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(54) METHOD OF FEEDING A PACKER FOR ROD-LIKE ARTICLES OF TOBACCO INDUSTRY AND FEEDING APPARATUS FOR FEEDING A GROUP OF ROD-LIKE ARTICLES TO A PACKER FOR ROD-LIKE ARTICLES

(57) The object of the invention is a method of feeding a packer (1) for rod-like articles of the tobacco industry comprising steps wherein: double-length rod-like articles (3D) are supplied in the form of two mass flows (MF) for two feeding paths 2P, 2P') of a feeding apparatus, whereas in the feeding paths: the mass flow of the double-length rod-like articles is converted into a single-layer mass flow (F3D) of the double-length rod-like articles so that the rod-like articles in the single-layer stream form single-layer groups (KD) of the double-length rod-like articles, the double-length rod-like articles are cut into two individual rod-like articles (3) and the single-layer stream of the double-length rod-like articles is converted into a single-layer stream of the rod-like articles comprising single-layer groups (K) of individual rod-like articles; the stream of individual rod-like articles is conveyed in a forming and transporting apparatus (5, 5'), a two-layer group (G) of rod-like articles is formed of the rod-like articles of the single-layer group of rod-like articles, then in the forming unit (25) of the forming and transporting apparatus the two-layer group of the rod-like articles is transferred from the forming and transporting apparatus to a conveyor (6) of the two-layer groups of rod-like articles, whereas the groups of rod-like articles are transferred from two feeding paths, the group of rod-like articles is transferred from the conveyor of the two-layer groups of rod-like articles to a packer, wherein in the step of conveying the groups of rod-like articles to the conveyor the groups of rod-like articles are buffered in a buffer (5A, 5A', 5B, 5B') of the forming and transporting apparatus so that the distance among the adjacent groups of rod-like articles is varied. The object of the invention is also a feeding apparatus for feeding the groups of rod-like articles to the packer of the rod-like articles.

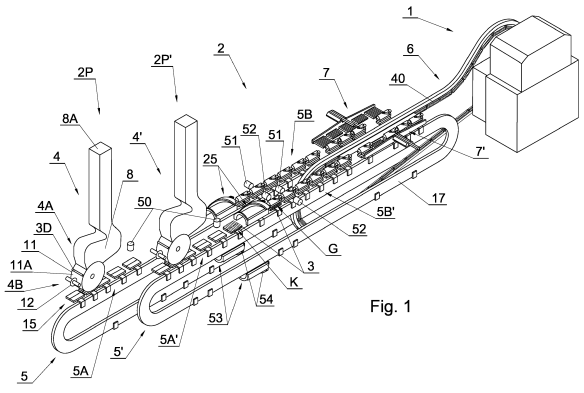

Fig. 1

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Description

[0001] The object of the invention is a method of feeding a packer for rod-like articles of the tobacco industry and a feeding apparatus for feeding a group of rod-like articles to a packer for rod-like articles.

[0002] The invention belongs to the tobacco industry solutions, in particular to the field of solutions finding application in the packers for finished tobacco products.

[0003] From the document US 2012/0090954 an apparatus for handling of objects is known. This apparatus comprises a handling apparatus which receives objects from a feeding area and which supplies the objects by means of a transferring apparatus to at least one workstation. The handling apparatus, respectively, simultaneously receives a specific number of objects by means of an object carrier in such a way that the transferring apparatus has multiple carrying elements for multiple objects respectively held by the handling apparatus. Furthermore, the sequence of movements of each carrying element on the transferring apparatus is individually controlled so that the handling apparatus removes respectively multiple objects from the respective carrying element after passing through at least one workstation.

[0004] From the document US7165668 an apparatus for conveying rod-like articles from a longitudinal conveyor is known, whereas such apparatus conveys the articles onto a transverse conveyor. Furthermore, the apparatus comprises a conveyor which receives the articles from the longitudinal conveyor and delivers the articles to the transverse conveyor, whereas the conveyor comprises at least a first carrying element and a separate second transport element, these elements being configured for a functional connection with each other. In addition, the first carrying element is structured and positioned so as to rotate the articles by a specific angle. Furthermore, the second carrying element is structured and positioned so as to reduce the transport speed of the articles.

[0005] From the document WO2003051718 a cigarette packing machine, comprising an endless drying conveyor having at least one substantially spiral part, an input station and an output station, is known. This conveyor moves endlessly along a given path in a given direction of movement in order to feed successive cigarette batches between the said input and output stations. The apparatus is characterised in that the said drying conveyor comprises a sequence of coils out of which the first said coil extends in the said direction of movement from the said input station and is connected, at the input station, to the last-mentioned coil running through the said output station.

[0006] From the document EP1020357 a method for forming groups of rod-like articles with a determined orientation of the rod-like articles in the group is known. The rod-like articles are supplied through multiple channels, and layers of the three-layer group of rod-like articles are placed into the pockets of an endless pocket conveyor, and the groups of rod-like articles are transferred for packaging.

[0007] From the prior art, apparatuses and methods for rotating oppositely oriented rod-like articles are known.

[0008] From the document US2988199 an apparatus for rotating oppositely oriented rod-like articles with the use of a double-sided V-belt is known. The V-belt is provided with wedges adapted to receive the rod-like articles from a drum feeder, securing against the possibility of rod-like article falling out of the wedge. The rod-like articles, individually placed in the wedges, are rotated in the axis corresponding to the direction of movement of the rod-like articles, due to a twist of the belt on the transmission rollers. The rotated rod-like articles are released individually from the wedges onto a belt feeder which forms them into an oriented flow of the rod-like articles.

[0009] From the document US2929489 an apparatus for rotating oppositely oriented cut rod-like articles is known. In the rod-like article cutting process, two flows with opposite orientations are obtained. In order to unify the orientation, one of the belt conveyors is provided with a crossed transfer belt which enables the rod-like articles arranged one after another to rotate by 180 degrees in the axis corresponding to the direction of movement of the rod-like articles, as a result of which a common orientation for both parallel flows is obtained. A similar solution was shown in the document GB1015562, the difference being that in place of the transfer belt a small belt consisting of an inner element, e.g. a steel cable covered on the outside with a soft material e.g. a rubber sponge ensuring an appropriate adhesion of the rod-like articles and preventing their damage, was used.

[0010] From the document GB1519293 an apparatus for rotating oppositely oriented rod-like articles is known. The apparatus comprises two independent belt conveyors on which oppositely oriented rod-like articles arranged one after another are situated. At least one of the belt conveyors is adapted to changing the orientation of the rod-like articles by 90 degrees in the axis corresponding to the direction of movement of the rod-like articles, as a result of which a common orientation for both flows is obtained. The correctly oriented rod-like articles from each of the belt conveyors merge and, at a further stage, form a mass flow.

[0011] From the document US4860880 an apparatus for rotating a multi-layer flow of rod-like articles is known. The apparatus comprises belt conveyors on which oppositely oriented rod-like articles are situated. By controlling the conveyor travel speed, multi-layer flows of rod-like articles with opposite orientations are created, whereas such flows are rotated, by means of appropriately twisted belts, by the angle of 90 degrees in the axis corresponding to the direction of movement of the rod-like articles. The correctly oriented flows obtained in this way merge and form a mass flow. During a further transport, the mass flow may be rotated again to set the desired orientation.

[0012] The object of the invention is a method of feeding a packer for rod-like articles of the tobacco industry comprising steps wherein: double-length rod-like articles are supplied in the form of two mass flows for two feeding paths of a feeding apparatus, whereas in the feeding paths the mass flow of the double-length rod-like articles is converted into a single-layer mass flow of the double-length rod-like articles so that the rod-like articles in the single-layer stream form single-layer groups of the double-length rod-like articles, the double-length rod-like articles are cut into two individual rod-like articles and the single-layer stream of the double-length rod-like articles is converted into a single-layer stream of the rod-like articles comprising single-layer groups of individual rod-like articles, the stream of the rod-like articles is conveyed in a forming and transporting apparatus, whereas in the course of conveying the distance among adjacent single-layer groups of individual rod-like articles is changed, a two-layer group of rod-like articles from the rod-like articles of the single-layer group of rod-like articles is formed in a forming unit of the forming and transporting apparatus, then the two-layer group of the rod-like articles is transferred from the forming and transporting apparatus to a conveyor of two-layer groups of rod-like articles, whereas the groups of the rod-like articles are transferred from two feedings paths, the group of the rod-like articles is transferred from the conveyor of two-layer groups of rod-like articles to the packer, characterised in that in the step of conveying the groups of the rod-like articles to the conveyor the groups of the rod-like articles are buffered in the buffer of the forming and transporting apparatus so that the distance among the adjacent groups of the rod-like articles is varied.

[0013] The method is further characterised in that the quality of the rod-like articles in the groups is monitored and defective rod-like articles in the groups are rejected.

[0014] The method is further characterised in that the single-layer flow of the rod-like articles is refilled after rejecting defective rod-like articles from the groups.

[0015] The method is further characterised in that in the case of stopping one feeding path the packer is slowed down, and the packer is fed from the second feeding path.

[0016] The method is further characterised in that the mass flow of the double-length rod-like articles is continuously converted into a single-layer flow.

[0017] The method is further characterised in that the groups of the rod-like articles are transferred from the conveyor to the packer in a start-stop cycle.

[0018] The object of the invention is also a feeding apparatus for feeding a group of rod-like articles to the packer of rod-like articles, comprising two feeding paths for supplying the rod-like articles to a conveyor situated between the feeding paths, whereas a feeding path comprises: a feeding apparatus for feeding double-length rod-like articles having a channel for the mass flow of the double-length rod-like articles and a container for the double-length rod-like articles, an apparatus for converting the mass flow of the double-length rod-like articles into a single-layer stream of the double-length articles so that the double-length rod-like articles in the single-layer stream form single-layer groups, a cutting apparatus for converting the single-layer stream of the double-length rod-like articles into the single-layer stream of the rod-like articles comprising single-layer groups of rod-like articles, a forming and transporting apparatus provided with transport units for conveying the rod-like articles in the single-layer groups and the two-layer groups of rod-like articles as well as forming units for forming the two-layer groups of rod-like articles, whereas the forming and transporting apparatus is adapted to vary the distance among the transport units, and a transferring unit adapted to transfer a group of rod-like articles from the forming and transporting apparatus to the conveyor of the two-layer groups of rod-like articles from two feeding paths, and in addition the conveyor of the groups of rod-like articles is adapted to feed the groups of rod-like articles to the packer, characterised in that the forming and transporting apparatus is adapted to buffer the groups of rod-like articles in a buffer so that the distance among the adjacent groups of rod-like articles is variable.

[0019] The feeding apparatus is further characterised by additionally comprising a sensor for monitoring the quality of the rod-like articles in the groups and a rejecting apparatus for rejecting defective rod-like articles in the groups.

[0020] The feeding apparatus is further characterised in that the feeding path is provided with an apparatus for refilling the single-layer flow of the rod-like articles in the groups.

[0021] The feeding apparatus is further characterised in that the apparatus for converting the mass flow into a single-layer flow comprises a drum conveyor.

[0022] The feeding apparatus is further characterised by being provided with a conveyor for conveying the single-layer stream of the rod-like articles, in particular a chain conveyor or a belt conveyor.

[0023] The feeding apparatus is further characterised in that the buffer is adapted to receive a variable quantity of the transport units.

[0024] The feeding apparatus is further characterised in that the distance among the successive groups in the feeding unit is different from the distance among the transport units conveying the two-layer groups fed by the feeding unit to the packer.

[0025] The feeding apparatus is further characterised in that the quantity of groups of the rod-like articles in the paths is variable.

[0026] The feeding apparatus is further characterised by being adapted to feed the packer from one of two feeding paths.

[0027] The feeding apparatus is further characterised in that the apparatus for converting the mass flow of the double-length rod-like articles into a single-layer stream of the double-length articles is adapted to a continuous operation.

[0028] The feeding apparatus is further characterised in that the conveyor of the groups of rod-like articles is adapted to feed the groups of rod-like articles to the packer and to operate in a start-stop cycle.

[0029] The feeding apparatus according to the invention allows reducing the number of downtimes. Due to maintaining a continuous operation of the production line, the line efficiency is increased. The application of buffering between the feeding unit and the conveyor of the groups of rod-like articles at which the distance among the groups of rod-like articles is varied allows configuring the feeding unit and the packer independently of each other.

