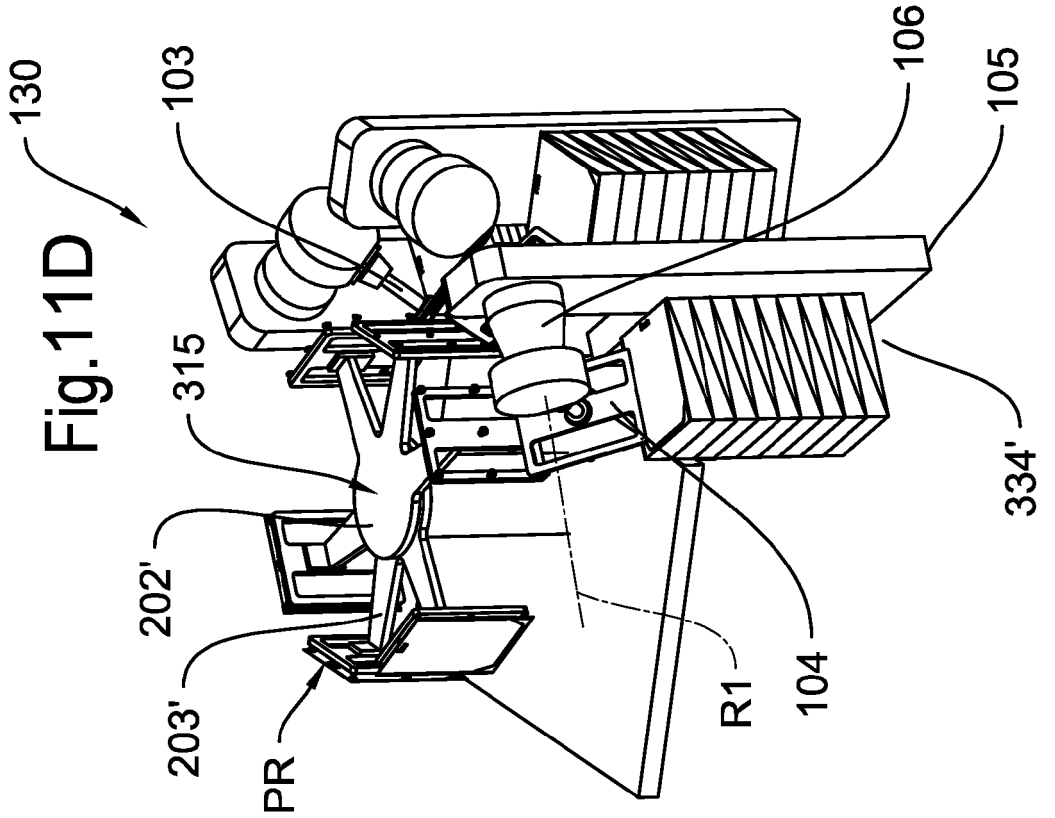


