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(54) Apparatus for manufacturing slide fasteners with flies.

(57) An apparatus automatically manufactures a succession of slide fasteners (22) with flies (14) from a continuous slide fastener chain (10) having a pair of intermeshed rows of coupling elements (12) with element-free spaces (13) therein and stringer tapes (11) supporting the rows of coupling elements (12), respectively, with the flies (14) sewn to one of the tapes (11). The apparatus includes a feed path (29) along which the chain (10) can be fed along, a fly folder (26) in the feed path (29) for folding one of the flies (14) on itself at a time, a slider applicator (27) in the feed path (29) for mounting one of the sliders (17) at a time on the rows of coupling elements (12), a feed roller assembly (32) for feeding the chain (10) along the feed path (29) in selective engagement with the intermeshed rows of coupling elements (12), a bottom stop applicator and chain cutter (28) in the feed path (29) for applying a bottom stop (21) to the rows of coupling elements (12) and cutting off the chain (10) across one of the element-free spaces (13) to produce a slide fastener (22) with a fly (14), and a discharge roller assembly (33) actuatable in synchronism with the feed roller assembly (32) for discharging the produced slide fastener (22) with the fly (14).

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FIG. 1

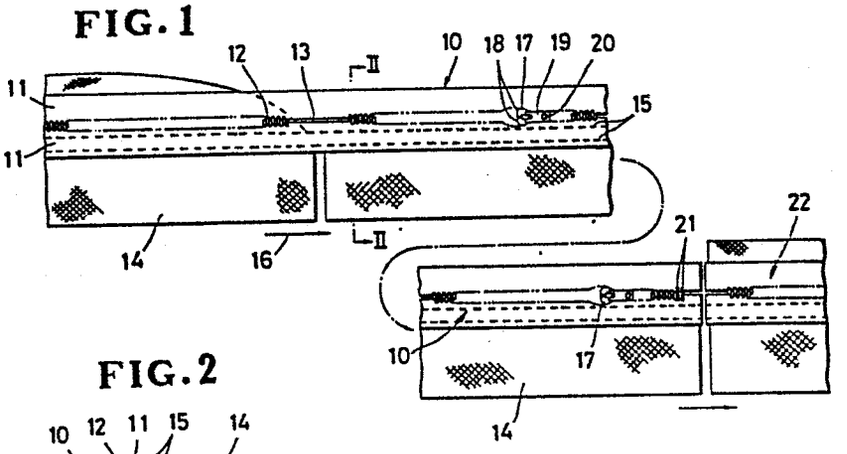
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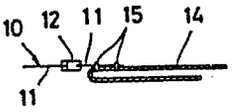
FIG. 2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APPARATUS FOR MANUFACTURING SLIDE FASTENERS WITH FLIES

Various apparatus have been put to use for automatically manufacturing slide fasteners successively. However, no apparatus has been proposed or employed in the art for automatically manufacturing slide fasteners with flies attached thereto.

It has been customary practice to use slide fasteners with flies stitched thereto in advance for increased efficiency when slide fasteners are to be attached to a closing at the front of men's trousers. The fly is sewn to one of stringer tapes longitudinally along a transversely substantially central line, the fly being wider than the slide fastener. At the time of sewing the slide fastener, the fly is folded on itself about the stitching and then sewn to the trousers. In the production of slide fasteners with flies, if a fly were to be attached to a finished slide fastener, then difficulty would arise in sewing the fly to the slide fastener on a sewing machine due to the

presence of a slider on the slide fastener. Therefore, it is more advantageous to sew flies to a slide fastener chain in advance, and then to process the slide fastener chain into individual finished slide fasteners. However, since flies have already been sewn to the slide fastener chain, the fly has to be folded on itself before a slider is mounted on the chain, and the folded fly presents an increased thickness on one side of the chain, which has prevented the chain from being accurately fed along. The folded fly attached to one of stringer tapes renders the tapes different in rigidity, making it less reliable to thread the tape edges through the slider. For accurately feeding the chain, it would be possible to drive the chain with a feed roller assembly engaging the row of coupling elements only. However, the slider would interfere with the feed roller assembly. For the reasons described above, only manually operated apparatus have been available in the past for manufacturing slide fasteners with flies.

The present invention seeks to provide an apparatus for automatically manufacturing a succession of slide fasteners with flies from a slide fastener chain with such flies sewn thereto in advance.

According to the present invention, there is provided an apparatus for automatically manufacturing a succession of slide fasteners with flies from a

continuous slide fastener chain having a pair of intermeshed rows of coupling elements with element-free spaces therein and stringer tapes supporting the rows of coupling elements, respectively, with the flies sewn to one of the tapes, comprising:

(a) a feed path along which the chain can be fed along;

(b) first means in said feed path for folding one of the flies on itself at a time;

(c) second means in said feed path for mounting one of the sliders at a time on the rows of coupling elements;

(c) a feed roller assembly for feeding the chain along said feed path in selective engagement with the intermeshed rows of coupling elements (12);

(d) third means in said feed path for applying a bottom stop to the rows of coupling elements and cutting off the chain across one of the element-free spaces to produce a slide fastener with a fly; and

(e) a discharge roller assembly actuatable in synchronism with said feed roller assembly for discharging the produced slide fastener with the fly.

Many other advantages and features of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which a preferred structural embodiment incorporating

the principles of the present invention is shown by way of illustrative example.

Figure 1 is a plan view showing the progressive process in which a slide fastener with a fly is manufactured;

Figure 2 is a cross-sectional view taken along line II - II of Figure 1;

Figure 3 is a side elevational view of an apparatus for manufacturing slide fasteners with flies;

Figure 4 is a fragmentary perspective view of the apparatus shown in Figure 3;

Figure 5 is a vertical cross-sectional view of a guide roller assembly;

Figure 6 is a front elevational view of a feed roller assembly;

Figure 7 is a horizontal cross-sectional view of the feed roller assembly and a discharge roller assembly;

Figure 8 is a vertical cross-sectional view of a chain splitter and a slider supply unit;

Figure 9 is a front elevational view of the chain splitter, taken along line IX - IX of Figure 8;

Figure 10 is a perspective view of a slide fastener chain as it runs below the chain splitter;

Figure 11 is a perspective view of the slide fastener chain as it is spread by the chain splitter;

Figure 12 is a perspective view of the slide

fastener chain on which a slider is mounted;

Figure 13 is a cross-sectional view taken along line XIII - XIII of Figure 12;

Figure 14 is a vertical cross-sectional view of the slider supply unit as it places a slider in an element-free space in a slide fastener chain;

Figure 15 is a view similar to Figure 14, illustrating the slider released from a slider holder;

Figure 16 is a fragmentary vertical cross-sectional view of a bottom stop applicator and a chain cutter;

Figure 17 is an enlarged fragmentary vertical cross-sectional view of the bottom stop applicator before it cuts off a bottom stop blank wire;

Figure 18 is an enlarged fragmentary vertical cross-sectional view of the bottom stop applicator after it has produced a bottom stop from the bottom stop blank wire;

Figure 19 is a side elevational view, partly in cross section, of a chain guide device in the apparatus shown in Figure 3;

Figure 20 is a side elevational view of a stopper as it stops a slide fastener chain;

Figure 21 is a side elevational view, partly in cross section, of the chain guide device;

Figure 22 is a perspective view of the chain guide device; and

Figure 23 is a fragmentary front elevational view of the discharge roller assembly as it discharges a slide fastener chain.

As shown in Figures 1 and 2, a slide fastener chain 10 is composed of a pair of continuous stringer tapes 11, 11 supporting intermeshed rows of discrete coupling elements 12 on confronting longitudinal edges thereof with an element-free space or gap 13 in the intermeshed rows of coupling elements 12. A fly 14 wider than the chain 10 is sewn to one of the stringer tapes 11 by two rows of sewing threads 15 along a transversely substantially central portion of the fly 14. The chain 10 with the stitched fly 14 is progressively processed as follows:

As the chain 10 travels in the direction of the arrow 16, the fly 14 is folded on itself about the sewing threads 15, as shown in Figure 2, thus exposing the intermeshed rows of coupling elements 12. A slider 17 is put in the element-free space 13 as the intermeshed rows of coupling elements 12 is threaded through the slider 17 from its open shoulders 18, 18. The slider 17 has a pull tab 19 with a through-hole 20 defined therein. Then, bottom stops 21 are applied to an end of the intermeshed rows of coupling elements 12, and the chain 10 is cut into a predetermined length, thereby completing a slide fastener 22 with the fly 14.

The slide fastener chain 10 with the fly 14 can

be processed into the slider fastener 22 with the fly 14 by an apparatus generally designated by the reference numeral 25 in Figures 3 and 4. The apparatus 25 essentially comprises a fly folder 26, a slider applicator 27, and a bottom stop applicator and chain cutter 28, which are arranged in the order named along a feed path 29 for the slide fastener chain 10 and mounted on a bed or base 30.

The feed path 29 is primarily defined by a guide roller assembly 31 in the fly folder 26, a feed roller assembly 32 disposed downstream of the slider applicator 27, and a discharge roller assembly 33 disposed downstream of the bottom stop applicator and chain cutter 28.

As illustrated in Figure 5, the guide roller assembly 31 is composed of a pair of upper and lower idling rollers 34, 35 for guiding the intermeshed rows of coupling elements 12 sandwiched therebetween. The upper roller 34 is rotatably mounted by a shaft 36 secured to a vertical support plate 37 mounted on the bed 30. The lower roller 35 is mounted on a shaft 38 extending through the vertical support plate 37 and supporting thereon a brake mechanism 39. The brake mechanism 39 includes a disk 40 keyed to the shaft 38 for rotation therewith, a brake drum 41 with a brake shoe 42 force-fitted thereover and fixedly mounted in an attachment plate 43 mounted on the vertical support

plate 37, and a clutch plate 44 axially movably attached to the brake drum 41 by pins 45. An electromagnet 46 is mounted in the vertical support plate 37 closely to the disk 40. In response to energization of the electromagnet 46, the clutch plate 44 can be pressed against the disk 40 to stop rotation of the guide roller assembly 31 for thereby interrupting the travel of the chain 10.

As the chain 10 is fed along through the guide roller assembly 31, the fly 14 starts being progressively folded by an inclined guide plate 47 before reaching the guide roller assembly 31 and is folded completely on itself after moving past the guide roller assembly 31, as illustrated in Figure 5.

As shown in Figures 3, 4, and 6, the feed roller assembly 32 comprises a pair of upper and lower rollers 48, 49 for feeding the intermeshed rows of coupling elements 12 therebetween. The upper roller 48 is rotatably mounted on a bracket 50 (Figure 4) which is movable vertically by a first fluid cylinder 23 to bring the upper roller 48 toward and away from the lower roller 49. The lower roller 49 is rotatably mounted by a shaft 51 in a bearing 52 mounted on a block 53. The shaft 51 supports on an end thereof a sprocket 54 which is driven via an endless chain 55 by a sprocket 56 mounted on an end of a shaft 57 of the discharge roller assembly 33. As shown in Figure 6,

the upper and lower rollers 48, 49 have toothed or otherwise roughened peripheral surfaces 58, 59, respectively, for engaging and driving the intermeshed rows of coupling elements 12.

