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Description

The present invention relates to an apparatus for manufacturing spring units suitable for forming mattresses or box spring mattresses.

Spring units each comprising a wire whose both ends are formed as torsion bar springs have been well-known as the spring units used in forming mattresses or box spring mattresses. It has been pointed out, however, that the mattress formed by torsion bar springs has the following problem. Because the torsion bar spring has small deformation ability relative to the compressed load applied, when incorporated into a mattress it has the necessary hardness to reliably support a person. However, the mattress is likely to be strained permanently when a load is repeatedly applied to it, as the spring unit provided with torsion bar springs quickly loses its elasticity.

In order to solve this problem, therefore, a mattress which is formed by spring units each comprising a wire whose both ends are formed as coil springs is proposed by US-A-4 619 445 filed May 10, 1983 and its corresponding EPC Application EP-A-0 095 761 filed May 27, 1983.

When the spring portion is formed by a coil spring, it is more difficultly fatigued, as compared with the torsion bar spring portion, and the elasticity of the spring unit can be thus kept good over a long time period. However, there is not yet developed an apparatus for mass producing spring units comprising a linear portion whose both ends are formed as continuous coil springs. This is the reason why spring units for box spring mattresses assembled by spring units having coil springs could not be provided.

DE-A-1 602 637, from which the present invention starts in its pre-characterizing part of claim 1, shows an apparatus for forming coil springs at one, preferably both ends of a flat linear wire. According to this known apparatus, said flat linear wire is stretched between two bodies which are moved on a guide rail by means of a toothed rack and pinions, respectively. Means are provided at the bodies to coil the wire in a desired manner, as the two bodies are moved in a direction towards each other by means of the drive pinions and the rack, said means are actuated via a gear driven from said rack.

As the gear relationships must be carefully adjusted prior to coiling a desired number of wires in order to arrive at a specific coil curvature and pitch, this known apparatus is not too suitable for mass production of spring units.

It is therefor an object of the present invention to provide an apparatus for producing spring units, according to the pre-characterizing part of claim 1, said apparatus being suitable for a full automatic mass production of such spring units.

Solution of this object is achieved by the characterizing features of claim 1.

The subclaims contain advantageous embodiments and modifications of the invention.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Figs. 1A and 1B are plane views showing a first shaping apparatus for manufacturing spring units according to the present invention.

Figs. 2A and 2B are front views showing the first shaping apparatus for manufacturing the spring units according to the present invention.

Fig. 3 is a plane view showing part of a stacking section where the wires shown in Figs. 1A and 1B are stacked.

Fig. 4 is a sectional view taken along a line IV-IV in Fig. 3.

Fig. 5 is a sectional view taken along a line V-V in Fig. 3.

Fig. 6 is a sectional view taken along a line VI-VI in Fig. 3.

Fig. 7 is a plane view showing that portion of the stacking section which feeds the wires which have been stacked at the stacking section.

Figs. 8 and 9 are plane and side views showing a holding arm.

Figs. 10 and 11 are front and plane views showing a movable body shown in Figs. 2A and 2B.

Fig. 12 is a sectional view taken along a line XII-XII in Fig. 10.

Fig. 13 is a sectional view showing the arrangement of attaching a holding roller shown in Fig. 12 and movable up and down.

Fig. 14 is a plane view showing the arrangement of attaching a projecting pin shown in Figs. 10 and 11.

Fig. 15 is a sectional view showing the arrangement of attaching a guide body shown in Fig. 10.

Fig. 16 is a sectional view taken along a line XVI-XVI in Fig. 15.

Fig. 17 is a sectional view showing the arrangement of attaching a shaping roller shown in Fig. 10.

Fig. 18 is a plane view showing the arrangement of attaching a pitch rod shown in Fig. 11.

Fig. 19 is a sectional view taken along a line XIX-XIX in Fig. 18.

Fig. 20 is a front view showing a holding mechanism shown in Fig. 2B.

Fig. 21 is a sectional view taken along a line XX-XX in Fig. 20.

Fig. 22 is a front view showing in enlarged scale a part of a pair of movable bodies shown in Fig. 10.

Fig. 23 is a plane view showing an end of the wire which has been bent to form a bent portion.

Fig. 24 is a perspective view showing a spring unit having coil springs formed at both ends thereof.

Fig. 25 is a plane view showing the spring unit having coil springs formed at both ends thereof.

Fig. 26 is a perspective view showing a spring unit which has been completed by forming bent portions at both ends of the spring unit shown in Figs. 24 and 25.

Fig. 27 is a plane view showing the spring unit incorporated into the mattress, said spring unit being the complete one shown in Fig. 26.

Fig. 28 is a graph showing the relation between the interval from the shaping roller to the guide body and the rotating angle of the shaping roller.

Figs. 29, 30 and 31 are perspective views showing various kinds of spring units formed, varying the interval between the shaping roller and the guide body.

Fig. 32 is a plane view showing a second shaping apparatus embodied according to the present invention.

Fig. 33 is a side view showing the apparatus in Fig. 32.

Fig. 34 is a front view showing a mechanism for driving a conveying chain employed by the second shaping apparatus shown in Figs. 32 and 33.

Fig. 35 is a front view showing a driving plate incorporated in the driving mechanism shown in Fig. 34.

Fig. 36 is a perspective view showing an attaching member and an engaging rod dismantled, said attaching member and engaging rod being shown in Fig. 35.

Fig. 37 is a plane view showing a hardening section in Figs. 32 and 33.

Fig. 38 is a side view showing the hardening section in Fig. 37.

Fig. 39 is a side view showing the hardening section operating.

Fig. 40 is a plane view showing a coating section in Figs. 32 and 33.

Fig. 41 is a side view showing the coating section.

Fig. 42 is a longitudinally-sectioned view showing the coating section.

Fig. 43 is a longitudinally-sectioned view showing a bend-processing section in Figs. 32 and 33.

Fig. 44 is a plane view showing a pair of rotary bodies which form the bend-processing section.

Fig. 45 is a side view showing a center cylinder.

Fig. 46 is a side view showing a side cylinder.

Fig. 47 is a plane view showing main and intermediate support springs connected.

Figs. 48A and 48B are plane views showing a first shaping apparatus for manufacturing spring units, which is another embodiment of the invention.

Figs. 49 and 50 are front and plane views showing a movable body shown in Figs. 48A and 48B.

Fig. 51 is a sectional view taken along a line L-L in Fig. 50.

Fig. 52 is a plane view showing the arrangement of attaching the shaping roller in a first shaping apparatus which is a further embodiment of the present invention.

Fig. 53 is a front view showing the arrangement of attaching the shaping roller in the first shaping apparatus shown in Fig. 52.

A first shaping apparatus for manufacturing spring units shown in Figs. 1A, 1B, 2A and 2B has a frame body 1. Arranged at the upper portion of this body 1 is a stacking section 5 for stacking wire materials 27, as shown in Figs. 2A, 2B, 3 and 4. More specifically, arranged at the upper portion of the frame body 1 are three mounting members 7 which are slanted a little toward the front side of the frame body 1 and on which the wires 27 are mounted, as shown in Figs. 2A, 2B and 4. A keeping-down member 9 is arranged above each of the paired mounting members 7 located at a peripheral region of the frame body 1 in the longitudinal direction thereof, the keeping-down member 9 extending along the mounting member 7 with a gap therebetween. As shown in Figs. 5 and 7, one end of a delivery plate 11 having a cutaway portion 13 is fixed onto the front end of the mounting member 7. The front end of the keeping-down member 9 which corresponds to the cutaway portion 13 is provided with a recess 15, as shown in Fig. 3. The delivery plate 11 is slanted at substantially the same angle as that of the mounting members 7 at the upper side of the body 1, and the other end thereof is located on the surface of a rectangular receiving plate 17 which is positioned lower than the mounting members 7. The receiving plate 17 is fixed on the surface of an attaching plate 18. A projecting air cylinder 19 is located under the delivery plate 11 to correspond to the cutaway portion 13 thereof. A rod 21 of the air cylinder 19 is provided with a pushing body 25 which has a tapered surface 23. A plurality of wire 27 having a certain length is stacked to be freely rollable in a space between the mounting members and the keeping-down members 9. The wire 27 located at the foremost end is contacted with the end face of the delivery plate 11. When the projecting cylinder 19 is operated to lift its rod 21, therefore, the wire 27 located at the foremost end is released from its contact with the delivery plate 11 and rolls down on the delivery plate 11 to the receiving plate 17. The rolling-down of this wire material 27 is detected by first sensors 28 which are arranged at the receiving plate 17, as shown in Figs. 1A and 1B. Arranged outside the paired mounting members 7 at the upper portion of the body 1 are guide plates 29 for preventing the wire 27 from shifting in the axial direction thereof.

Stoppers 28 for preventing the wire from rolling out from the receiving plate 17 are located on the front region of the body 1, as shown in Figs. 1A and 1B. Bent portions 27a are formed at both ends of the wire by means of a bending mechanism which will be described next. The attaching plate 18 is provided with a cutaway portion 35 opened at one side thereof and a part of a movable plate 37 is slidably fitted into the cutaway portion 35, as shown in Fig. 3. The movable plate 37 is connected to a rod 41 of a driver cylinder 39 located under the attaching plate 18, as shown in Fig. 6, and is driven along the axial direction of the wire material 27 by means of a cylinder 39. A position determining cylinder 43 is arranged on the movable plate 37 and a pushing plate 47 for moving the wire material 27 in the longitudinal direction of this wire material 27 is attached to a cylinder rod 45. A circular hole 49 is provided in the movable plate 37 and a rotary plate 51 is fitted to be freely rotatable, into the hole 49 and is kept same level as the attaching plate 18. A rod 55 of a first rotating cylinder held by the movable plate 37 is connected to the underside of the rotary plate 51. When the cylinder 53 operates, the rod 55 is adapted to rotate by a certain angle or by 90°, for example. The rotation of the rod 55 or of the rotary plate 51 is detected by a first limit switch 54 shown in Fig. 4. A center pin 57 is erected on the upper surface of the rotary plate 51 in the rotating center thereof, and a bearing 59 is also located eccentrically on the upper surface of the rotary plate 51 at a given interval from the center pin 57.

When the wire 27 is rolled down by the lifting cylinders 19 and comes onto the receiving plate 17, each end of the wire 27 enters between the center pin 57 and the bearing 59 on the rotary plate 51 after striking the stopper 33. The position determining cylinders 43 respond to a detection signal applied from the sensor 8 and press both ends of the wire 27 by means of their pushing plates 47, thereby enabling the wire 27 to be positioned in the axial direction thereof. Thereafter, the wire 27 is held by holding arms 61 which will be described later, and the rotating cylinders 53 operate to rotate the rotary plates 51 by 90°, so that the bent portions 27a which will be described later can be formed at both ends of the wire 27 by the center pins 57 and the bearings 59. After the bent portions 27a are formed, the driving cylinders 39 operate to drive the movable plates 37 toward the center of the body 1, thereby causing the bent portions 27a to be easily released from between the center pins 57 and the bearings 59. The movement of the movable plates 37 is detected this time by the second limit switches 38 shown in Fig. 3.

The wire 27 whose both ends have bent portions 27a is picked up from the upper portion of the frame body 1 by the paired holding arms 61 which form a picking-up mechanism. In short, an attaching axis 63 extends along the longitudinal direction of the body 1 on the upper front end side thereof, and one end of the attaching axis 63 is supported to be freely rotatable, by a bearing 65, as shown in Fig. 2A. The other end thereof is connected to a rod 69 of a rotating cylinder 67, which is attached to the body 1, via a coupling 70. The attaching axis 63 is rotated by a certain angle, by 270°, for example, by the second rotating cylinder 67. The paired holding arms 61 are connected halfway to the attaching axis 63. As shown in Figs. 8 and 9, the holding arm 61 comprises: a base 71 whose one end is fixed to the attaching axis 63; a driving cylinder 73 arranged at the other end of the base 71; a hook 77 pivoted to a rod 75 of the driving cylinder 73; and a sleeve 79 fitted onto the rod 75 and fixed to the cylinder 73. A groove 80 is formed at the front end portion of the sleeve 79, and a pin 82 erected in the groove 80 is inserted through a guide hole 84 of the hook 77. When the rod 75 of the driving cylinder 73 is retreated, therefore, the hook 77 is swung in the direction shown by the arrow in Fig. 9. The paired holding arms 61 are located on the side of the upper portion of the frame body 1, holding the wire 27 until the bent portions 27a are formed at its both ends. When the bent portions 27a are formed at both ends of the wire 27, the second rotating cylinder 67 operates to rotate the arms 61 by about 270°. The wire 27 is thus positioned to face the front of the body 1.

As shown in Figs. 2A and 2B, a channel-like traverse member 81 is suspended at the front of the body 1 along the longitudinal direction thereof. A pair of guide rails 83 are laid, parallel to each other, on the traverse member 81. A pair of movable bodies 87 are mounted to be freely movable on the guide rails 83. More specifically, the movable body 87 comprises a base plate 89 and an upper casing 91 attached to the base plate 89, and pedestals 93 engaged to be freely slidable, with the guide rails 83 arranged under the base plate 89, as shown in Figs. 10 and 12. Further, a connecting member 95 is arranged on the base plate 89. A rod 99 of a driving cylinder 97 located above the traverse member 81 is connected to the connecting member 95. The driving cylinder 97 is supported by an attaching member 101 mounted on the end portion of the traverse member 81. When the paired movable bodies 87 are driven toward each other along the guide rails 83, as will be described later, therefore, the rod 99 of the driving cylinder 97 is projected. When this rod 99 is projected by a certain length, it is detected by a reed switch 98 arranged at the cylinder 97 shown in Fig. 10. The rod 99 is operated only in the direction in which it enters into the cylinder 97, and the paired movable bodies 87 are thus moved to separate from each other. When the movable bodies 97 return to their predetermined positions, the end faces of the base plates 89 contact buffers 103 mounted on the traverse member 81, thereby enabling the interval between the paired movable bodies 97 to be maintained.

On the other hand, first and second shafts 115 and 117 which extend from the front to the back of the upper casing 91 are supported to be freely rotatable, by the casing 91. First and second sprockets 119 and 121 are fitted onto that one end of the first shaft 115 which is projected from the back of the casing 91. A first chain 127 is stretched between the first sprocket 119 and a third sprocket 120 which is fitted onto a rotating shaft 118 of a driving motor 116 mounted on the base plate 89. First and second gears 129 and 131, engageable with each other, are fitted halfway onto the first and second shafts 115 and 117, respectively. As shown in Figs. 11 and 12, fitted onto those other ends of the first and second shafts 115 and 117 which are projected from the front of the upper casing 91 are holding rollers 135, each of which has a groove 133 on its outer circumference. The paired holding rollers 135 are vertically separated from each other by an interval which is larger than the diameter of the wire 27, and this interval between the paired holding rollers 135 is made narrower by swinging the other end of the second shaft 117 upward. In short, one end of the second shaft 117 are supported to be freely swingable by the upper casing 91 through self-aligning bearings 137. One of the self-aligning bearings 137 which supports the one end of the second shaft 117 is held by a slider 139, which is inserted to be freely slidable into a slide groove 141 vertically formed in a front plate 91a of the upper casing 91, as shown in Fig. 13. A lifting cylinder 143 is arranged at the lower end of the slide groove 141. Pedestals 145 are attached to a rod (not shown) of the cylinder 143 and the lower end face of the slider 139, respectively, and a compression spring 147 is interposed between the pedestals 145. When the lifting cylinder 143 operates to compress the compression spring 147, the slider 139 is lifted due to the restoring force of this compression spring 147 to thereby swing the second shaft 117. The swinging of this second shaft 117 is detected by a third limit switch 142 shown in Fig. 12. The lifting cylinder 143 operates after the paired holding arms 61 are rotated 270° from the upper portion to the front of the body 1 by means of the rotating cylinder 67. Namely, when the holding arms 61 are rotated and both end portion of the wire 27 are inserted between the holding rollers 135 on the paired movable bodies 87 separated from each other, the lifting cylinders 143 operate to lift the lower holding rollers 135. Therefore, both end portions of the wire 27 are caught in the grooves 133 of the two pairs of the holding rollers 135. The first and second gears 129 and 131 are engaged with each other at this time. The bent portions 27a which have been formed at the both ends of the wire 27 are directed downward, as shown in Fig. 22. When both end portions of the wire 27 are inserted between the paired holding rollers 135, respectively, they are detected by a pair of second sensors 144 shown in Fig. 10. Thereafter, the second rotating cylinder 67 operates to rotate the holding arms 61 reversely by 270° and return them to their original positions. The return of the holding arms 61 is detected by a fourth limit switch 146 shown in Fig. 1B.

As shown in Fig. 10, a projecting pin 149, guide 151 and shaping roller 153 are arranged on the front plate 91a of the upper casing 91; and a pitch rod 155 is arranged between the guide 151 and the shaping roller 153. As shown in Fig. 14, the projecting pin 149 is connected to one end of a link 159 whose halfway portion is pivoted to a bracket 157 mounted on the inner face of the front plate 91a of the upper casing 91. The other end of this link 159 is pivoted to a rod 163 of an operating cylinder 161. Therefore when the operating cylinder 161 operates to pull the rod 163 in the direction shown by the arrow in Fig. 14, the projecting pin 149 projects from the front plate 91a. The guide 151 is made like a disk and is fixed eccentrically to a rod 167 of a third rotating cylinder 165 housed in the upper casing 91, as shown in Figs. 15 and 16. The guide 151 is provided with an insertion groove 169. When wire 27 is supplied between the paired holding rollers 135, both end portions of this wire 27 are inserted into the grooves 169, respectively. The guide 151 is rotated at an angle of about 90° by the third rotating cylinder 165. The rotation of this guide 151 is detected by a fifth limit switch 166 shown in Fig. 16. The third rotating cylinder 165 becomes operative after spiral spring portions 27b shown in Fig. 24 are formed at the both ends of the wire 27, as will be described later. The shaping roller 153 is provided with a guide face 171 formed on its outer circumference, as shown in Fig. 17, and it is supported to be freely rotatable, by an attaching rod 173 which is projected through a hole 170 formed in the front plate 91a. The attaching rod 173 is fixed to one end of a slider 172, which is held to be freely slidable, by a holder 174 attached to the inner face of the front plate 91a. Further, a pitch rod 155 is attached to one end of a projecting rod 175, as shown in Figs. 18 and 19. The projecting rod 175 has a rectangular section and is supported to be freely slidable by a pedestal 177 housed in the upper casing 91, as shown in Fig. 18. Arranged at the other end of the projecting rod 175 is a cam follower 179, which is contacted with a cam face 183 of a first cam 181, as shown in Fig. 19. The cam 181 is fitted onto a third shaft 185 supported to be freely rotatable by the pedestal 177. A tension spring 187 is interposed between one end of the projecting rod 175 and the pedestal 177, thereby urging the cam follower 179 against the cam face 183 of the first cam 181. Furthermore, fourth and fifth sprockets 189 and 190 are fitted onto the third shaft 185; and a second chain 191 is stretched between the fourth sprocket 189 and the second sprocket 121 fitted onto the first axis 115, as shown in Fig. 11. When the driving motor 116 becomes operative to rotate the first axis 115, therefore, the first cam 181 is rotated together with the first axis 115. The ratio of teeth between the second and third sprockets 121 and 189 is determined in such a way that the first cam finishes one rotation during the time period of forming the spiral spring portions 27b at the both ends of the wire 27. When the first cam 181 rotates, it is detected by a sixth limit switch 180.

A cam follower 191 is attached to be freely rotatable to the other end of the slider 172, as shown in Fig. 17. The cam follower 191 is urged against the circumferential cam face of a second cam 193 because the slider 172 is urged by a spring (not shown). The second cam 193 is fitted onto one end of a fourth shaft 197 which is supported to be freely rotatable by a pedestal 195. Fitted onto the other end of the fourth shaft 197 is a sixth sprocket 199. A third chain 201 is stretched between the sixth and fifth sprockets 199 and 190, as shown in Fig. 11. Therefore, the second cam 193 rotates together with the third shaft 115. When the second cam 193 rotates, the slider 172 is slid accordingly. The shaping roller 153 is thus shifted by this slider 172. Namely, the interval between the shaping roller 153 and the guide 151 can be changed. As shown in Fig. 10, a guiding member 203 is arranged on the front plate 91a of the upper casing 91 between the pitch rod 155 and the lower holding roller 135. The guiding member 203 prevents the spiral spring portion 27b from striking the holding rollers 135, as will be described later, when the guides 151 are rotated to form the bent portions 27a at the both ends of the wire 27 after the spiral spring portions 27b have been formed at each end.

As shown in Fig. 2B, a holding mechanism 205 is arranged in the front center of the body 1 as viewed from the width of the body 1. The holding mechanism 205 has a support member 207 whose lower end is fixed to the traverse member 81, as shown in Figs. 20 and 21. A clamp cylinder 209 is vertically held on the support member 207. A movable clamping piece 213 is attached to a rod 211 of the clamping cylinder 209. An attaching plate 215 is erected on the upper end of the support member 207, and a fixed clamping piece 217 which is located above the movable clamping piece 213 is attached to the attaching plate 215. When the clamping cylinder 209 operates to push the rod 211, the movable clamping piece 213 is brought into contact with the fixed clamping piece 217, so that the halfway portion of the wire 27 whose ends are held by the holding rollers 135 of the paired movable bodies 87 can be clamped between the movable and fixed clamping pieces 213 and 217, thereby preventing the wire 27 from shifting in the axial direction thereof.

Further, a delivery plate 221 which is shown by the broken lines in Figs. 1B and 2B is arranged in the front center portion of the body 1. The wire 27 whose ends have been formed as spiral springs 27b falls onto the delivery plate 221 and is then delivered therefrom to the next process. A wire detecting switch 222 is arranged at the delivery plate 221 and detects the wire 27 which has fallen on the delivery plate 221.

