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Method and apparatus for removing coupling elements from slide fastener stringers.

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A slide fastener stringer tape (T) is held in a substantially vertical plane between a pair of openable punch dies (50, 51) with coupling elements (E) having legs mounted on the stringer tape (T) and coupling heads disposed downwardly of the punch dies (50, 51). The coupling elements (E) are gripped vertically between the punch dies (50, 51), and a punch (54; 54a) and a pair of punch guides (55, 56). The punch dies (50, 51) are moved laterally away from each other to spread the legs apart from each other out of engagement with the stringer tape (T). The punch (54) has a sharp upper end (80) for thrusting into the coupling heads to split the coupling elements (E) into scraps (E').

Alternatively, the punch (54a) has a rounded upper end (80a) for pressing engagement with the coupling heads.

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METHOD AND APPARATUS FOR REMOVING COUPLING
ELEMENTS FROM SLIDE FASTENER STRINGERS

The present invention relates to a method of and an apparatus for removing from a slide fastener stringer a plurality of discrete coupling elements such for example of die-cast coupling elements of metal or
5 injection-molded coupling elements of synthetic resin, and more particularly to a method of and an apparatus for removing slide fastener coupling elements as they are erected and pressed vertically between punch dies and a punch or a punch guide.

10 Slide fasteners are generally manufactured by successively attaching coupling elements to a stringer tape through a die-casting or injection-molding process to produce an elongate slide fastener stringer, removing a prescribed number of attached coupling
15 elements from the slide fastener stringer to form an element-free space, and cutting off the stringer tape across the element-free space to provide a slide fastener length. It is general practice in the art to shorten a finished slide fastener of predetermined

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length in order to meet the dimensions of a textile article to which the slide fastener is to be stitched. To reduce the length of the finished slide fastener, it is necessary to remove a certain number of coupling
5 elements from an end of the slide fastener.

Conventional apparatus for removing coupling elements include an apparatus for cutting off the heads of the coupling elements and then forcibly removing the legs thereof off the slide fastener tape and an
10 apparatus for pressing the legs of the coupling elements to a flattened configuration and thereafter pulling the slide fastener tape from the flattened legs. However, since these known apparatus forcibly remove the legs of the coupling elements from the slide
15 fastener tape, the tape is liable to be damaged, and the coupling elements or their legs may not be removed thoroughly.

To eliminate the above prior drawbacks, there have been devised apparatus for gripping a slide
20 fastener tape with a pair of dies so that the coupling elements are erected, pressing some of the coupling elements and splitting them vertically with a punch and the dies, and thereafter knocking the split coupling elements off the tape. Examples of such apparatus are
25 disclosed in Japanese Patent Publications Nos. 57-61406, 57-61407, and 58-20783. The disclosed apparatus require a support for keeping the coupling

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elements erected in upstanding condition, the support including sharp upper ends of the dies for contact with portions of coupling element legs on the slide fastener tape. The desired coupling elements are split into two
5 halves by the punch moved downwardly to thrust into the coupling elements, from their heads to legs. If the apparatus had no such support, then the coupling elements would tend to be tilted with respect to the slide fastener tape. With the coupling elements to be
10 removed being tilted, they would not be split apart by the lowering punch, and could not be removed from the tape.

The present invention seeks to provide a method of and an apparatus for reliably keeping coupling
15 elements erected and removing the coupling elements from the slide fastener tape.

According to a first aspect of the present invention, A method of removing coupling elements from a slide fastener stringer, comprising the steps of:

20 (a) holding a slide fastener stringer tape in a substantially vertical plane with coupling elements having legs mounted on the stringer tape and coupling heads directed downwardly;

(b) gripping the coupling elements vertically
25 between said legs and said coupling heads; and

(c) spreading said legs apart from each other out of engagement with said stringer tape.

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According to a second aspect of the present invention, there is provided a method of removing coupling elements from a slide fastener stringer, comprising the steps of:

- 5 (a) holding a slide fastener stringer tape in a substantially vertical plane between a pair of openable punch dies with coupling elements having legs mounted on the stringer tape and coupling heads disposed downwardly of said punch dies;
- 10 (b) gripping said coupling elements vertically between said punch dies and a vertically movable member; and
- (c) moving said punch dies laterally away from each other to spread said legs apart from each other
- 15 out of engagement with said stringer tape.

According to a third aspect of the present invention, there is provided an apparatus for removing coupling elements from a slide fastener stringer, comprising:

- 20 (a) a support plate;
- (b) a pair of punch dies each composed of a substantially vertical member and a substantially horizontal member joined thereto, said horizontal members of said punch dies being disposed upwardly of
- 25 said vertical members and pivotably mounted on said support plate, said vertical members of said punch dies being disposed in confronting relation for holding

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therebetween a slide fastener stringer tape with coupling elements having legs mounted on said stringer tape and coupling heads disposed downwardly of said vertical members;

5 (c) a base;

(d) a pair of punch guides vertically movably mounted on said base and disposed in vertically confronting relation to said vertical members, respectively, said punch guides being movable upwardly
10 for pressing said coupling elements against said vertical members;

(e) a punch vertically movably disposed between said punch guides for engaging said coupling heads of said coupling elements; and

15 (f) an actuator mounted on said support plate and having a pusher for lowering said vertical members to move lower ends thereof engaging said legs away from each other to spread said legs apart from each other.

Many other advantages and features of the
20 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 preferred structural embodiments incorporating the principles of the present invention are shown by
25 way of illustrative example.

Figure 1 is a front elevational view of an apparatus for removing coupling elements according to

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the present invention;

Figure 2 is a plan view of the apparatus illustrated in Figure 1;

Figure 3 is a plan view, partly in cross section, of an upstream stop mechanism and a seam detector mechanism;

Figure 4 is a cross-sectional view taken along line IV - IV of Figure 2;

Figure 5 is a cross-sectional view taken along line V - V of Figure 4;

Figures 6A, 6B, 7A, 7B, 8A, 8B, 9A, and 9B are cross-sectional views illustrative of successive steps of operation of the apparatus; and

Figures 10A, 10B, 11A, 11B, 12A, 12B, 13A, and 13B are cross-sectional views showing successive steps of operation of an apparatus according to another embodiment of the present invention.

Like or corresponding parts are denoted by same reference characters throughout several views.

As shown in Figures 1 through 3, an apparatus for removing coupling elements according to the present invention generally comprises a pair of posture control mechanisms 11 for controlling the posture of elongate slide fastener stringers S fed parallel to each other, a pair of seam detectors 12 for detecting any joint or seam in the stringers S, a pair of upstream stop

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mechanisms 13 for forcibly stopping the stringers S when coupling elements E are to be removed therefrom, a pair of element remover mechanisms 14 for removing the coupling elements E with punch dies and punches or punch guides, a pair of coupling element detectors 15 for counting coupling elements E as they pass therethrough, a pair of downstream stop mechanisms 16 for forcibly stopping the stringers S in synchronism with the upstream stop mechanisms 13, and a pair of main feed mechanisms 17 for feeding the stringers S. The paired fastener stringers S are fed by the main feed mechanisms 17 respectively along feed paths P through the various components referred to above of the apparatus 10. Coupling elements can be removed from the stringers S by the element remover mechanisms 14 while the stringers S are being forcibly stopped in the feed paths P by the stop mechanisms 13, 16.

Each of the stringers S is composed of a slide fastener stringer tape T and discrete coupling elements E injection-molded or die-cast on a longitudinal beaded edge B (Figure 6B) of the stringer tape T. The stringers S are discharged by the main feed mechanisms 17 from an injection-molding or die-casting machine or from storage units. Each of the posture control mechanisms 11 operates to orient the stringer S from a horizontal posture into a vertical posture with the coupling elements E directed downwardly. The posture

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control mechanism 11 comprises a pair of guide rollers 20, 22 having their axes lying perpendicularly to each other. The guide rollers 20 of the posture control mechanisms 11 are rotatably supported on a support 21 mounted on a base 19 and have coaxial horizontal axes. The guide roller 21 comprises a conical roller rotatably supported on an L-shaped arm 23 attached to the support 21 with a larger-diameter end of the guide roller 21 being positioned downwardly. The guide roller 22 has its axis directed vertically and is located downstream of the guide roller 20 in each of the feed paths P. The guide roller 20 guides the stringer S in a horizontal plane, while the guide roller 22 guides the stringer S to travel in a substantially vertical plane along the feed path P with the coupling elements E positioned downwardly.

