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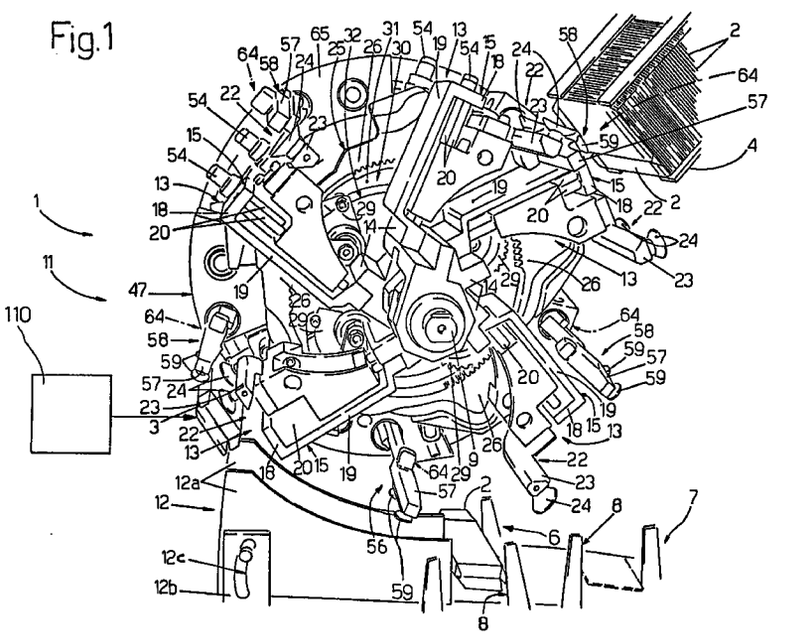
(54) Device for transferring semirigid cartons

(57) A device (1) for transferring semirigid cartons (2) having a rectangular-section tubular body (3), wherein a withdrawing assembly (11), rotating about a horizontal axis (10), has a number of pneumatic heads (23) for withdrawing the cartons (2), with the respective tubular bodies (3) flattened, from a release station (6); and a number of pneumatic flexing tools (58), each cooperating with a respective head (23) to restore the aforementioned section to a rectangular shape; the heads (23) and flexing tools (58) feeding the parallelepiped cartons (2) on to an adjustable chute (12), and successively depositing the cartons (2) into respective pockets (8) on a pocket conveyor (7).

Fig.1



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Description

The present invention relates to a device for transferring semirigid cartons.

Products are known to be packed inside semirigid, substantially parallelepiped, rectangular-based cartons comprising a tubular body substantially defined by a parallelepipedon, which is closed by end tabs on the free edges of the tubular body.

Such cartons are normally formed from a substantially rectangular blank made of cardboard or similar material, and comprising a number of preformed bend lines defining a number of panels. To save space, the finished cartons are stored substantially flat, so that the rectangular base is substantially flat and rhomboidal in shape; and, before the cartons can be filled with the products, the tubular bodies must be restored to their parallelepiped shape by an operation which, here and hereinafter, for the sake of simplicity, will be referred to as "opening the cartons."

For this purpose, devices are known for withdrawing the flat cartons from a stack by means of a number of pneumatic gripping heads, opening the cartons along an arc by means of a respective tool - here and hereinafter referred to as a flexing tool - and feeding the open cartons by gravity into respective pockets on an endless conveyor by which the cartons are fed to a work station and filled with given products.

As it is dropped into the respective pocket on the conveyor, each carton tends to return to its original shape, or, even if the desired shape is maintained, may shift, so that, by the time it reaches the work station, it may not be of the right shape or in the best position to receive the product.

It is an object of the present invention to provide a transfer device designed to overcome the aforementioned drawback.

According to the present invention, there is provided a device for transferring semirigid cartons; each said carton comprising a substantially parallelepiped tubular body; and said device being characterized by comprising a store in which said cartons are housed with the respective tubular bodies substantially flat; a release station for releasing said cartons, located beneath said store, and in turn comprising a conveyor having a number of equally spaced pockets; and a withdrawing assembly located to the side of said store and rotating about a horizontal axis; said withdrawing assembly comprising a number of pneumatic gripping members arranged about said horizontal axis and for successively withdrawing said flat cartons; said withdrawing assembly also comprising a number of pneumatic flexing tools, each cooperating with a respective gripping member to impart a parallelepiped shape to said tubular bodies; and said gripping members and flexing tools cooperating with each other to grip said flat cartons from said store, successively feed each carton on to an adjustable chute, and deposit the carton inside one of said pockets at said release station.

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic view in perspective, with parts removed for clarity, of a device in accordance with the teachings of the present invention;
Figure 2 shows a larger-scale longitudinal section, with parts removed for clarity, of Figure 1;
Figure 3 shows a larger-scale front view, with parts removed for clarity, of Figure 1;
Figure 4 shows a schematic plan view (Figure 4a), with parts removed for clarity, of a conveyor operating with the Figure 1 device, and a section (Figure 4b) along line b-b in Figure 4a;
Figure 5 shows a larger-scale plan view, with parts removed for clarity, of a detail of the Figure 1 device;
Figure 6 shows a smaller-scale section, with parts removed for clarity, along line VI-VI in Figure 5;
Figure 7 shows plan views, with parts removed for clarity, of the Figure 5 detail at successive operating stages.

Number 1 in the accompanying drawings indicates a device for transferring semirigid cartons 2, each of which comprises a substantially parallelepiped tubular body 3 (only two shown in Figure 1) and is made of cardboard or similar material. More specifically, each of the faces defining each body 3 is defined by two preformed bend lines, each of which defines a hinge between the respective adjacent faces to enable the two faces to rotate with respect to each other. As such, the cross section of body 3 may selectively assume a flat rhomboidal shape of substantially zero height to occupy as little space as possible, or a rectangular shape to receive a product in known manner.

The ends of tubular body 3 of carton 2 are connected to lateral tabs 103 and central tabs 104. More specifically, the lateral tabs are four in number and connected to the short edges of the two openings of tubular body 3; and the central tabs are two in number and connected to a first long edge of one opening and to a second long edge of the other opening; the first and second edges forming part of opposite faces of tubular body 3.

Device 1 comprises a First In - First out (FIFO) store 4 housing a stack of cartons 2 with bodies 3 flat and oriented in a substantially horizontal longitudinal direction 5 (Figure 2), and from which cartons 2 are withdrawn from the bottom; a release station 6 for releasing cartons 2, located beneath store 4, and in turn comprising an endless conveyor 7 with a number of equally spaced pockets 8; a shaft 9 located between store 4 and station 6, and having a horizontal longitudinal axis 10 parallel to direction 5; and a withdrawing assembly 11 fitted to shaft 9. Assembly 11 provides for withdrawing cartons 2 from the bottom of store 4, imparting a rectangular cross section to cartons 2, feeding each carton 2 on to a chute 12 in station 6, and sub-

sequently releasing carton 2 inside a respective pocket 8 on conveyor 7. More specifically, chute 12 is defined by two shaped panels 12a, the base of each of which is fitted at the end with a threaded pin engaging a slot 12c in a support 12b to adjust the position of chute 12 according to the size of bodies 3.

As shown in Figure 4, a known product conveyor 101 is provided parallel to conveyor 7, and comprises a succession of boxes 102, each defined by a U-shaped portion facing upwards so that an open end faces conveyor 7, and each so positioned and moved as to be substantially parallel to and facing a respective pocket 8. In actual use, at a station upstream from the device transferring semirigid cartons 2, a known product loading device (not shown) provides for depositing inside each box 102 a product 105, which is later inserted in known manner inside a respective open carton 2 inside respective pocket 8.

