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(54) DEVICE FOR REVERSING THE ELASTIC EDGE OF TUBULAR TEXTILE ARTICLES, MACHINE COMPRISING THE DEVICE AND METHOD

(57) The device comprises at least a first loading form extending along a longitudinal direction and adapted to receive a tubular textile article and a first pair of grippers movable in synchronous manner parallel to the longitudinal extension of the first loading form. The grippers are provided with an opening and closing movement to engage an edge of the tubular textile article inserted over the first loading form, and with a rotation movement of approximately 180° around a respective rotation axis orthogonal to the longitudinal extension of the first loading form.

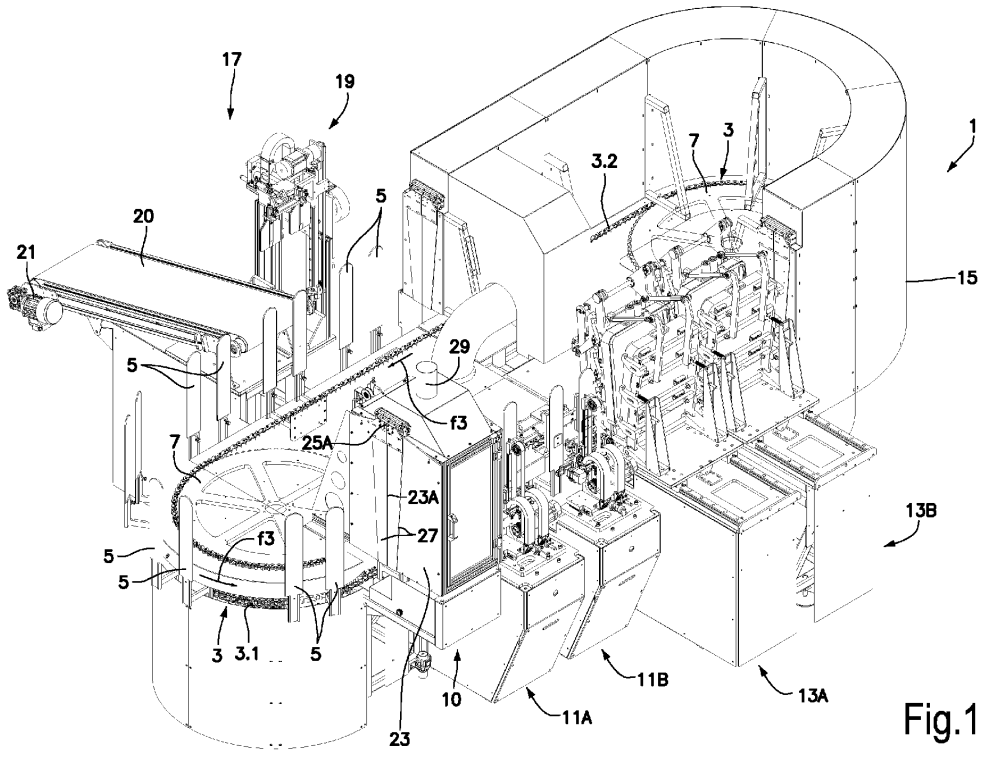

Fig.1

EP 4 116 477 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to textile machines for treating or handling tubular textile articles, in particular tubular knitted articles, for example socks. Specifically, according to one aspect, the invention relates to a machine for simplifying and automating operations prior to packaging the tubular textile articles.

BACKGROUND ART

[0002] In the hosiery sector, it is known to subject tubular textile articles, in particular, for example, socks or the like, to boarding operations before final packaging. For this purpose, the tubular articles are loaded on loading forms, also called boarding forms, and subsequently subjected to vaporizing and drying operations.

[0003] For instance, WO2007/020667 discloses a device and a method for handling tubular textile knitted articles in order to orient them correctly for performing thereon subsequent working steps. This known device comprises a cylindrical loading form, on which the tubular knitted textile article is loaded by opening the elastic edge thereof. For this purpose, the elastic edge is tensioned transversely and a pair of jaws of a gripper are introduced therein. The jaws are opened and cause the elastic edge to take up a square shape. The article is then loaded on the cylindrical form with a translation motion between the gripper and the loading form, while the gripper is maintained in the open position, i.e., with the two jaws spaced part from one another.

[0004] WO2007/015277 discloses a device for handling socks, which includes substantially flat forms having a peripheral edge. The two main faces of the forms have two central grooves, allowing to load an article on the form with a first gripper having a pair of jaws and to remove it from the form by means of a second gripper oriented at 90° with respect to the first gripper.

[0005] Some tubular textile articles of this type, for example socks, in particular for children, are packaged after reversing their elastic edge. The elastic edge is reversed once or twice over itself before inserting the sock into its package. These operations are usually carried out after the boarding operations and require time and manpower, with a consequent negative impact on the production cost of the article.

[0006] The increasingly small profit margins on this type of article require a reduction in production costs and time. Therefore, it would be beneficial to eliminate the manual operation of reversing the edge of the socks or other tubular textile articles.

[0007] Moreover, in order to soften the textile articles, it is known to subject these articles to a treatment cycle with silicone resins (siliconizing) before packaging and more in particular before vaporizing and drying on the boarding forms. Currently, this treatment takes place in a bath with very long treatment times and high energy consumption, which once again has a negative influence on the cost of the finished article and reduces the profit margins. Moreover, the treatment has a significant environmental impact.

[0008] Therefore, it would be desirable to simplify this operation and reduce its impact in terms of production costs.

SUMMARY OF THE INVENTION

[0009] According to one aspect, disclosed herein is a device for reversing the elastic edge of a tubular textile article, such as a sock or the like, the device comprising at least a first loading form, or boarding form, extending along a longitudinal direction and adapted to receive a tubular textile article. The device further comprises a first pair of grippers movable in synchronous manner parallel to the longitudinal extension of the first loading form. Each gripper comprises a first jaw and a second jaw. The jaws of each gripper are provided with an opening and closing movement to engage, in two opposite points, an edge of the tubular textile article that is inserted over the first loading form. Each of the two grippers of the first pair of grippers is further provided with a rotation movement, preferably through approximately 180° around a respective rotation axis orthogonal to the longitudinal extension of the first loading form, to reverse the elastic edge of a textile article loaded on the first form.

[0010] In particularly advantageous embodiments, the device comprises at least a second loading form extending along a longitudinal direction, preferably parallel to the first boarding form, and adapted to receive a tubular textile article. The device further comprises a second pair of grippers movable in a synchronous manner parallel to the longitudinal extension of the second loading form. Each gripper of the second pair of grippers comprises a first jaw and a second jaw. The two jaws of each gripper of the second pair of grippers are provided with an opening and closing movement to engage, in two opposite points, an edge of the tubular textile article which is inserted over the second loading form. Each of the two gripers of the second pair of grippes is moreover provided with a rotation movement, preferably through approximately 180°, around a respective rotation axis orthogonal to the longitudinal extension of the second loading form, to reverse the elastic edge of a textile article loaded on the second form.

[0011] In this way, the device can simultaneously handle a pair of socks or other tubular textile articles loaded on the two loading forms.

[0012] According to a further aspect, disclosed herein is a machine for boarding tubular knitted articles, such as socks and the like, comprising a device for reversing the elastic edge of a tubular textile article as defined above, and wherein each loading form is constrained to a conveying member movable along a working trajectory, which can pass through a plurality of further stations.

[0013] One or more of the following stations can be arranged along the trajectory of the conveying member:

a loading station of the tubular articles on the loading forms;

a reversing station of the edges of the tubular articles, in which the device for reversing the elastic edge of the tubular articles is located;

a vaporizing station comprising a steam chamber arranged to allow transit of the loading forms therethrough;

a drying station, comprising a drying tunnel adapted to allow transit of the loading forms;

an unloading station with a device for removing the tubular textile articles from the loading forms.

[0014] The machine can further comprise a spraying station, arranged along the trajectory of the conveying member, between the loading station and the reversing station. Spraying members are arranged in the spraying station to spray or atomize a liquid, preferably atomized liquid, on the tubular textile articles loaded on the loading forms. The spraying station is configured to allow transit of the loading forms therethrough.

[0015] The subject matter of the invention is also a spraying station of the aforesaid type, which can optionally be integrated, or is integrated, in a different treatment machine of the tubular textile articles.

[0016] According to yet another aspect, a method for handling tubular textile articles, comprising an elastic edge is provided. In embodiments described herein, the method comprises the following steps:

loading the tubular textile article on a loading form having a longitudinal extension; and

reversing the elastic edge on the loading form by means of a pair of rotating grippers, movable along the loading form.

[0017] According to yet another aspect, the subject matter of the invention is also a method for treating a tubular textile article, such as a sock or the like, comprising the steps of:

loading the tubular textile article on a loading form;

spraying a liquid or semi-liquid product, preferably nebulized, in particular, for example, comprising a silicone based product, onto the tubular textile article while the tubular textile article is loaded on the respective loading form.

[0018] Also disclosed herein is a loading form for boarding machines of tubular textile articles, such as socks and the like, comprising: a first face and a second face, preferably flat and preferably parallel to each other, joined to each other along a perimeter edge. The form comprises, on one of said first face and second face, a spacer block having a surface spaced from the respective face of the loading form. The spacer block defines, with the perimeter edge of the loading form, two channels parallel to the longitudinal extension of the loading form, configured to allow insertion of respective gripper jaws for reversing an edge of a tubular textile article loaded on the loading form.

[0019] Further advantageous features and embodiments of the device for reversing the edge of tubular textile articles, of the boarding machine, of the method and of the loading form are described below and set forth in the appended claims, which form an integral part of the present description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The invention will be better understood by following the description and the accompanying drawings, which illustrate a non-limiting example of embodiment of the invention. More in particular, in the drawing:

Fig.1 shows an axonometric view of a boarding machine comprising a spraying device of a solution containing a silicone resin and a double reversing station of the elastic edge of the tubular textile articles;

Fig.2 shows a plan view of the machine of Fig.1;

Figs.3 and 4 show axonometric view in two different angles of the nozzles of the spraying device;

Fig.5 shows a front view, according to the line V-V of Fig.6, of a device for reversing the elastic edge of the tubular textile articles;

Fig.6 shows a side view according to VI-VI of Fig.5;

Fig.7 shows a partial section view according to the line VII-VII of Fig.6;

Fig. 8 shows a plan view according to the line VIII-VIII of Fig. 5;

Fig.9 shows a rear axonometric view of the device of Figs. 5 to 8;

Fig.10 shows an enlargement of a portion of Fig.9;

Fig.11 shows the enlargement of Fig.10 with parts removed;

Fig.12 shows a front axonometric view of the device of Figs. 5 to 11;

Fig.13 shows an enlargement with parts removed of the view of Fig.12;

Fig.14 shows an axonometric view of a loading form;

Fig.15 shows a side view of the loading form according to XV-XV of Fig.17;

Fig.16 shows a plan view according to XVI-XVI of the Fig.15;

Fig.17 shows a front view according to XVII-XVII of Fig.15;

Figs. 18 to 23 show a side view of the device for reversing the edge of the tubular textile articles in an operating sequence; and

Figs. 18A-23A show respective simplified sections, according to the lines A-A of Figs. 18 to 23.

DETAILED DESCRIPTION

[0021] Figs. 1 and 2 show as a whole a machine for boarding tubular textile articles, for example tubular knitted articles, before packaging thereof. Hereinafter reference will be made to tubular articles in the form of socks, provided with an elastic edge and with a closed toe. However, it would also be possible to use the machine to carry out similar operations on other tubular textile articles that have similar needs.

[0022] The machine is indicated as a whole with reference number 1 and has, in the illustrated embodiment, a conveying member, i.e., a conveyor 3, on which pairs of loading forms 5 are applied. Fig.1 shows only some of the pairs of loading forms 5 for simplicity and clarity of representation. However, it must be understood that in general a plurality of pairs of loading forms 5 spaced equidistant from one another is preferably arranged on the conveying member 3.

[0023] Each loading form 5, one of which is shown separately from the other components of the machine 1 in Figs. 14 to 17, has a longitudinal extension according to a longitudinal axis X-X, and a flat form, with two opposite faces 5A, 5B, which can be substantially flat and preferably parallel to each other. The two faces 5A, 5B are joined to each other by a perimeter edge 5C (see in particular Figs. 14 to 17).

[0024] In the example illustrated in the accompanying drawings, the loading forms 5 have a rectilinear extension. In other embodiments, the loading forms can have a different shape, for example closer to the anatomical structure of the foot, of the ankle and of the leg of a human being, to allow the sock that is inserted over the form to take a shape folded at the ankle, so that the foot part of the sock is inclined with respect to the leg part.

[0025] In the illustrated embodiment, the conveying member 3 comprises an endless flexible member 3.1, to which the loading forms 5 are fixed. The endless flexible member 3.1, lying in a horizontal plane, is moved along a closed path by means of a belt 3.2, driven around two toothed wheels 7, one or which is motorized. The movement of the conveying member 3 and of the loading forms 5 is indicated with f3.

[0026] In other embodiments, the conveying member 3 can have a different shape, for example can comprise a carousel rotating around an axis, preferably vertical. In yet other embodiments, the conveying member 3 can comprise an endless flexible member movable along a closed path lying on a vertical, instead of horizontal, plane, as in Figs. 1 and 2, with a return branch underneath the active conveying branch, along which the stations of the machine 1 are arranged in line.

[0027] At least one loading station 9, in which an operator loads single socks on the loading forms 5, is arranged along the path of the conveying member. In some embodiments several loading stations can be provided, to allow a slower loading speed for more than one operator.

[0028] In the illustrated embodiment, downstream of the loading station 9, with respect to the movement f3 of the conveying member 3, a spraying station 10 is provided, in which members are positioned to spray or nebulize a liquid on the socks loaded on the loading forms 5 transiting through the spraying station 10. The liquid can contain a silicone resin or other product that can be sprayed or atomized, the purpose of which is to soften the textile material with which the sock is produced, for example. Details of the spraying station 10 will be described below with reference in particular to Figs.3 and 4.

[0029] Downstream of the spraying station 10 at least one reversing station is arranged, in which a device is located for reversing the elastic edge of each sock loaded on the loading forms 5, which move through the reversing station.

[0030] In the illustrated embodiment, two elastic edge reversing stations are provided. The two reversing stations of the elastic edges of the socks are indicated with 11A and 11B. In other embodiments, a single reversing station can be provided. The two reversing stations 11A, 11B of the edges are identical and one of them will be described in detail below with reference to Figs. 5 to 17. The presence of two reversing stations allows production to be accelerated, in particular when it is necessary to carry out a double reversing of the edge of each sock loaded on the loading forms 5.