The seam detectors 12 are located downstream of the posture control mechanisms 11, respectively. The seam detectors 12 are of the same construction, and one of the seam detectors 12 is illustrated in Figure 3. The seam detector 12 comprises a pair of photosensors 24, 25 for detecting a metal tape applied to a seam or joint between elongate stringers S, and a pair of support members 26, 27 supporting the photosensors 24, 25, respectively. The support members 26, 27 are mounted in spaced relation on a support arm 28 fixed to the base 19, there being a vertical guide space or slot

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29 defined between the support members 26, 27 for passage therethrough of the stringer S from the posture control mechanism 11. The photosensor 24 is mounted on the support member 26, while the photosensor 25 is
5 mounted on the support member 27 in confronting relation to the photosensor 24 across the guide space 29. The photosensors 24, 25 are electrically connected by conductors 30, 31, respectively, to an electric control circuit (not shown). Each of the photosensors
10 24, 25 comprises a light-emitting element such as a light-emitting diode and a photodetector such as a phototransistor. A beam of light emitted from the light-emitting element is directed toward the guide space 29. A beam of light reflected from the tape T of
15 the stringer S moving through the guide space 29 is sensed by the photodetector.

When there is no stringer S present in the guide space 29, an increased quantity of light is transmitted from the photosensor 24 to the opposite photosensor 25
20 and vice versa in each of the seam detectors 12. When a metal tape on any seam between the stringers S is present in the guide space 29, a greater quantity of light is reflected by the metal tape than by the tape T and received by each of the photosensors 24, 25.
25 Therefore, an increased signal output from each of the photosensors 24, 25 is indicative of the absence of any stringer tape T in the guide space 29 or the presence

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of a metal tape attached across a seam between stringers S. Since the photosensors 24, 25 are disposed one on each side of the guide space 29, a metal tape on any side of the stringer S can be
5 detected.

The upstream stop mechanisms 13 are of the mirror image of each other, and one of the upstream stop mechanisms 13 is shown in Figure 3. The upstream stop mechanism 13 comprises a pair of guide blocks 32,
10 33 mounted on the support arm 28 and defining a vertical guide space or slot 34 therebetween which is aligned with the guide space 29 in the seam detector 12 along the feed path P. A pneumatic cylinder 35 is bolted to the guide block 32 and has a piston rod 36
15 supporting a pusher 38 on a distal end thereof. The piston rod 36 is axially slidably disposed in a hole 37 defined in the guide block 32 and extends toward the guide block 33. The pusher 38 is disposed in confronting relation to the guide block 33 across the
20 guide space 34 or the feed path P. When the pneumatic cylinder 35 is inoperative, the pusher 38 remains retracted from the guide space 34. When the pneumatic cylinder 35 is actuated, the pusher 38 is projected into the guide space 34 toward the guide block 33,
25 pressing the coupling elements E of the stringer S against the guide block 33 for forcibly stopping the stringer S in the feed path P.

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Each upstream stop mechanism 13 is associated with a tensioning mechanism 40 composed of a pneumatic cylinder 41 mounted by a support member 42 on the guide block 32 and having a piston rod 43, and a pusher 44
5 mounted on a distal end of the piston rod 43. The pneumatic cylinder 41 is normally kept inoperative to retract the pusher 44 out of the feed path P. When the pneumatic cylinder 41 is operated, the pusher 44 is projected across the feed path P to push the stringer
10 S, thus giving a back tension to the stringer S. The pneumatic cylinder 41 is actuated after the pneumatic cylinder 35 of the stop mechanism 13 has been actuated.

As shown in Figure 4, the element remover mechanisms 14 are of the same arrangement. A central
15 support post 45 is vertically mounted on the base 19 and supports on its upper end a horizontal support plate 46. Each of the element remover mechanisms 14 includes a pair of guide walls 47, 48 mounted on the base 19, a pair of punch dies 50, 51 pivotably mounted
20 by pins 52, 53 on a lower side of the horizontal support plate 46, a plate-shaped punch 54 disposed below the punch dies 50, 51, and a pair of punch guides 55, 56 disposed one on each side of the punch 54 and slidably guided by the guide walls 47, 48 within a
25 cavity 57 defined jointly by and between the guide walls 47, 48.

Each of the punch dies 50, 51 is of an L-shaped

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cross section composed of a vertical member 58 and a horizontal member 59. The vertical members 58 of the punch dies 50, 51 extend substantially parallel to each other. The vertical members 58 have confronting vertical flat surfaces jointly defining a vertical slot 49 therebetween and having lower ends 63 tapered toward the vertical flat surfaces of the vertical members 58. The horizontal members 59 extend parallel to the feed path P and are pivotably mounted by pins 52, 53, respectively, on the lower side of the support plate 46. The horizontal members 59 have upper surfaces 62 tapered downwardly and are urged by compression coil springs 60, 61 to angularly move the vertical members 58 in a direction to bring the lower ends 63 toward each other. A pneumatic cylinder 64 is mounted on the horizontal support plate 46 and has a vertical piston rod 65 supporting a pusher 66 on its lower end. The pneumatic cylinder 64 is normally inoperative to retract the piston rod 65 for keeping the vertical flat surfaces of the vertical members 58 in parallel relation, thus defining a passage for the tape T. When the pneumatic cylinder 64 is actuated, the piston rod 65 is extended to cause the pusher 66 to push the punch dies 50, 51 downwardly about the pins 52, 53 for moving the lower ends 63 apart from each other.

The punch 54 is vertically mounted on an upper end of a support base 67 connected to a piston rod of a

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pneumatic cylinder 68, the punch 54 extending longitudinally along the stringer S. The punch 54 has a sharp pointed upper end 80, as shown in Figure 6B, positioned downwardly of the lower ends 63 of the vertical members 58 of the punch dies 50, 51. The punch 54 is normally urged to move downwardly by compression coil springs 69, 70 acting between the punch guides 55, 56 and the support base 67. The upper edge of the sharp upper end 80 of the punch 54 is normally held in horizontal alignment with the upper edges of narrower upper ends 71, 72 of the punch guides 55, 56.

The punch guides 55, 56 are fixed to a pair of respective vertically movable members 73, 74. The upper ends 71, 72 of the punch guides 55, 56 are disposed in vertically confronting relation respectively to the lower ends 63, 63 of the vertical members 58, 58 of the punch dies 50, 51. The vertically movable members 73, 74 are integrally joined with each other across upstream and downstream ends of the support base 67, and are coupled to a piston rod 110 (Figure 5) of a pneumatic cylinder 111. The vertically movable members 73, 74 are normally urged to move downwardly by compression coil springs 75, 76 acting between the guide walls 47, 48 and the vertically movable members 73, 74, defining a passage 112 for the coupling elements E between the upper ends

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71, 72 of the punch guides 55, 56 and the lower ends 63, 63 of the punch dies 50, 51. When the pneumatic cylinder 111 is actuated, the punch guides 55, 56 are moved upwardly relatively to the punch 54 to cause the upper ends 71, 72 thereof to press legs of the coupling elements E against the lower ends 63, 63 of the punch dies 50, 51.

The guide walls 47, 48 face each other across the cavity 57 and include upper flanges 77, 78 extending toward each other above the punch 54 and the punch guides 55, 56. The upper flanges 77, 78 double as covers for preventing removed coupling elements E from being scattered around. The upper flanges 77, 78 jointly define a slot 79 extending in the longitudinal direction of the punch 54 and the punch dies 50, 51. The guide walls 47, 48 have confronting inner guide surfaces for guiding vertical movement of the punch guides 55, 56.

