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(54) DEVICE AND METHOD FOR THE EXCHANGE OF BOBBINS AND TUBES IN A SPINNING LINE

(57) A tubes (12,14) / bobbins (10) exchange device (50) for a spinning line comprises a peg carrier group (100) rotatable and vertically movable, carrying radially movable carriages (64), each carrying pegs (84a, 84b) for supporting the bobbins (10) or the tubes (12,14). The motion of the peg carrier group and of the carriages occurs by means of electric motors (54, 55, 90).

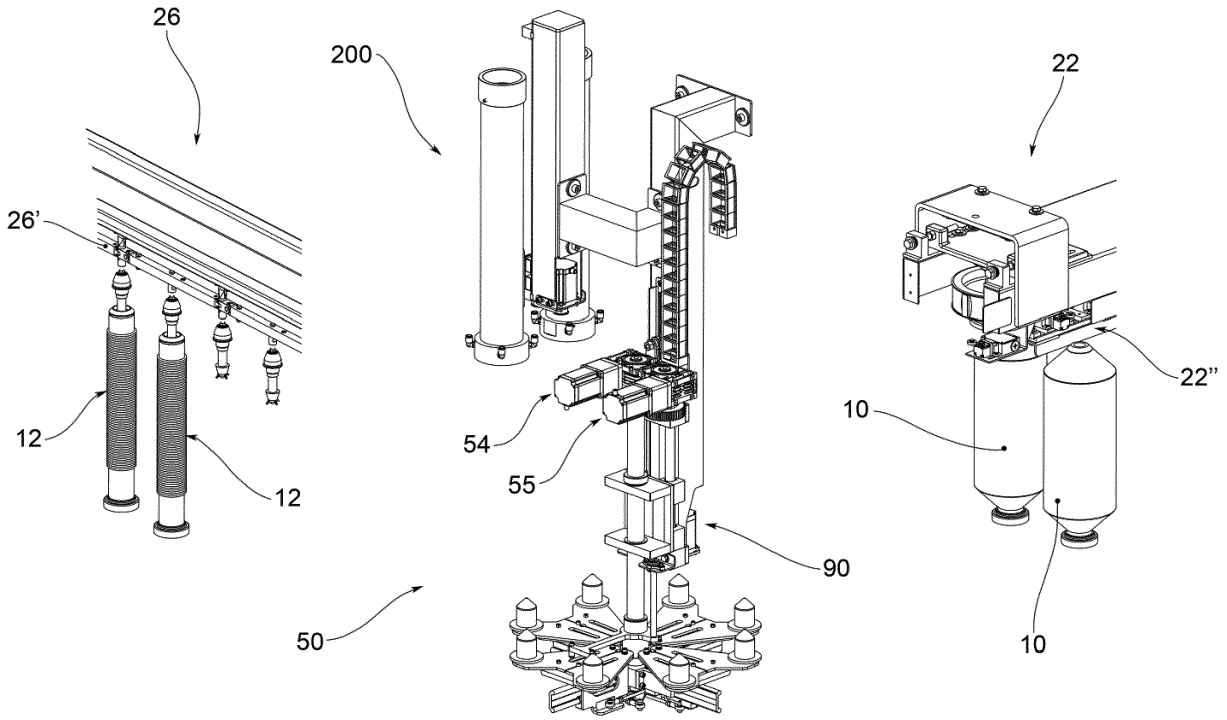

FIG.3

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Description

[0001] It is the object of the present invention a device for the exchange of bobbins and tubes of a spinning line and an exchange method.

[0002] As is known, the bobbins formed at the spindle frame, consisting of a tube on which the roving stretched at the roving frame is wound, are transported to the spinning frame. At the spinning frame, hanging from a loom, the bobbins being worked are located, from which the rovings to be worked start. When the bobbins being worked are exhausted, they are replaced by the bobbins originating from the spindle frame.

[0003] The exhausted bobbins consist of the tube completely devoid of roving (defined as "empty tube") or of the tube provided with some windings of roving residues (defined as "dirty tube").

[0004] The dirty tubes (and sometimes also the empty ones) are cleaned in a special device, usually referred to as "cleaner", which eliminates the residual roving, obtaining empty tubes.

[0005] The empty tubes originating from the cleaner and those removed from the spinning frame are brought back to the roving frame and replaced here with the bobbins which have been formed in the meantime; the empty tubes may thus be reused for the formation of new bobbins.

[0006] Such stages were conventionally completed manually or by means of entirely or partially automatic mechanised systems.

[0007] Recently, the Applicant has devised an integrated device which locally carries out the removal of the empty or dirty tubes and of the bobbins, the cleaning of the dirty tubes and the exchange of the bobbins with the empty tubes. Such integrated device and the related working method are illustrated in International Application WO 2016/083944.

[0008] Despite the high degree of automation such integrated device allows to obtain, the tendency is to further speed up the performance of such operations, above all because of the tendency of the spindle frames and of the spinning frames to provide for an ever increasing number of spindles.

[0009] To this end, the Applicant has devised a further apparatus, object of the Italian patent application for the invention No. 10 2017 000 037 751, capable of reducing the overall execution times of the removal, exchange and release stages, and possibly of the cleaning one.

[0010] It is the object of the present invention to further reduce the overall execution times of the removal, exchange and release stages, and possibly of the cleaning one, eliminating downtime.

[0011] Such object is achieved by an exchange device according to claim 1 and by a working method according to claim 16.

[0012] The features and advantages of the exchange device and of the working method will be apparent from the following description, given by way of explanation and not by way of limitation, in accordance with the following Figures, in which:

- Figure 1 shows a portion of a spinning line provided with a spindle frame, with a plurality of spinning frames, with a transport system and with an exchange device according to an embodiment of the present invention;
- Figure 2 shows a diagram of the spindle frame of Figure 1;
- Figure 3 shows the exchange device of Figure 1, in conjunction with the transport devices of the spinning frame and of the spindle frame, according to an embodiment of the present invention;
- Figure 4 shows a longitudinal sectional view of the exchange device of Figure 1;
- Figures 5a and 5b show a drive group of the exchange device of Figure 1;
- Figure 5c shows the exchange device of Figure 1;
- Figure 6 shows a plan view from below of the exchange device of Figure 5;
- Figure 7 shows an enlargement of the exchange device of Figure 5;
- Figure 8 shows a further sectional view of the exchange device of Figure 5;

Figures 9 and 10 show the exchange device of Figure 5, in a raised configuration and in a lowered configuration, respectively;

- Figures 11a to 11e diagrammatically show the working stages of an exchange device;
- Figures 12 to 14 show a further embodiment of the invention.

[0013] With reference to the accompanying Figures, reference numeral 1 overall indicates a portion of a spinning line comprising a can region 2 in which a plurality of cans 4, each containing a roll of roving, a spindle frame 6, adjacent to the can region 2 to be fed thereby with the roving, and a plurality of spinning frames 8, for example, arranged parallel to one another, are housed.

[0014] The spindle frame 6 stretches the roving originating from the cans 4 and winds it on empty tubes, forming bobbins 10 to be transported to the spinning frame. To this end, the bobbins 10 are made available to a cart 20 of the spindle frame 6.

[0015] A transport system comprises a roving frame side transport device 22, usually referred to as the "plank", suitable to remove the bobbins 10 from the cart 20 and to move them in suspension, at a predetermined height, generally by means of a main belt 22'. The roving frame side transport device 22 is also suitable to load the cart 20 with empty tubes 14.

[0016] For example, according to a preferred embodiment, the spindle frame 6, which extends along a spindle frame axis along which working points are distributed in sequence, provides for a pair of flaps 6a for each working point.

[0017] Each flap 6a rotates around a vertical axis, to

guide the roving being wound around an empty tube 14, thus forming the spool 10.

[0018] The empty tube 14 is inserted in a removable manner on a spindle 6b integral with the spindle motion cart 20.

[0019] In a working position (Figure 2), the cart 20 is arranged at a height suitable to allow the winding of the roving to the tube, so as to realise the bobbin 10.

[0020] In other words, in said working position, the axes of the spindles carried by the cart 20 are substantially coincident with the axes of the flaps.

[0021] Once obtained the bobbins, for example, of the desired weight, the cart 20 is lowered from the raised working position to a retracted lowered position in which it acts in conjunction with cart motion means for the horizontal translation of the cart towards the advanced raising position, below the plank.

[0022] Said horizontal motion means comprise a slide 6c which acts in conjunction with motor means for the horizontal translation of the cart.

[0023] Following the horizontal translation of the cart 20 carried by the slide 6c, the cart 20 moves into the advanced raising position suitable to allow the cooperation of said cart 20 with the bobbin carrier plank 22 to raise the bobbins from the cart and/or deposit them on said spindles 6b of new empty tubes 14 for the formation of new bobbins.

[0024] The plank 22 is supported by a sustaining and guiding structure 6d, comprising a vertically movable crosspiece 6e.

[0025] The plank 22 is thus vertically movable between a raised position, in which the motion of the bobbins towards the next working stage occurs, and a lowered position suitable to remove the bobbins from the cart in the raising position.

[0026] To this end, the spindle frame 6 comprises support and motion means suitable to sustain said plank and to allow the vertical movement thereof.

[0027] For example, said support and motion means comprise a band 6f, preferably flat, connected, at one end, to the crosspiece 6e and wound, at the opposite end, to a plank motion shaft 6g connected to a motor.

[0028] The transport system further comprises a spinning frame side transport device 26 suitable to move the bobbins 10 towards the spinning frames 8 and the dirty tubes 12 (or sometimes the empty 14 ones) towards the spindle frame 6.

[0029] For example, the spinning frame side transport device 26 is shaped as a closed ring and comprises a track 26' having sections 8' which run parallel to the spinning frames 8, seamlessly.

[0030] Furthermore, the transport system comprises means of operation, comprising for example a PLC or a microprocessor, suitable to control the advancement of the bobbins along the plank and the advancement of empty 14 or dirty tubes 12 along the track 26'.

[0031] Furthermore, the spinning line 1 comprises an exchange device 50 suitable to act in conjunction with the roving frame side transport device 22, serving the spindle frame 6, and with the spinning frame side transport device 26, serving the spinning frames 8, to locally carry out, i.e., in a predetermined zone of the transport system, the removal of the dirty tubes 12 from the spinning frame side transport device 26 and of the bobbins 10 from the roving frame side transport device 22, possibly, the cleaning of the dirty tubes 12 to obtain empty tubes 14, the exchange of the bobbins 10 with the empty tubes 14 and the release of the bobbins 10 to the spinning frame side transport device 26 and of the empty tubes 14 to the roving frame side transport device 22.

[0032] As shown in Figure 3, the exchange device 50 acts in conjunction with an end section 26" of the track 26' of the spinning frame side transport device 26 serving the spinning frames 8 and with an end section 22'' of the transport belt 22' of the roving frame side transport device 22 serving the spindle frame 6.

[0033] For example, the end section 22" of the belt 22' extends along a direction perpendicular to the end section 26" of the track 26'.

[0034] According to a preferred embodiment (Figures 4 to 10), the exchange device 50 comprises a peg carrier group 100 comprising an opening drive shaft 52 having an extension along a substantially vertical axis of rotation Z, and a first electric motor 54, preferably arranged at the upper end of the opening drive shaft 52, kinematically connected thereto to drive it in rotation.

[0035] Furthermore, the peg carrier group 100 comprises a rotary drive shaft 56, supported by an abutment 58 which is fixed and rotatable by actuating a second electric motor 55 of the peg carrier group 100.

[0036] Preferably, the rotary drive shaft 56 is hollow and coaxial with the opening drive shaft 52, which is housed therein, guided in rotation by one or more bearings.

[0037] According to an embodiment, a drive group 300 comprises a motor carrier plate 302, the first electric motor 54 and the second electric motor 55.

[0038] The motor carrier plate 302 is vertically sliding and supports the first electric motor 54 and the second electric motor 55, arranged side-by-side.

[0039] Furthermore, preferably, the drive group 300 comprises a first adaptor 304 connected to the first electric motor 54, for example, of the type with orthogonal input/output axes, placed in axis with the opening drive shaft 52 and connected thereto.

