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(54) Machine for gluing a liner sheet to a box with means for positioning the box.

(57) The machine for gluing a liner sheet (F) to the base and sides of the outer surface of a box (S), comprises : a transport device (5) for said sheet (F) ; feeder means for feeding individual sheets to a glue spreader (3) and from this to said transport device (5) ; conveyor means (9) for conveying individual boxes (S) that are to be lined with said sheet along guide means (115) at a higher level than said transport device (5) ; positioning means (13, 15, 17) for positioning the box over the respective liner sheet (F) arranged on said transport device (5), with a system of vertical guides (13) down which the box is pushed toward said liner sheet (F) ; and a push means (79) for pushing said box down onto the liner sheet below. The positioning means (13, 15, 17) are carried by a structure which is provided with a system of actuators (83, 84, 85) and a system of sensors (A), which move said structure in order to position each box accurately over the respective sheet arranged on said transport device (5), without modifying the relative position of said vertical guides (13).

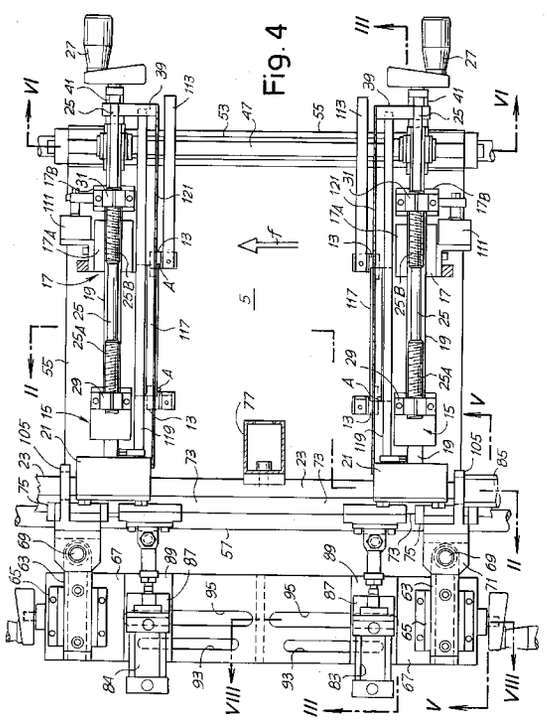

Fig. 4

EP 0 685 329 A2

The invention relates to a machine for gluing a liner to the base and sides of the outer surface of a box, of the type comprising in combination: a transport device for the sheet; feeder means for feeding individual sheets to a glue spreader and from this to the transport device; conveyor means for conveying individual boxes that are to be lined with the sheets along guide means at a higher level than the transport device; positioning means for positioning the box, comprising a system of vertical guides along which the box is carried toward the liner sheet below it, after having been positioned relative to it; and a push means for pushing the box down onto the liner sheet below.

Such a machine is described for example in Italian Patent No. 1,224,973. In the known machine the positioning means for positioning the box over the liner sheet have four vertical guides which are positioned at a distance from each other equal to the dimensions of the base of the box to be lined. Once in position, the vertical guides assume an unvarying aspect relative to the-transport device below it, on which the liner sheets are brought in succession. The correct relative positioning of the box with regard to the sheet in each individual operation is thus entirely entrusted to the transport device feeding in the previously glued sheet and to the positioning means linked to this transport device.

There are also machines in which the four vertical guides are moved by means of a piston-cylinder arrangement. However, in these machines the four guides do not maintain their relative position and therefore, when the guides are moved in order to center the box relative to the sheet, the box becomes distorted as it follows the movements of the vertical guides.

In certain cases, especially when lining very small boxes, it would be beneficial to have more accurate positioning between sheet and box and it is also necessary to avoid any distortion of the box during its positioning.

It is an object of the present invention to provide a machine of the type described at the beginning which will provide a more accurate positioning of the boxes and the liner sheets relative to each other.

These and other objects and advantages, which will be clear to those skilled in the art as they read the following text, are achieved according to the invention by means of a machine of the kind described, characterized in that said positioning means are carried by a structure comprising a system of longitudinal and transverse running guides, along which said vertical guides are positioned according to the shape of the box, and in that said structure is provided with a system of actuators and a system of sensors, which position each box accurately over the respective sheet arranged on said transport device, without modifying the relative position of said vertical guides.

The movements of the structure that carries the four vertical guides are such that the positioning of the box can be effected correctly and accurately without modifying the relative positioning of the vertical guides, and therefore without distorting the box to be positioned.

The machine described in Italian Patent No. 1,224,973 employs a push means in an essentially stationary position relative to the box positioning and guiding means. In some cases, depending on the size of the box, this results in imperfect centering of the push means relative to the box. This can be a problem when the box is small and also when, as in the present case, the positioning means can move in each operating cycle to position the box accurately relative to the liner sheet below it.

To avoid this problem, in an especially advantageous embodiment of the machine according to the invention, it is provided that the push means is movable as one integral piece with the positioning means under the action of the above-described system of actuators. In this way it is possible to ensure that the push means is always positioned centrally relative to the box, whatever oscillatory or translational movements the positioning means have made.

Other advantageous embodiments of the machine according to the invention are indicated in the accompanying claims and will be described in greater detail with reference to the accompanying figures.

A better understanding of the invention will be obtained from the description and accompanying drawing. The latter shows a practical, non-restricting, illustrative embodiment of the invention. In the drawing:

Fig. 1 is a schematic block diagram in plan view of the machine according to the invention;

Fig. 2 is a longitudinal section through the positioning means on the line II-II marked in Fig. 4;

Fig. 3 is a transverse section on the line III-III marked in Fig. 4;

Fig. 4 is a plan view on IV-IV marked in Fig. 3;

Fig. 5 is a local section on V-V marked in Fig. 4;

Fig. 6 is a local section on VI-VI marked in Fig. 4;

Fig. 7 is a simplified lateral view, with some parts removed, on VII-VII marked in Fig. 3;

Fig. 8 is a partial local section on VIII-VIII marked in Fig. 4;

Fig. 9 shows a detail of the activating system of the push means;

Fig. 10 shows a local section on X-X marked in Fig. 9 and

Fig. 11 shows a detail of the side with the components that convey the individual sheet to the gluing unit.

Fig. 1 is a block diagram of the machine according to the invention, showing in general outline the relative positions of the main components, some of which will be described in detail below, while others are of conventional type and basically the same as descri-

bed in Italian Patent No. 1,224,973, the content of which is incorporated in the present description.

The machine comprises, as a whole, a station 1 in which the individual sheets F for lining the boxes S are stacked and then individually taken and fed to a glue applicator unit having the general reference 3. The individual sheets F taken from the station 1 and glued by the gluing unit 3 are fed to a transport device 5 which forwards the individual sheet F in the direction of arrow f to a station 7 where the sheet is arranged underneath a station in which the boxes to be lined are positioned. The individual boxes are fed by a conveyor belt 9 in the direction of arrow fs, in a direction perpendicular to the direction f in which the liner sheets F are fed. The conveyor belt 9 is at a higher level than the transport device 5. Each individual box is arranged by the conveyor 9 between the positioning means bearing the general reference 11, which will be described in greater detail with reference to Figs. 2-8, which cooperate with a push means 79 which, when the positioning means 11 have positioned the box accurately over the sheet F, push the box down and stick it onto the sheet F to whose upper surface the glue has been applied by the spreader unit 3.

The conveyor 9, the transport device 5, the glue spreading unit 3 and the associated activating means are basically similar to or equivalent to those described in Italian Patent No. 1,224,973 and will not be described in greater detail herein.