[0031] In the illustrated embodiment, downstream of the reversing stations 11A, 11B at least one vaporizing station is arranged, through which the loading forms 5 with the socks loaded thereon pass, and in which the socks are moistened with steam. In the illustrated embodiment, two vaporizing stations 13A, 13B are provided, which can be identical to each other.

[0032] Downstream of the vaporizing stations 13A, 13B a drying station 15 is arranged, which can have the form of a U-shaped or J-shaped tunnel, with an inlet on

one branch of the path of the conveying member 3 and an outlet on the other branch of the path of the conveying member. Fig.2 schematically shows loading forms 5 inside the drying station 5. In the drying station 15 the socks, previously moistened in the vaporizing stations 13A, 13B, are dried. The purpose of the vaporizing and drying operations is to stabilize the shape and the size of the socks and to give them the correct fold before removal from the loading forms 5 and subsequent packaging. In substance, the socks are boarded and shaped.

[0033] Between the drying station 15 and the loading station 9 an unloading station 17 is provided, in which an unloading device 19 removes the boarded socks from the loading forms 5 and transfers them onto an outlet conveyor 20 driven by a motor 21.

[0034] The spraying station 10 can be omitted. In other embodiments, the reversing stations 11A, 11B can be omitted. When both the spraying station and the reversing station or stations 11A, 11B are present, one or more of these stations can be deactivated, if required by the type of article being processed from time to time.

[0035] Moreover, the spraying station 10 can be utilized on its own or in combination with a different machine with respect to the boarding machine 1. Similarly, the reversing stations 11A, 11B and the respective reversing devices, described below, can be used in other machines, or even on their own.

[0036] The spraying station can be used to spray a silicone-based softening product on the socks, in order to give the socks greater softness, without the need for treatment in a bath, which is normally required for this purpose. The spraying or atomizing of the silicone resin, or of other products that can be sprayed or atomized, makes it possible to shorten the production cycle of the socks or other tubular textile articles and to save energy.

[0037] In the illustrated embodiment, the spraying station 10 comprises a transit chamber 23, which advantageously has an inlet 23A and an opposite outlet 23B, arranged in sequence along the path of the loading forms 5 (arrow f3). The reference numerals 25A, 25B indicate actuators for opening and closing suitable doors, of which 27 indicates those associated with the opening 23A. A similar arrangement is provided on the outlet 23B (not visible). The doors 27 are opened and closed by the actuators 25A, 25B in synchronism with the movement, preferably stepped, of the loading forms 5. The actuators 25A, 25B and the doors 27 form closing and opening members to allow the loading forms 5 with the socks loaded thereon to enter the transit chamber 23, and the treatment of the socks by means of a spraying device in isolated conditions with respect to the surrounding environment. Preferably, the inside of the transit chamber 23 is maintained in a vacuum, or at a pressure slightly below the ambient pressure, during treatment of the socks. A suction duct 29 can be provided for this purpose. This prevents dispersion of atomized product into the surrounding environment.

[0038] Inside the transit chamber 23 spraying, or atomizing, members are arranged, adapted to spray or atomize a product, for example a product containing a silicone resin, on the socks loaded on the loading forms 5. An embodiment of the spraying members, indicated as a whole with 31, is illustrated in Figs. 3 and 4.

[0039] In the embodiment of Figs. 3 and 4, the spraying members comprise a first pair of opposite nozzles 33A, 33B and a second pair of opposite nozzles 35A, 35B. The nozzles 33A, 33B, 35A, 35B are carried by bars 37 and 39 so as to be able to adjust the mutual distance between the two pairs of nozzles. The bars 37, 39 are carried by a bracket 41 integral with a slide 43 movable along a guide 45 integral with an upright 47. A lifting and lowering movement of the bracket 41, and hence of the nozzles 33A, 33B, 35A, 35B along the guide 45, is indicated with f41. The movement is controlled by an actuator 49, for example an electric motor, by means of a belt 51 driven around a drive pulley 53 and a driven pulley 55. In other embodiments, the electric motor can be replaced by another actuator, for example a piston-cylinder actuator.

[0040] To carry out the treatment on the socks loaded on the loading forms 5, a pair of loading forms 5 with the respective socks loaded thereon is positioned so as to be located between the two pairs of nozzles 33A, 33B, 35A, 35B. Maintaining the loading forms 5 stationary for sufficient time, the slide 43 carries out one or more lifting and lowering movements, while the nozzles 33A, 33B, 35A, 34B spray or atomize the product generating jets or sprays S that strike the entire outer surface of the socks loaded on the loading forms 5.

[0041] As mentioned above, the machine 1 comprises two reversing stations of the edge of the socks, indicated with 11A and 11B, which can be identical to each other. With reference to Figs. 5 to 13, one of the two reversing stations is described, which is indicated generically with 11.

[0042] The reversing station 11 comprises a device 60 for reversing the elastic edge of the socks loaded on the loading forms 5. In some of Figs. 5 to 13, the loading forms 5 are also shown in the operating position. In some figures, in particular in Figs. 7, 9, 10 11 and 13, one or two of the loading forms 5 are removed to allow a clearer view of the components of the reversing device 60.

[0043] Figs. 14 to 17 show a loading form 5 isolated from the rest of the machine 1, for a better illustration of some of the features thereof, which will be described with reference in particular to Figs. 5 to 13.

[0044] The device 60 comprises two pairs of grippers, each indicated with 61. The grippers 61 of each pair are symmetrical to each other with respect to a vertical plane, extending parallel to the longitudinal extension of the loading forms 5.

[0045] Each gripper 61 has two jaws 61.1 and 61.2. In general, the two jaws 61.1, 61.2 of each gripper 61 have a respective opening and closing movement. In some embodiments, both the jaws 61.1, 61.2 can be movable with respect to a load-bearing structure. However, in the

embodiment illustrated, the jaw 61.1 is fixed with respect to a load-bearing structure, while the jaw 61.2 is movable with respect to the load-bearing structure. See in particular Fig.7.

[0046] The opening and closing movement of the grippers 61 can preferably be a pivoting movement. In the illustrated embodiment, the movable jaws 61.1 are provided with a pivoting movement around an axis 63. The opening and closing movement of the movable jaws 61.2 can be controlled by an actuator 65 for each gripper 61. In some embodiments, the actuator 65 is a, preferably single-acting ,piston-cylinder actuator, which causes the opening movement of the respective jaw 61.2, while closing is controlled by a spring 67. It would also be possible to use other types of actuators, for example a double-acting piston-cylinder actuator, or an electric motor.

[0047] Each gripper 61 is carried by a plate 71 having a rotation movement, preferably a reciprocating rotation, for example through more or less 180° in the two directions, around an axis parallel to the pivoting axis 63 of the movable jaws 61.2 of the grippers 61. The rotation axes of the plates 71 and the pivoting axes of the moving jaws 61.2 are substantially orthogonal to the axes X-X of the loading forms 5 that are positioned in front of the grippers 61 and orthogonal to the faces 5A, 5B of said loading forms 5. since in the illustrated embodiment the loading forms 5 are arranged with their longitudinal axes X-X vertical, the rotation axes of the plates 71 and the pivoting axes of the jaws 61.2 are horizontal and perpendicular to the direction of forward movement of the loading forms 5 that are positioned in the reversing station 11.

[0048] In advantageous embodiments, the rotation axes of the plates 71 approximately through the distal ends of the fixed jaws 61.1 of the respective gripper 61. The distal ends of the jaws 61.1 are the ends opposite the ends of the jaws 61.1 that are positioned close to the pivoting axis 63 of the movable jaws 61.2. The rotation axes of the plates 71 are labeled 73 in Fig.7.

[0049] The rotation movement of the plates 71 is controlled by respective actuators, preferably one for each gripper 61. It would also be possible to use a common actuator with suitable drive members. In some embodiments, the actuator that controls the rotation of each plate 71 of each gripper 61 is an electronically controlled electric motor. The actuators that control the rotation of the plates 71 of the grippers 61 are labeled 75.

[0050] In the illustrated embodiment, each actuator 75 transmits the rotation motion to the respective plate 71 by means of a belt 77 driven around a drive pulley 79 and a driven pulley 81, see in particular Figs. 10 and 11. Driven pulleys 81, whose rotation axes correspond to the rotation axes 73 of the plates 71, transmit the rotation motion to the plates 71 by means of shafts 83.

[0051] As will be clarified below, the rotation movement of the plates 71 and of the grippers 61 around the axes 73 are used to carry out the reversing movement of the edges of the socks loaded on the loading forms 5 according to a cycle that will be described below.

[0052] Each motor 75 and the respective gripper 61, with the actuator members described above, are carried by a respective slide. For each pair of grippers 61, the slide farthest from the centerline of the device 60 is indicated with 85.1 and the slide closest to the centerline of the device 60 is indicated with 85.2. The two slides 85.1, 85.2 are movable symmetrically with respect to each other to move the two grippers 61 of each pair of grippers toward and away from each other. The mutual distance between the two grippers is adapted in this way to the transverse dimension of the loading forms 5. In fact, these latter can be interchangeable, as a function of the different sizes of the socks to be handled.

[0053] In some embodiments, as illustrated in the accompanying drawings, the two slides 85.1 and 85.2 are guided on a common guide 87, which extends parallel to the plane on which the conveying member 3 lies and orthogonal to the longitudinal extension (axis X-X) of the loading forms 5.

[0054] In advantageous embodiments, the mutual movement of the grippers 61 toward and away from a vertical plane orthogonal to the respective guide 87 is obtained with a single actuator for each pair of grippers 61.

[0055] In the illustrated embodiment, an electronically controlled electric motor 89 is provided for this purpose. The two motors 89 of the two pairs of grippers 61 are visible in particular in Fig.10. In Fig.11 the motor 89 has been removed to show the mechanism for transmission of the rotation motion of the motor 89 to the slides 85.1, 85.2. The transmission mechanism comprises a pinion 91, mounted on the output shaft 92 of the respective motor 89. The pinion 91 of each motor 89 meshes with two opposite racks 93.1, 93,2, integral with the slide 85.1 and with the slide 85.2, respectively. In this way the rotation motion of the motor 89 is transformed into symmetrical linear movements of the slides 85.1 and 85.2 and hence into a movement of the respective pairs of grippers 61 away from and toward each other.

[0056] The two motors 89, the guide 87, the slides 85.1, 85.2 and the grippers 61 with the respective actuators 75 and the transmission members described above are in turn carried on a slide or carriage 95, engaged on a vertical guide 97, which extends parallel to the axes X-X of the loading forms 5 and perpendicular to the plane on which the conveying member 3 lies. A vertical movement of the slide 95 along the guide 97 is indicated with f95.

[0057] In the illustrated embodiment, the movement of the slide 95 along the guide 97 is controlled by means of a belt 99 driven around an upper idle pulley 101 and around a lower motorized pulley 103 mounted on the output shaft of a motor 101.

[0058] The system described above is carried by a main slide 107, sliding on horizontal guides 109, orthogonal to the axes X-X of the loading forms 5 and to the plane on which the two axes X-X of the pair di loading forms 5 that are located in the operating in the reversing

station 11 lie.

[0059] The movement of the main slide 107, indicated by the double arrow f107, is controlled by an actuator 111, for example a piston-cylinder actuator, by a rotary motor with threaded bar, or other suitable mechanism. The movement according to arrow f107 is used to move the grippers 61 toward and away from the vertical plan on which the axes X-X of the loading forms 5 are located, for the purposes that will be more apparent from the description below of the operating cycle of the reversing device 60 for reversing the elastic edges of the socks.

[0060] Finally, the device 60 comprises a pair of movable pads 115, carried by respective vertical uprights 117, preferably fixed to a load-bearing structure and positioned at a distance equal to the distance of the axes X-X of the two loading forms 5. Each pad 115 each is operated by an actuator 119, for example a piston-cylinder actuator, to move toward and away from the face of the respective loading form 5 facing the respective pad 115. One or both pads 115 with related actuators 119 and uprights 117 are omitted in some of the figures for greater clarity of representation.

[0061] As will be clear from the description of the operating cycle, the purpose of the pads 115 is to retain the socks with respect to the loading forms 5 in some operating steps of the reversing cycle of the edge.

[0062] In embodiments described herein, the loading forms 5 have a different structure with respect to the normal loading forms 5 for boarding and finishing machines. As shown in particular in Figs. 14-17, a spacer block 121 with a face 122 approximately parallel to the face 5B of the respective loading form 5 and spaced therefrom, is applied on the face 5B of each boarding form 5. The block 121 defines, together with the perimeter edge 5C of the respective loading form 5, a pair of channels 123 parallel to each other and parallel to the longitudinal extension (axis X-X) of the respective loading form 5. The channels 123 allow the insertion of the movable jaws 61.2 inside a sock loaded on the respective loading form 5, while the fixed jaws 61.1 are on the outside of said sock. This facilitates engagement of the elastic edge of the sock by the two opposite grippers along the rectilinear and parallel sections of the perimeter edge 5C of the respective loading form 5.

[0063] The reversing cycle of the edge of the socks carried out by the device 60 described above is represented schematically in Figs. 18, 19, 20, 21, 22 and 23. Each of these figures shows a side view of the device 60. Figs. 18A, 19A, 20A, 21A, 22A and 23A show sections according to the line A-A of the respective Figs. 18 to 23. The sections of Figs. 18A-23A show only one of the two loading forms 5.

[0064] Figs. 18, 18A show the initial step of the reversing cycle, in which a sock or other article M has been loaded on the loading form 5 with the respective elastic edge BM positioned higher than the two grippers 61. The grippers 61 are in the lowered and open position, with the rotation axis 63 in the lower position and the opening of the grippers, corresponding to the distal ends of the jaws 61.1 and 61.2, facing upward, at a height lower than the elastic edge BM of the sock M.

[0065] In the subsequent step, illustrated in Figs. 19 and 19A, the grippers are held open and moved upward, so that the two movable jaws 61.2 are inserted between the block 121 and the face 5B of the loading form 5, inside the elastic edge BM. Insertion of the jaws 61.2 inside the elastic edge BM of the sock M is facilitated by the fact that the elastic edge is inserted on the loading form 5 at the block 121 that, with the perimeter edge 5C of the loading form 5, forms the two channels 123.

[0066] Figs. 20, 20A show the subsequent step, in which the grippers 61 close, with a pivoting movement of the movable jaws 61.2, which grip two areas of the edge BM, corresponding to the perimeter edge of the loading form 5, against the fixed jaws 61.1.