[0040] Furthermore, preferably, the drive group 300 comprises a second adaptor 306, connected to the second electric motor 55, for example, of the type with orthogonal input/output axes, arranged side-by-side to the first adaptor 304, connected to the rotary drive shaft 56 by means of gears 308, 310.

[0041] Furthermore, the drive group 300 comprises anti-rotation means suitable to prevent the rotation of the motor carrier plate 302 and to allow, at the same time, the vertical translation of said motor carrier plate 302.

[0042] For example, said anti-rotation means comprise

a slide 312 fastened to a fixed abutment, for example a column 314 of the exchange device 50, and a pin 316 fastened to a portion 318 of the motor carrier plate 302, slidable on the slide 312.

[0043] Preferably, the pin 316 is provided with a roller at the end, to facilitate the sliding on the slide 312.

[0044] The peg carrier group 100 further comprises a plurality of rectilinear radial guides 60, arranged near the lower end of the rotary drive shaft 56, supported thereby; said radial guides 60 radially extend from the rotary drive shaft 56 outwards, each along a respective radial direction R*, and are preferably angularly arranged equally spaced.

[0045] For the sake of clarity, hereinafter reference will be made to an embodiment which provides for 4 equally spaced radial guides.

[0046] Preferably, each radial guide 60 is supported by an end portion of the rotary drive shaft 56 and, by means of a bearing 62, by an end portion of the opening drive shaft 52; during the rotation of the opening drive shaft 52, said guides do not, therefore, undergo any displacement, while they rotate around the axis of rotation Z by actuating, in rotation, the rotary drive shaft 56.

[0047] The peg carrier group 100 further comprises, for each radial guide 60, a carriage 64 slidable on the respective radial guide 60, and a return rod 66, hinged at one end distal to the respective carriage 64.

[0048] Furthermore, the peg carrier group 100 comprises a rotary drive member 68, for example, in the form of a star, coaxially and integrally fastened to the opening drive shaft 52, preferably at the lower end thereof.

[0049] Each return rod 66 is hinged, at the respective proximal end, to the rotary drive member 68, at a point off-center with respect to the axis of rotation Z, for example at the points of the star rotary drive member.

[0050] Preferably, some return rods are hinged to the rotary drive member at the upper face thereof, others are hinged at the lower face, to avoid structural interference. For example, in the case of four return rods, two of these, relative to two carriages diametrically opposite each other, are hinged at the upper face of the rotary drive member, while the other two, relative to the other two carriages diametrically opposite each other, are hinged at the lower face of the rotary drive member.

[0051] On each carriage 64, the peg carrier group 100 provides for two peg carrier plates 70a, 70b, side-by-side circumferentially and opposite each other, hinged so as to be spreadable. For example, said peg carrier plates 70a, 70b are hinged near the axis of rotation Z, for example, at two hinge points 72a, 72b, and are kept close together by the action of elastic means, for example, a spring 74.

[0052] Each plate 70a, 70b carries a respective peg 84a, 84b, suitable for the insertion of a tube 14.

[0053] According to a preferred embodiment, the carriage 64 provides for two arched slots 76a, 76b, and each peg carrier plate 70a, 70b provides for a pin 78a, 78b which passes through the base of the carriage 64; the spring 74 operates on the two pins 78a, 78b, so as to continuously operate in reciprocal approach.

[0054] Therefore, the rotation of the opening drive shaft 52 produces the rotation of the rotary drive member 68 and the translation or roto-translation of the return rods 66, which actuate in motion, along the respective radial guide 60, the respective carriage 64, carrying pegs 84a, 84b, for example a pair.

[0055] The rotation in one direction, for example clockwise, of the opening drive shaft 52 produces the exit of the carriages 64 (and of the pegs 84a, 84b) outwards, along the radial direction R*, i.e., a centrifugal motion, while the rotation in the opposite direction, for example counterclockwise, produces the return of the carriages 64 (and of the pegs 84a, 84b) towards the axis of rotation Z, i.e., a centripetal motion.

[0056] In other words, the peg carrier group 100 is provided with radial motion means suitable to radially move pegs 84a, 84b.

[0057] According to the embodiment described above, said radial motion means comprise the first electric motor 54, the opening drive shaft 52, the radial guides 60, the carriages 64 and the peg carrier plates 70a, 70b.

[0058] The second electric motor 55 and the rotary drive shaft 56, on the other hand, constitute an embodiment of rotary motion means suitable to move the radial guides 64 in rotation around the axis of rotation Z, so as to provide the pairs of pegs 84a, 84b with subsequent angular positions.

[0059] The radial motion means are synchronised, for example, electronically, with the rotary motion means.

[0060] To this end, the exchange device 50 comprises synchronization means suitable to synchronise the rotation of the opening drive shaft 52 and the rotation of the rotary drive shaft 56, so that a predetermined rotation of the rotary drive shaft 56 corresponds to an adequate counter-rotation of the opening drive shaft 52, so that the pegs 84a, 84b remain in the same radial position.

[0061] For example, said synchronization means are electronic and provide for the synchronization between the actuation of the second electric motor 55, which drives in rotation the rotary drive shaft 56, and the actuation of the first electric motor 54, which drives in rotation the opening drive shaft 52.

[0062] Furthermore, the exchange device 50 provides for spreading means operating in a predetermined angular position, preferably corresponding to the angular position in which said exchange device 50 acts in conjunction with the spinning frame side transport system 26, and, for this reason, referred to as spinning frame side angular position, suitable to operate on the pair of peg carrier plates 70a, 70b arranged in said spinning frame side angular position, to spread them circumferentially during the motion along the radial direction R*.

[0063] For example, each peg carrier plate 70a, 70b provides for a preferably through slit 80a, 80b; said slits 80a, 80b extend radially along respective spreading axis D1, D2, diverging outwards.

[0064] Preferably, the spreading means comprise a pair of spreading pins 82a, 82b supported by a flange 84 mounted coaxially with the rotary drive shaft 56.

[0065] The spreading pins 82a, 82b are positioned so as to be engageable with the respective slit 80a, 80b.

[0066] When the carriage 64 is in the retracted position, the peg carrier plates 70a, 70b are brought closer by virtue of the action of the elastic means, and the spreading pins 82a, 82b are located in the respective slits 80a, 80b, at the external radial end thereof.

[0067] When the carriage 64 is pushed towards the advanced position, the peg carrier plates 70a, 70b spread apart, since the spreading pins 82a, 82b, engaged in the respective slits 80a, 80b having a divergent course, guide said peg carrier plates 70a, 70b in reciprocal circumferential distancing, overcoming the resistance of the elastic means.

[0068] When the carriage 64 is in the advanced limit position, the peg carrier plates 70a, 70b are in the spreading limit position, which corresponds to a predetermined limit distance between the pegs 84a, 84b carried by said peg carrier plates 70a, 70b; by modifying the shape and/or the size of the components of the spreading means and/or of the slits, it is possible to record the limit distance between the pegs 84a, 84b.

[0069] Advantageously, this allows to overcome any differences between the distance between the tubes carried by the spinning frame side transport device and the distance between the bobbins carried by the roving frame side transport device or to overcome any differences between the distance between the tubes carried by the spinning frame side transport device for different spinning frame models or to overcome any differences between the distance between the bobbins carried by the roving frame side transport device for different spindle frame models.

[0070] The exchange device 50 further comprises vertical motion means suitable to put the peg carrier group 100 in motion, along a vertical direction, parallel to the axis of rotation Z.

[0071] Said vertical motion means are preferably electric and comprise, for example, a third electric motor 90, for example a stepper motor, fastened to a fixed abutment.

[0072] Furthermore, said vertical motion means comprise a kinematic chain which kinematically engages the third electric motor 90 with the peg carrier group 100, to put it in vertical motion in accordance with the rotation imparted by said third electric motor 90.

[0073] For example, the kinematic chain engages the rotary drive shaft 56 and comprises, for example:

- a strap 92 connected to the driving axis of the third electric motor 90;
- a worm screw 94 engaged with the strap 92, arranged parallel to the axis of rotation Z, at a predetermined distance therefrom, and operatively supported by a fixed frame 93; and
- a nut 96 which engages the worm screw and is fixed to the rotary drive shaft 56.

[0074] The actuation of the vertical motion means produces the raising or the lowering of the entire peg carrier group 100, also comprising the drive group 300, and therefore the first electric motor 54 and the second electric motor 55.

[0075] In particular, the peg carrier group 100 is movable between a lower limit position and an upper limit position.

[0076] When the peg carrier group 100 is in the lower limit position, the spreading means are disengaged from the peg carrier plates 70a, 70b, so that the actuation of the radial motion means causes the radial advancement of the peg carrier plates 70a, 70b, without these being spread apart, not even those arranged in the spinning frame side angular position.

[0077] Passing from the lower limit position to the upper limit position, the peg carrier group 100 passes through an intermediate vertical position in which the spreading means engage the peg carrier plates 70a, 70b, so that the actuation of the radial motion means in one direction corresponds to an advancement of the peg carrier plates 10a, 70b and, for the peg carrier plates 70a, 70b located in the spinning frame side angular position, also a spreading, i.e., a reciprocal circumferential distancing.

[0078] In other words, the spreading means are synchronised with the vertical motion means, so as to engage the peg carrier plates 70a, 70b at a predetermined intermediate vertical position, when it is moving from the lower limit position to the upper limit position, possibly in said upper limit position.

[0079] Passing from the upper limit position to the lower limit position, the peg carrier group 100 passes through the intermediate vertical position in which the spreading means disengage the peg carrier plates 70a, 70b.

[0080] To this end, according to a preferred embodiment, the flange 84 which carries the spreading pins 82a, 82b is supported by a collar 102, mounted coaxially to the rotary drive shaft 56 and slidable thereon.

[0081] When the peg carrier group 100 moves towards the upper limit position, it moves the flange 84 upwards and therefore the collar 102 slides upwards; when the peg carrier group 100 moves towards the lower limit position, the collar 102 slides downwards, for example, by virtue of the action of the force of gravity (or, according to an alternative embodiment, by virtue of the action of elastic return means), up to the intermediate vertical position, in which said collar is locked by a locking system 110.

[0082] For example, preferably, said locking system 110 comprises a small rod 112 vertically fastened to the flange 84, and a locking plate 114 fastened to the fixed frame 93, slidably crossed by the small rod 112.

[0083] The small rod 112 provides, at the upper free end, for a bush which abuts against the locking plate 114

when the flange is in the intermediate vertical position, thus preventing the flange 84 from going below said intermediate vertical position.

[0084] Furthermore, said locking system 110 also performs the function of locking the rotation of the flange 84, necessary to counteract the action exerted by the peg carrier plates 70a, 70b during the radial advancement. In other words, said locking system is an example of rotation locking means of said spreading means.

[0085] During the normal operation of the spinning line comprising the aforesaid exchange device (Figures 11a to 11e), the roving frame side transport device 22 carries two bobbins 10, hanged by means of a respective hooking/releasing device, generally referred to as the "pendulum"; the two bobbins 10 stop in a bobbin removal position such that the respective axes define an imaginary bobbin exchange plane Pb, substantially perpendicular to the advancement direction of the bobbins along the roving frame side transport device 22.

[0086] For the exchange device 50, the angular position facing the bobbin exchange plane Pb, in which said exchange device 50 acts in conjunction with the roving frame side transport device 22, is defined roving frame side angular position.

[0087] Furthermore, the spinning frame side transport device 26 carries two dirty 12 or empty tubes 14, hanged by means of respective hooking/releasing devices; the tubes 12, 14 stop in a tube removal position in which they are aligned on an imaginary tube transport plane Pt, on which the advancement direction of the tubes along the spinning frame side transport device 26 also lies.

[0088] For the exchange device 50, the angular position facing the tube transport plane Pt, in which said exchange device 50 acts in conjunction with the spinning frame side transport device 26, is the spinning frame side angular position mentioned above.

[0089] Starting from the lower limit position, the peg carrier group 100 moves vertically upwards by actuating the vertical motion means and engages the spreading means in the intermediate vertical position.

[0090] By actuating the radial motion means, the pegs 84a, 84b radially move outwards up to an advanced radial limit position; the pegs 84a, 84b placed in the spinning frame side angular position, in addition to moving externally radially, spread apart.