[0030] The object of the invention was discussed in detail based on an embodiment illustrated in a drawing in which:

Fig. 1 shows a fragment of a production line in a perspective view comprising a feeding apparatus in a first embodiment,

Fig. 2 shows, in simplified terms, a drum conveyor and a transport unit in a perspective view,

Fig. 3 shows, in simplified terms, the transport unit in an open configuration,

Fig. 4 shows a forming unit and a transport unit in the open configuration in a perspective view,

Fig. 5 shows the forming unit and the transport unit of Fig. 4 in the open configuration in a perspective view from below,

Fig. 6, 6a show the transport unit in the open configuration in the direction of movement of such unit,

Fig. 7, 7a show the transport unit during the change of configuration from open to closed in the direction of movement of such unit,

Fig. 8 shows the transport unit in a closed configuration in a side view,

Fig. 9 shows fragments of two forming and transporting apparatuses, a fragment of a conveyor for groups of rod-like articles and two transferring units before transferring the groups of the rod-like articles,

Fig. 10 shows fragments of two forming and transporting apparatuses, a fragment of the conveyor for the groups of the rod-like articles and two transferring units after transferring the groups of the rod-like articles,

Fig. 11 diagrammatically shows a packing apparatus and a fragment of the conveyor for the groups of the rod-like articles,

Fig. 12 shows, in simplified terms, a view of a feeding apparatus in a second embodiment,

Fig. 13 diagrammatically shows the feeding of a packer from one feeding path,

Fig. 14 shows, in simplified terms, a view of the feeding apparatus in a third embodiment,

Fig. 15 shows, in simplified terms, a view of the feeding apparatus in a fourth embodiment of Fig. 14,

Fig. 16 shows, in simplified terms, in a front view, the production line of Fig. 15.

[0031] Fig. 1 shows a fragment of a production line comprising a packing apparatus 1 for packing groups of rod-like-articles 3 and a feeding apparatus 2 adapted to feed the groups G of the rod-like articles 3. The feeding apparatus 2 comprises two feeding paths 2P, 2P' through which the groups of the rod-like articles 3 are supplied to a conveyor 6 of the groups G of rod-like articles situated between the feeding paths 2P, 2P', whereas the conveyor 6 of the groups G of the rod-like articles 3 supplies the groups G of the rod-like articles 3 to the packing apparatus 1. The feeding path 2P comprises a feeding unit 4 for feeding double-length rod-like articles 3D (the rod-like article 3D has the length of two rod-like articles 3 of which the groups G of the rod-like articles are formed), an apparatus 4A for converting the mass flow of the double-length rod-like articles 3D into a single-layer flow of such articles, an apparatus 4B for converting the stream of the double-length rod-like articles 3D into a single-layer stream of individual rod-like articles 3, a forming and transporting apparatus 5 for forming and conveying the groups G of individual rod-like articles 3, and a transferring unit 7 for transferring the groups G of the rod-like articles 3 from the forming and transporting apparatus 5 to the conveyor 6 of the groups G. The feeding path 2P' is built similarly, however, the paths 2P, 2P' may be differently shaped, in different spatial configurations.

[0032] The feeding unit 4 is provided with a container 8 to which a channel 8A supplying the rod-like articles 3D from above or from the side to the container 8 is attached. The channel 8A may be situated vertically or slantwise to the vertical direction. The double-length rod-like articles 3D fed to the container 8 are twice longer than the rod-like articles 3 of which the groups G fed to the packing apparatus 1 are formed. The container 8 is provided with walls 9, 10 (Fig. 2), underneath the container 8 there is situated a grooved drum conveyor 11 for conveying the rod-like articles 3D, the circumferential surface 11A of the drum conveyor 11 constitutes the bottom of the container 8 (for the sake of simplification, in Fig. 1 the circumferential surface 11A is shown as smooth). The rod-like articles 3D are transported in grooves 14. The drum conveyor 11 together with the container 8 constitute the apparatus 4A for converting the

mass flow FM of the rod-like articles 3D into the single-layer stream F3D of the rod-like articles 3D, whereas the rod-like articles are grouped in the groups KD. Next to the drum conveyor 11, there is situated a circular knife 12 adapted to cut the rod-like article 3D transported on the drum 11 into two individual rod-like articles 3. For example, in Fig. 2 the rod-like article 3D was shown as a double-length cigarette which is cut into two individual cigarettes. The rod-like article 3D may be any other article, for example a double-length multi-segment filter rod. The drum conveyor 11 together with the circular knife 12 constitute the apparatus 4B for converting the single-layer stream F3D of the double-length rod-like articles 3D comprising the groups KD into a single-layer stream F3 of individual rod-like articles 3 comprising groups K of the rod-like articles 3, whereas the groups K are formed by cutting the rod-like articles 3D in the groups KD, i.e. the division of the stream F3 into the groups K of the rod-like articles 3 corresponding to the division of the stream F3D into the groups KD of the double-length rod-like articles 3D is maintained.

[0033] The drum conveyor 11 is fed from the container 8, whereas it is possible to feed the drum conveyor 11 also in another way, for example from another drum conveyor. On the drum conveyor 11, the rod-like articles 3 formed by cutting the rod-like article 3D are further transported in the form of the single-layer stream F3 in the grooves 14 from which the rod-like articles 3 are transferred onto the trays 13 of the transport unit 15 of the forming and transporting apparatus 5, in other words, the single-layer stream F3 is further conveyed by means of the transport units 15. The grooves 14 are grouped in sections 14A on the circumferential surface 11A of the drum conveyor 11, whereas the number of the grooves 14 in the section 14A is adapted to the number of grooves in the tray 13. In one section 14A, there are conveyed both the single-layer group KD of the double-length rod-like articles 3D and the single-layer group K of the rod-like articles 3 of which the group G of the rod-like articles will be formed. The tray 13 consists of two parts and is composed of a first transport section 13A permanently attached to a transport trolley 16 of the transport unit 15 and a second transport section 13B rotatably attached to the first transport section 13A. The arrows show the direction of rotation of the drum conveyor 11 and the direction of movement of the transport units 15 along the path 17. The transport sections 13A, 13B, the transport trolley 16 and the path 17 were shown in simplified terms, in other drawings they may be shown in another way. Fig. 2 shows two transport units 15, 15', whereas the tray 13' of the transport unit 15' has received the rod-like articles 3, whereas the transfer of the rod-like articles 3 onto the tray 13 of the transport unit 15 is just beginning. The transport units 15 constitute the apparatus or conveying the single-layer stream F3 of the individual rod-like articles 3. The forming and transporting apparatus 5 may be provided with multiple transport units 15 moving along the path 17 independently of one another. In Fig. 3, the transport sections 13A, 13B are in the open configuration, they are situated so that the grooves 18 of both sections 13A, 13B are in one plane, whereas the groove 18 has a diameter adapted to the diameter of the rod-like article 3, and the axis X of the rod-like article 3 substantially overlaps the axis Y of the groove 18, whereas the axes Y of the grooves 18 are situated in one plane k. The second transport section 13B is adapted to rotate around the axis 20 as shown by the arrow R. After the rotation of the second transport section 13B by 180°, the transport sections 13A, 13B are in the closed configuration, the plane of the grooves of the section 13B will be situated parallel to the plane of the grooves of the section 13A. The groove 18 is provided with openings 19 supplying the vacuum necessary to hold the rod-like article 3 in the groove 18. Fig. 3 shows the first transport section 13A unfilled, while all grooves 18 of the second transport section 13B are filled with the rod-like articles 3. The openings 19 supplying the vacuum may be provided in both the first transport section 13A and the second transport section 13B.

[0034] In Fig. 3, looking in the direction of movement T of the transport trolley, the second transport section 13B is situated on the left side and is adapted to make a clockwise rotation R, and the axis of rotation 20 corresponds to the direction of movement T. It is possible to arrange the transport sections reversely, i.e. to situate the second transport section 13B on the right side and to make an anticlockwise rotation. Fig. 4 shows an embodiment of the transport unit 15 in the open configuration, just before changing to the closed configuration, moving in the direction T which is parallel to the path 17, whereas the second transport section 13B is on the right side when looking in the direction of movement T. As shown in Fig. 1, the path 17 is shaped as endless, i.e. the transport units 15 move on a closed path. The transport sections 13A, 13B of the forming and transport unit 15 are adapted to a change of configuration of their reciprocal position during the shift of the transport unit 15 by the forming unit 25. The first section 13A and the second section 13B are rotatably connected on the axis 20 by means of pivots 21, 22. The second transport section 13B is provided with a steering element 23, for example it may be a rotating roller (the steering element 23 is visible in Fig. 5). The steering element 23 is adapted to work with a closing cam 24 of the forming unit 25. The closing cam 24 is designed in such a way that the raceway runs on a cylindrical surface. During the movement of the transport unit 15 in the open configuration, the steering element 23 comes into contact with the raceway 24C of the part 24A of the closing cam 24 and with the raceway 24D of the part 24B, which forces the second transport section 13B to make a rotational movement relative to the first transport section 13A in the direction marked with the arrow L. The steering element 23 moves in the channel 26 formed by the raceways 24C and 24D of the parts 24A and 24B, respectively, of the closing cam 24 as shown in Fig. 5, whereas the movement of the steering

element 23 only on the raceway 24C is sufficient to force the rotation of the second transport section 13B. During the shift of the transport unit 15 by the forming unit 25, the transport section 13B rotates in an accelerated movement so that the force of inertia acting on the rod-like articles 3 presses them against the grooves 18 in order to prevent the rod-like articles 3 from falling out of the grooves 18 during the rotation of the second transport section 13B. In addition, the rod-like articles 3 may be held by the vacuum supplied to the openings 19 through the channels in the body 27 of the transport section 13B. Fig. 6 shows the transport sections 13A, 13B before inserting into the forming unit 25, i.e. before beginning the rotational movement of the second transport section 13B. The closing cam 24 and the steering element 23 are shown diagrammatically with a broken line. Fig. 7 shows transport sections 13A and 13B inside the forming unit 25 during the rotation of the second transport section 13B. As shown in Fig. 5, the inlet opening 28A of the channel 28 for the vacuum is situated in a lengthwise hollow 29 in the cylindrical outer surface 27A of the body 27. During the movement of the transport unit 15 during the rotational movement of the transport section 13B, the hollow 29 together with the outlet opening 28A of the channel 28 directed towards the cylindrical surface 31 are moved before the openings 30 on the cylindrical surface 31 (Fig. 7) which come to the vacuum channel 32. The vacuum channel 32 is situated on the closing cam 24 and runs substantially parallel to the channel 26 in which the steering element 23 is moving, and on the cylindrical surface 31 there are situated several openings 30 which connect the vacuum channel 32 with the cylindrical surface 31 and through which the vacuum is supplied to the hollow 29, and through the channel 28, the chamber 33 and the channels 34 to the openings 19. At the vacuum channel 32 there is situated an inlet 35 to which the vacuum is supplied. The shape of the vacuum channel 32 and the arrangement of the openings 30 corresponding to the course of the channel 26, thus to the path of movement of the channel 28, ensure that the transport section 13B is continuously supplied with the vacuum when making a rotation and shifting the transport unit 15 by the forming unit 25. The vacuum channel 32 having the cylindrical surface 31 is fastened to the stationary closing cam 24. The vacuum channel 32 may be fastened as stationary independently of the closing cam 24.

[0035] Fig. 6a and 7a show an embodiment of the forming unit 25' wherein the forming of the group G takes place after stopping the transport unit 15. An actuator 36 is adapted to rotate the transport section 13B, whereas the vacuum is supplied to the hollow 29 and further to the channel 28 through a vacuum channel 37.

[0036] Fig. 8 shows the transport unit 15 after the second section 13B has made a rotation by 180° after passing through the forming unit 25; the rod-like articles 3, originally forming the single-layer group K, transported in the grooves 18 of the transport sections 13A and 13B, were formed in the group G which comprises two layers of the rod-like articles 3. In the open configuration, the movable transport sections 13A, 13B are situated next to each other (Fig. 6) so that the planes k, k' in which lie the axes of the grooves of both transport sections 13A, 13B overlap. In the closed configuration, the planes k, k' of both transport sections 13A, 13B are situated parallel to each other at a distance equal to about one diameter of the rod-like article 3. Fig. 1 shows one transport section 15 filled with the rod-like articles 3 and situated before the forming unit 25, and one transport unit 15 in which the group G of the rod-like articles 3 is situated behind the forming unit 25.