As illustrated in Figure 7, a one-way clutch 60 is disposed between the shaft 51 and the lower roller 49 for rotating the lower roller 49 only in a direction to feed the intermeshed rows of coupling elements 12.

As shown in Figures 3 and 4, the discharge roller assembly 33 is composed of a pair of laterally spaced upper rollers 61, 61 and a lower roller 62 coacting with the upper rollers 61, 61 for discharging a completed slide fastener in sandwiching relation. Each of the upper rollers 61, 61 is rotatably mounted on one end of a lever 63 pivotably connected by a pin 64a to a bracket 64 mounted on a vertical mount plate 65. The other end of the lever 63 is pivotably connected to a piston rod of a second fluid cylinder 66 supported on the vertical mount plate 65. Thus, the levers 63, 63 are pivotably movable to bring the respective upper rollers 61, 61 into and out of engagement with the lower roller 62, in response to operation of the second fluid cylinder 66. The upper rollers 61, 61 are normally urged against the lower roller 62 by means of a pair of tension coil springs 63a, 63a acting between the respective levers 63, 63 and the vertical mount plate 65. The levers 63, 63 are

loosely connected to the piston rod of the cylinder 66 such that the levers 63, 63 are pivotally movable against the bias of the respective springs 63a, 63a when the chain 10 is passed between the uper and lower rollers 61, 62. As illustrated in Figure 7, the lower roller 62 is supported on the shaft 57 which is rotatably supported on the vertical mount plate 65 and driven to rotate by a motor 67 mounted in the bed 30 through a drive mechanism 68. The drive mechanism 68 includes a pulley 69 rotatably mounted on an end of the shaft 57 remote from the sprocket 56 and rotatable by a belt 70 trained around the pulley 69 and a pulley (not shown) coupled to the motor 67. A clutch plate 71 is axially movably mounted by a pin 72 on the pulley 69. A disk 73 supporting an electromagnet 74 is keyed to the shaft 57 in axialy confronting relation to the clutch plate 71. The lower roller 62 is axially interposed between a pair of set collars 75, 76 and resiliently pressed therebetween by a pair of springs 24 (one being shown) axially acting on the set collar 75. A pinion 77 is mounted by a one-way clutch 78 on the shaft 57 and held in mesh with a rack 80 which is vertically movable by a third fluid cylinder 81 (Figures 3 and 4).

As shown in Figures 3 and 4, the slider applicator 27 is composed of the feed path 29, a chain splitter 85, a slider supply unit 86, and a tape edge inserter 87.

The chain splitter 85 is mounted on the vertical mount plate 65 and inclined along the feed path 29 progressively downwardly in the direction in which the chain 10 is fed along. As illustrated in detail in Figures 8 and 9, the chain splitter 85 includes a chain guide 88 through which the feed path 29 extends, and an arm 89 vertically angularly movably mounted by a pivot pin 90 on the mount plate 65 above the chain guide 88. A pair of levers 91, 91 (Figure 10) is laterally swingably mounted by pivot pins 92, 92 on a forward end of the arm 89. The levers 91, 91 have a pair of downward fingers 93, 93 for normally contacting an upper surface of the intermeshed rows of coupling elements 12 under the resilient force of a spring 94 acting between the arm 89 and the chain guide 88. Therefore, when any one of the element-free spaces 13 between adjacent lengths of coupling elements 12 reaches the fingers 93, 93, the fingers 93, 93 are displaced downwardly into the element-free space 13 under the force of the spring 94. The fingers 93, 93 will then be lifted out of the space 13 by a fourth cylinder 95 which depresses a rear end of the arm 89 against the resiliency of the spring 94. The fingers 93, 93 are normally urged toward each other by a tension spring 93a connected at opposite ends to the respective levers 91, 91, as shown in Figure 10. Another lever 96 is vertically pivotably mounted by a

pivot pin 97 on a bracket 65a secured to the mount plate 65, the lever 96 being positioned above the arm 89. The lever 96 has a front wedge 98 directed downwardly between the fingers 93, 93. The lever 96 is operatively coupled by a pin 100 to a bracket 65b fixed to a piston rod of a fifth fluid cylinder 99, which will be actuated to move the wedge 98 into a lower position between the fingers 93, 93 or into an upper position above the fingers 93, 93.

When the fingers 93, 93 arrive at one of the element-free spaces 13, the fingers 93, 93 project downwardly into the space 13. At this time, the chain 10 is stopped in its travel in response to such downward movement of the fingers 93, 93, as detected by an arrangement shown in Figure 9. More specifically, a detector plate 101 is positioned laterally of the rear end of the arm 89 for substantially horizontal movement about a pin 102, the detector plate 101 being normally urged by a spring 103 to move toward the arm 89. The detector plate 101 has a shoulder or step 104 facing upwardly and disposed adjacent to the arm 89 and an inclined cam surface 105 progressively projecting laterally in an overhanging relation to the lever 96. A detector rod 106 extends from the detector plate 101 away from the cam surface 105 and has an end normally engaging a sensor 107. When the fingers 93, 93 are moved downwardly into the space 13, the rear end of the

arm 89 is raised until it clears the shoulder 104, whereupon the detector plate 101 is turned to the right (Figure 9). The detector rod 106 now disengages from the sensor 107, which produces an electric signal indicative of the depression of the fingers 93, 93 into the space 13. Thereafter, the wedge 98 is lowered to spread the fingers 93, 93 against the bias of the tension spring 93a (Figure 11) for thereby splitting the intermeshed rows of coupling elements 12 into disengaged rows from the trailing end of the space 13.

When the movement of the chain 10 is interrupted, the brake mechanism 39 for the guide roller assembly 31 is actuated to lock the chain 10 which is now kept taut between the guide roller assembly 31 and the discharge roller assembly 33 so that a slider can smoothly be placed onto the rows of coupling elements 12.

The slider supply unit 86 is disposed below the downstream end of the chain splitter 85 and angularly movably supported on a horizontal shaft 108 mounted on a post 109 vertically disposed on the bed 30. As shown in Figure 8, a slider holder 110 is securely fitted over the shaft 108, and a clip 111 is rotatably mounted on the shaft 108 for holding the pull tab 19 of a slider 17 against the slider holder 110, the clip 111 having a through-hole 112. A lever 114 angularly movably mounted by a pin 115 on the slider holder 110

has a locking prong 113 for engaging in the hole 20 in the pull tab 19 through the hole 112 in the clip 111. The locking prong 113 is forced into the hole 20 in the pull tab 19 by a sixth fluid cylinder 116 having a piston rod 117 acting on the lever 114 through a steel ball 118. The locking prong 113 is normally urged to move in a direction out of the pull tab hole 20 under the resiliency of a tension spring 119 acting between the slider holder 110 and the lever 114.

Sliders 17 are successively delivered from a chute 82 (Figure 3) to the slider holder 110. The shaft 108 is angularly moved back and forth through about 90 degrees to move the slider holder 110 between substantially horizontal and vertical positions, the angular movement of the shaft 108 being effected by a pinion (not shown) fixed to the shaft 108 and meshing with a rack (not shown) actuatable by a fluid cylinder (not shown). The slider holder 110 receives one slider 17 at a time from the chute 82 with the shoulders 18 of the slider 17 directed upwardly as shown in Figure 10 when the slider holder 110 is in the horizontal position (Figure 8). When the slider holder 110 is turned into the vertical position to position the slider 17 in the element-free space 13 as it is spread by the fingers 93 as illustrated in Figure 11, the shoulders 18 of the slider 17 are oriented toward the leading end of following intermeshed rows of coupling

elements 12, with the pull tab 19 depending downwardly, and the slider 17 is angularly positioned in parallel to the chain 10.

The tape edge inserter 87 is disposed above the feed path 29 between the chain splitter 85 and the feed roller assembly 32, as shown in Figure 3. The tape edge inserter 87 comprises a substantially horizontal rod 121 secured to a piston rod 129 (Figure 12) of a seventh fluid cylinder 120 mounted on the mount plate 65. The horizontal rod 121 extends substantially perpendicularly to the feed path 29, and is movable downwardly by the seventh fluid cylinder 120 for depressing engagement with the chain 10 (Figure 13).

The bottom stop applicator and chain cutter 28 generally comprises, as shown in Figure 16, a casing 122 mounted on the mount plate 65, and a punch 123 and a cutter 124 vertically movably disposed in the casing 122 and drivable by an eighth fluid cylinder 125 mounted on the mount plate 65. The punch 123 is positioned in another cutter 126 having cutter blades 127 one of which cuts off, upon depression, a bottom stop blank wire 147 supplied horizontally below the punch 123, as shown in Figure 17. A blank wire length as severed by the cutter blade 127 is formed into a bottom stop 21 by coaction of the lowering punch 123 and a wire bender 128 located therebelow, as shown in Figure 18. The formed bottom stop 21 is then applied

to the leading end of the intermeshed rows of coupling elements 12 by the punch 123 which is continuously depressed, while at the same time the chain 10 is transversely cut off across the element-free space 13 adjacent to the leading end of the intermeshed rows of coupling elements 12.

As shown in Figures 3, 4, 19, and 20, a vertical stop bar 130 is angularly movably mounted on an end of a lever 131 pivotably mounted by a pin 132 on the mount plate 65. The stop bar 130 has an upper end normally slidably held against a lower surface of the intermeshed rows of coupling elements 12, and a lower end normally engaging a sensor 133. When an element-free space 13 in the chain 10 reaches the upper end of the stop bar 130, the stop bar 130 is moved upwardly under the bias of a spring 144 acting on the lever 131 for projection into the space 13. The upper end of the stop bar 130 is slightly displaced downstream due to the movement of the chain 10, whereupon the lower end of the stop bar 130 disengages from the sensor 133 which issues a signal to de-energize the motor 67. A ninth fluid cylinder 145 is mounted on the mount plate 65 for acting on the lever 131 to lower the stop bar 130 out of the space 13 when the chain 10 is to be fed along again. The lever 131 has an adjustment bolt 146 for adjusting the interval which the stop bar 130 is vertically movable.

As illustrated in Figures 19, 21, and 22, there is a substantially U-shaped element guide 138 pivotably mounted on a shaft 136 and including front and rear guide legs 137, 135 disposed forward and rearward, respectively, of the feed roller assembly 32. The front and rear guide legs 137, 135 have guide grooves 143, 134, respectively, opening downwardly and aligned with the feed path 29. The element guide 138 is normally urged to turn clockwise (Figures 19 and 21) about the shaft 136 under the bias of a spring 139 acting on a rear end of the element guide 138. The bracket 50 on which the upper feed roller 48 is rotatably mounted has a vertical bolt 140 vertically aligned with the rear guide leg 135 for depressing the rear guide leg 135 when the upper feed roller 48 is lowered. When the upper feed roller 48 is raised by the first fluid cylinder 23 (Figure 3), the element guide 138 is turned clockwise under the resiliency of the spring 139 to cause the rear guide leg 135 to be lifted and the front guide leg 137 to be lowered. The bracket 53 on which the lower feed roller 49 is rotatably mounted has an upper element guide base 142 with an upwardly opening guide groove 141 aligned with the feed path 29. When the front guide leg 137 of the element guide 138 is lowered, the guide groove 143 in the front guide leg 137 and the guide groove 141 in the element guide base 142 jointly define a guide slot

(Figure 21) for guiding the intermeshed rows of coupling elements 12 therethrough.