[0091] The pegs 84a, 84b arranged in the roving frame side angular position, when reaching the advanced radial limit position, have not undergone any spreading and are vertically aligned to the bobbins 10 to be removed, i.e., aligned on the bobbin exchange plane Pb, while the pegs 84a , 84b arranged in the spinning frame side angular position, when reaching the respective advanced radial limit position, are spread apart and vertically aligned to the dirty 12 or empty tubes 14 to be removed, i.e., aligned on the tube transport plane Pt (Figure 11a).

[0092] By further actuating the vertical motion means, the pegs 84a, 84b in the spinning frame side angular position engage the dirty 12 or empty tubes 14, and the pegs 84a, 84b in the roving frame side angular position engage the bobbins 10, and by raising a little beyond an engagement height, they release said bobbins 10 and said tubes 12, 14 from the respective hooking/releasing devices.

[0093] Subsequently, by actuating the vertical motion means, the peg carrier group 100 returns to the lower limit position, bringing the bobbins 10 and the tubes 12, 14 therewith.

[0094] Subsequently, preferably, by actuating the radial motion means, the pegs 84a, 84b return to the retracted radial limit position (Figure 11b).

[0095] Subsequently, by actuating the rotary motion means, the radial guides 60 undergo a rotation, for example, in the clockwise direction, so that the tubes 12, 14 are brought in an intermediate spinning frame/roving frame angular position between the spinning frame side angular position and the roving frame side angular position, for example, rotated by 90° with respect to said spinning frame side angular position (Figure 11c).

[0096] Preferably, the exchange device 50 comprises a cleaning device 200 suitable to operate on the tubes 12, 14 arranged in said intermediate angular position, on a plurality of tubes simultaneously, for example on two.

[0097] In said intermediate angular position, the tubes 12, 14 undergo a cleaning operation.

[0098] At the same time, the bobbins 10 are brought in an intermediate roving frame/spinning frame angular position between the roving frame side angular position and the spinning frame side angular position, for example, rotated by 90° with respect to said roving frame side angular position.

[0099] At the same time, the roving frame side transport device 22 advances by a first stroke C1. Said first stroke C1 is such that two hooking/releasing devices are positioned on the bobbin exchange plane Pb.

[0100] Subsequently, by further actuating the rotary motion means, the tubes (possibly cleaned) pass from the spinning frame/roving frame angular position to the roving frame side angular position and the bobbins pass from the roving frame/spinning frame angular position to the spinning frame side angular position (Figure 11d).

[0101] The actuation of the radial motion means and of the vertical motion means brings the bobbins placed in the spinning frame side angular position to be hanged to the spinning frame side transport device 26, with a spreading due to the action of the spreading means, and the tubes placed in the roving frame side angular position to be hanged to the roving frame side transport device 22.

[0102] At the same time, the cleaning operation is possibly started for other two tubes, which, in the meantime, have reached the spinning frame/roving frame angular position.

[0103] The roving frame side transport device 22 advances the bobbins carried by the plank 22 by a second stroke C2, so that two further bobbins 10, between which an empty hooking/releasing device is conventionally arranged, are arranged on the bobbin exchange plane Pb.

[0104] Conventionally, the second stroke C2 is greater than the first stroke C1, since the first stroke C1 allows the alignment of two hooking/releasing devices on the bobbin exchange plane Pb, one of which is close to the desired position, while the second stroke C2 allows the positioning of two following bobbins on the bobbin exchange plane Pb.

[0105] Furthermore, the spinning frame side transport device 26 advances by a third stroke C3, so that two other dirty tubes 12 are ready for the spinning frame side removal (Figure 11e).

[0106] In other words, said means of operation comprise plank motion means suitable to advance the plank by a predetermined stroke, which varies according to the operating stage of the exchange device 50.

[0107] In particular, said plank motion means are suitable to make the plank 22 advance by a first stroke C1 to align two hooking/releasing devices on the bobbin exchange plane Pb, and to make the plank 22 advance by a second stroke C2 to align two bobbins 10 on the bobbin exchange plane Pb.

[0108] The further motion of the vertical motion means allows to load the other two tubes 12, 14 on the pegs placed in the spinning frame side angular position and the other two bobbins on the pegs placed in the roving frame side angular position.

[0109] According to an alternative embodiment of the invention, the exchange device 50 comprises a cleaning device 200 suitable to operate on at least one dirty tube 12 to eliminate the roving residues.

[0110] Preferably, said cleaning device 200 is suitable to operate on several dirty tubes (12) simultaneously, for example in a number of two.

[0111] Preferably, said cleaning device 200 is configured to operate on said dirty tubes 14 when arranged in an intermediate angular position, between a first angular position of cooperation with the spinning frame side transport device and a second angular position of cooperation with the roving frame side transport device.

[0112] Preferably, said cleaning device operates said cleaning pneumatically, i.e., carrying out an air blowing or suction, so as to separate the roving residues from the tube.

[0113] The cleaning device 200 is described, according to an embodiment, in International Application WO 2016/083944 and in the Italian patent application for the invention No. 10 2017 000 037 751, both in the name of the Applicant, of which the teachings in relation to such cleaning device is incorporated herein as a reference.

[0114] Figures 12 to 14 show a further embodiment of the invention; in such Figures, the same reference numerals are used to identify the same components.

[0115] According to such embodiment, the anti-rotation means of the motor carrier group 300, suitable to prevent the rotation of the motor carrier plate 302 and to allow, at the same time, the vertical translation of said motor carrier plate 302, comprise a window 312', having a vertical extension, made in the column 314 of the exchange device 50, and a tab 316' of the motor carrier plate 302, slidable in the window 312'.

[0116] Preferably, the tab 316' is provided, at the end thereof, with a roller 316", to facilitate the sliding in the window 312'.

[0117] Furthermore, preferably, according to such embodiment, the kinematic chain of the vertical motion means comprises at least one belt 92', preferably a pair of belts 92', being wound by the third electric motor 90 and fastened to the peg carrier group 100, for example fastened to the motor carrier group 300, preferably to the motor carrier plate 302.

[0118] The actuation of the third electric motor 90 leads to the winding of the belts 92' and to the raising of the peg carrier group 100, while the release of the motor 90 leads to the lowering of the peg carrier group 100 by gravity.

[0119] Innovatively, the integrated device described above satisfies the needs referred to in relation to the background art, since it allows to reduce the overall times necessary for the exchange of the bobbins with the tubes, and possibly for the cleaning of the dirty tubes.

[0120] In particular, advantageously, the use of electric motors for the radial motion means and the rotary motion means, allows the peg carrier group to be always rotated in the same direction, to the advantage of the operation of the exchange device.

[0121] It is clear that a skilled in the art, in order to satisfy contingent needs, may make changes to the integrated device and to the working method described above, all included within the scope of protection as defined by the following claims.

Claims

1. An exchange device (50) for a spinning line suitable to act in conjunction with a spinning frame side transport device (26) carrying empty (14) or dirty tubes (12) and a roving frame side transport device (22) or plank, carrying bobbins (10), comprising

   - a peg carrier group (100) comprising:

     i) a rotary drive shaft (56) rotatable around an axis of rotation (Z);
     (ii) a plurality of carriages (64) supported by said rotary drive shaft (56), each carriage (64) being slidable along a respective radial direction (R*) and carrying at least one peg (84a,84b) for supporting the bobbins (10) or tubes (12,14);
     iii) actuatable radial motion means for radially moving said carriages (64);
     iv) actuatable rotary motion means for rotating said rotary drive shaft (56);

   - actuatable vertical motion means for vertically

moving said peg carrier group (100) operatively connected to said rotary drive shaft;

wherein the radial motion means comprise a first electric motor (54) actuatable to radially move said carriages (64), and the rotary motion means comprise a second electric motor (55) actuatable to place said rotary drive shaft (56) in rotation around said axis of rotation (Z).

2. An exchange device according to claim 1, wherein the vertical motion means comprise a third electric motor (90) actuatable to place said peg carrier group (100) in vertical motion.

3. An exchange device according to claim 1 or 2, wherein a drive group (300) comprises a vertically sliding motor carrier plate (302) supporting the first electric motor (54) and the second electric motor (55).

4. An exchange device according to claim 3, wherein the drive group (300) comprises anti-rotation means suitable to prevent the rotation of the motor carrier plate (302) and to allow, at the same time, the vertical translation of said motor carrier plate (302).

5. An exchange device according to any one of the preceding claims, comprising synchronization means suitable to synchronise the rotation of the opening drive shaft (52) and the rotation of a rotary drive shaft (56) of the radial motion means, so that a predetermined rotation of the rotary drive shaft (56) corresponds to an adequate counter-rotation of the opening drive shaft (52), so that the peg (84a, 84b) remains in the same position.

6. An exchange device according to claim 5, wherein said synchronization means are electronic and provide for the synchronization between the actuation of the second electric motor (55) and the actuation of the first electric motor (54).

7. An exchange device according to any one of the preceding claims, wherein the peg carrier group (100) comprises:

- a plurality of radial guides (60) extending radially outwards, each along a respective radial direction (R*), supported by said rotary drive shaft (56), on which the respective carriage (64) is slidable;
- return rods (66), each hinged at one end distal to the respective carriage (64);
- a rotary drive member (68) secured coaxially and integrally to the rotary drive shaft (52);
- wherein each return rod (66) is hinged, at the respective proximal end, to the rotary drive member (68) at a point off-center with respect to the axis of rotation (Z).

8. An exchange device according to claim 7, wherein the peg carrier group (100) comprises

- on each carriage (64), two peg carrier plates (70a,70b), side-by-side circumferentially and opposite each other, hinged so as to be spreadable, wherein each plate (70a,70b) carries a respective peg (84a,84b).

9. An exchange device according to claim 8, comprising spreading means operating in a predetermined angular position, suitable to operate on the pair of peg carrier plates (70a,70b) arranged in said predetermined angular position, to spread the plates during travel along the radial direction (R*).

10. An exchange device according to any one of the preceding claims, wherein said vertical motion means comprise a worm screw (94) engaged with the third electric motor (90), arranged parallel to the axis of rotation (Z), operatively supported by a fixed frame (93), and a nut (96) which engages the worm screw and is fixed to the rotary drive shaft (56).

11. An exchange device according to any one of claims 1 to 9, wherein said vertical motion means comprise at least one belt (92') engaged with the third electric motor (90) connected to said peg carrier group (100) to raise it.

12. An exchange device according to claim 9 or 10 or 11, wherein the spreading means are synchronized with the vertical motion means so as to engage the peg carrier plate (70a,70b) at a predetermined intermediate vertical position when the peg carrier group (100) is moving from the lower limit position to the upper limit position, possibly in said upper limit position.

13. An exchange device according to any one of claims 9 to 12, comprising a locking system (110) suitable to lock the rotation of said spreading means.

14. An exchange device according to any one of the preceding claims, comprising a cleaning group for removing roving residues (R) from dirty tubes (12), said cleaning group being operative in a predetermined angular cleaning position.

15. An exchange device according to claim 14, wherein said angular cleaning position is intermediate between the spinning frame side angular position and a roving frame side angular position on which the exchange device cooperates with the roving frame side transport device (22) .

16. An assembly comprising:

- an exchange device (50) according to any one of the preceding claims;
- a spinning frame side transport device (26) suitable to act in conjunction with the spinning frames (8) of the spinning line, carrying empty (14) or dirty tubes (12);
- a roving frame side transport device (22) or plank, suitable to act in conjunction with a spinning line carrying the bobbins (10);
- means of operation comprising plank motion means suitable to advance the plank by a predetermined stroke, which varies according to the operating stage of the exchange device (50).

17. A working method of an exchange device (50) for a spinning line, carried out locally by means of a peg carrier group (100),
the removal of dirty (12) or empty (14) tubes from a spinning frame side transport device (26) and bobbins (10) from a roving frame side transport device (22), the exchange of the bobbins (10) with the empty tubes (14) and the release of the bobbins (10) to the spinning frame side transport device (26) and the empty tubes (14) to the roving frame side transport device (22),
wherein said peg carrier group (100) performs a succession of consecutive rotations always in the same direction of rotation.