[0037] The transport trolleys 16 of the forming and transporting apparatus 5 are driven by means of an electric or magnetic drive mechanism which enables the transport units 15 to move independently of one another with different speeds. For this purpose, the Beckhoff's XTS drive may be used. Due to the fact that the transport trolleys 16 move independently of one another, it is possible to situate the transport trolleys 16 as shown in Fig. 2, i.e. so that the transport trays 13, 13' are adjacent to one another and it is possible to transfer the rod-like articles 3 from the drum conveyor 11 to the grooves 18 continuously, i.e. without stopping the drum conveyor 11. The drum conveyor 11 may be adapted to operate in the start-stop mode, may take a position at which the transferring of the single-layer group K begins, wait for pushing of the transport unit 15, and after pushing continue the rotation and the transferring of the rod-like articles 3.

[0038] The section of the path 17 before the forming unit 25 constitutes a buffer 5A, 5A' for the transport units carrying the single-layer groups K of the rod-like articles 3, while the section of the path 17 behind the forming unit 25 constitutes a buffer 5B, 5B' for the transport units 15 carrying two-layer groups G of the rod-like articles 3. In the buffer 5A, 5A' and 5B, 5B' (shown also in Fig. 12 and 13), the space allowing to receive a certain number of the transport units 15 is provided. The number of the transport units which may be accumulated in the buffer allows, on the one hand, a continuous operation of the feeding unit 4, and on the other hand allows conveying the transport units 15 to the area from which the groups G of the rod-like articles 3 are transferred to the conveyor 6 of the groups of rod-like articles. The buffer 5A, 5A' and 5B, 5B' of the transport units 15 is big enough to receive the transport units 15 after stopping the packer 1, and to convey the transport units 15 to the packer 1 during momentary stopping of the feeding unit 4. In the case of a decrease in the efficiency of feeding of the rod-like articles 3 from the feeding unit 4, a decrease in the number of the transport units in the buffer 5A, 5A' and 5B, 5B' will take place, whereas the minimum feeding efficiency of the feeding unit 4 relative to the efficiency of the packer 1 is such that in the buffer 5A, 5A' and 5B, 5B' there are no accumulated groups K, G of the rod-like articles 3. The maximum feeding efficiency of the feeding unit 4 relative to the efficiency of the packer 1 is such that the

buffer 5A, 5A' and 5B, 5B' is completely filled with the groups K, G of the rod-like articles 3. In the course of buffering of the groups K, G the distance among the adjacent transport units 15 and the carried groups K, G is varying (in Fig. 12 variable distances among geometric centres of the groups K, G were shown), whereas the transport units 15 move with variable speeds. In the case of stopping of the feeding unit 4 in one feeding path 2P, 2P' the operation of the packing line may be continued in such a way that the feeding of the packer takes place form one feeding path only, and the packer itself has a temporarily decreased efficiency. Fig. 13 shows a situation where the feeding path 2P feeds the packer 1, whereas momentarily the buffer 5A and 5B is completely filled, and the feeding path 2P' is temporarily shut off, whereas the buffer 5A' and 5B' is empty, and in addition the single-layer flow F3 of the rod-like articles 3 is interrupted before and behind the forming unit 25. In a real embodiment of the feeding apparatus, the buffers 5A, 5A', 5B, 5B' may be considerably longer depending on the required efficiency of the feeding apparatus. Also possible is an embodiment of the feeding apparatus wherein only the buffers 5B, 5B' for the transport units carrying the groups G are used.

[0039] After passing through the forming unit 25, the transport unit 15 is conveyed to the area in which the group G of the rod-like articles 3 may be conveyed to the pockets 40 of the conveyor 6 of the groups of rod-like articles. The pockets 40 are pivotally connected with one another like chain links. Successive transport units 15 carrying the groups G stand one after another as shown in Fig. 1 on both sides of the conveyor 6. Three transport units 15 of the transporting and forming apparatus 5 and three transport units 15' of the transporting and forming apparatus 5' shown in Fig. 9 were stopped so that the groups G of the rod-like articles 3 held in these units may be transferred to six pockets 40 of the conveyor 6, whereas the transfer takes place in a direction perpendicular to the direction of movement T of the transport units 15 and simultaneously in a direction perpendicular to the direction of movement P of the pockets 40. The transport unit 15-1 is situated directly opposite the pocket 40-1, the transport unit 15-2 directly opposite the pocket 40-3, the transport unit 15-4 directly opposite the pocket 40-5. The group G in the transport unit 15-1 will be conveyed to the pocket 40-1 by means of a pushing unit 41-1. The group G in the transport unit 15-2 will be conveyed to the pocket 40-3 by means of the pushing unit 41-3. The group G in the transport unit 15-4 will be conveyed to the pocket 40-5 by means of the pushing unit 41-5. In the transport unit 15-3, there is the group G containing defective rod-like articles 3. The group G will be pushed out of the transport unit 15-3 by means of the pushing unit 41-4, whereas an individual pusher 43 of the pushing unit 41-4 and 41-2 is shorter than an individual pusher 42 of the pushing unit 41-1, 41-3, 41-5, and the group G-1 pushed out of the transport unit 15-3 is not placed into the pocket 40-4. The transport unit 15'-1 is situated directly opposite the pocket 40-2, the transport unit 15'-2 directly opposite the pocket 40-4, the transport unit 15'-3 directly opposite the pocket 40-6. The group G in the transport unit 15'-1 will be conveyed to the pocket 40-2 by means of the pushing unit 41'-1. The group G in the transport unit 15'-2 will be conveyed to the pocket 40-4 by means of the pushing unit 41'-3. The group G in the transport unit 15'-3 will be conveyed to the pocket 40-6 by means of the pushing unit 41'-5. After positioning the transport units 15, 15' carrying the groups G and after stopping the conveyor 6 of the groups G so that the transport units 15, 15' are situated directly opposite the empty pockets 40 of the conveyor 6, the transferring unit 7 and 7' is activated. The transferring unit 7 transfers the groups G from the forming and transporting apparatus 5, and the transferring unit 7' transfers the groups G from the forming and transporting apparatus 5'. Fig. 10 shows the transferring units 7, 7' after conveying six groups G to the pockets 40 of the conveyor 6, while the group G-1 containing defective rod-like articles will fall down into an unshown container and will not be fed to the packing apparatus 1. In Fig. 9 and 10, the drives of the transferring units 7, 7' were not shown. The transferring of the groups G of rod-like articles may take place in the start-stop operation, the transferring unit may be also adapted to transfer the groups G continuously to the conveyor 6 moving with a constant speed. After conveying the groups G to the pockets 40 of the conveyor 6, the transport units 15 move further on the path 17, and their transport sections 13A, 13B are in the closed configuration. The transport sections 13A, 13B will be switched from the closed configuration to the open configuration after shifting by an opening unit 53 (Fig. 1) which is provided with an opening cam 54 which will force a rotation of the steering element 23, thus a movement of the transport section 13B. The action of the opening unit 53 is opposite to the action of the forming unit 25. The opening unit 53 may be situated both at the lower section of the path 17 as shown in Fig. 1 and at the upper section of the path 17, i.e. behind the transferring unit 7, 7' of before the feeding unit 4, 4'.

[0040] Each of the forming and transporting apparatuses 5, 5' is provided with sensors 50 to check the transported rod-like articles 3 transversely to the axis of such articles. The sensors 50 are adapted to receive the radiation passing through the rod-like articles 3 and are situated above the path 17; the not shown sources of radiation are situated beneath the path 17. Furthermore, the forming and transporting apparatus 5, 5' is provided with sensors 51, 52 to check the quality of tips of the rod-like articles 3. The sensors 51, 52 are situated on both sides of the path 17, 17'. If defective rod-like articles 3 in the groups G are detected, it is possible to reject such group as described above.

[0041] The monitoring of the quality of the rod-like articles 3 by means of the sensors 50 takes place in the area of the single-layer flow F3. The sensor 50 may use the electromagnetic radiation, for example visible, microwave, X-ray radiation. As discussed above, it is possible

to reject whole groups G of the rod-like articles 3. On the production line shown in Fig. 12, in the area of single-layer flow F3, apart from the sensor 50 there is situated a rejecting unit 55 for rejecting the rod-like articles 3, and a refilling unit 56 for refilling the flow in the spaces after rejected defective articles. The rejecting unit 55 may comprise mechanical elements for pushing out the rod-like articles 3 or compressed air nozzles for pneumatic rejection, whereas two rod-like articles situated coaxially in the transport sections 13A and 13B will be simultaneously rejected. The refilling unit 56 may comprise a drum conveyor rotating in accordance with the speed of the flow F3 so as to refill the occurring gaps.

[0042] The transport units 15 move independently of one another, as a result the distances among geometric centres of the single-layer groups K and the groups G are variable during the movement between the feeding unit 4 and the packer 2. As shown in Fig. 12, the adjacent groups K on the drum conveyor 11 are situated at the distance d1, after transferring the groups K to the transport units 15 the distance among the adjacent groups K is increased to the distance d2, and then to d3. In the buffer 5, 5', the adjacent groups G are kept a the distance d4, in the group G transferring area, on the conveyor 6 and in the packer the distance d5 is kept, whereas the distance d5 differs from the distance d1.

[0043] The transport pockets 40 of the conveyor 6 are moved to the packing apparatus 1. The transport pockets 40 are placed onto a transport wheel 60 (Fig. 11). The conveyor 6 and the transport wheel 60 make a rotational movement by leaps. The transport wheel 60 stops when for example three filled transport pockets 40 are situated directly opposite the packing channels 61. The pushers 62 push the groups G of the rod-like articles 3 from the transport pockets 40 to the packing channels 61. After pushing the groups G of the rod-like articles 3, the transport wheel 60 makes a rotation by a determined angle so that the successive three filled transport pockets 40 will be situated directly opposite the packing channels 61. An embodiment of the packer which is adapted to receive individual groups G of the rod-like articles is also possible.

[0044] In the feeding apparatus according to the invention, the feeding unit 4 operates continuously, while the feeding of the groups G of the rod-like articles 3 to the packing apparatus 1 takes place in a start-stop cycle after stopping the conveyor 6, whereas it is possible to carry out the group G feeding process in such a way that the feeding unit also operates in a start-stop cycle. The operation in a start-stop cycle is understood as a typical operating cycle of the packer, namely stopping the mechanism receiving a group or groups of rod-like articles, and after transferring the group or the groups of articles the feeding apparatus and the receiving mechanism of the packer make a movement following which it will be possible to transfer and receive a next group or groups of articles. It is possible to carry out the process in such a way that the feeding of the groups G takes place continuously, i.e. without stopping the packing apparatus and during the movement of the conveyor.

[0045] Fig. 14 shows a third embodiment of the feeding apparatus wherein the double-length rod-like articles 3D are fed by the feeding unit 4, 4' onto the trays 13 of the transport units 15. Similarly to the embodiment shown in Fig. 1, the transport units 15 are moved independently of one another. The container 8 of the feeding unit together with the transport units 15 constitute an apparatus for converting the mass flow MF of the rod-like articles 3D into a single-layer stream F3D of such articles. Above the path of movement of the transport units 15 there is situated a circular knife 12 which cuts the double-length rod-like articles 3D into individual rod-like articles 3. The circular knife 12 together with the transport units 15 constitute an apparatus for converting a single-layer flow of the double-length rod-like articles 3D into a single layer flow of the rod-like articles 3.

[0046] Fig. 15 shows a fourth embodiment of the feeding apparatus which, like the feeding apparatuses in preceding embodiments, has two feeding paths between which the conveyor 6 of groups of the rod-like articles 3 is situated. The feeding unit 4, 4' is built similarly to the apparatus of Fig. 1. The conversion of the mass flow MF into a single-layer flow F3D of the double-length rod-like articles 3D and the conversion of a single-layer stream F3D of the double-length rod-like articles 3D into a single-layer flow F3 of the rod-like articles 3 is accomplished in a similar way. The single-layer flow F3 of the rod-like articles 3 is transferred onto a chain conveyor 70, 70' provided at its length with grooves into which the rod-like articles 3 are placed. The conveyor 70, 70' is adapted to convey the single-layer stream F3, whereas for this purpose in each conveyor 70, 70' respectively two chains 71, 71' are used. A grooved belt conveyor may also be used to convey the single-layer stream F3 of the rod-like articles 3. As shown in Fig. 16, the apparatus 50 for monitoring the quality of the rod-like articles and the apparatus 55 for rejecting the rod-like articles are situated at the horizontal section of the conveyor 70, 70', whereas such apparatuses may be situated at another point of the single-layer stream F3 of the rod-like articles 3. Also at the horizontal section of the conveyor 70, 70', there is situated the apparatus 56 for refilling gaps in the stream F3 after rejected defective rod-like articles 3. An additional monitoring apparatus 57 is situated at the vertical section of the conveyor 70, 70'. The transferring of the rod-like articles 3 takes place in such a way that a slat 72 pushes the rod-like articles 3 out of the grooves of the conveyor 70, 70' so as to place them into the grooves of the tray on the transport unit 15. If it is not possible to refill a gap after a defective rod-like article, there is the possibility of momentary stopping of the transport unit 15 so as to fill all grooves 18 of the transport sections 13A and 13B.