The positioning means for positioning each box S over the respective liner sheet F comprise four vertical guides 13, three of which are of L section while one is of flat section. Each vertical guide 13 is carried by its own transverse sliding block. In the drawing, the numeral 15 indicates the transverse sliding blocks arranged on one side of the transport device 5 and the numeral 17 indicates the transverse sliding blocks arranged on the other side. The two sliding blocks 17 are constructed in two portions marked 17A and 17B respectively, for purposes which will be described later. The sliding blocks 15 and 17 are mounted so as to slide on transverse running guides 19, each of which is formed (in the example illustrated) by two parallel cylindrical bars at right angles to the direction of advance of the transport device 5. Each transverse running guide 19 is mounted at one end on a respective longitudinal sliding block 21. The sliding blocks 21 run along a longitudinal running guide 23 which, in the example illustrated, is of prismatic form.

The relative distance between the two transverse sliding blocks 15 and 17 can be adjusted by a respective threaded bar 25. The threaded bar 25 has two portions 25A and 25B threaded in opposite directions so that when the threaded bar 25 is turned by a handwheel 27 the transverse sliding blocks 15, 17 mounted on a common running guide 19 are moved toward or away from each other. The portions 25A, 25B of the threaded bar 25 engage in threads formed in two mountings 29 and 31 integral with the sliding blocks 15 and 17. The mountings 29 and 31 can be tightened by means of screws 33 when the transverse sliding blocks 15 and 17 are the desired distance apart. In this way the transverse sliding blocks 15, 17 are locked in position on their respective transverse running guides 19.

A threaded bar system is similarly provided for adjusting the position and distance apart of the longitudinal sliding blocks 21, on which the ends of the transverse running guides 19 are mounted. The system for adjusting the position of the sliding blocks 21 comprises a threaded bar 35 attached to which is a handwheel 37. The threaded bar 35 is made up of two portions 35A and 35B with threads in opposite directions which engage in tapped mountings 37 integral with the respective longitudinal sliding blocks 21. Suitable means of tightening, not shown, lock the threaded bar 35 once the longitudinal sliding blocks 21 are in their desired positions.

At the opposite end from the longitudinal running guide 23 and from the longitudinal sliding blocks 21, the two cylindrical bars that each form a transverse running guide 19 are attached to a plate 39 and to a bracket 41, on which is mounted the support of the respective threaded bar 25. The lower cylindrical bar 19A of each transverse running guide 19 passes through a ball bearing 43, which in turn is supported by a spherical support 45 on a supporting bar 47 parallel with the direction of advance of the transport device 5 (see in particular Fig. 6). In this way each transverse running guide 19 can move back and forth in a horizontal plane approximately parallel with the plane of the transport device 5, in the manner and for the purposes described later.

The supporting bar 47 is carried by end supports 49. Each end support 49 is attached to a ball bearing 51 that runs on a cylindrical bar 53. The cylindrical bar 53 is integral with a fixed supporting structure 55 that carries a second cylindrical bar 57 parallel with the cylindrical bar 53. The fixed supporting structure 55 carries guide means 59, 61 for the transport device 5 and also supports the structure formed by the transverse running guides 19 and the longitudinal running guide 23.

More particularly, the structure formed by the transverse running guides 19 and longitudinal running guide 23 is supported, on the opposite side from the supporting bar 47, by two running mountings 63. Each mounting 63 runs in a guide 65 at right angles to the direction of advance F of the transport device 5. The guides 65 are mounted on a base 67 fastened to the fixed supporting structure 55. Each mounting 63 is connected, by a pin 69 whose axis is vertical, to a connecting member 71 attached by a prismatic guide 73, 75 to the longitudinal running guide 23. The connection provided by the pin 69 enables the struc-

ture formed by the longitudinal running guide 23 and transverse running guides 19 to oscillate in a horizontal plane, whereas the connection to running guides 73, 75 permits a translational movement of said structure formed by the guides 23, 19 in a direction parallel with the longitudinal running guide 23.

Integral with the longitudinal running guide 23 is a column 77 carrying a push means 79 that moves vertically in the direction of double arrow f79. The push means 79 is controlled by a flexible member 81 activated by actuators carried by the fixed structure of the machine, and described hereinafter with reference to Figs. 9 and 10. The push means 79 can be provided with an interchangeable rectangular plate 78 whose dimensions are equal to the dimensions of the base of the box so as to apply a uniform pressure to the latter. Integral with the plate 78 is a retaining lamina 80 which holds the boxes fed by the conveyor 9 in position during the lowering and lifting stroke of the push means 79, so that incoming boxes do not obstruct the descent of the box previously positioned on the sheet presented by the transport device 5.

When the box to be lined has been brought over the vertical guides 13, it can be positioned accurately relative to the sheet F on the transport device 5 below, by slightly moving the structure formed by the longitudinal running guide 23 and transverse running guides 19. Movements are effected by means of two actuators 83, 84 and a further actuator 85. Each actuator 83, 84, which in the example illustrated is a cylinder-piston system, is carried by a bracket 87 fastened to a supporting part 89 on a pin 91 (Fig. 3). The pin 91 passes through a slot 93 formed in the base 67 and is partly threaded at 91A in order to engage with the supporting part. A tightening lever 92 is used to tighten the supporting part 89 against the base 67.

Parallel with the slot 93 is a second slot 95, through which passes a running block 97 with a threaded hole 99 housing a threaded bar 101 that has two threaded portions 101A and 101B that engage with the corresponding threads formed in the two running blocks 97. The threaded bar 101 is activated by a handwheel 103 by means of which the distance between the running blocks 97 and hence between the actuators 83 and 84 along the base 67 can be adjusted.

Integral with one of the connecting members 71 that connect the structure formed by the guides 23, 19 with the mountings 63 is a bracket 105 on which the cylinder-piston actuator 85 is mounted. The rod 85A of the cylinder-piston actuator 85 is attached to an end plate 107 applied to the end of the longitudinal running guide 23.

Using this arrangement it is possible, through the actuator 85, to cause a translational movement of the structure formed by the longitudinal running guide 23 and transverse running guides 19 parallel with said longitudinal running guide 23. Using actuators 83, 84, on the other hand, it is possible to cause an oscillatory movement of the structure formed by the abovementioned longitudinal and transverse running guides in a horizontal plane. The actuators 83, 84 and 85 are controlled by a processor or programmable controller to which the signals from photoelectric-cell or suchlike sensors mounted at positions A (Fig. 4) are sent. In practice the positioning or centering of the box S relative to the sheet F below is effected by first activating the actuators 83, 84 which move the structure 19, 23 from a position of maximum approach to the base 67 toward the opposite edge of the transport device 5. Each of the two actuators 83, 84 operates independently of the other and under the control of one of the two sensors A positioned beside the vertical guides 13 closest to the base 67. Each actuator 83, 84 is stopped when its sensor A has detected the edge of the liner sheet. The two actuators 83, 84 therefore produce either a rotation of the structure 19, 23 in a plane parallel with the plane of the transport device 5, or a translation approximately perpendicular to the direction f in which the sheets F are fed.

Once the box has been positioned transversely by the actuators 83, 84, the actuator 85 is activated in order to position it longitudinally in a similar manner, advantageously making use of a third sensor A.

Once the correct position has been reached, the push means 79 is activated and pushes the box down onto the transport device 5 where the liner sheet sticks to it. When the box has been stuck to the sheet the transport device 5, which was momentarily stationary to allow the box to descend, is again set in motion in order to carry away the box together with its liner sheet. In order to allow the box to be removed from the positioning area, the box itself must be freed from the vertical guides 13. This is done by moving the vertical guides 13 carried by the sliding blocks 17 away from the vertical guides 13 carried by the sliding blocks 15. To this end two pneumatic cylinders 111 are provided in order to connect together the portions 17A and 17B of each sliding block 17. Activating the cylinders 111 causes the portion 17A to approach the portion 17B, thus releasing the box. Advantageously, the two cylinders 111 connected to the two sliding blocks 17 have slightly different strokes from each other, the cylinder 111 downstream with respect to the direction of advance of the transport device 5 having a longer stroke in order to ensure that the box is freed from the corresponding L-sectioned vertical guide under all conditions.