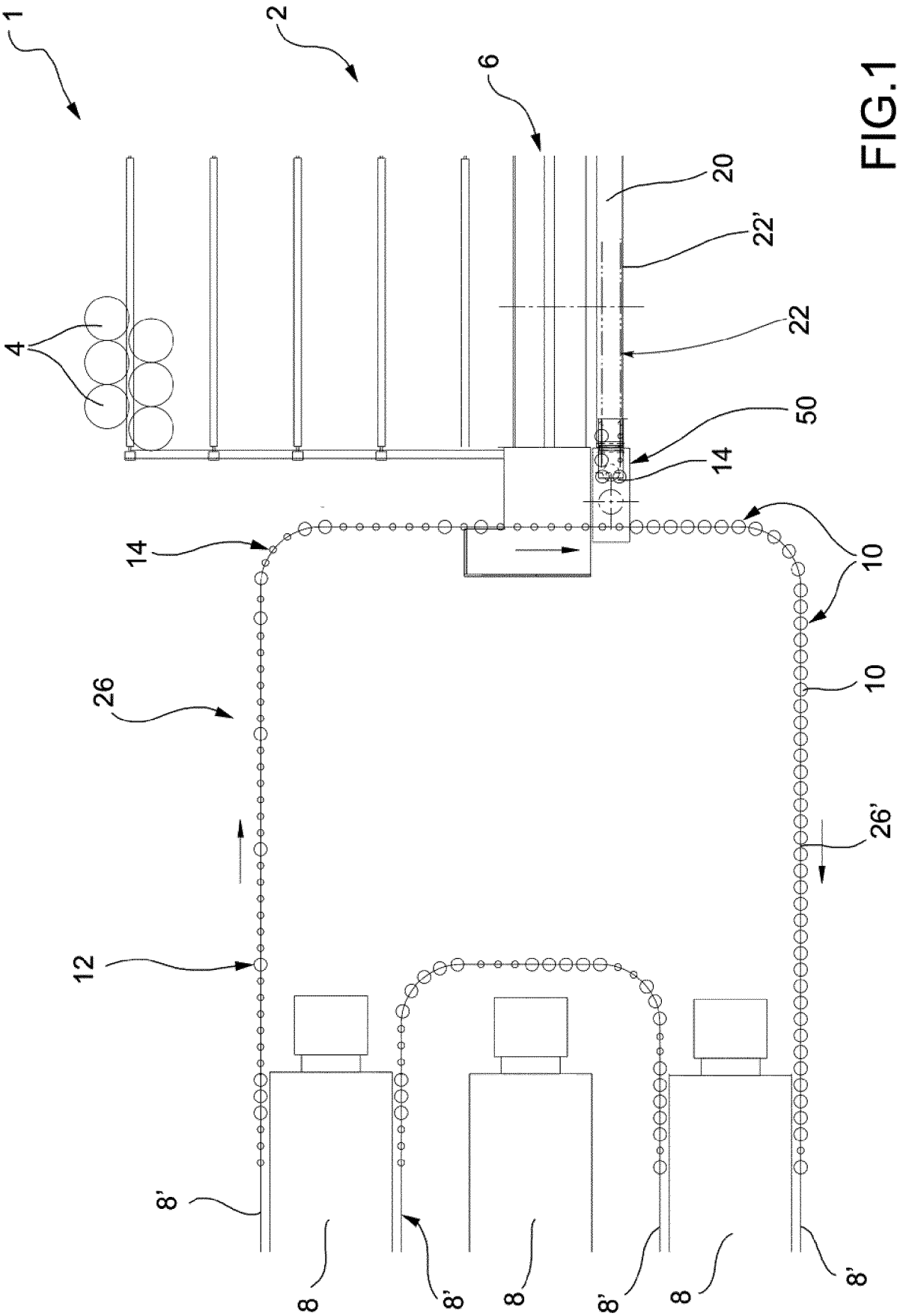

FIG.1

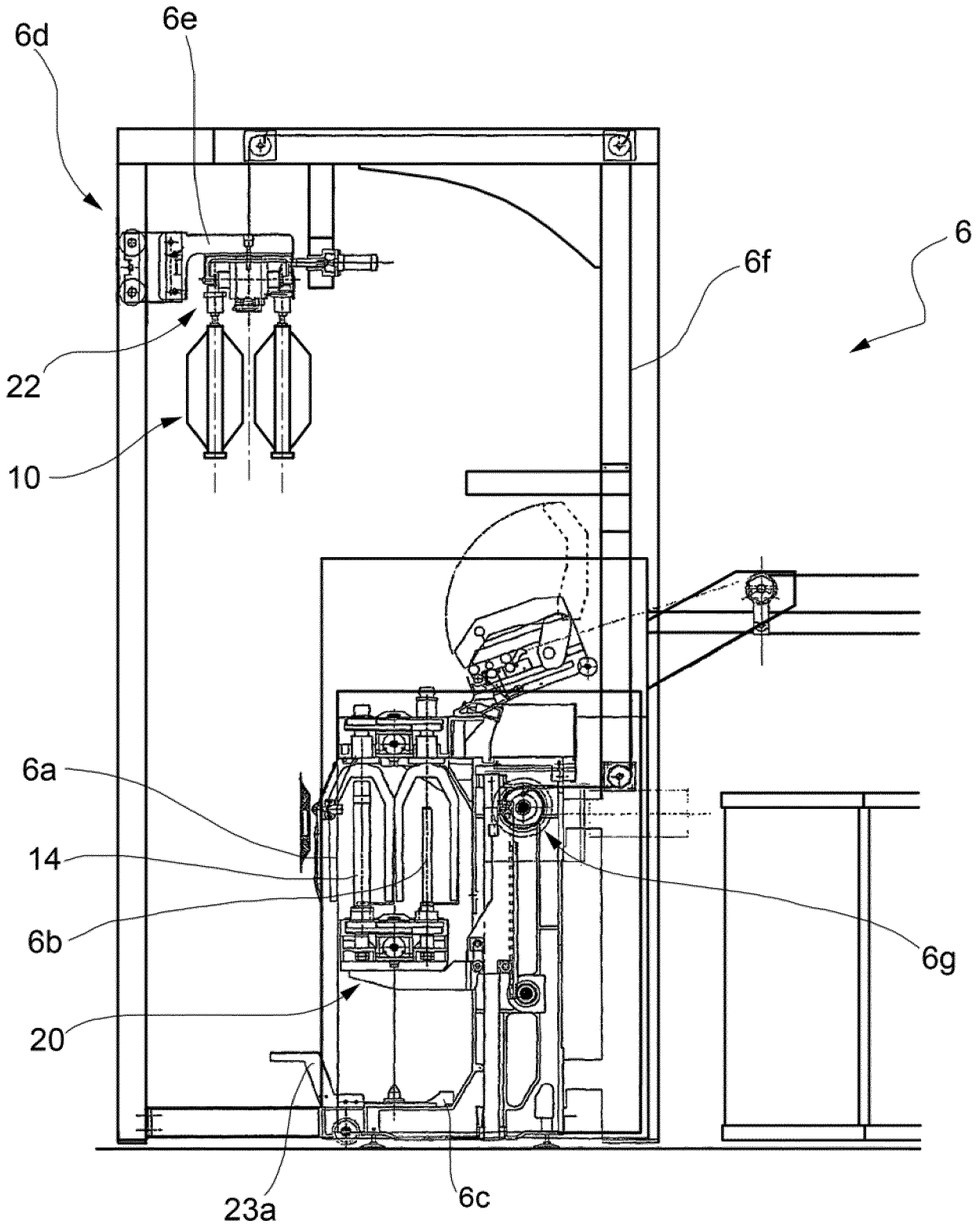

FIG.2

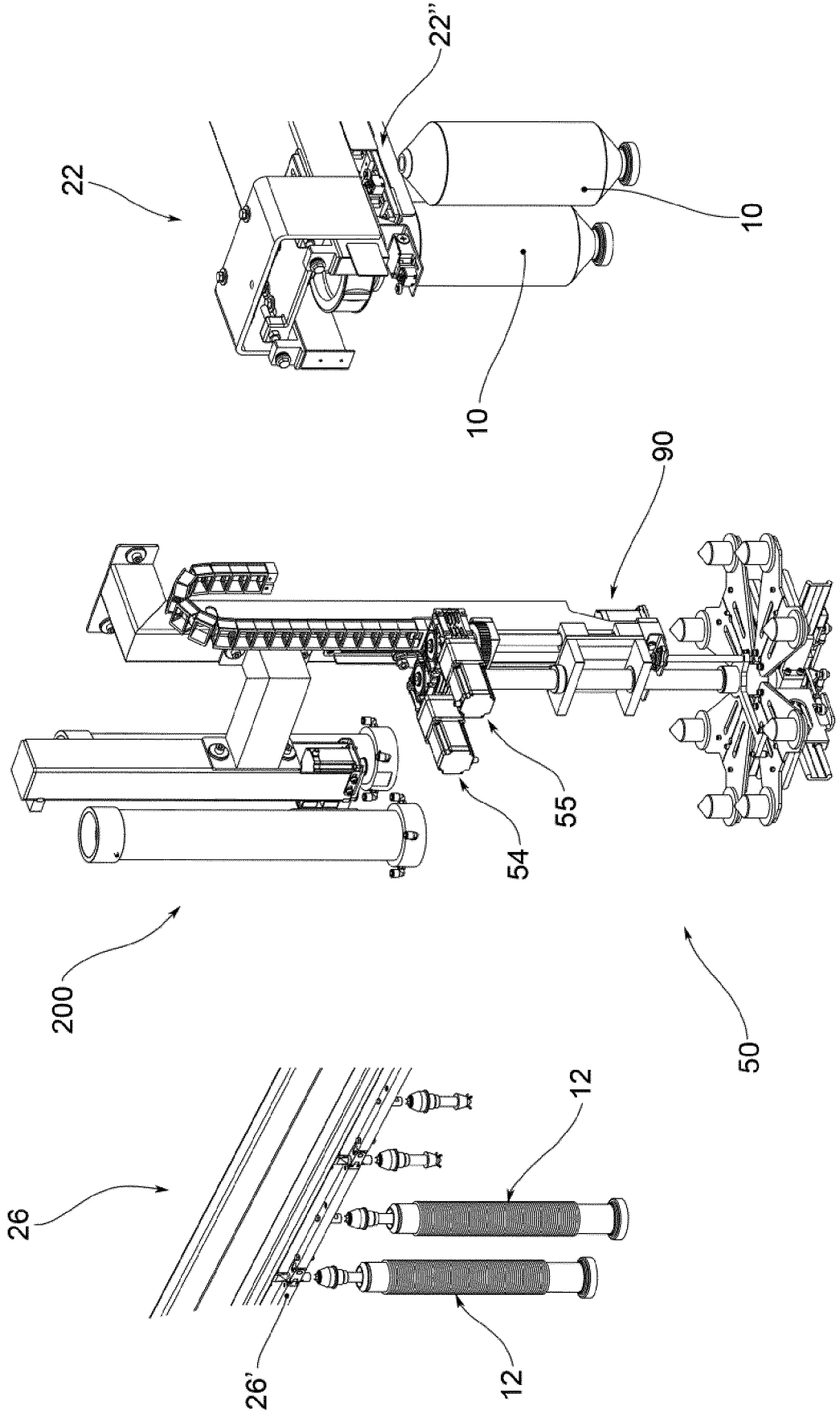

FIG.3

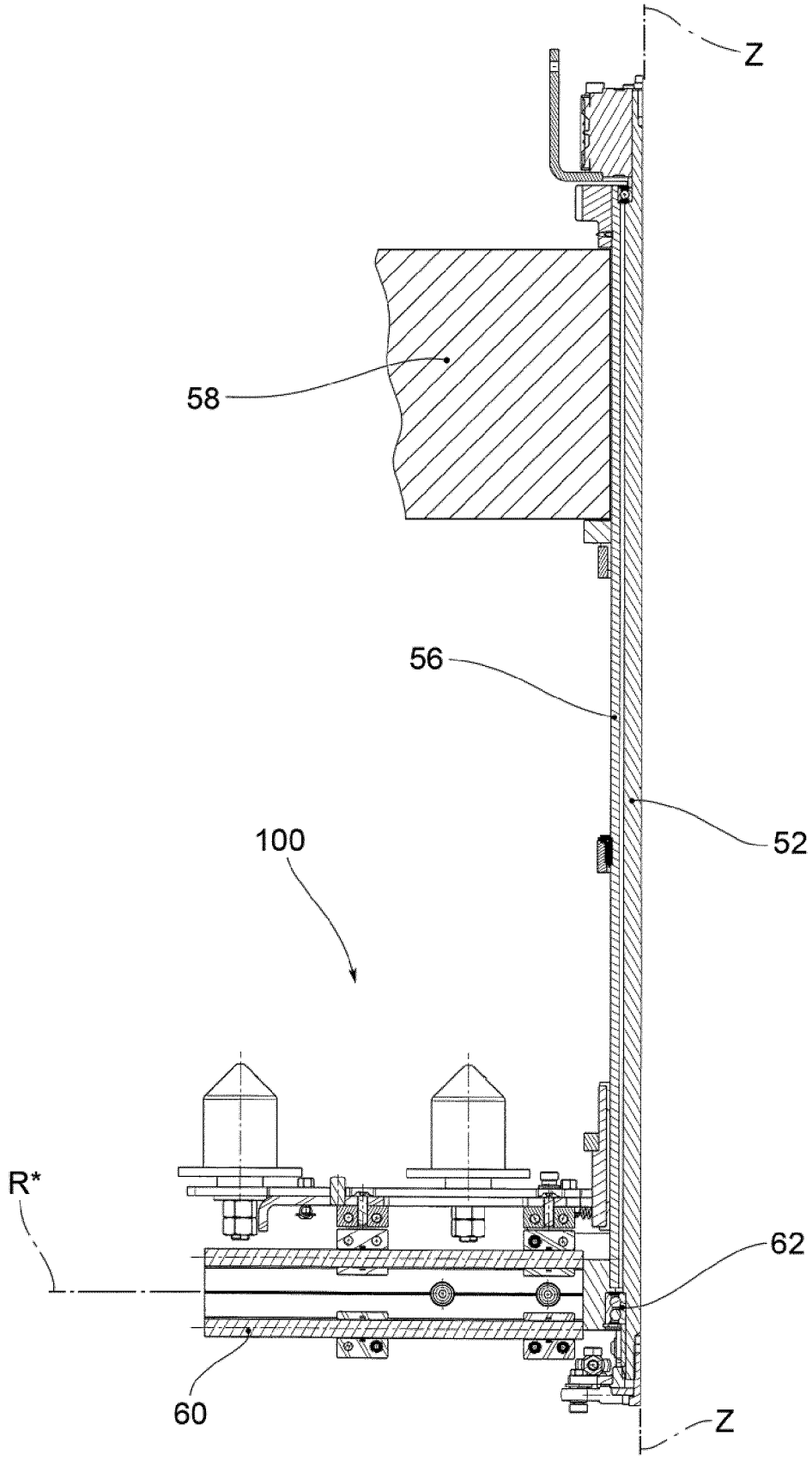

FIG.4

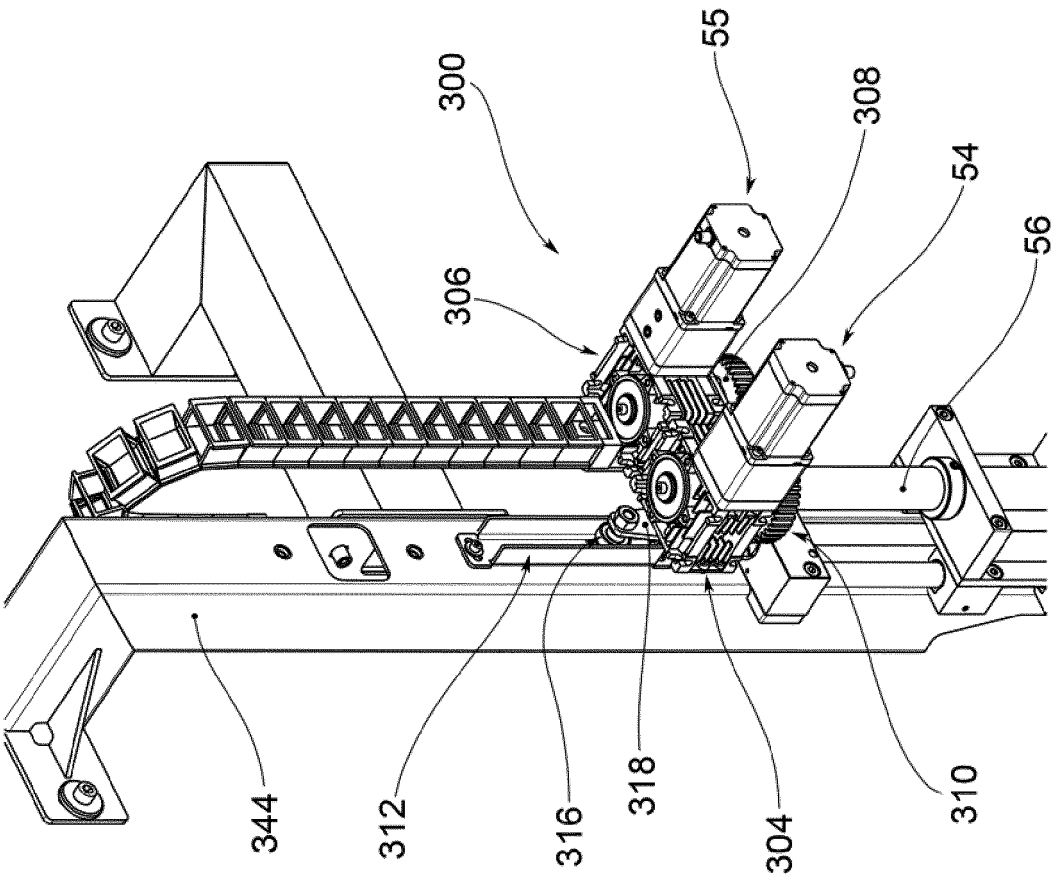
55
300