As illustrated in Figure 5, support walls 81, 82 are fixedly mounted on the base 19 upstream and downstream respectively of the punch 54 and the punch guides 55, 56. The support walls 81, 82 have horizontal holes 83, 84, respectively, extending in a direction parallel to the feed path P and accommodating tiltable members 85, 86 respectively therein. The tiltable members 85, 86 extend longitudinally through the holes 83, 84 and are pivotably supported by pins

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87, 88 on the support walls 81, 82, the tiltable members 85, 86 having upwardly extending fingers 89, 90, respectively on ends thereof. The other ends of the tiltable members 85, 86 are coupled to piston rods 5 93, 94, respectively, of pneumatic cylinders 91, 92 mounted on the base 19. Normally, the pneumatic cylinders 91, 92 remain inoperative to retract the fingers 89, 90 downwardly out of the passage for the coupling elements E. When the pneumatic cylinders 91, 10 92 are actuated, the piston rods 93, 94 are retracted to project the fingers 89, 90 into the passage for the coupling elements E so as to fit between adjacent coupling elements E, thus positioning the coupling elements E with respect to the punch dies 50, 51 and 15 the punch 54.

As shown in Figure 2, each of the coupling element detectors 15 comprises a limit switch 95 having an actuator 96, and a roller 97 rotatably mounted on the actuator 96 and normally projecting into the 20 passage for the coupling elements E to press them against a bearing plate 98. Each time the roller 52 is retracted by the coupling elements E as the stringer S is transported, the limit switch 95 is actuated to thereby detect the coupling elements E. A signal from 25 the limit switch 95 is sent to a counter circuit for counting the coupling elements E moving past the coupling element detector 15. The bearing plate 98 is

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attached to a support arm 99 mounted on the base 19.

Each of the downstream stop mechanisms 16 is of substantially the same construction as that of the upstream stop mechanism 12 except that the downstream stop mechanism 16 is mounted on the support arm 99 and has a support arm 103 on which the coupling element detector 15 is supported. The downstream stop mechanism 16 is composed of a pair of guide blocks 100, 101 defining a guide space 62 for passage of the stringer S, a pneumatic cylinder 104, and a pusher 106 mounted on a piston rod 105 of the pneumatic cylinder 104.

Each of the main feed mechanisms 17 has a drive roller 107 operatively coupled to a common drive source 108 such as a motor, and a pinch roller 109 for pressing the stringer S against the driver roller 107, the driver roller 107 and the pinch roller 109 having vertical axes. The driver roller 107 comprises a friction roller for normally frictionally engaging the stringer S to feed the same. When the stop mechanisms 13, 16 are operated to stop the stringer S, the drive roller 107 continues to rotate and slips on the stringer S.

Operation of the apparatus 10 thus constructed will be described. While the stringers S are being fed along, the pushers 35, 106 of the upstream and downstream stop mechanisms 12, 16 are retracted out of the passages for the coupling elements E. The

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stringers S, with the coupling elements E directed downwardly, are independently driven by the main feed mechanisms 17 to move along the feed paths P through the seam detectors 12, the upstream stop mechanisms 13, the element remover mechanisms 14, the coupling element detectors 15, and the downstream stop mechanisms 16. While the stringers S are being thus fed along, the coupling element detectors 15 detect the coupling elements E of the stringers S, and apply detected signals to the counter circuits for counting the coupling elements E having moved past the coupling element detectors 15. As shown in Figures 6A and 6B, the stringer tape T is moved along between the punch dies 58 with the coupling elements E oriented downwardly and fed along between the punch 54 and the punch dies 58.

When a prescribed number of coupling elements E have moved past each of the coupling element detectors 15, the pneumatic cylinders 35, 104 of the upstream and downstream stop mechanisms 13, 16 are actuated to press the coupling elements E against the guide blocks 33, 100 to forcibly stop the stringer S. The friction drive roller 107 is then caused to rotate and slip with respect to the stringer S. By thus operating the stop mechanisms 13, 16 in response to the detection of a predetermined number of coupling elements E by the coupling element detector 15, the interval of feed of

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the stringer S can be more accurately equalized to:

The pitch of coupling elements E x the number of
coupling element E

than by actuating the stop mechanisms 13, 16 based on
5 the number of r.p.m. of the driver roller 107 or the
time in which the drive roller 107 rotates. The
actuation of the stop mechanisms 13, 16 through
independent detection of the coupling elements E of the
stringers S is effective in eliminating any unwanted
10 difference between the rates at which the stringers S
are fed along by the main feed mechanisms 17.

When the pneumatic cylinder 41 of each
tensioning mechanism 40 is actuated, the pusher 44 is
projected to a position indicated by the dotted lines
15 in Figure 3. The stringer S is therefore laterally
displaced while it is being gripped in positions
upstream and downstream of the element remover
mechanism 14, so that the stringer S is subjected to a
back tension. The tensioned stringer S is stretched or
20 kept taut in the element remover mechanism 14 even when
the stringer S is loosened between the upstream and
downstream stop mechanisms 13, 16. The tape T and the
coupling elements E are properly positioned as shown in
Figures 6A and 6B.

25 The pneumatic cylinders 91 of the element
remover mechanism 14 are actuated to project the
fingers 89, 90 of the tiltable members 85, 86 into the

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passage for the coupling elements E to engage coupling elements, whereupon coupling elements E to be removed are securely positioned between the punch 54 and the punch dies 58.

5 After the pneumatic cylinders 91, 92 have been actuated, the pneumatic cylinders 68, 111 are actuated to raise the punch 54 and the punch guides 55, 56, and then the pneumatic cylinder 64 is actuated to lower and move the punch dies 50, 51 apart for vertically
10 splitting the coupling elements E for removal.

More specifically, the punch 54 is first raised as shown in Figures 7A and 7B to cause the sharp upper end 80 thereof to thrust into the coupling heads of the coupling elements E while pressing the ends of the legs
15 of the coupling elements E against the end surfaces of the lower ends 63 of the punch dies 58. Since the coupling elements E are directed downwardly, the sharp end 80 of the punch 54 is forced reliably into biting engagement with central portions of the coupling heads
20 to start cracking the coupling heads. Then, the punch dies 58 are lowered and simultaneously the punch guides 55, 56 are lifted. The coupling elements E are forcibly gripped by and between the punch dies 58 and the punch guides 55, 56, and the lower ends 63 of the
25 punch dies 58 are spread open apart from each other to split each coupling element E vertically into halves or scraps as illustrated in Figures 8A and 8B. The split

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scraps E' then come off the longitudinal beaded edge B of the tape T and fall along the punch guides 55, 56 into a discharge chute 39 (Figure 1).

After the desired coupling elements E have been
5 removed from the tape T, the pneumatic cylinders 64, 68, and 111 are rendered inoperative to allow the punch dies 58, the punch 54, and the punch guides 55, 56 to return to their starting or standby positions.

Thereafter, the pneumatic cylinders 35, 41, 104, and
10 91, 92 return to their original positions to allow the stringer S to be fed again by the main feed mechanisms 17. While the stringers S are being fed along, the coupling elements E are detected by the coupling element detectors 15, which apply detected signals to
15 the counter circuits to count coupling elements E having moved past the coupling element detectors 15. The counts in the counter circuits are cleared during operation of the pneumatic cylinders 35, 104 of the stop mechanisms 13, 16.

20 Figures 10A, 10B through 13A, 13B illustrate progressive steps of operation of an apparatus according to another embodiment of the pres^{er}net invention. The apparatus is substantially of the same arrangement as that of the apparatus of the previous
25 embodiment except that a punch 54a has a rounded upper end 80a for spreading the legs of coupling elements E to remove them from the stringer tape T. As shown in

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Figures 10A and 10B, the tape T is positioned between the punch dies 50, 51 with the coupling elements E directed downwardly, and the rounded upper end 80a of the punch 54a has an upper edge horizontally aligned
5 with the upper edges of the upper ends 71, 72 of the punch guides 55, 56. The punch 54 and the punch guides 55, 56 are moved upwardly to press the coupling elements E against the lower end surfaces of the lower ends 63 of the vertical punch die members 58, as
10 illustrated in Figures 11A and 11B. At this time, the coupling elements E are oriented downwardly, and stably gripped between the punch guides 55, 56 and the punch dies 50, 51. As the punch 54a is lifted, its rounded upper end 80a is pressed exactly against the central
15 portions of the coupling heads of the coupling elements E.