In order to move each individual box from the conveyor belt 9 into position between the vertical guides 13, two of said guides 13 are provided with supporting laminae 113 (see Fig. 4). Over the supporting laminae 113 are retaining laminae 115, which prevent the individual boxes fed in succession from overlapping each other. The retaining laminae 115 can be adjusted for height to suit the height of the box

being processed, as can be seen in Fig. 2, where the two laminae 115 are positioned at two different heights corresponding to the minimum and maximum shape which the machine can handle. In actual use, of course, the laminae 115 will be positioned at the same height. The laminae 115 also prevent the box from being lifted by the friction of the lamina 80 during the ascending stroke of the push means 79.

The individual box positioned between the vertical guides 13 is held in position, before being pushed by the push means 79, by two elastic tongues 117 (see in particular Fig. 2) extending transversely across the transport device 5. The tongues 117 are carried by bars 119 which, when the box is pushed down by the push means 79, move, causing the tongues 117 to move apart and thus allowing the box to descend on the plane defined by the transport device 5. The tongues 117, which are made of sheet metal, are connected by mountings made of an elastic material, such as foam rubber, to corresponding guide strips 121 shaped so as to guide the box down toward the vertical guides 13.

As mentioned earlier, owing to the fact that the push means 79 is movable during each individual operation of positioning and lowering the box, it must be activated by a flexible control member 81. A first end 81A of said flexible member is fastened to the push means 79, while the second end 81B (see Fig. 9) is fastened to a cursor 131 guided along a vertical guide 133 carried by an extension 55A of the fixed supporting structure 55 of the machine. The cursor 131 is kinematically connected, by a link and crank system 135, 137, to the output shaft 139 of a geared motor 141. The rotation of the shaft 139 causes the cursor 131 to reciprocate along the vertical guide 133 and thus activate the push means 79.

Keyed to the output shaft 139 of the geared motor 141 is a cam 143 controlling a follower 145 (Fig. 10) whose movements (caused by the cam 143) open and close the control valves of the cylinders 111 by which the vertical guides 13 are opened. This provides a simple and reliable means for synchronizing the vertical movement of the push means 79 with the opening movement of the vertical guides 13.

As initially indicated, the system for introducing the individual sheets and the glue applicator unit, bearing the respective references 1 and 3 in Fig. 1, may be substantially identical to those already known from Italian Patent No. 1,224,973. Fig. 11, however, shows a slightly modified embodiment of the means for introducing individual sheets and applying the glue. These means have been specially designed to adapt to the extremely small sizes for which the box positioning device described above is particularly intended.

The stack of sheets F is brought towards a vertical wall 151 with an upper edge 151A. Downstream of the edge 151A is a strip 153 mounted on a transverse shaft 155 which pivots in such a way as to move the strip 153 alternately between the vertical position shown in Fig. 11 and an inclined position which allows the individual sheets to pass through to the glue applicator unit 3.

The removal of individual sheets F from the stack is formed by a head having the general reference 157. This moves horizontally and vertically in the direction of the two double arrows shown in Fig. 11. The head 157 has a sucker system 159 that grips the forward margin, that is the margin closest to the upper edge 151A, of the sheet F to be taken. Behind the sucker system 159 is a pivoting mouth 161 that can pivot between the position 161X and the position 161Y by rotating about a horizontal axis 163. The sucking mouth 161 grips the sheet F near its rear edge and, by rotating about the axis 163, separates it from the sheets below and thus facilitates the removal of individual sheets F and their transfer over the edge 151A and the strip 153 which for this purpose is lowered.

Each sheet F taken by the head 157 is introduced into a guide channel 165 at the mouth of which are two gripping cylinders 167, 169 which grasp the individual sheet and propel it through the channel 165 toward a gluing cylinder 171. The cylinder 171 is fed with glue from a spreading cylinder 173 and rotates counterclockwise to deposit a layer of glue on the sheet as it emerges from the guide channel 165, while said sheet is simultaneously advanced toward the transport device 5 located downstream of the glue spreading unit 3. The sheet is detached from the cylinder 171 by a scraper blade 175 and is then laid on the transport device 5, which is provided with a vacuum holding system of a type known per se.

The operation of the cylinders of the glue spreading unit 3 and of the transport device 5 can take place in the manner described in Italian Patent No. 1,224,973. The peripheral speed of the cylinder 171 and of the rollers 167, 169 is equal to the speed of the transport device 5 during the transfer of each individual sheet. However, whereas the transport device 5 stops cyclically after arranging the sheet underneath the box positioning means, the cylinders 171 and 173 remain constantly in rotation so that glue does not accumulate and/or dry out.

Advantageously, on the kinematic chains along which the motion is transmitted from the machine's main source of power to the transport device 5 and to the unit 3, speed-changing units can be provided so that from a single central power source it is possible to obtain variable speeds, but speeds that are always equal, for the transport device 5 and for the glue applicator unit 3.

It will be understood that the drawing shows only an illustrative embodiment purely by way of a practical demonstration of the invention, it being possible for the invention to be varied as regards shapes and arrangements without thereby departing from the

scope of the concept underlying the invention. The presence of reference numerals in the accompanying claims is for the purpose of facilitating the reading of the claims with reference to the above description, and does not limit the scope of protection defined by the claims.

Claims

1. Machine for gluing a liner sheet (F) to the base and sides of the outer surface of a box (S), comprising:
   - a transport device (5) for said sheet (F);
   - feeder means for feeding individual sheets to a glue spreader (3) and from this to said transport device (5);
   - conveyor means (9) for conveying individual boxes (S) that are to be lined with said sheet along guide means (115) at a higher level than said transport device (5);
   - positioning means (13, 15, 17) for positioning the box over the respective liner sheet (F) arranged on said transport device (5), with a system of vertical guides (13) down which the box is pushed toward said liner sheet (F);
   - and a push means (79) for pushing said box down onto the liner sheet below;

   characterized in that said positioning means (13, 15, 17) are carried by a structure comprising a system of longitudinal and transverse running guides (19, 23), along which said vertical guides (13) are positioned according to the shape of the box, and in that said structure is provided with a system of actuators (83, 84, 85) and a system of sensors (A), which move said structure in order to position each box accurately over the respective sheet arranged on said transport device (5), without modifying the relative position of said vertical guides (13).

2. Machine according to Claim 1, characterized in that said push means (79) is carried by said structure and is movable with it under the action of said system of actuators (83, 84, 85) so as always to be in the same position relative to the box.

3. Machine according to Claim 1 or 2, characterized in that said structure (19, 23) is provided with at least two independent actuators (83, 85) for positioning said box in two degrees of freedom.

4. Machine according to Claim 1, 2 or 3, characterized in that said structure that carries said vertical guides (13) is capable of oscillatory and translational movement in a plane parallel with the plane of the transport device (5).

5. Machine according to one or more of the previous claims, characterized in that said positioning means have four sliding blocks (15, 17), each of which carries a respective vertical guide (13) for said box, and whose relative distance is adjustable so that said vertical guides can position themselves at the corners of an imaginary rectangle of variable dimensions which can be preset, said dimensions being approximately equal to the dimensions of the base of the box to be lined.

6. Machine according to one or more of the previous claims, characterized in that said structure (19, 23) is provided with three independent actuators (83, 84, 85) controlled by respective sensors (A), one (85) of which actuators moves said structure in a direction approximately parallel with the direction of advance of said transport device (5) while the two other actuators move the points to which they are attached to said structure (19, 23) in a direction approximately parallel with the plane of the transport device (5) and perpendicular to its direction of advance.