Fig.11C

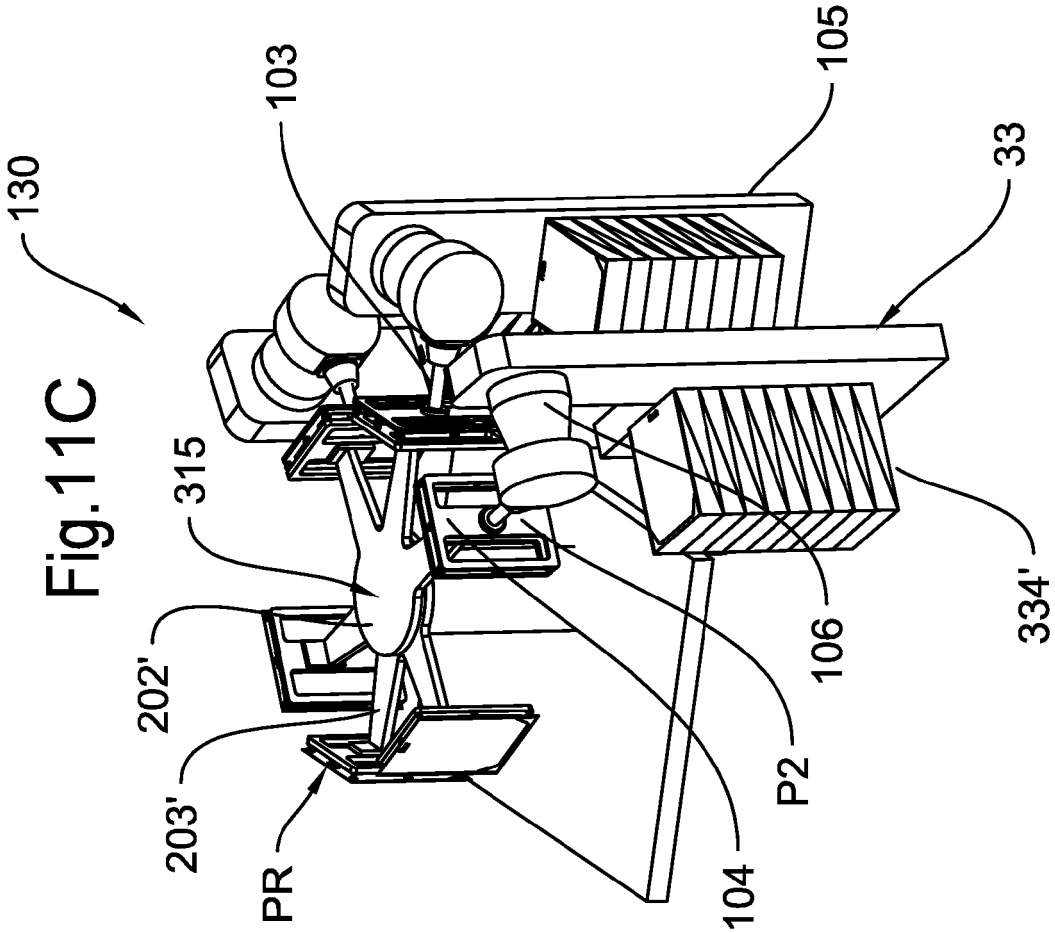