As shown in Figure 23, the lower discharge roller 62 has a pair of axially spaced roller portions 62a, 62b of equal diameters which are vertically aligned with the upper rollers 61, 61, respectively. Since the levers 63, 63 are connected pivotably and loosely connected to the piston rod of the cylinder 66, the upper rollers 61, 61 are vertically movably away from the respective roller portions 62a, 62b of the lower roller 62 so as to define a gap 83 between one of the upper rollers 61 and the lower portion 62b which is greater than a gap 84 between the other upper roller 61 and the lower portion 62a. The wider gap 83 allows the folded fly 14 of the slider fastener 22 to smoothly pass between the upper roller 61 and the lower roller portions 62b.

Operation of the apparatus thus constructed is as follows: The slide fastener chain 10 with the fly 14 stitched thereto is fed along the feed path 29 first into the fly folder 26 in which the fly 14 is folded on itself by the guide plate 47 while the chain 10 is guided by the guide roller assembly 31, as shown in Figure 5. The chain 10 is driven through the chain splitter 85 by the feed roller assembly 32 with the fingers 93, 93 contacting the upper surface of the intermeshed rows of coupling elements 12, as shown in

Figure 10. At this time, a slider 17 is mounted on the slider holder 110 angularly positioned as shown in Figure 8, with the open shoulders 18 opening upwardly. The slider 17 is securely retained in place by the locking prong 113 engaging in the pull tab hole 20. As an element-free space 13 reaches the fingers 93, 93, the fingers 93, 93 project downwardly into the space 13. Upon continued travel of the chain 10, the fingers 93, 93 abut against the leading end of a successive length of coupling elements 12, whereupon the clutch disk 73 is disengaged from the clutch plate 71 to stop movement of the chain 10 and the brake mechanism 39 is actuated in response to a signal from the sensor 107, to keep the chain 10 under tension. Then the fifth cylinder 99 is actuated to retract its piston rod, whereupon the wedge 98 is lowered to spread the fingers 93, 93 apart to open the space 13 and split open the leading end of the rows of coupling elements 12, as shown in Figure 11. The slider supply unit 86 is turned counterclockwise to position the slider 17 in the space 13. Retracting movement of the piston rod of the cylinder 99 causes the rear end of the lever 96 to engage the cam surface 105 and to urge the detector plate 101 to rotate against the bias of the spring 103 until the detector rod 106 engages the sensor 107, as shown in Figure 9. Then the fourth cylinder 95 is actuated to extend its piston rod, whereupon the arm 89

is rotated countercloskwise (Figure 8) about the pin 90 against the bias of the spring 94 to thereby move the fingers 93, 93 upwardly away from the element-free space 13. The confronting inner edges of the stringer tapes 11, 11 are now inserted into the slider 17 through side slots therein. To enable the tape edges to be reliably inserted into the slider 17, the rod 121 of the tape edge inserter 87 is lowered to depress the chain 10 so that the tape edges which may have engaged an upper slider surface will enter the slider 17, as illustrated in Figures 12 and 13. During this time, the upper feed roller 48 is lowered to sandwich the chain 10 between the upper and lower feed rollers 48, 49, and the upper and lower discharge rollers 61, 62 sandwich the chain 10 therebetween. Because the rear guide leg 135 of the element guide 138 is lowered, the rows of coupling elements 12 are smoothly guided by the guide groove 134, as shown in Figure 19.

The rack 80 (Figure 7) is then actuated by the third fluid cylinder 81 to turn the lower discharge roller 62 through a certain angular interval against the braking force effected by the brake mechanism 39. The lower feed roller 49 is also turned by the chain 55 in synchronism with the lower discharge roller 62. The chain 10 is advanced slightly to cause the rows of coupling elements 12 to enter the slider 17 through the open shoulders 18, 18, respectively, whereupon the

slider 17 is placed on the rows of coupling elements 12.

Then, the brake mechanism 39 is inactivated, and the sixth fluid actuator 116 is inactivated to move the locking prong 113 away from the slider holder 110 for thereby releasing the slider 17, as shown in Figure 15. The upper feed roller 48 is raised by the first fluid cylinder 23, and the clutch disk 73 is engaged with the clutch plate 71 with the result that the lower discharge roller 62 is driven by the motor 32 through the drive mechanism 68 (Figure 7) to feed the chain 10 with the slider 17 mounted thereon. When the leading end of the rows of coupling elements 12 is engaged by the stop bar 130, the lower discharge roller 62 is stopped. At this time, the slider 17 on the chain 10 has moved past the rear guide leg 135 which has been lifted. Since the front guide leg 137 is lowered, the rows of coupling elements 12 are smoothly guided by the joined guide grooves 143, 141. Then, a bottom stop is applied and the chain 10 is cut off by the bottom stop applicator and chain cutter 28 in response to actuation of the eighth fluid cylinder 125. The upper feed and discharge rollers 48, 61 are now lowered. A severed slide fastener is then discharged by the discharge roller assembly 33. The chain 10 is also fed along by the feed roller assembly 32, during which time the front guide leg 137 is in the upper position allowing

the slider 17 to go toward the discharge roller assembly 33.

During operation of the apparatus, the feed roller assembly 32 engages and drives the rows of coupling elements 12 so that the chain 10 can be fed along reliably regardless of the fly 14 sewn to one of the tapes 11. Since the chain 10 is kept under tension by the brake mechanism 39 when the slider 17 is to be mounted, the tape edges as they are kept taut are depressed by the rod 121 and reliably brought into the slider 17. The element guide 138 can accurately guide the rows of coupling elements 12 at all times alternately with the guide legs 135, 137 while allowing the slider 17 to pass therethrough. The discharge roller assembly 33 can discharge the completed slide fastener 22 reliably without causing any jam since the fly 14 can smoothly move through the wider gap 83 between the upper roller 61 and the lower roller portion 62b.

CLAIMS:

1. An apparatus for automatically manufacturing a succession of slide fasteners (22) with flies (14) from a continuous slide fastener chain (10) having a pair of intermeshed rows of coupling elements (12) with element-free spaces (13) therein and stringer tapes (11) supporting the rows of coupling elements (12), respectively, with the flies (14) sewn to one of the tapes (11), comprising:

(a) a feed path (29) along which the chain (10) can be fed along;

(b) first means (26) in said feed path (29) for folding one of the flies (14) on itself at a time;

(c) second means (27) in said feed path (29) for mounting one of the sliders (17) at a time on the rows of coupling elements (12);

(c) a feed roller assembly (32) for feeding the chain (10) along said feed path (29) in selective engagement with the intermeshed rows of coupling elements (12);

(d) third means (28) in said feed path (29) for applying a bottom stop (21) to the rows of coupling elements (12) and cutting off the chain (10) across one of the element-free spaces (13) to produce a slide fastener (22) with a fly (14); and

(e) a discharge roller assembly (33) actuatable in synchronism with said feed roller assembly (32) for

discharging the produced slide fastener (22) with the fly (14).

2. An apparatus according to claim 1, said second means (27) comprising a chain splitter (85) for spreading the element-free space (13) and splitting a leading end of the rows of coupling elements (12), and a slider supply unit (86) angularly movable between a first position in which it receives a slider (17) and a second position for placing the slider (17) in the spread element-free space (13).

3. An apparatus according to claim 2, said chain splitter (85) comprising an angularly movable arm (89), a pair of laterally spreadable levers (91, 91) having a pair of fingers (93, 93), respectively, a spring (94) acting on said arm (89) for normally urging said fingers (93, 93) to contact said rows of coupling elements (12), and a pivotable lever (96) having a wedge (98) movable between said fingers (93, 93) to spread the fingers (93, 93) when said fingers (93, 93) project into the element-free space (13).

4. An apparatus according to claim 3, said first means (26) including a guide roller assembly (31) for guiding the rows of coupling elements (12) to travel along said feed path (29), a guide plate (47) for folding over said fly (14) on itself, and a brake mechanism (39) for braking said guide roller assembly (31) to keep said chain (10) under tension across said

second means (27) in response to projection of said fingers (93, 93) into said element-free space (13).

5. An apparatus according to claim 4, said guide roller assembly (31) comprising a pair of idler rollers (34, 35) for sandwiching said rows of coupling elements (12), said brake mechanism (39) being operatively coupled with one (35) of said idler rollers.

6. An apparatus according to claim 4, said chain splitter (85) including a detector plate (101) engaging said arm (89) and movable in response to movement of said arm (89) caused by projection of said fingers (93, 93) into said element-free space (13), and a sensor (107) energizable in response to movement of said detector plate (101) for issuing a signal to actuate said brake mechanism (39).

7. An apparatus according to claim 2, said second means (27) including a tape edge inserter (87) disposed adjacent to said chain splitter (85) and said slider supply unit (86) for depressing said stringer tapes (11) to insert confronting edges thereof into said slider (17) as placed in said element-free space (13) by said slider supply unit (86).

8. An apparatus according to claim 7, said tape edge inserter (87) comprising a fluid cylinder (120) and a rod (121) extending across said feed path (29) and actuatable by said fluid cylinder (120) for engaging and depressing said stringer tapes (11).

9. An apparatus according to claim 1, said feed roller assembly (32) comprising a pair of feed rollers (48, 49) for sandwiching said rows of coupling elements (12) therebetween, and a fluid cylinder (23) selectively actuatable for moving one (48) of said feed rollers toward and away from the other feed roller (49).

10. An apparatus according to claim 9, said feed rollers (48, 49) having roughened peripheral surfaces (58, 59), respectively, confronting each other for engaging said rows of coupling elements (12).

11. An apparatus according to claim 9, said discharge roller assembly (33) comprising a pair of discharge rollers (61, 62) for sandwiching said chain (10) therebetween, a fluid cylinder (66) selectively actuatable for moving one (61) of said discharge rollers toward and away from the other feed roller (62), a motor (67) for rotating said other roller (62), and a mechanism by which said other feed roller (49) and said other discharge roller (62) are operatively coupled for synchronous rotation.

12. An apparatus according to claim 11, said mechanism including a first sprocket (54) mounted on a shaft (51) of said other feed roller (49), a second sprocket (56) mounted on a shaft (57) of said other discharge roller (62), and an endless chain (55) trained around said first and second sprockets (54,

56).

13. An apparatus according to claim 2, said discharge roller assembly (33) comprising a motor (32), a first driven discharge roller (62) rotatable by said motor (32), and a pair of second idling discharge rollers (61) coacting with said first driven discharge roller (62) for discharging the produced slide fastener (22), further including means for turning said driven discharge roller (62) for an angular interval to move said leading end of the rows of coupling elements (12) into and through said slider (17) as positioned in said element-free space (13) while said motor (32) is being de-energized.