7. Machine according to one or more of the previous claims, characterized in that said push means is activated by a flexible member (81).

8. Machine according to one or more of the previous claims, characterized in that said vertical guides can be moved by means of corresponding releasing actuators (111) to free the box after it has been lowered onto the sheet, and in that said push means (79) and said releasing actuators (111) are controlled synchronously by a cam-type distributor (143) or equivalent means.

9. Machine according to one or more of the previous claims, characterized in that said structure comprises a longitudinal running guide (23) approximately parallel with the direction of advance of said transport device (5); along which run two longitudinal sliding blocks (21; 21); and in that each of said longitudinal sliding blocks carries a respective transverse running guide (19) perpendicular to the longitudinal running guide (23), along each of which transverse running guides two respective transverse sliding blocks (15, 17) run, each carrying a respective vertical guide (13), said longitudinal sliding blocks (21) and said transverse sliding blocks (15, 17) being movable respectively along the longitudinal running guide (23) and the transverse running guides (19) in order to position the vertical guides (13) at distances corresponding to the dimensions of the box.

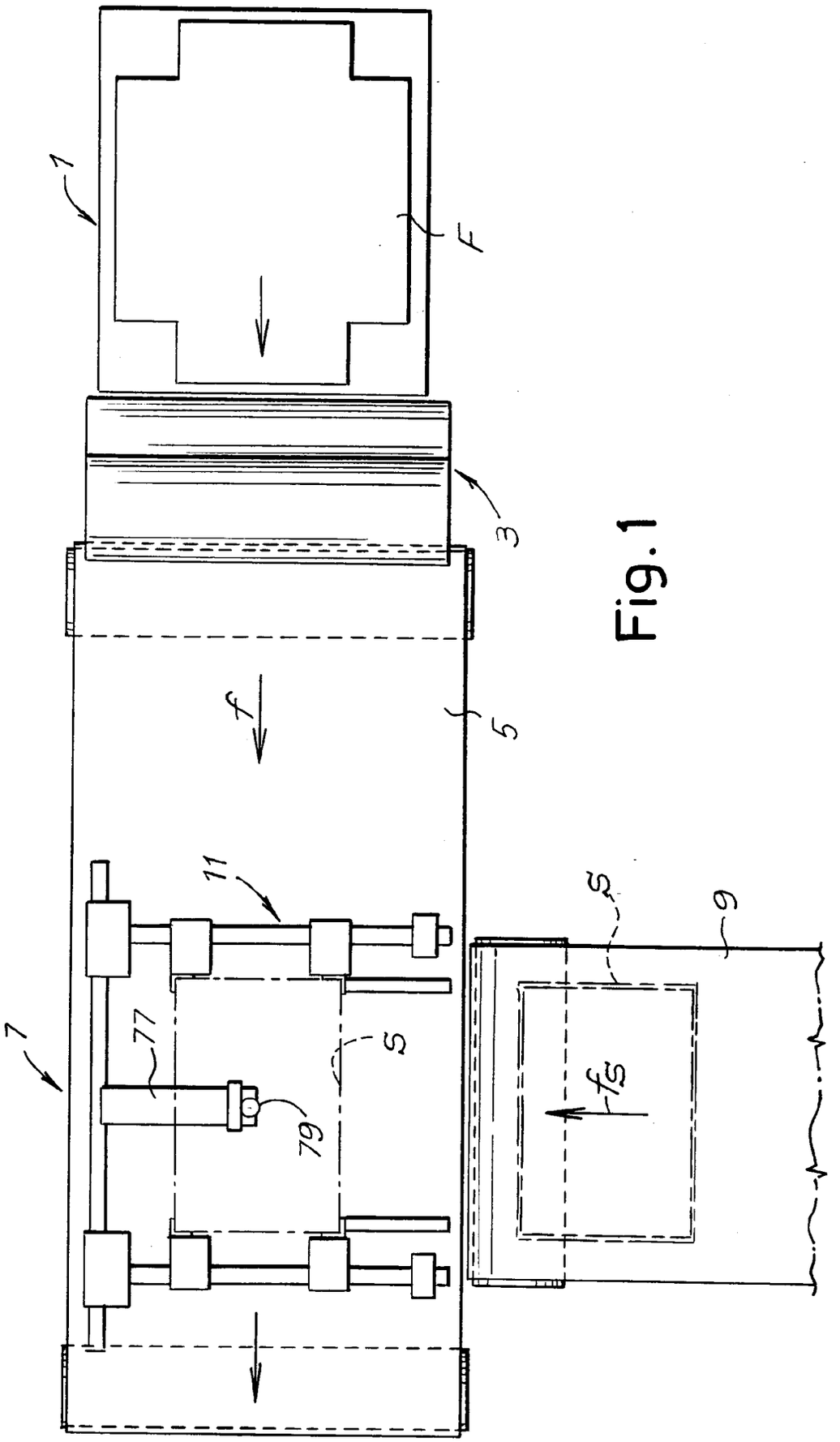

Fig. 1

Fig. 2

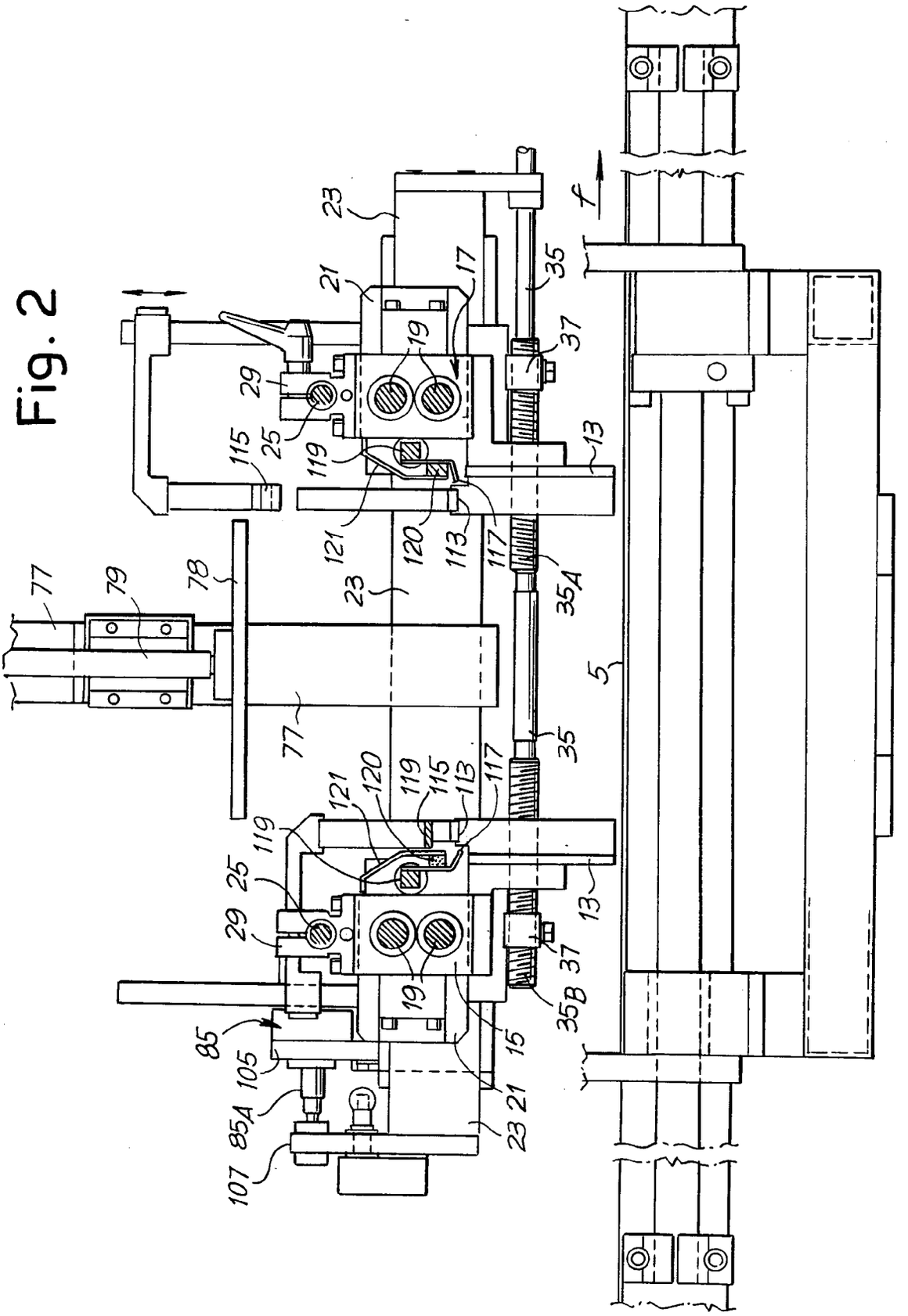
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Fig.3