308
54
56
306
344
312
316
318
304
310

FIG.5b

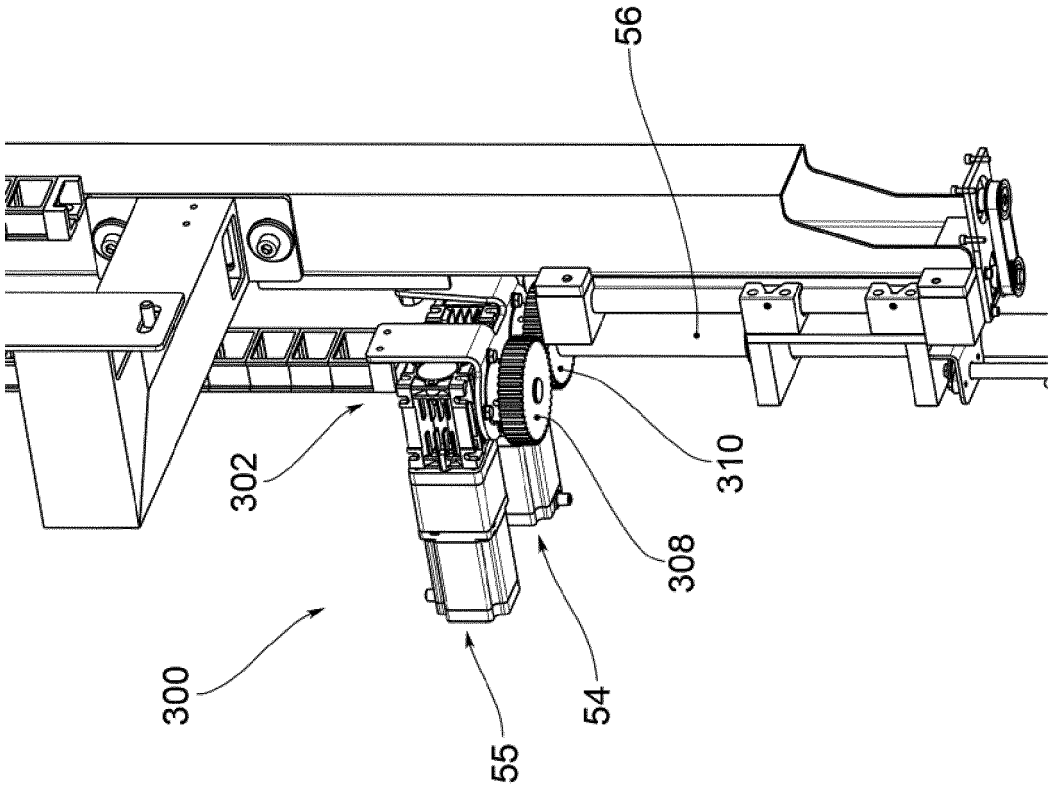
56
310
302
308
300
54
55

FIG.5a

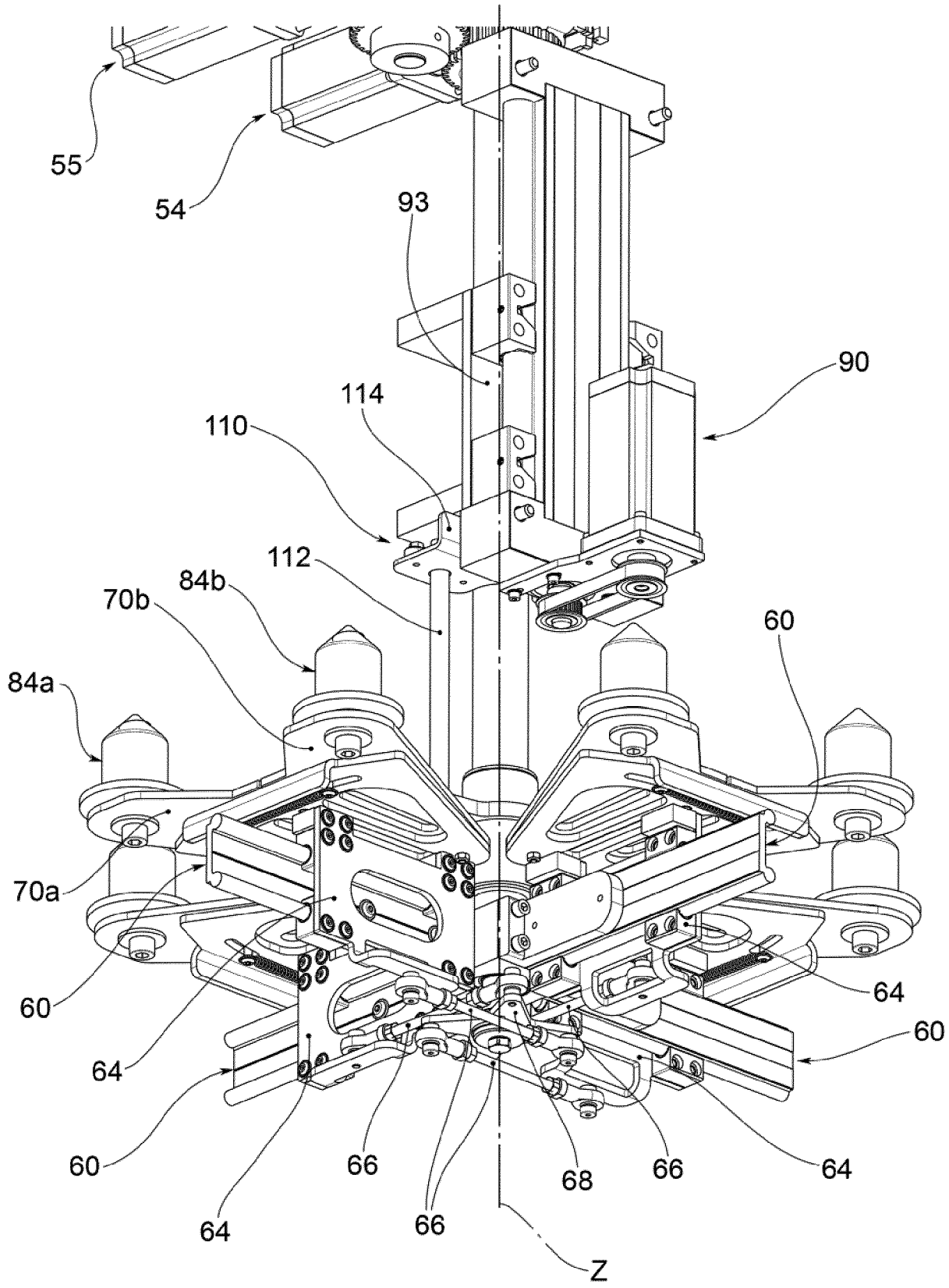
55
54
93
90
114
110
112
84b
70b
84a
60
70a
60
64
60
64
60
66
64
66
68
66
64
Z