It will be now described how the spring units are manufactured by the above-described manufacturing apparatus. When a start switch on the operating panel (not shown) is turned ON, the pushing cylinders 19 are operated to send one of the wires 27 from the stacking section 5 to the delivery plate 11. The wire 27 rolls down onto the delivery plate 11 and strikes against the stoppers 33. The rolling of the wire 27 is detected at this time by the first sensors 28. The position determining cylinders 43, in response to the detection signal applied from the first sensors 28, determine the position of the wire 27 along the longitudinal direction of the body 1. Thereafter, the driving cylinders 73 for the holding arms 61 become operative to clamp the halfway portion of the wire 27 by their hooks 77. Then, the first rotating cylinders 53 are operated to rotate the rotary plates 51 by 90°, so that bent portions 27a are formed at both ends of the wire 27 by means of the center pins 57 and bearings 59 on the rotary plates 51, as shown in Fig. 23. The first rotating cylinder 53 is stopped when the first limit switch 54 is closed. When the bent portions 27a are formed at both ends of the wire 27 as described above, the driving cylinders 39 shown in Fig. 6 operate to drive the movable plates 37, thereby causing the bent portions 27a to be easily released from between the center pin 57 and the bearing 59. The movement of the movable plate 37 is detected by the second limit switch 38. The second rotating cylinder 67 shown in Fig. 1B responds to the detection signal, and the holding arms 61 are rotated by about 270°, so that both ends of the wire 27 can be inserted between the paired holding rollers 135, respectively, arranged on each of the movable bodies 87. When the presence of the wire is detected by the second sensors 144, the clamp cylinder 209 shown in Figs. 2B, 20 and 21 operates to clamp and fix the wire 27 at its midpoint by means of the paired clamping pieces 213 and 217, thereby preventing the wire from shifting in the axial direction thereof. The lifting cylinder 143 shown in Fig. 12 arranged on each of the movable bodies 87 lifts the lower holding roller 135 so that it contacts the upper one. Each end of the wire 27 is held in the groove 133 between the upper and lower holding rollers 135. Next the presence of the wire is detected by the third limit switch 142.

The holding arms 61 and the movable plates 37 are returned to their initial positions, in response to the detection signal applied from the third limit switches 142. When the return of the movable plates 37 to their initial positions is detected by the fourth limit switch 146, the driving motors 116 shown in Fig. 12 arranged on the paired movable bodies 87 operate in response to the detection signal applied from the fourth limit switch 146. Because the holding rollers 135 are rotated and driven in the directions shown by the arrows in Fig. 22 by means of the motor 116, the wire 27 is thus fed from between the paired holding rollers 135. In short, the movable bodies 87 run toward each other, starting from the state under which they are separated from each other as shown in Figs. 2A and 2B. The bent portions 27a which have been formed at both ends of the wire 27 are thus put in contact with the outer circumferences of the shaping rollers 153, respectively, thereby enabling both ends of the wire 27 to be bent in a spiral. Since the bent portions 27a which have been formed at both ends of the wire 27 are directed downward at this time, both ends of the wire 27 itself are also bent downward. The diameter of the spiral is determined by the interval D between the guide 151 and the shaping roller 153, as shown in Fig. 22. When a spiral is formed in this manner at each end of the wire 27, the pitch rod 155 is projected forward from the front plate 91a of the upper casing 91, and pushes the spiral formed at each end of the wire 27. Since the third shaft 185 onto which the first cam 181 shown in Figs. 18 and 19 is fitted is rotated by the running of the movable body 87, the cam follower 179 which is in contact with the cam face 183 of the first cam 181 moves from its bottom dead point to its top dead point to shift the projecting shaft 175, causing the pitch rod 155 to be gradually projected. Therefore, the spirals which are successively formed, following the movement of the paired movable bodies 87, after one spiral is formed at each end of the wire 27. are formed at a pitch P shown in Fig. 24 which is determined according to the projected amount of the pitch rod 155. When it is detected by the reed switches 98 that the rods 99 of the driving cylinders 97 have been projected by a certain length by the paired movable bodies 87 which have moved a predetermined distance, the driving motors 116 stop in response to the detection signal. Namely, the movable bodies 87 are stopped. Therefore, the formation of the spiral springs 27b each having a predetermined number of spirals is finished. The wire material 27 is thus formed as a spring unit 250 comprising a linear portion 27c and spiral spring portions 27b continuous from both ends of the linear portion 27c.

When the formation of the spiral spring portions 27b is finished, the third rotating cylinders 165 shown in Fig. 15 are made operative to swing the guides 151 90° in the direction shown by the arrow in Fig. 22. Both ends of the linear portion 27c which are inserted into the grooves 169 of the guides 151 are thus bent by about 90° to form linear bent portions 27d each continuous from the last spiral formed on the spiral spring 27b. This bent portion 27d is used to connect the spring unit to a frame 300 by means of a clip 301, as shown in Fig. 27. Namely, when a plurality of the springs 250 is assembled, combining their linear portions 27c with one another in a lattice pattern, they form a spring which is surrounded by a frame 300. The spring unit 250 is connected to the frame 300 by the clips 301 so that the frame 300 is linearly contacted with the linear portion 27c, thereby enabling a reliable connection to be attained between the spring unit and the frame.

When the bent portions 27d are formed at both ends of the linear portion 27c of the spring 250 and when the rotation of the guides 151 is detected by the fifth limit switches 166, the lifting cylinder 143 shown in Figs. 10 and 12 operates in response to the detection signal applied from the fifth limit switch 166 to release the lower holding roller 135, thus separating the paired holding rollers 135 from each other. The clamp cylinder 209 is also operated to release the wire 27 from the clamping of the paired clamping pieces 213 and 217. The operating cylinder 161 shown in Fig. 11 is then operated to project the projecting pin 149. The linear portion 27c of the spring unit 250 is therefore pushed by the projecting pin 149, and the spring unit 250 falls on the delivery plate 221 located on the front side of the body 1. When this fall is detected by the proximity switch 222, the rods 99 of the driving cylinders 97 are driven in their retreating directions in response to the detection signal applied from the proximity switch 222; and the paired movable bodies 87 separate from each other by means of the driving motors 116 which are rotating reversely. These movable bodies 87 are thus returned to their initial positions. The first cam 181 is reversely rotated by 180° by the motor 116. This rotation is detected by the sixth limit switch 180. The above described process is again started in response to the detection signal applied from the sixth limit switch 180, and another spring unit 250 is formed from another piece of wire 27.

As described above, the diameter of the spring portion 27b can be changed by changing the interval D between the shaping roller 153 and the guide 151 shown in Fig. 22 at the time of forming the spirals 27b at the both ends of the wire 27. As shown in Fig. 17, the shaping roller 153 is made freely slidable by the slider 172. The cam follower 191 attached to the end of the slider 172 is urged against the second cam 193, and the interval D is therefore changed according to the shape of the cam 193, which is rotated by the driving motor 116 when the movable bodies 87 run toward each other. If the shape of the second cam 193 is set to change the interval between the shaping roller 153 and the guide 151 as shown by curve A in Fig. 28, therefore, the spiral spring 27b is shaped like a hand drum as shown in Fig. 29. When the interval is changed as in line B, the spiral spring 27 is shaped like a reverse cone as shown in Fig. 30; and when the interval is changed like line C, it is shaped like a cone as shown in Fig. 31. Namely, a spring having desired characteristics can be formed by optionally changing the shape of the spiral spring 27b by means of the cam 193.

When several reed switches 98 are arranged on the cylinder 92 and any one of these reed switches 98 can be selected by a changeover switch, the extended length of the rod 99, that is, the distance along which the movable bodies are moved can be selectively determined. The length of the linear portion 27c of the spring unit 250 formed can thus be varied. Similarly, it can also be varied by adjusting the initial length of the cylinder 97.

In the case where the spring unit 250 formed by the apparatus shown in Figs. 1A, 1B, 2A and 2B is further deformed to form an intermediate support spring unit 197, as shown in Fig. 47 for example, the spring unit 250 is dropped on the front side of the body 1 of the first shaping apparatus and is then delivered to a second shaping apparatus. This second shaping apparatus has a base 231, as shown in Figs. 32 and 33. A pair of walls 233 having a reverse U-shaped section is erected on the base 231 so that they are separated by a certain interval. Several attaching rods 237 are supported to be freely rotatable by bearings 239 between the inner faces 235 of these walls 233. Sprockets 243 are fitted onto those portions of each of the attaching rods 237 which are located between the inner face 235 and the wall 233. Endless conveying chains 245 are stretched around the sprockets 243 located on both ends of the attaching rods 237, respectively. A tongue piece 247 is erected on each of plates of the chain 245. A receiving plate 249 is slanted relative to the chains 245 at one end of the base 231 as viewed lengthwise. The spring unit 250 formed by the first shaping apparatus drops onto the receiving plate 249. In short, the linear portion 27c of the spring unit 250 is received by the receiving plate

249. As shown in Fig. 34, an intermediate sprocket 251 is fitted onto the center portion of the attaching rod 237 located at the other end of the base 231. A driving sprocket 253 is located at the lower portion of the base 231, corresponding to the intermediate sprocket 251, and is fitted onto a shaft 255 which is supported to be freely rotatable by the base 231. A driving chain 254 is stretched between the driving sprocket 253 and the intermediate sprocket 251. The driving sprocket 253 is intermittently rotated at every predetermined angle by means of a driving cylinder 257. Namely, a driving plate 261 is fitted onto a rod 259 of the driving cylinder 257, separating it from and placing it opposite to the driving sprocket 253. An attaching member 263 shown in Figs. 35 and 36 is fixed to the driving plate 261. A limiting recess 265 is formed at one end of the attaching member 263; and one end of an engaging rod 267 is supported to be freely rotatable in the limiting recess 265 through a pin 269. The other end thereof is projected radially and outwardly from the limiting recess 265, and a tension spring 271 is interposed between this other end and the attaching member 263 to urge the engaging rod 267. Further, a pair of pins 273 which are shifted from each other by 180° in the peripheral direction of the driving sprocket 253 is erected from the sprocket 253. When the driving cylinder 257 is operated to rotate its rod 259 by a predetermined angle or by 240°, for example, in the direction shown by the arrow, and when the driving plate 261 is associated with this rotation of the rod 259, the engaging rod 267 is engaged with one of the pins 273 to rotate the driving sprocket 253. Although the engaging rod 267 strikes the other pin 273 when the driving plate 261 returns after having been rotated by the predetermined angle, the driving plate 261 is not rotated because only the engaging rod 267 rotates at this time. Namely, since the driving plate 261 is intermittently rotated by every predetermined angle only in one direction by means of the engaging rod 267, the conveying chain 245 runs endlessly, following the rotation of the driving plate 261. Therefore, the spring unit 250 which has been dropped on the receiving plate 249 is conveyed in such a way that the linear portion 27c thereof is engaged with the tongue pieces 247 of the conveying chains 245.

Hardening, coating and bend-processing sections 275, 277 and 279 are arranged successively on the base 231 along the direction of conveyance of the springs 250. The hardening section 275 has the arrangement shown in Figs. 37 through 39. More specifically, a pair of traverse rods 281 is mounted on the base 231 and is mounted above the conveying chains 245 which cross the base 231, as shown in Fig. 32. Horizontal cylinders 283 are located at both ends of the traverse rods 281 whose rods 285 are kept horizontal. As shown in Fig. 38, an upper conductor 287 is attached to the rod 285. The upper conductor 287 has three-layers and is comprised by bonding an upper conductor plate 291 to the underside of an insulating material 289 and by bonding a guide plate 293 to the upper surface thereof. Both ends of the guide plate 293 are inserted to be freely slidable into guide grooves 294 formed in the traverse rod 281. The upper conductor 287 is usually located above the wall 233 or above and outside the wall 233 when the horizontal cylinder 283 is operated to retreat its rod 285. A vertical cylinder 295 is located outside and below the wall 233 to erect its rod 297 vertically. A lower conductor 299 is attached to the rod 297. The lower conductor 299 comprises fixing an attachment 301 to the rod 297 and bonding a lower conductor plate 305 onto the attachment 301 through an insulating material 303. The upper and the lower conductor plates 291 and 305 are connected to a power source (not shown). When the spring unit 250 is conveyed to the hardening section 275, the horizontal and vertical cylinders 283 and 295 are operated to hold each of the spirals 27b of the spring 250 between the upper and lower conductor plates 287 and 299, so that the upper and lower ends of each of the spirals 27b are contacted with the upper and lower conductor plates 287 and 299, respectively. Current thus flows to the spiral portions of each spring 27b to heat them.

The spring unit 250 which has been heated at the hardening section 275 is conveyed to the coating section 277, which has the arrangement shown in Figs. 40 through 42. More specifically, a container 309 having an opening at the top is located below the walls 233. The container 309 contains the powder 311 of a synthetic resin, such as polyethylene, for example, as shown in Fig. 42. A cylindrical body 311 having an opening 312 formed along its side is erected at the bottom of the container, and houses a screw shaft 314. The lower end portion of the screw shaft 314 is projected through the bottom of the container 309 and is supported to be freely rotatable by bearings 315. A follower pulley 317 is fitted onto the lowermost end of the screw shaft 314. A motor 321 is located adjacent to the follower pulley 317, its rotating shaft 319 kept parallel to the screw shaft 314. A driving pulley 323 is fitted onto the rotating shaft 319 of the motor 321, and a belt 325 is stretched between these paired pulleys 317 and 323. When the screw shaft 314 is rotated by the motor 321, therefore, the powder 311 entering into the cylindrical body 313 through its opening 312 is urged upward by the screw shaft 314 and is blown upward through the top opening of the cylindrical body 313. Therefore, the heated spiral spring portions 27b of the spring unit 250 which pass above the cylindrical bodies 313 are subject to being coated by the powder 311. A bracket 327 whose one end is fixed to the base 231 is arranged above the walls 233 at the coating section 277. A screw rod 329 is attached to freely move up and down to the bracket 327, and an attachment 331 is elastically attached to the screw rod 329 through a spring 333. The attachment 331 is pivoted to the base 231 through a pin 335 at the one end thereof, and an attaching rod 337 is horizontally attached to the attachment and is rotatably supported by bearings 338. Fitted onto the both ends of the attaching rod 337 are push rollers 339, which push the conveying chains 245 to curve downward. When the spring unit 250 which is conveyed by the conveying chains 245 reaches the coating section 277, therefore, it is shifted downward together with the conveying chains 245 by the push rollers 339. The lower end of the spiral 27b of the spring 250 thus approaches the opening of the cylindrical body 313, thereby making it easier for the powder 311 to be deposited on the lower portion of the spiral 27b. Formed at those portions of the walls 233 which correspond to the push rollers 339 are recesses 341, which enable the spring unit 250 to be shifted downward together with the conveying claims 245. The spring unit coated with the synthetic resin can reduce a noise which is produced at use of a bed assembly by the spring units and can be firmly and reliably fixed to the frame by the tacker.

The spring unit 250 which has passed through the coating section 277 reaches the bendprocessing section 279, which has the arrangement shown in Figs. 43 through 46. More specifically, a pair of lift side cylinders 343 is vertically arranged below the walls 233. A lift center cylinder 345 is vertically located between the paired walls 233. A first plate-like support 349 is fixed to a rod 347 of the lift side cylinder 343. A second support 355 having a Y-shaped receiving portion 353 is also fixed to a rod 351 of the lift center cylinder 345. A pair of the first supports 349 is placed opposite to the lower ends of the spirals 27b of the spring 250 which has been conveyed by the conveying chains 245; and a second support 355 is placed opposite to the linear portion 27c of the spring 250. When the cylinders 343 and 345 are operated, therefore, the spiral portions 27b and linear portion 27c of the spring unit 250 are supported by the first and second supports to float the spring unit 250 from the conveying chains 245. An attachment 357 is arranged above the cylinders 343 and 345, and a pair of bend-processing cylinders 359 are attached to the attachment 357, their rods 361 directed downward. A rotary block 363 is fixed to the rod 361 of each of the cylinders 359. A pin 365 is erected from the rotary block 363, adjacent to the rotating center of the block 363, and a roller 367 is located to be freely rotatable and adjacent to the pin 365 but is separated by a predetermined distance from the latter. When the spring unit 250 is lifted by the side and center lift cylinders 343 and 345, both ends of its linear portion 27c are held between the pin 365 and the roller 367. Pressing plates 369 which contact the opposite sides of both ends of the linear portion 27c of the spring unit 250 when both ends of the linear portions 27c are held between the pin 365 and the roller 367 are arranged at the attachment 357. After the side and center lift cylinders 343 and 345 are operated, the bend-processing cylinders 359 are rendered operative to rotate their rods 361 by a predetermined angle in the direction shown by the arrows in Fig. 44. Therefore, second bent portions 27e continuous from the first bent portions 27d are formed to be parallel to are another at both ends of the linear portion 27c of the spring 250, as shown in Fig. 47. In a case where a spring is formed by the main and intermediate spring portions, the first and second bent portions 27d and 27e are linearly contacted with the main spring units which are combined in a lattice pattern, and are connected thereto by clips 371.

The operation of the second shaping apparatus will be described. When the spring 250 which has been shaped by the first shaping apparatus is fed to the receiving plate 249 of the second shaping apparatus, the spring is conveyed by the conveying chains 245, and its linear portion 27c is held between the tongue pieces 247 of the chains 245. When the spring 250 conveyed by the conveying chains 245 reaches the hardening section 275, the horizontal cylinders 283 are rendered operative causing the upper conductors 287 to be opposite to the upper ends of the spiral portions 27b, as shown in Fig. 32. The vertical cylinders 295 then operate to lift the lower conductors 299. Therefore, the spring 250 is lifted to float its linear portion 27c from the conveying chains 245 while its spiral portions 27b are held between the paired conductors 287 and 299. Current is thus flowed to the spiral portions 27b, which are heated and hardened.

After this hardening is applied for a predetermined time period, the horizontal and vertical cylinders 283 and 295 return to their initial positions, and the spring 250 is again conveyed by the conveying chains 245. When the spring 250 reaches the coating section 277, the powder 311 blown up through the top opening of the cylindrical body 313 by the screw shaft 314 is deposited on the lower portions of the spiral portions 27b which have been heated at the hardening section 275. Therefore, the lower portions of the spiral portions 27b are coated by the powder 311.

When the spring 250 which has passed through the coating section 277 reaches the bend-processing section 279, the paired lift side cylinders 343 and the lift center cylinder 345 become operative to lift the spring 250. Both ends of the linear portion 27c of the spring 250 are thus held between the pin 365 and the roller 367 of each of the rotary blocks 363 which are fixed to the rods 361 of the bend-processing cylinders 359. The bend-processing cylinders 359 then operate to rotate their rods 361 by the predetermined angle. Therefore, the second bent portions 27e, each continuous from the first bent portion 27d which has been formed by the first shaping apparatus, are formed at both ends of the linear portion 27c.

When the second bent portions 27e are formed at both ends of the linear portion 27c of the spring unit 250, the lift side and center cylinders 343 and 345 return to their initial positions, and the spring 250 is fed from the second shaping apparatus by means of the conveying chains 245. The bend-processing cylinders 359 also return to their initial positions.

The paired movable bodies 87 shown in Figs.

2A, 2B and 10 are moved toward each other on guide rails 83 by the force generated when the holding rollers 135 pull the wire 27. A pair of rails 83 is laid on the upper face of the traverse member 81, while a rack 85 is attached to the underside thereof; and a pair of movable bodies 87 is mounted on the guide rails 83, as shown in Figs. 48A and 48B. The movable body 87 comprises lower and upper casings 89 and 91 which are combined as a unit, a pair of pedestals 93 which are engaged to be freely slidable, and guide rails 83 which are located at the upper inner face of the lower casing 89, as shown in Figs. 49 and 50.

A driver motor 105 is housed in the lower casing 89. Its rotating shaft 107 is projected outside the back of the lower casing 89.

The rotating force of the motor 105 is transmitted to the holding rollers 135 via the sprockets 111, 119, the shaft 115 and the chain 127. The same parts as those in Figs. 1A through 22 are represented by the same reference numerals as in Figs. 48A, 48B, 50 and 51, and a description of these parts is omitted.

It should be understood that the present invention is not limited to the above-described embodiment, and that the shaping rollers 153 in the first shaping apparatus may be arranged as shown in Figs. 52 and 53. More specifically, a guide groove 205 is formed in the front plate 91a of the upper casing 91 of the movable body 87 along the width of the front plate 91a, and a support 207 is arranged to be freely slidable in the guide groove 205. An attaching rod 209 is penetrated through the support 207 from the front to the back thereof. The shaping roller 153 is fitted onto that end of the attaching rod 209 which projects forward from the front of the support 207, while a cam follower 211 is fitted onto the other end thereof which is located in the upper casing 91. A sixth shaft 213 is supported to be freely rotatable and parallel to the fifth shaft 185, by the pedestral 177 which is located in the upper casing 91. A cam 215 is fitted onto one end of the sixth shaft 213. The support 207 is urged in the direction shown by the arrow by means of a tension spring 217, and the cam follower 211 arranged on the support 207 is contacted with the outer circumferential face of the cam 215. Further, pulleys 219 having same number of teeth are fitted onto the other ends of the fifth and sixth shafts 185 and 213, and a chain 211 is stretched between these pulleys 219.