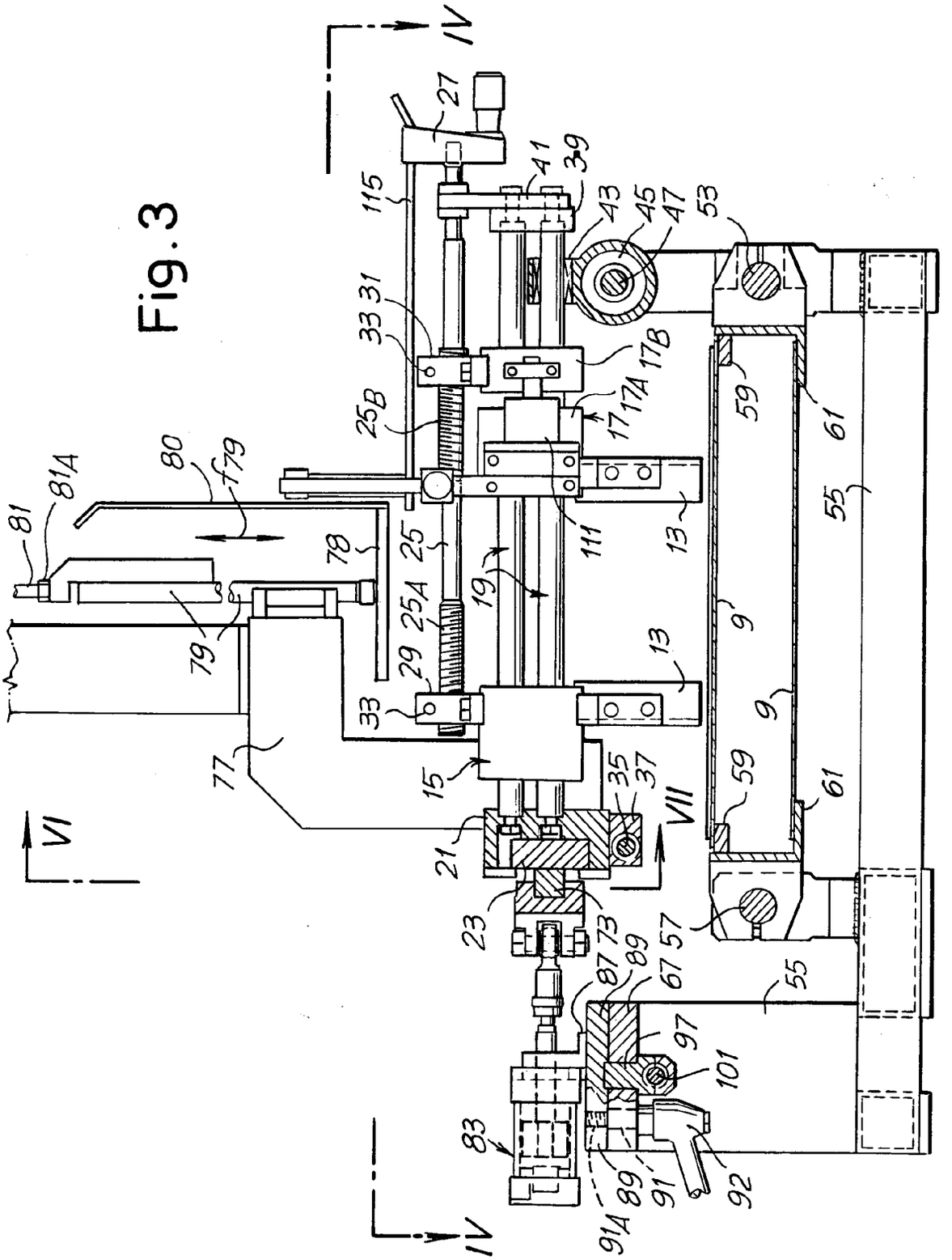
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Fig. 4