[0067] The subsequent step consists in reversing the edge BM of the sock M. The end of this step is shown in Figs. 21, 21A. The two grippers 61 have been rotated around the horizontal axes 73 through 180° by the motors 75.

[0068] Subsequently, the grippers 61 open (Figs. 22, 22A) and are removed from the sock M with an upward movement, releasing the reversed elastic edge BM (Figs. 23, 23A). To prevent the sock M from moving, dragged by the grippers 61 due to friction, in this step the pad 115 is pressed against the surface 5A of the loading form 5, preventing movements of the sock M.

[0069] The cycle can be repeated if requiring to reverse the elastic edge BM of the sock M twice. By providing two stations 11A, 11B in the machine 1, two reversing operations can be carried out on the same sock without reducing the production speed of the machine.

[0070] To facilitate positioning of the loading forms 5 with the socks M inserted thereon in the reversing station 11 and their withdrawal after reversing of the elastic edges BM, it is advantageous to move the grippers 61 and the loading forms 5 towards and away from each other according to the double arrow f107 (Fig.6). The slide 107 movable on the guide 109 is provided for this purpose.

Claims

1. A device for reversing the elastic edge of a tubular textile article, such as a sock or the like, comprising

   at least a first loading form extending along a longitudinal direction and adapted to receive a tubular textile article;

   a first pair of grippers movable in a synchronous manner parallel to the longitudinal extension of the first loading form; wherein each gripper of the first pair of grippers comprises a first jaw and a second jaw, the first jaw and the second jaw of each gripper of the first pair of grippers being provided with an opening and closing movement

to engage an edge of the tubular textile article inserted over the first loading form; and wherein each gripper of the first pair of grippers is provided with a rotation movement around a respective rotation axis orthogonal to the longitudinal extension of the first loading form to reverse the elastic edge of a tubular textile article loaded on the first loading form.

2. The device of claim 1, comprising;

at least a second loading form extending along a longitudinal direction and adapted to receive a tubular textile article, the second loading form being approximately parallel to the first loading form;
a second pair of grippers movable in a synchronous manner parallel to the longitudinal extension of the second loading form; wherein each gripper of the second pair of grippers comprises a first jaw and a second jaw, the first jaw and the second jaw of each gripper of the second pair of grippers being provided with an opening and closing movement; to engage an edge of the tubular textile article inserted over the second loading form; and wherein each gripper of the second pair of grippers is provided with a rotation movement around a respective rotation axis orthogonal to the longitudinal extension of the second loading form to reverse the elastic edge of a textile tubular article loaded on the second loading form.

3. The device of one or more of the preceding claims, wherein: the opening and closing movement of the jaws of said grippers is a movement of rotation around a pivoting axis of at least one jaw of each griper; and preferably the pivoting axis of the jaw is parallel to the rotation axis of the gripper and preferably spaced therefrom.

4. The device of one or more of the preceding claims, wherein each gripper is carried on a plate rotating around the respective rotation axis of the gripper; wherein the first jaw and the second jaw of each gripper are carried by the rotating plate; each jaw having a proximal end constrained to the plate and a distal end; and wherein the rotation axis of each plate is positioned close to the distal end of one of the two jaws of the respective gripper.

5. The device of claim 4, wherein one of the jaws of each gripper is rigidly fixed to the respective plate in proximity of the proximal end of the jaw, and the other of the jaws of each gripper is provided with a pivoting movement for opening and closing the gripper around a pivoting axis placed in proximity of the proximal end of the jaws and preferably orthogonal to the rotation axis of the gripper.

6. The device of one or more of the preceding claims, wherein each loading form is flat and has a first face and a second face approximately parallel to each other, joined to each other along a perimeter edge; and wherein the rotation axes of the grippers are approximately orthogonal to the first flat face and to the second flat face of the respective loading form.

7. The device of claim 6, wherein each loading form has, on one of said first face and second face, a spacer block having a surface spaced from the face of the respective loading form; wherein the surface of the spacer block defines, with the perimeter edge of the respective loading form, two channels parallel to the longitudinal extension of the loading form, configured to allow the insertion of respective jaws of the respective grippers inside the tubular article loaded on the loading form.

8. The device of claim 6 or 7, wherein a blocking pad of the tubular article with respect to the loading form is associated with each loading form, the pad being movable to press against one of said first face and second face of the respective loading form.

9. The device of one or more of the preceding claims, wherein each pair of grippers is provided with a relative movement toward and away from the loading form in a direction orthogonal thereto.

10. The device of one or more of the preceding claims, wherein the grippers of each pair of grippers are provided with a movement of adjustment of the mutual distance.

11. The device of one or more of the preceding claims, wherein each loading form is movable along a plane parallel to a plane on which the respective pair of grippers lies.

12. A machine for boarding tubular knitted articles, such as socks and the like, comprising a device for reversing the elastic edge of a tubular textile article according to one or more of the preceding claims; wherein each loading form is constrained to a conveying member movable along a closed trajectory.

13. The machine of claim 12, wherein the following are arranged along the closed trajectory of the conveying member:

a loading station of the tubular articles on the loading forms;
a reversing station of the edges of the tubular articles, in which the device for reversing the elastic edge of the tubular articles is located;

a vaporizing station comprising a steam chamber arranged to allow transit of the loading forms therethrough;
a drying station, comprising a drying tunnel adapted to allow transit of the loading forms;
an unloading station with a device for removal the tubular textile articles from the loading forms.

14. The machine of claim 13, further comprising a spraying station arranged along the closed trajectory of the conveying member, between the loading station and the reversing station; wherein spraying members are arranged in the spraying station to spray or atomize a liquid onto the tubular textile articles loaded on the loading forms, the spraying station being configured to allow transit of the loading forms.

15. The machine of claim 14, wherein the spraying station comprises a chamber inside which at least a first pair of spraying nozzles, preferably two pairs of spraying nozzles, are arranged; the spraying nozzles being movable in a direction parallel to the longitudinal extension of the loading forms.

16. The machine of claim 14 or 15, wherein the spraying station comprises a transit chamber of the loading forms, inside which said spraying members are arranged; and wherein the transit chamber is preferably provided with an inlet and with an opposite outlet, each inlet and outlet being provided with a closing and opening member; wherein preferably the transit chamber is connected to a suction system.

17. A method for handling tubular textile articles, comprising an elastic edge; the method comprising the following steps:

loading the tubular textile article on a loading form having a longitudinal development;
reversing the elastic edge on the loading form by means of a pair of rotating grippers, movable along the loading form.

18. The method of claim 17, wherein each gripper has a first jaw and a second jaw; wherein the first jaw and the second jaw of each gripper is provided with an opening and closing movement to engage the elastic edge by means of the pair of rotating grippers; and wherein the elastic edge is reversed by rotating the pair of rotating gripers each around an axis orthogonal to the longitudinal extension of the loading form.

19. The method of claim 17 or 18, comprising one or more of the following further steps:

a step of spraying a silicone product onto the tubular textile article while said tubular textile article is loaded on the respective loading form and before reversing the elastic edge of the tubular textile article;
a step of vaporizing subsequent to the step of reversing the elastic edge of the tubular textile article;
a step of drying subsequent to the step of vaporizing;

20. A loading form for boarding machines of tubular textile articles, such as socks and the like, comprising:

a first face and a second face, joined to each other along a perimeter edge; and
on one of said first face and second face, a spacer block attached centrally on said face and having a surface spaced from the face of the loading form on which the spacer block is attached;

wherein the spacer block defines, with the perimeter edge of the loading form, two channels parallel to the longitudinal extension of the loading form, developing along the perimeter edge of the loading form and configured to allow insertion of respective jaws of grippers for reversing an edge of a tubular textile article loaded on the loading form.