Assembly 11 comprises a given number of radial arms 13 (five in the example shown), each of which is connected in freely rotating, axially-fixed manner to shaft 9 by a respective fork 14 (Figure 2) so formed as to permit the other arms 13 to rotate about shaft 9. Each arm 13 comprises an elongated C-shaped support 15 in turn comprising a base 16 integral with fork 14 and from which extends radially a flat, substantially radial plate 17. On the opposite side to respective fork 14, plate 17 terminates with a flat plate 18 perpendicular to plate 17; and plates 17 and 18 are connected to each other and to base 16 by a further flat plate 19 to the rear of and perpendicular to plates 17 and 18. Between base 16 and plate 18, and via the interposition of two radial rods 20 and two linear recirculating-ball bearings 21, support 15 houses a gripping member 22, which, by means of rods 20, slides radially, is angularly fixed, and is fitted integrally with an elongated, rod-shaped pneumatic gripping head 23 parallel to axis 10 and comprising a pair of aligned suction cups 24.

As shown in Figure 2, assembly 11 also comprises an annular body 25 coaxial with and fitted in axially-fixed manner to shaft 9 as described in detail later on. Annular body 25 rotates continuously anticlockwise (in Figures 1 and 3), and comprises an inner cylindrical edge coaxial with shaft 9 and having a given number of toothed portions 26 equally spaced about axis 10. Just above respective base 16, each arm 13 comprises a pin 27 parallel to axis 10 and having an end 28 extending on the opposite side of plate 19 to plate 18. Each end 28 is fitted in angularly-fixed manner with a sector gear 29 meshing with a respective portion 26, so that each oscillation of sector gear 29 on portion 26 corresponds to a substantially identical oscillation of respective arm 13.

Again with reference to Figure 2, assembly 11 comprises an actuating device 30, in turn comprising a flange 31 fitted to shaft 9 to the rear of annular body 25. On the arm 13 side, flange 31 comprises a flat annular groove 32 defined by an inner edge 33 and an outer edge 34 facing each other, parallel to axis 10, and having a step so as to define a cam 35 and a cam 36 adjacent to each other and separated by said step. For each sector gear 29, device 30 comprises a pin 37 parallel to pin 27, having one free end housed inside a hole in the body of sector gear 29, and fitted on the other free end with a pair of eccentric tappet rollers 38 and 39 respectively engaging cam 35 and cam 36. More specifically, roller 38 is tangent to cam 35 at edge 34, and roller 39 is tangent to cam 36 at edge 33. The whole comprising cams 35 and 36 and respective rollers 38 and 39 therefore defines a slack takeup device 40 wherein roller 38 keeps roller 39 contacting respective edge 33, and roller 39 keeps roller 38 contacting edge 34 to eliminate any in-service oscillation of pin 37. Groove 32 comprises a number of active portions arranged in series and for determining oscillation of respective sector gear 29 with respect to a respective idle position, and so selectively delaying or anticipating rotation of arm 13 about axis 10 with respect to annular body 25, as explained in more detail later on. It should be pointed out that, here and hereinafter, the "active portion" of a cam or annular groove is intended to mean a portion of the cam or groove which so activates the respective tappet connected to the cam or groove as to vary the distance between the tappet and the axis of rotation of the cam or the longitudinal axis about which the groove extends (axis 10 in the case of assembly 11). Conversely, an "inactive portion" is intended to mean a substantially circular portion for maintaining the corresponding tappet in a fixed position.

As shown in Figure 2, assembly 11 also comprises a further actuating device 41 comprising, for each gripping member 22, a pin 42 parallel to pin 27, having a respective free end housed inside a hole in the body of member 22 beneath suction cups 24, and fitted on the other free end, facing annular body 25, with a tappet roller 44 engaging one of a number of grooves 45, each of which is formed, on the arm 13 side, on the face of a radial portion 46 of annular body 25 extending about the same arc as one of toothed portions 26. Each groove 45 is so shaped as to move gripping member 22 between a position at a minimum distance and a position at a maximum distance from axis 10, as explained in detail later on.

As shown in Figure 2, assembly 11 also comprises a wheel 47 coaxial with axis 10, of a larger outside diameter than annular body 25, fitted in angularly free manner to shaft 9, and in turn supporting annular body 25 via the interposition of a sleeve 48, which has an inside diameter larger than the outside diameter of flange 31, extends about the same portion of shaft 9 to which flange 31 is fitted, and therefore houses flange 31. Wheel 47 is rotated anticlockwise (in Figure 3) by an electric motor 49 (shown schematically in Figure 2) to which it is connected in angularly fixed manner by a sleeve 50 coaxial with and connected in angularly free manner to shaft 9.

As shown in Figure 3, wheel 47 comprises a number of cavities 51, each comprising two parallel lateral walls 52 extending perpendicularly from a bottom

wall 53 located tangentially with respect to a cylindrical surface coaxial with axis 10 and of a radius equal to the distance between wall 53 and axis 10. Cavities 51 are equally spaced about axis 10, are equal in number to portions 26, and are delayed with respect to portions 26 in the rotation direction of annular body 25. A pair of filtering members 54 (Figure 1) of a known pneumatic circuit (not shown) extends from each wall 53, and each member 54 houses a known pellet filter (not shown), which is easily accessible and easily changed by unscrewing a cylindrical cap on top.

Wheel 47 also comprises a number of cylindrical longitudinal seats 55, which are equally spaced about axis 10, have respective central axes 55a located about a circumference with its center at axis 10 and of a radius approximately equal to but no less than the distance between plates 18 and axis 10, and precede toothed portions 26 in the anticlockwise rotation direction in Figure 3. Via the interposition of rolling bearings, each seat 55 houses a pin 56 (only one shown in Figure 2) terminating on the arm 13 side with a rod 57 parallel to axis 10, so as to define a flexing tool 58 (only one shown in Figure 2) fitted with a pair of suction cups 59 substantially identical to suction cups 24, and for cooperating with one of the downward-facing faces of carton 2, as explained in detail later on. Pin 56 also comprises an end portion 60 projecting from seat 55 on the opposite side to rod 57, and fitted integrally with a pinion 61. For each pinion 61, wheel 47 also comprises an angularly free pin 62 delayed with respect to pinion 61, projecting from the rear of wheel 47, and fitted integrally with a sector gear 63 meshing with pinion 61 for the purpose described later on.

Assembly 11 also comprises a further actuating device 64 in turn comprising a flange 65, which is connected in angularly free manner to sleeve 50, is angularly fixed in known manner (not shown) with respect to shaft 9, and has an annular groove 66 facing wheel 47. On the opposite side to the teeth, each sector gear 63 comprises a pin 67 parallel to axis 10 and engaging annular groove 66, which, as described in detail later on, comprises a series of active portions for rotating (with reference to Figure 2) sector gear 63 anticlockwise, pinion 61 clockwise, and, more importantly, flexing tool 58 clockwise.

Like groove 32, groove 66 is defined by an inner edge 68 and an edge 69 facing each other, parallel to axis 10, and having a step so as to define a cam 70 and a cam 71 adjacent to each other and separated by said step. On the other free end of each pin 67, device 64 comprises a pair of eccentric tappet rollers 73 and 74 respectively engaging cam 70 and cam 71. More specifically, roller 73 is tangent to cam 70 at edge 69, and roller 74 is tangent to cam 71 at edge 68, so that the whole comprising cams 70 and 71 and respective rollers 73 and 74 defines a slack takeup device 75 wherein roller 73 keeps roller 74 contacting respective edge 68, and roller 74 keeps roller 73 contacting edge 69 to eliminate any in-service oscillation of pin 67. Groove 66 comprises a number of active portions in series with one another and for oscillating respective sector gear 63 with respect to a respective idle position, and so selectively delaying or anticipating rotation of flexing tools 58 about respective axes 45, as explained in detail later on.