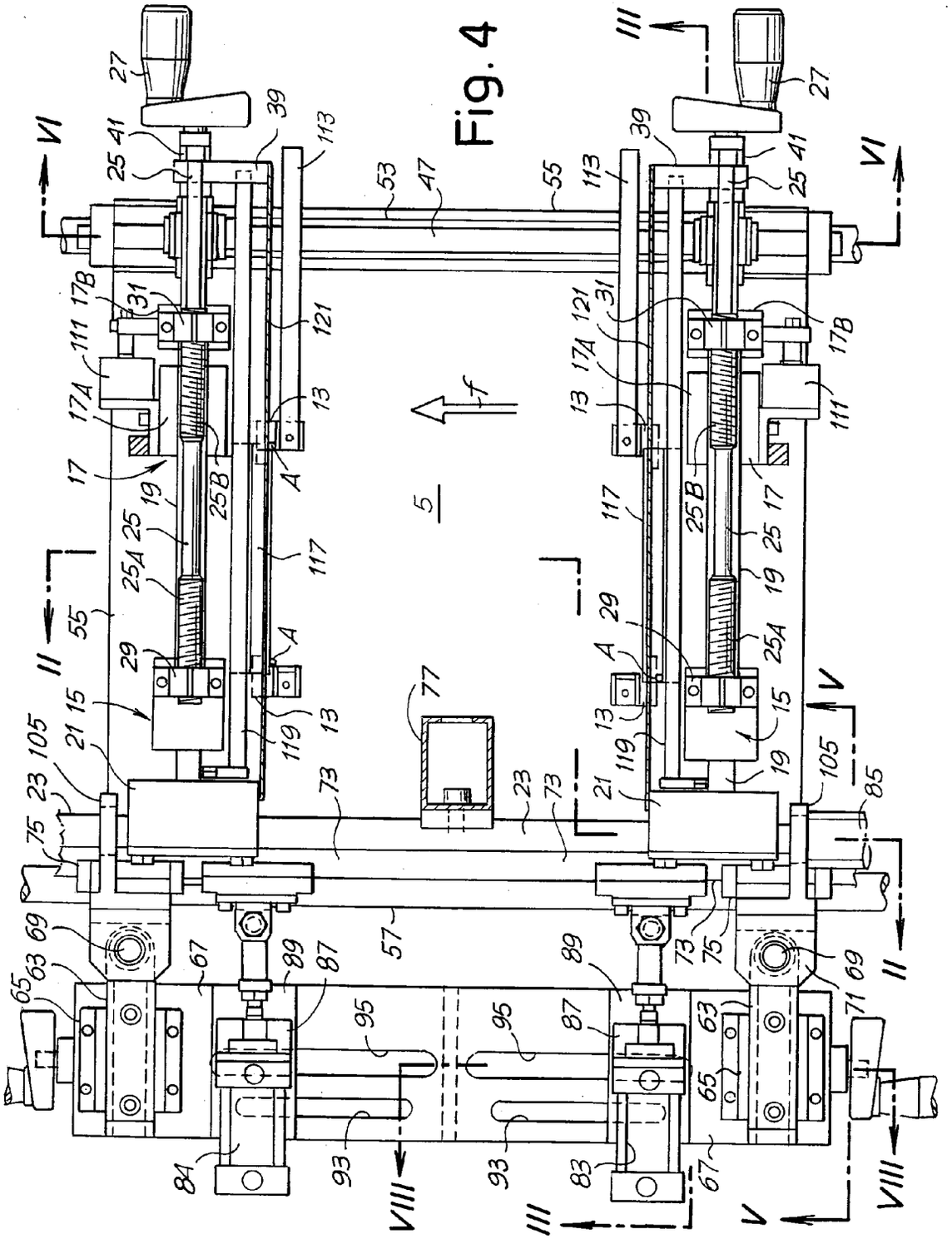

Fig. 6

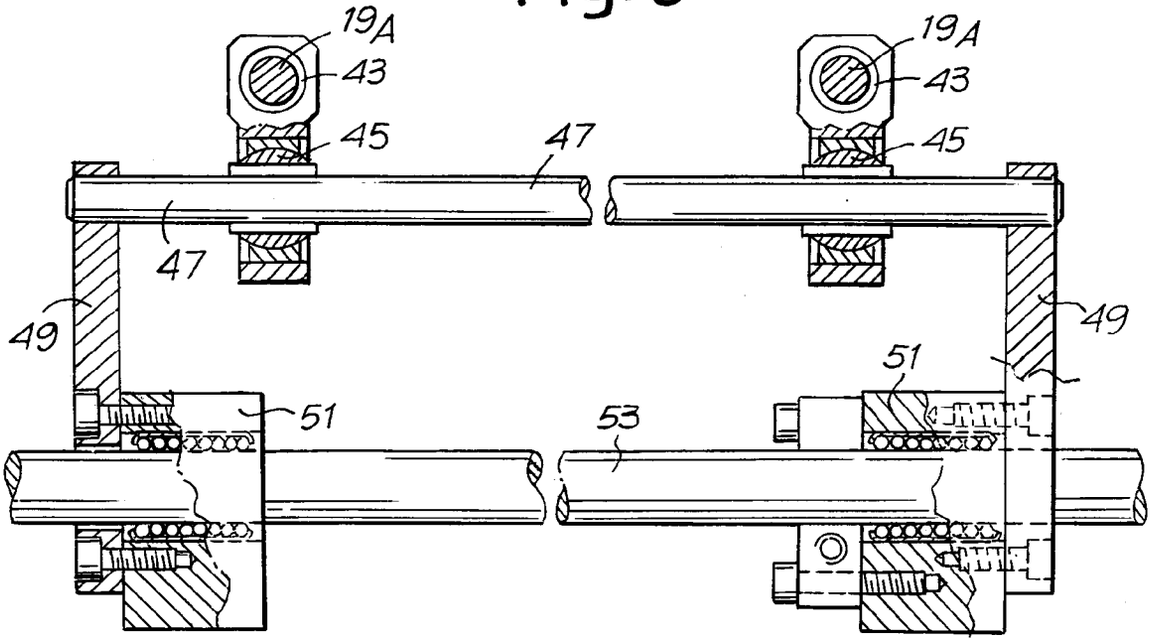

Fig. 10

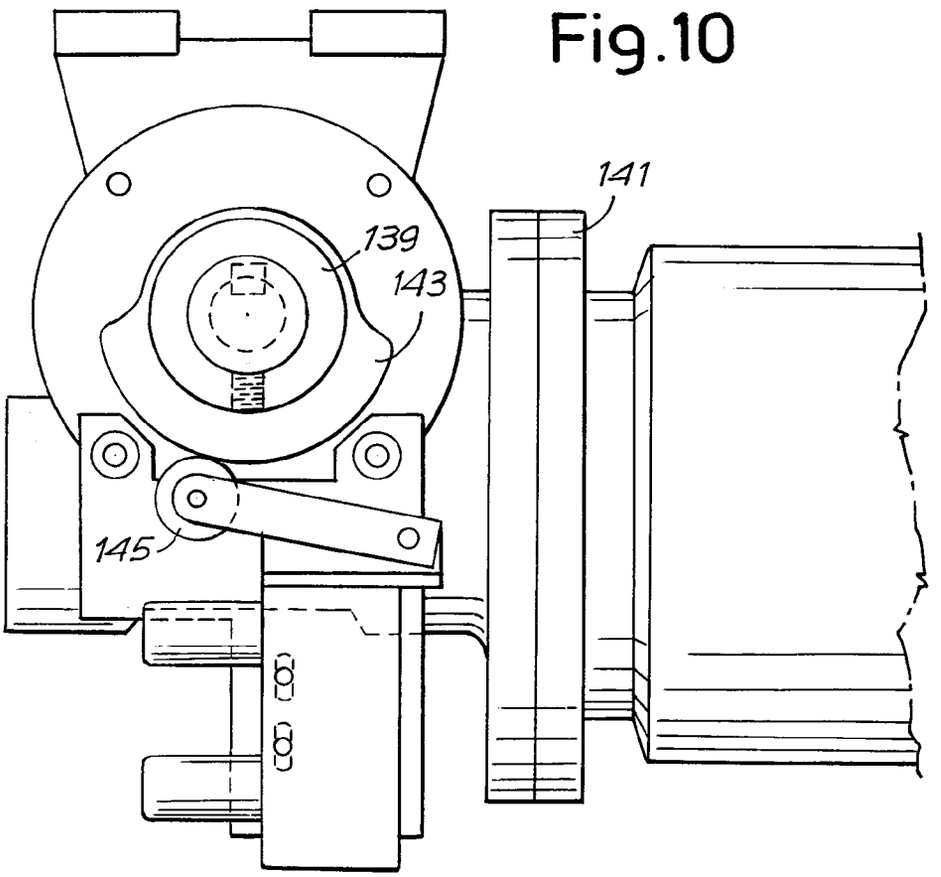

Fig.5

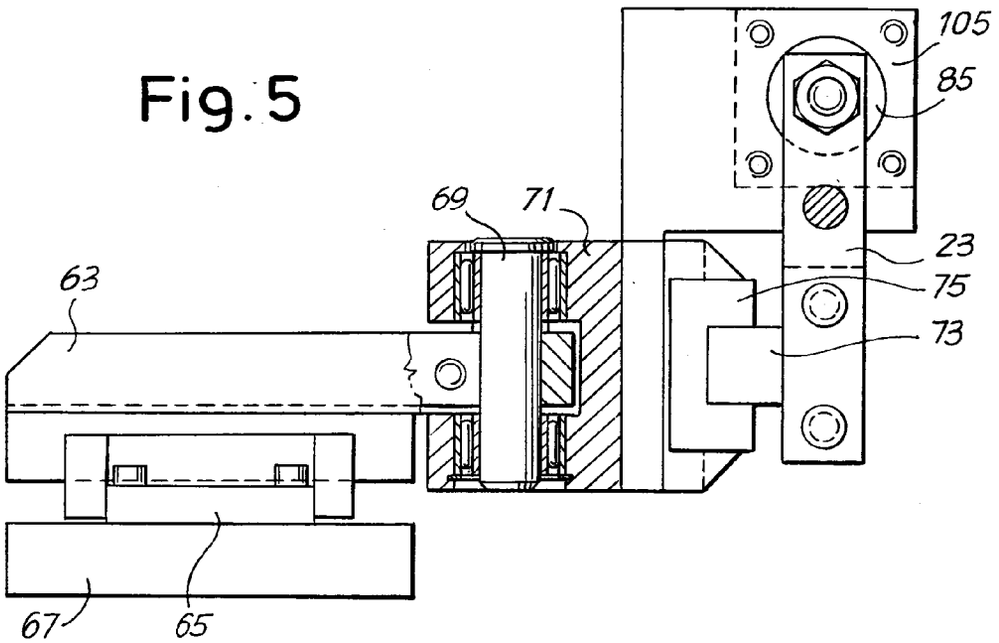
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Fig.8