The punch dies 50, 51 are then pushed downwardly to move their lower ends 63 apart from each other, as shown in Figures 12A and 12B, for thereby forcibly
20 spreading the legs of the coupling elements E off the longitudinal beaded edge B of the tape T. The deformed coupling elements E which have been removed from the tape T fall by gravity along the punch guides 55, 56 and are discharged out of the apparatus. Thereafter,
25 the punch dies 50, 51, the punch 54a, and the punch guides 55, 56 are returned to the positions of Figures 13A and 13B.

CLAIMS:

1. A method of removing coupling elements from a slide fastener stringer, comprising the steps of:

(a) holding a slide fastener stringer tape (T)
5 in a substantially vertical plane with coupling elements (E) having legs mounted on the stringer tape (T) and coupling heads directed downwardly;

(b) gripping the coupling elements (E)
vertically between said legs and said coupling heads;
10 and

(c) spreading said legs apart from each other out of engagement with said stringer tape (T).

2. A method according to claim 1, including the step of splitting the coupling elements (E) apart into
15 scraps (E') at the same time that said legs are spread apart.

3. A method according to claim 2, said coupling elements (E) being split from said coupling heads.

4. A method of removing coupling elements from a
20 slide fastener stringer, comprising the steps of:

(a) holding a slide fastener stringer tape (T)
in a substantially vertical plane between a pair of openable punch dies (50, 51) with coupling elements (E)
having legs mounted on the stringer tape (T) and
25 coupling heads disposed downwardly of said punch dies (50, 51);

(b) gripping said coupling elements (E)

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vertically between said punch dies (50, 51) and a vertically movable member (54 or 55, 56; 54a or 55, 56); and

(c) moving said punch dies (50, 51) laterally
5 away from each other to spread said legs apart from each other out of engagement with said stringer tape (T).

5. A method according to claim 4, said vertically movable member comprising a punch (54)
10 having a sharp upper end (80), including the step of thrusting said sharp upper end (80) of the punch (54) into the coupling elements (E) to split the coupling elements (E) apart into scraps (E') at the same time that said legs are spread apart.

15 6. A method according to claim 2, said sharp upper end (80) being thrust into said coupling heads to split coupling elements (E) from said coupling heads.

7. An apparatus for removing coupling elements from a slide fastener stringer, comprising:

20 (a) a support plate (46);

(b) a pair of punch dies (50, 51) each composed of a substantially vertical member (58) and a substantially horizontal member (59) joined thereto, said horizontal members (59, 59) of said punch dies
25 (50, 51) being disposed upwardly of said vertical members (58, 58) and pivotably mounted on said support plate (46), said vertical members (58, 58) of said punch

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dies (50, 51) being disposed in confronting relation for holding therebetween a slide fastener stringer tape (T) with coupling elements (E) having legs mounted on said stringer tape (T) and coupling heads disposed
5 downwardly of said vertical members (58, 58);

(c) a base (19);

(d) a pair of punch guides (55, 56) vertically movably mounted on said base (19) and disposed in vertically confronting relation to said vertical
10 members (58, 58), respectively, said punch guides (55, 56) being movable upwardly for pressing said coupling elements (E) against said vertical members (58, 58);

(e) a punch (54; 54a) vertically movably disposed between said punch guides (55, 56) for
15 engaging said coupling heads of said coupling elements (E); and

(f) an actuator (64) mounted on said support plate (46) and having a pusher (66) for lowering said vertical members (58, 58) to move lower ends (63, 63)
20 thereof engaging said legs away from each other to spread said legs apart from each other.

8. An apparatus according to claim 7, said vertical members (58, 58) have lower outer surfaces tapered into said lower ends (63, 63).

25 9. An apparatus according to claim 7, including springs (60, 61) acting between said support plate (46) and said horizontal members (59, 59) for normally

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urging said vertical members (58, 58) toward each other.

10. An apparatus according to claim 7, said punch (54) having a sharp upper end (80) for thrusting
5 into said coupling heads to split said coupling elements (E).

11. An apparatus according to claim 7, said punch (54a) having a rounded upper end (80a) for pressing engagement with said coupling heads.

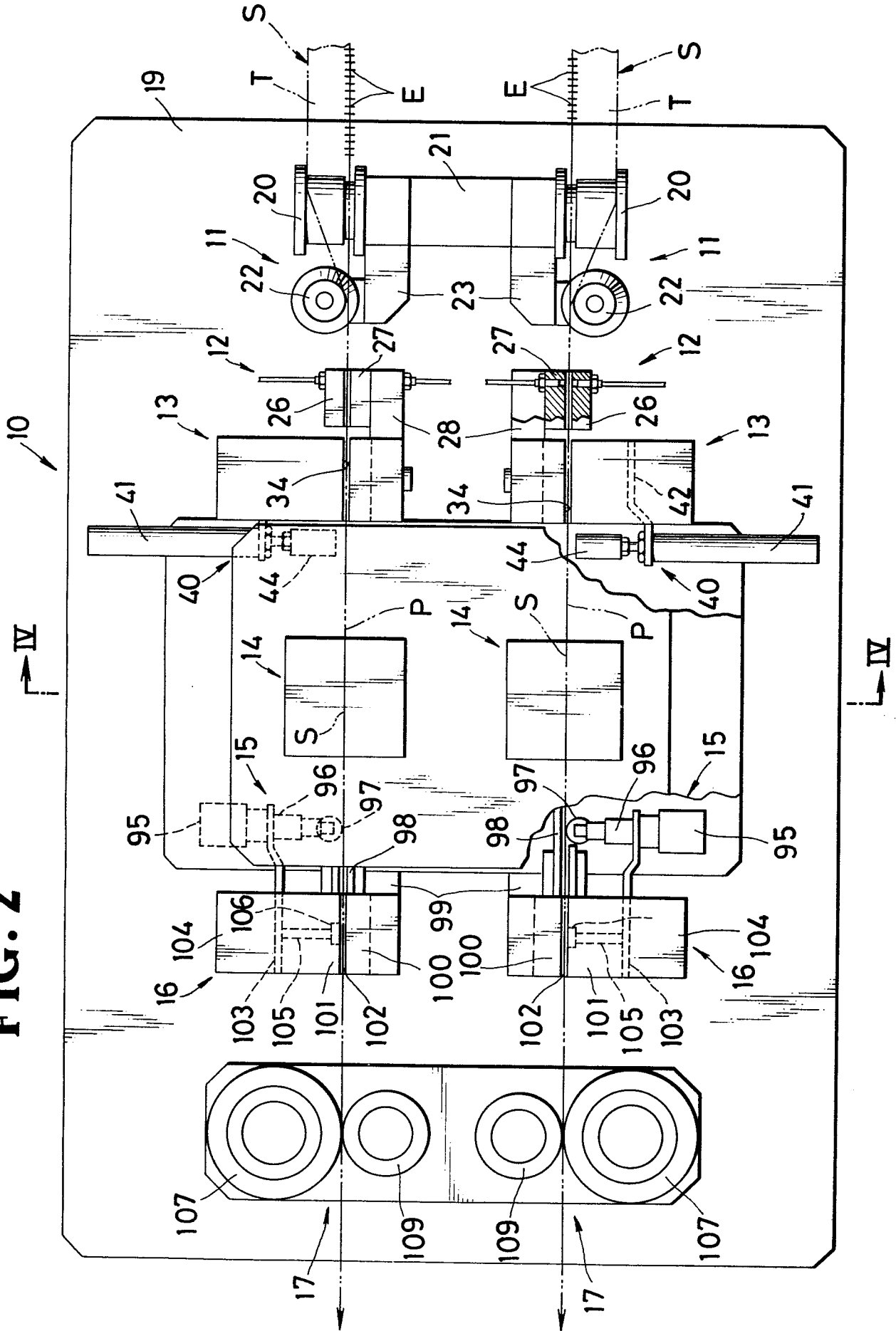
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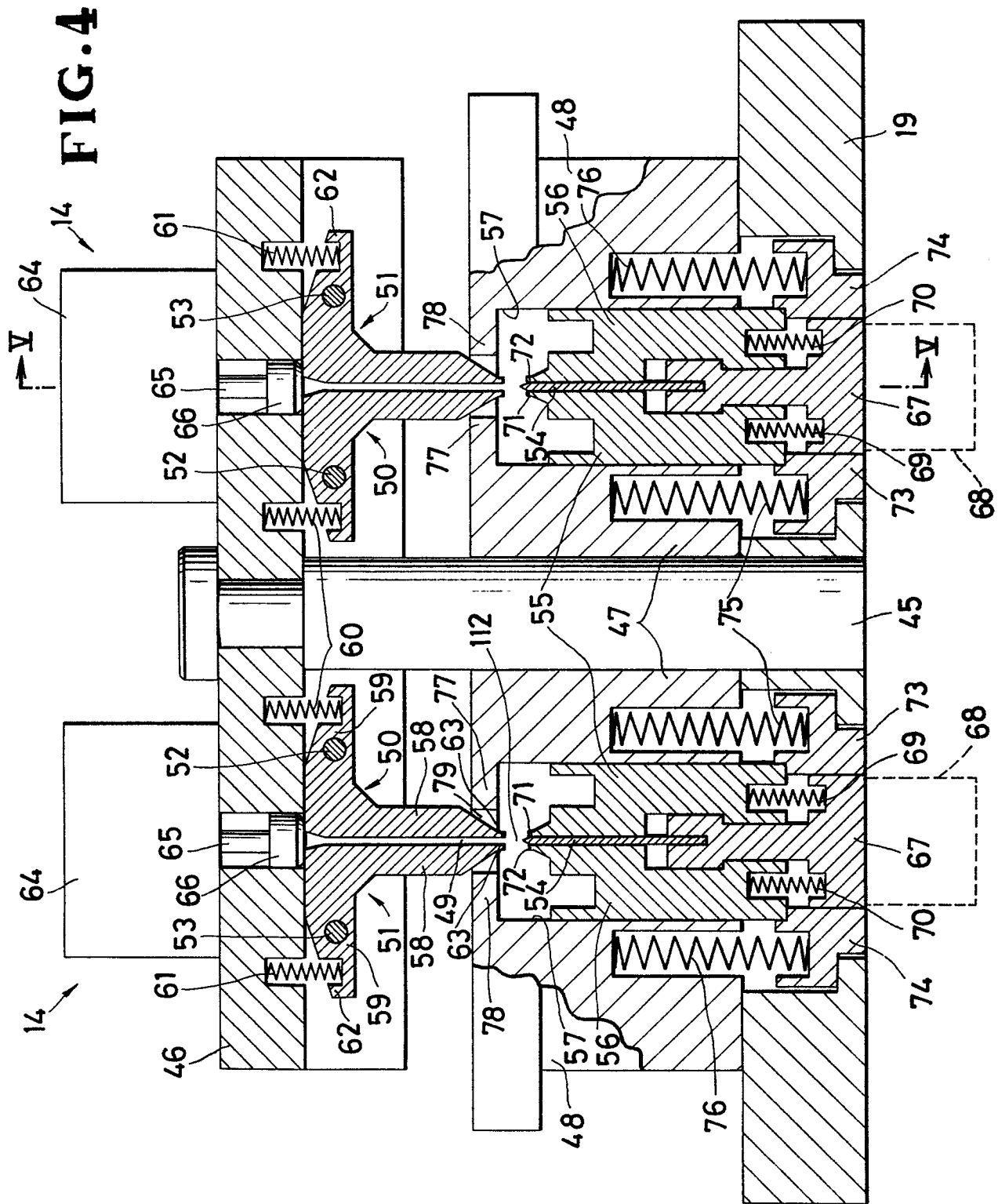
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FIG. 2