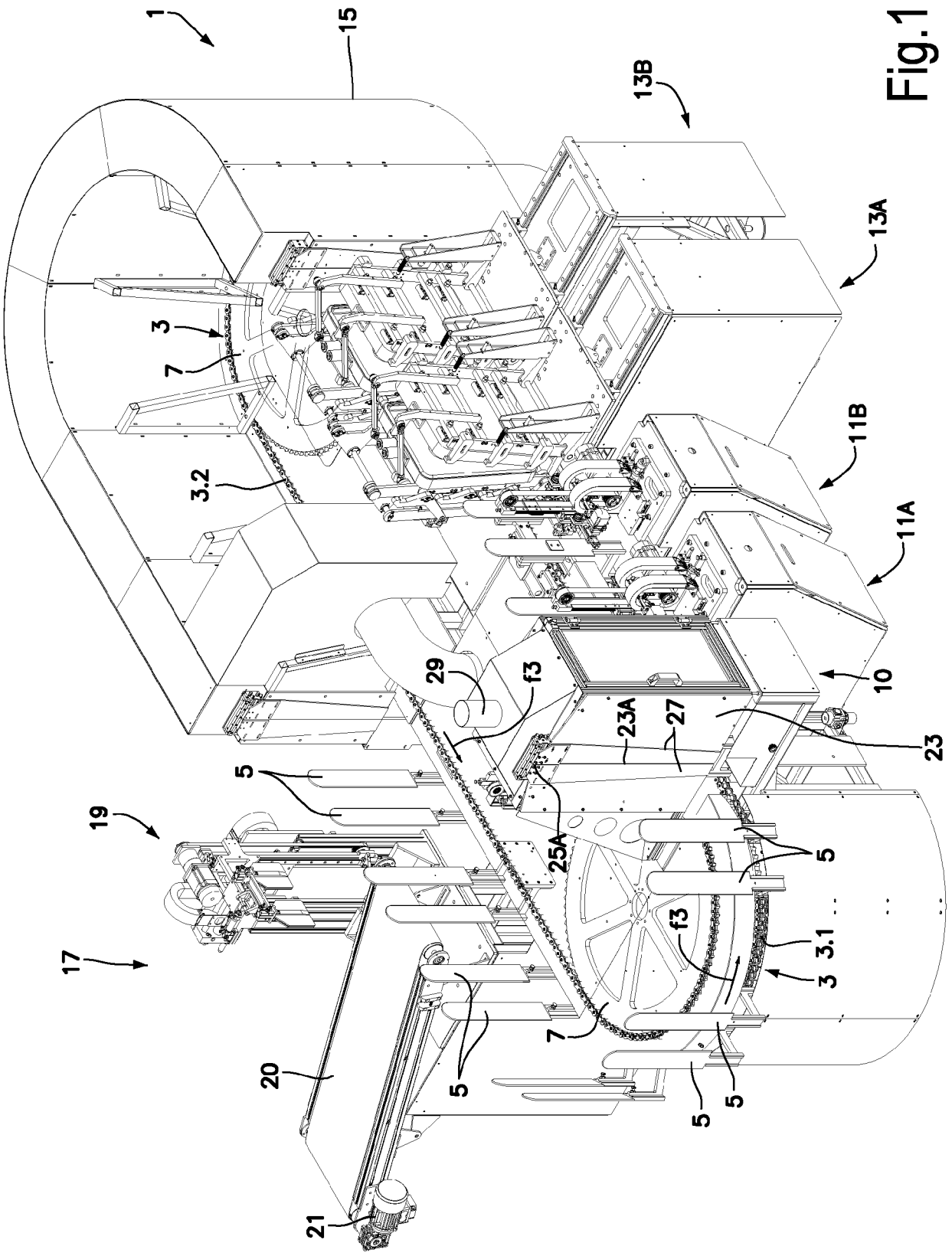

Fig.1

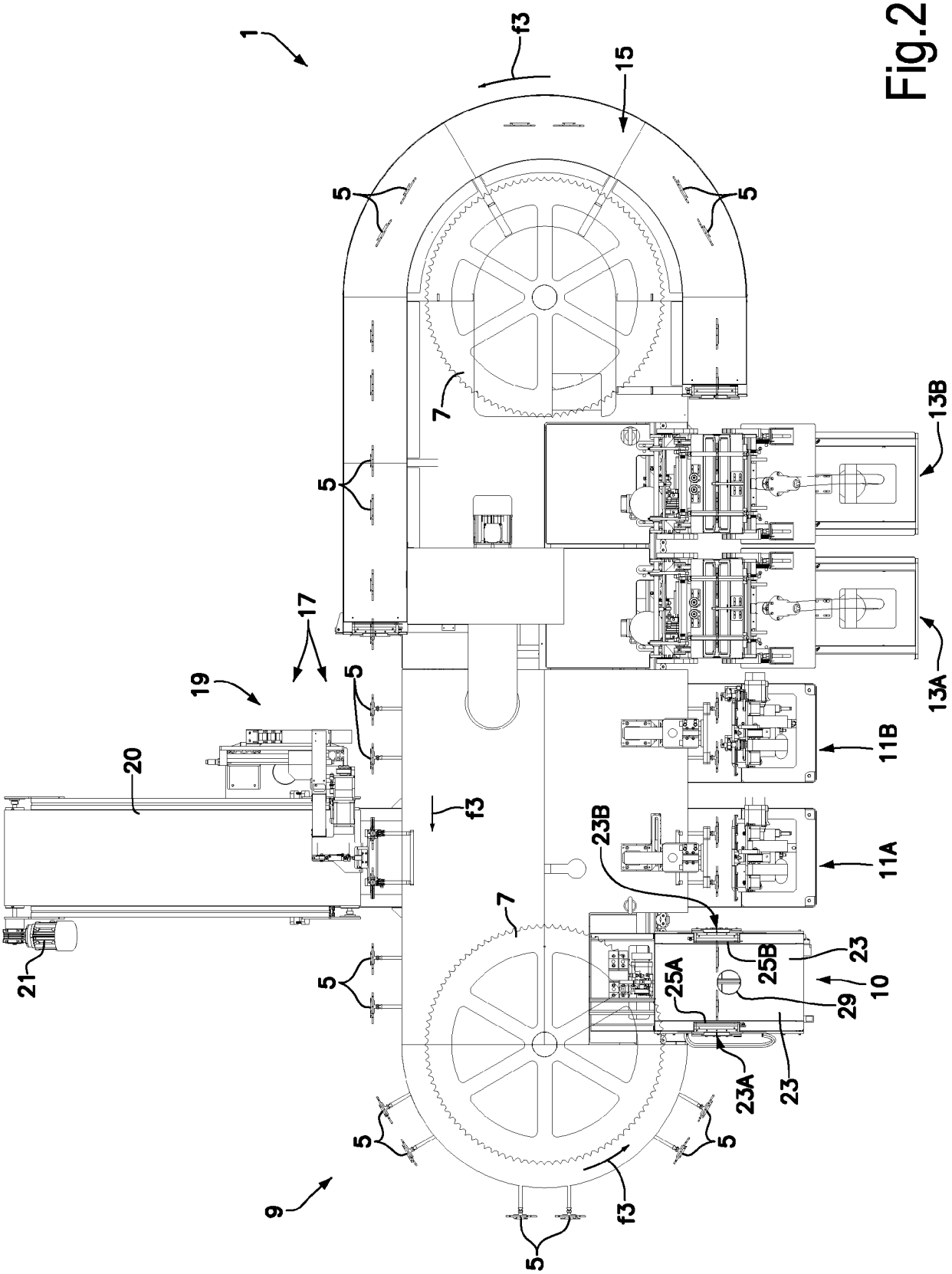

Fig.2

Fig.4

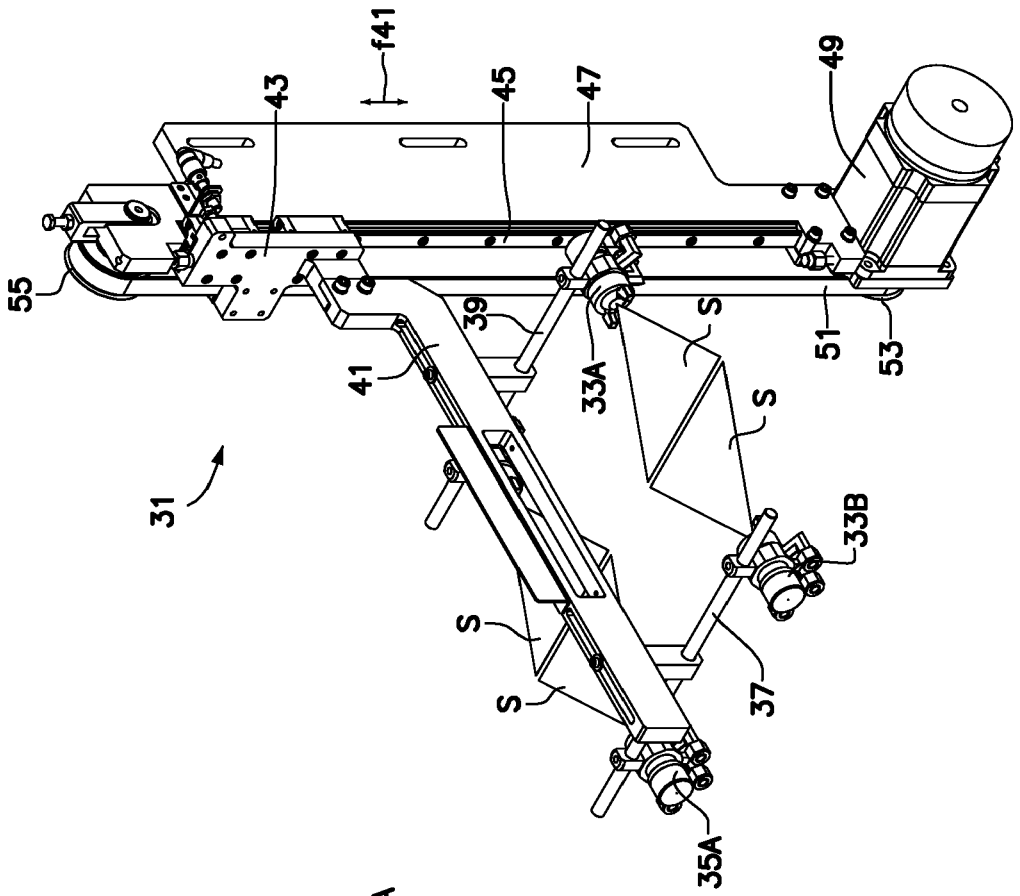
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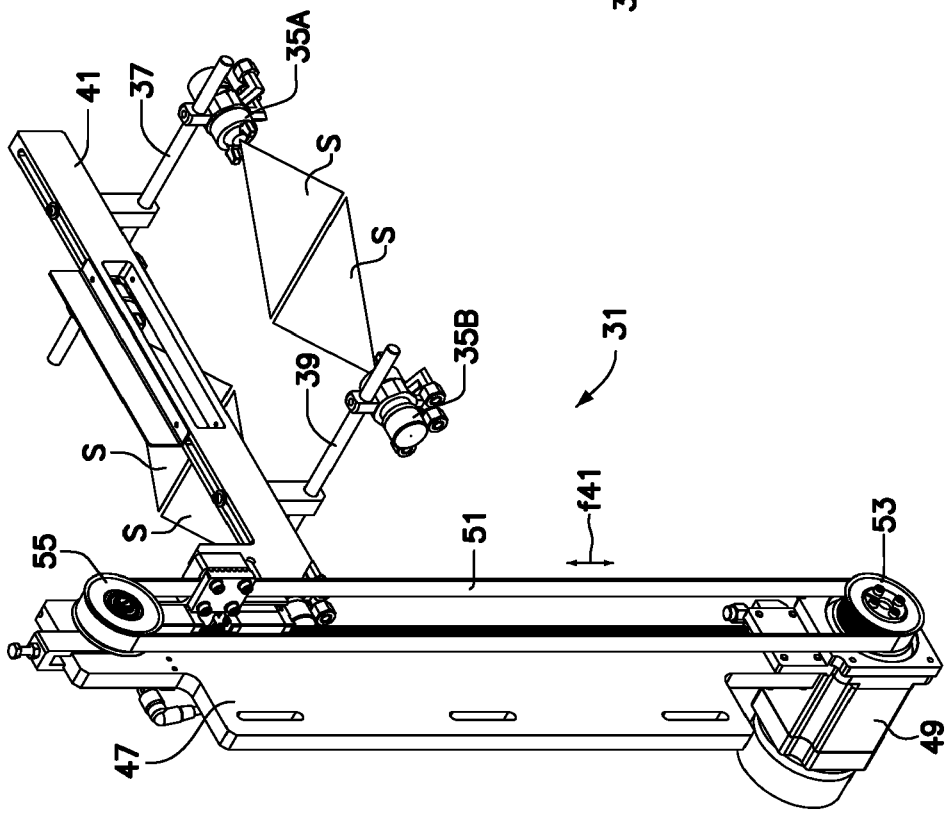
Fig.3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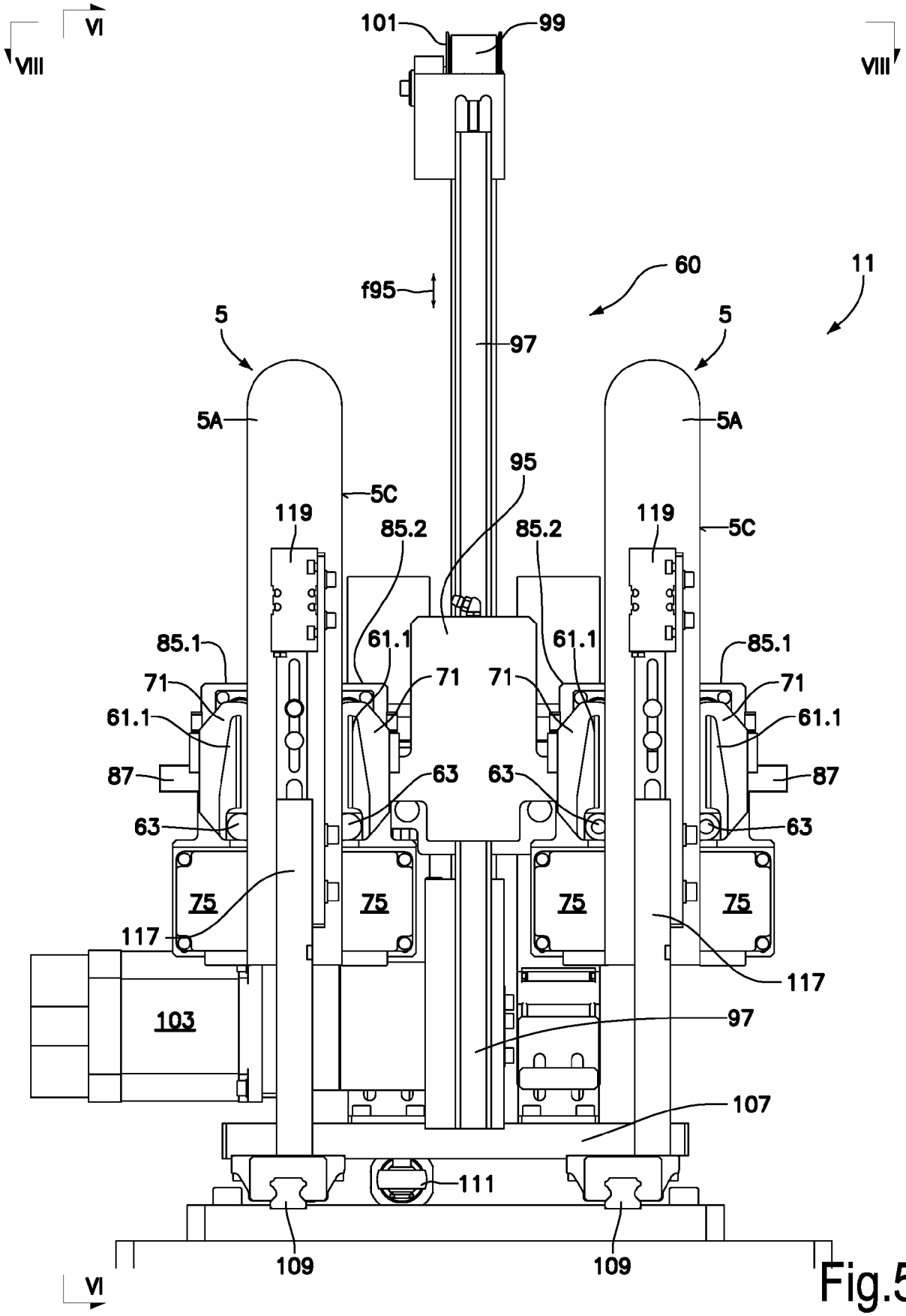
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Fig.5