At this point, it should be stressed that each arm 13 corresponds with a gripping head 23 and a flexing tool 58, which therefore rotate together at constant angular speed about axis 10; at store 4 and station 6, each arm 13 is moved by device 30 to and from a respective idle position in which arm 13 is at rest with respect to annular body 25; at store 4 and station 6, each gripping head 23 is moved by device 41 between said maximum and minimum distance positions from axis 10; and each flexing tool 58 is oscillated with respect to the respective idle position at store 4 and station 6.

Operation of device 1 will be described with reference to the steady-state condition in which wheel 47 rotates anticlockwise (in Figure 3) at a given speed, so as to rotate annular body 25 and arms 13; and chute 12 is so adjusted as to be tangent to cartons 2 upstream from station 6.

When an arm 13 is located upstream from store 4, rollers 38 and 39 engage an inactive portion 76 of respective groove 32, so that pin 37 keeps the corresponding sector gear 29 at rest with respect to respective portion 26; roller 44 of respective gripping member 22 engages an inactive portion 77 (Figure 3) of groove 45, so that gripping member 22 and head 23 are maintained in the respective minimum distance position from axis 10; and pin 67 of corresponding sector gear 59 engages an inactive portion 78 (Figure 3) of groove 66, so that flexing tool 58 is stationary in a respective idle position.

When the arm 13 in question is rotated by wheel 47 up to store 4, assembly 11 prepares head 23 and flexing tool 58 to grip carton 2 from the bottom of store 4. Consequently, pin 37, which was formerly at rest with respect to wheel 47, is slowed down by rollers 38 and 39 engaging groove 32 at a respective active portion 79 (Figure 3) downstream from portion 76 in the rotation direction of annular body 25, and which, by increasing the distance between pin 37 and axis 10, rotates arm 13 clockwise with respect to wheel 47, so as to slow down and eventually arrest arm 13 beneath store 4. In the meantime, roller 44 engages an active portion 80 (Figure 3) of respective groove 45, which increases the distance between roller 44 and axis 10 until, during the pause in the movement of arm 13, head 23 is set to the respective maximum distance position in which respective suction cups 24 contact and integrally engage by suction one of the two downward-facing faces of body 3. Meanwhile, rollers 73 and 74 travel along an active portion 81 (Figure 3) of groove 66, which, by means of pin 67, causes suction cups 59 of flexing tool 58 to contact and integrally engage by suction the other downward-facing face of body 3.

Once carton 2 is withdrawn from store 4, pin 37 continues along respective portion 79 to set respective

sector gear 29 at rest with respect to respective portion 26, so that, up to release station 6, arm 13 rotates about axis 10 at rest with respect to wheel 47. Meanwhile, roller 44 has left active portion 80, respective head 23 has been restored to the minimum distance position, and pin 67, by means of sector gear 63 and groove 66, begins rotating anticlockwise (in Figure 3) to flex and impart a rectangular cross section to tubular body 3 on nearing station 6. From this point on, tubular body 3 maintains its parallelepiped shape in the absence of external force, even when, on nearing station 6, an active portion 82 of groove 66 (Figure 3) causes pin 67 to restore flexing tool 58 to its original position, so that suction cups 59 of flexing tool 58, by now no longer needed, release the respective face of carton 2.

When the arm 13 in question is positioned facing station 6, an outer face of carton 2, facing the face of the tubular body retained by suction cups 24, is substantially tangent to the edge of panels 12a of chute 12, and is maintained in this position until carton 2 is deposited inside a respective pocket 8 of conveyor 7, prior to which, assembly 11 prepares head 23 to release carton 2 by performing a sequence of operations similar to those described for gripping carton 2. That is, rollers 38 and 39 travel along an active portion 83 (Figure 3) of groove 32, located downstream from portion 79 in the anticlockwise rotation direction, and which, by reducing the distance between pin 37 and axis 10, rotates arm 13 anticlockwise with respect to wheel 47 until arm 13 eventually precedes wheel 47. At the end of active portion 83, head 23 is positioned facing a pocket 8, and pin 37 encounters a portion 84 (Figure 3) of groove 32 substantially equivalent to portion 79, so that arm 13 slows down until it is eventually moving substantially at rest with respect to, and over, pocket 8.

At this point, the relative rotation between arm 13 and annular body 25 as a result of arm 13 being slowed down causes head 23 to move into the maximum distance position wherein suction cups 24 release carton 2 inside respective pocket 8. From this point, and until arm 13 nears store 4, arm 13 is accelerated by a further portion 85 (Figure 3), which precedes portion 76 and accelerates arm 13 until it is at rest with respect to wheel 47. As shown in Figure 1, carton 2 is deposited by suction cups 24 through the top opening of pocket 8, and falls by force of gravity so that the bottom face comes to rest on the bottom of pocket 8. This type of release is imposed by member 22 being unable to move down into pocket 8 to deposit carton 2 on to the bottom of the pocket, but is in no way disadvantageous, in that the carton falls only a short distance, at slow speed (the carton is made of cardboard or similar, is empty, and falls solely by force of gravity), and along an ideal trajectory imposed by the walls of pocket 8.

As stated, each pocket 8 on the conveyor is associated with a corresponding box 102 on product conveyor 101; and, as shown in Figure 4, carton 2 is so deposited that, in the final position inside pocket 8, a central tab 104 of carton 2 is positioned over box 102 and the product 105 inside the box, and the lateral tabs 103, facing box 102, of carton 2 are positioned outside the box. Depositing the carton in this way provides for trouble-free insertion of product 105 inside carton 2, which is normally effected by means of a known loading device (not shown) which pushes product 105 from box 102 into tubular body 3 of carton 2.

Upstream from release station 6, provision is also made for a further flexing device 110 (shown schematically, for the sake of clarity, in Figure 1) as shown in the front view in Figure 5 and in section along line VI-VI in Figure 6.

Device 110 comprises a pair of flexing members 111 integral with a shaft 112 of axis 113 substantially parallel to the rotation axis of device 1. Shaft 112 is supported on bearings 114 in turn supported on a structure 115, and is integral with a first gear 116 meshing with a second gear 117. Second gear 117 is supported on bearings 118 in turn supported on structure 115, and is driven by a pulley 120 in turn driven by a belt 119 driven by a known drive device (not shown). Flexing member 111 substantially comprises a cylindrical sector, and therefore has a pressure surface 121 substantially defined by a lateral surface portion of a cylinder.

Since the angle and diameter of pressure surface 121 depend on the size and physical characteristics of the carton 2 being worked, flexing members 111 are fitted to shaft 112 in such a manner as to be changed easily according to the type of carton 2. The effectiveness of flexing member 111, in fact, obviously increases in proportion to its angle and diameter; the first being due to the fact that, for a given rotation speed, the greater the angle, the longer carton 2 is subjected to the action of member 111; and the second being due to the fact that, for a given distance between carton 2 and rotation axis 113, the greater the diameter, the greater the deformation imposed by member 111.

In actual use, shaft 112 is rotated at a multiple angular speed synchronized with the angular speed of device 1. More specifically, the angular speed of shaft 112 equals the angular speed of device 1 multiplied by the number of radial arms 13 provided (five in the example shown) so as to enable the flexing cycle to be repeated for each carton 2 traveling past device 110.