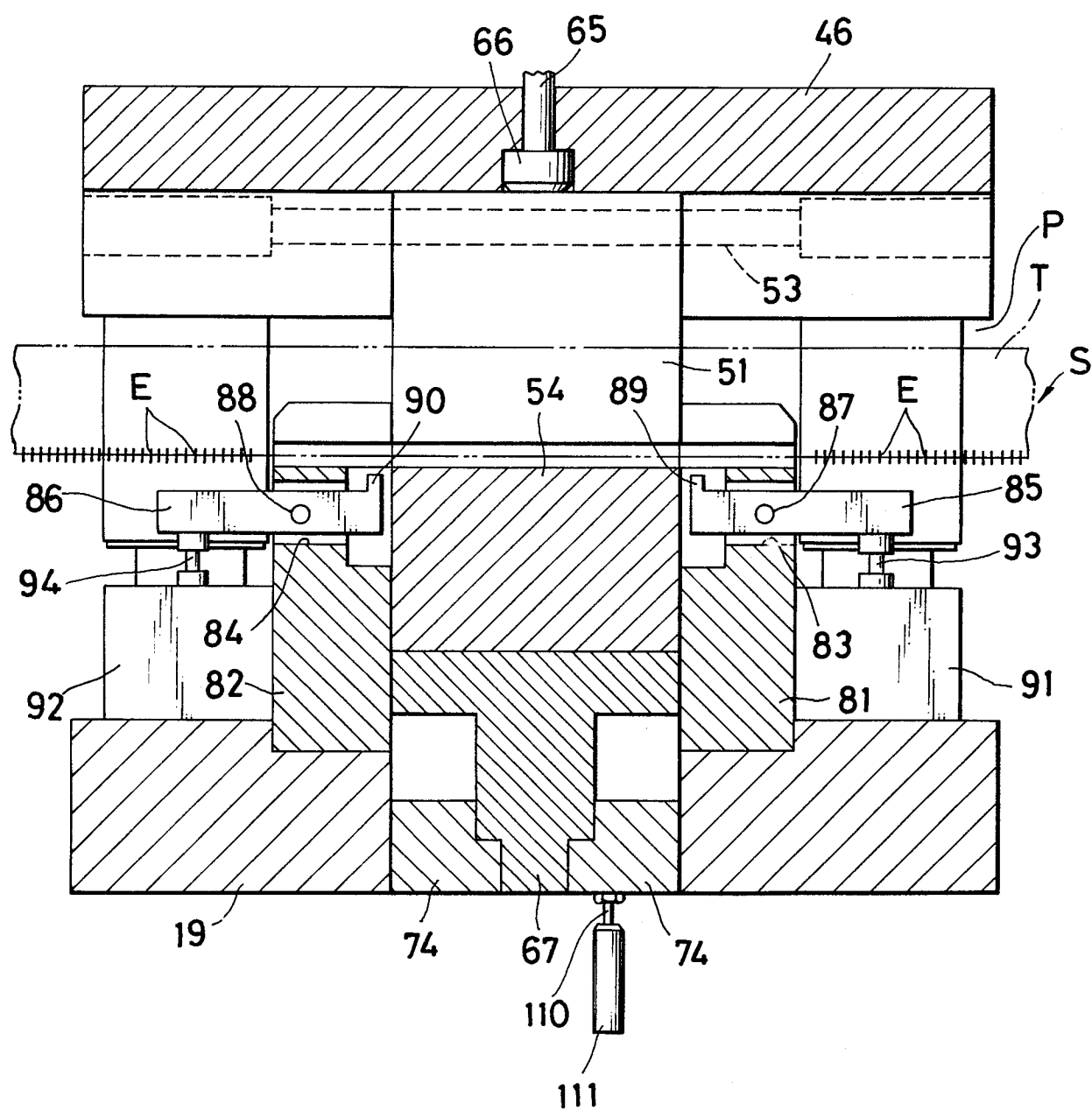


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FIG. 5



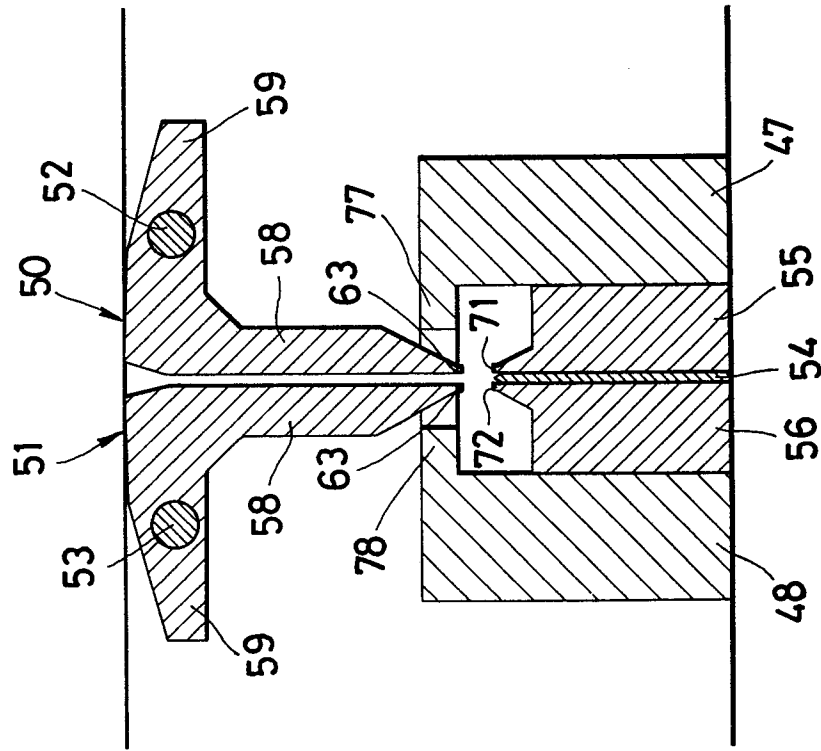
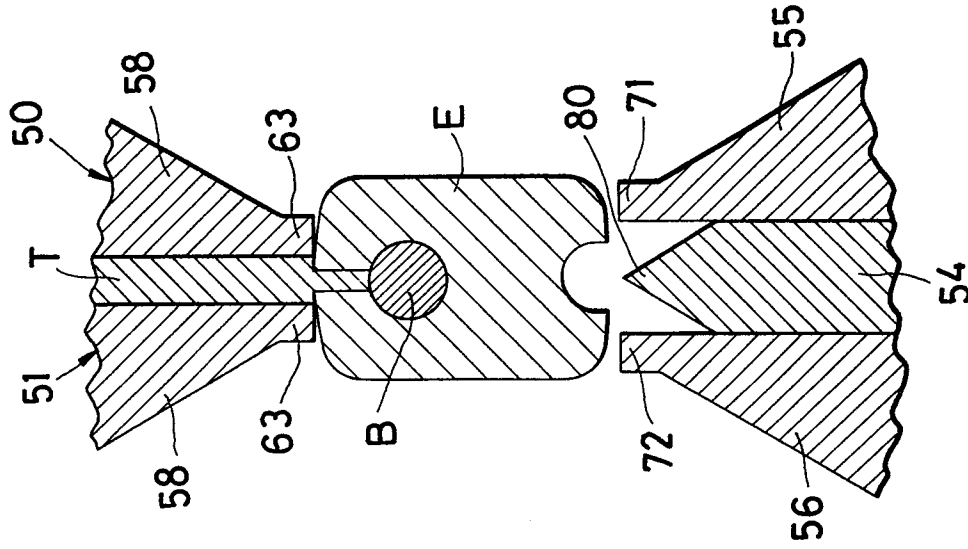