Fig.6

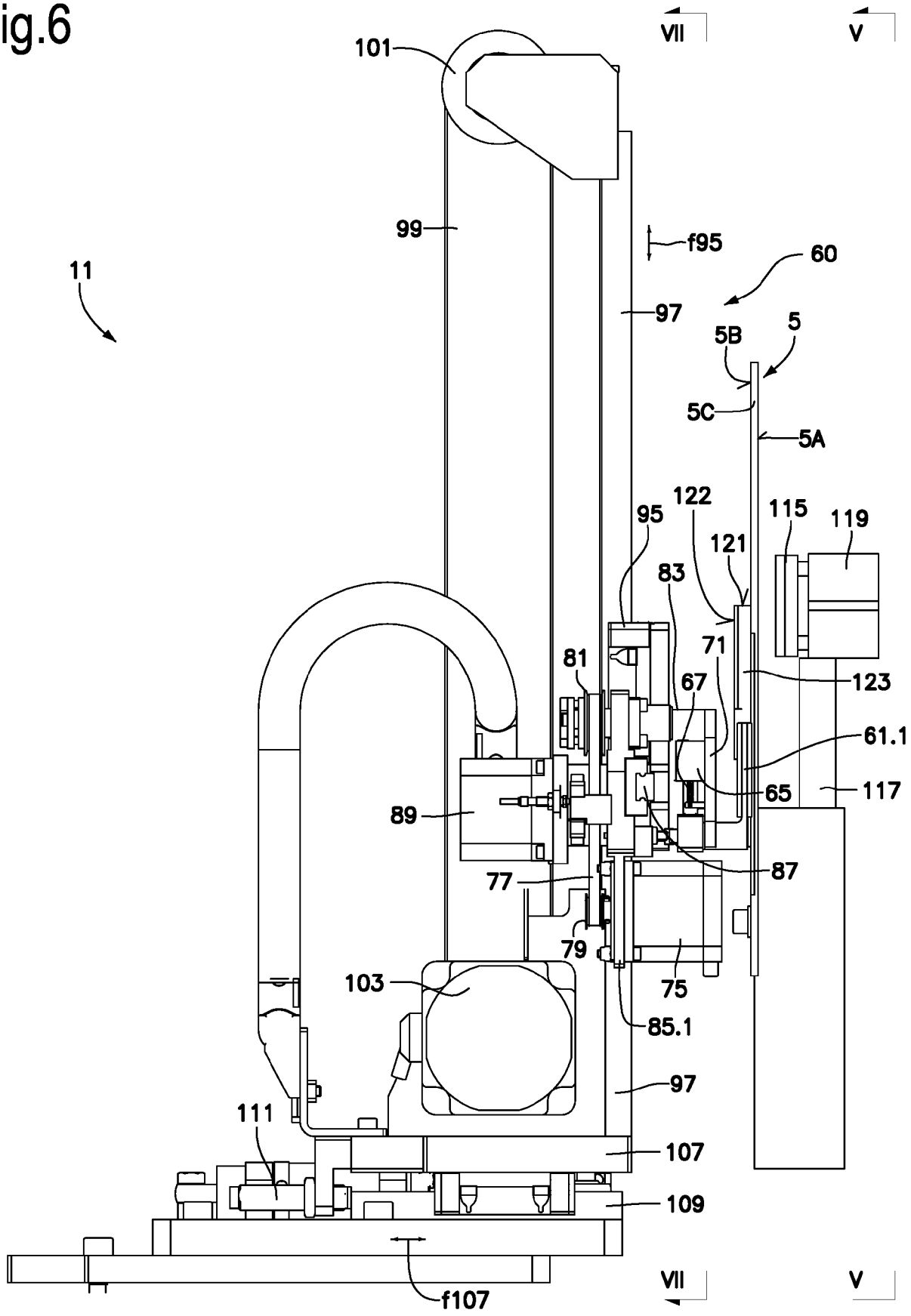
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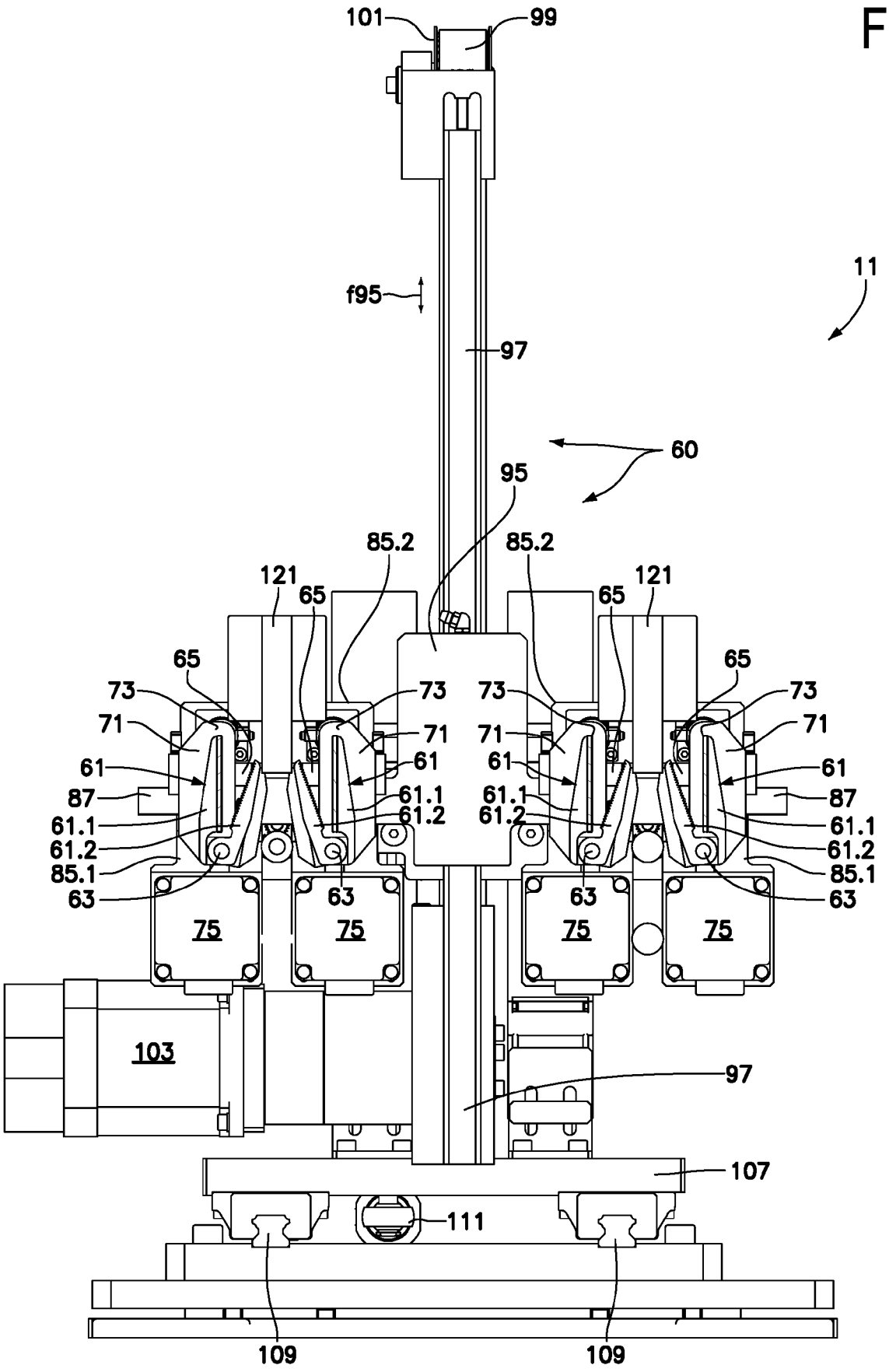
Fig.7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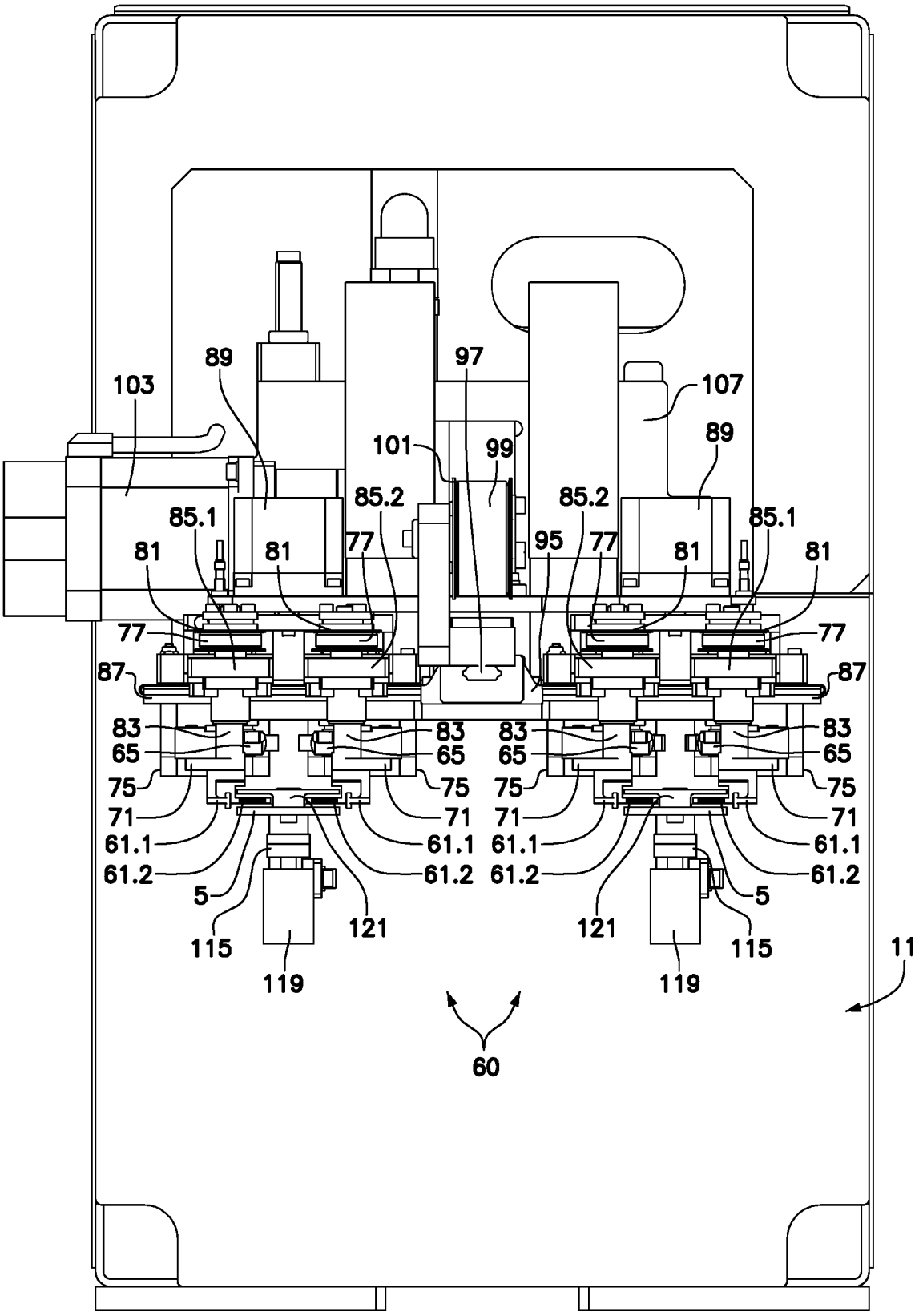
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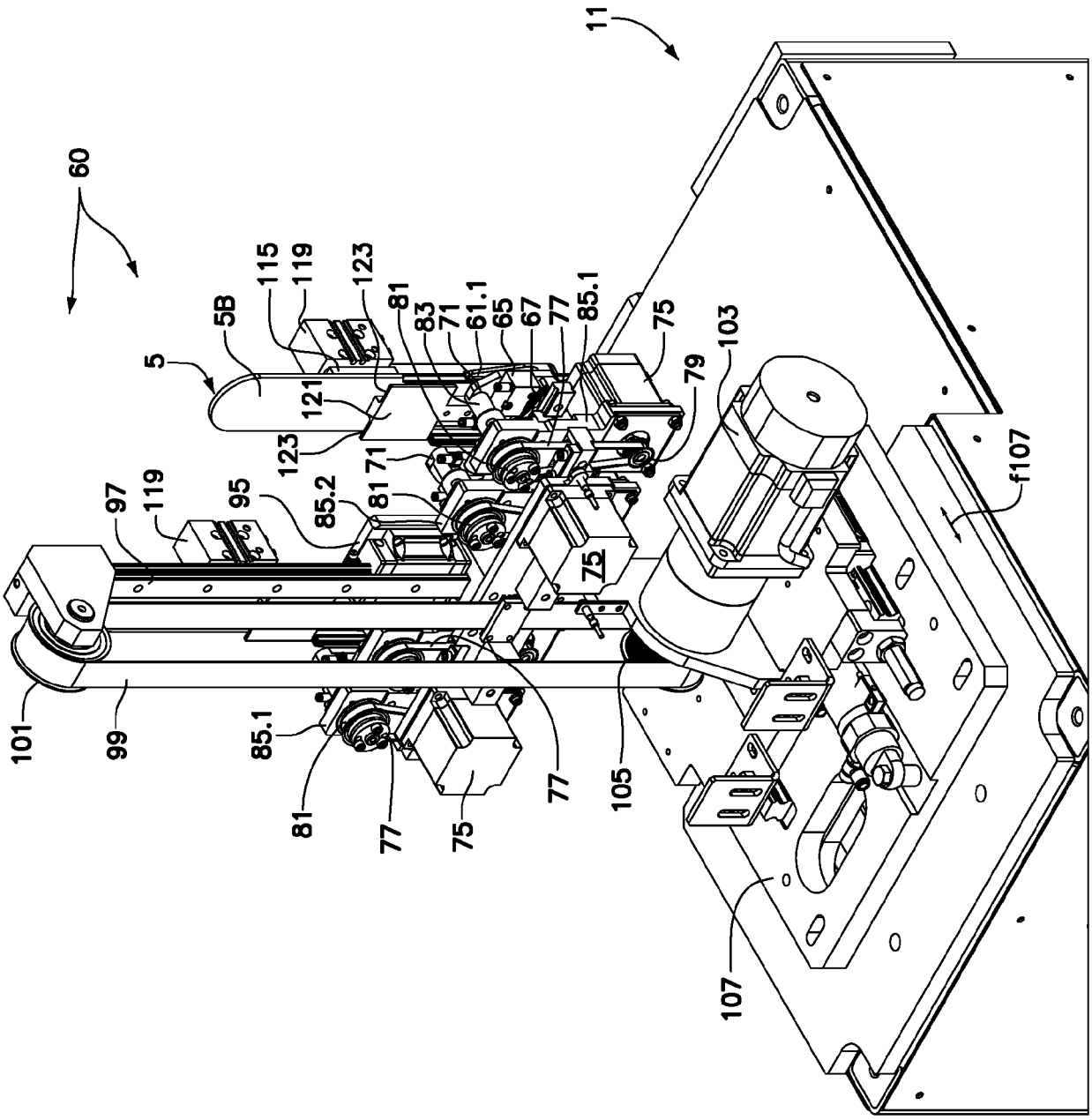
Fig.8

Fig.9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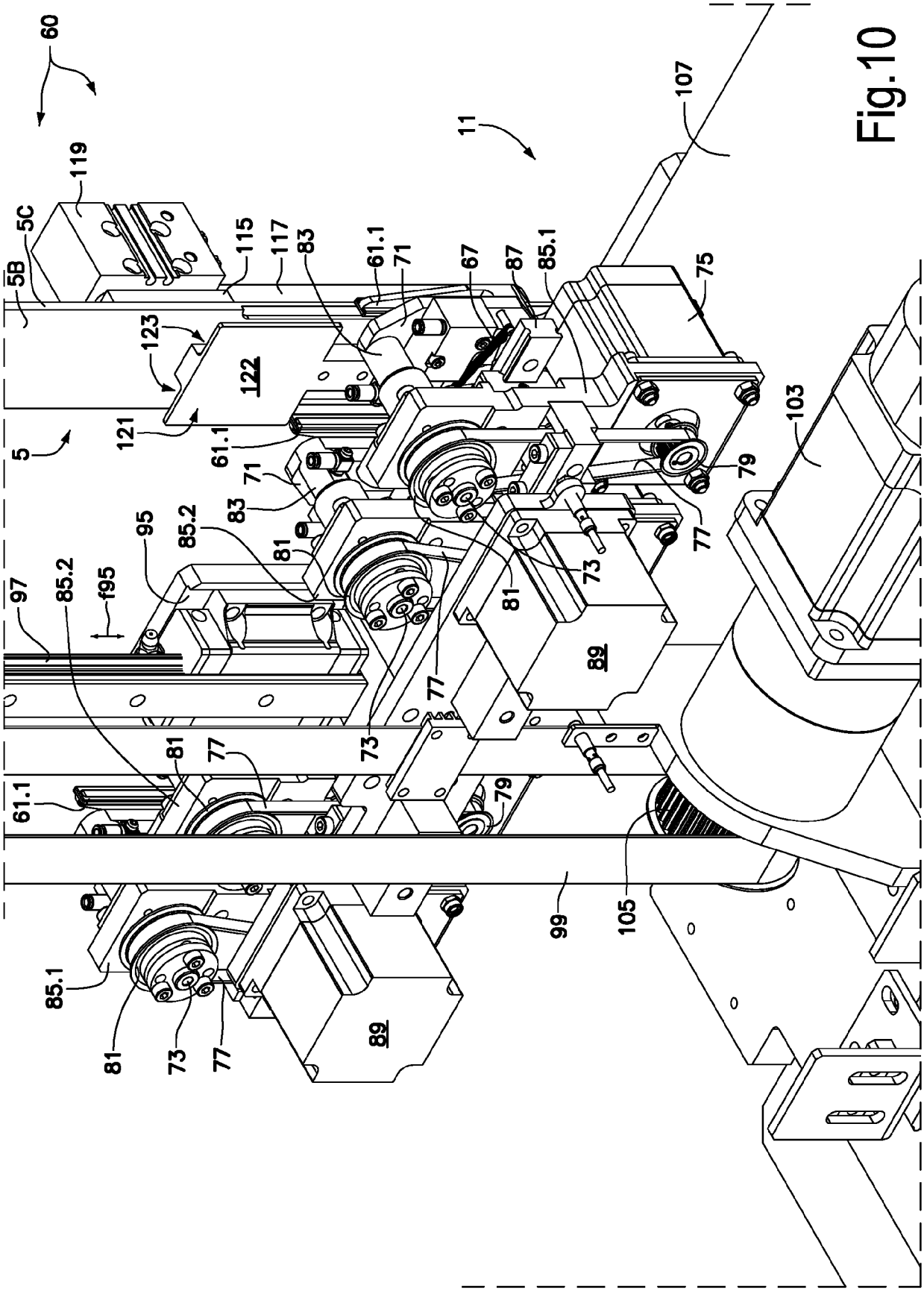
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Fig.10