As shown in Figure 7, the angular speed of shaft 112 is so timed that pressure surface 121 interacts with the outer face of carton 2 (i.e. the face parallel to and opposite the one retained by suction cups 24) as carton 2 travels within the operating region of device 110; which region corresponds with that in which the action of flexing device 110 ceases and suction cups 59 release carton 2, which at that point tends to return to its original shape. Device 110 is particularly useful, in fact, by further flexing the carton precisely as it tends to return to its original closed configuration; and numerous tests have shown that a second flexing operation provides for safely maintaining the desired shape of carton 2.

Flexing member 111 is rotated in the opposite

direction to device 1, so that the surface speed of carton 2 is equal in direction to the surface speed of members 111, and carton 2 is flexed gently with no risk of damage.

Device 1 may therefore be used to considerable advantage for preparing cartons 2 to receive the products, and for depositing cartons 2 inside respective pockets 8 with respective tubular bodies 3 ready to receive the products from a machine downstream from device 1.

Clearly, changes may be made to device 1 as described and illustrated herein without, however, departing from the scope of the present invention.

Claims

1. A device (1) for transferring semirigid cartons (2); each said carton (2) comprising a substantially parallelepiped tubular body (3); and said device (1) being characterized by comprising: a store (4) in which said cartons (2) are housed with the respective tubular bodies (3) substantially flat; a release station (6) for releasing said cartons (2), located beneath said store (4), and in turn comprising a first conveyor (7) having a number of equally spaced pockets (8); and a withdrawing assembly (11) located to the side of said store (4) and rotating about a horizontal first axis (10); said withdrawing assembly (11) comprising a number of pneumatic gripping members (23) arranged about said first axis (10) and for successively withdrawing said flat cartons (2); said withdrawing assembly (11) also comprising a number of pneumatic flexing tools (58), each cooperating with a respective said gripping member (23) to impart a parallelepiped shape to said tubular bodies (3); and said device (1) also comprising a mechanical flexing device (110) substantially outside and fixed with respect to said withdrawing assembly (11), and located in the region immediately downstream from the region in which the action of said pneumatic flexing tools (58) ceases.

2. A device as claimed in Claim 1, characterized in that said flexing device (110) comprises at least one flexing member (111) having a pressure surface (121) for compressing said cartons (2) and imparting to the cartons (2) retained by the pneumatic gripping members (23) a substantially flat shape opposite to that assumed in said store (4).

3. A device as claimed in Claim 2, characterized in that said flexing member (111) is defined by a body in the form of a cylindrical sector.

4. A device as claimed in Claim 3, characterized in that said flexing member (111) is fitted to a shaft (112) rotating, in use, at an angular speed synchronized with and which is a multiple of the angular speed of the withdrawing assembly (11).

5. A device as claimed in any one of the foregoing Claims, characterized in that said gripping members (23) and said flexing tools (58) cooperate with each other to grip the flat cartons (2) from said store (4), successively feed each carton (2) on to an adjustable chute (12), and deposit the carton (2) inside one of said pockets (8) at said release station (6).

6. A device as claimed in Claim 5, characterized in that, parallel to said first conveyor (7), there is provided a second conveyor (101) comprising a succession of boxes (102) for retaining products (105) and substantially parallel to and facing corresponding said pockets (8); each of said boxes (102) being substantially U-shaped with the open upper side facing said device (1), and with an open side facing said corresponding pocket (8); each said carton (2) comprising a tubular body (3), the ends of which are connected to lateral tabs (103) at the short edges of the two openings of the tubular body (3), and to two central tabs (104) at a first long edge of one opening and at a second long edge of the other opening, the first and second long edges forming part of opposite faces of the tubular body (3); said gripping members (23) depositing each carton (2) inside a respective said pocket (8) at said release station (6) in such a manner that one of said central tabs (104) of the carton (2) is substantially positioned over the box (102), and the lateral tabs (103), facing the box (102), of the carton (2) are positioned outside the box (102).

7. A device as claimed in any one of the foregoing Claims, characterized by comprising a shaft (9) coaxial with said first axis (10) and supporting said withdrawing assembly (11); said withdrawing assembly in turn comprising an annular body (25) coaxial with said shaft (9) and fitted to said shaft (9) in axially-fixed manner; said annular body (25) rotating continuously in a rotation direction which goes from said store (4) to said release station (6) about the opposite side of said shaft (9) to said first conveyor (7), and comprising an inner cylindrical edge coaxial with said shaft (9) and having a given number of internally toothed portions (26) equally spaced about said shaft (9); said withdrawing assembly (11) comprising radial arms (13) equal in number to said given number; each of said arms (13) being connected in freely rotating manner to said shaft (9), and comprising a pneumatic gripping member (23) for gripping said cartons (2); each said gripping member (23) being fitted to said arm (13) in radially free manner via the interposition of respective sliding guide means (21); said arm (13) supporting for rotation a first sector gear (29) having a respective second axis of rotation parallel to

said shaft (9) and located between said first axis (10) and said gripping member (23), and which meshes with a respective toothed portion (26) to rotate said arm (13); first cam means (30) being provided for selectively controlling oscillation of said first sector gears (29) with respect to the respective toothed portions (26) to oscillate the respective said arms (13) about said first axis (10); second cam means (41) being provided for moving said gripping member (23) to and from a maximum distance position with respect to said first axis (10); and said first cam means (30) and said second cam means (41) cooperating with each other to move said gripping members (23) to and from said maximum distance position as the respective arms (13) oscillate about said first axis (10).

8. A device as claimed in any one of the foregoing Claims, characterized in that said maximum distance position is alternatively a withdrawal position wherein said cartons (2) are withdrawn from said store (4), and a release position wherein said cartons (2) are released at said release station (6); said sliding guide means (21) comprising at least one rod (20) fitted to the respective said arm (13) and extending radially, a movable assembly (22) supporting said gripping member (23) and fitted in freely sliding manner to said rod (20) by recirculating-ball sleeves (21), and a further rod (20) for maintaining said movable assembly (22) angularly fixed with respect to said rod (20).

9. A device as claimed in Claim 8, characterized in that said first cam means (30) comprise a first annular body (25) fitted to said shaft (9) and having a first annular groove (32) defined, parallel to said first axis (10), by two edges (33, 34) parallel to each other and located one inwards of the other; and, for each of said arms (13), a first pin (37) integral with the respective first sector gear (29) and parallel to said first axis (10); said first pin (37) being fitted on a free end with a first tappet roller (38)(39) positively engaging said first groove (32) while remaining constantly in contact with a first (33)(34) of said two edges (33, 34); and first slack takeup means (40) for taking up the slack between said first roller (38)(39) and said first edge (33)(34) being provided to keep the first roller (38) in contact with said first groove (32) at all times.

10. A device as claimed in Claim 9, characterized in that said first groove (32) comprises a first portion (76) located beneath said store (4) and for maintaining said first sector gears (29) at rest with respect to the corresponding toothed portions (26); an active second portion (79) located downstream from said first portion (76) in said rotation direction, and for moving said first sector gears (29) with respect to the respective toothed portions (26) to slow down the respective arms (13) with respect to said annular body (25) and move the respective said gripping members (23) into the respective withdrawal positions; an active third portion (83) located downstream from said second portion (79) in said rotation direction, and for accelerating said first sector gears (29) with respect to the respective toothed portions (26) so that said arms (13) are successively in advance of said annular body (25); an active fourth portion (84) located downstream from said third portion (83) in said rotation direction, and for slowing down said arms (13) so that the arms (13) successively travel at rest with respect to said pockets (8) to move the respective said gripping members (23) into the respective release positions; and an active fifth portion (85) located between said fourth portion (84) and said first portion (76), and for accelerating the arms (13) so that the arms (13) are at rest with respect to said annular body (25).