14. An apparatus according to claim 13, said turning means including a fluid cylinder (81), a rack (80) movable by said fluid cylinder (81), and a pinion (77) mounted on a shaft of said driven discharge roller (62) and meshing with said rack (80).

15. An apparatus according to claim 1, including means operatively coupled with said feed roller assembly (32) for guiding the rows of coupling elements (12) along said feed path (29) across said feed roller assembly (32).

16. An apparatus according to claim 15, said feed roller assembly (32) comprising a driven roller (49) rotatable in synchronism with said discharge roller assembly (33), a fluid cylinder (23), and an

idling roller (48) coacting with said driven roller (49) for feeding the chain (10) along said feed path (29), said idling roller (48) being movable by said fluid cylinder (23) toward and away from said driven roller (49), said guiding means comprising an angularly movable element guide (138) having guide legs (135, 137) disposed upstream and downstream of said feed roller assembly (32) in said feed path (29).

17. An apparatus according to claim 16, said guide legs (135, 137) having guide grooves (134, 143), respectively, aligned with said feed path (29), including a spring (139) acting on said element guide (138) for normally urging said element guide (138) into an angular position to cause one (143) of said guide legs to guide said rows of coupling elements (12) in the guide groove (143) therein while allowing the mounted slider (17) to move past the other guide leg (135).

18. An apparatus according to claim 17, said idling roller (48) having a member (140) engagable with said element guide (138) when said idling roller (48) is displaced toward said driven roller (49), for angularly moving said element guide (138) against the resiliency of said spring (139) to cause the other guide leg (135) to guide the rows of coupling elements (12) through the guide groove (134) therein while allowing the mounted slider (17) to move past said one

guide leg (137).

19. An apparatus according to claim 17, including a guide base (142) disposed below said element guide (138) and having a guide groove (141), said guide groove (143) in said one guide leg (137) and said guide groove (142) in said guide base (142) jointly defining a guide slot alinged with said feed path (29) for guiding the rows of coupling elements (12) therethrough when said element guide (138) is in said angular position.

FIG. 1

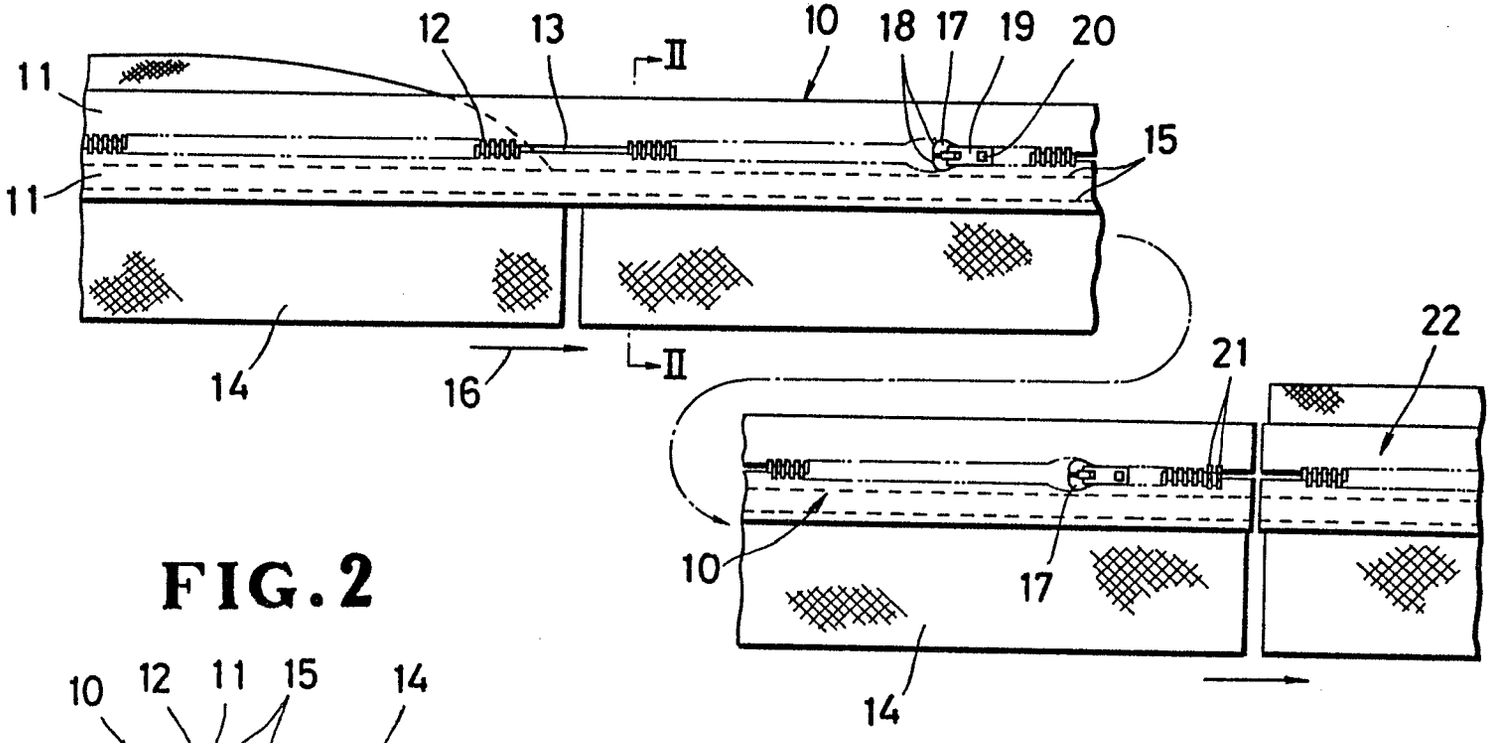
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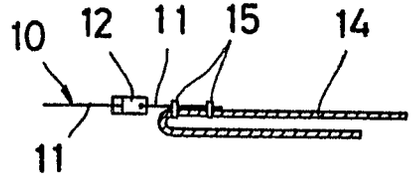
FIG. 2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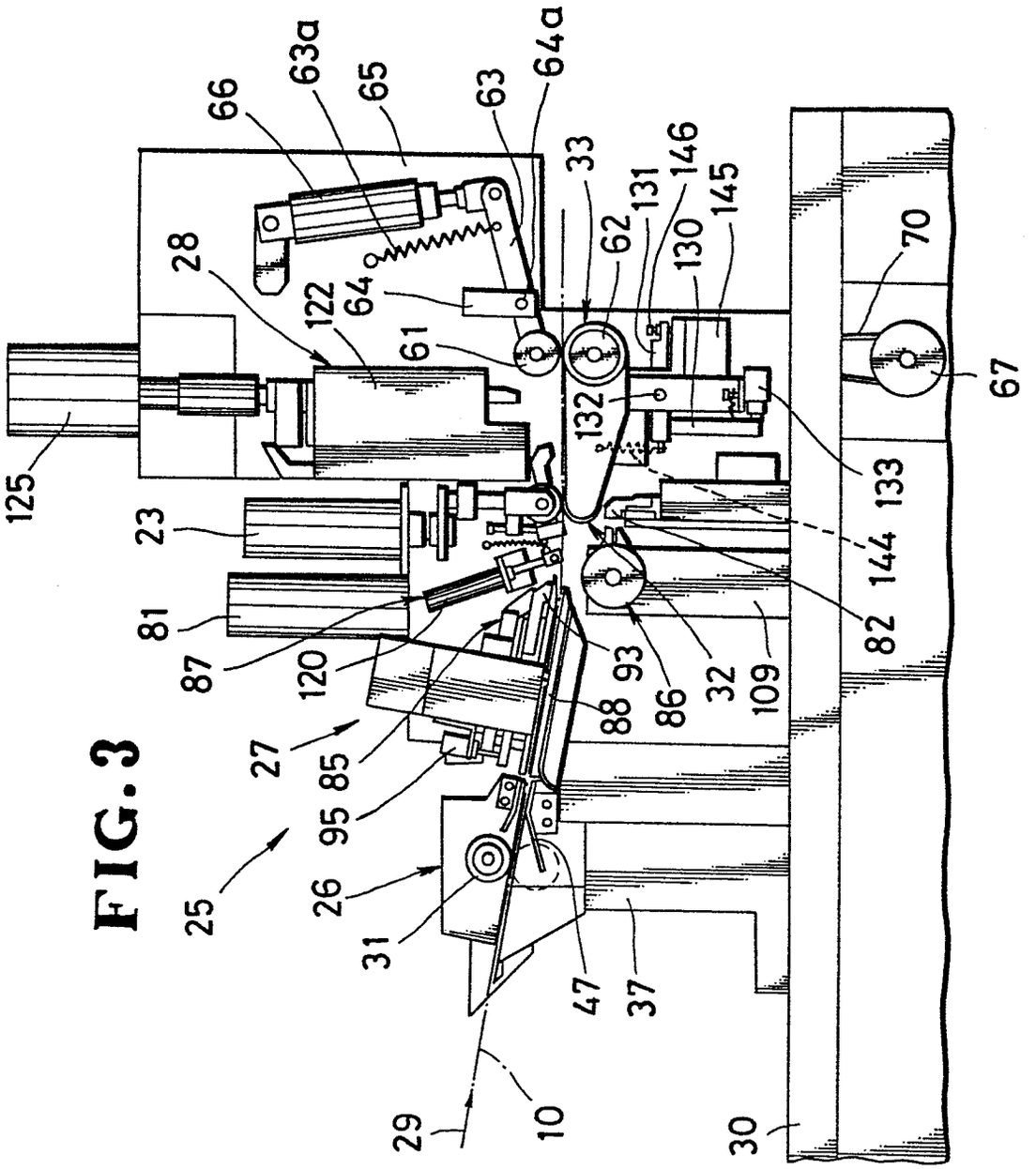
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FIG. 3