FIG. 7 B

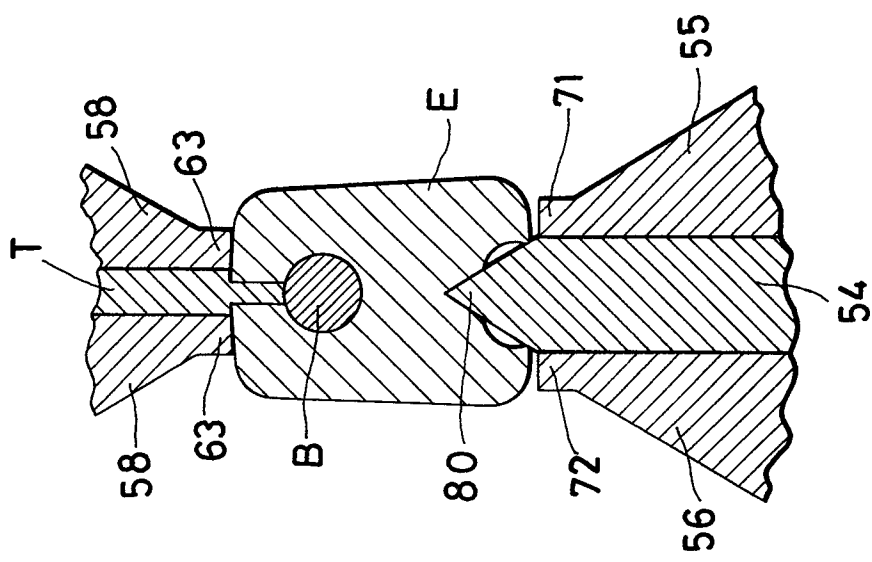


FIG. 7 A

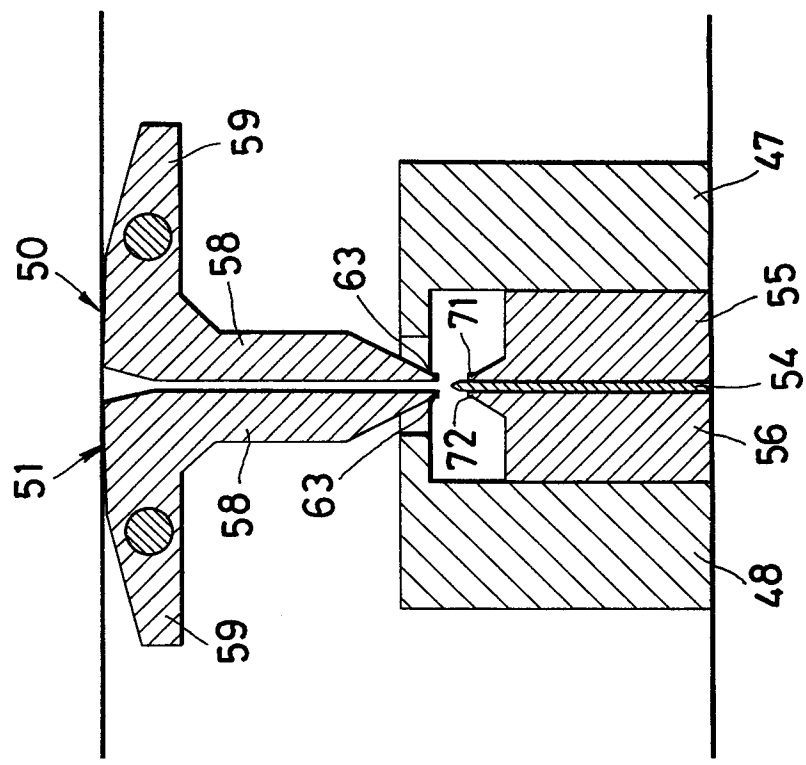


FIG. 9B

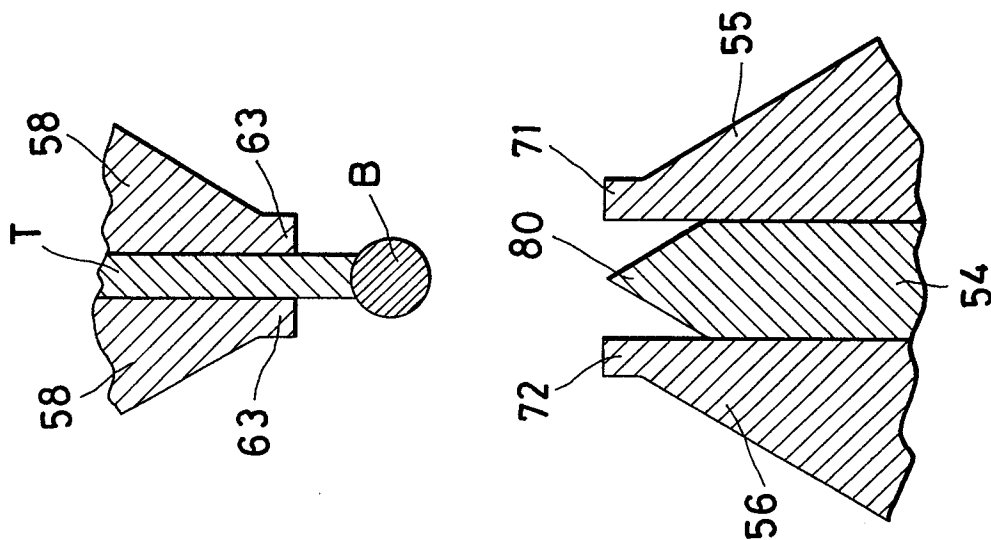


FIG. 9A

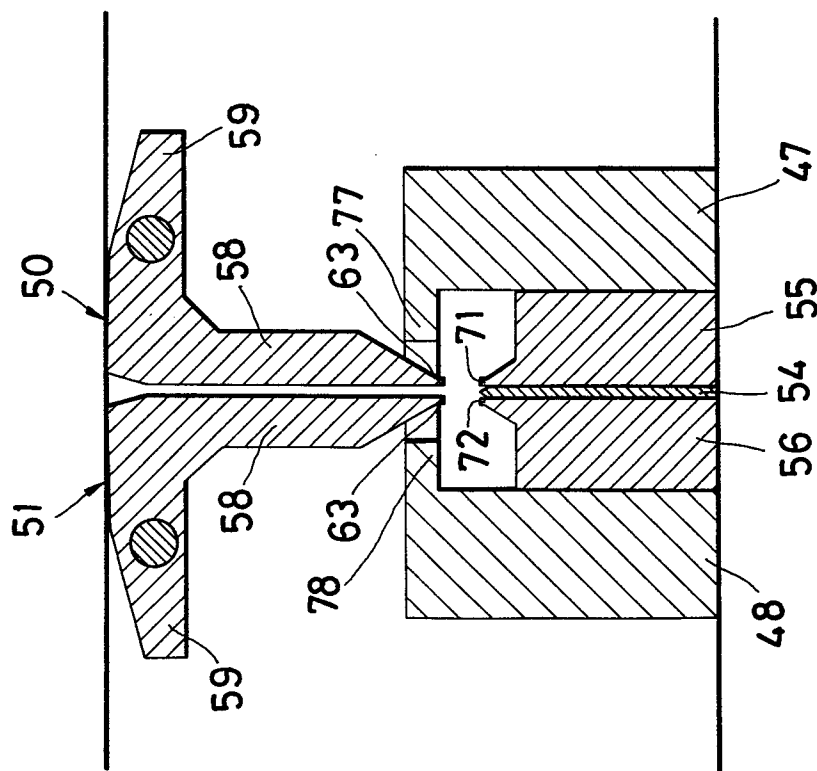