11. A device as claimed in Claim 9 or 10, characterized in that said first slack takeup means (40) comprise a first cam (35)(36) and a second cam (36)(35), both parallel to said first groove (32); and a second tappet roller (39)(38) fitted to said first pin (37) and parallel to said first roller (38)(39); said second roller (39)(38) positively engaging said second cam (36)(35) so as to remain permanently in contact with one of said two edges (33, 34) of said first groove.

12. A device as claimed in any one of the foregoing Claims, characterized in that said second cam means (41) comprise, for each of said first sector gears (29), a second face groove (45) formed in said annular body (25) on the side facing said arms (13); and, for each of said arms (13), a second pin (42) integral with the respective said arm (13) and parallel to said first axis (10); said second pin (42) being fitted on a free end with a third tappet roller (44) coaxial with said second pin (42) and positively engaging said second groove (45).

13. A device as claimed in any one of the foregoing Claims, characterized in that said withdrawing assembly (11) comprises a wheel (47) coaxial with said first axis (10) and having a number of cavities (51) equal in number to said given number; said wheel (47) being fitted in angularly free manner to said shaft (9) and connected in angularly fixed manner to said annular body (25); said wheel (47) supporting each of said flexing tools (58) in freely rotating manner about a respective fourth axis (55a) parallel to said first axis (10); said fourth axes (55a) being equally spaced about said first axis (10) along a circumference concentric with said first axis (10), and being located over the respective said arms (13); said fourth axes (55a) being in advance

with respect to said toothed portions (26) in said rotation direction; and third cam means (64) being provided to control the oscillation of each said flexing tool (58) about the respective fourth axis (55a).

14. A device as claimed in Claim 13, characterized in that said flexing tools (58) each comprise a first end (57) projecting from said wheel (47) on the side facing said arms (13); and a second end (60) projecting from said wheel (47) on the opposite side to said first end (57); said second end (60) being fitted with a pinion (61) adjacent to said wheel (47); said wheel (47) also supporting, in freely rotating manner and on the side facing said second ends (60), third pins (62) parallel to said first axis (10) and equal in number to said given number; each of said third pins (62) being fitted with a said second sector gear (63) meshing with said pinion (61); and each of said third pins (62) extending on the opposite side to said arms (13).

15. A device as claimed in Claim 13 or 14, characterized in that said third cam means (64) comprise a fixed third flange (65) with a fourth annular groove (66) facing said arms (13); and, for each of said third pins (62), a fourth tappet roller (73)(74) positively engaging said fourth groove (66); said fourth groove (66) cooperating with said fourth roller to rotate the respective second sector gear (63) in said rotation direction; and second slack takeup means (75), identical to said first slack takeup means (40), being provided to keep said fourth roller (73)(74) and said fourth groove (66) permanently in contact with each other.

16. A device as claimed in any one of the foregoing Claims, characterized in that said gripping members (23) and said flexing tools (58) comprise at least one suction cup (24)(59) to engage respective adjacent lateral faces of said tubular bodies (3) by suction.

17. A device as claimed in Claim 5 or 6, characterized in that said chute (12) is defined by a pair of shaped panels (12a), each having a threaded pin engaging a respective slot (12c) in a support (12b) to adjust the position of the chute (12) according to the size of said tubular bodies (3).

18. A device as claimed in any one of the foregoing Claims, characterized in that said cavities (51) are defined by a bottom wall (53) substantially tangent to a cylindrical surface coaxial with said first axis (10), and by two lateral walls (52) parallel to each other and perpendicular to said bottom wall (53); a pair of filtering members (54) projecting from each of said bottom walls (53), and each comprising a removable pellet filter.