Claims

1. A method of feeding a packer for rod-like articles of the tobacco industry comprising steps wherein:

   double-length rod-like articles (3D) are supplied in the form of mass flows (MF) for two feeding paths (2P, 2P') of a feeding apparatus, whereas in the feeding paths (2P, 2P'):

   the mass flow (MF) of the double-length rod-like articles (3D) is converted into a single-layer mass flow (F3D) of the double-length rod-like articles (3D) so that the rod-like articles (3D) in the single-layer stream (F3D) form single-layer groups (KD) of the double-length rod-like articles (3D),
   the double-length rod-like articles (3D) are cut into two individual rod-like articles (3) and the single-layer stream (F3D) of the double-length rod-like articles (3D) is converted into a single-layer stream (F3) of the rod-like articles (3) comprising single-layer groups (K) of the rod-like articles (3);
   the stream (F3) of the rod-like articles (3) is conveyed in a forming and transporting apparatus (5, 5'),
   a two-layer group (G) of rod-like articles (3) is formed from the rod-like articles (3) of the single-layer group (K) of rod-like articles (3) in a forming unit (25) of the forming and transporting apparatus (5, 5'), then

   the two-layer group (G) of the rod-like articles (3) is transferred from the forming and transporting apparatus (5, 5') to a conveyor (6) of two-layer groups (G) of rod-like articles, whereas the groups (G) of the rod-like articles (3) are transferred from two feeding paths (2P, 2P'),
   the group (G) of the rod-like articles (3) is transferred from the conveyor (6) of two-layer groups (G) of rod-like articles (3) to the packer (1),
   characterised in that
   in the step of conveying the groups (K, G) of rod-like articles (3) to the conveyor (6), the groups (K, G) of the rod-like articles (3) are buffered in the buffer (5A, 5A', 5B, 5B') of the forming and transporting apparatus (5, 5') so that the distance among the adjacent groups (K, G) of the rod-like articles (3) is varied.

2. The method as in claim 1, **characterised in that** additionally the quality of the rod-like articles (3) in the groups (K, G) is monitored and defective rod-like articles (3) in the groups (K, G) are rejected.

3. The method as in claim 2, **characterised in that** the single-layer flow (F3) of the rod-like articles (3) is refilled after rejecting defective rod-like articles (3) from the groups (K).

4. The method as in claim 1, **characterised in that** in the case of stopping one feeding path (2P, 2P') the packer (1) is slowed down and the packer (1) is fed from the second feeding path (2P, 2P').

5. The method as in any of the preceding claims 1 to 4, **characterised in that** the mass flow (MF) of the double-length rod-like articles (3D) is continuously converted into a single-layer flow (F3D).

6. The method as in any of the preceding claims 1 to 5, **characterised in that** the groups (G) of the rod-like articles (3) are transferred from the conveyor (6) to the packer (1) in a start-stop cycle.

7. A feeding apparatus for feeding a group (G) of rod-like articles (3) to the packer (1) of rod-like articles, comprising
   two feeding paths (2P, 2P') for supplying the rod-like articles to a conveyor (6) situated between the feeding paths (2P, 2P'), whereas the
   feeding path (2P, 2P') comprises:

   a feeding apparatus (4, 4') for feeding double-length rod-like articles (3D) having a channel (8A) for a mass flow (MF) of the double-length rod-like articles (3D) and a container (8) for the double-length rod-like articles (3D),
   an apparatus (4A) for converting the mass flow (MF) of the double-length rod-like articles (3D) into a single-layer stream (F3D) of the double-length articles (3D) so that the double-length rod-like articles (3D) in the single-layer stream (F3D) form single-layer groups (KD),
   a cutting apparatus (4B) for converting the single-layer stream (F3D) of the double-length rod-like articles (3D) into a single-layer stream (F3) of the rod-like articles (3) comprising single-layer groups (K) of the rod-like articles (3),
   a forming and transporting apparatus (5, 5') provided with transport units (15) for conveying the rod-like articles (3) in the single-layer groups (K) and the two-layer groups (G) of rod-like articles (3) as well as forming units (25) for forming the two-layer groups (G) of rod-like articles (3), whereas the forming and transporting apparatus (5, 5') is adapted to vary the distance between the transport units (15), and

   a transferring unit (7) adapted to transfer a group (G) of rod-like articles (3) from the forming and transporting apparatus (5, 5') to the conveyor (6) of the two-layer groups (G) of rod-like articles (3) from two feeding paths (2P, 2P'), and in addition
   the conveyor (6) of the groups (G) of rod-like articles

(3) is adapted to feed the groups (G) of rod-like articles (3) to the packer (1)
characterised in that
the forming and transporting apparatus (5, 5') is adapted to buffer the groups (K, G) of rod-like articles in a buffer (5A, 5A, 5B, 5B') so that the distance among the adjacent transport units (15) carrying the groups (K, G) of rod-like articles (3) is variable.

8. The feeding apparatus as in claim 7 **characterised by** additionally comprising a sensor (50) for monitoring the quality of the rod-like articles (3) in the groups (K, G), and a rejecting apparatus for rejecting defective rod-like articles (3) in the groups (K, G).

9. The feeding apparatus as in claim 7 or 8 **characterised in that** the feeding path (2P, 2P') is provided with an apparatus (56) for refilling the single-layer flow (F3) of the rod-like articles (3) in the groups (K).

10. The feeding apparatus as in any of the preceding claims 7 or 8 or 9 **characterised in that** the apparatus (4A) for converting the mass flow into a single-layer flow comprises a drum conveyor (11).

11. The feeding apparatus as in any of the preceding claims 7 to 10 **characterised by** being provided with a conveyor (70, 70') for conveying the single-layer stream (F3) of the rod-like articles (3), in particular a chain conveyor or a belt conveyor.

12. The feeding apparatus as in any of the preceding claims 7 to 11 **characterised in that** the buffer (5A, 5A', 5B, 5B') is adapted to receive a variable quantity of the transport units (15).

13. The feeding apparatus as in any of the claims 7 to 12 **characterised in that** the distance (d1) among the successive groups (K) in the feeding unit (4) is different from the distance (d5) among the transport units (15) conveying the two-layer groups (G) fed by the feeding unit to the packer (1).

14. The feeding apparatus as in any of the claims 7 to 14 **characterised in that** the quantity of the groups (K, G) of the rod-like articles in the paths (2P, 2P') is variable.

15. The feeding apparatus as in claim 7 to 15 **characterised by** being adapted to feed the packer (1) from one of two feeding paths (2P, 2P').

16. The feeding apparatus as in any of the preceding claims 7 to 15 **characterised in that** the apparatus (4A) for converting the mass flow (MF) of the double-length rod-like articles (3D) into a single-layer stream (F3D) of the double-length articles (3D) is adapted to a continuous operation.

17. The feeding apparatus as in any of the preceding claims 7 to 16 **characterised in that** the conveyor (6) of the groups (G) of rod-like articles (3) is adapted to feed the groups (G) of rod-like articles (3) to the packer (1) and to operate in a start-stop cycle.

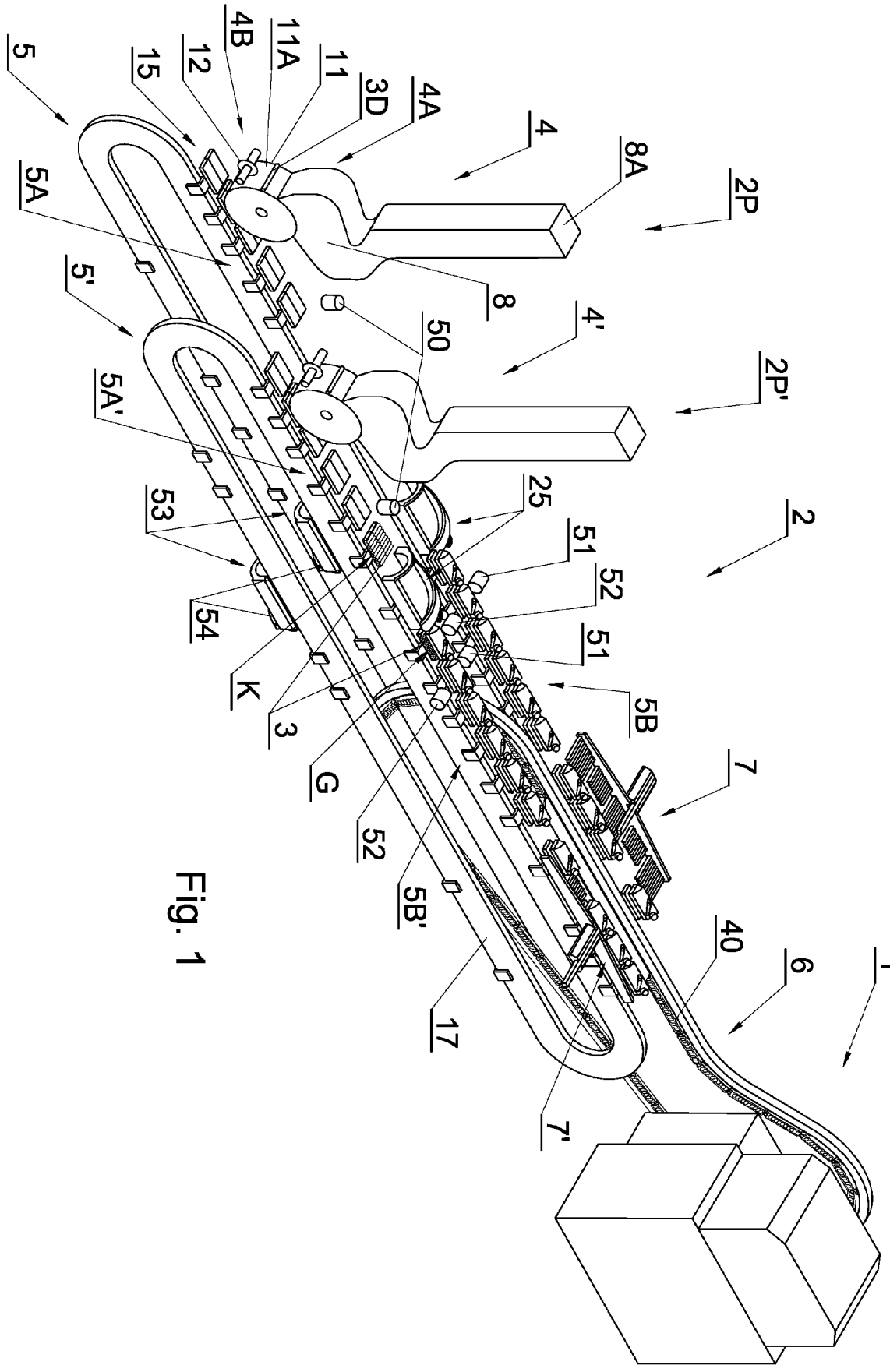
5
4B
11A
11
12
15
3D
4A
4
8A
2P
5A
5'
8
50
4'
2P'
5A'
25
53
2
51
52
54
51
K
5B
3
7
G
52
5B'
40
6
1
17
7'