FIG.10 B

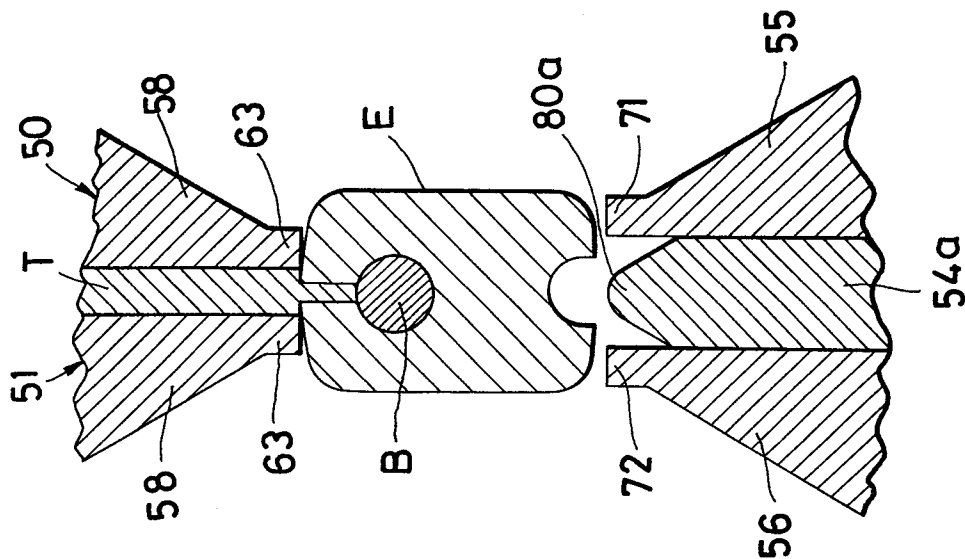


FIG.10 A

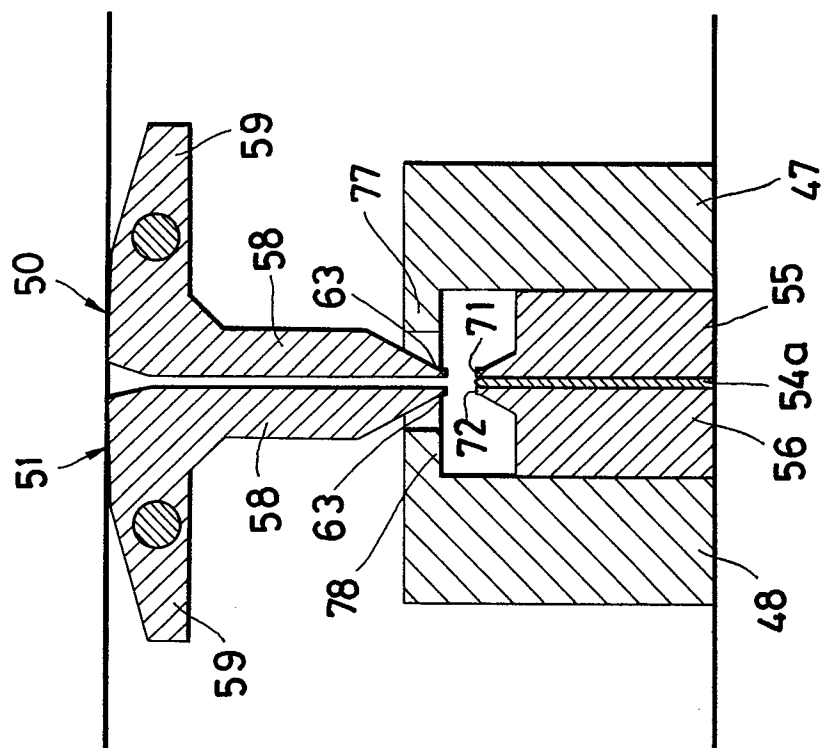


FIG. 11B

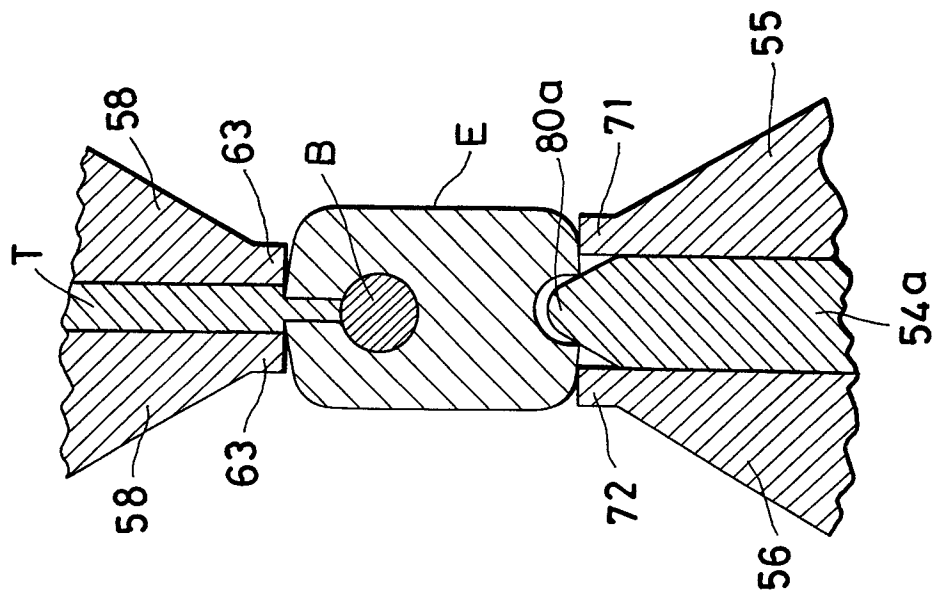


FIG. 11A