According to the above-described arrangement, the sixth shaft 213 also rotates when the fifth shaft 185 is rotated at the time of shaping the spring unit 250 by means of the movable bodies 87. When the sixth shaft 213 rotates, the support 207 to which the cam follower 211 is attached is slid along the guide groove 205, according to the shape of the cam 215 which is fitted onto the shaft 213. Therefore, the interval between the shaping roller 153 attached to the support 207 and the guide 151 attached to the rod 167 of the third rotating cylinder 165 is changed, thereby enabling the diameter of the spiral formed at the both end portions of the wire material 27 to be changed.

When the shape of the cam 215 is set in such a way that the interval between the shaping roller 153 and the guide 151 is changed as shown by curve A in Fig. 28, in response to the rotation of the sixth shaft 213, each of the spirals 27b can be formed like a hand drum as shown in Fig. 29. When the interval is changed as shown by line B, each of the spirals 27b can be formed like a reverse cone as shown in Fig. 30; and when the interval is changed as shown by line C, it can be formed like a cone as shown in Fig. 31. Namely, the shape of the spiral spring portion 27b can be changed by the cam 215, thereby enabling a spring 250 having the desired properties to be formed.

Claims

1. An apparatus for manufacturing spring units, comprising:

a frame (1) having guide rails (83) for mounting a pair of moveable bodies (87);

first and second holding means (135) arranged at said paired moveable bodies (87), respectively, to hold both ends of a wire (27) which is to be formed as a spring unit; and

first and second coil forming means (151, 153, 155) arranged at said moveable bodies (87), respectively, to bend those portions of the wire (27) which extend from the first and second holding means (135), respectively, in a spiral as the moveable bodies (87) run toward each other, characterized in that

said first and second moveable bodies (87) are mounted on said guide rails such that they are driven exclusively by said holding means (135) during the spring forming procedure, during which said holding means (135) pull the wire (27) stretched between them.

2. An apparatus for manufacturing spring units according to claim 1, characterized in that each of said first and second coil forming means (151, 153, 155) includes a shaping roller (153) in contact with the wire (27) to bent it like a coil, a guide member (151) arranged between the shaping roller (153) and each of the first and second holding means (135) to determine the diameter of one turn of the spiral formed by the shaping roller (153), and a pitch rod (155) arranged between the guide member (151) and the shaping roller (153) to determine the pitch of the spiral formed by the shaping roller (153).

3. An apparatus for manufacturing spring units according to claim 2, characterized in that each of the first and second coil forming means (151, 153, 155) further includes a means (170, 172, 173, 174, 191, 193, 197, 199, 190) for linearly moving the shaping roller (153) to change the interval between the guide member (151) and the shaping roller (153), in response to the running of each of the first and second movable bodies (87).

4. An apparatus for manufacturing spring units according to claim 2, characterized in that each of the first and second coil forming means (151, 153, 155) further includes a means (175, 177, 179, 181, 183, 188) for reciprocating the pitch rod (155) in

response to the running of each of the first and second movable bodies (87).

5. An apparatus for manufacturing spring units according to claim 2, characterized in that each of the first and second coil forming means (151, 153, 155) further includes a means (165, 167) for rotating the guide member (151) by about 90° to bend at right angle the boundary between a linear portion (27c) and a coil portion (27b) of the wire (27) at the time of forming at both end portions of the wire's spiral portions each having a predetermined length.

6. An apparatus for manufacturing spring units according to claim 1, characterized by further comprising a clamping means (205) for clamping the wire (27) between the first and second holding means (87) to prevent the wire (27) from sliding lengthwise.

7. An apparatus for manufacturing spring units according to claim 1, characterized in that each of the first and second holding means (87) comprises a pair of holding rollers (135) for contacting and holding the wire (27) between them, and a means (115, 117, 116, 118, 119, 120, 121, 127) for driving at least one of the paired holding rollers (135) to feed the wire (27) from between the holding rollers (135).

8. An apparatus for manufacturing spring units according to claim 7, characterized by further comprising a means (143, 145, 147) for approaching and separating the paired holding rollers (135).

9. An apparatus for manufacturing spring units according to claim 1, characterized by further comprising a means (5) for supplying a piece of the wire (27) to the first and second holding means (135).

10. An apparatus for manufacturing spring units according to claim 9, characterized by further comprising a means (51, 57, 59) for slightly bending both ends of the wire (27) supplied.

11. An apparatus for manufacturing spring units according to claim 1, characterized by further comprising a means (237, 243, 245, 247, 257) for conveying the spring unit (250) which has coil springs (27b) formed at both ends of the linear portion (27c) thereof.

12. An apparatus for manufacturing spring units according to claim 11, characterized by further comprising rotary bodies (363) positioned to correspond to both ends of the linear portion (27c) of the spring unit (250) conveyed, engaging members (365, 367) arranged at the rotary bodies (363), respectively, to engage both ends of the linear portion (27c) and means (359) for rotating the rotary bodies (363) by a predetermined angle to bend the linear portion (27c) by means of the engaging members (365, 367) at the time when both ends of the linear portion (27c) are engaged with the engaging members (365, 367).

13. An apparatus for manufacturing spring units according to claim 12, characterized by further comprising a means (275) for heating and hardening the spring unit (250) conveyed, and a means (277) for depositing the powder of a synthetic resin (311) on the heated spring unit (250) to coat it.

Patentansprüche

1. Eine Vorrichtung zur Herstellung von Federeinheiten, mit:

einem Rahmen (1) mit Führungsschienen (83) zur Anordnung eines Paares von beweglichen Körpern (87);

ersten und zweiten Haltemitteln (135) an dem Paar von beweglichen Körpern (87) um die beiden Enden eines Drahtes (27) zu halten, aus dem eine Federeinheit geformt werden soll; und

ersten und zweiten Federformmitteln (151, 153, 155), welche an den beweglichen Körpern (87) angeordnet sind, um diejenigen Bereiche des Drahtes (27) zu biegen, welche sich von den ersten bzw. zweiten Haltemitteln (135) erstrecken, in eine Spirale zu biegen, während die beweglichen Körper (87) aufeinander zulaufen, dadurch gekennzeichnet, daß

die ersten und zweiten beweglichen Körper (87) auf den Führungsschienen derart angeordnet sind, daß sie ausschließlich von den Haltemitteln (135) während des Federformvorganges angetrieben werden, währenddem die Haltemittel (135) den Draht (27), der zwischen ihnen gespannt ist, ziehen.

2. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 1, dadurch gekennzeichnet, daß jedes der ersten und zweiten Federformmittel (151, 153, 155) eine Formrolle (153) in Anlage mit dem Draht (27), der spiralförmig gebogen werden soll, ein Führungsteil (151) zwischen der Formrolle (153) und jedem der ersten und zweiten Haltemittel (135) angeordnet, um den Durchmesser einer Wicklung der durch die Formrolle (153) geformten Spirale zu bestimmen und einen Steigungsstab (155) aufweist, der zwischen dem Führungsteil (151) und der Formrolle (153) angeordnet ist, um die Steigung der durch die Formrolle (153) geformten Spirale zu bestimmen.

3. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 2, dadurch gekennzeichnet, daß jedes der ersten und zweiten Federformmittel (151, 153, 155) weiterhin eine Einrichtung (170, 172, 173, 174, 191, 193, 197, 199, 90) aufweist, um die Formrolle (153) linear zu bewegen, um das Intervall zwischen dem Führungsteil (151) und der Formrolle (153) als Antwort auf den Lauf von jedem der ersten und zweiten beweglichen Körper (87) zu ändern.

4. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 2, dadurch gekennzeichnet, daß jedes der ersten und zweiten Federformmittel (151, 153, 155) weiterhin eine Einrichtung (175, 177, 179, 181, 183, 188) aufweist, um den Steigungsstab (155) als Antwort auf den Lauf eines jeden der ersten und zweiten beweglichen Körper (87) hin- und herzubewegen.

5. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 2, dadurch gekennzeichnet, daß jedes der ersten und zweiten Federformmittel (151, 153, 155) weiterhin eine Einrichtung

(165, 167) aufweist, um das Führungsteil (151) um ungefähr 90° zu drehen, um einen rechten Winkel an dem Übergang zwischen einem gestreckten Bereich (27c) und eines Spiralteils (27b) des Drahtes (27) zu dem Zeitpunkt zu biegen, zu dem an beiden Endbereichen des Drahtes Spiralbereiche mit jeweils einer festgelegten Länge ausgebildet werden.

6. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 1, weiterhin gekennzeichnet durch eine Klemmvorrichtung (205) zum Festklemmen des Drahtes (27) zwischen den ersten und zweiten Halteeinrichtungen (135) um zu verhindern, daß der Draht (27) längs gleitet.

7. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 1, dadurch gekennzeichnet, daß jedes der ersten und zweiten Haltemittel ein Paar von Halterollen (135) aufweist zum Kontaktieren und Halten des Drahtes (27) zwischen ihnen und eine Einrichtung (115, 117, 116, 118, 119, 120, 121, 127) zum Antrieb wenigstens einer der gepaarten Halterollen (135) um den Draht (27) zwischen den Halterollen (135) zu fördern.

8. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 7, weiterhin gekennzeichnet durch eine Einrichtung (143, 145, 147) zum Aufeinanderzubewegen und Voneinandertrennen der paarweisen Halterollen (135).

9. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 1, weiterhin gekennzeichnet durch eine Einrichtung (5) zur Zufuhr eines Stückes des Drahtes (27) zu den ersten und zweiten Haltemitteln (135).

10. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 9, weiterhin gekennzeichnet durch eine Einrichtung (51, 57, 59) zum geringfügigen Biegen der beiden Enden des zugeführten Drahtes (27).

11. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 1, weiterhin gekennzeichnet durch eine Einrichtung (237, 243, 245, 247, 257) zum Fördern der Federeinheit (250), welche an beiden Enden des gestreckten Bereiches (27c) Spiralfedern (27b) aufweist.

12. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 11, weiterhin gekennzeichnet durch Drehkörper (363), welche angeordnet sind, den beiden Enden des gestreckten Bereiches (27c) der geförderten Federeinheit (250) zu entsprechen, Eingriffsteile (365, 367) an den Drehkörpern (363), um mit beiden Enden des gestreckten Bereiches (27c) in Anlage zu geraten und Einrichtungen (359) zum Drehen der Drehkörper (363) um einen festgelegten Winkel, um den gestreckten Bereich (27c) mittels der Eingriffsteile (365, 367) zu biegen, zu dem Zeitpunkt, zu dem beide Enden des gestreckten Bereiches (27c) mit den Eingriffsteilen (365, 367) in Anlage geraten.

13. Eine Vorrichtung zur Herstellung von Federeinheiten nach Anspruch 12, weiterhin gekennzeichnet durch eine Einrichtung (275) zum Erhitzen und Härten der geförderten Federeinheit (250) und eine Einrichtung (277) zum Abscheiden eines Pulvers eines Kunstharzes (311) auf die erhitzte Federeinheit (250), um diese zu überziehen.

Revendications

1. Appareil pour fabriquer des ensembles de ressorts, comprenant:

un bâti (1) ayant des rails de guidage (83) pour supporter deux corps mobiles (87);

un premier et un second moyens de maintien (135) disposés respectivement sur lesdits corps mobiles (87) appariés pour maintenir les deux extrémités d'un fil (27) à mettre en forme d'ensemble de ressorts; et

un premier et un second moyens (151, 153, 155) d'enroulement respectivement disposés au niveau desdits corps mobiles (87) pour courber en spirale les parties du fil (27) qui s'étendent respectivement depuis les premier et second moyens de maintien (135) à mesure que les corps mobiles (87) se rapprochent l'un de l'autre, caractérisé en ce que lesdits premier et second corps mobiles (87) sont montés sur lesdits rails de guidage de façon qu'ils soient entraînés exclusivement par lesdits moyens de maintien (135) pendant le processus de formation de ressorts au cours duquel lesdits moyens de maintien (135) tirent le fil (27) tendu entre eux.

2. Appareil pour fabriquer des ensembles de ressorts selon la revendication 1, caractérisé en ce que chacun desdits premier et second moyens d'enroulement (151, 153, 155) comporte un galet de formage (153) au contact du fil (27) pour le courber comme une hélice, un organe de guidage (151) disposé entre le rouleau de formage (153) et chacun des premier et second moyens de maintien (135) pour établir le diamètre d'une première spire de la spirale formée par le galet de formage (153), et une tige (155) d'inclinaison disposée entre l'organe de guidage (151) et le galet de formage (153) pour établir le pas de la spirale formée par le galet de formage (153).

3. Appareil pour fabriquer des ensembles de ressorts selon la revendication 2, caractérisé en ce que chacun des premier et second moyens d'enroulement (151, 153, 155) comporte en outre un moyen (170, 172, 173, 174, 191, 193, 197, 199, 190) pour déplacer de manière linéaire le galet de formage (153) afin de modifier l'intervalle entre l'organe de guidage (151) et le galet de formage (153) en réponse au déplacement de chacun des premier et second corps mobiles (87).

4. Appareil pour fabriquer des ensembles de ressorts selon la revendication 2, caractérisé en ce que chacun des premier et second moyens d'enroulement (151, 153, 155) comporte en outre un moyen (175, 177, 179, 181, 183, 188) pour faire aller et venir la tige (155) d'inclinaison en réponse au déplacement de chacun des premier et second corps mobiles (87).

5. Appareil pour fabriquer des ensembles de ressorts selon la revendication 2, caractérisé en ce que chacun des premier et second moyens d'enroulement (151, 153, 155) comporte en outre un moyen (165, 167) pour faire tourner d'environ 90° l'organe de guidage (151) afin de couder à angle droit la limite entre une partie linéaire (27c) et une partie hélicoïdale (27b) du fil (27) au moment de

former aux deux parties extrêmes du fil des parties spiralées ayant chacune une longueur prédéterminée.

6. Appareil pour fabriquer des ensembles de ressorts selon la revendication 1, caractérisé en ce qu'il comporte en outre un moyen de serrage (205) pour serrer le fil (27) entre les premier et second moyens de maintien (135) pour empêcher le fil (27) de glisser dans le sens de la longueur.

7. Appareil pour fabriquer des ensembles de ressorts selon la revendication 1, caractérisé en ce que chacun des premier et second moyens de maintien comporte deux galets de retenue (135) pour venir au contact et maintenir entre eux le fil (27), et un moyen (115, 117, 116, 118, 119, 120, 121, 127) pour entraîner au moins un des galets de maintien appariés (135) afin de faire avancer le fil (27) depuis une position entre les galets de retenue (135).

8. Appareil pour fabriquer des ensembles de ressorts selon la revendication 7, caractérisé en ce qu'il comporte en outre un moyen (143, 145, 147) pour approcher et éloigner l'un de l'autre les galets de maintien appariés (135).

9. Appareil pour fabriquer des ensembles de ressorts selon la revendication 1, caractérisé en ce qu'il comporte en outre un moyen (5) pour fournir un morceau de fil (27) aux premier et second moyens de maintien (135).

10. Appareil pour fabriquer des ensembles de ressorts selon la revendication 1, caractérisé en ce qu'il comporte en outre un moyen (51, 57, 59) pour courber légèrement les deux extrémités du fil (27) fourni.

11. Appareil pour fabriquer des ensembles de ressorts selon la revendication 1, caractérisé en ce qu'il comporte en outre un moyen (237, 243, 245, 247, 257) pour acheminer l'ensemble (250) de ressorts possédant des ressorts hélucoïdaux (27b) formés aux deux extrémités de la partie linéaire (27c) de celui-ci.

12. Appareil pour fabriquer des ensembles de ressorts selon la revendication 11, caractérisé en ce qu'il comporte en outre des corps rotatifs (363) placés pour correspondre aux deux extrémités de la partie linéaire (27c) de l'ensemble (250) de ressorts acheminé, des organes d'engagement (365, 367) disposés respectivement au niveau des corps rotatifs (363) pour venir au contact des deux extrémités de la partie linéaire (27c) et un moyen (359) pour faire tourner d'un angle prédéterminé les corps rotatifs (363) afin de courber la partie linéaire (27c) à l'aide des organes d'engagement (365, 367) à l'instant où les deux extrémités de la partie linéaire (27c) sont en prise avec les organes d'engagement (365, 367).

13. Appareil pour fabriquer des ensembles de ressorts selon la revendication 12, caractérisé en ce qu'il comporte en outre un moyen (275) pour chauffer et durcir l'ensemble (250) de ressorts acheminé, et un moyen (277) pour déposer une résine synthétique (311) en poudre sur l'ensemble (250) de ressorts chauffé afin de l'enduire.