FIG.5c

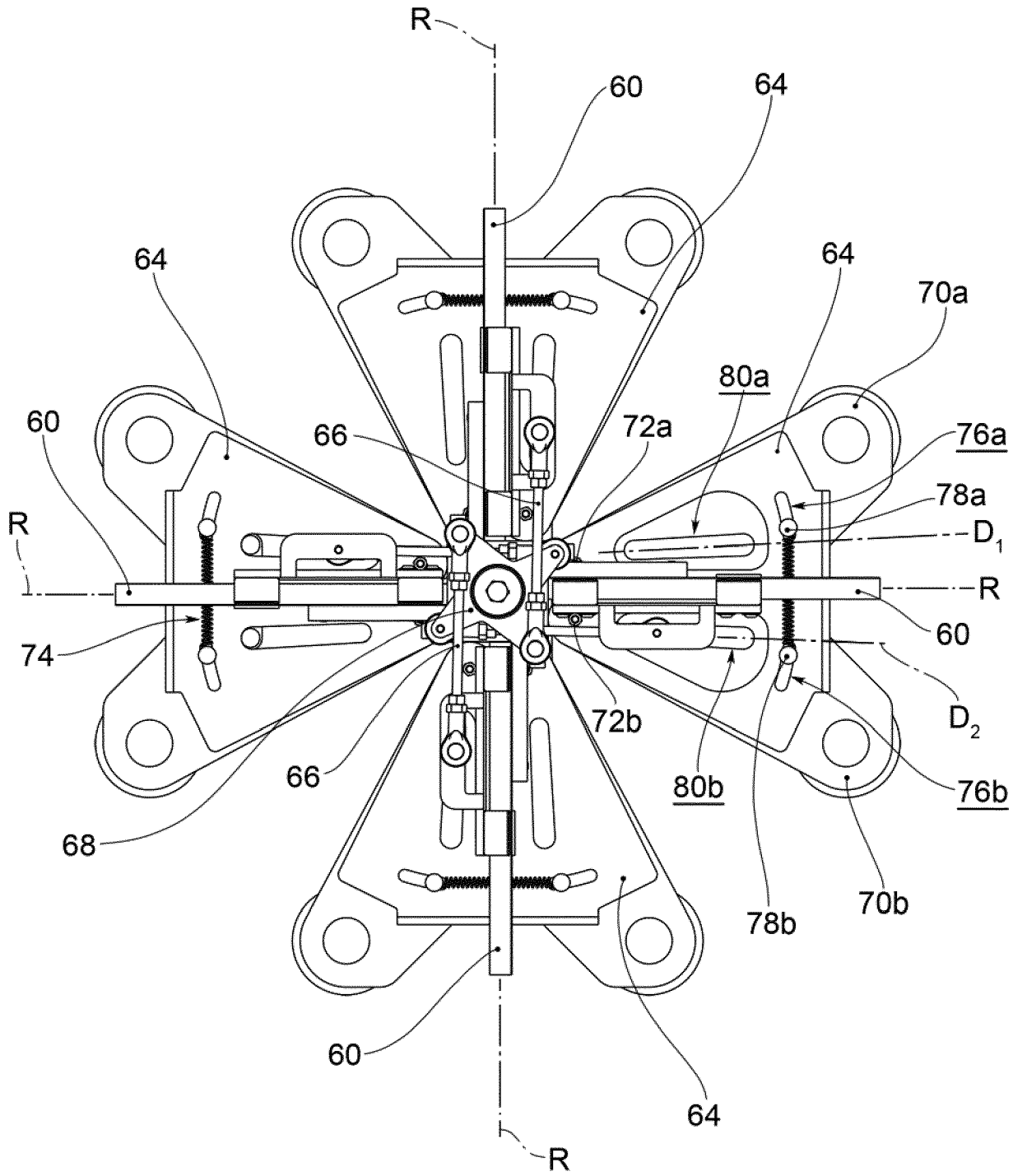
R
60
64
64
64
70a
80a
60
66
72a
76a
78a
R
D1
R
60
74
D2
72b
66
80b
76b
68
70b
78b
60
64
R