Fig. 1

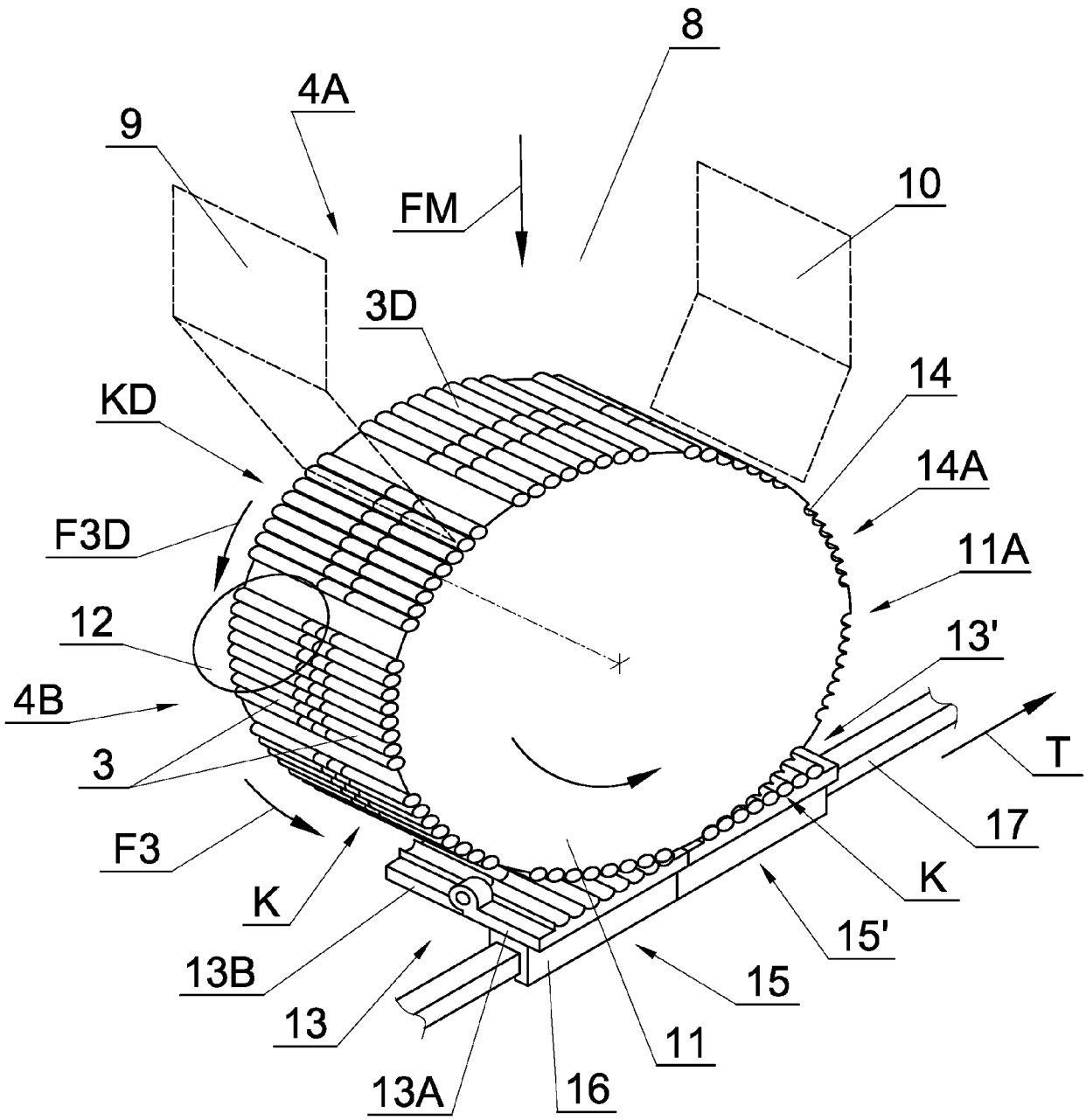
8
4A
9
FM
10
3D
14
KD
14A
F3D
11A
12
13'
4B
T
3
17
F3
K
K
15'
13B
15
13
11
13A
16