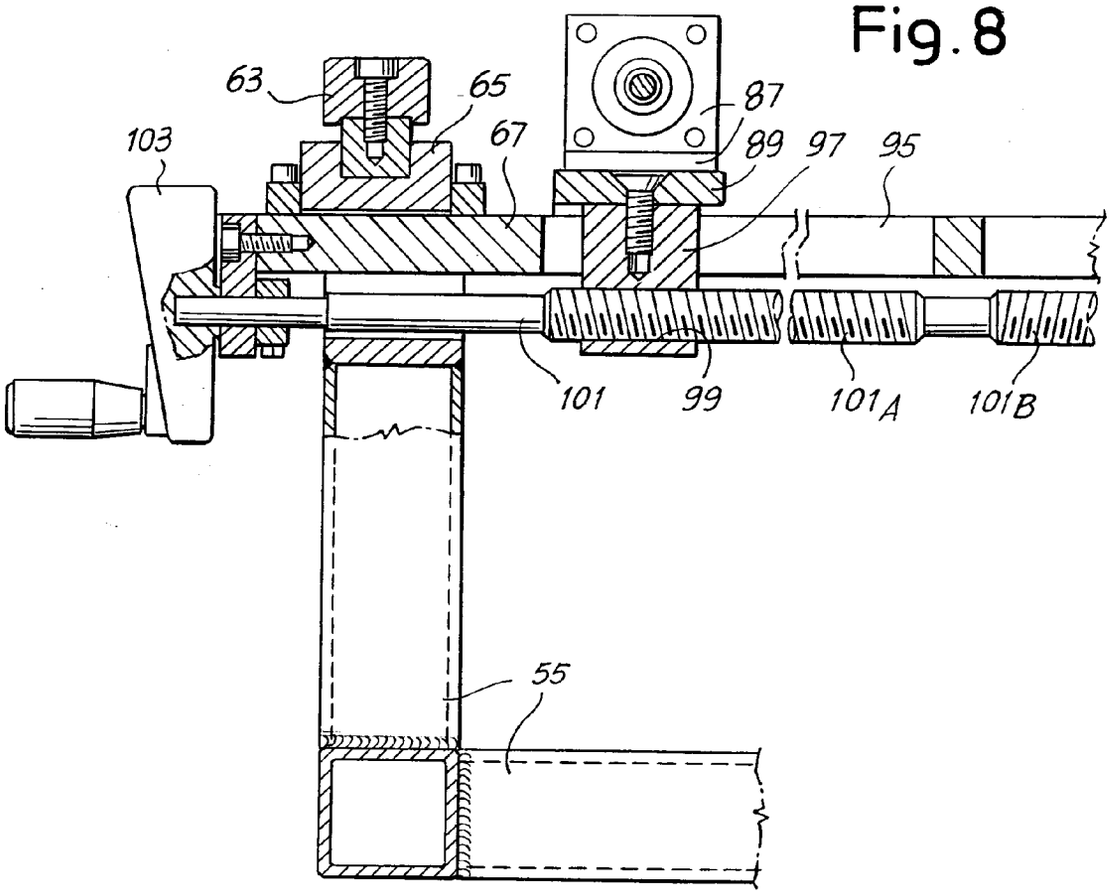
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Fig. 7

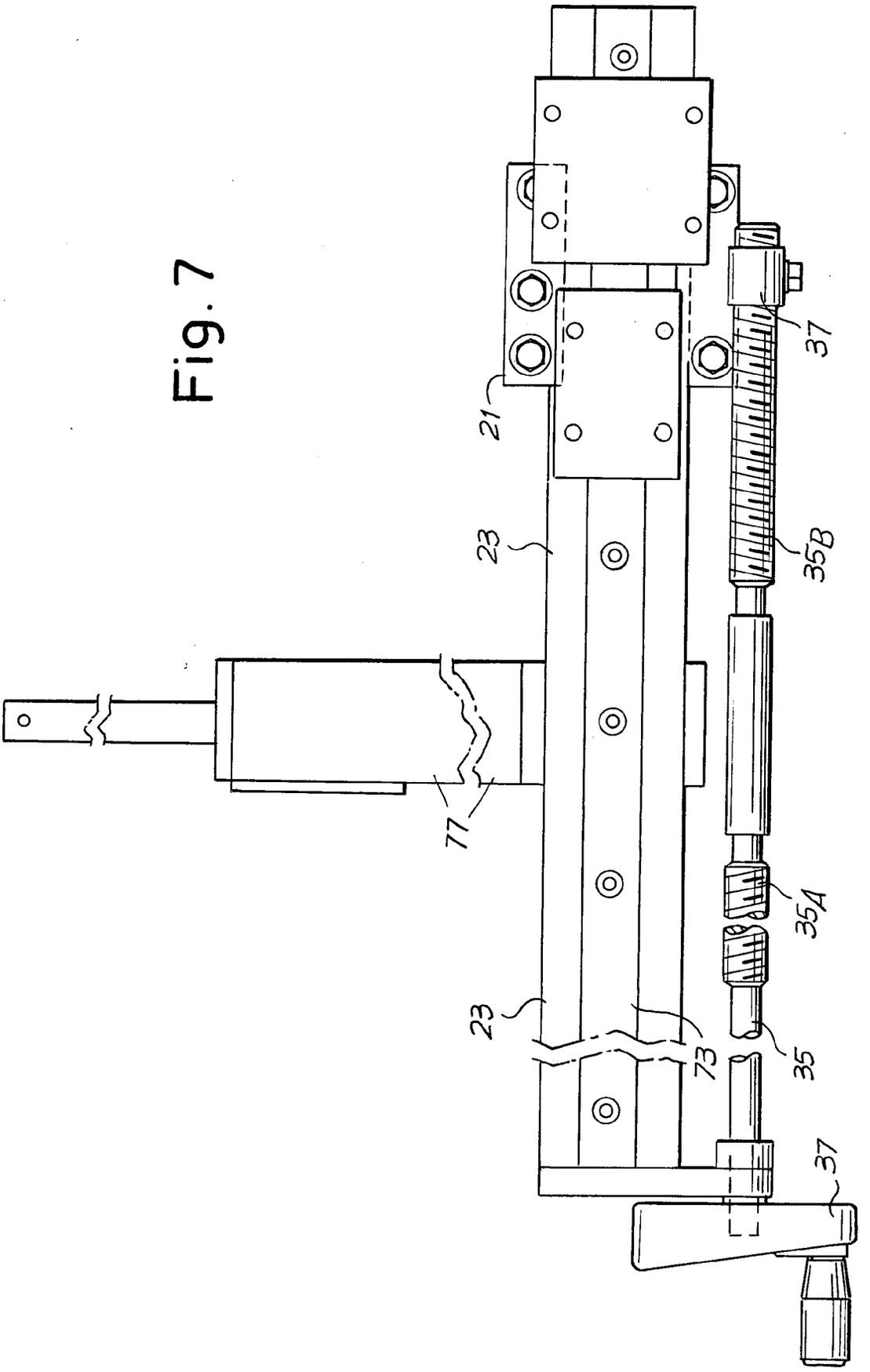
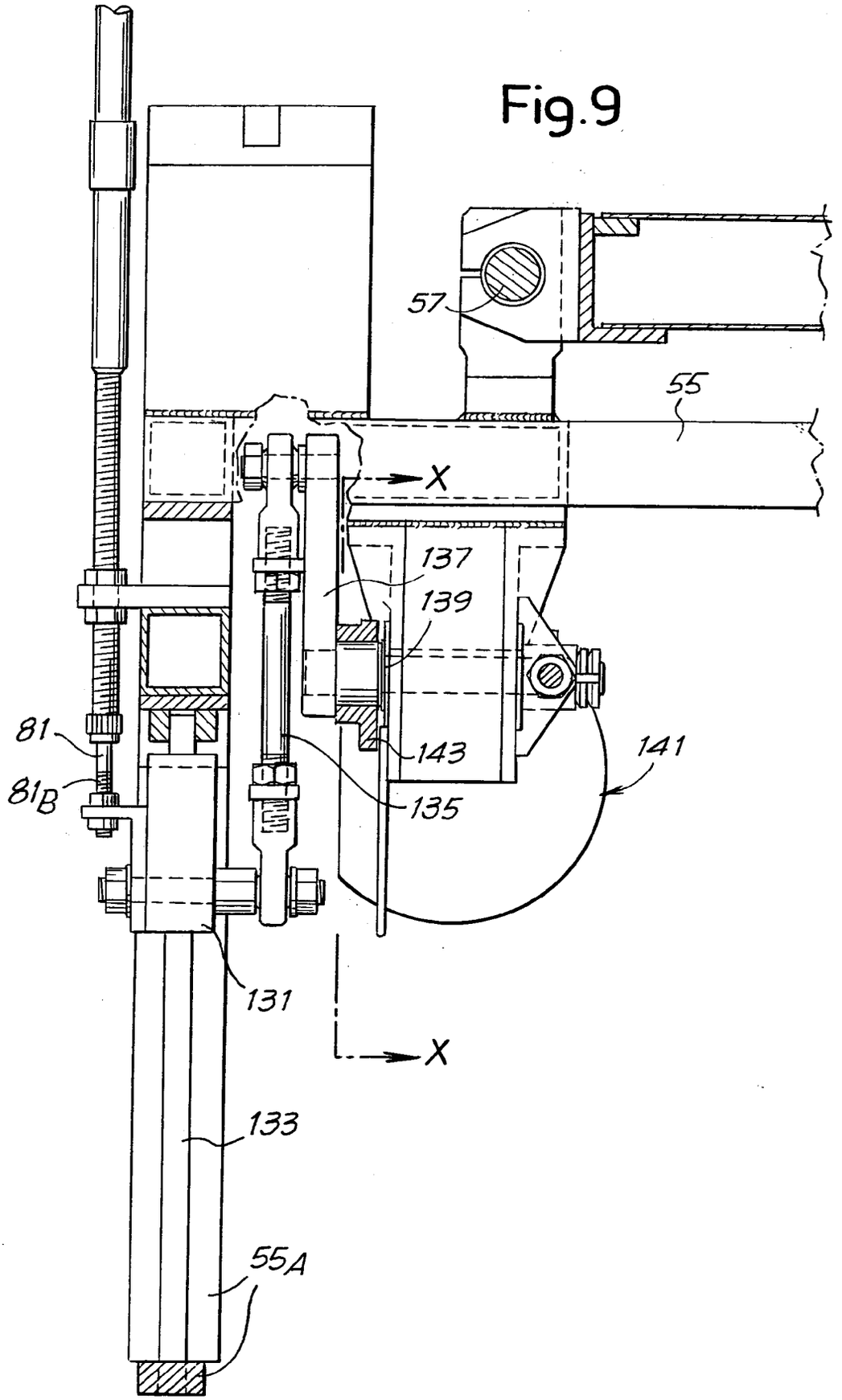