FIG.6

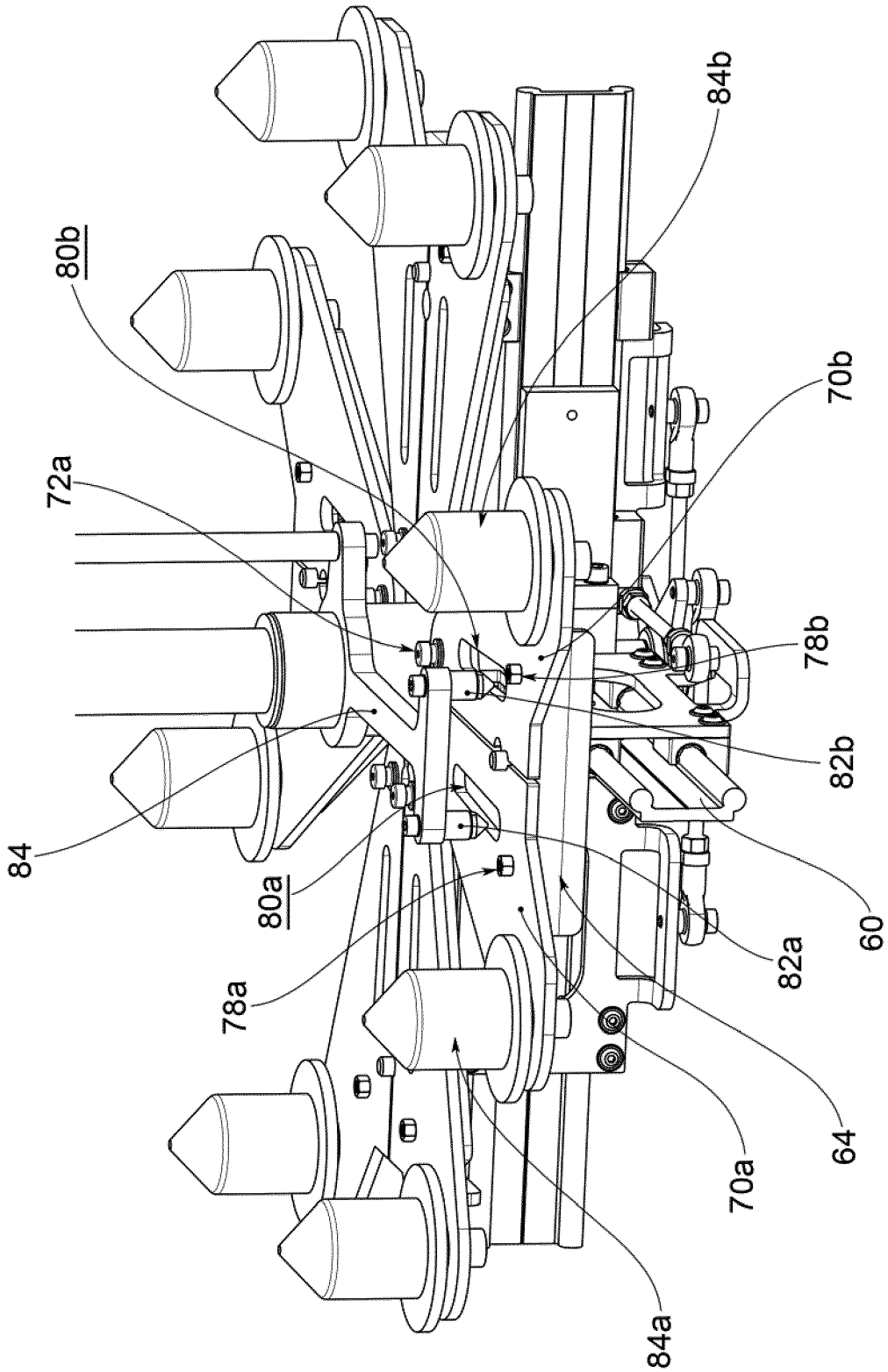

FIG.7

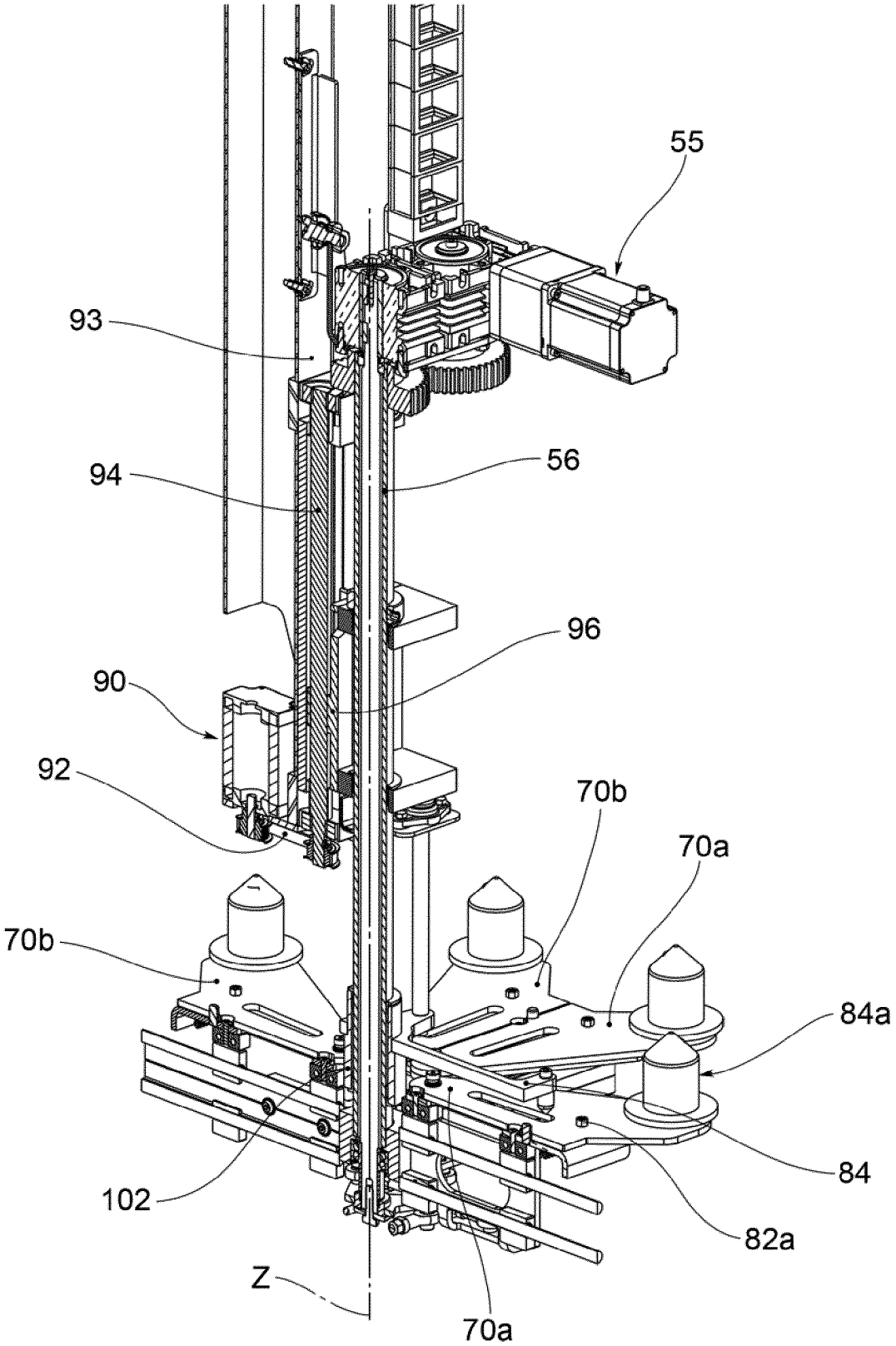

FIG.8

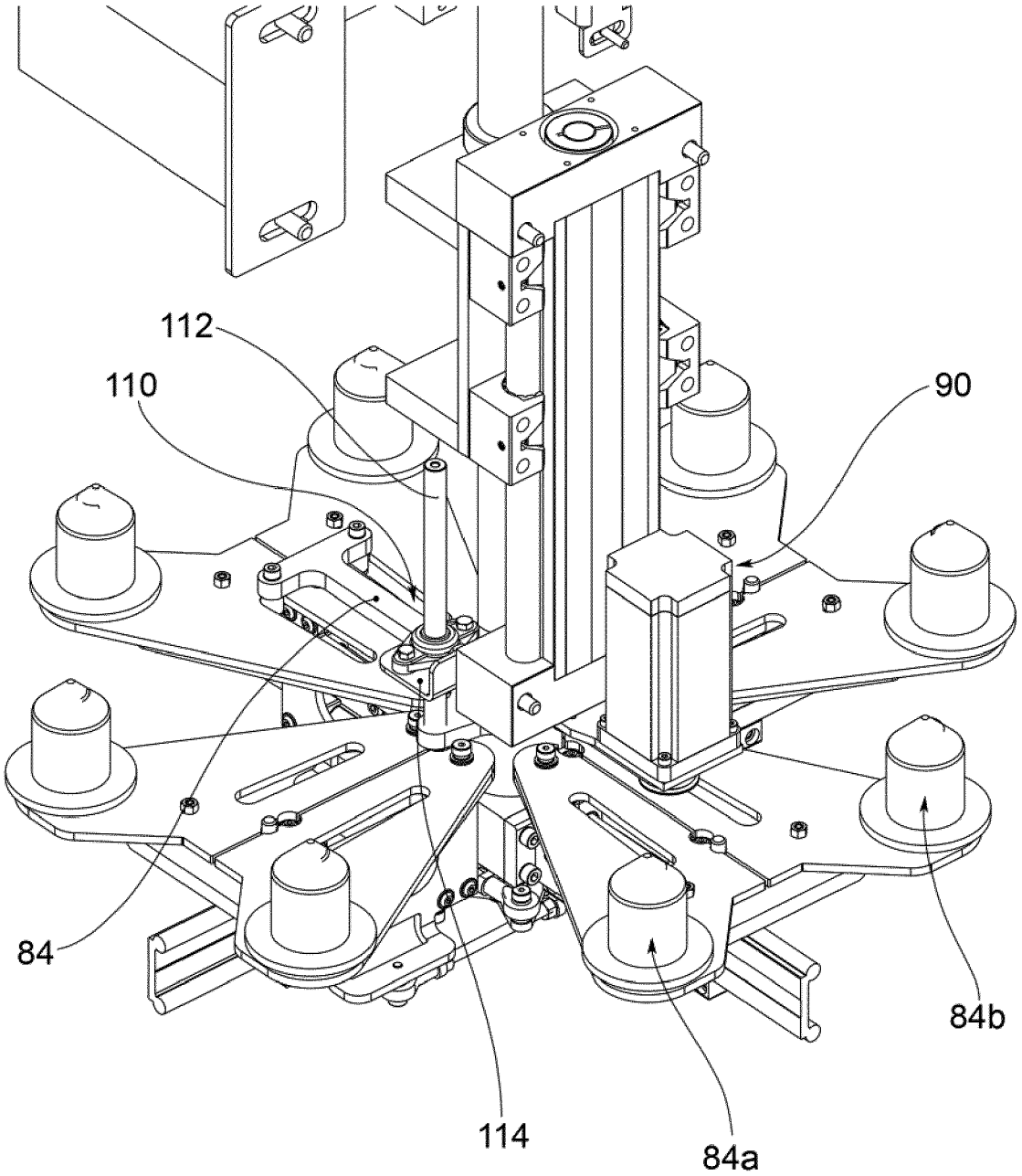

FIG.9

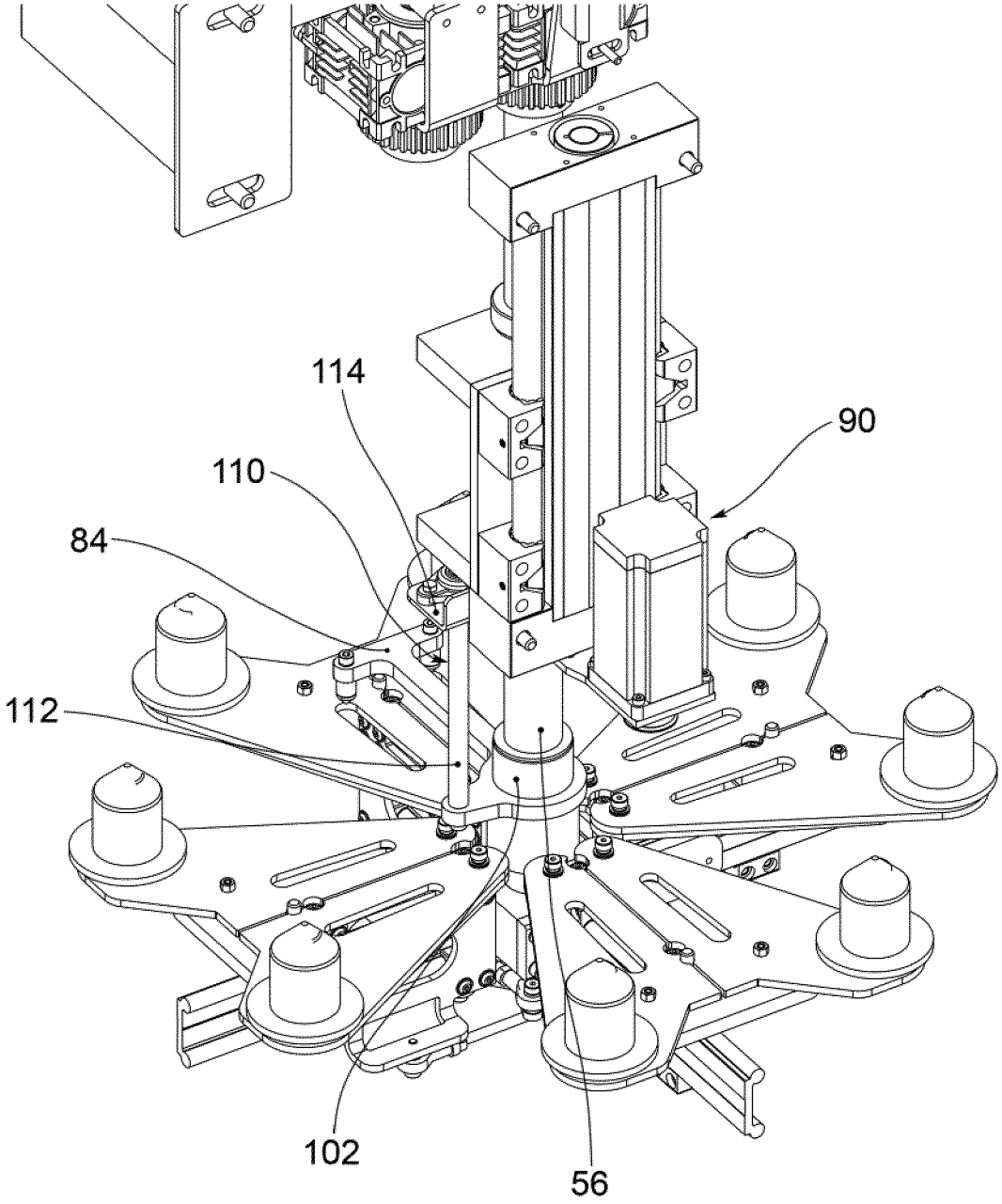

FIG.10

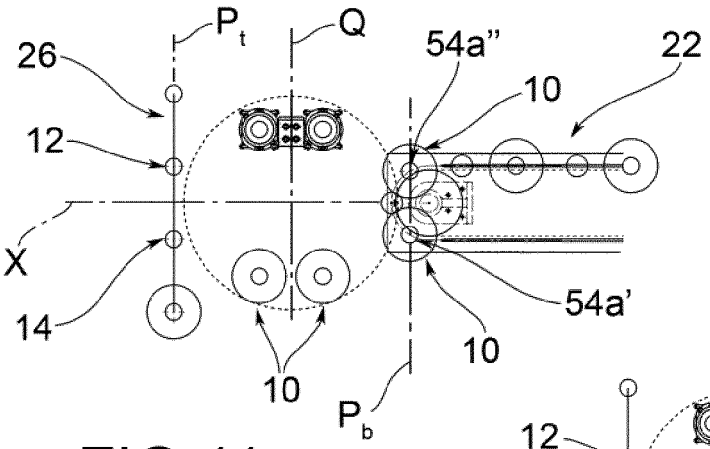

FIG.11a

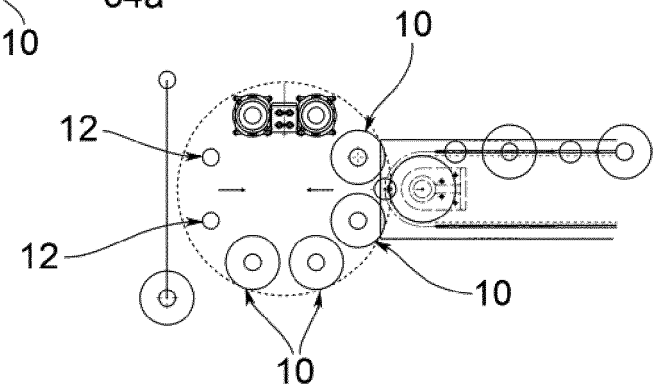

FIG.11b

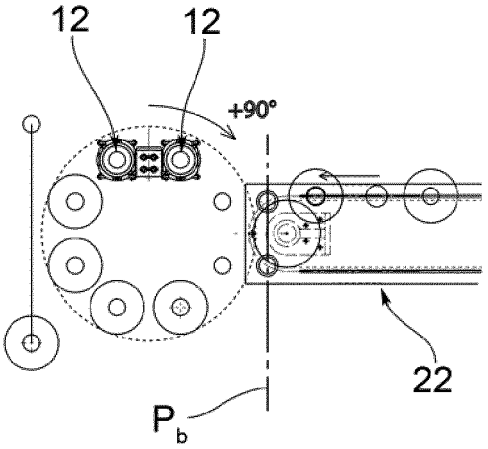

FIG.11c

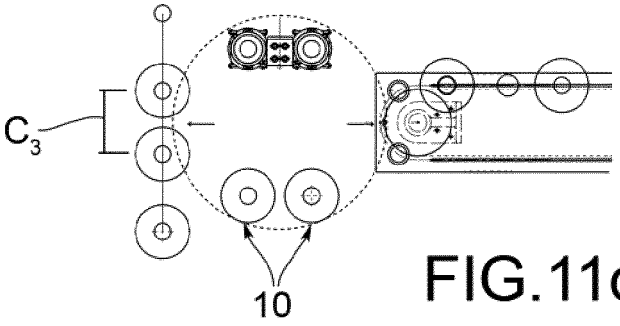

FIG.11d

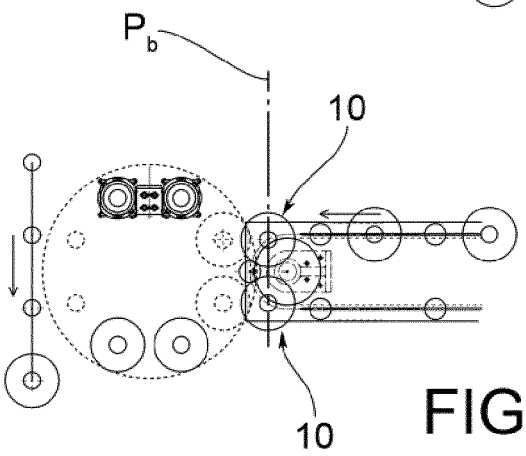

FIG.11e