Fig.11

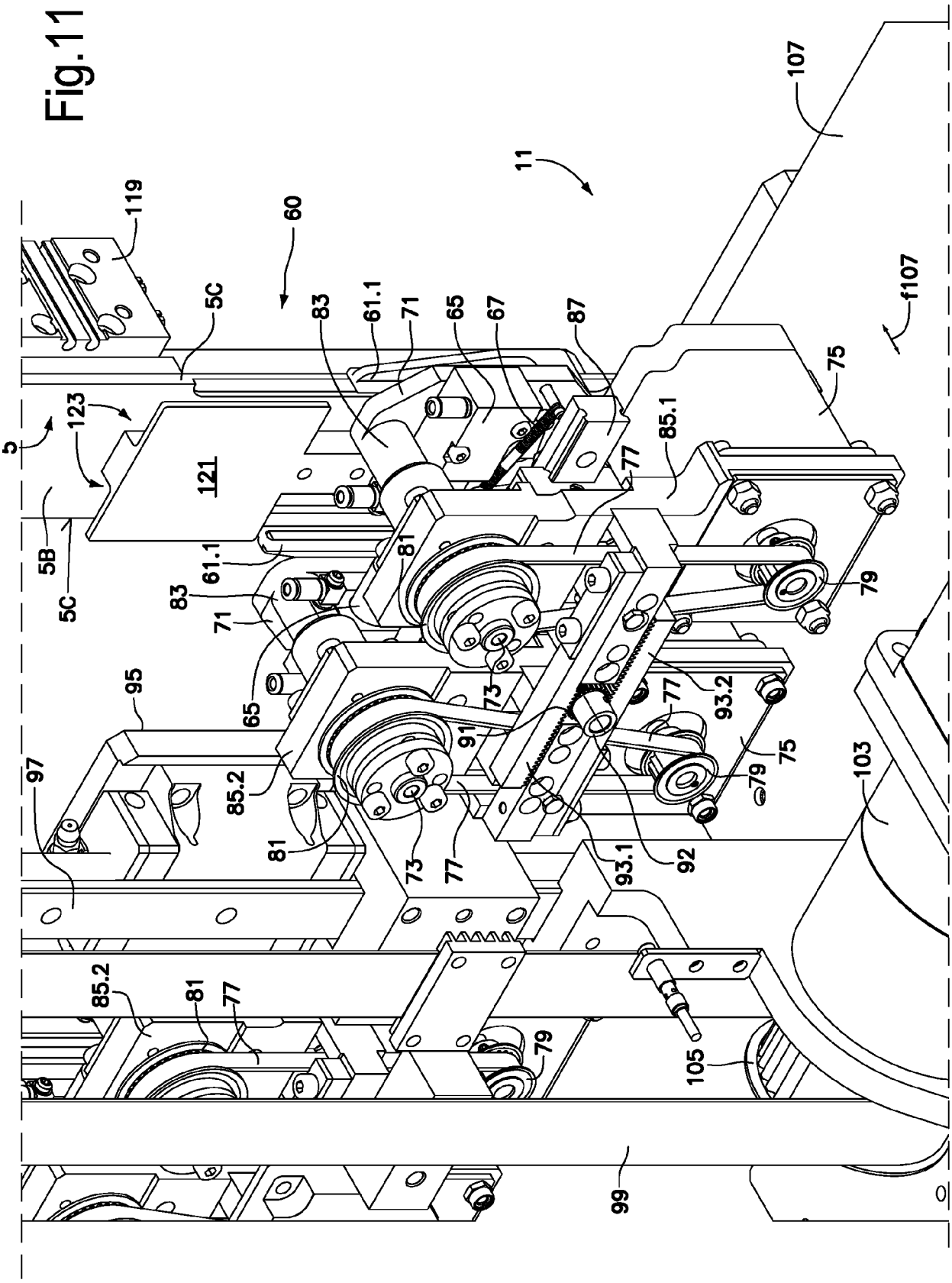
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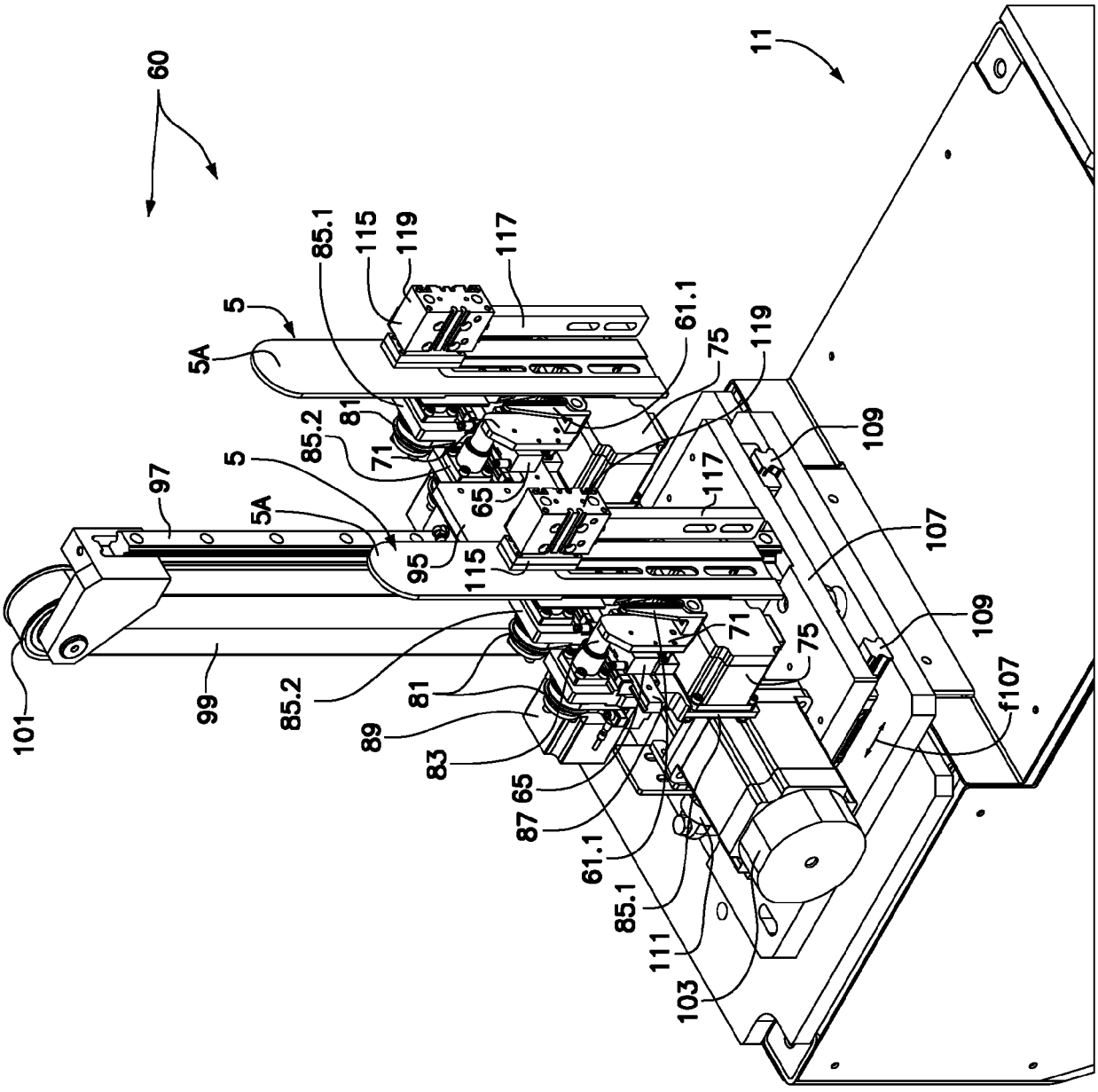
Fig.12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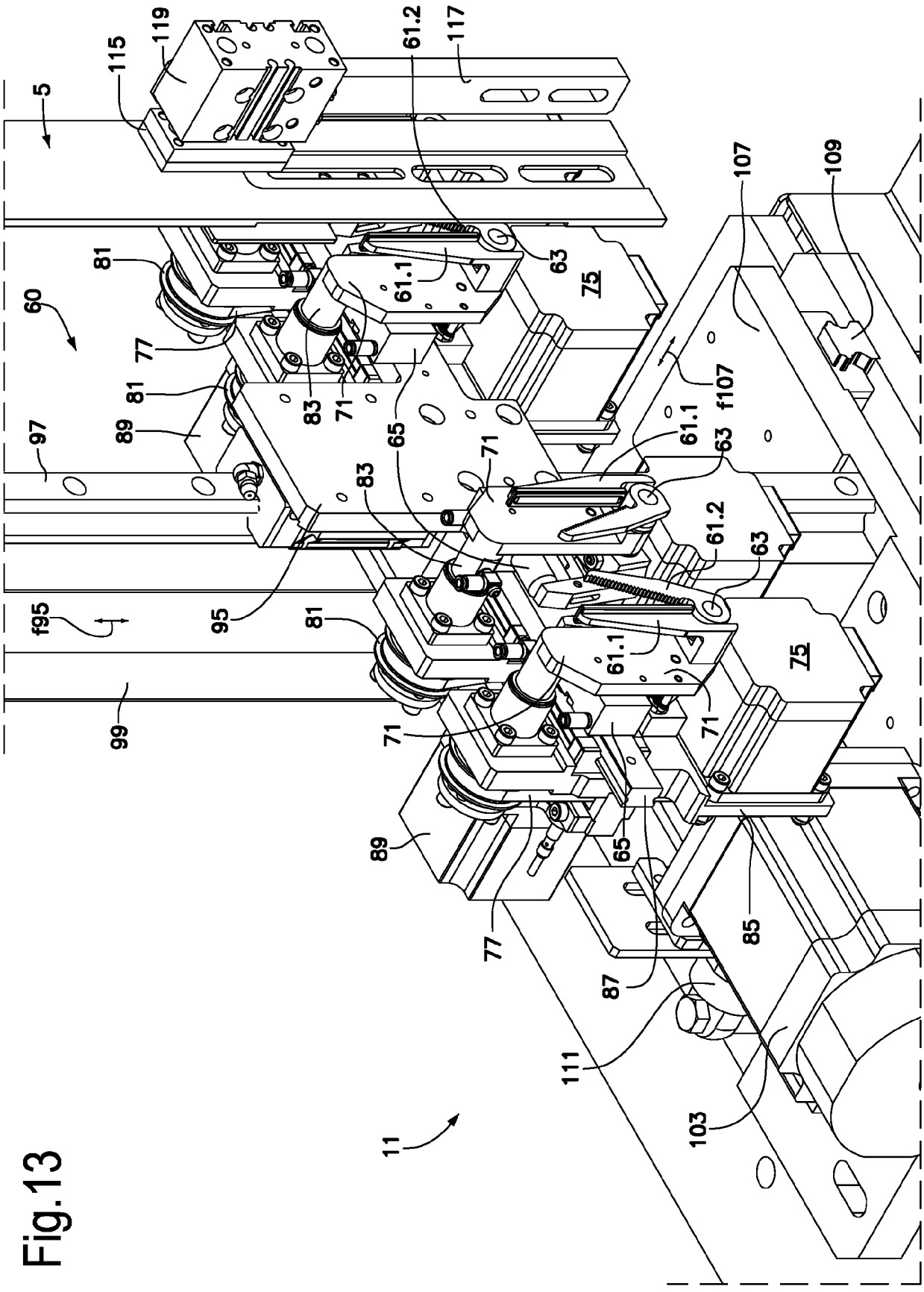
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Fig.13