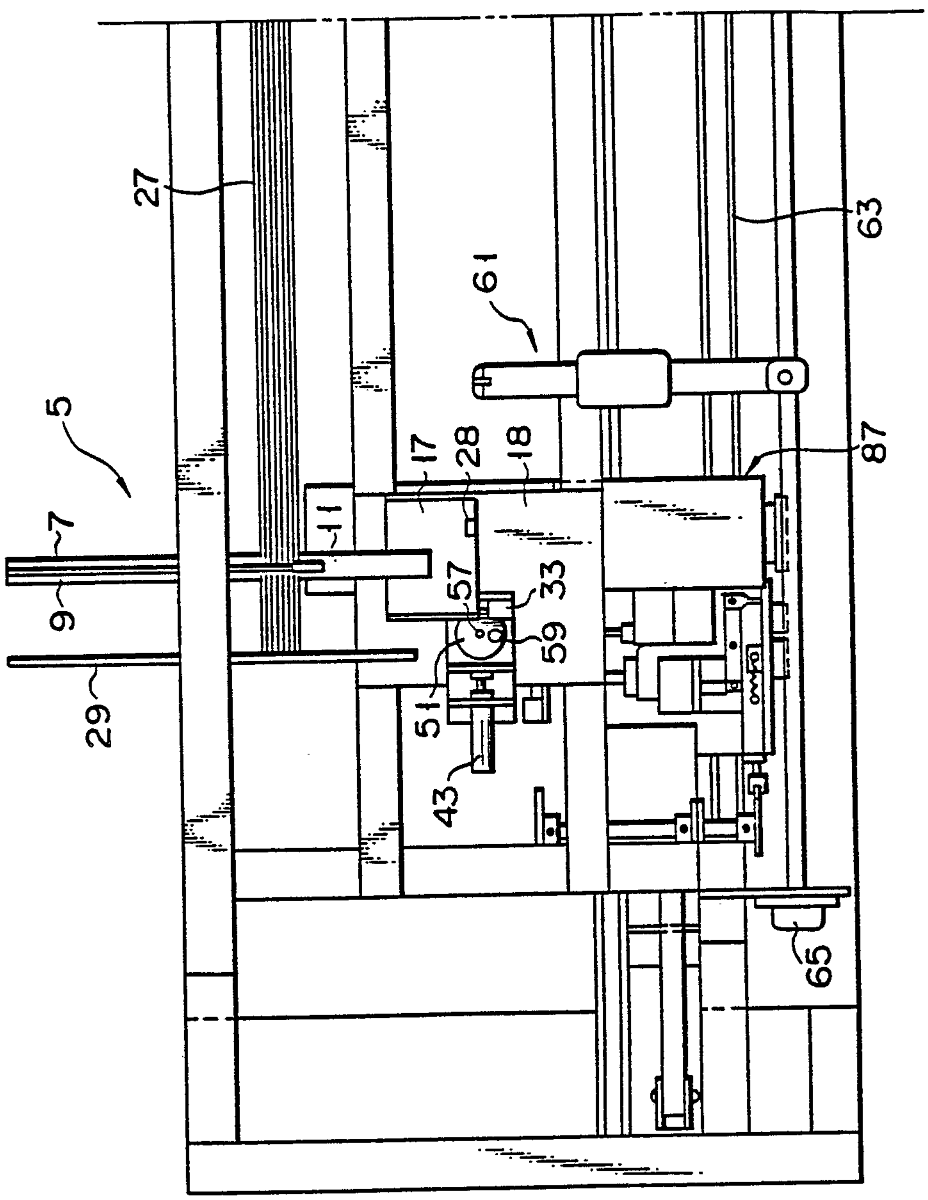
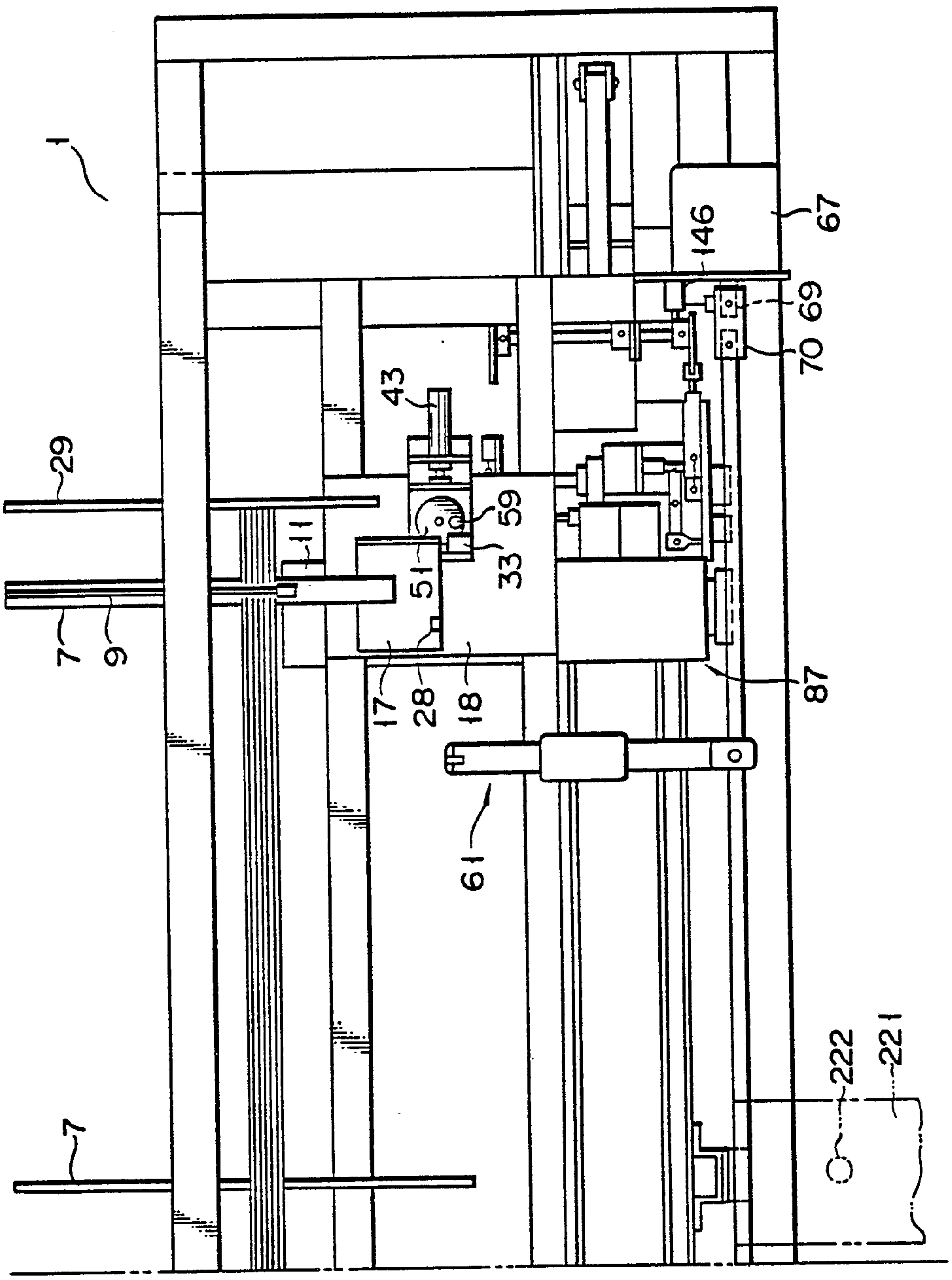
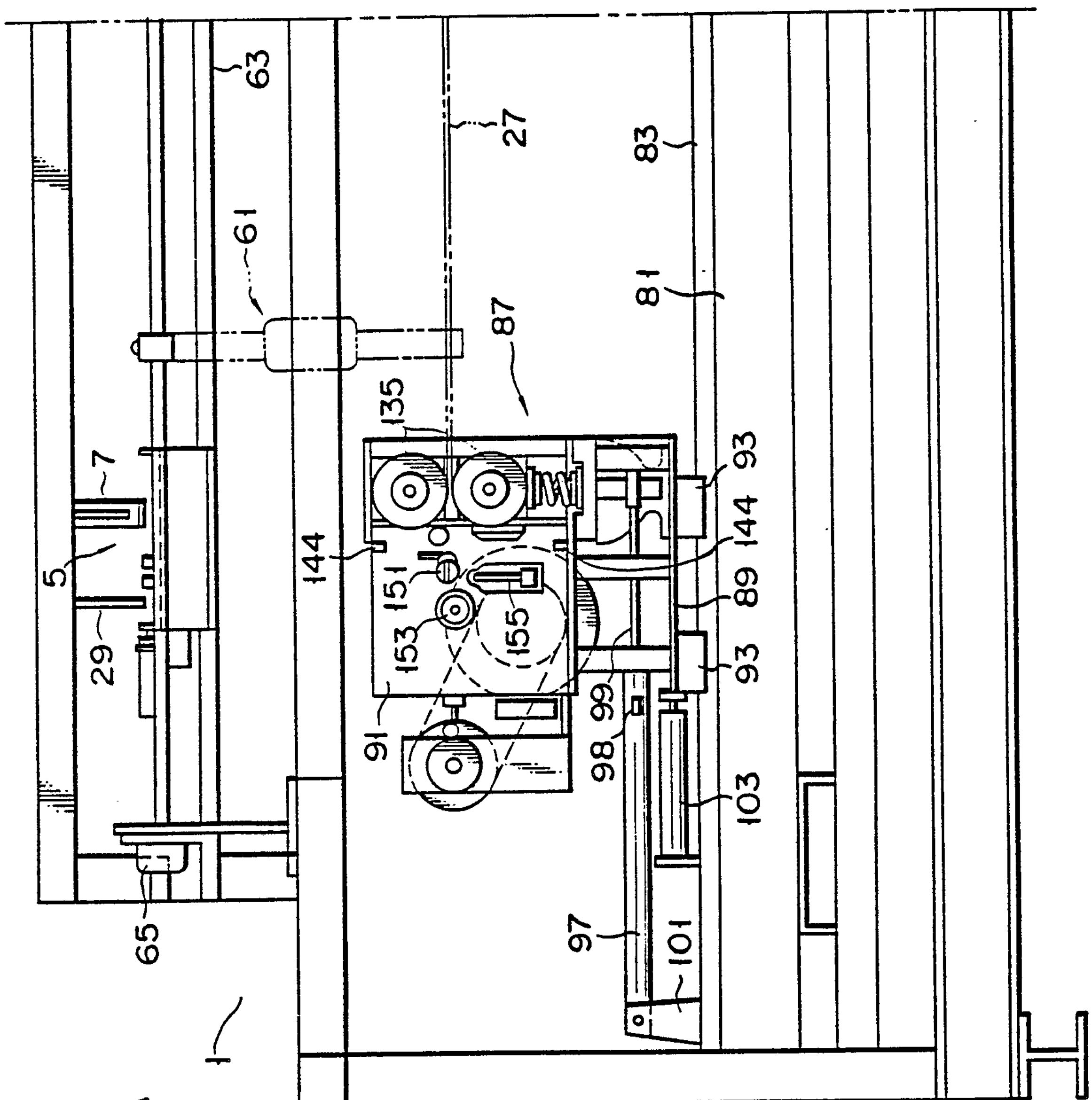


FIG. 1A

FIG. 1B

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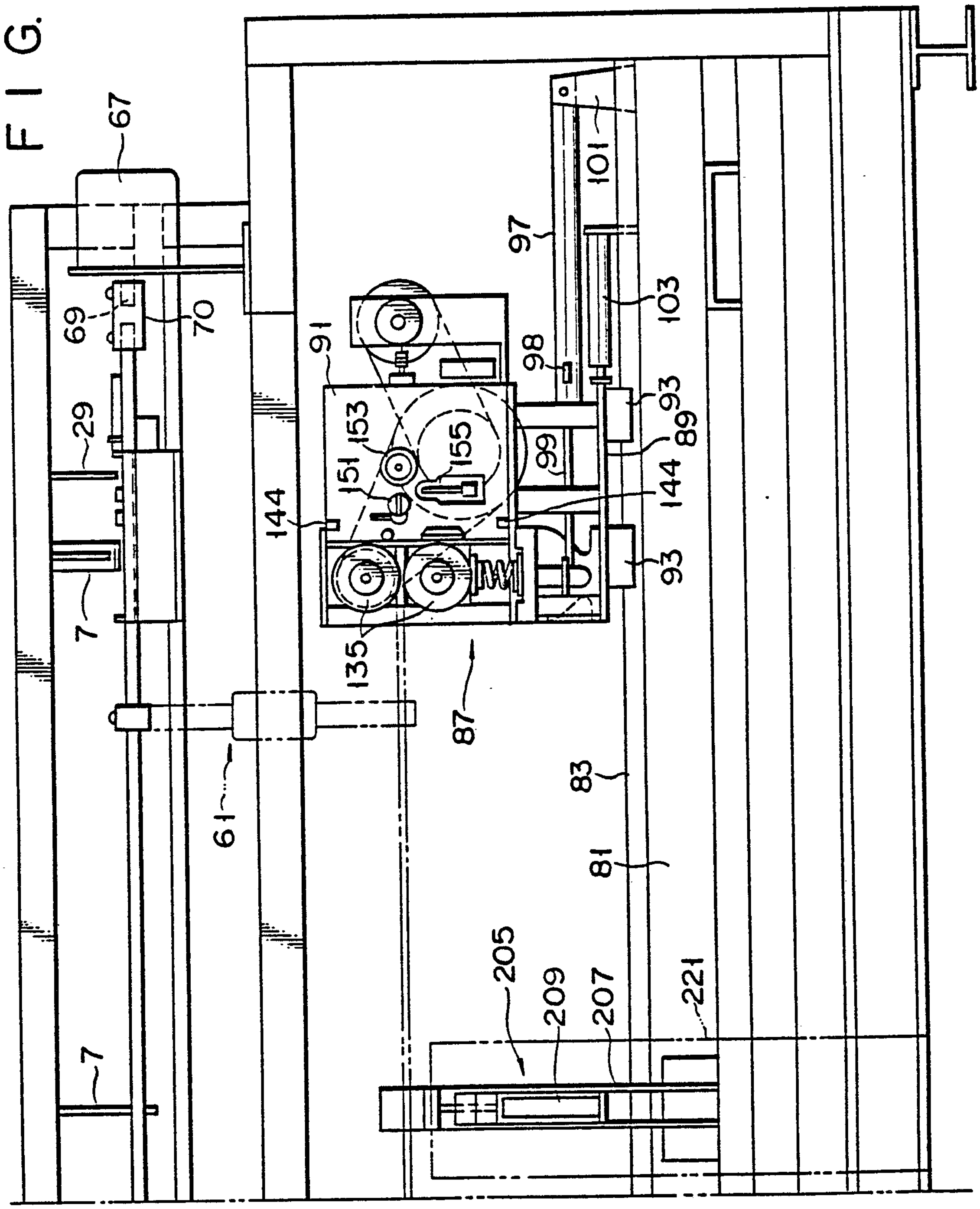
F I G. 2A

FIG. 2B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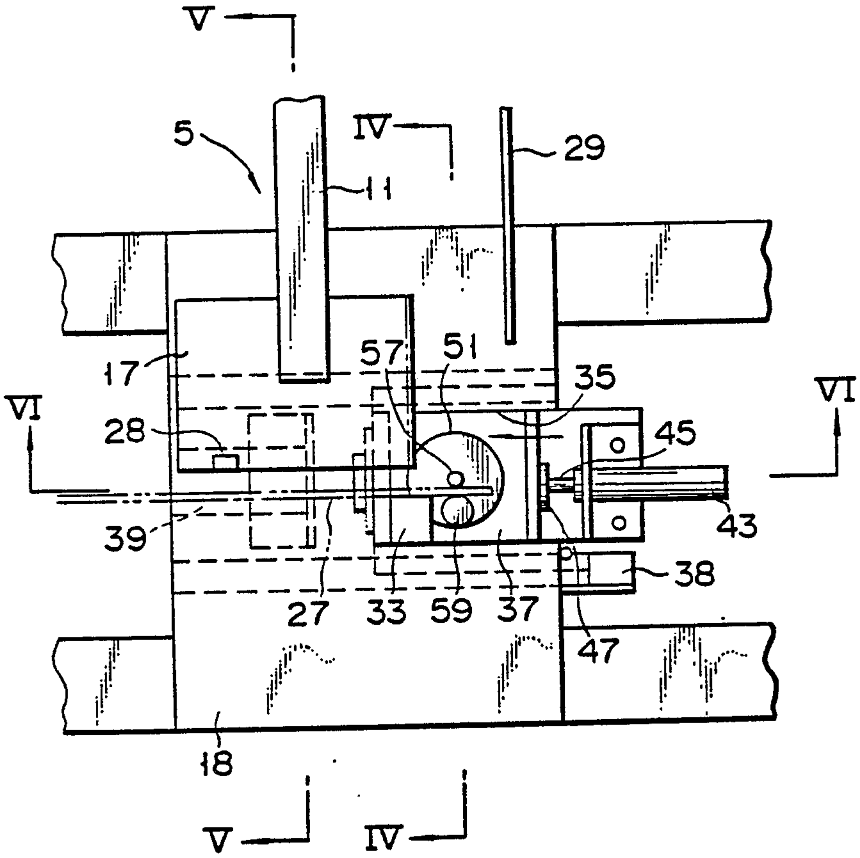
F I G. 3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F I G. 4

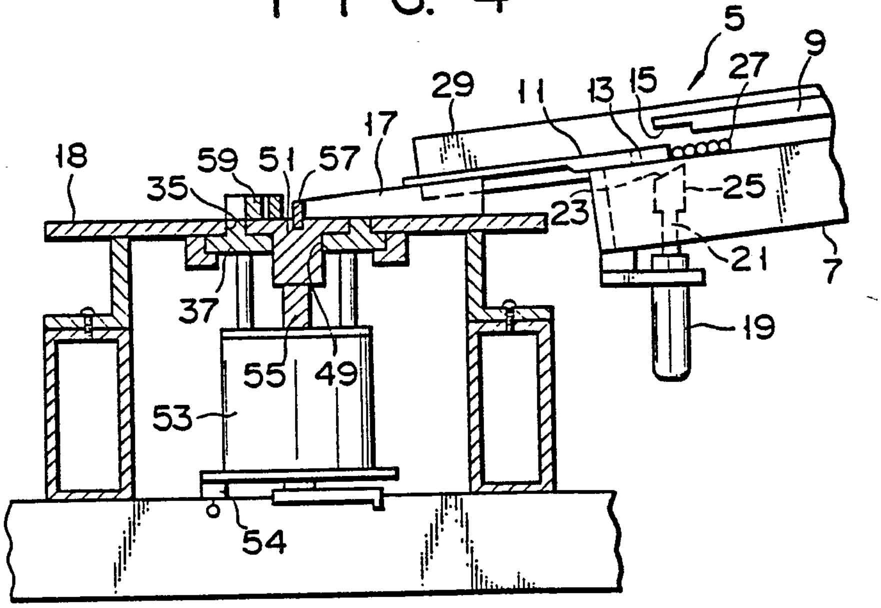
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FIG. 5