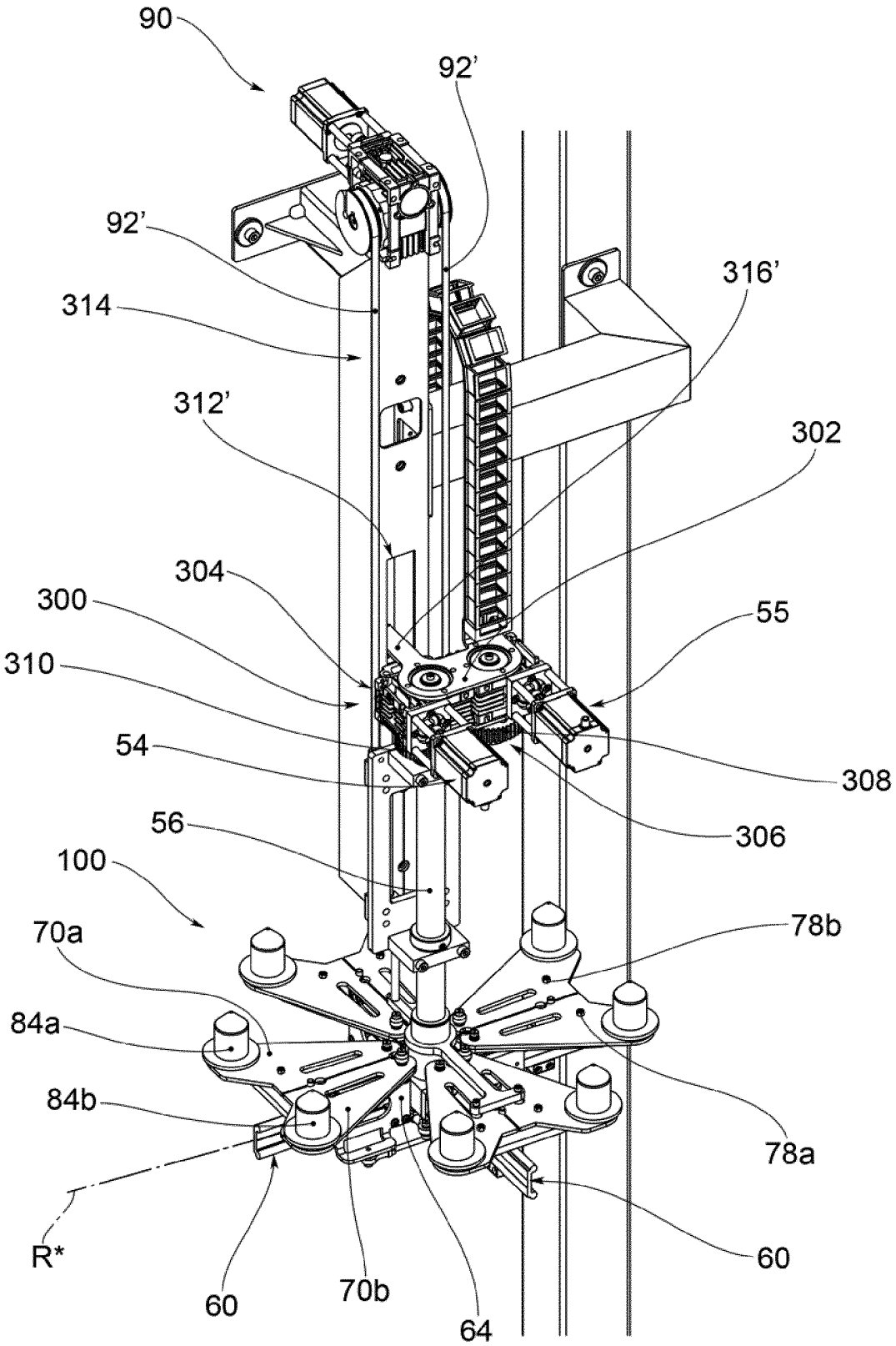
90
92'
92'
316'
314
312'
302
304
300
55
310
54
308
306
56
100
70a
78b
84a
84b
78a
R*
60
70b
64
60

FIG.12

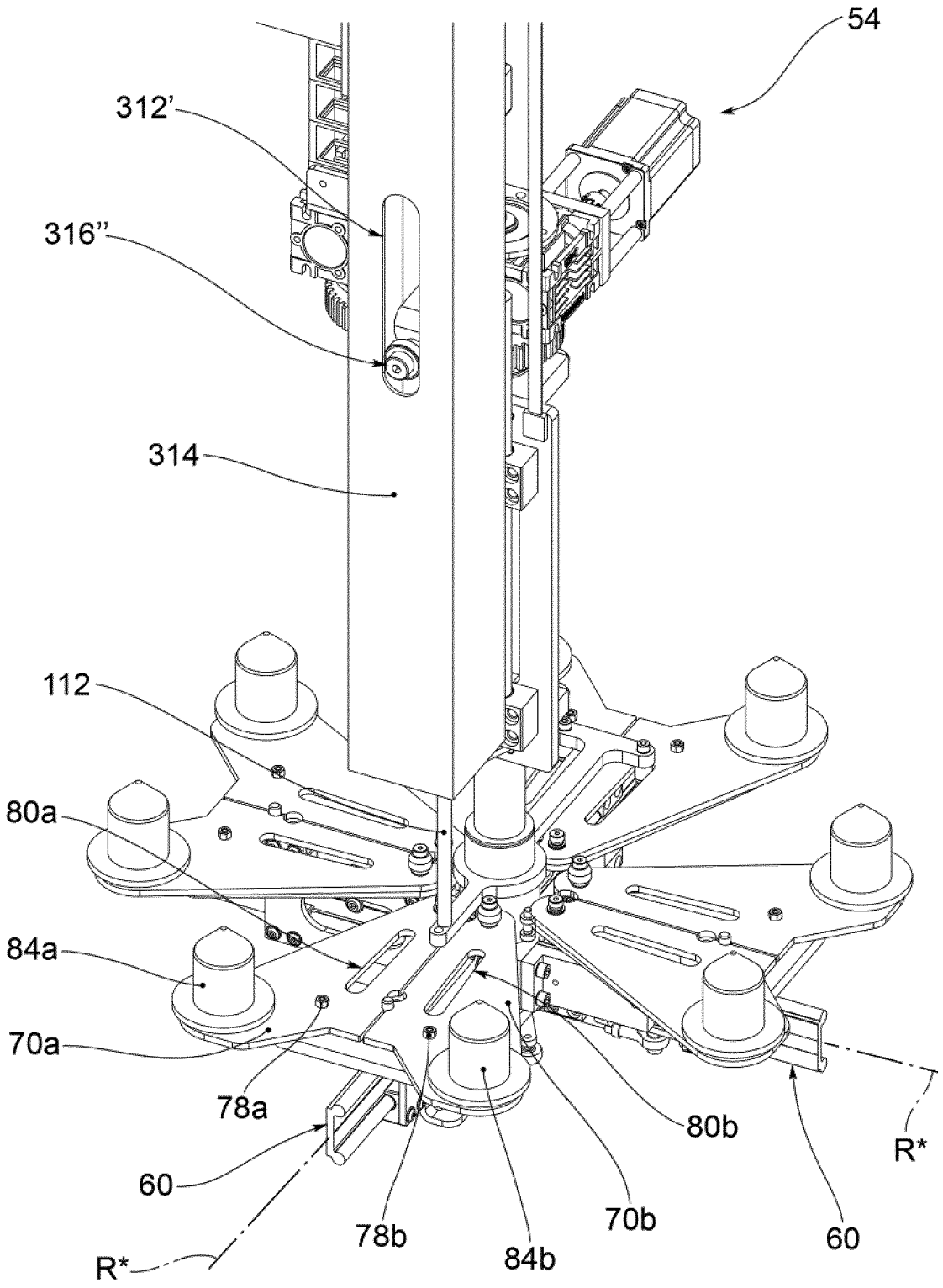

FIG.13

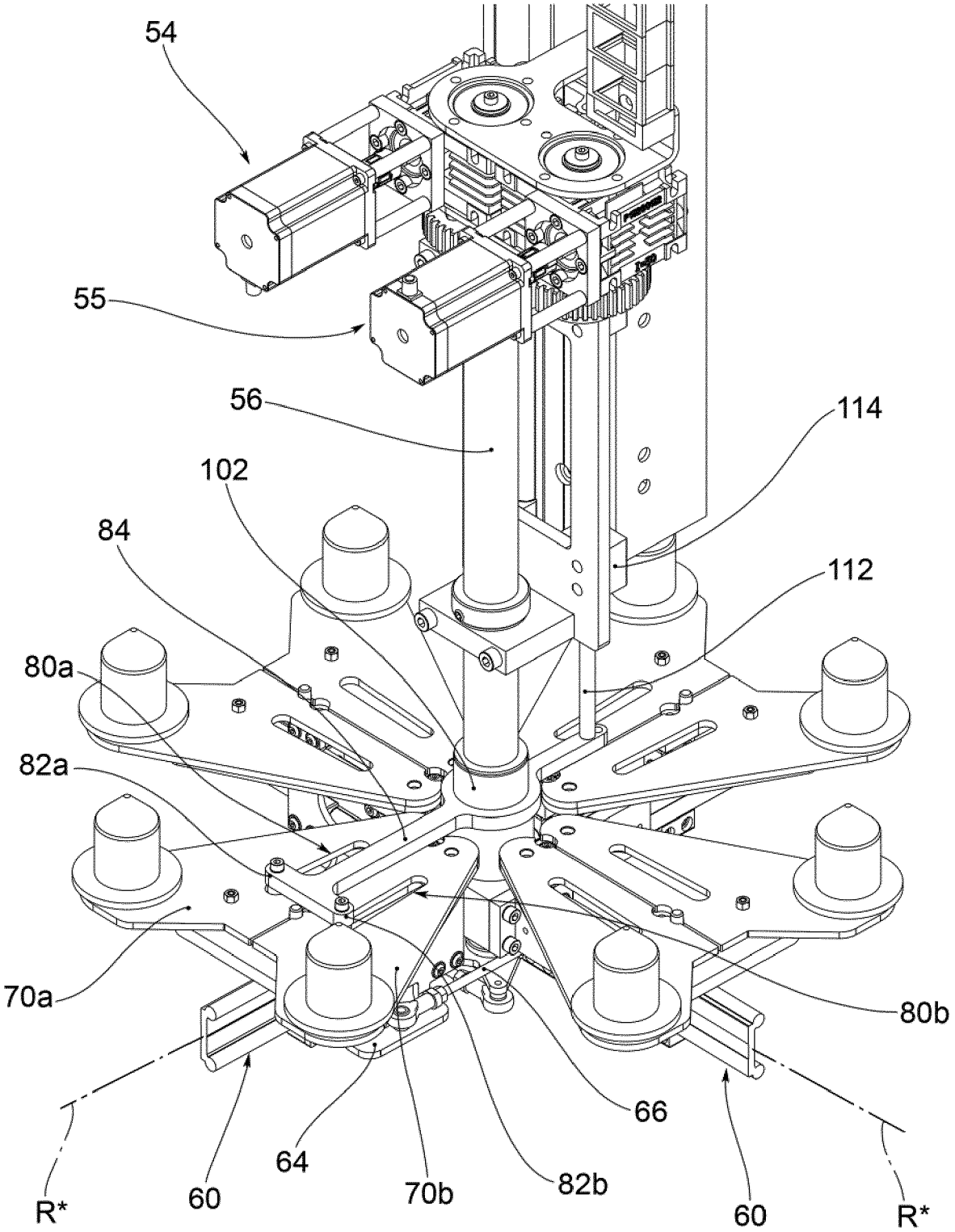

FIG.14

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EUROPEAN SEARCH REPORT

Application Number
EP 18 19 9453

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 October 2018	Todarello, Giovanni

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