Fig.9



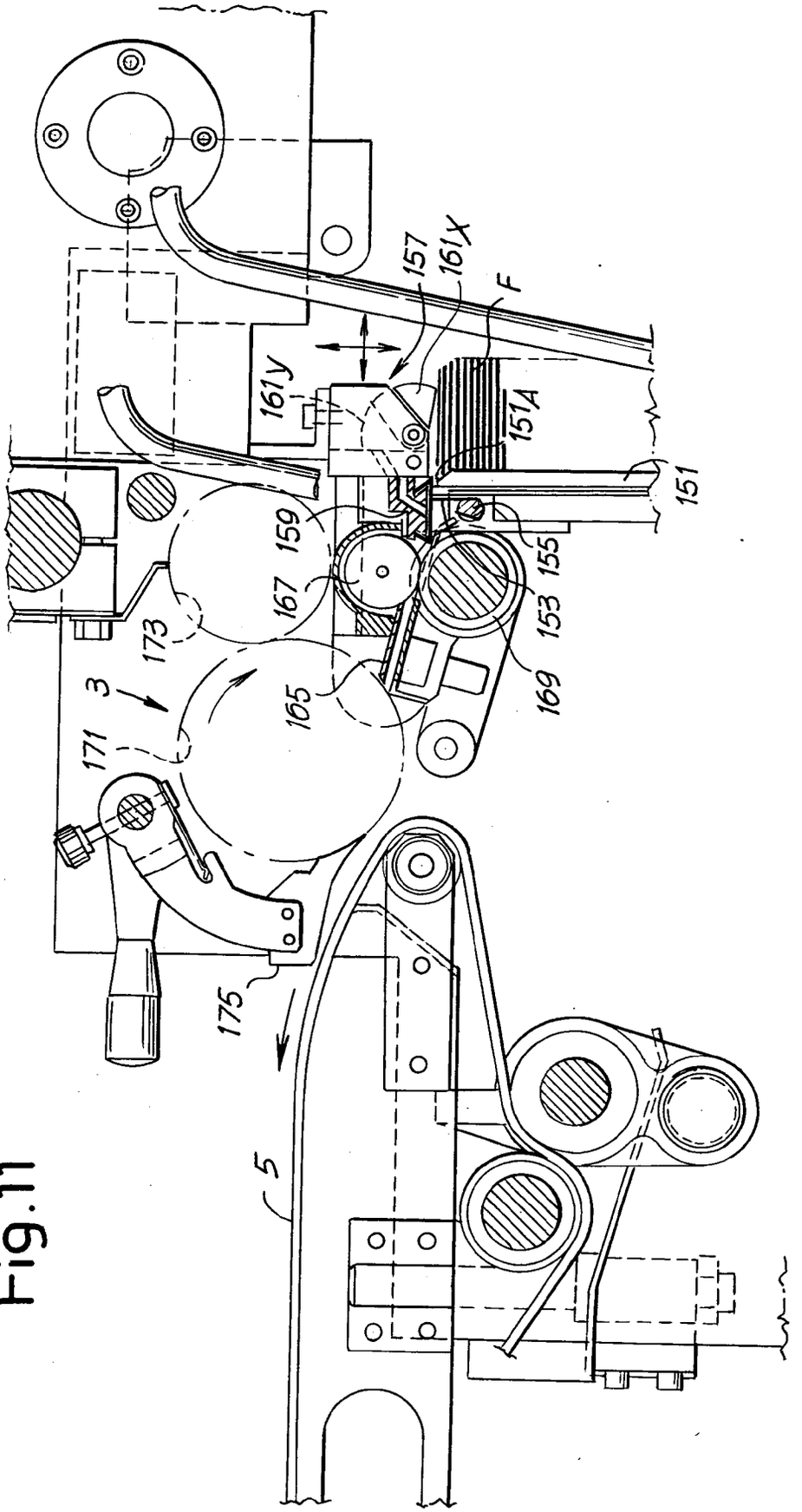


Fig.11