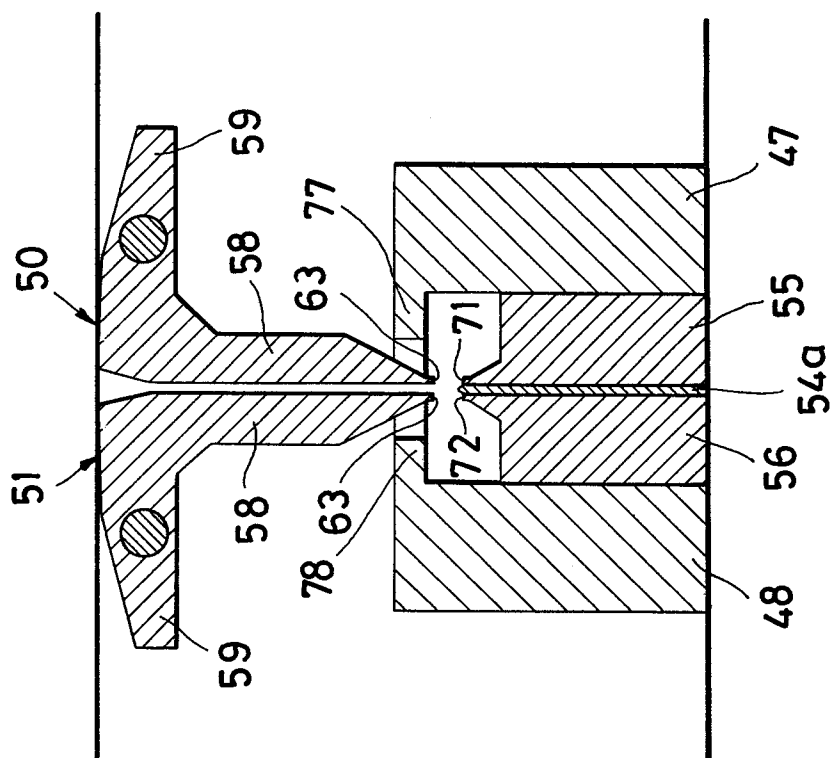


FIG. 12A

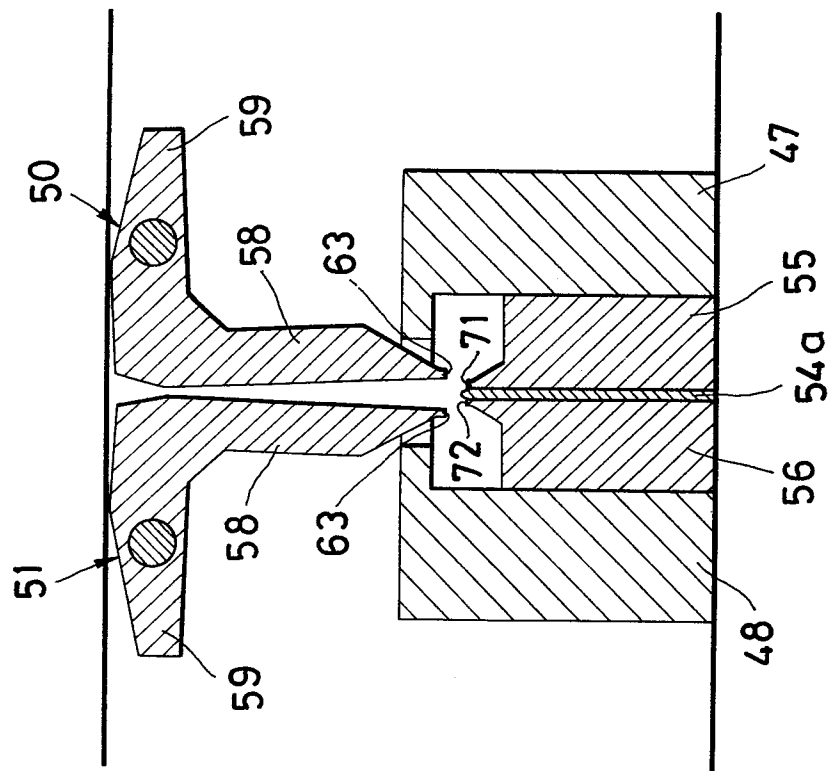


FIG. 12B

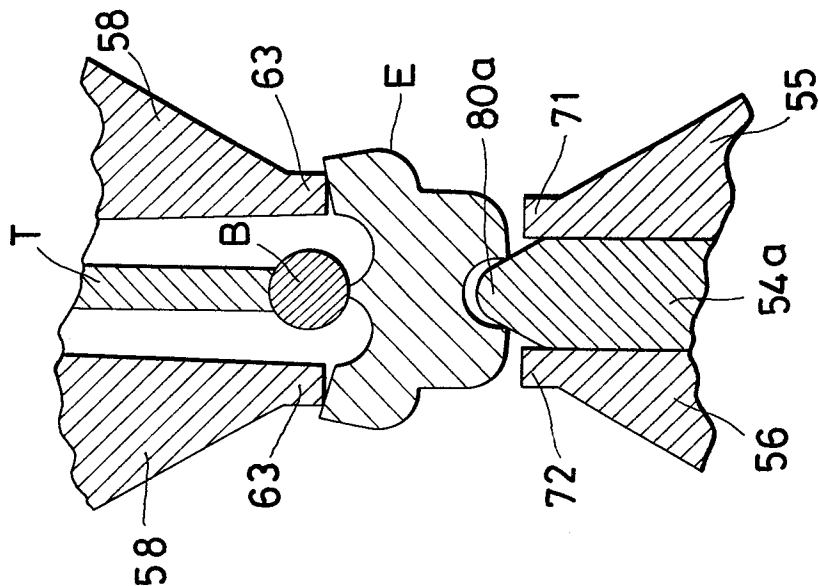


FIG. 13 A

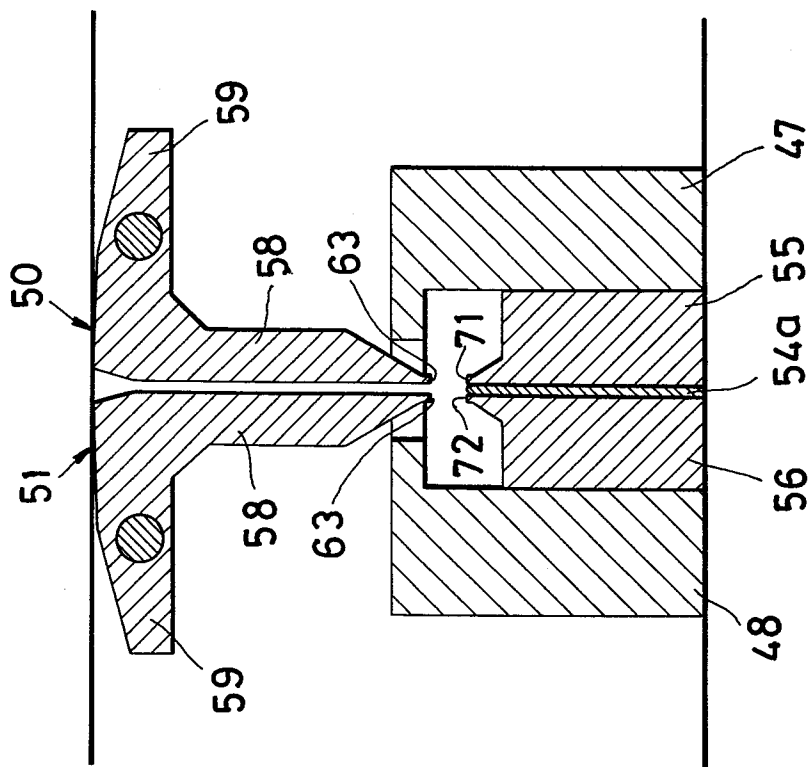


FIG. 13 B