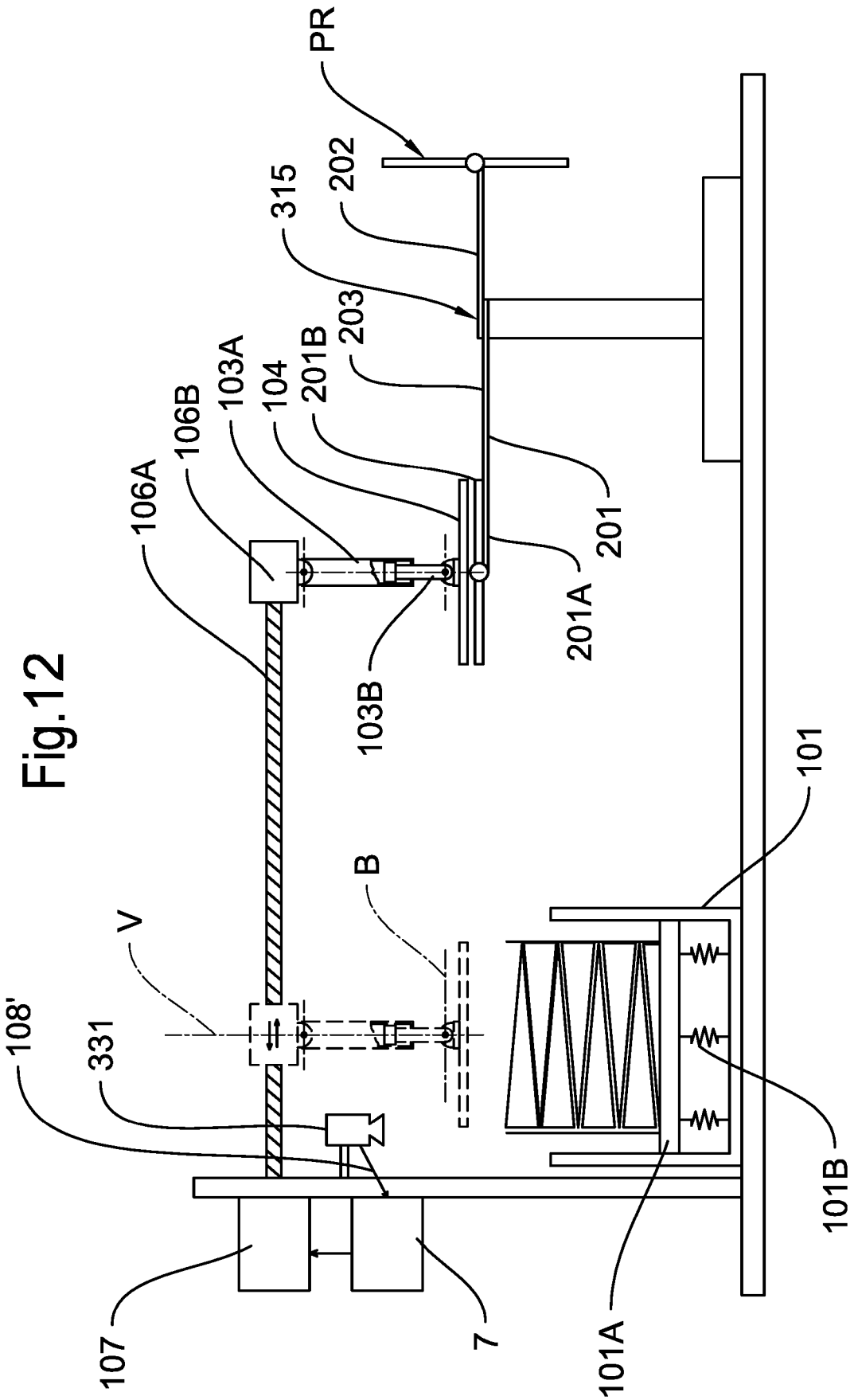