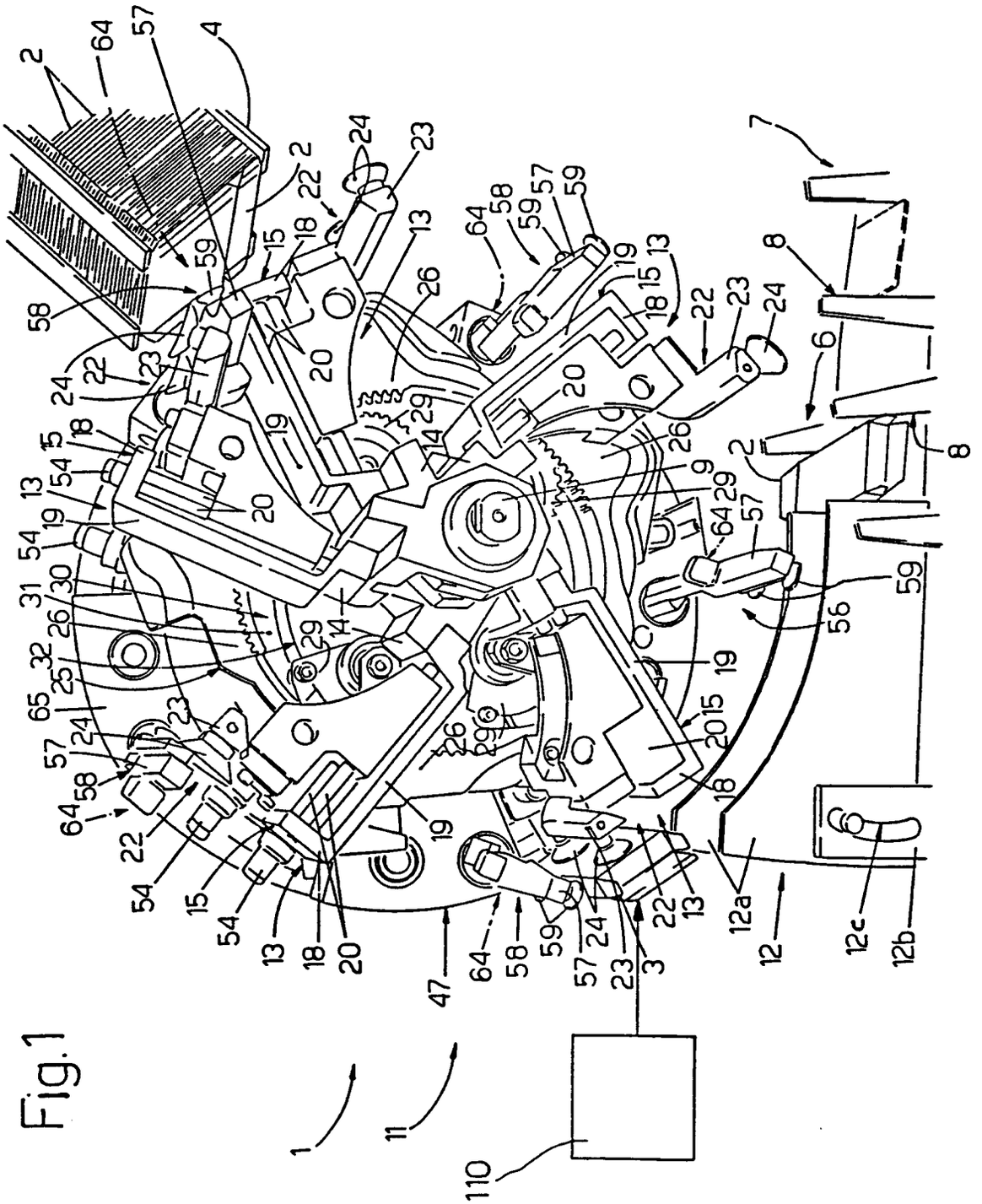

Fig.1

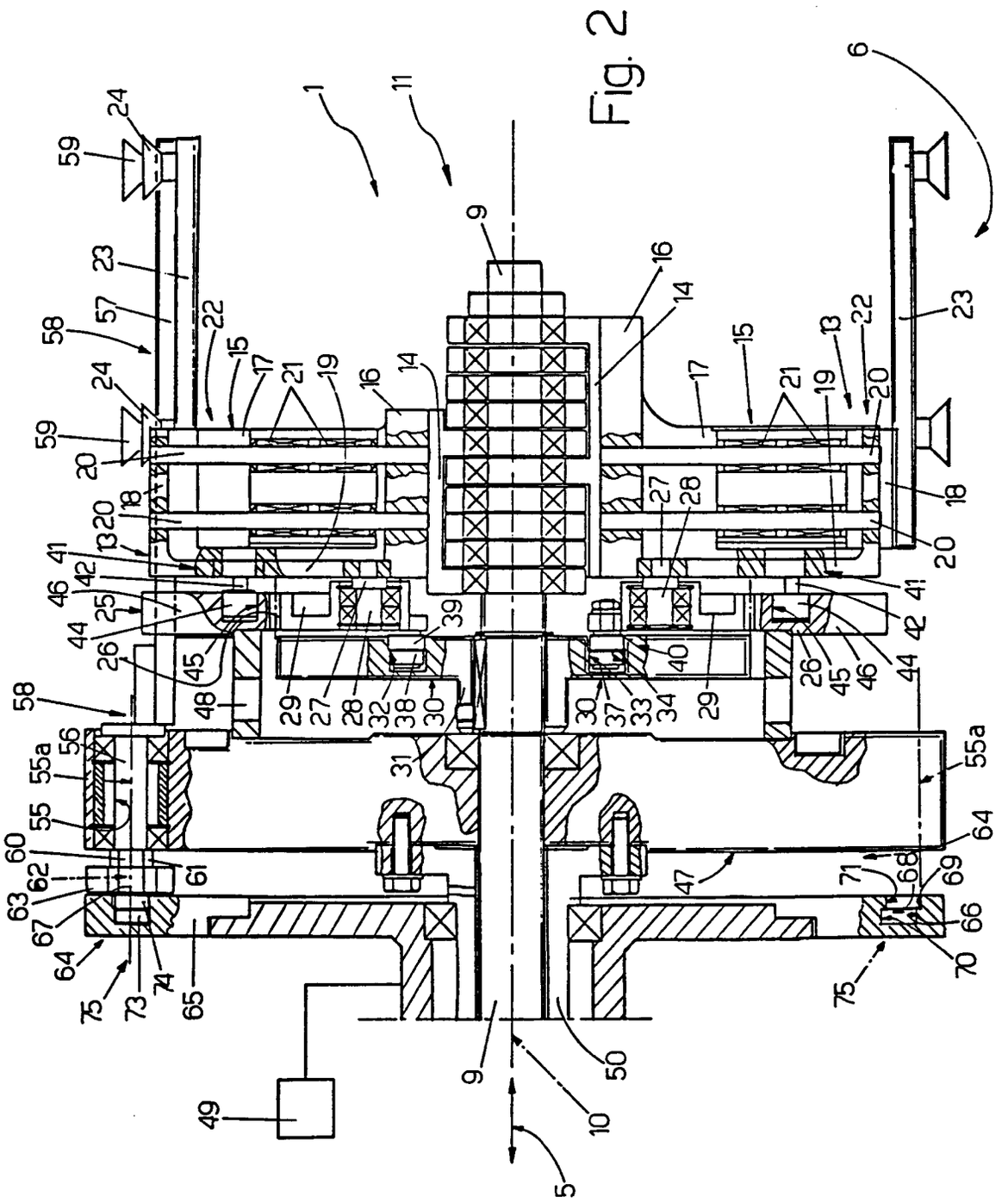

Fig. 2