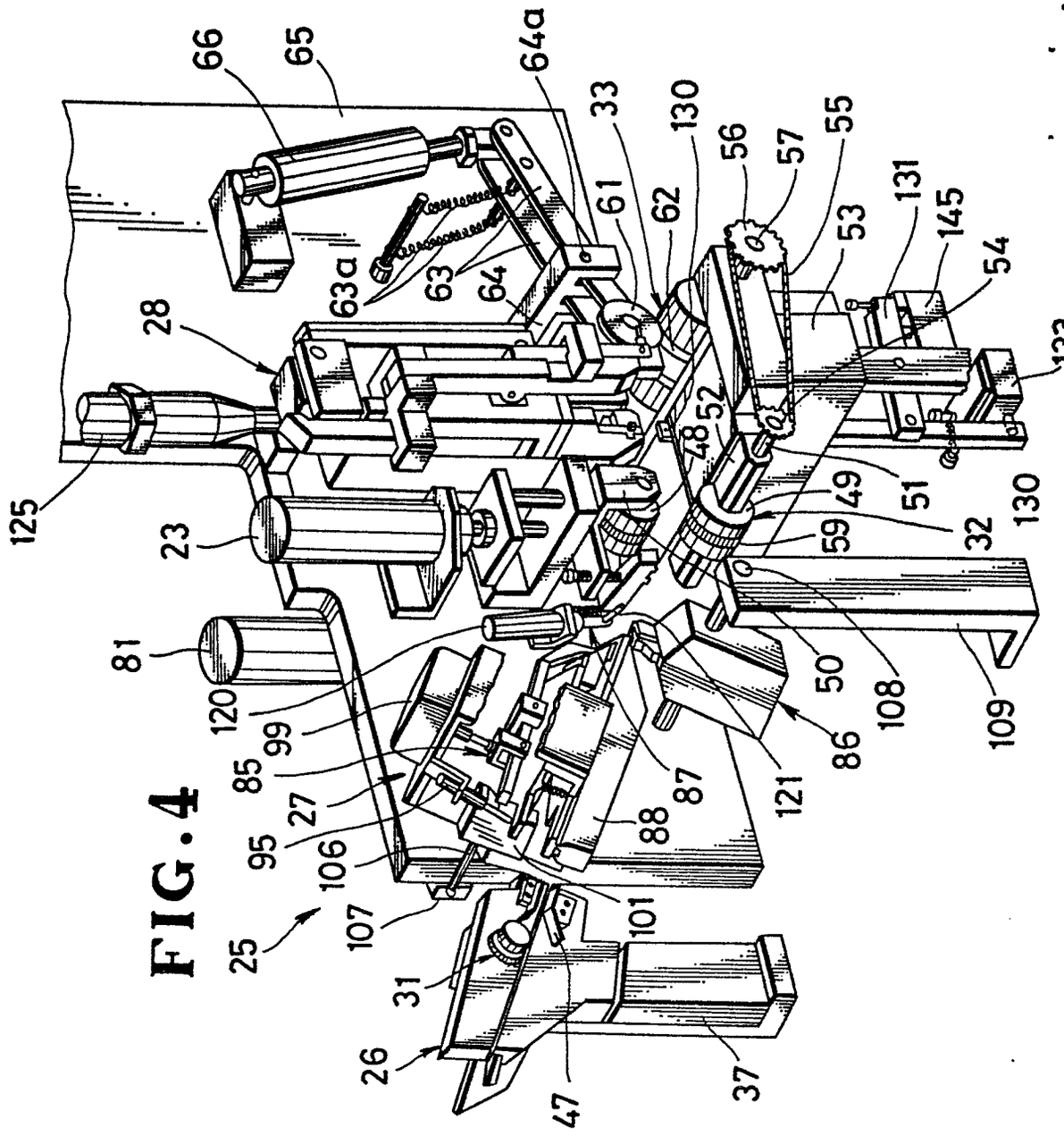
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FIG. 4

FIG. 5

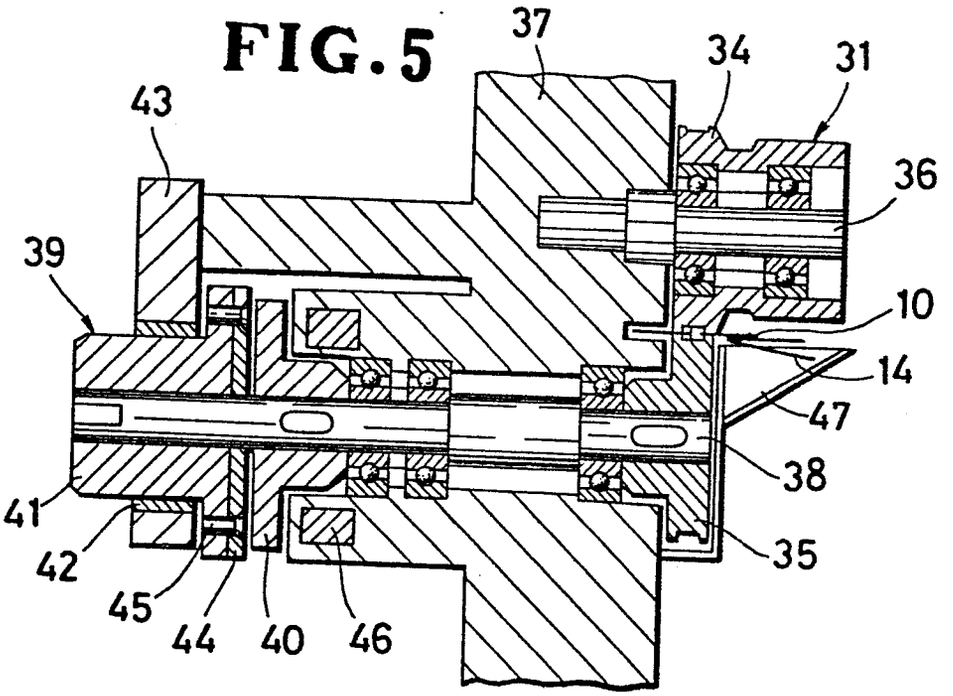
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FIG. 6

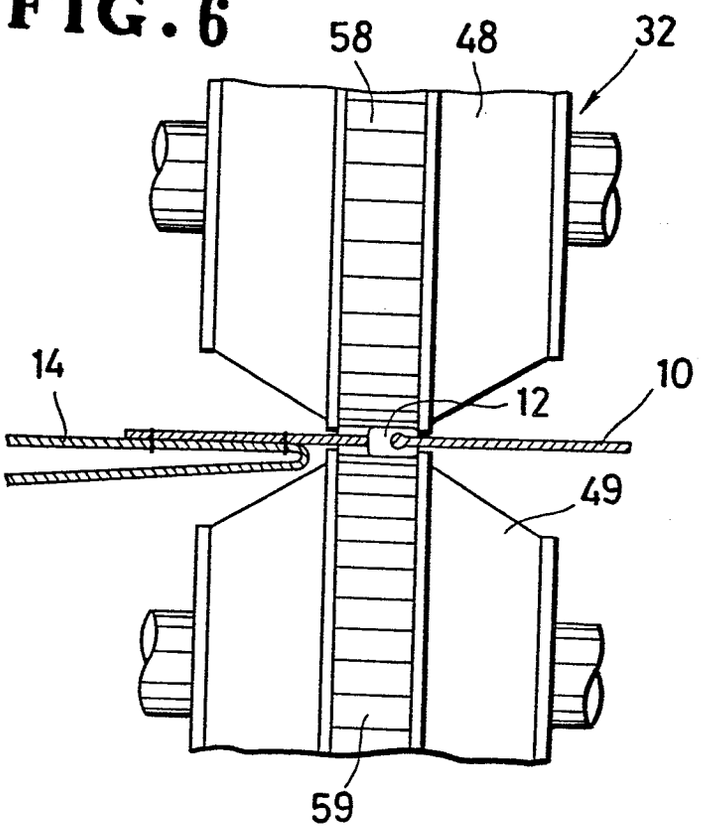
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FIG. 7

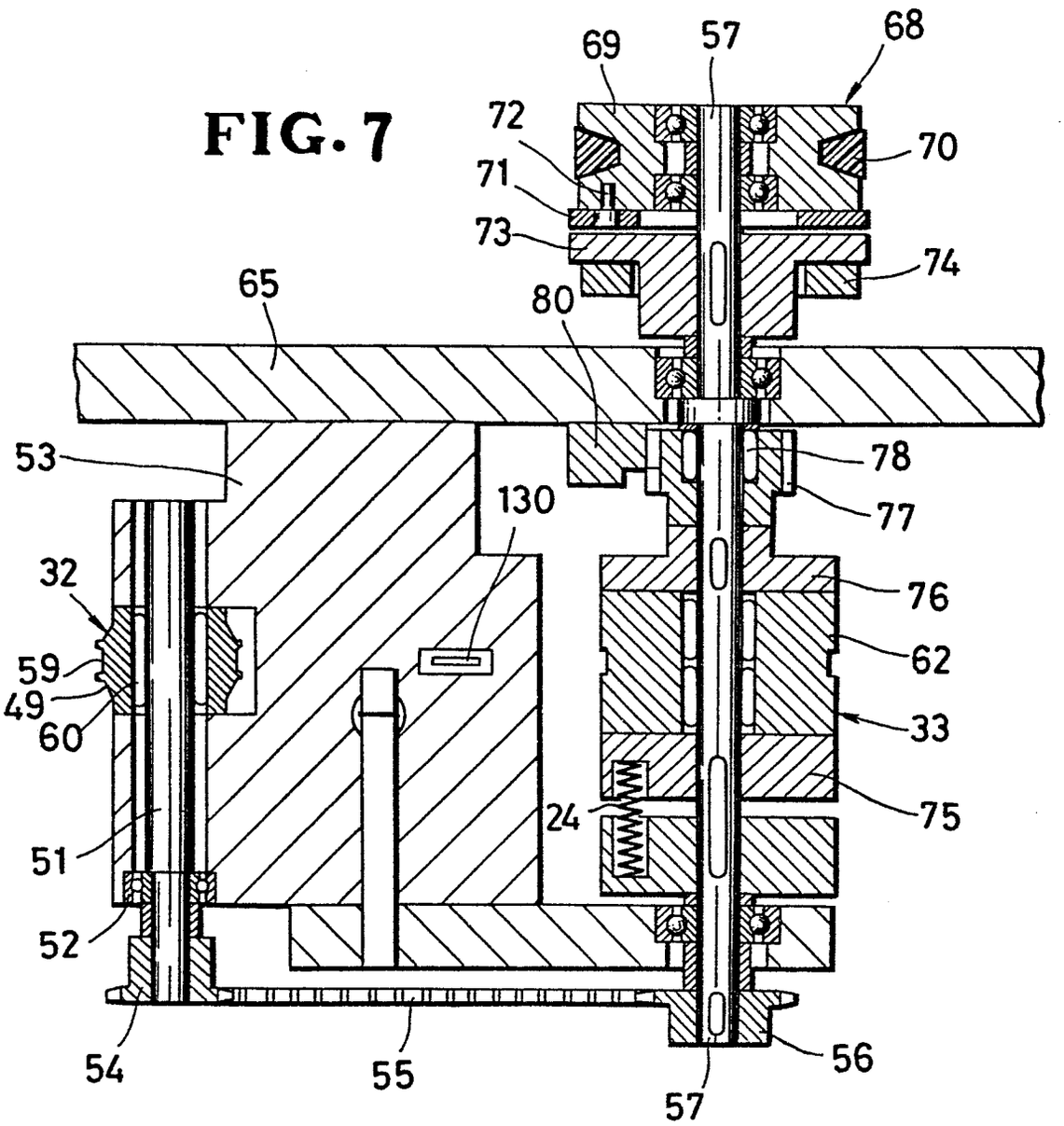
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FIG. 8