Fig. 2

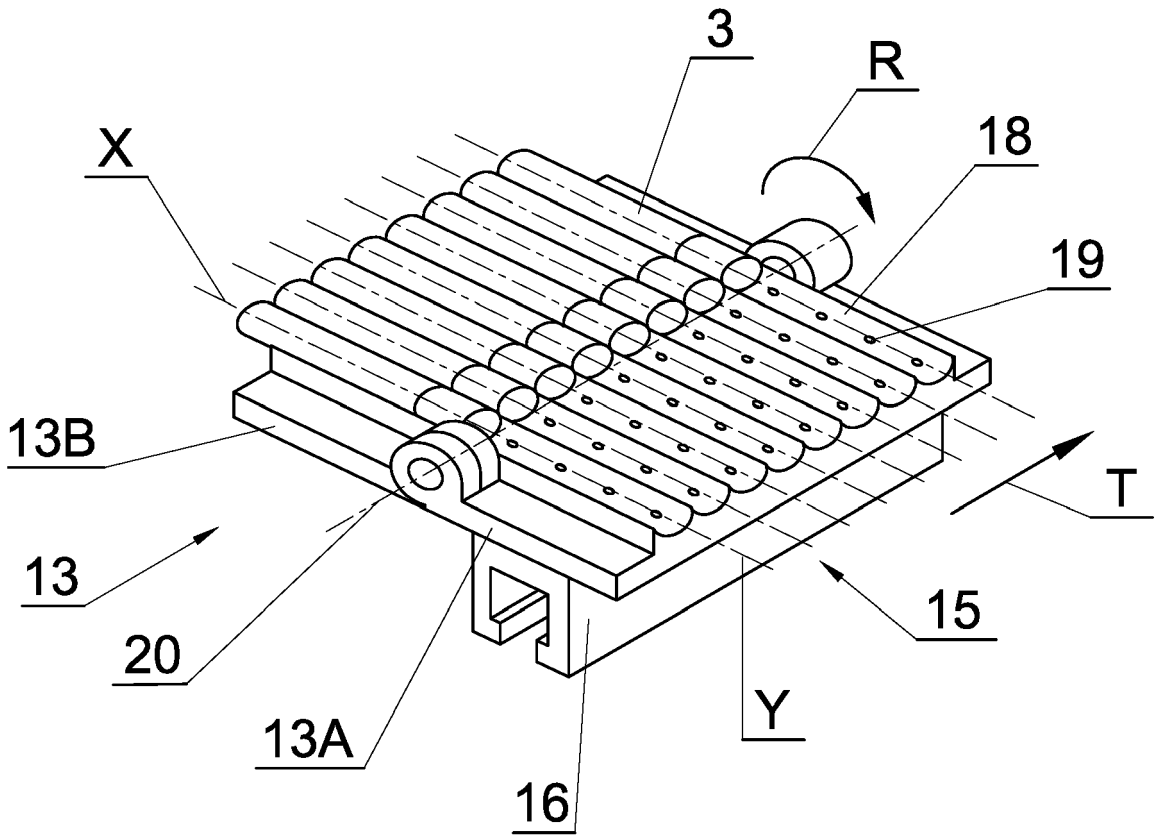

Fig. 3

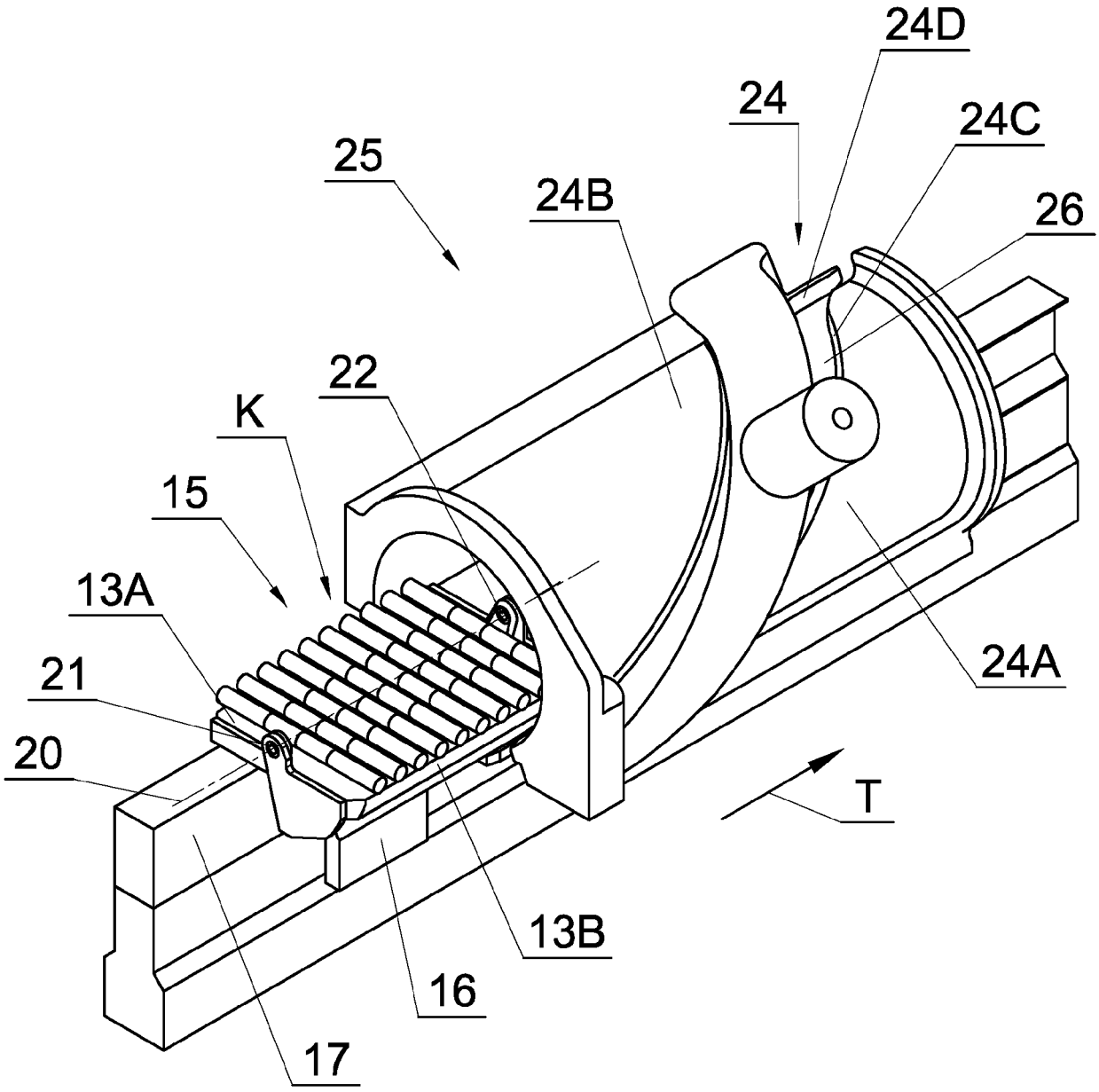

Fig. 4

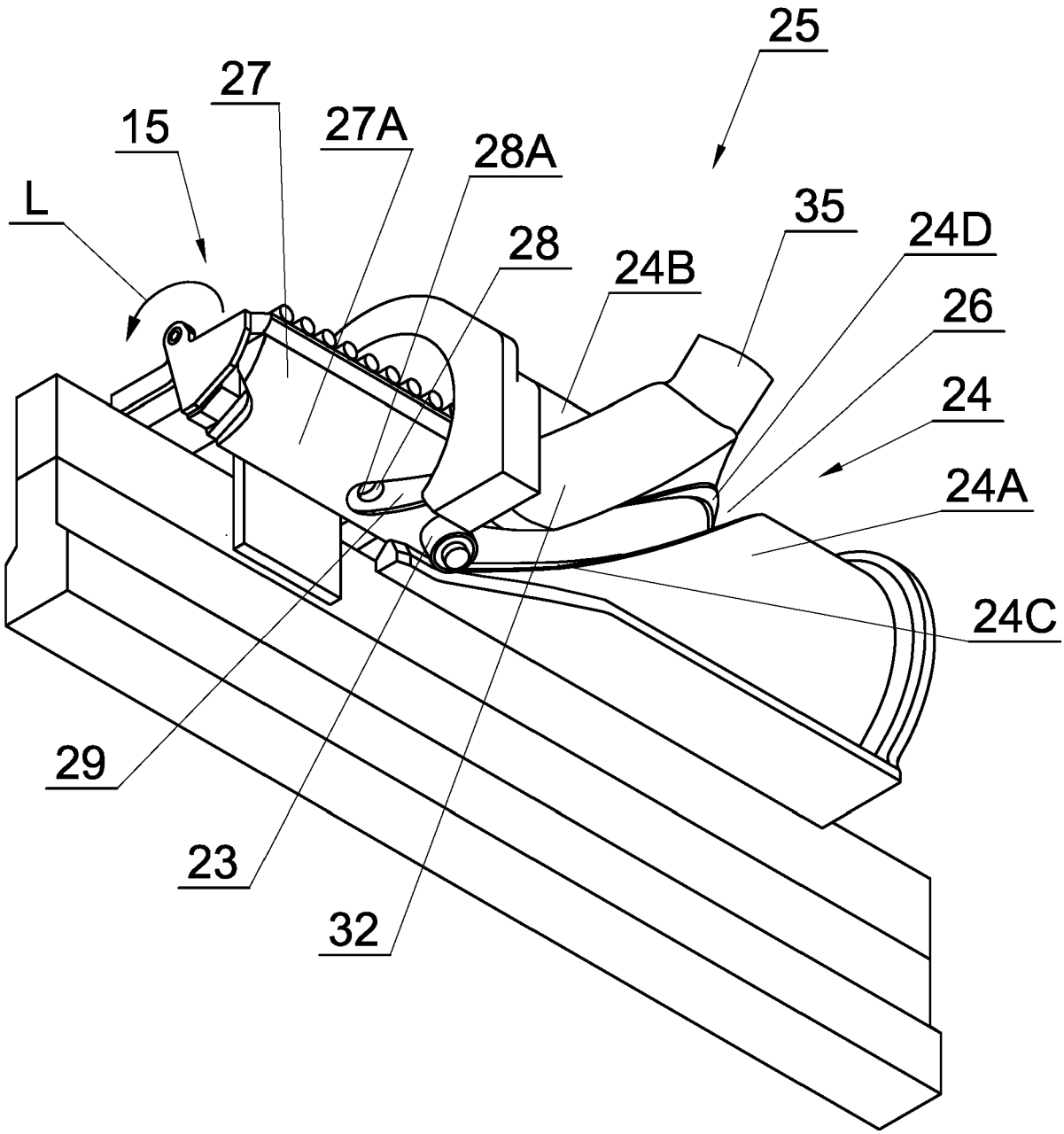

Fig. 5

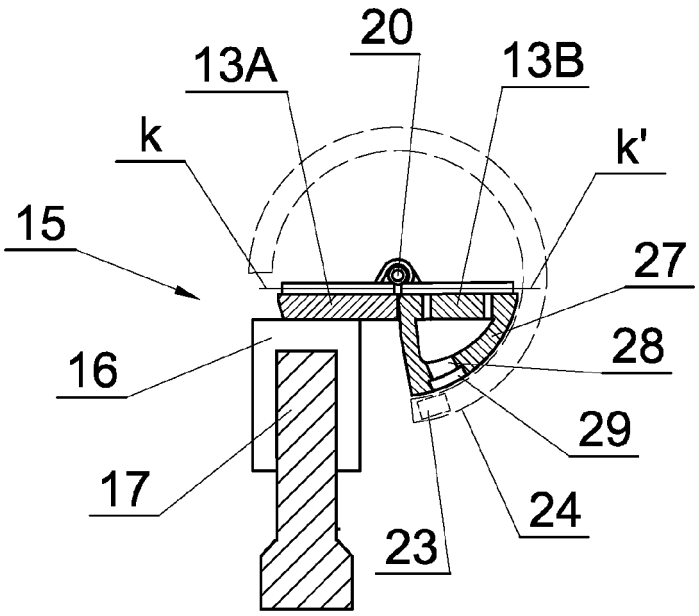
20
13A
13B
k
k'
15
27
28
16
29
17
24
23

Fig. 6

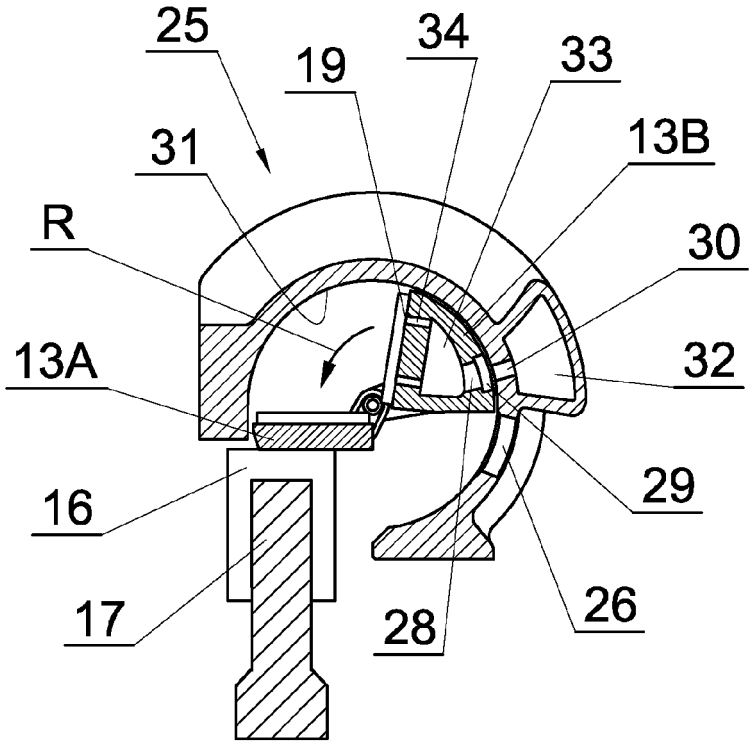
25
19
34
33
31
13B
R
30
13A
32
29
16
17
28
26

Fig. 7

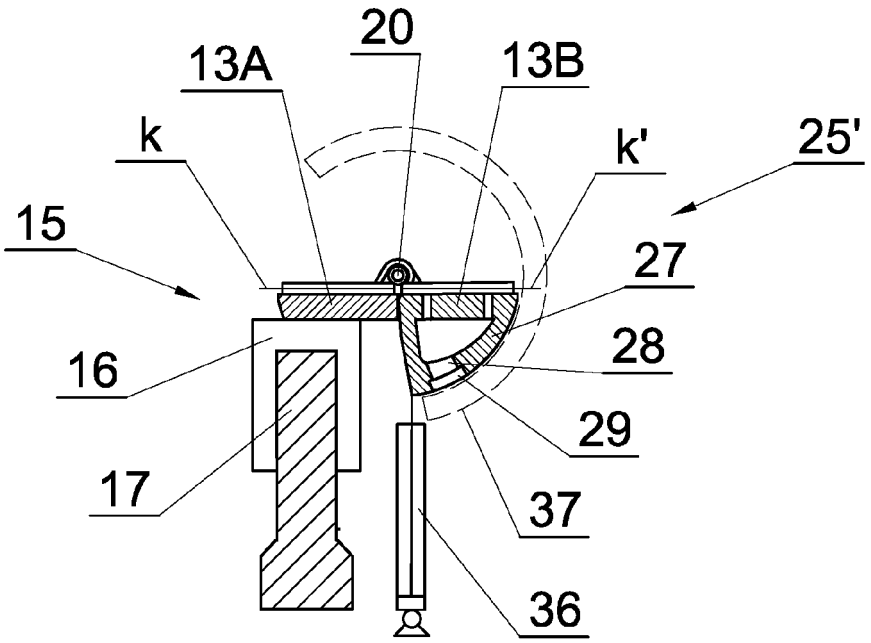
20
13A
13B
k
k'
25'
15
27
28
16
29
17
37
36

Fig. 6a

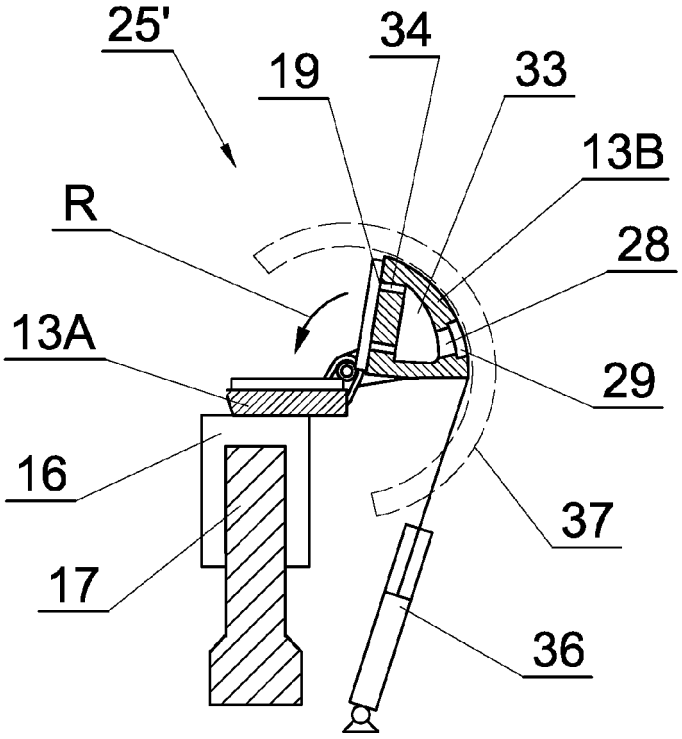
25'
34
19
33
13B
R
28
13A
29
16
37
17
36