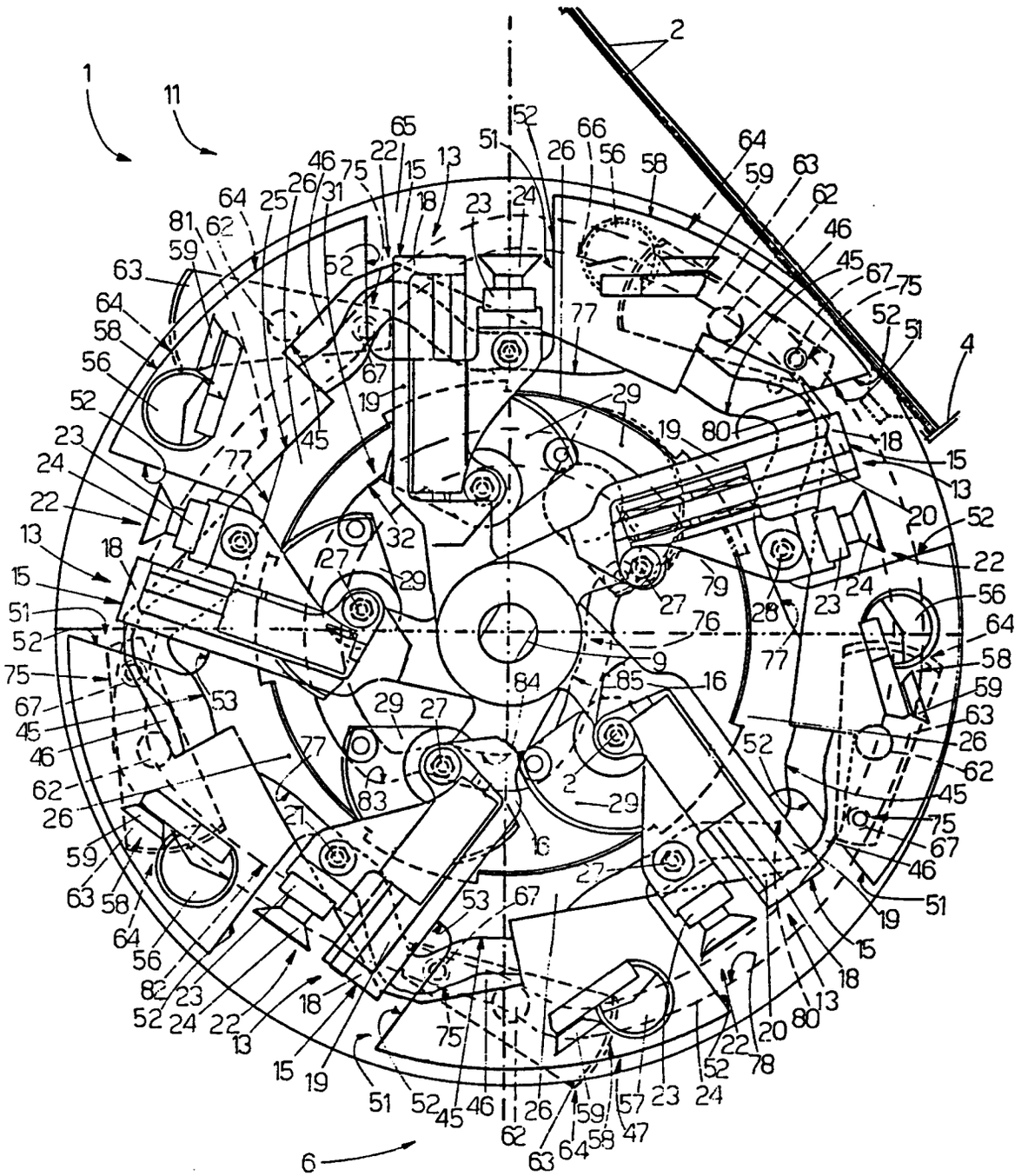

Fig. 3

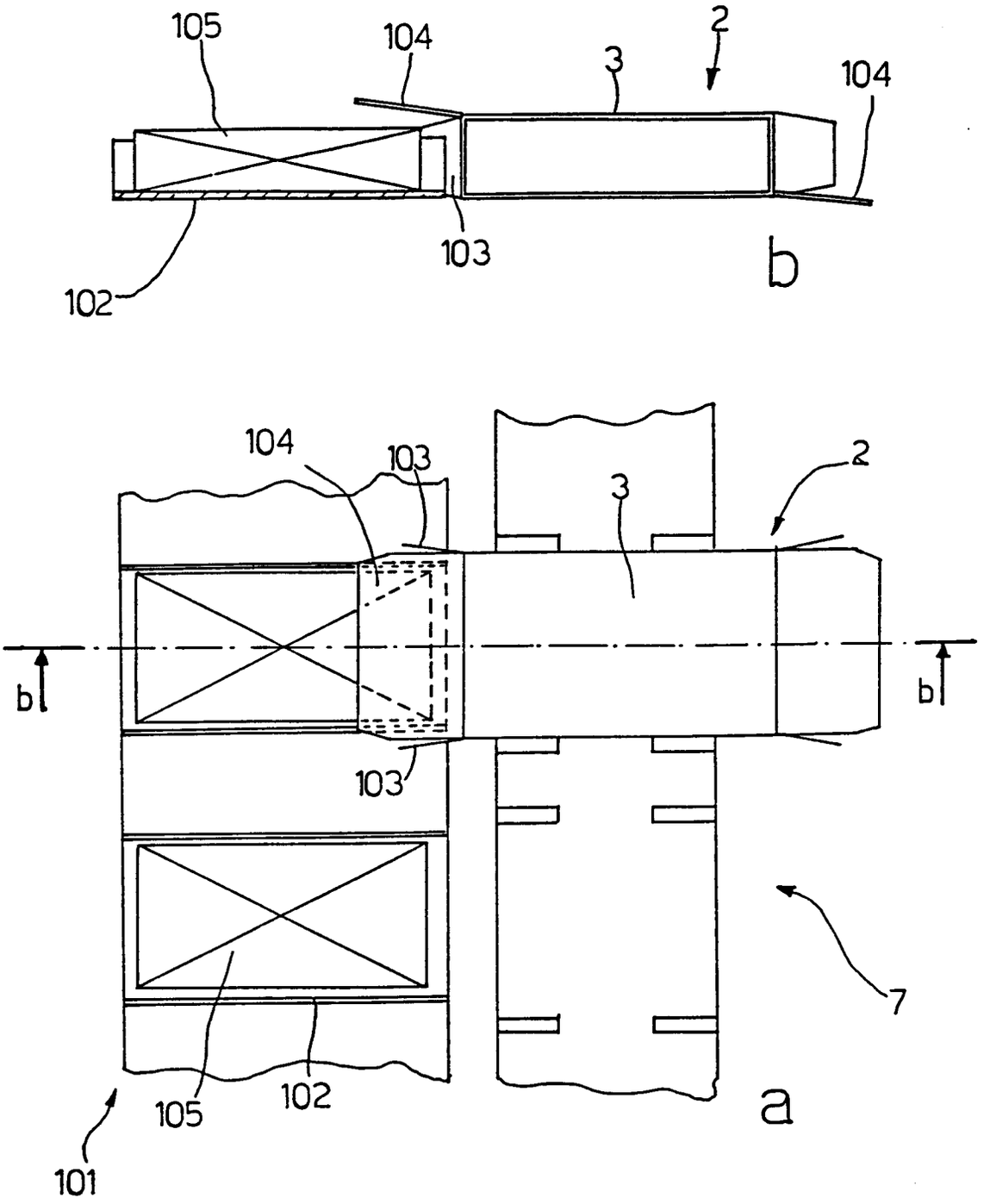

Fig. 4

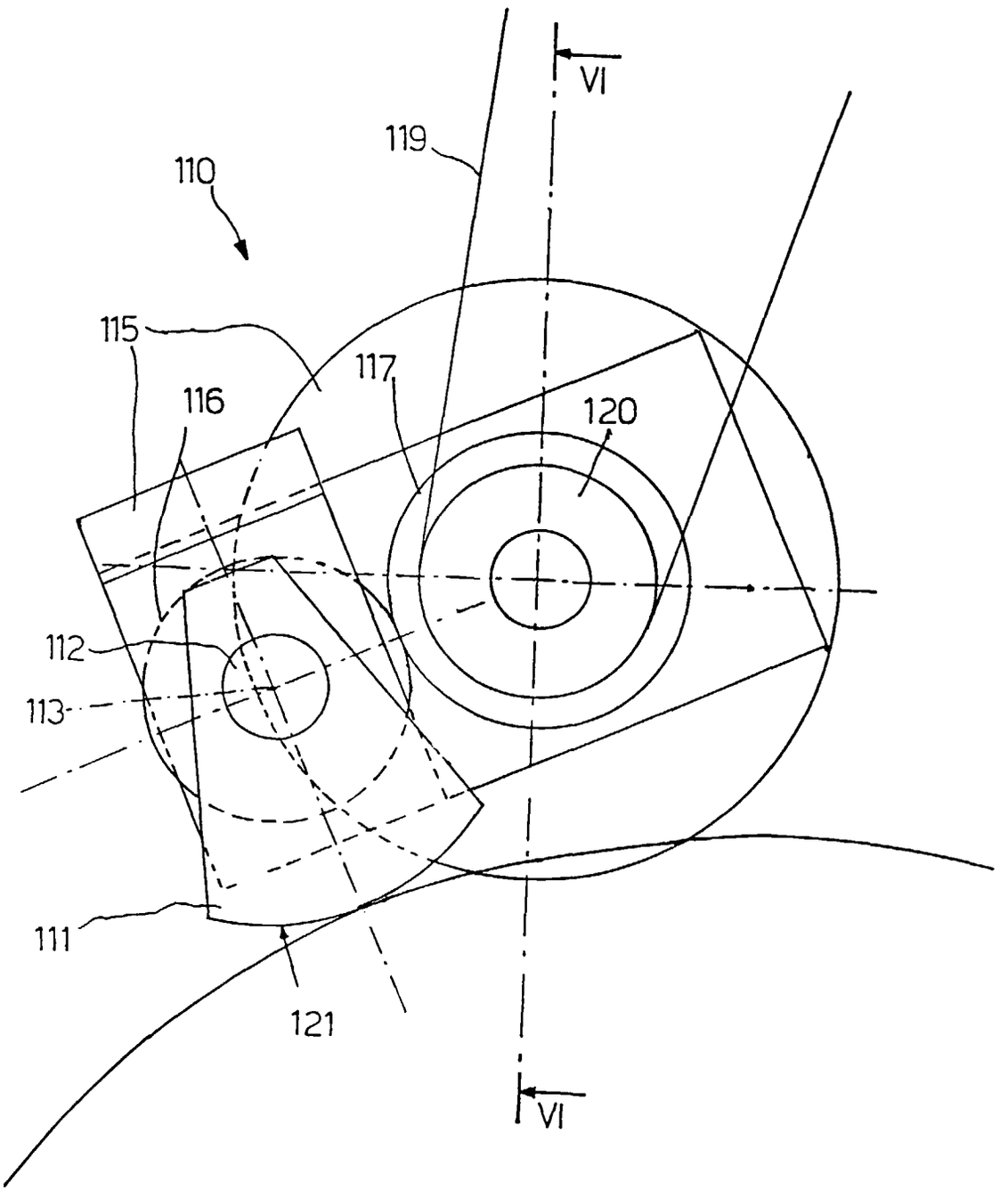