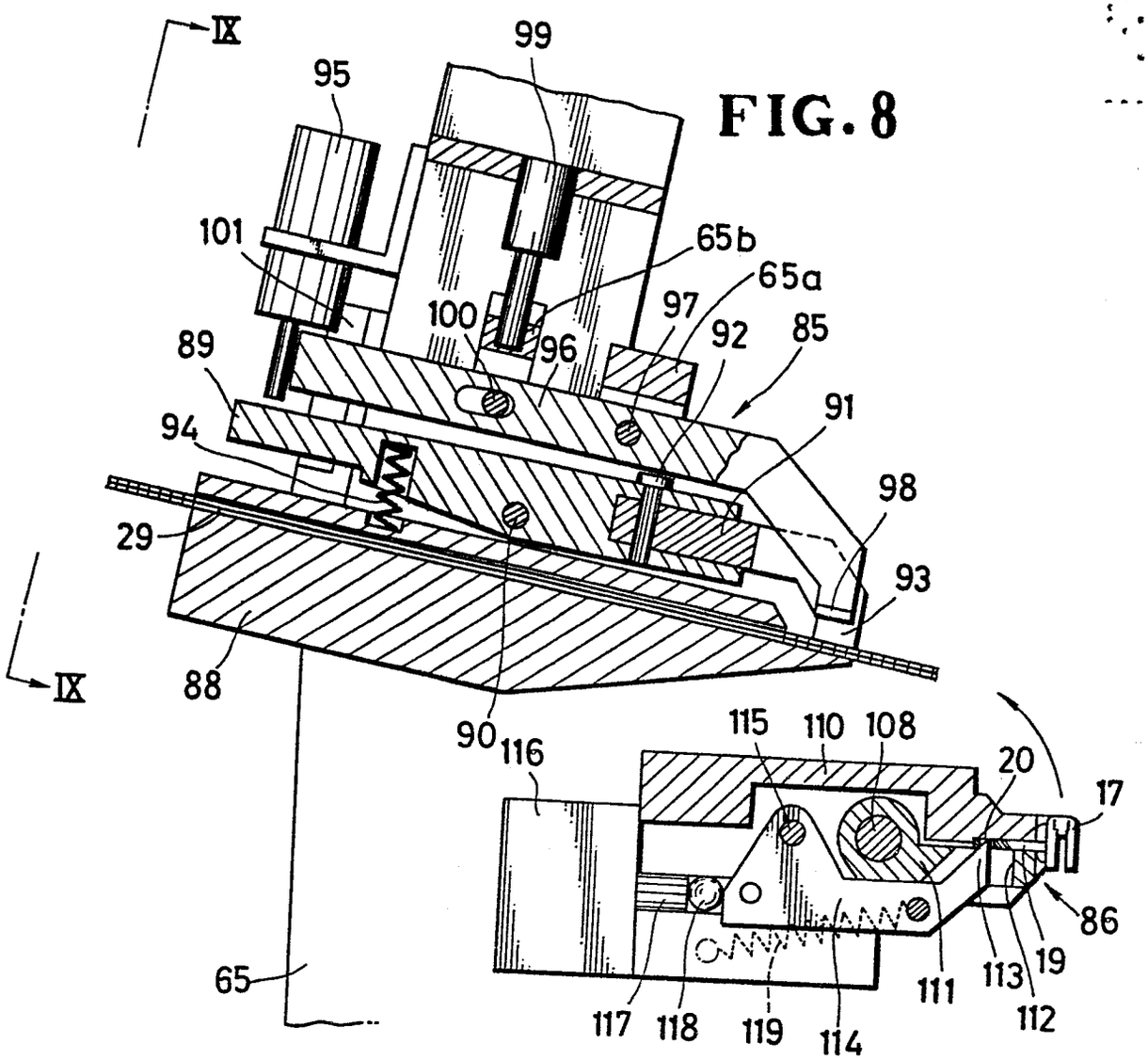
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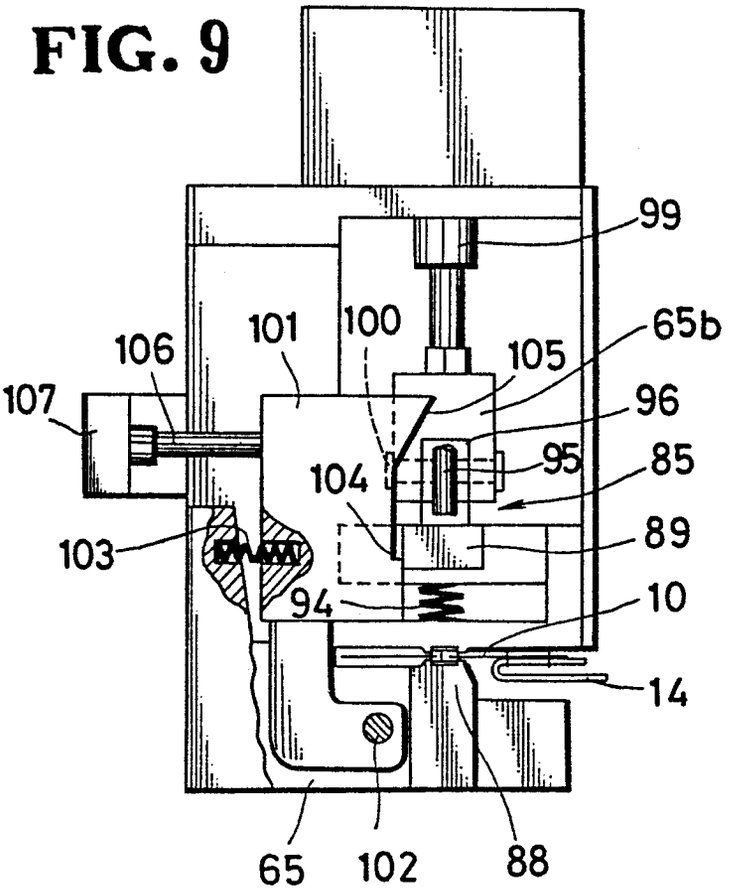
FIG. 9



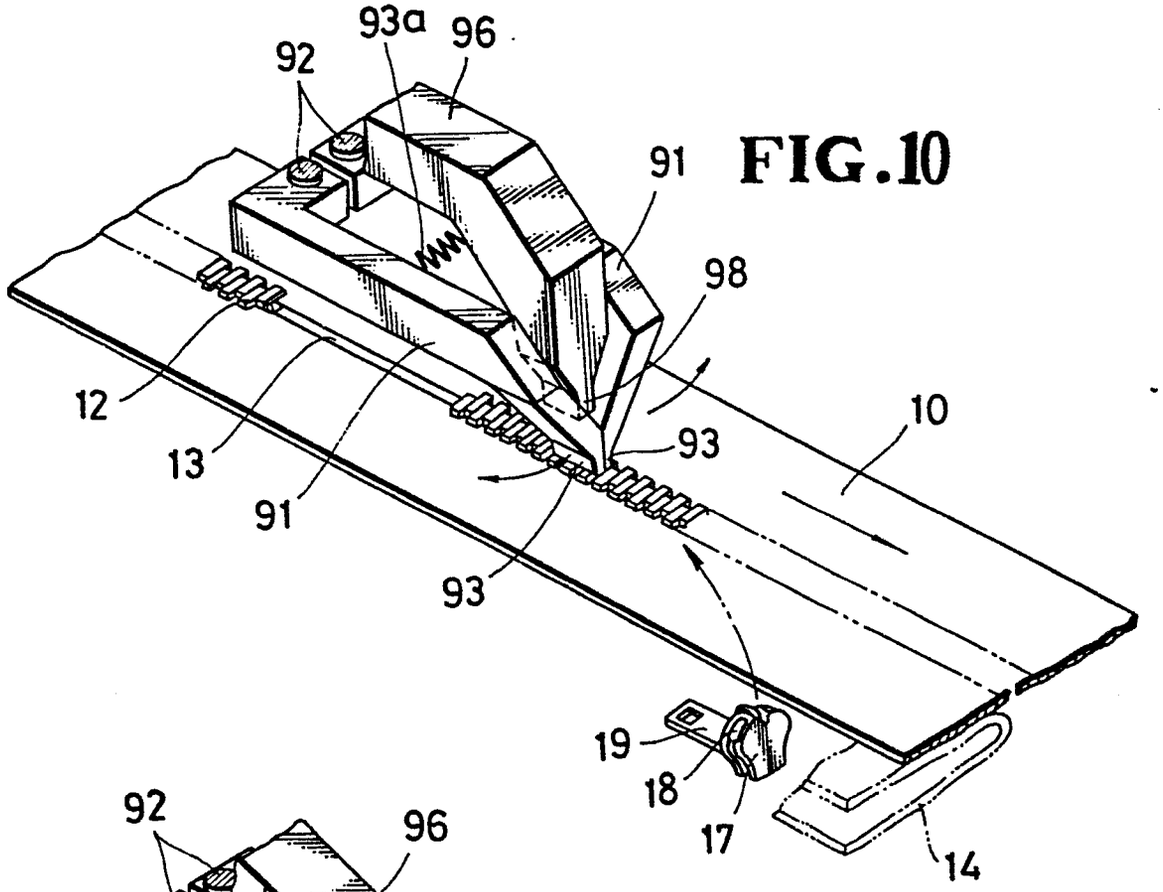

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FIG.10

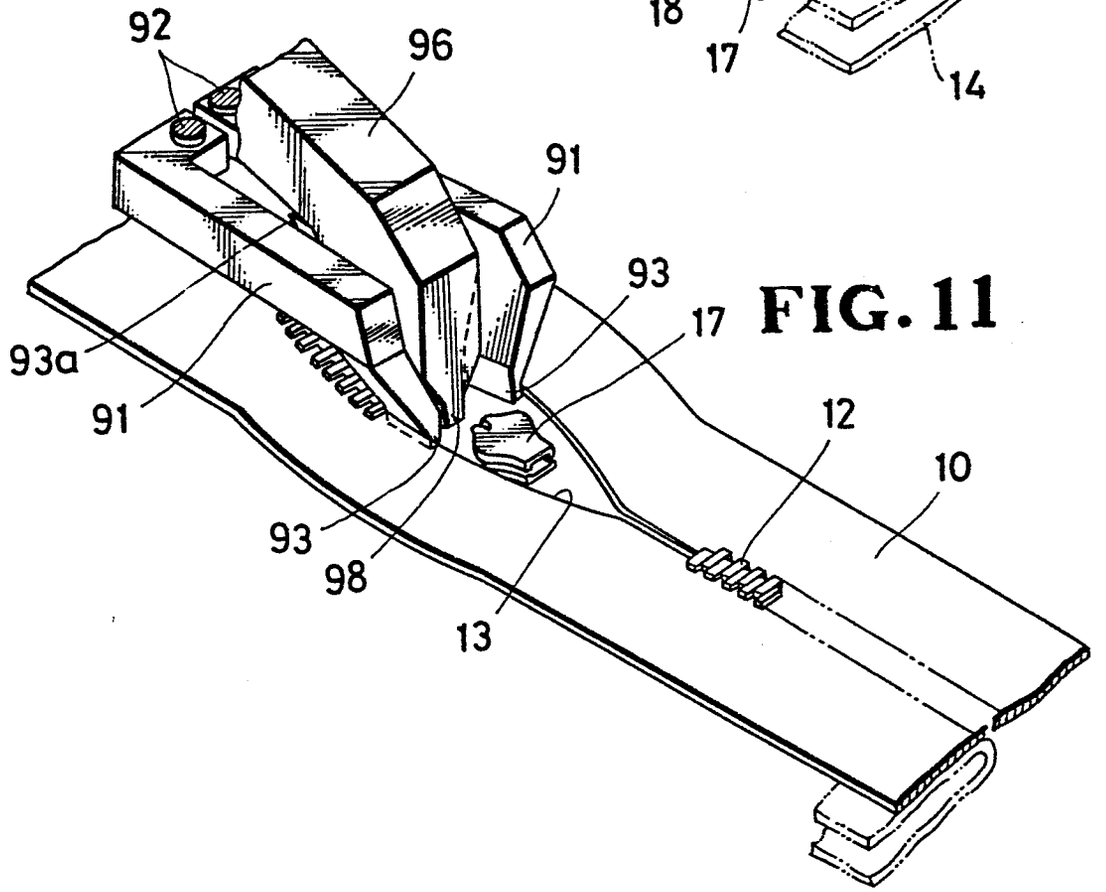
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FIG.11