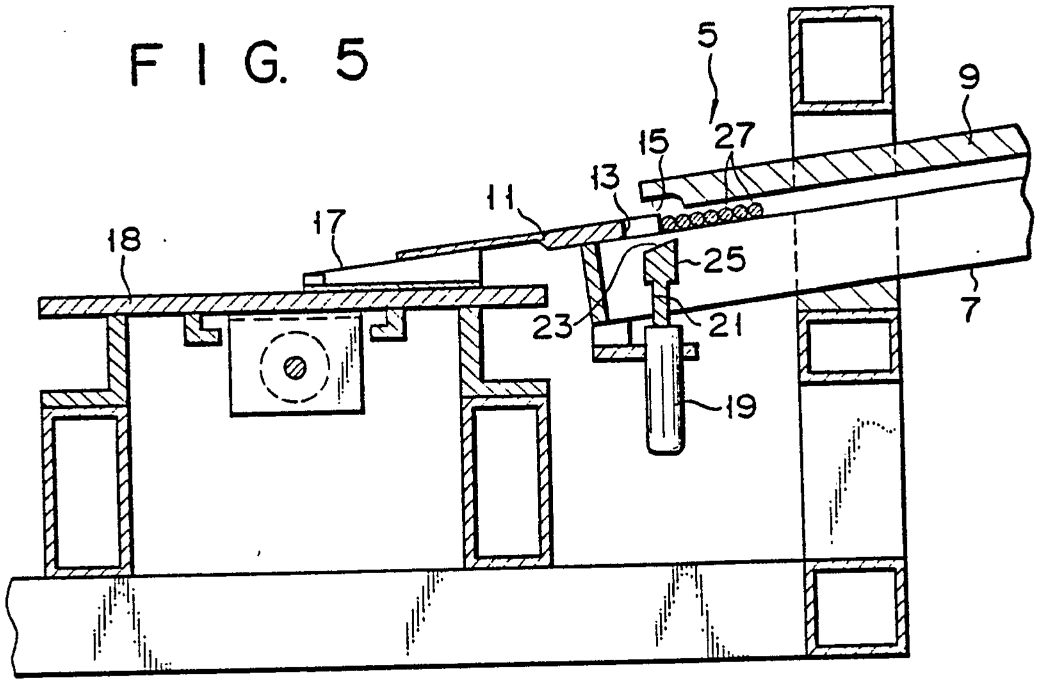

FIG. 6

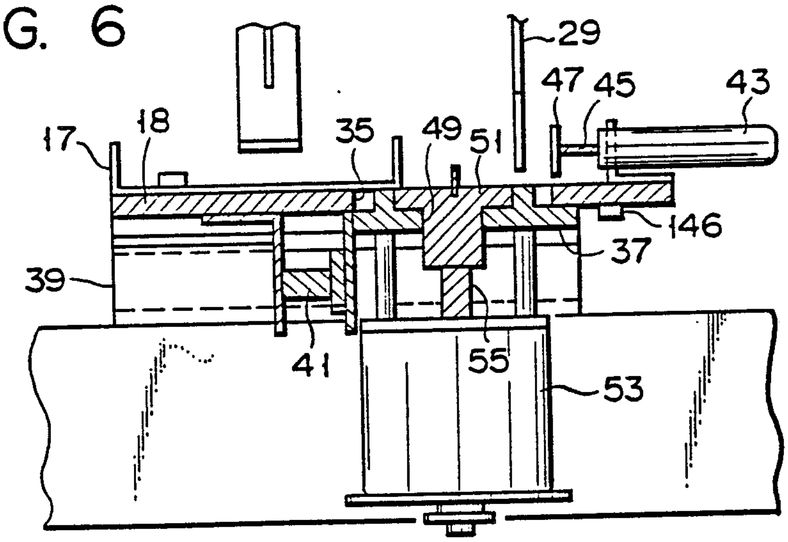

FIG. 7

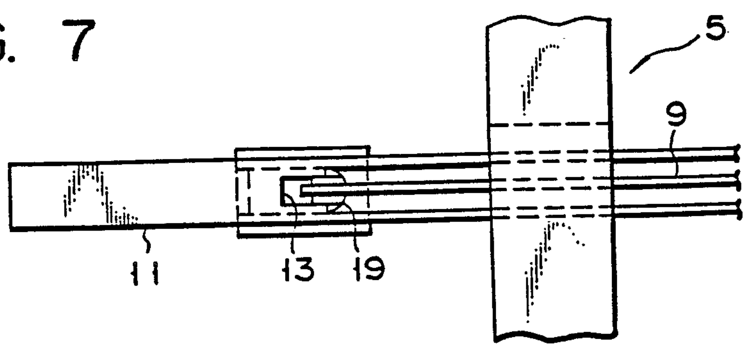

FIG. 8

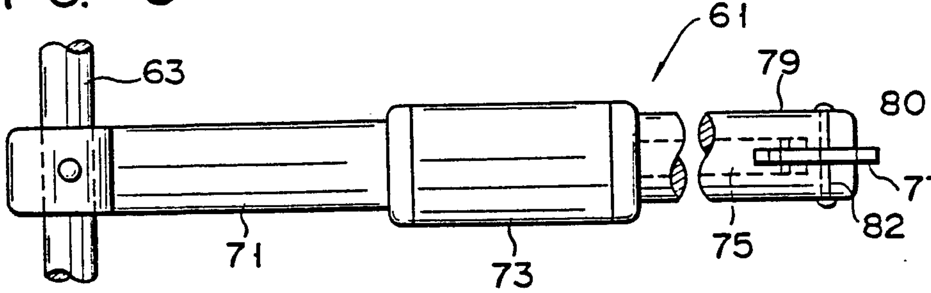

FIG. 9

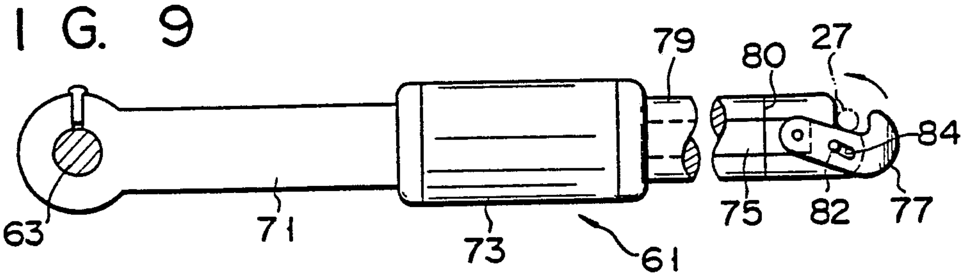

FIG. 10

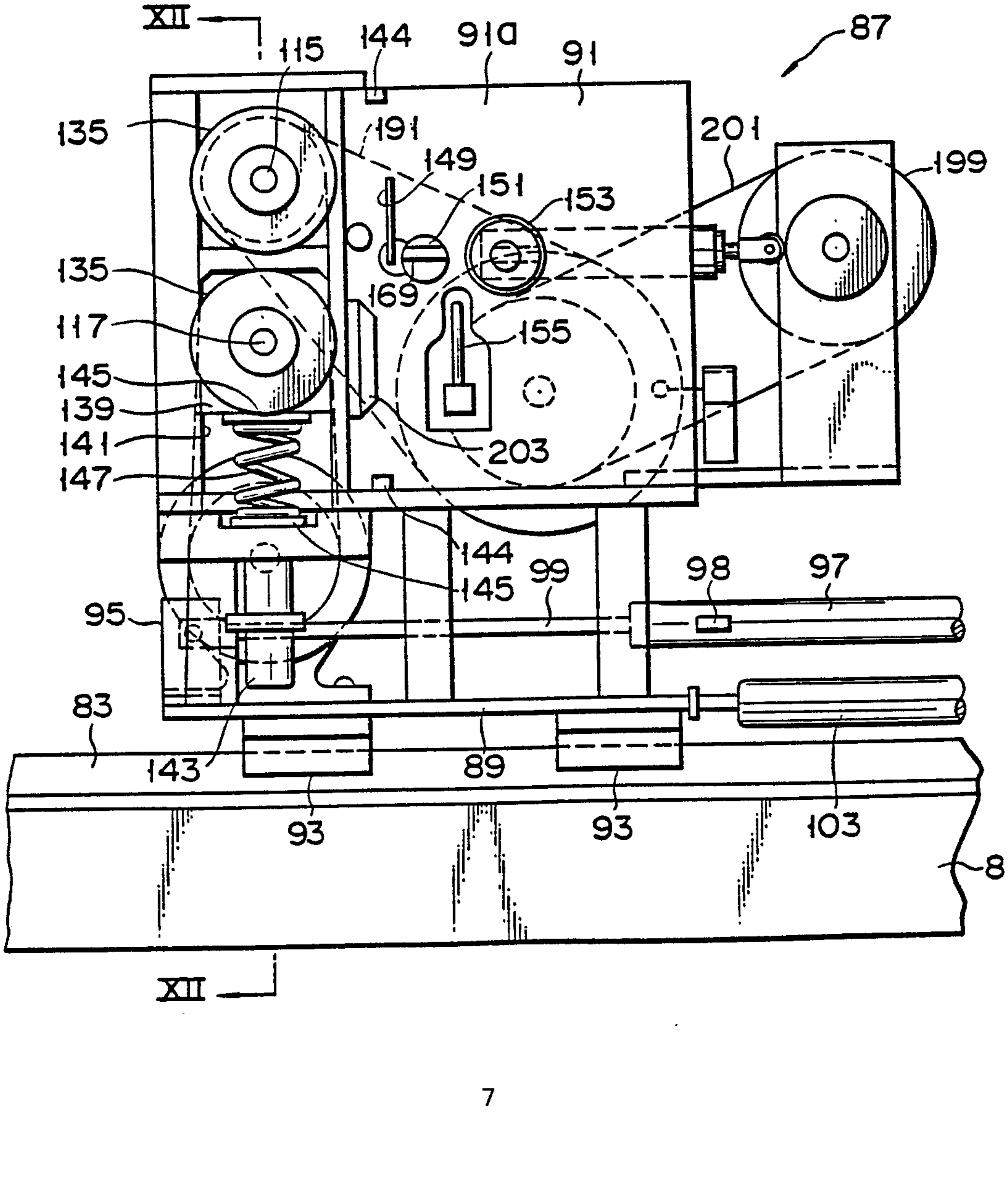

FIG. 11

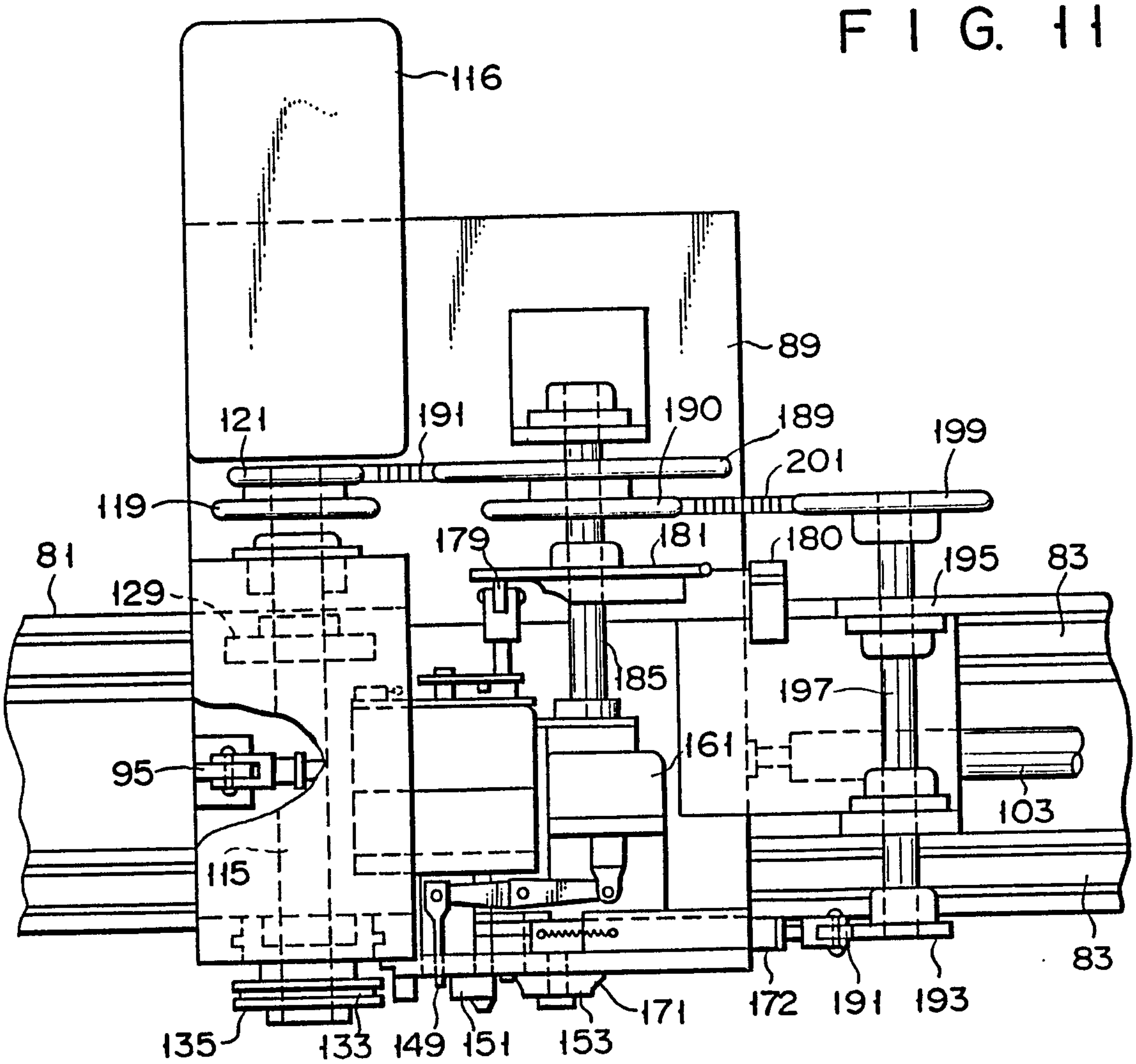
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FIG. 12

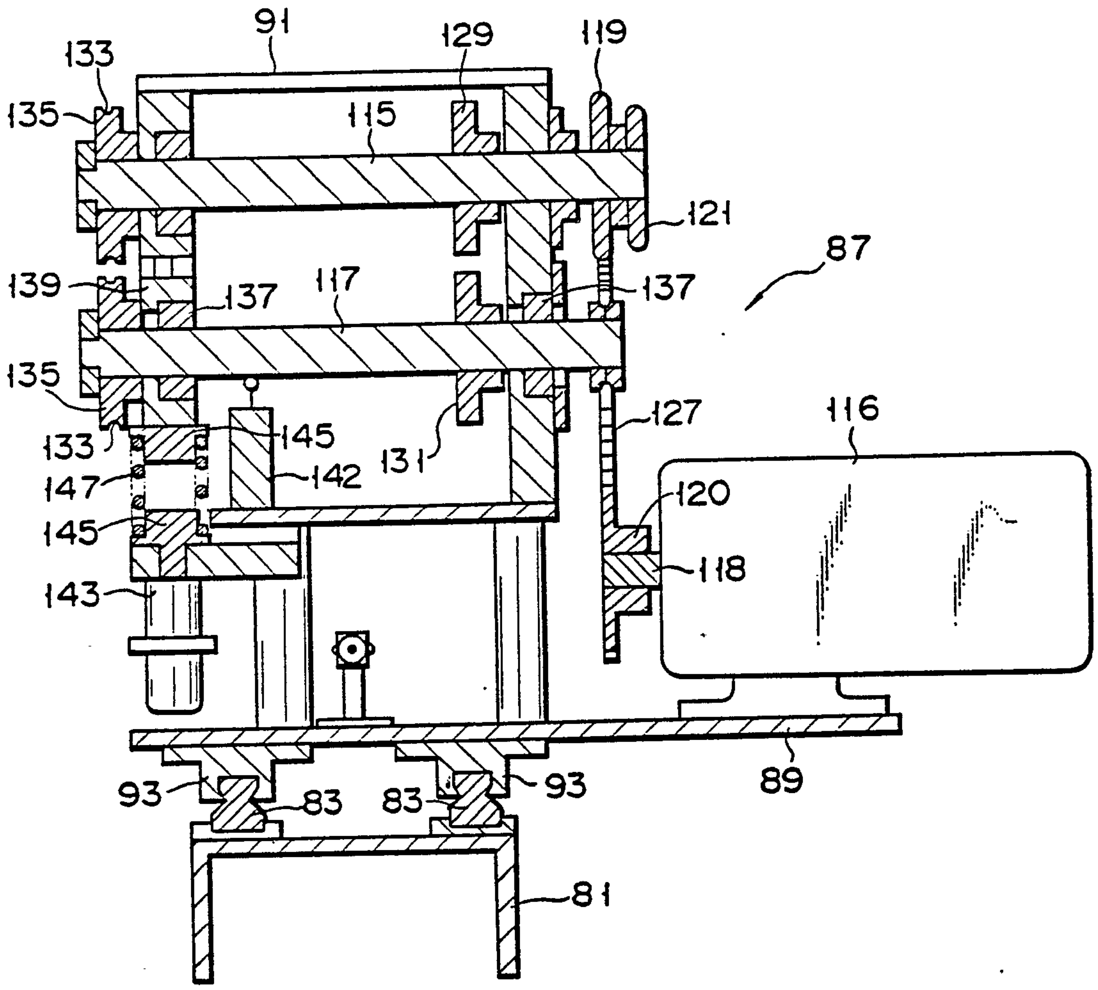


FIG. 13

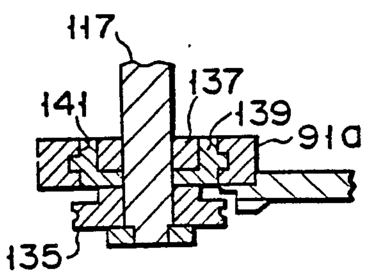
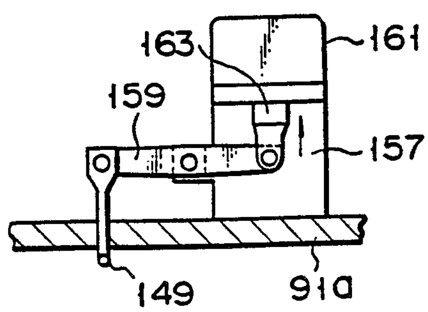
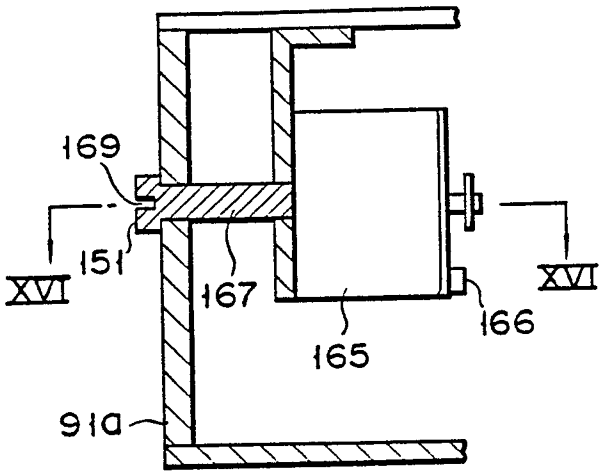


FIG. 14



F I G. 15



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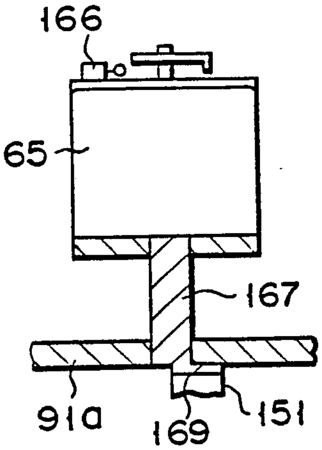
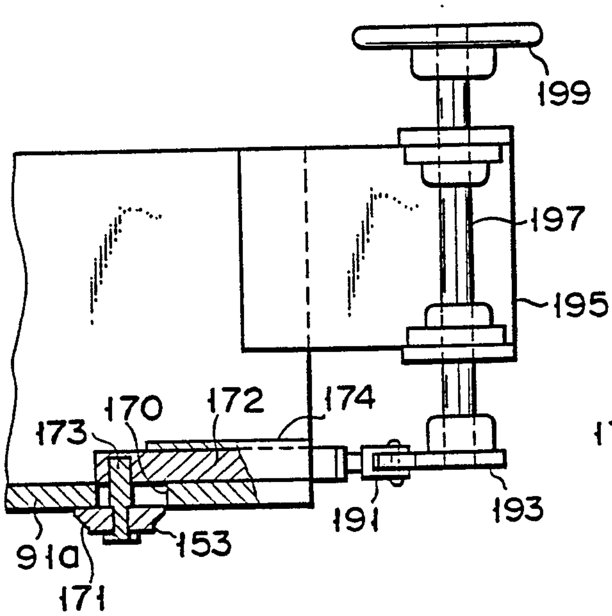


F I G. 17



F I G. 18

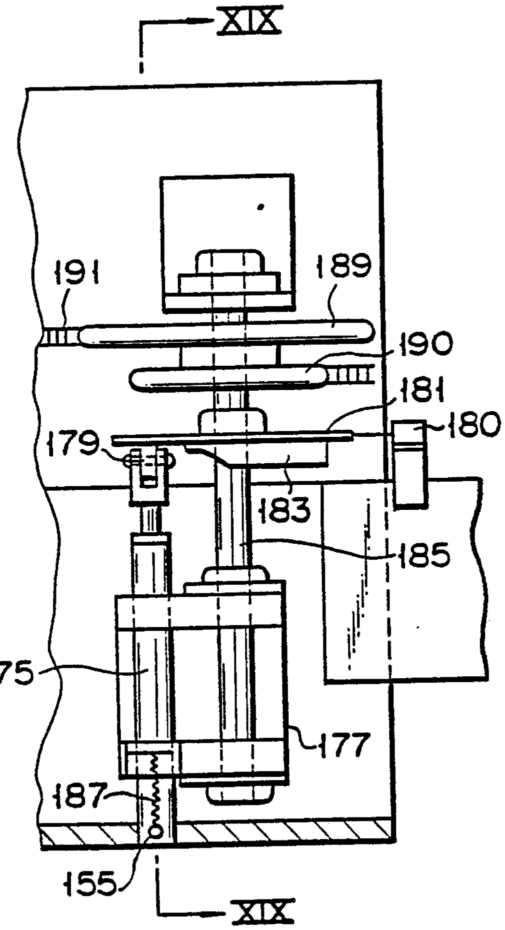


FIG. 19

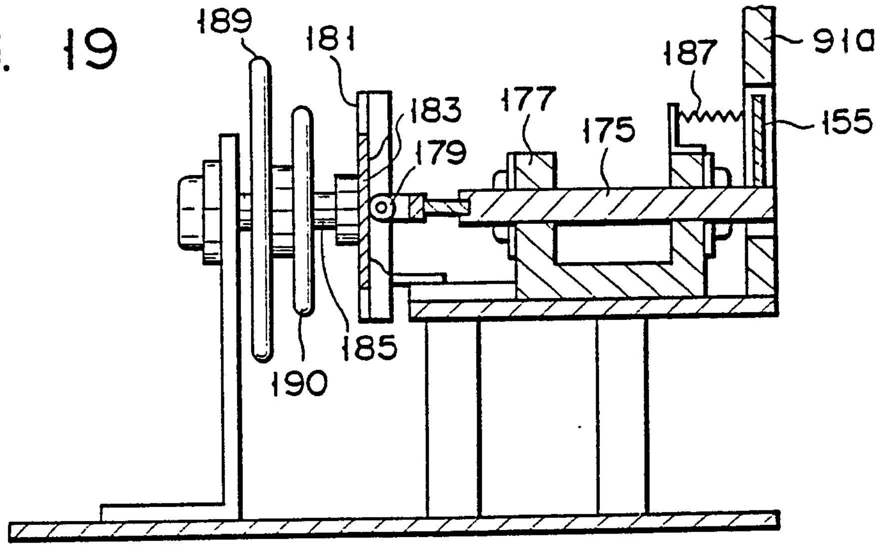


FIG. 20

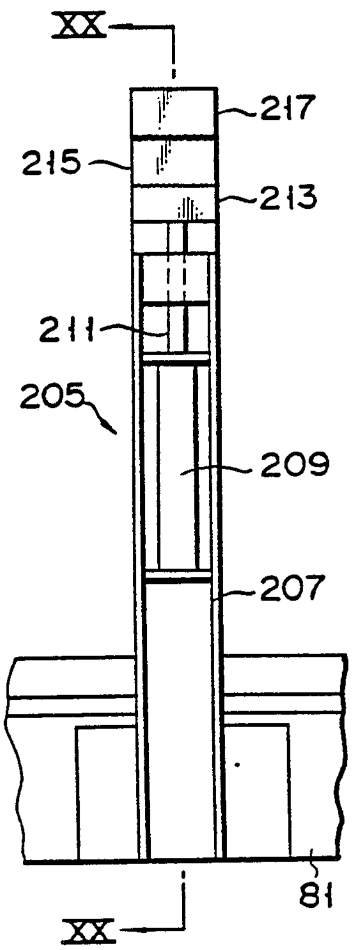


FIG. 21

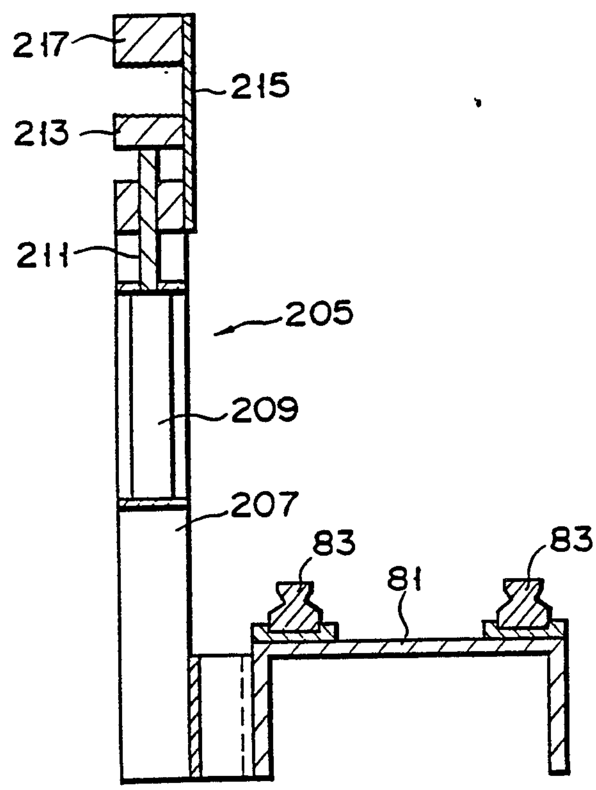


FIG. 22

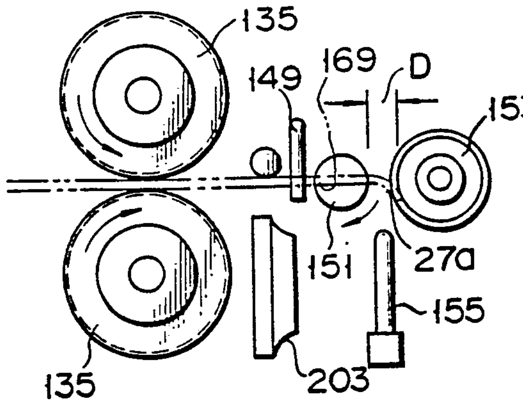


FIG. 23

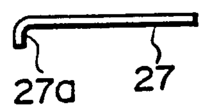


FIG. 24

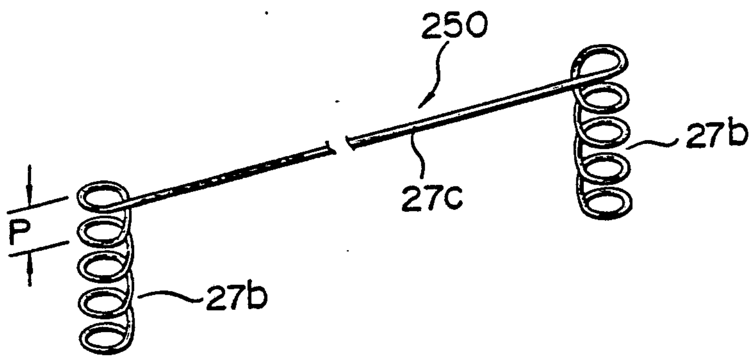


FIG. 25

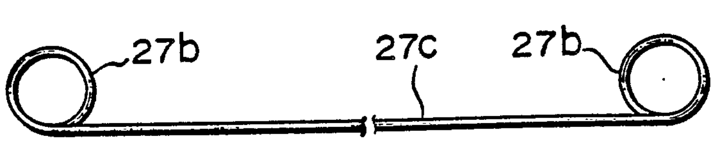


FIG. 26

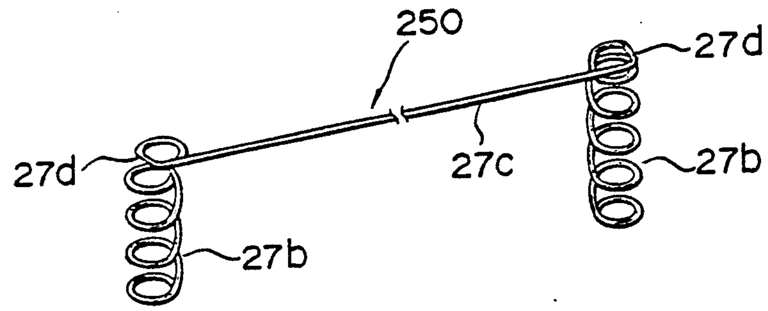


FIG. 27

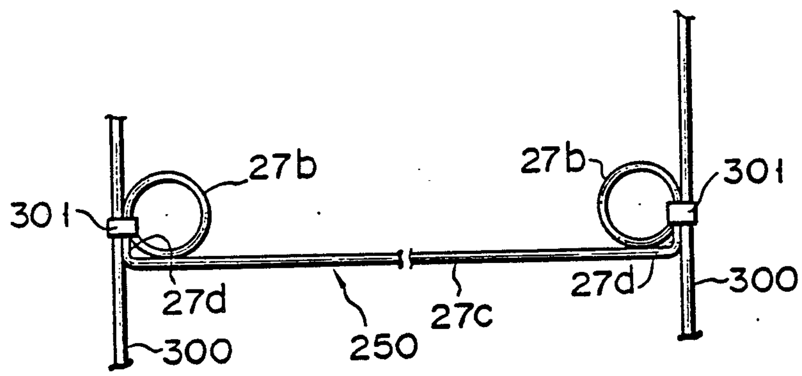
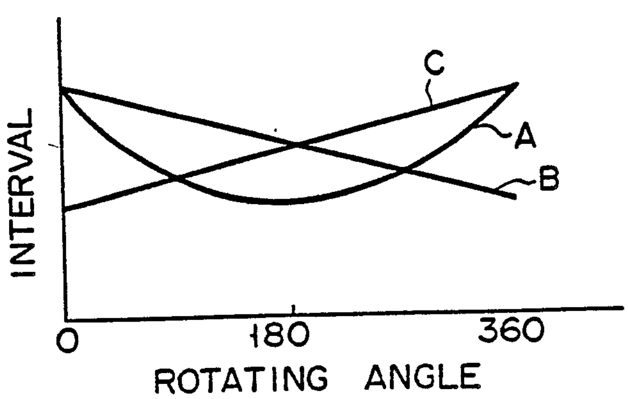
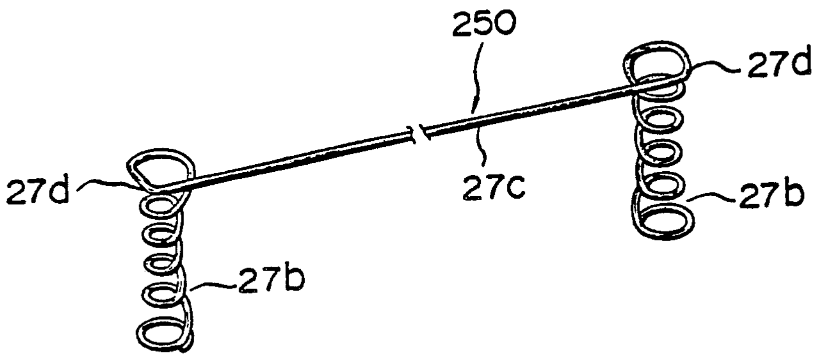