Fig. 5

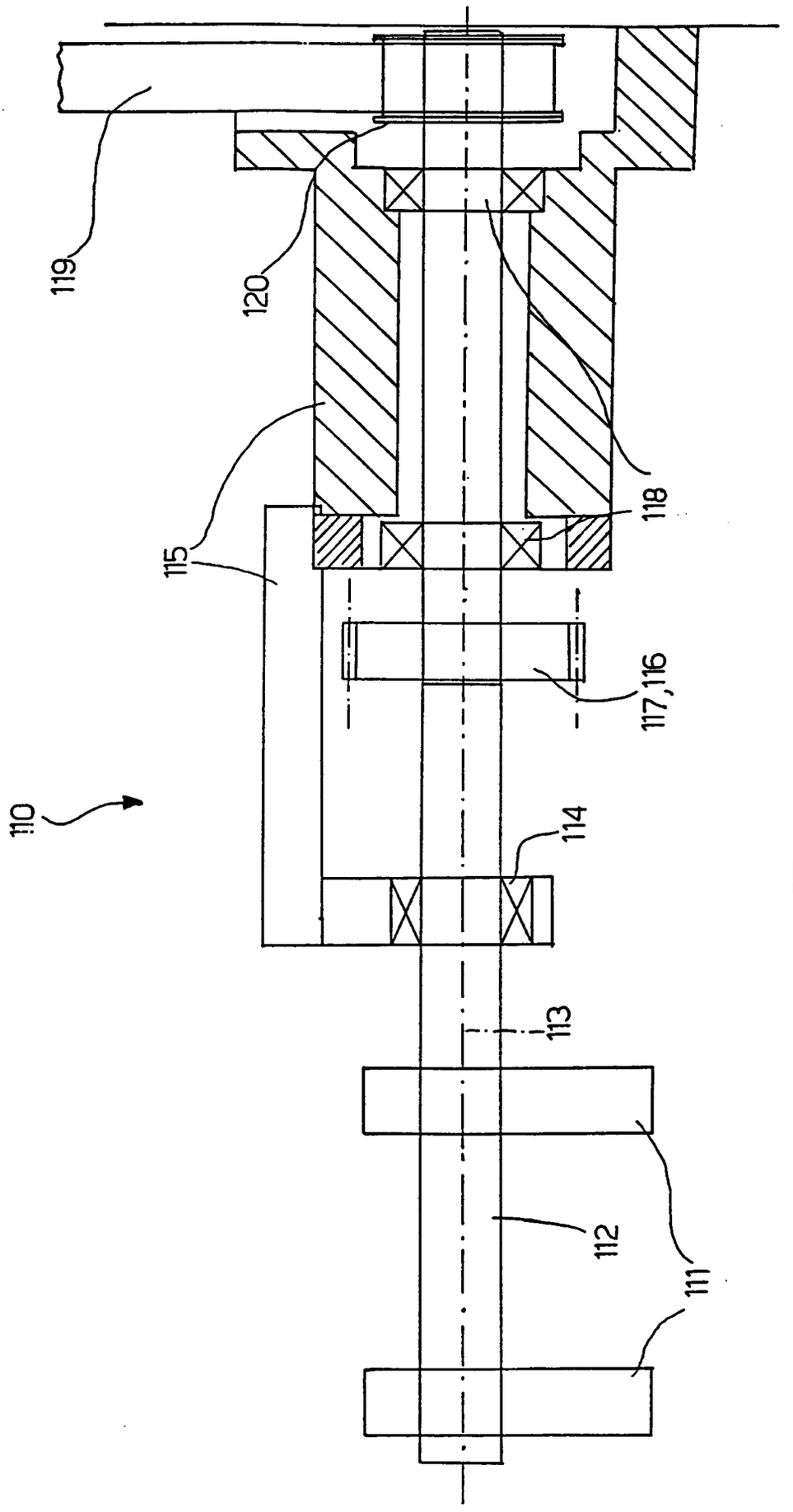

Fig. 6

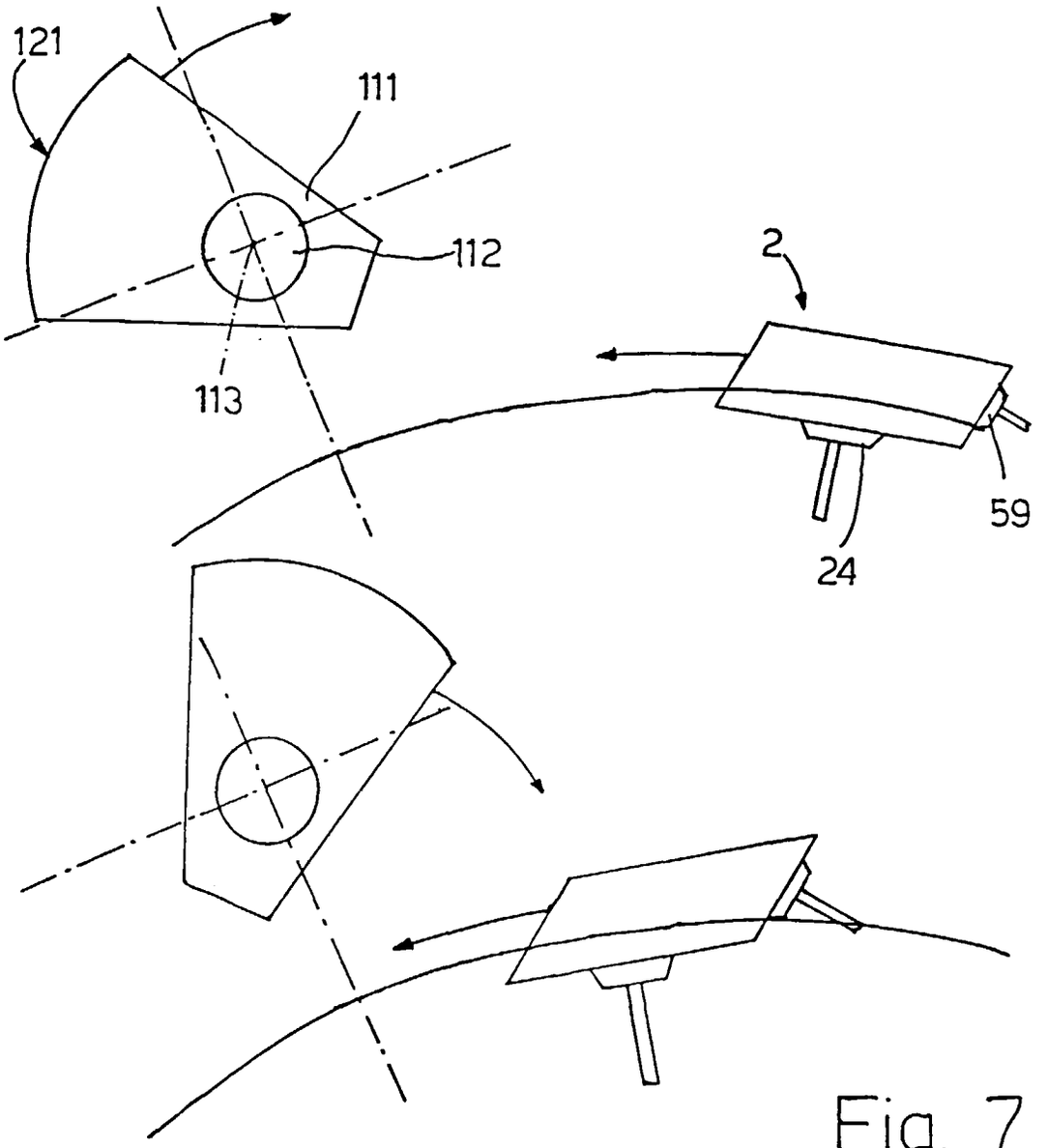

Fig. 7