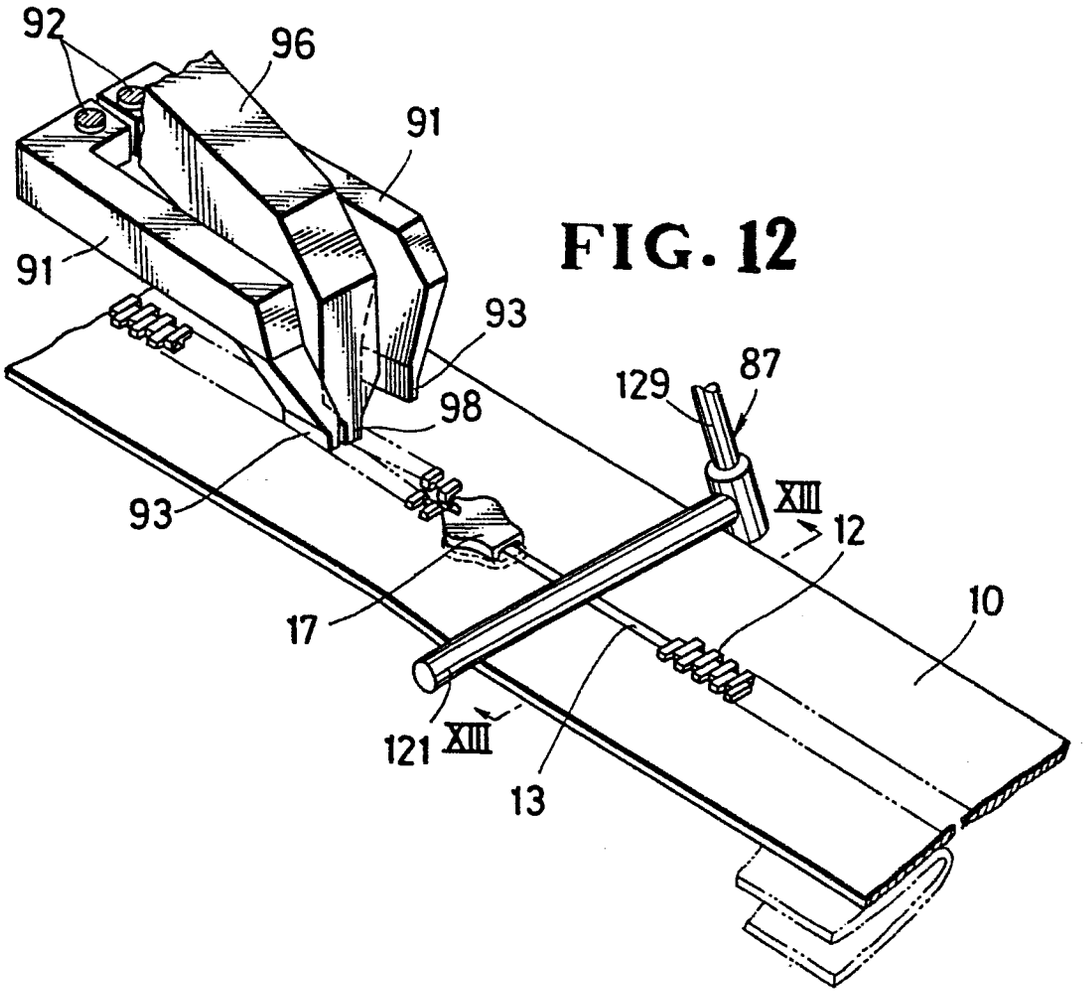
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FIG. 12

FIG. 13

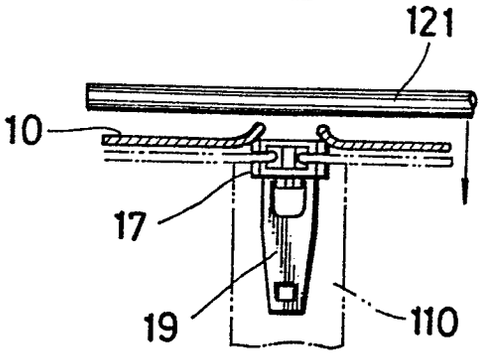
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FIG.14

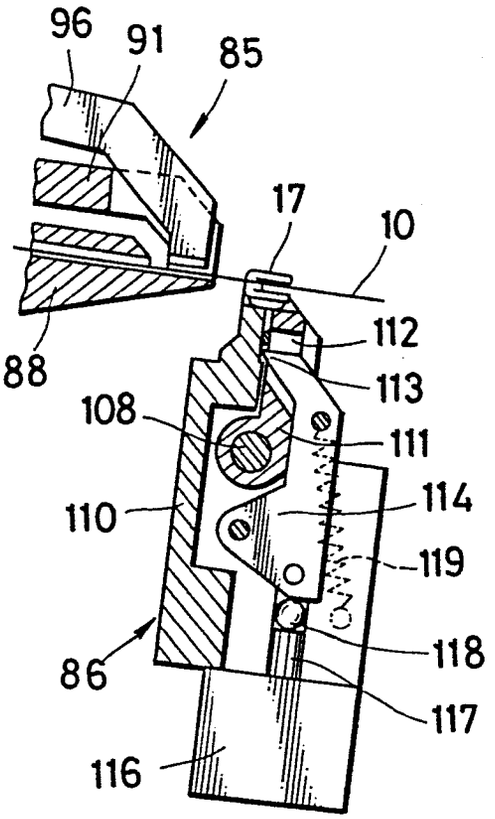
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FIG. 15

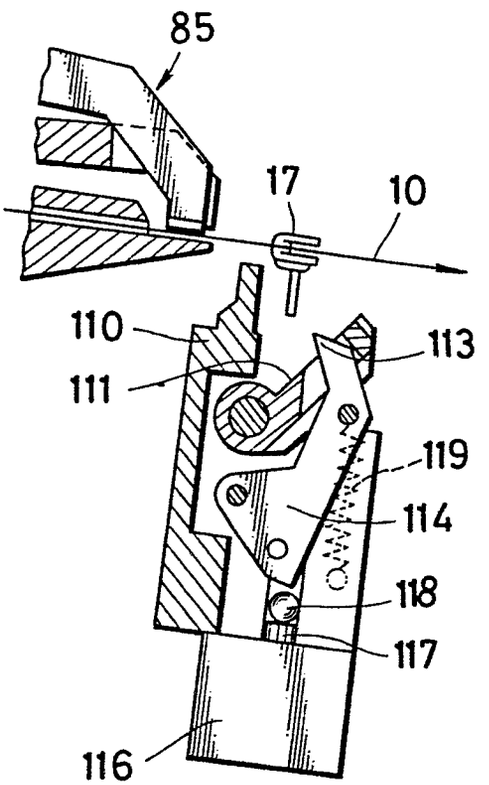
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FIG. 16