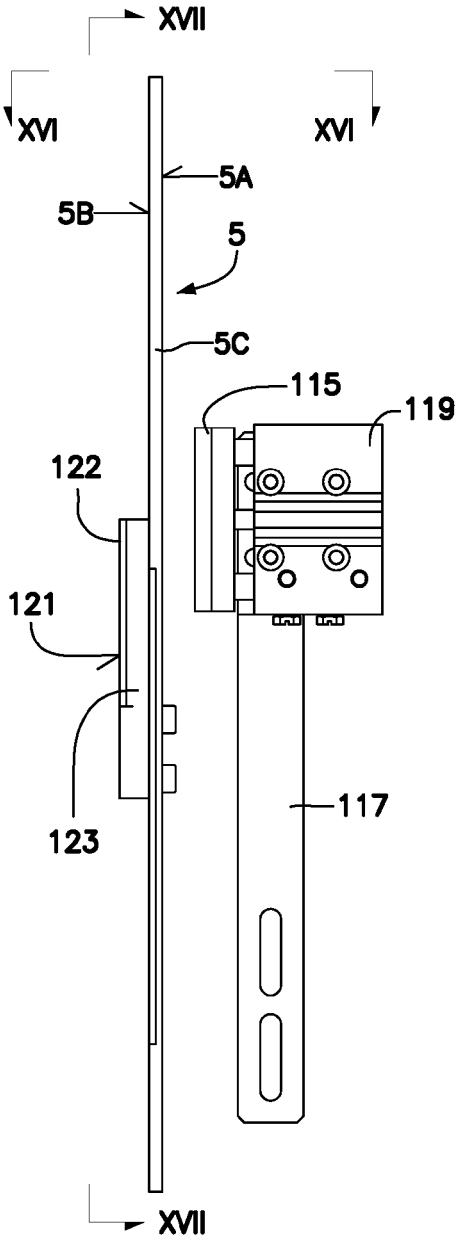

Fig.15

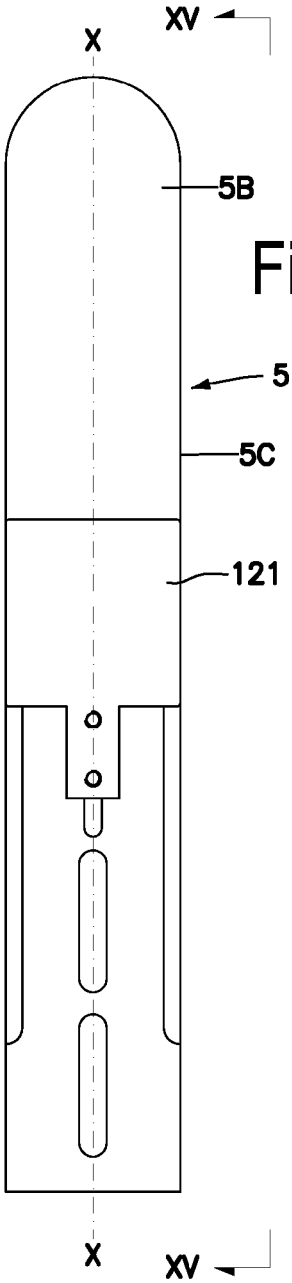

Fig.17

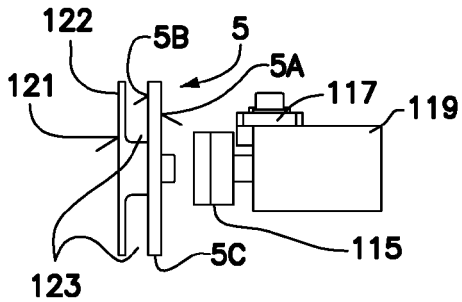

Fig.16

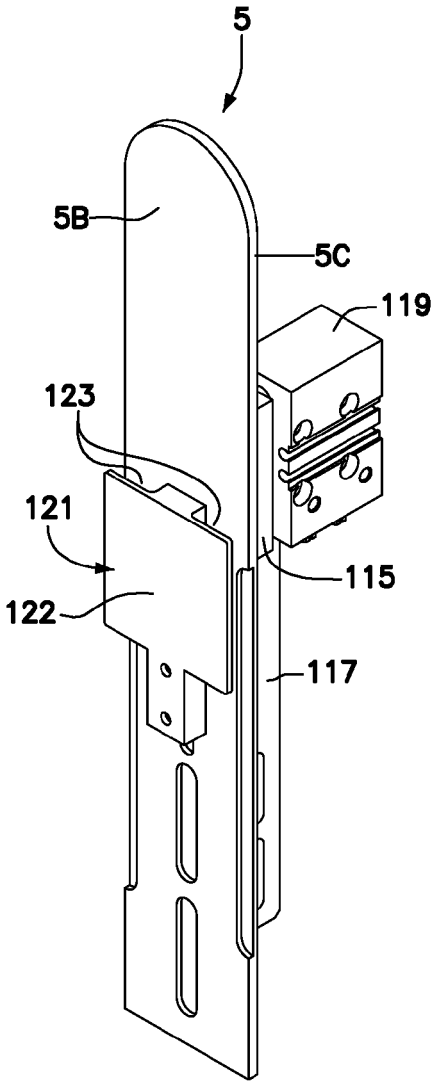

Fig.14

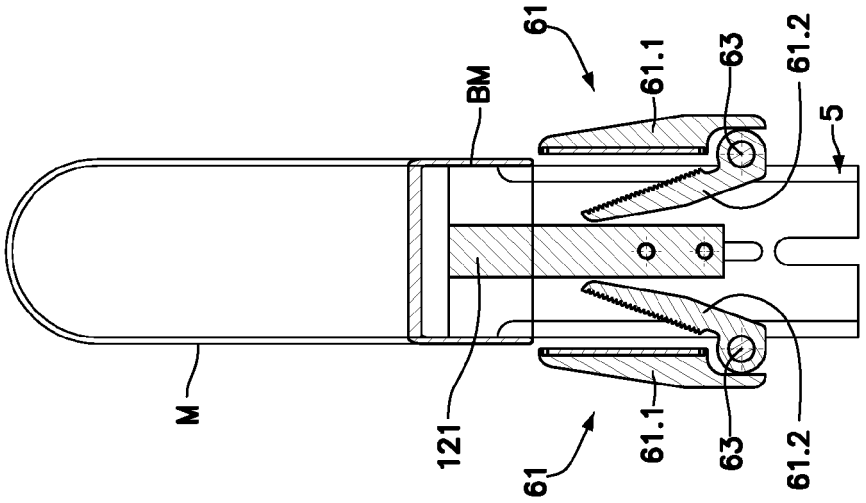

Fig.18A

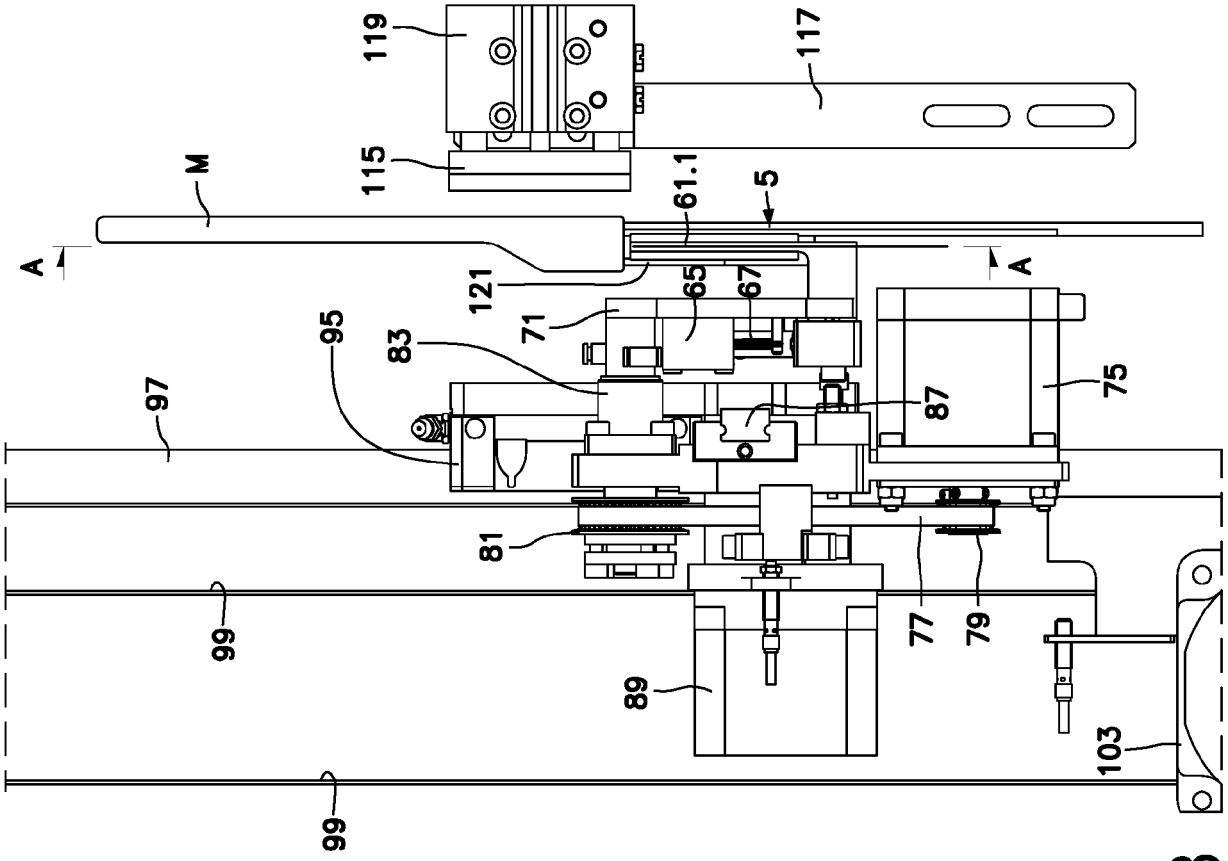

Fig.18

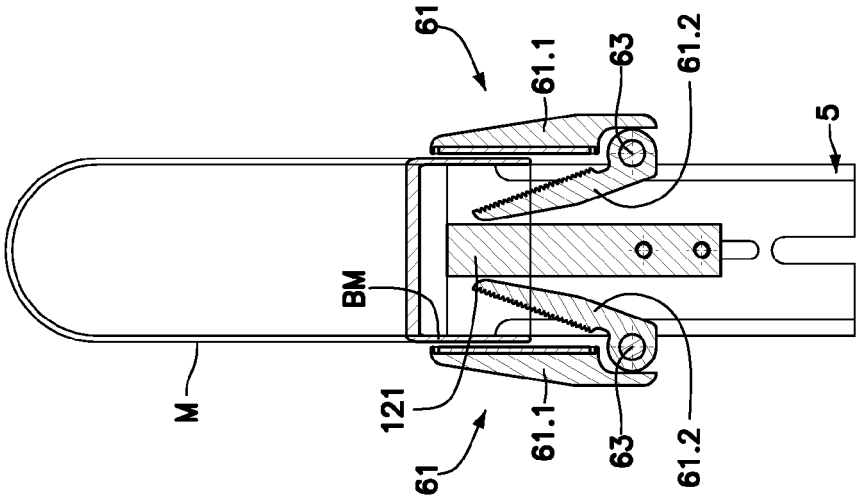

Fig.19A

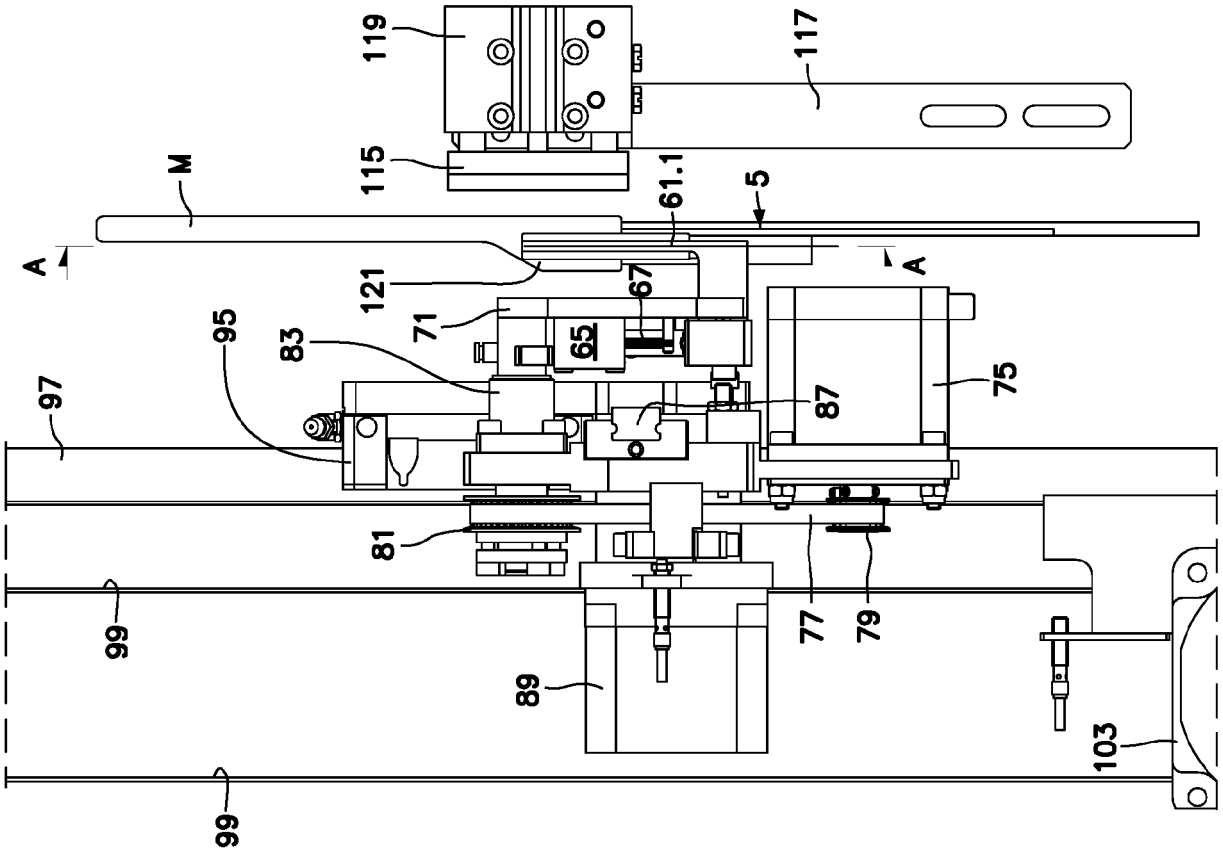

Fig.19

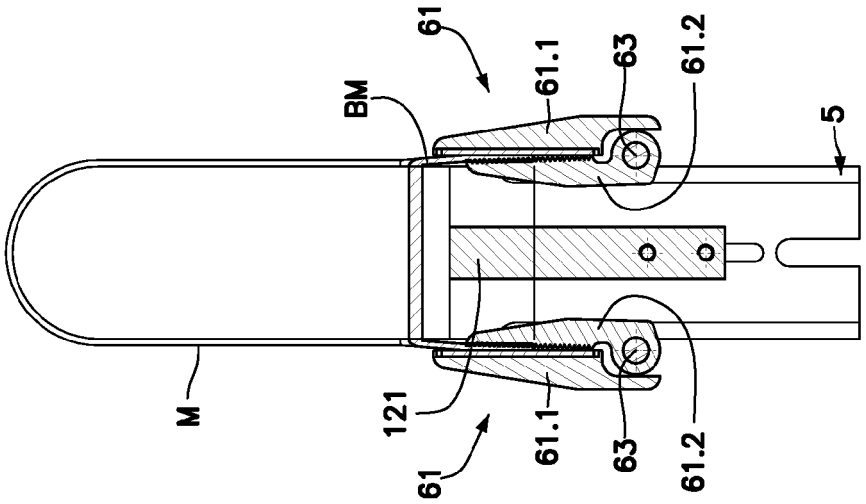

Fig.20A

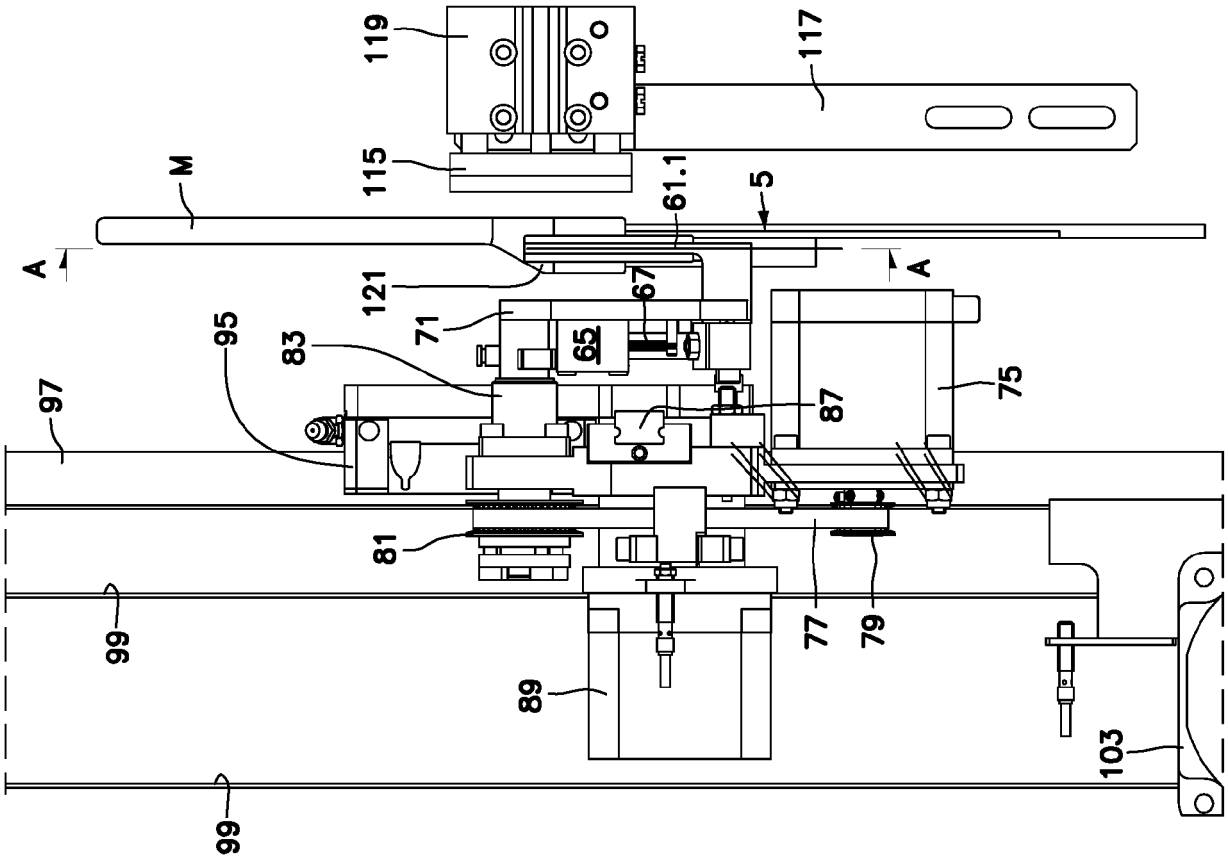

Fig.20

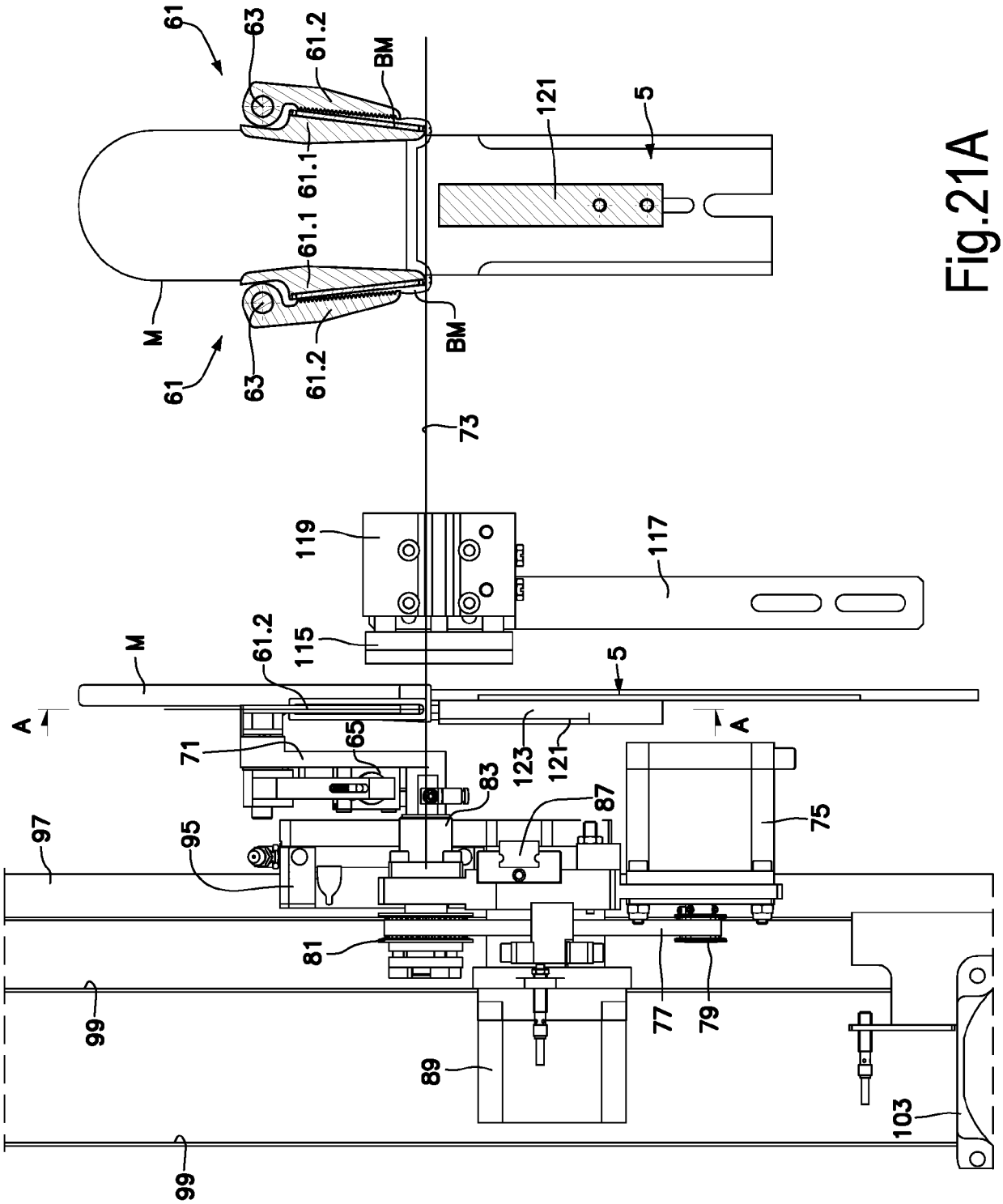

Fig.21A

Fig.21

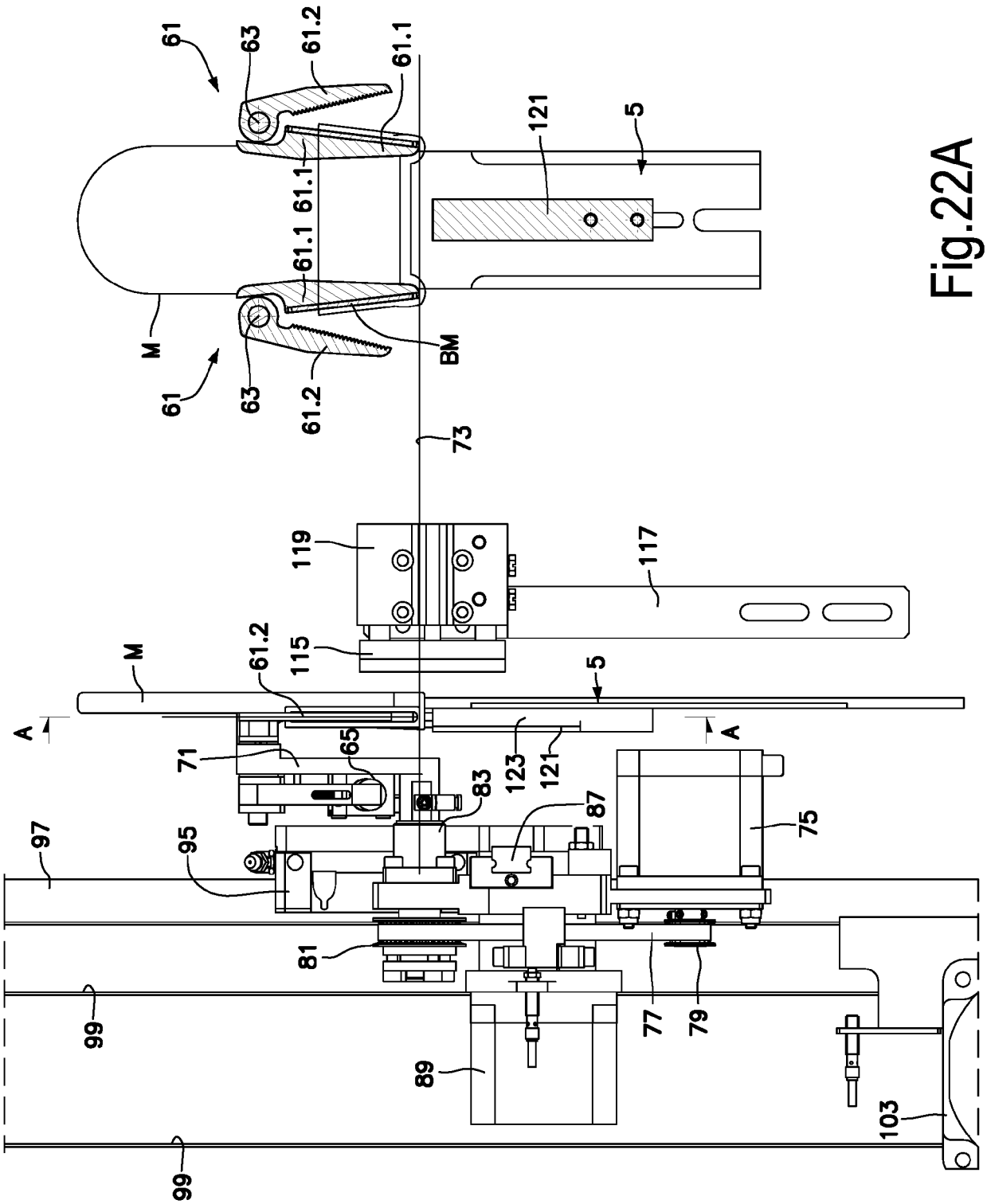

Fig.22A

Fig.22

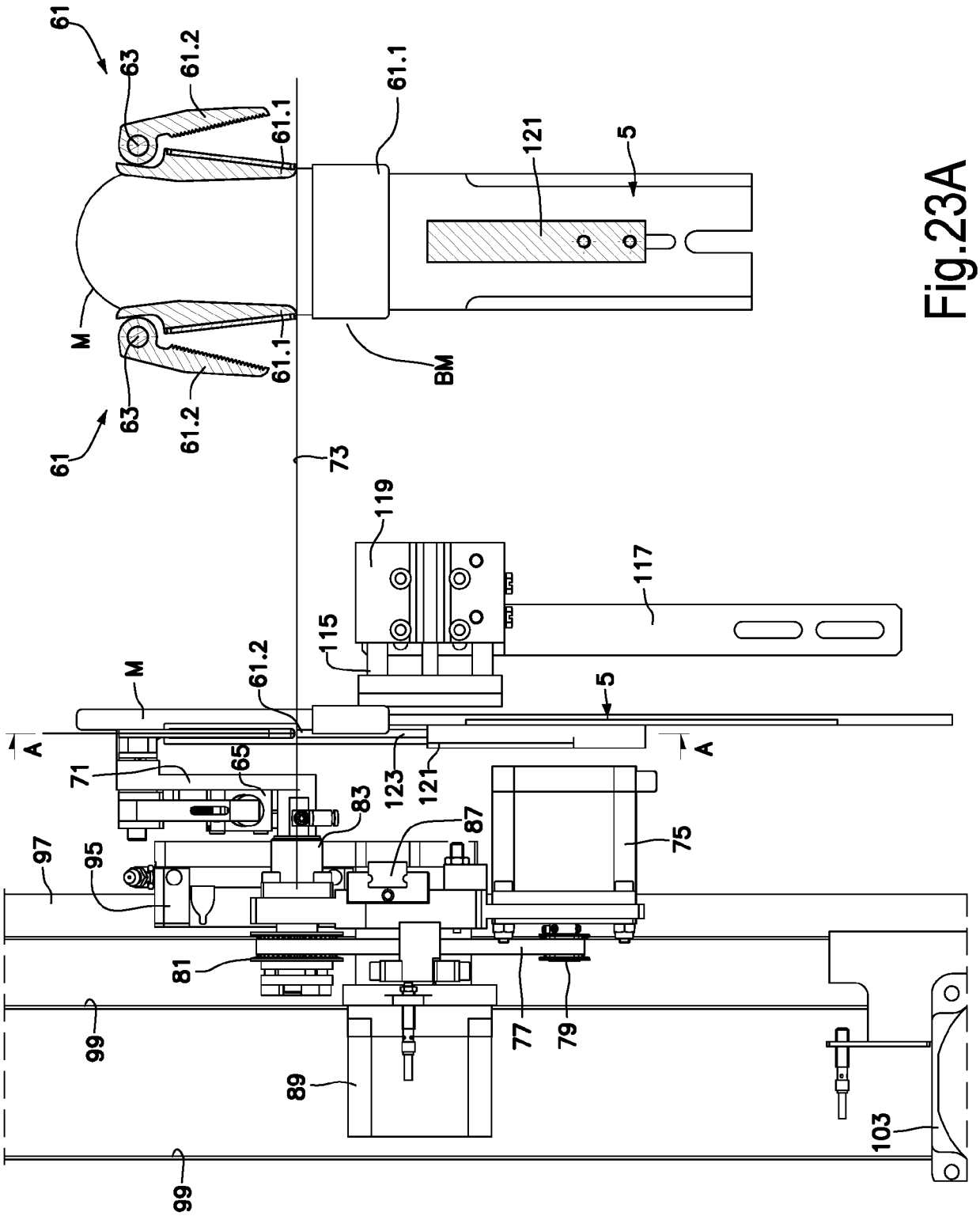

Fig.23A

Fig.23

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EUROPEAN SEARCH REPORT

Application Number
EP 22 18 2616

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/020667 A1 (GOLDEN LADY CO SPA [IT]; MAGNI ANTONIO [IT]; GRASSI NERINO [IT]) 22 February 2007 (2007-02-22)	17,19	INV. D06C5/00 D06C25/00
A	* page 20, line 17 - page 21, line 32; figures 8, 9, 16-20 *	1-16,18, 20	D06G3/02
A	WO 2007/015277 A1 (SANTONI & C SPA [IT]; PATERLINI STEFANO [IT]) 8 February 2007 (2007-02-08) * abstract; figures 4-8 *	20	
A	EP 0 121 956 A1 (SELVI FABIO) 17 October 1984 (1984-10-17) * the whole document *	1-20	

TECHNICAL FIELDS SEARCHED (IPC)

D06C
D06G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 November 2022	Braun, Stefanie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 22 18 2616

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 22 18 2616

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-20

device and method for reversing elastic edges of tubular textile articles comprising among features others a loading form and a specifically formed loading form

1.1. claims: 1-19

device and method for reversing elastic edges of tubular textile articles comprising among features others a loading form

1.2. claim: 20

specifically formed loading form

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 18 2616

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18-11-2022

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- WO 2007015277 A **[0004]**