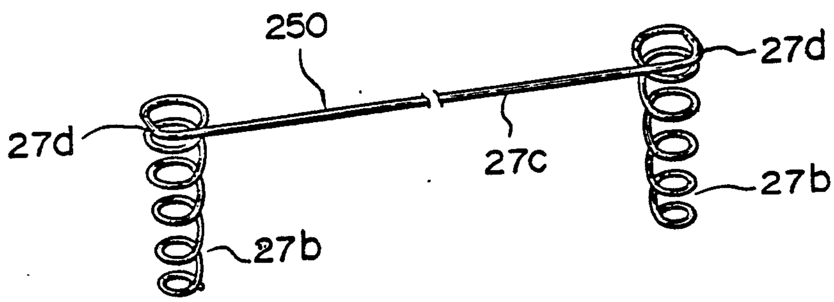
FIG. 28



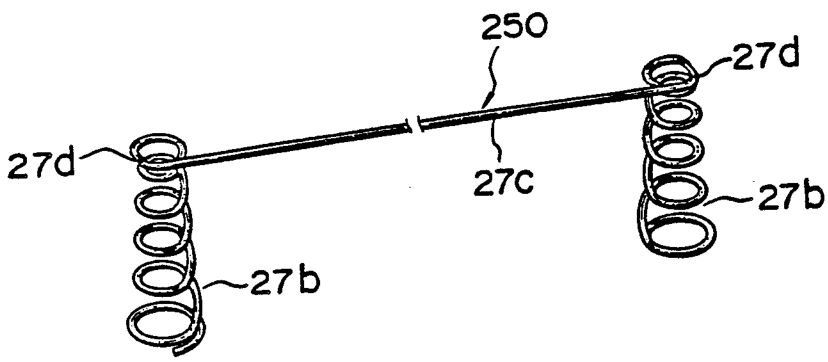
F I G. 29



F I G. 30



F I G. 31



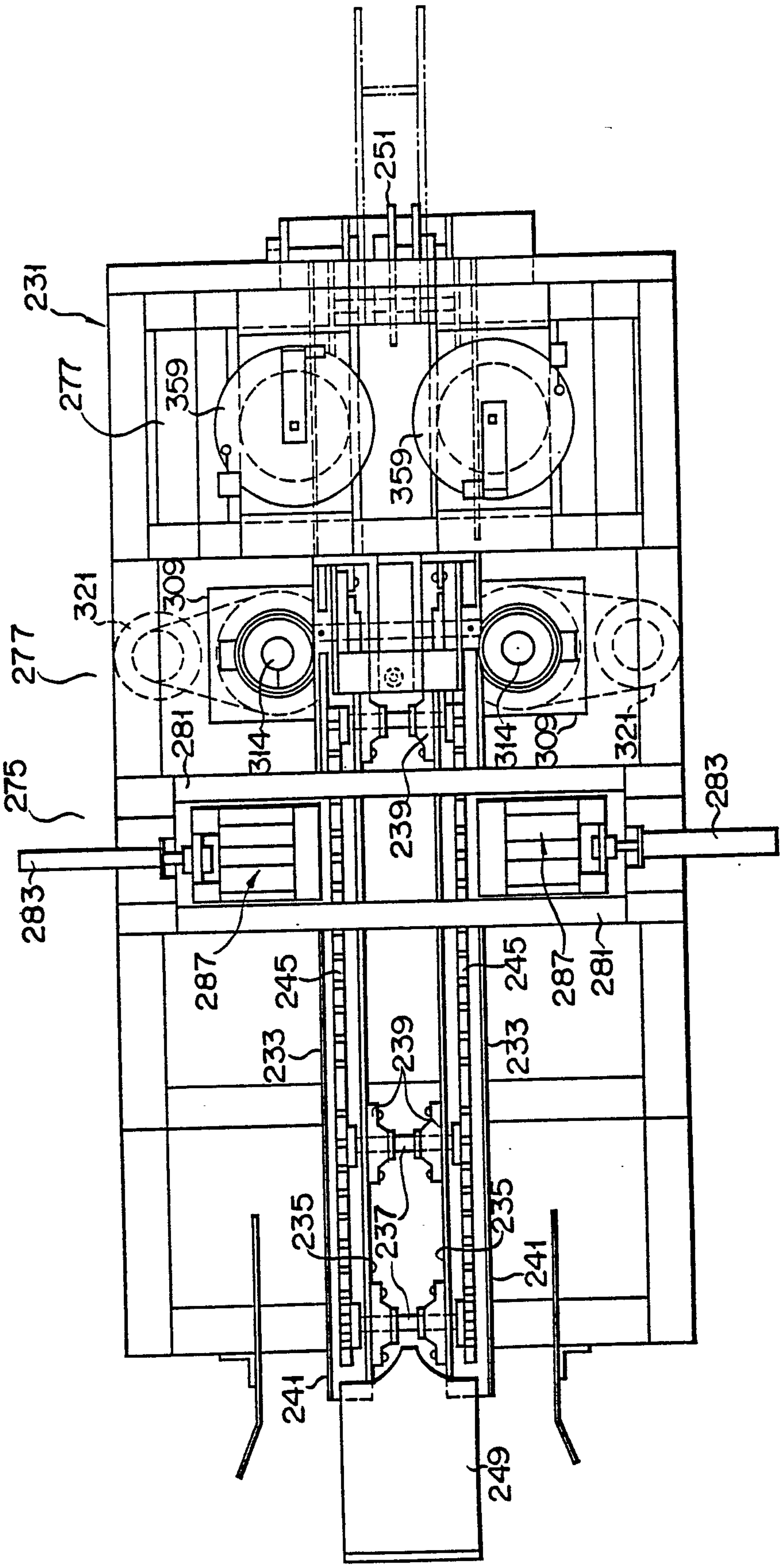

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FIG. 32

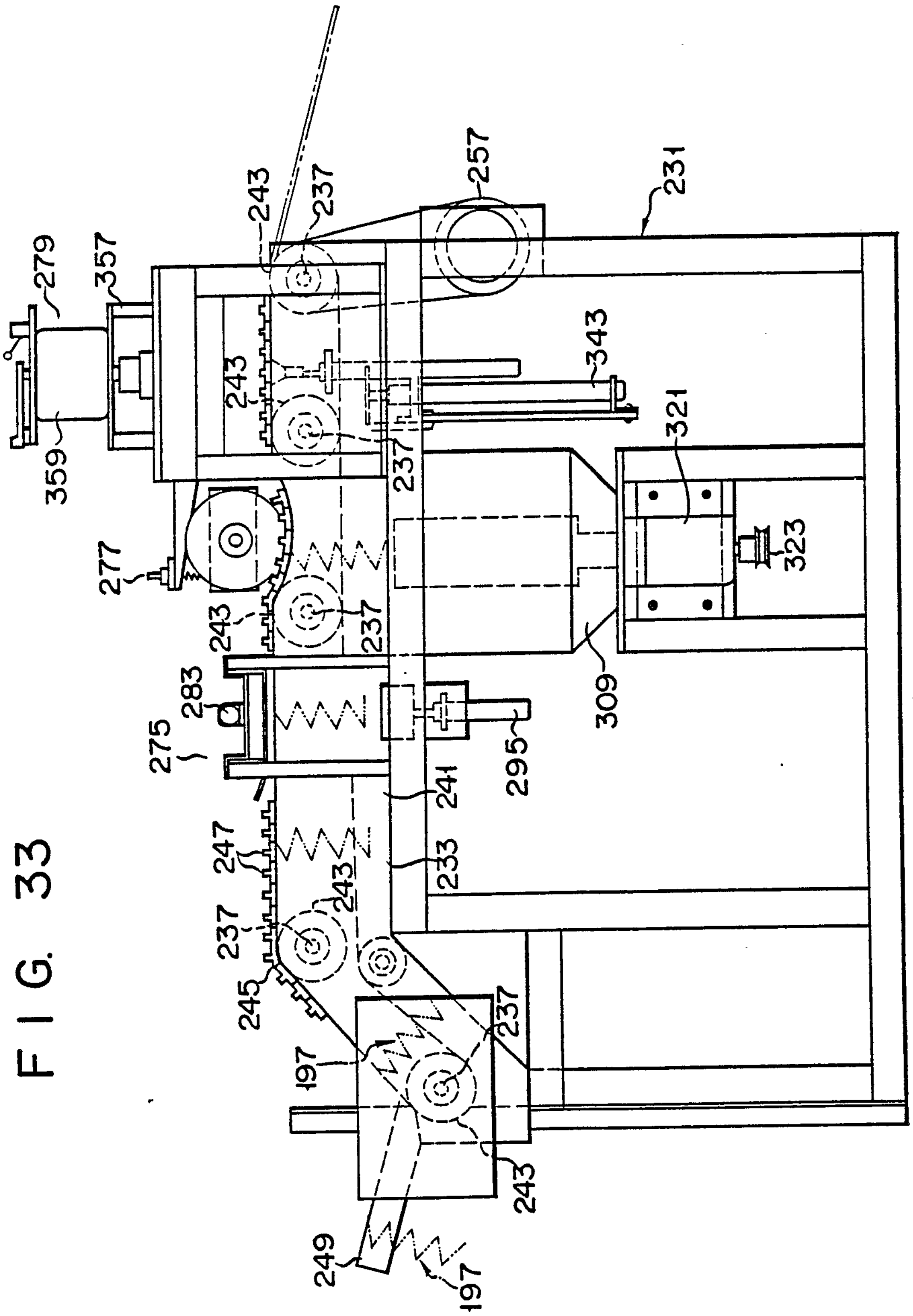
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FIG. 33

FIG. 34

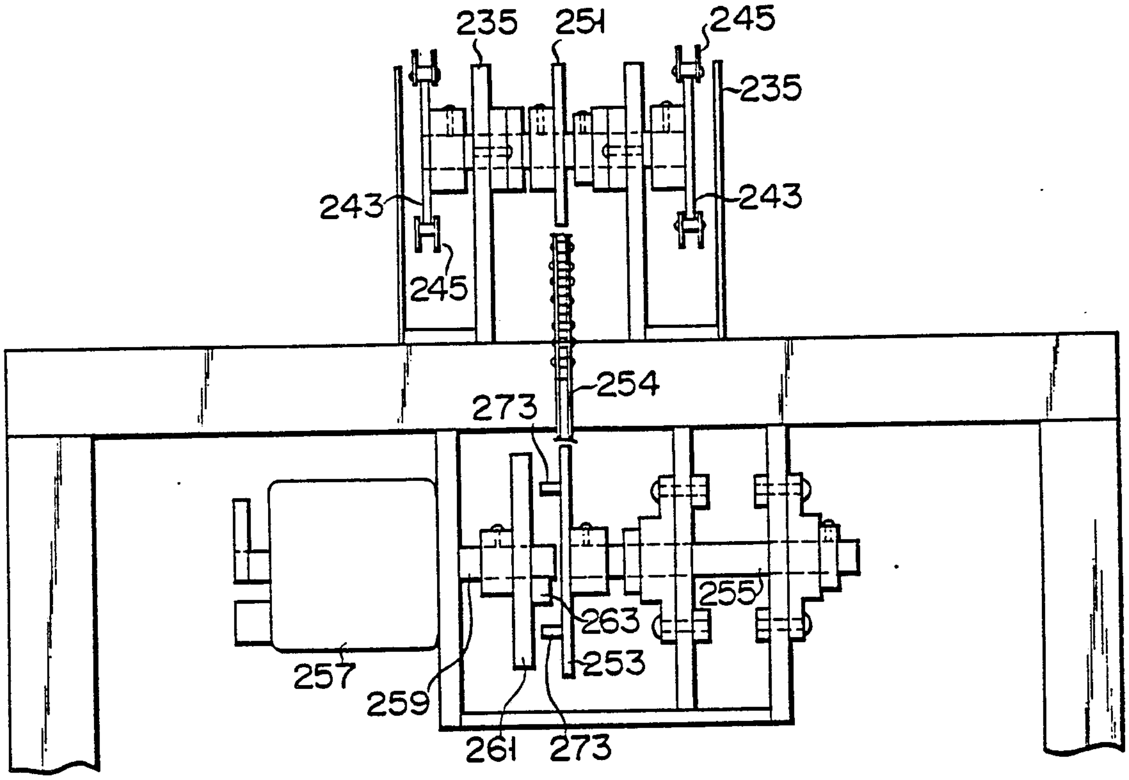
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FIG. 35

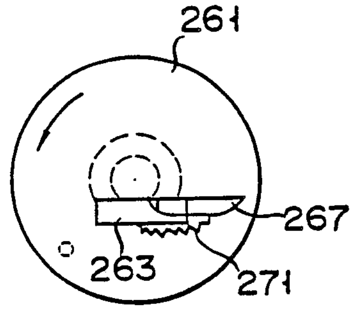
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FIG. 36

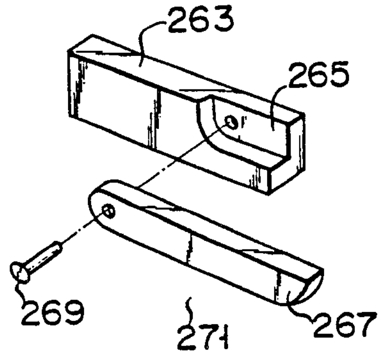

FIG. 37

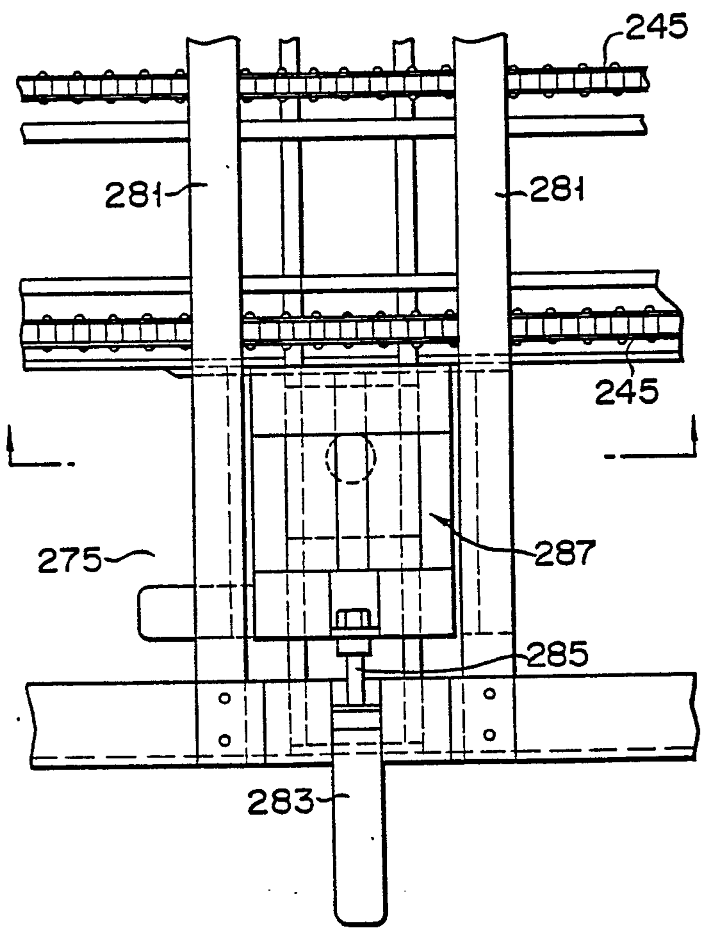

FIG. 38

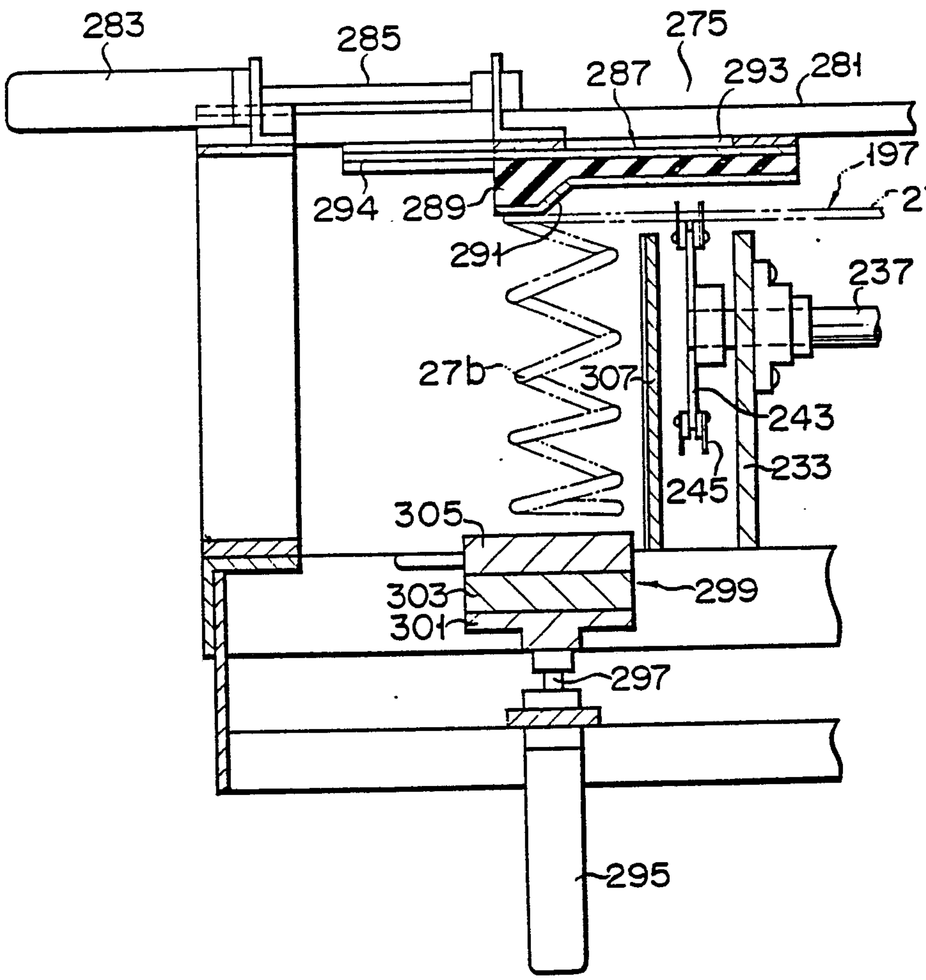
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FIG. 39