Fig. 7a

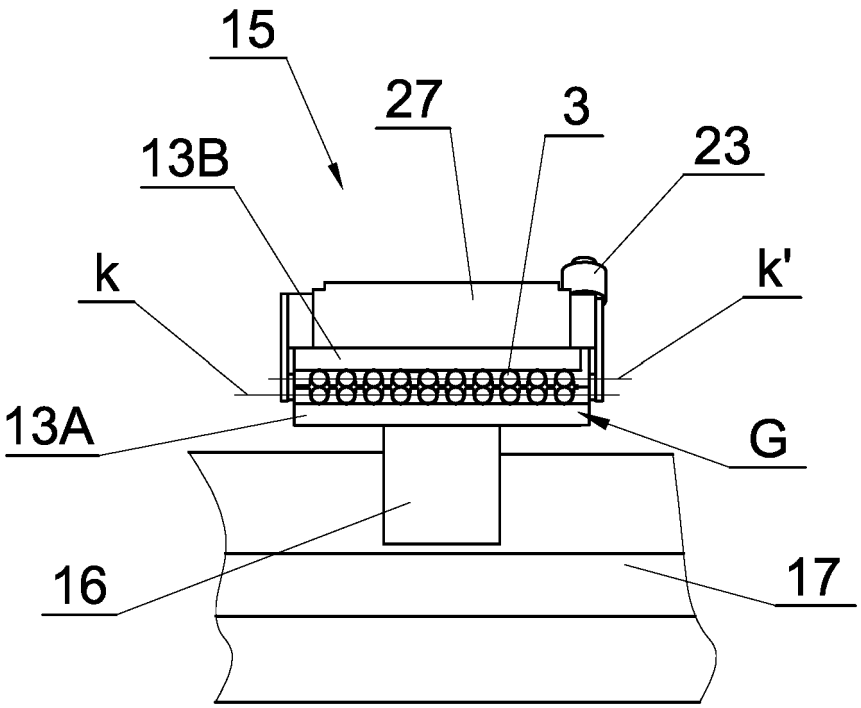

Fig. 8

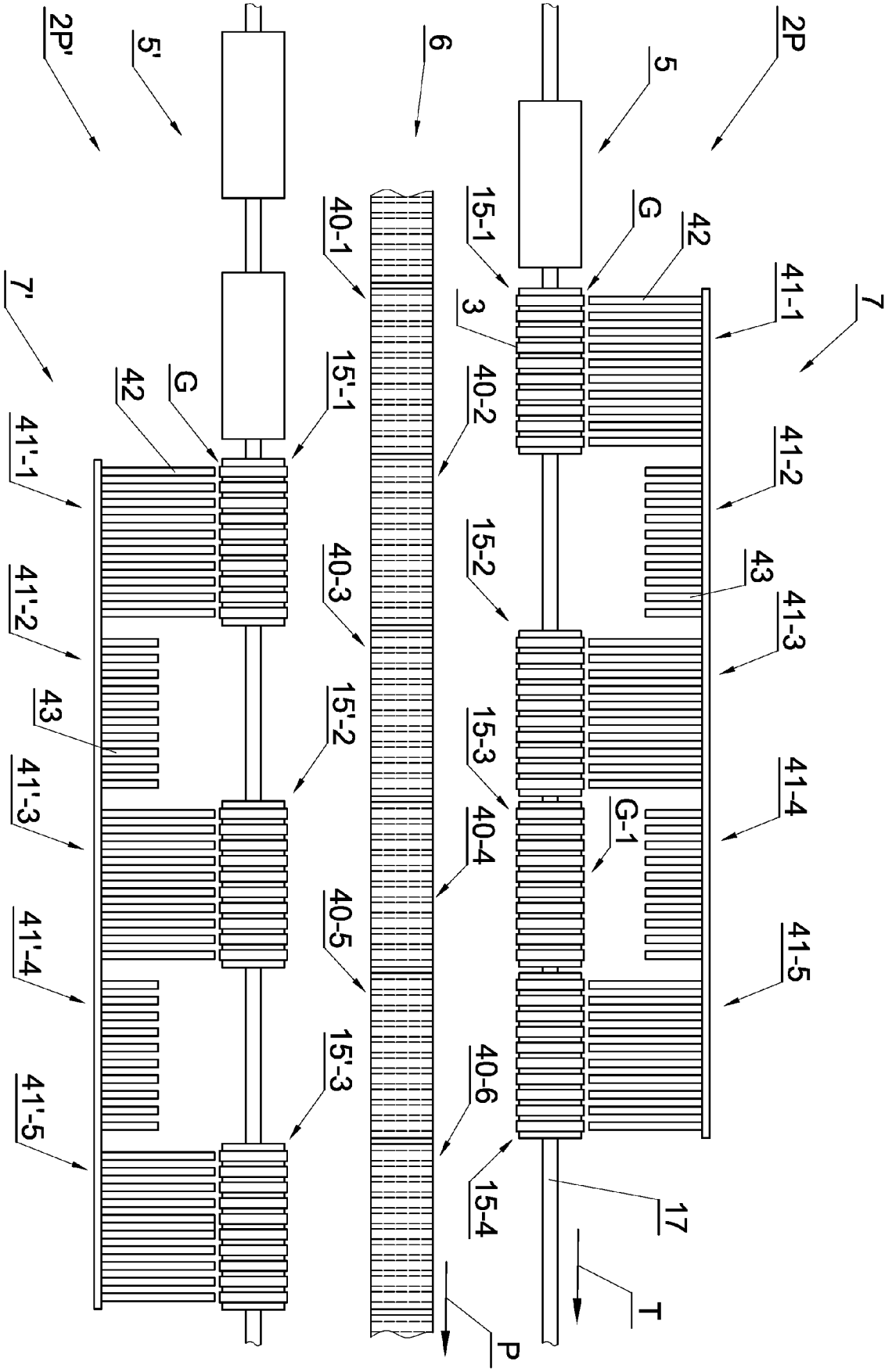
2P
5
6
2P'
5'
7
7'
G
42
41-1
41-2
41-3
41-4
41-5
43
3
15-1
15-2
15-3
15-4
40-1
40-2
40-3
40-4
40-5
40-6
G-1
17
T
P
15'-1
15'-2
15'-3
41'-1
41'-2
41'-3
41'-4
41'-5

Fig. 9

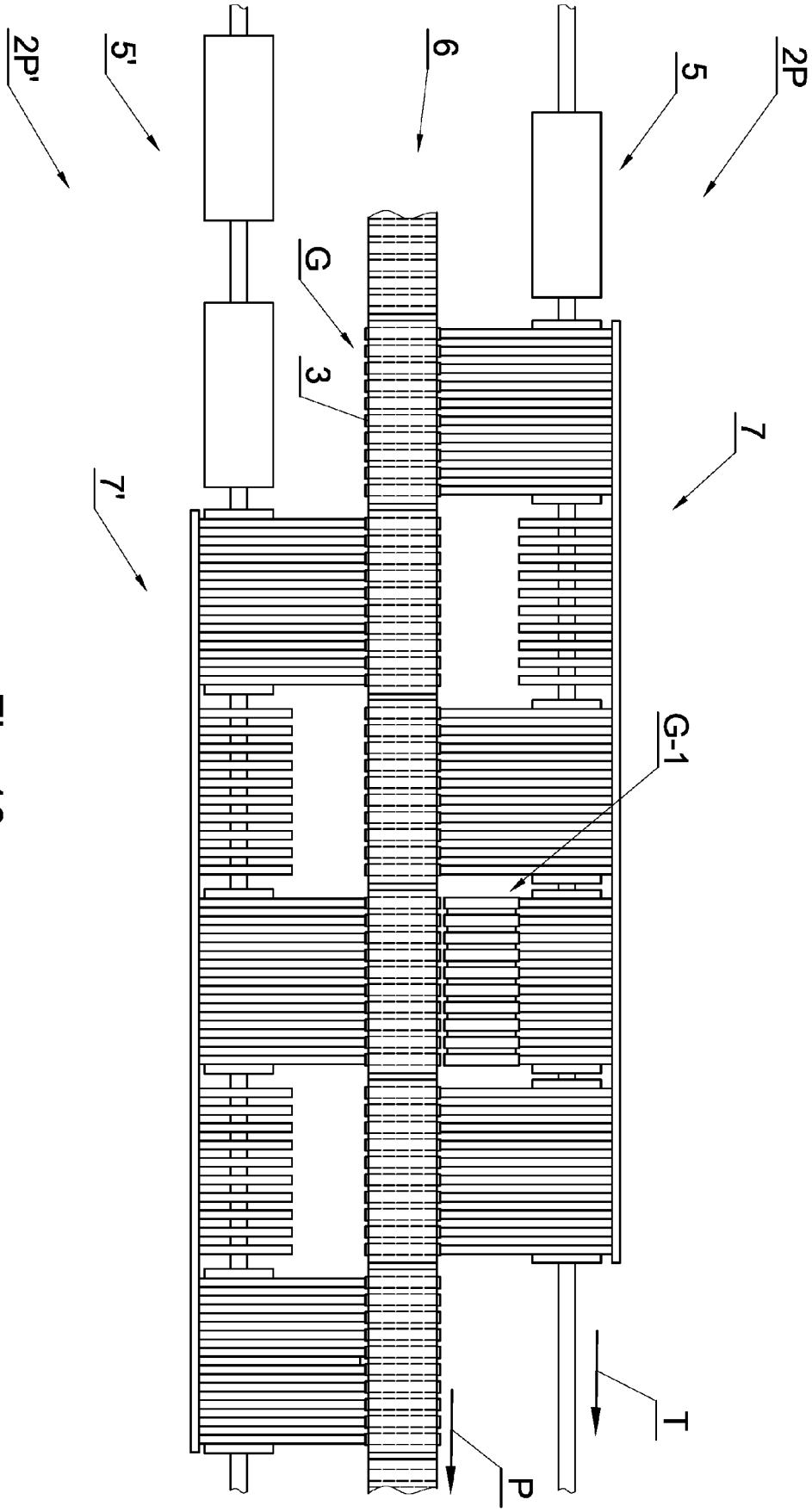

Fig. 10

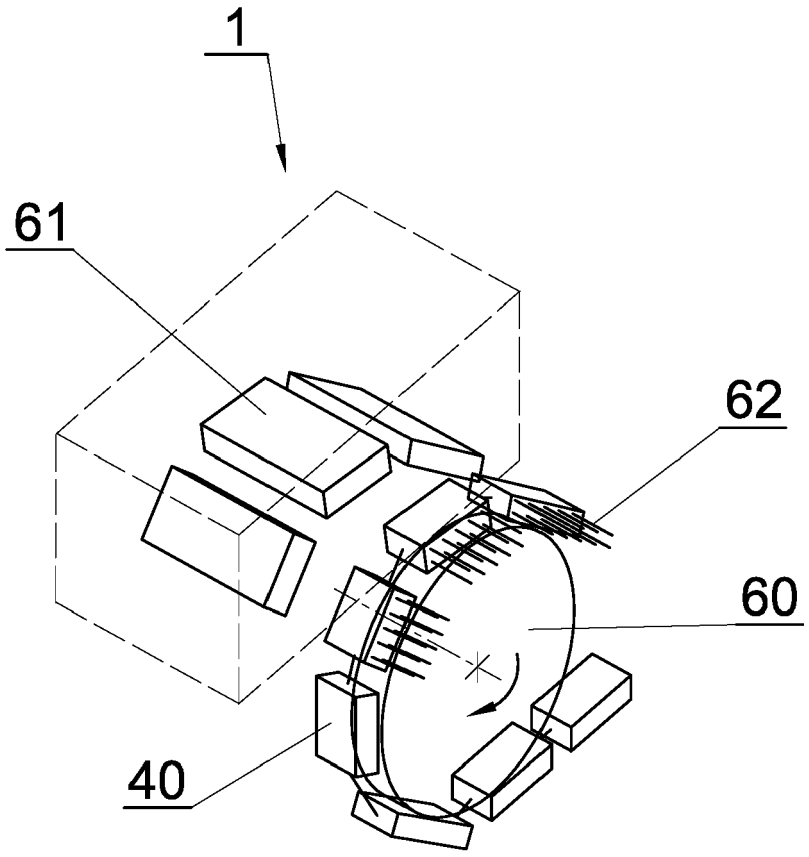

Fig. 11

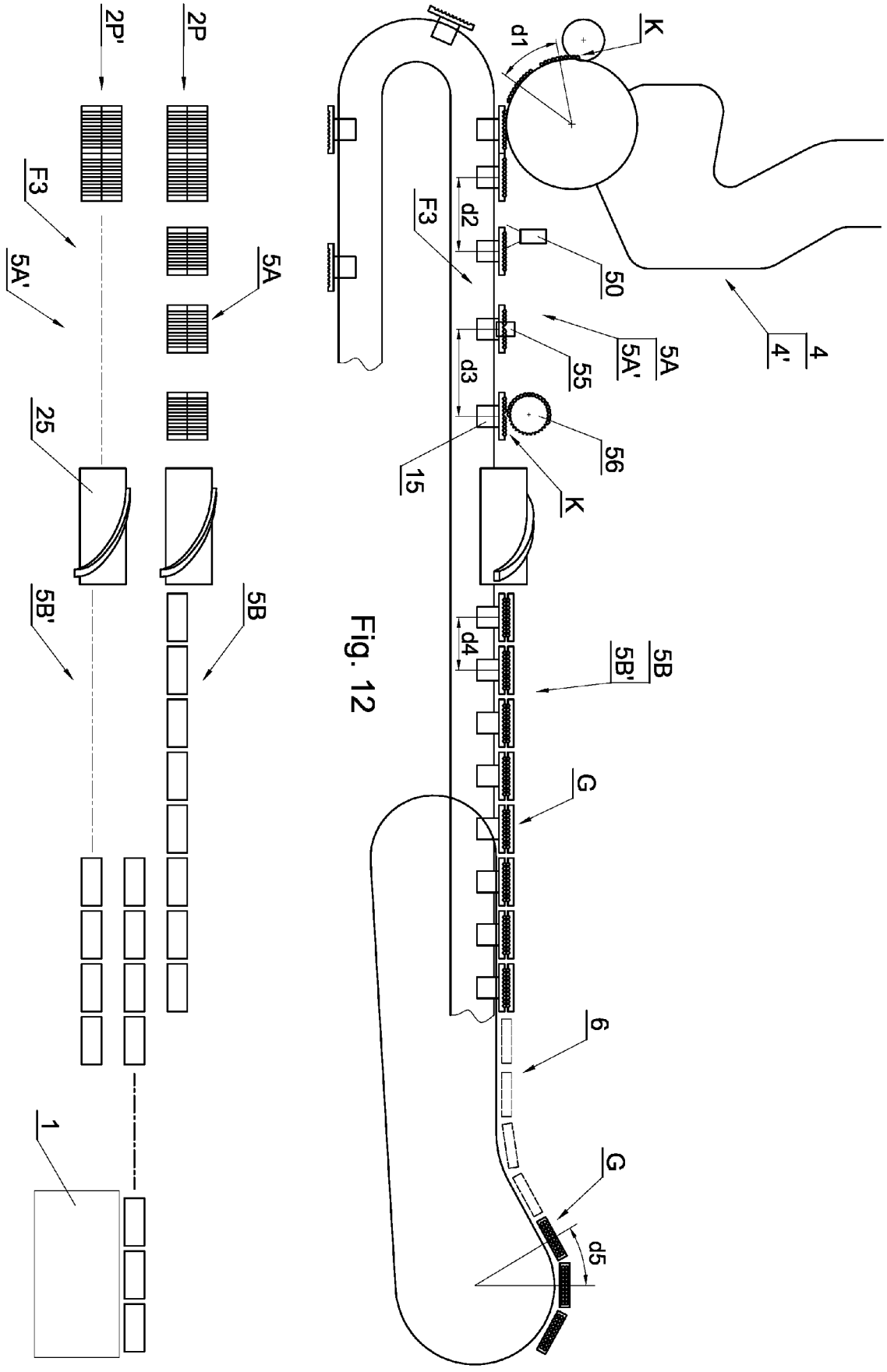
K
d1
F3
d2
50
5A
5A'
55
4
4'
d3
56
15
K
d4
5B
5B'
G
6
G
d5