Fig.12


PR
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201
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101B
107
7
101A

Fig.13

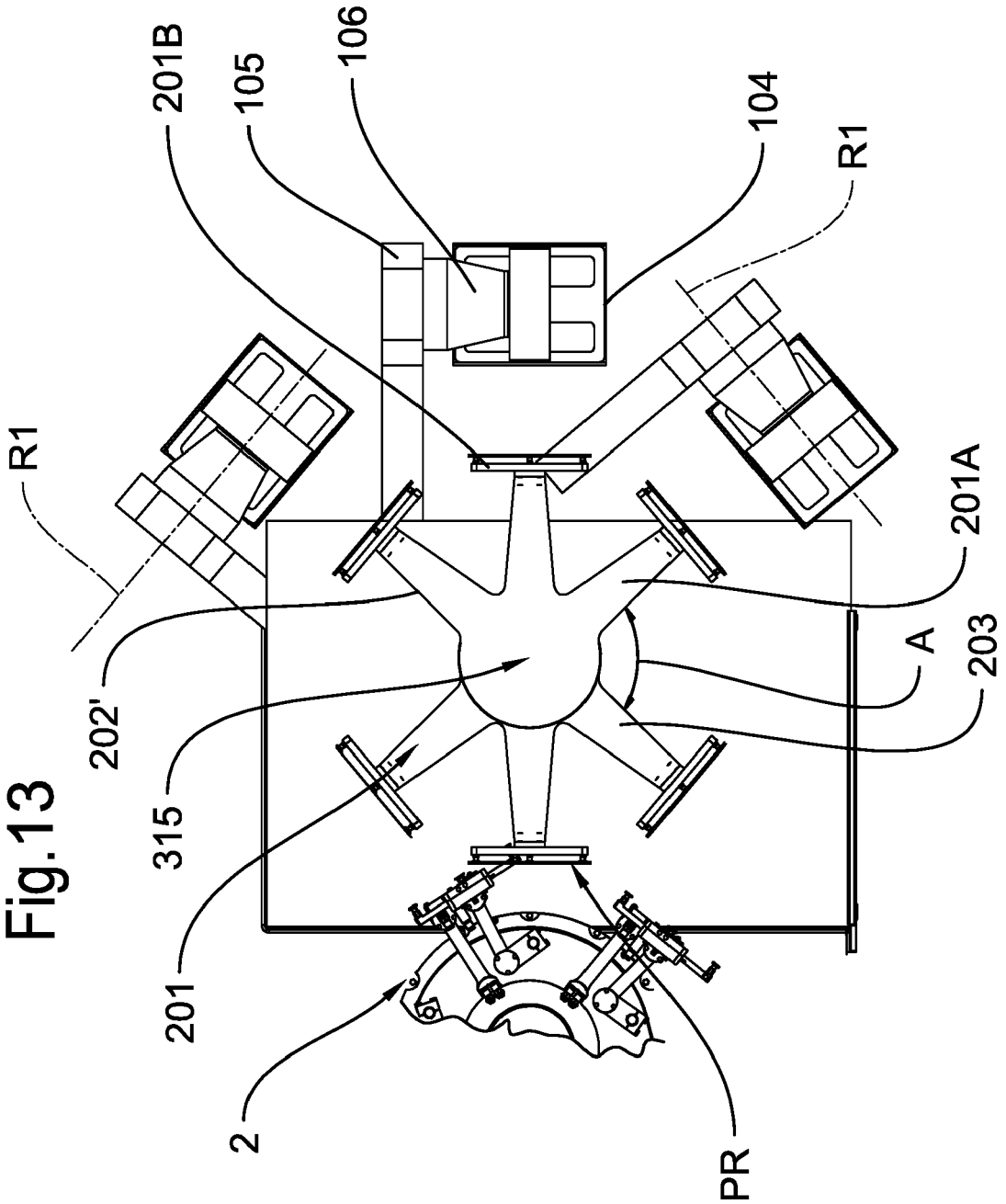


Fig.14B

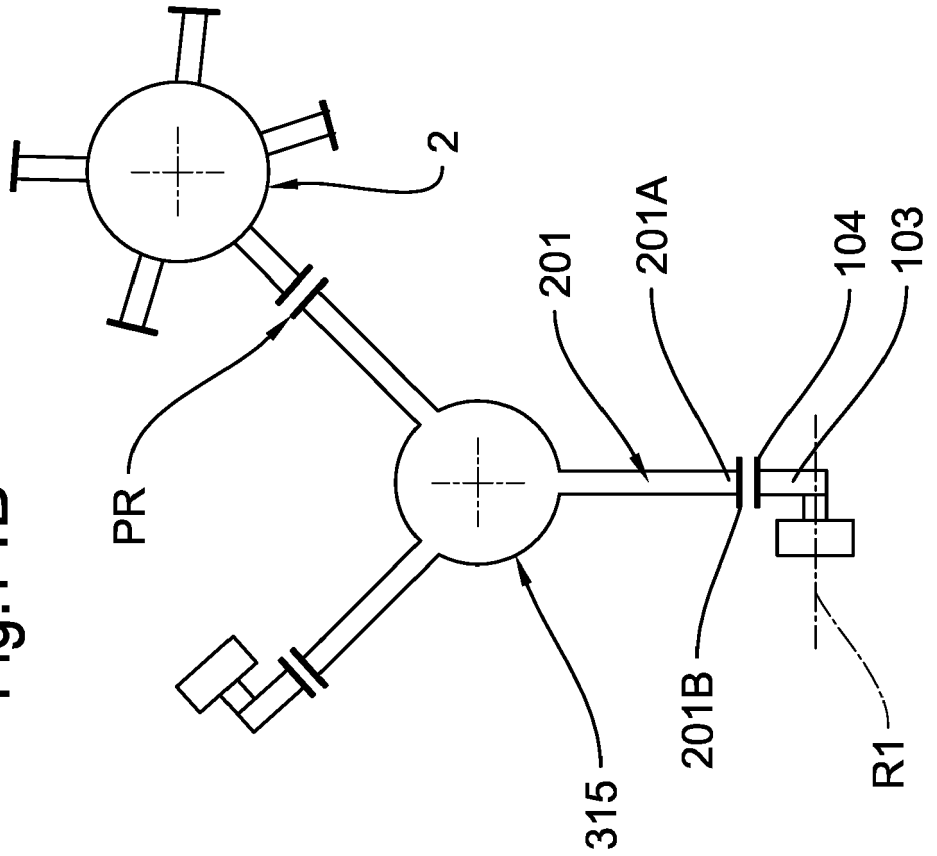
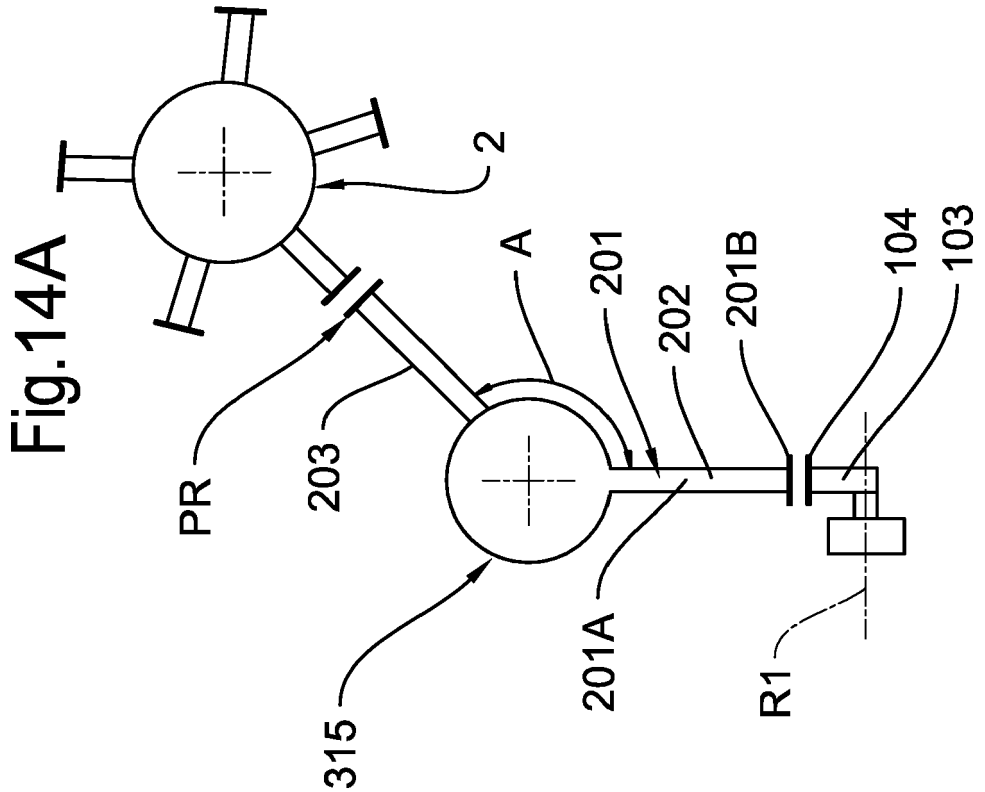


Fig.14A



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EUROPEAN SEARCH REPORT

Application Number
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B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 November 2019	Yazici, Baris

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