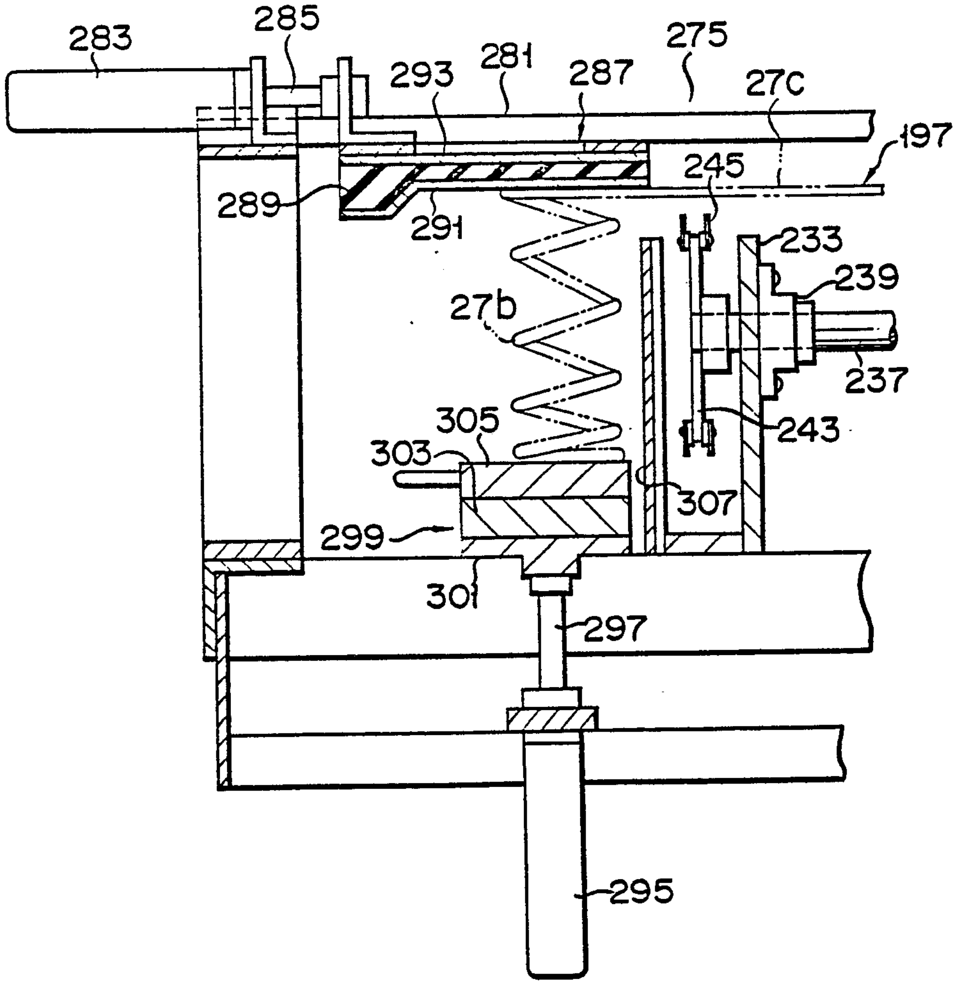
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FIG. 40

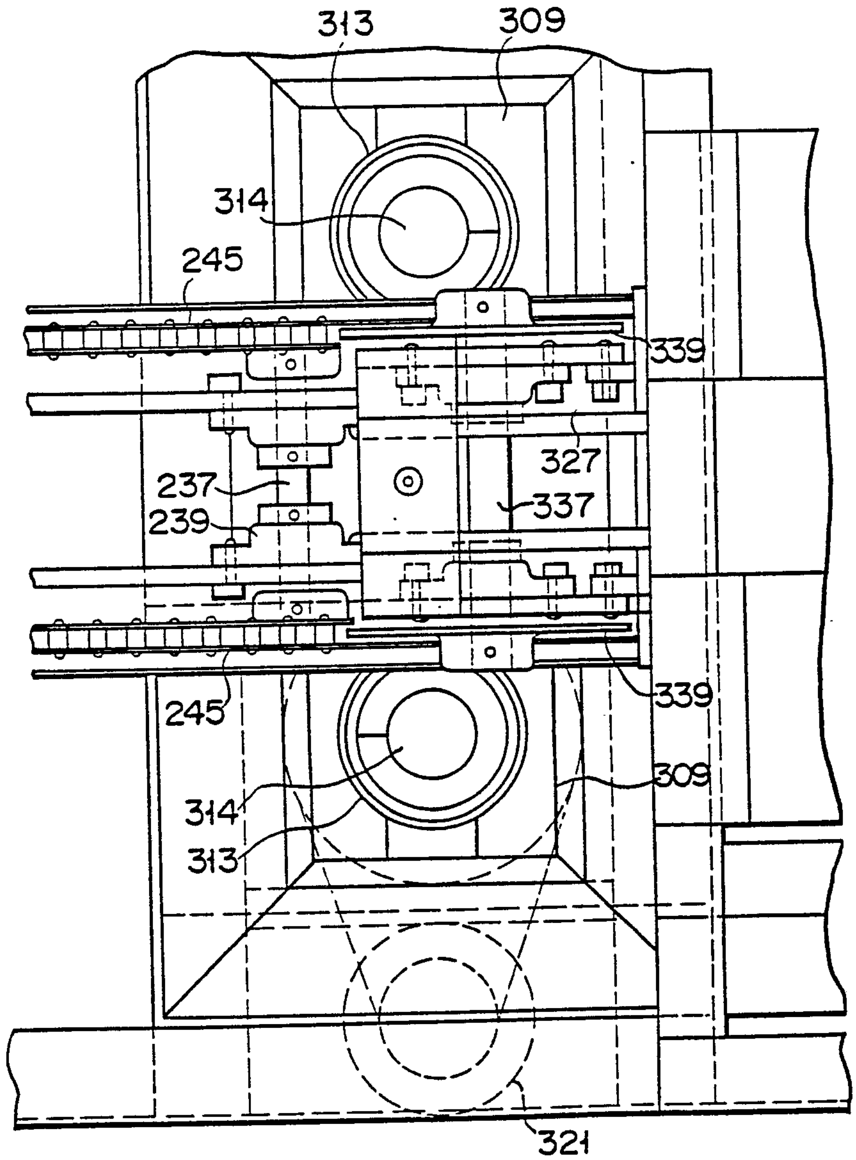

FIG. 41

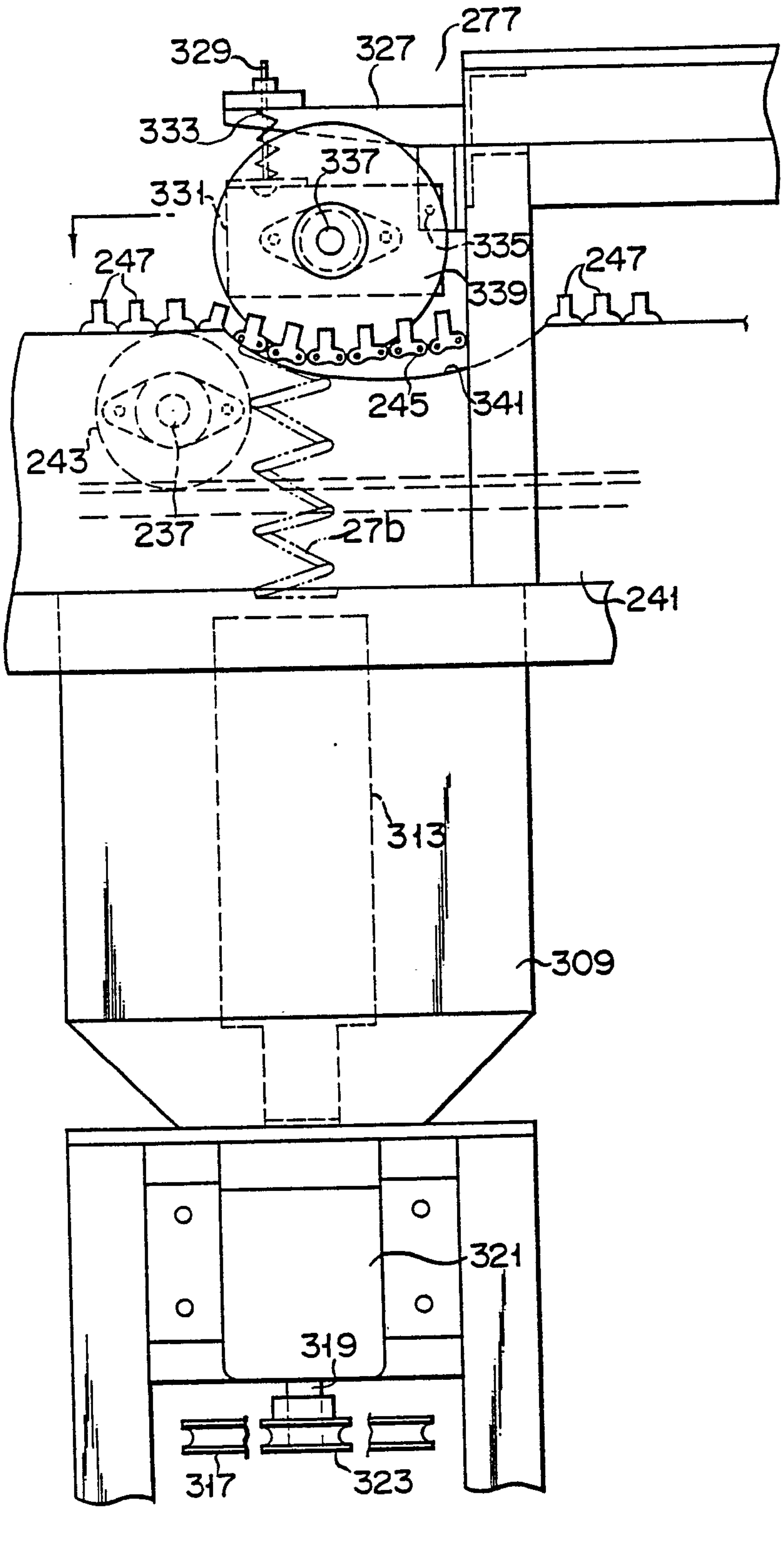
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FIG. 42

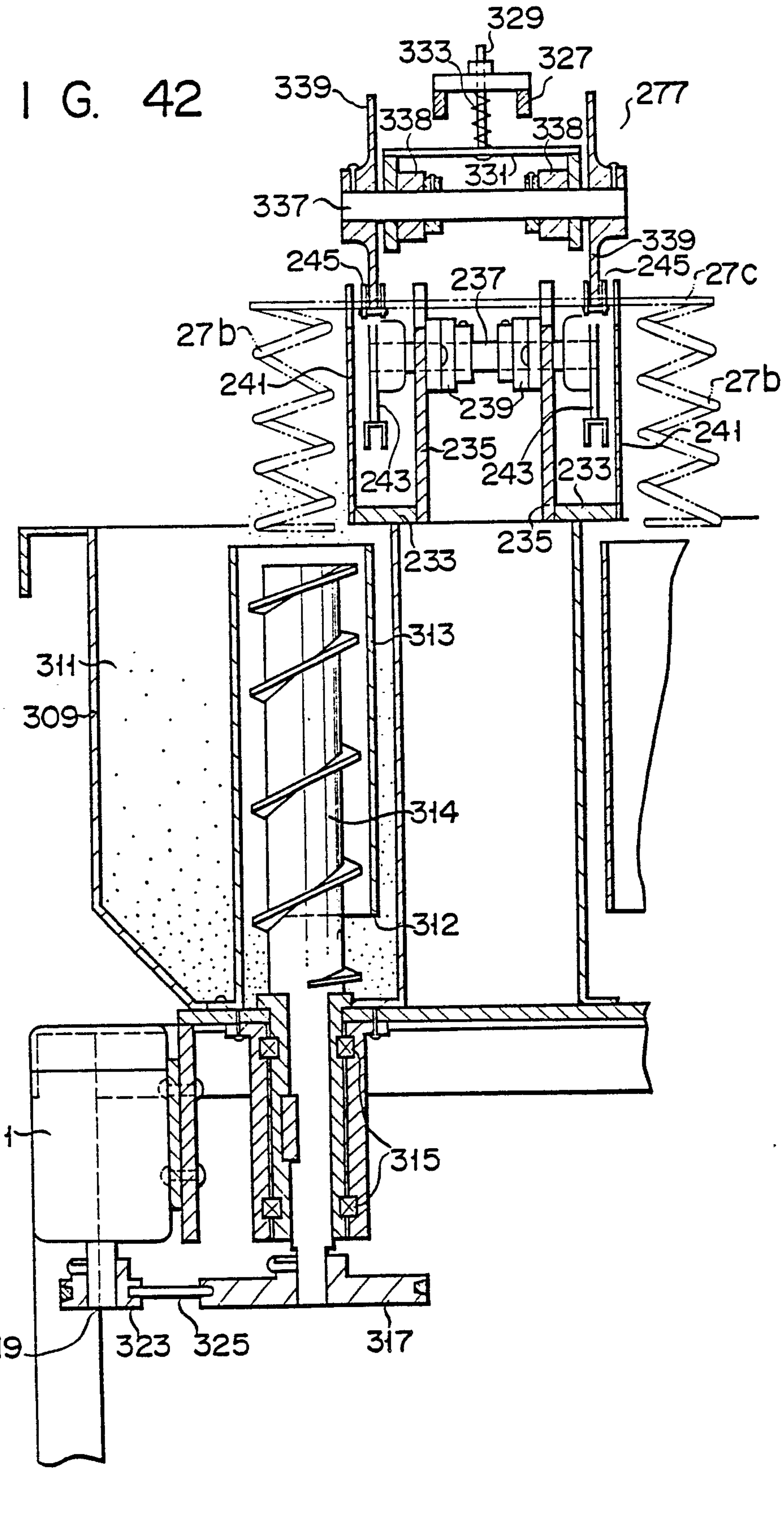
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FIG. 43

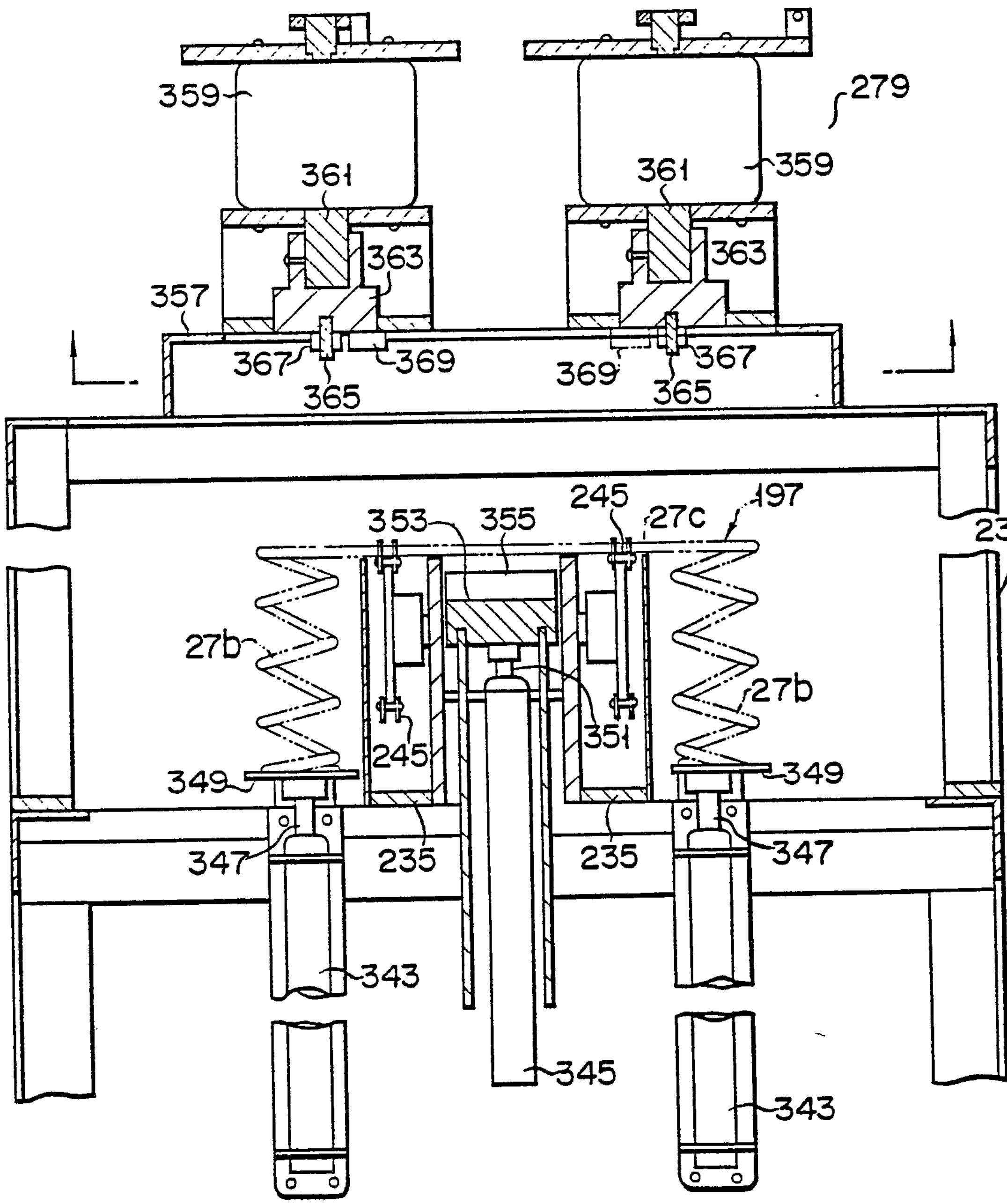
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FIG. 44