Fig. 12

2P'
2P
F3
5A'
5A
25
5B'
5B
1

Fig. 13

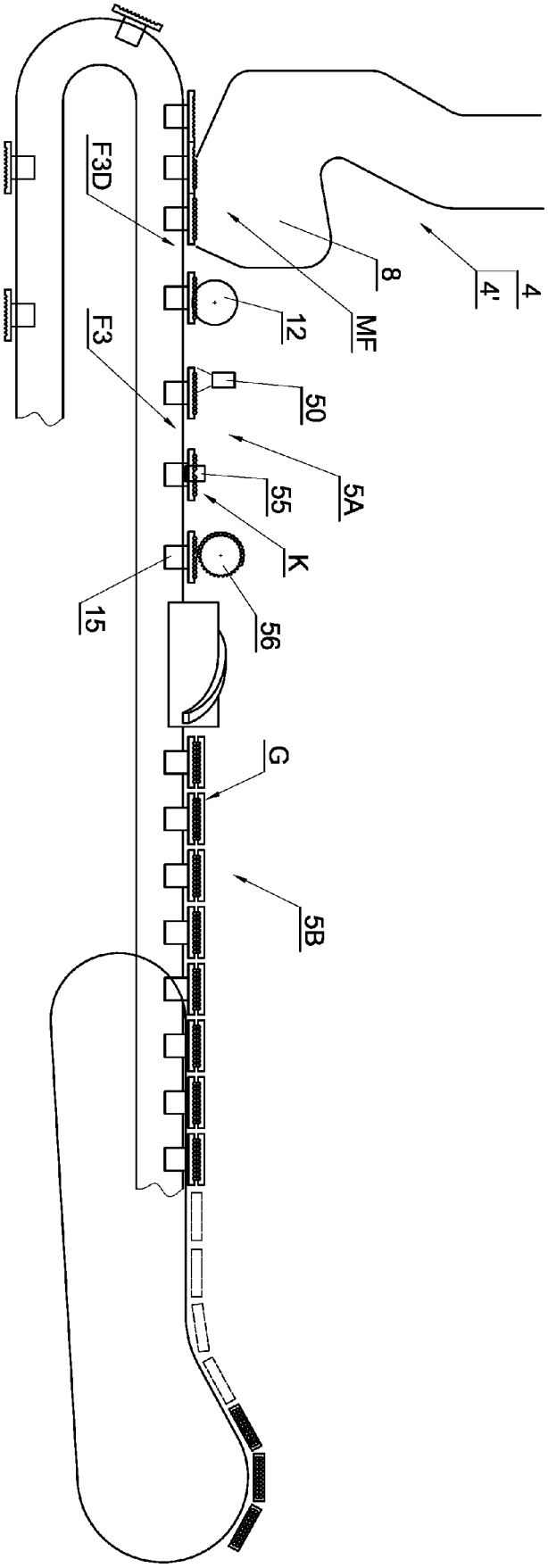

Fig. 14

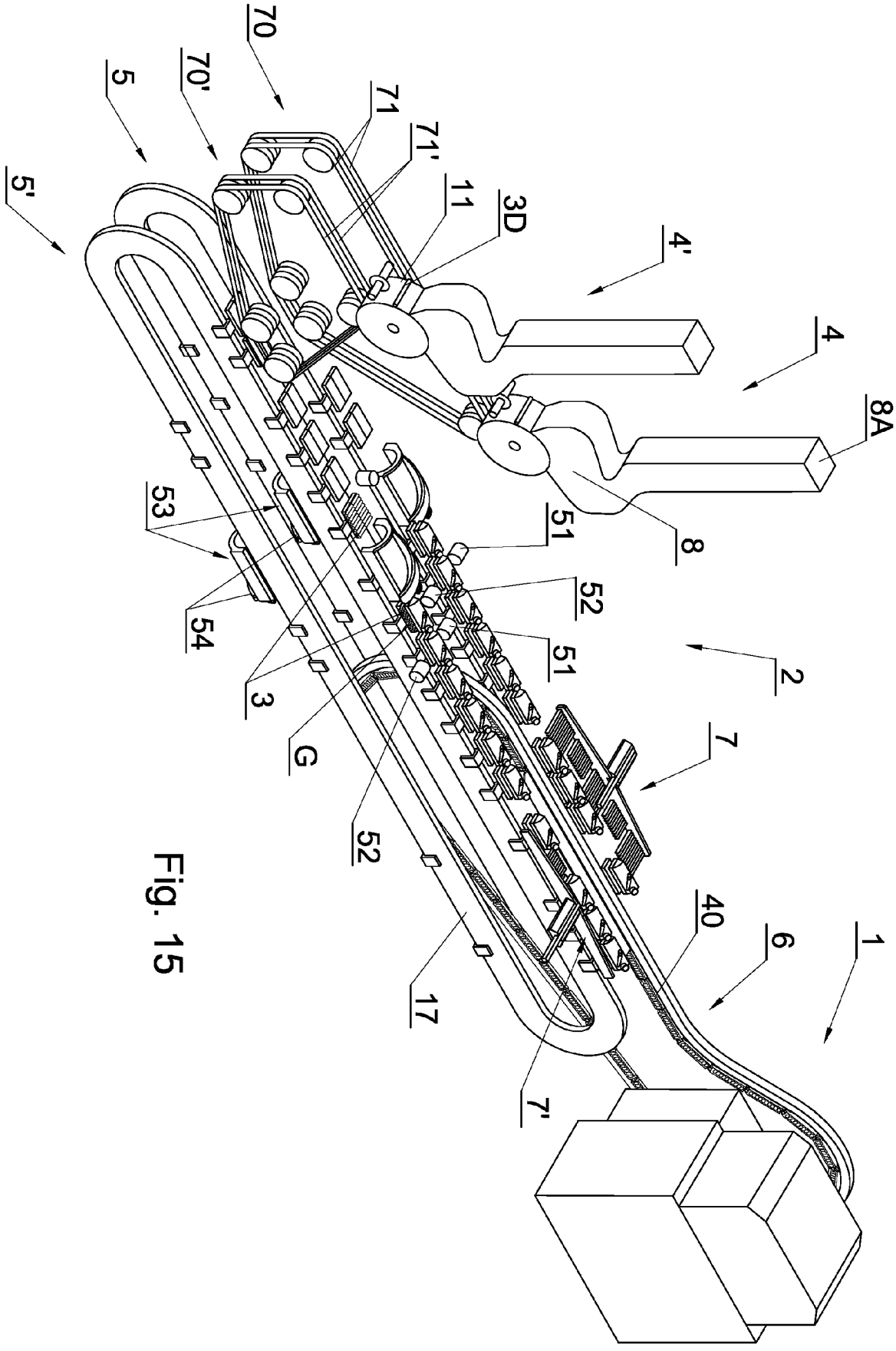

Fig. 15

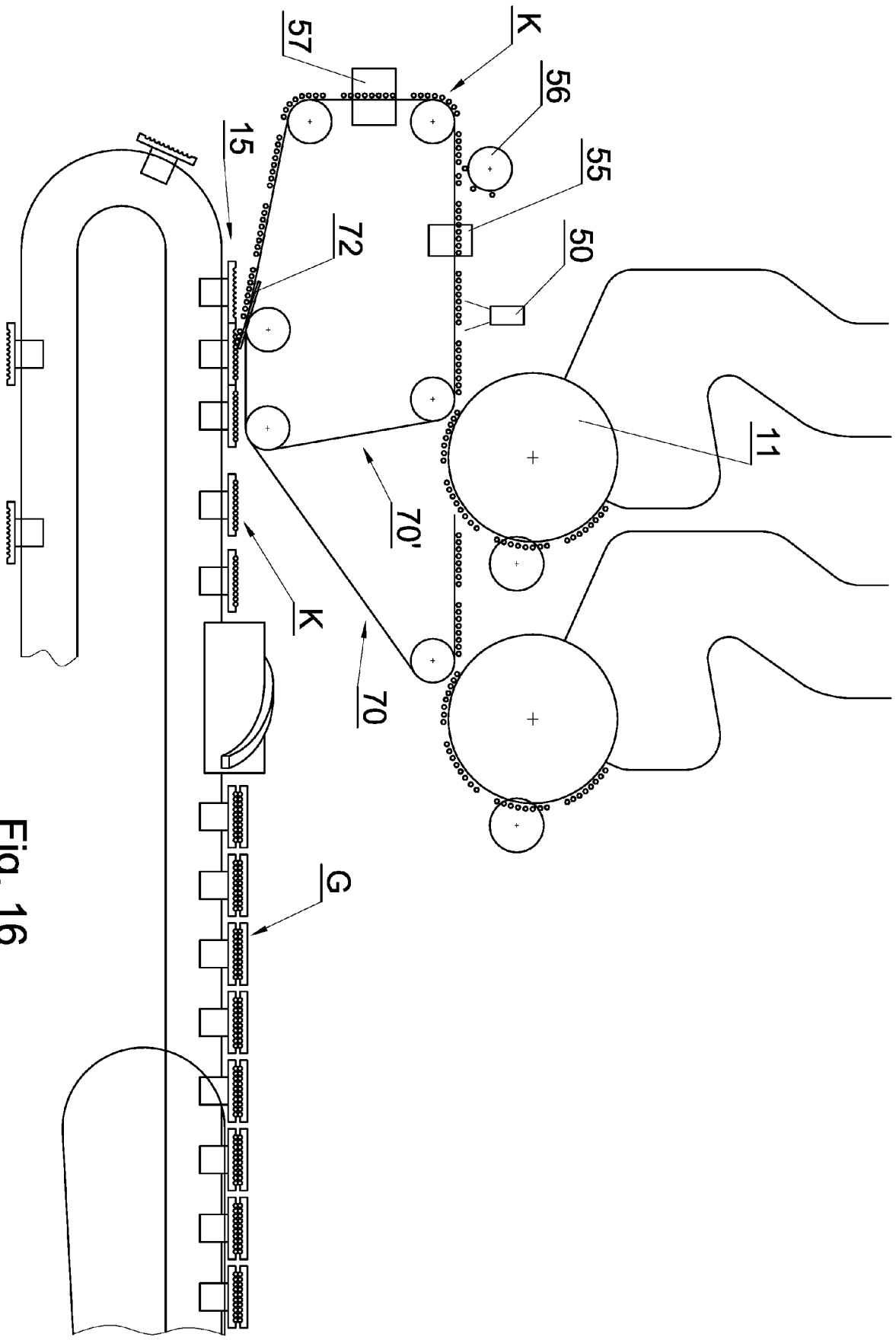

Fig. 16

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EUROPEAN SEARCH REPORT

Application Number
EP 19 16 1680

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 10 14 011 B (HAUNI WERKE KOERBER & CO KG) 14 August 1957 (1957-08-14) * column 1, line 50 - column 3, line 19; figures *	1-17	INV. A24C5/33 A24C5/34 A24C5/35 B65B19/10
A	LU 42 309 A1 (HAUNI-WERKE KÖRBER [DE]) 5 November 1962 (1962-11-05) * page 7 - page 9; figures *	1-17	B65B19/04
A,D	GB 1 015 562 A (ZD Y V I PLZEN) 5 January 1966 (1966-01-05) * page 2, line 8 - line 43; claims; figures *	1-17	
A	GB 2 051 552 A (MOLINS LTD) 21 January 1981 (1981-01-21) * page 2, line 47 - page 3, line 97; claims; figures *	1-17	
A,D	US 2012/090954 A1 (KRAUSS ULRICH [DE] ET AL) 19 April 2012 (2012-04-19) * paragraph [0018] - paragraph [0019]; figures *	1-17	TECHNICAL FIELDS SEARCHED (IPC) A24C B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 September 2019	Marzano Monterosso

CATEGORY OF CITED DOCUMENTS

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12-09-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 1014011 B	14-08-1957	NONE	
LU 42309 A1	05-11-1962	NONE	
GB 1015562 A	05-01-1966	NONE	
GB 2051552 A	21-01-1981	NONE	
US 2012090954 A1	19-04-2012	CN 102470995 A	23-05-2012
		DE 102009027462 A1	05-01-2011
		EP 2448847 A1	09-05-2012
		US 2012090954 A1	19-04-2012
		WO 2011000603 A1	06-01-2011

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Patent documents cited in the description

- US 20120090954 A **[0003]**
- US 7165668 B **[0004]**
- WO 2003051718 A **[0005]**
- EP 1020357 A **[0006]**
- US 2988199 A **[0008]**
- US 2929489 A **[0009]**
- GB 1015562 A **[0009]**
- GB 1519293 A **[0010]**
- US 4860880 A **[0011]**