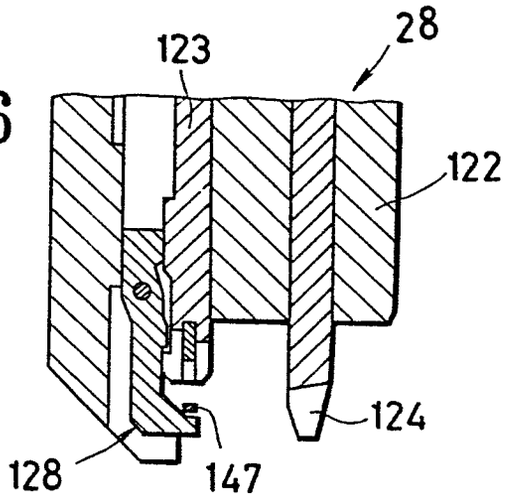

FIG. 17

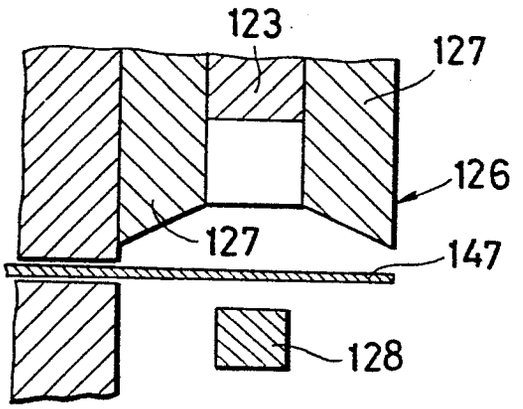

FIG. 18

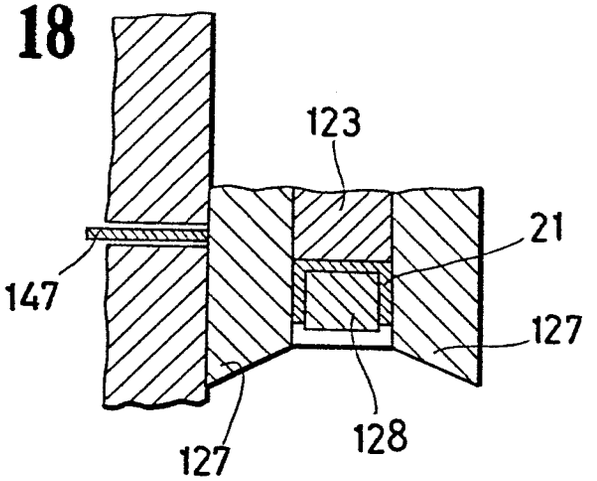

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FIG. 19

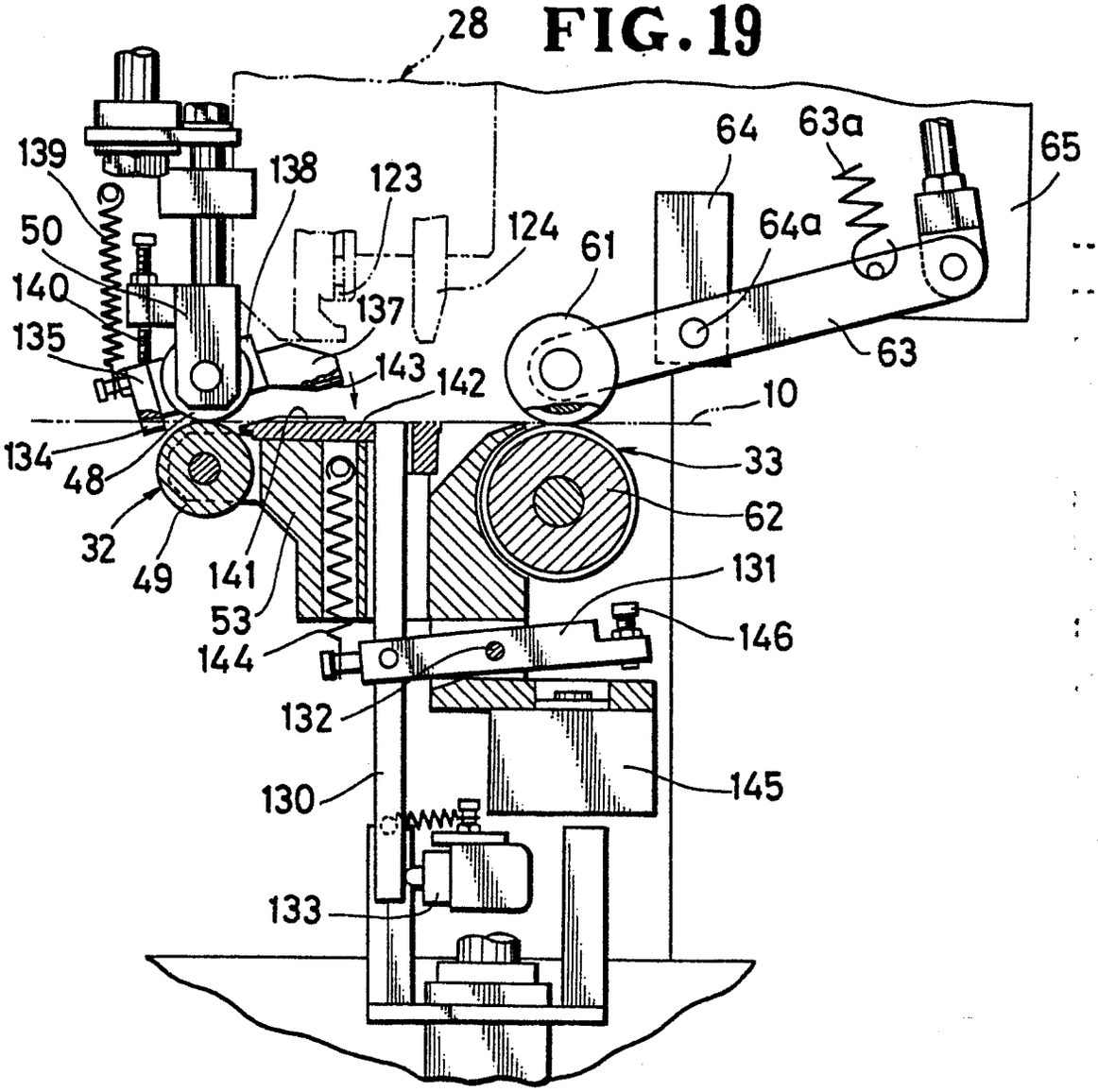
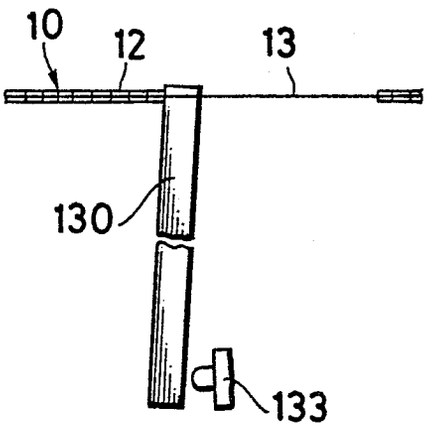


FIG. 20



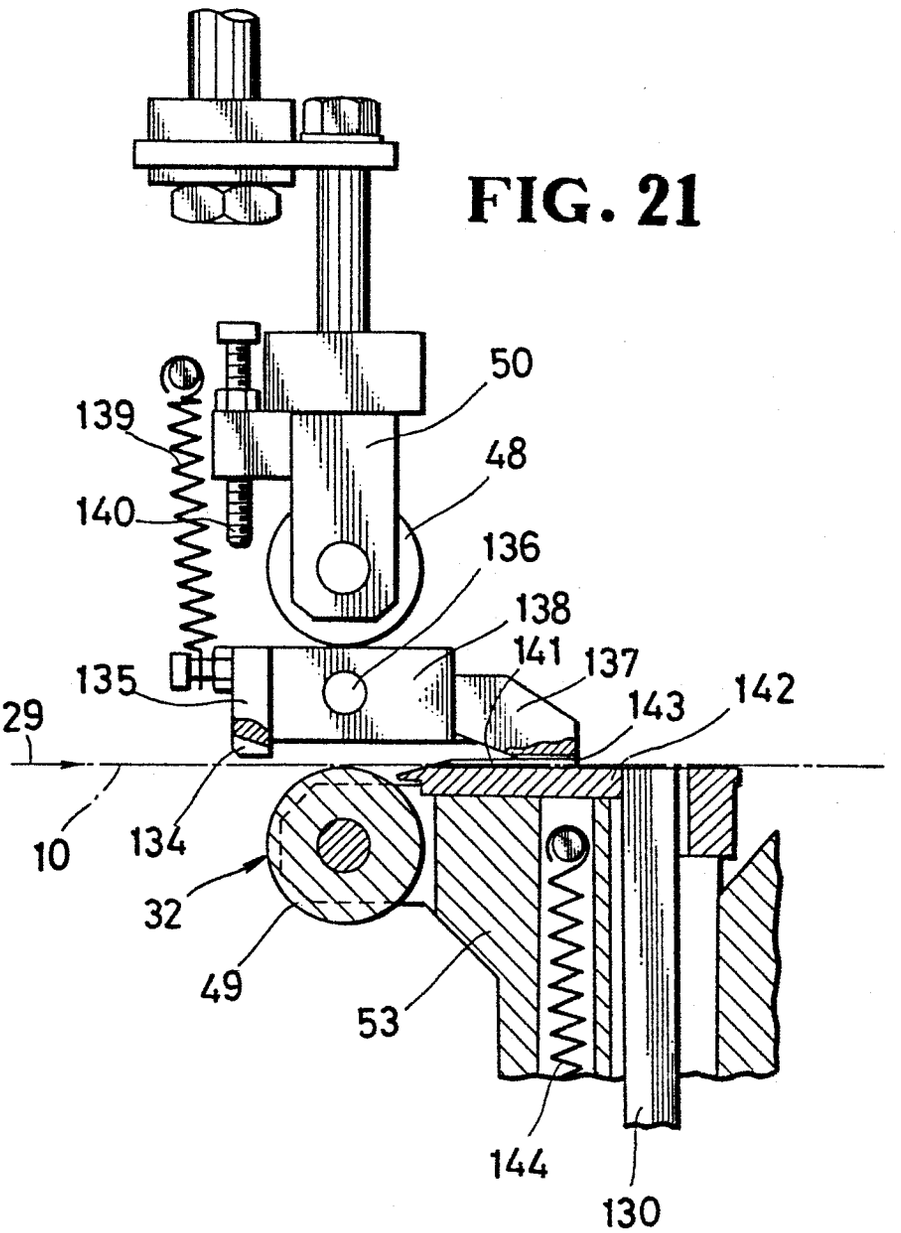

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FIG. 21

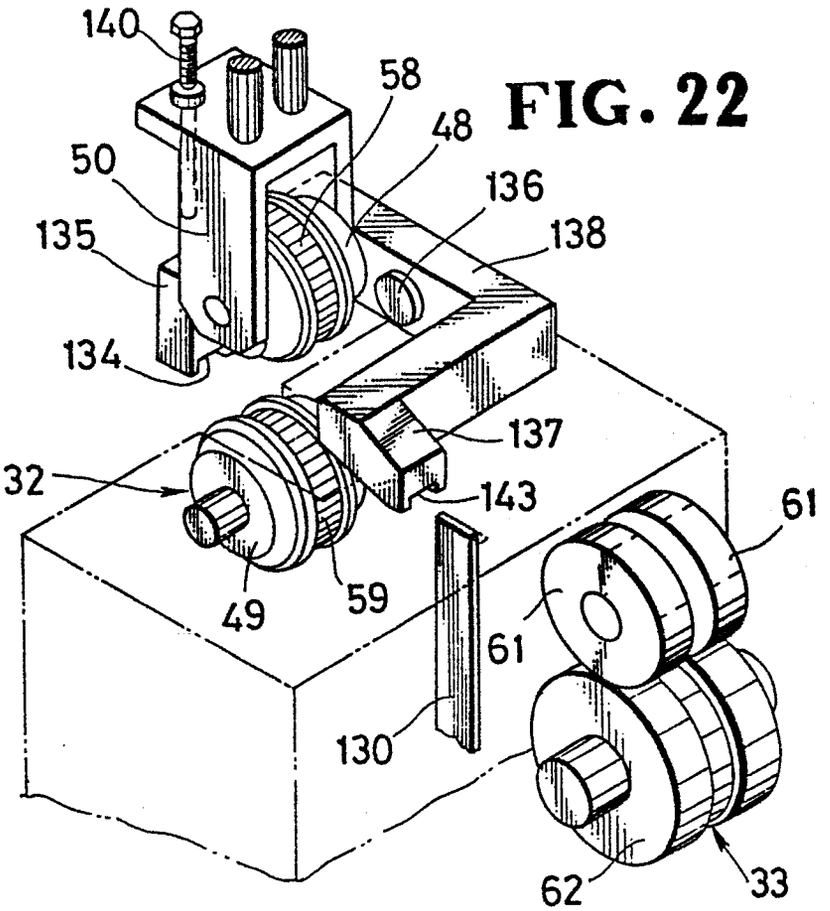
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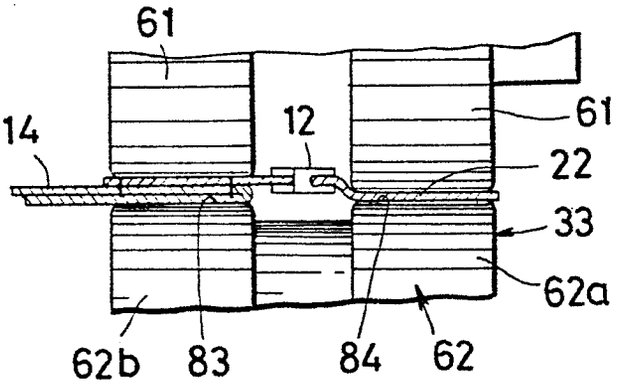
FIG. 22

FIG. 23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