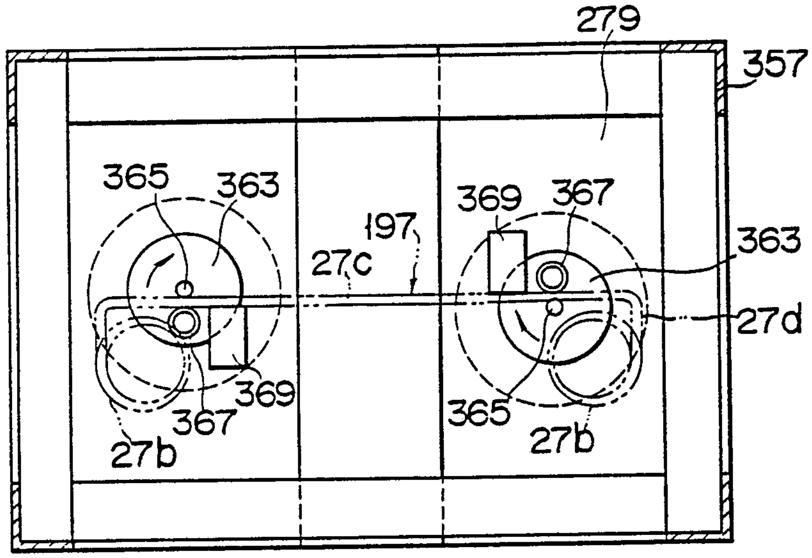

FIG. 45

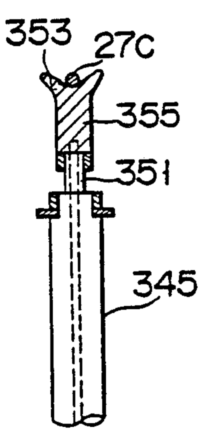

FIG. 46

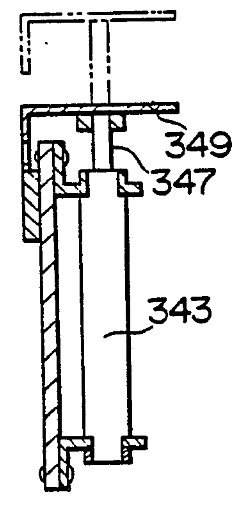

FIG. 47

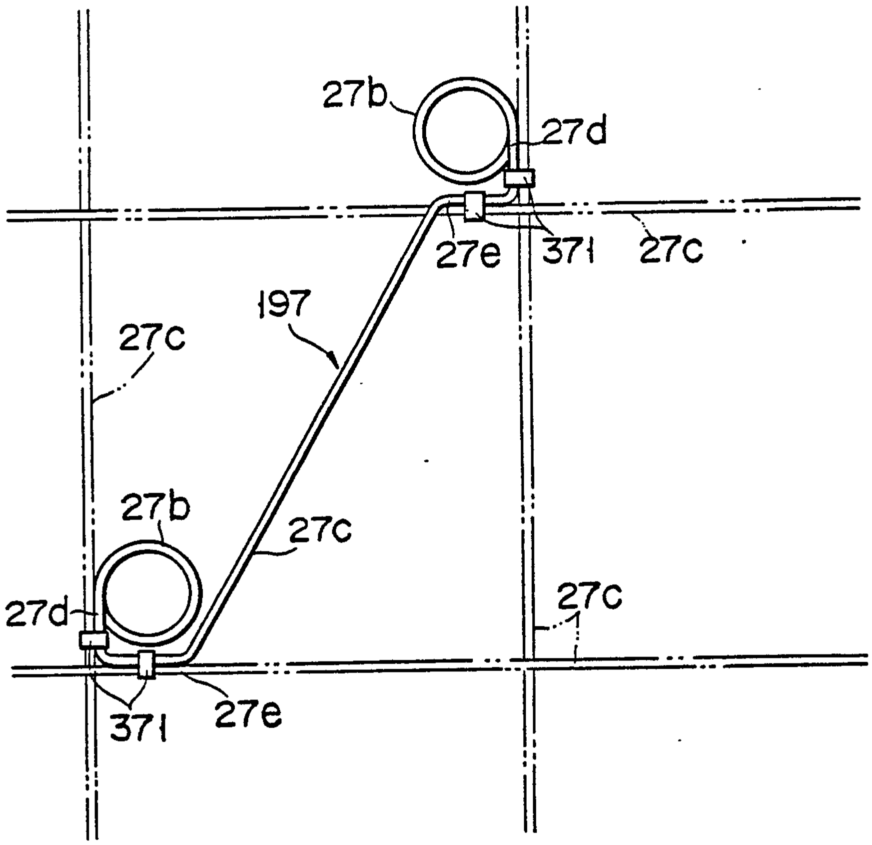

FIG. 48A

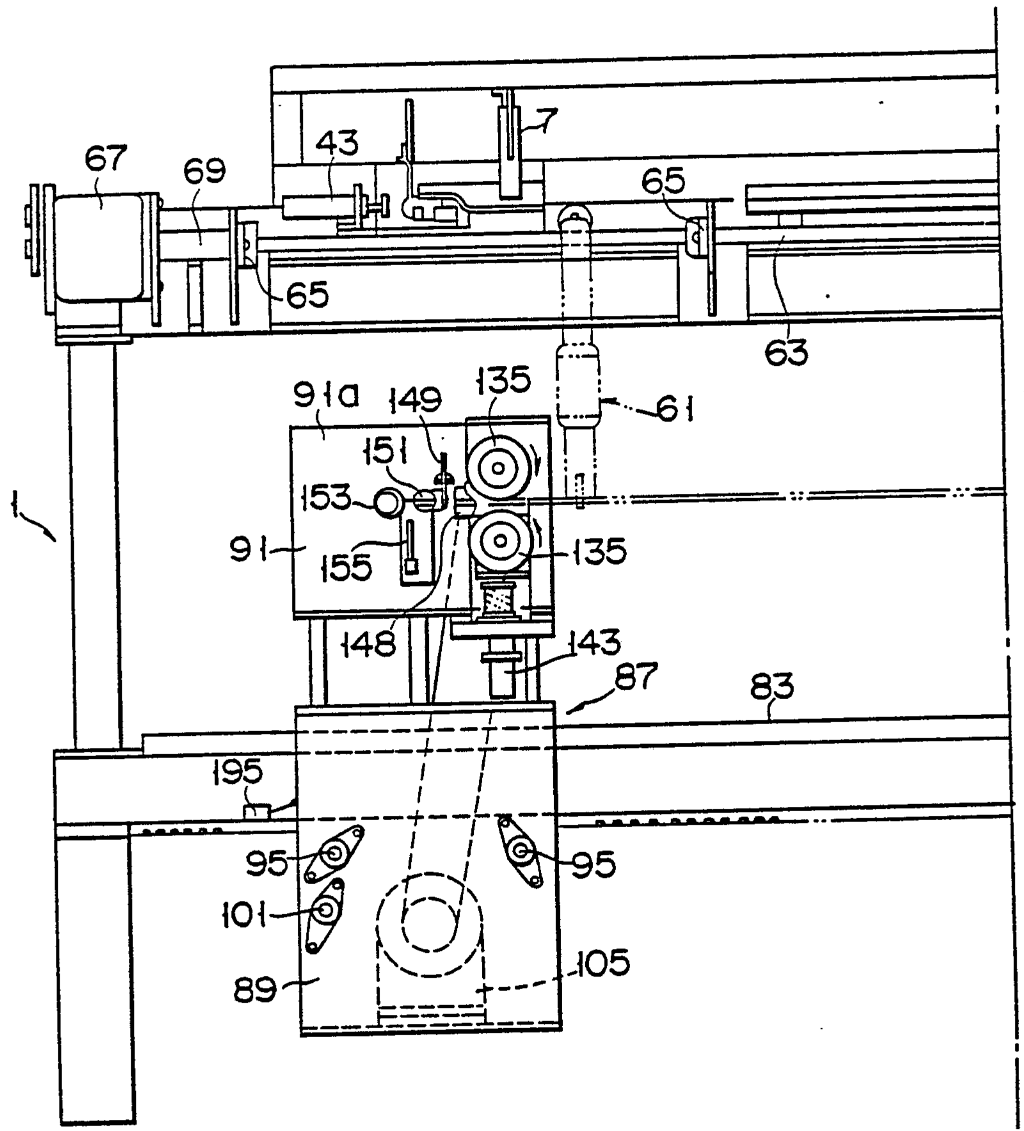

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FIG. 48B

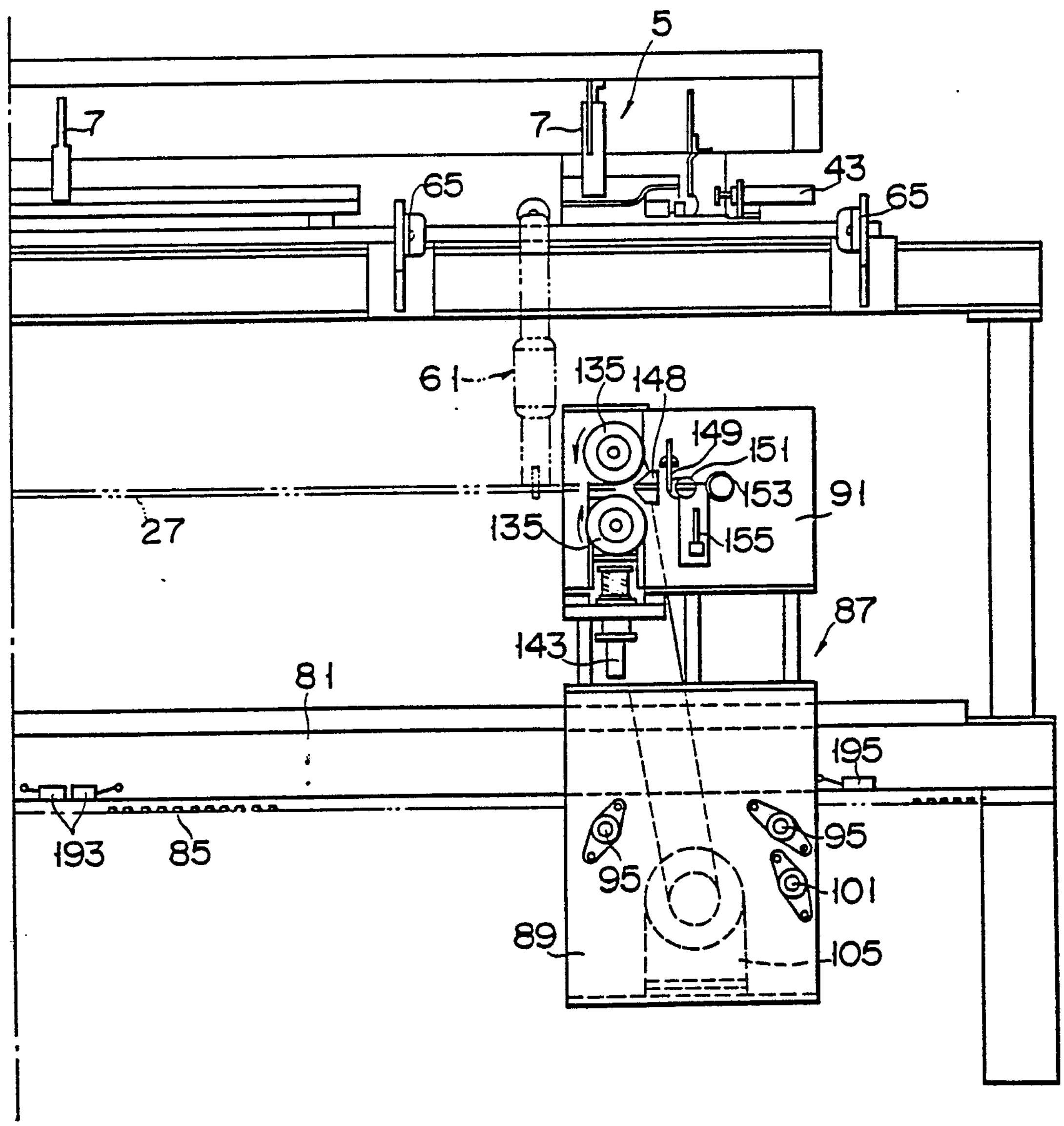
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FIG. 49

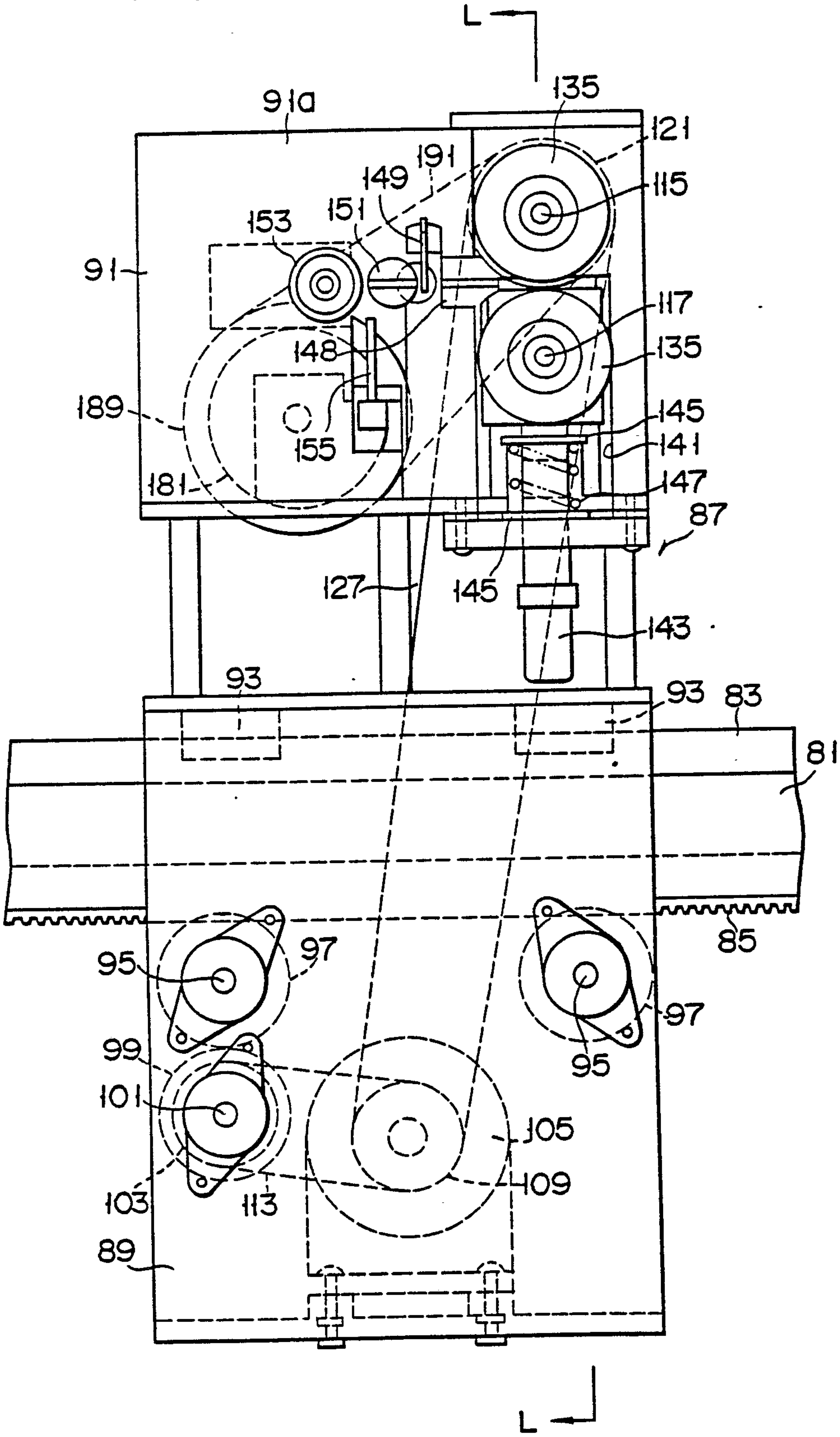
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FIG. 50

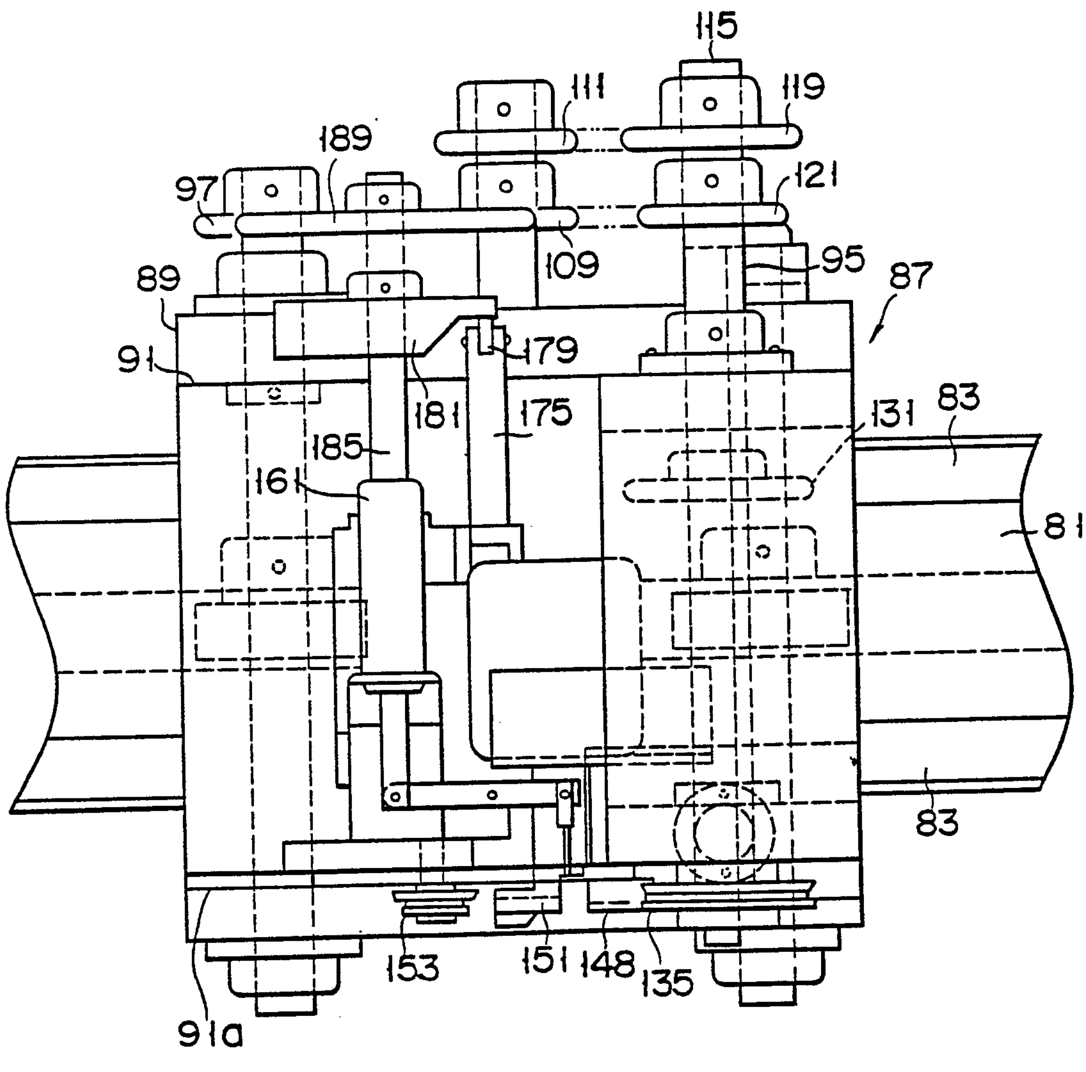
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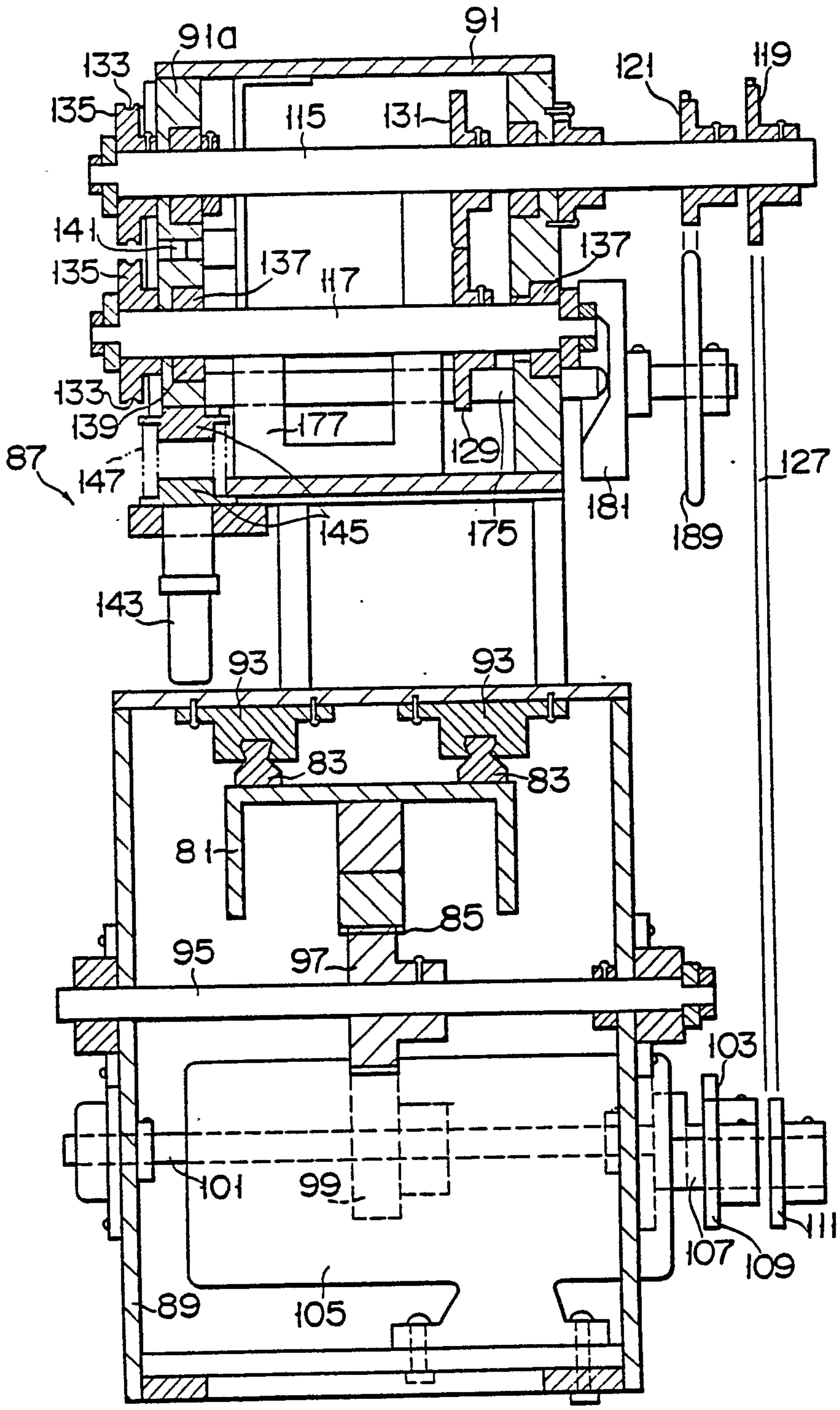
FIG. 51


91a
91
133
135
115
131
121
119
141
135
137
117
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133
139
177
129
87
147
145
175
181
189
127
143
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107
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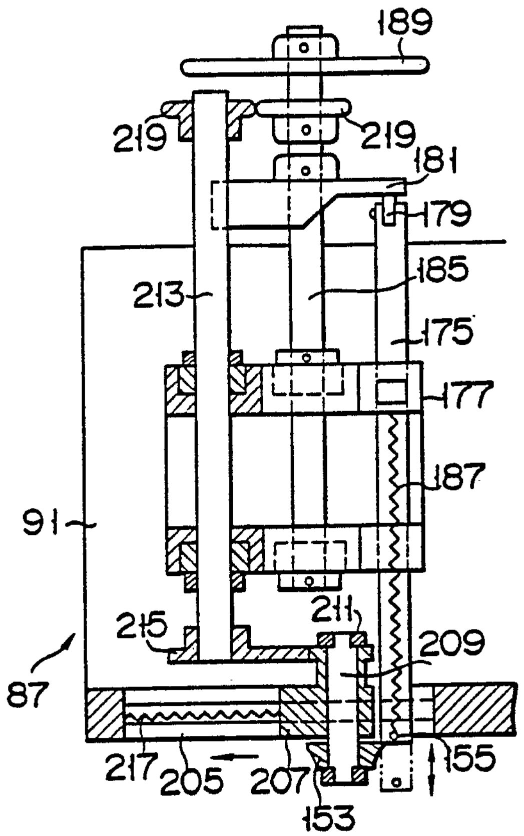
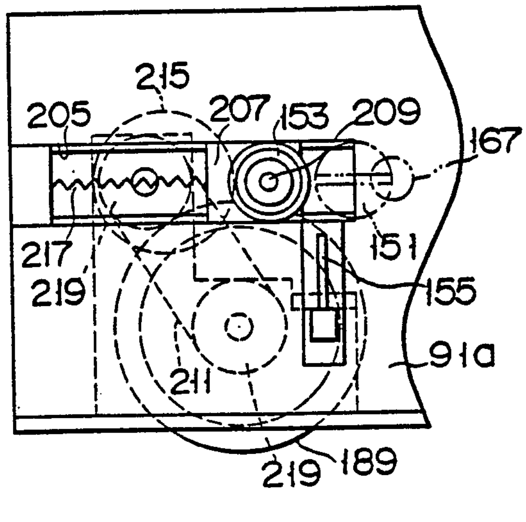
111
89
105

F I G. 52


189
219
219
181
179
213
185
175
177
187
91
215
211
209
87
217
205
207
153
155

F I G. 53


215
205
207
153
209
167
217
219
151
155
91a
211
219
189