United States Patent [19]

Fröhlich et al.

[11] **3,807,326**

[45] **Apr. 30, 1974**

[54] **APPARATUS FOR MAKING SLIDE-FASTENER STRINGERS**

[75] Inventors: **Alfons Fröhlich; Franz Hochlehnert,** both of Essen, Germany

[73] Assignee: **Opti-Holding AG,** Glarus, Switzerland

[22] Filed: **Mar. 17, 1972**

[21] Appl. No.: **235,564**

[30] **Foreign Application Priority Data**

Oct. 29, 1971 Germany 2154056

[52] **U.S. Cl.** **112/105**

[51] **Int. Cl.** **D05b 3/18**

[58] **Field of Search** 112/265, 205, 105, 203, 112/12, 26, 63, 211, 214

[56] **References Cited**

UNITED STATES PATENTS

3,026,831	3/1962	Johnson	112/221 X
3,026,833	3/1962	Schreck et al.	112/214
2,776,635	1/1957	Blamenkrantz	112/105
2,885,774	5/1959	Waldes	112/105 X
3,443,532	5/1969	Posey et al.	112/12.26
3,633,528	1/1972	Frohlich et al.	112/105 X

FOREIGN PATENTS OR APPLICATIONS

104,071	9/1966	Great Britain	121.26/

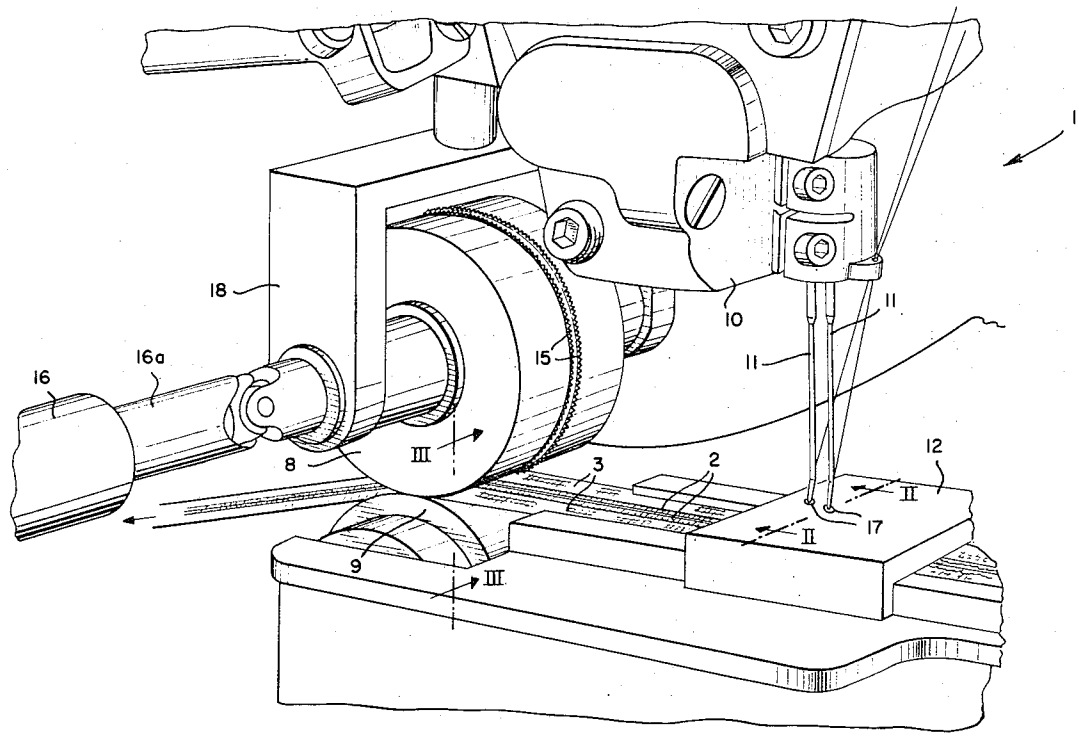
Primary Examiner—Geo. V. Larkin

Attorney, Agent, or Firm—Karl F. Ross; Herbert Dubno

[57] **ABSTRACT**

A pair of interleaved slide-fastener coupling elements are simultaneously stitched to the edges of a pair of parallel support tapes. Downstream of the sewing station in the direction of advance of the stringer thus formed are a pair of continuously driven rollers one of which is formed with teeth to positively engage and pull the downstream portion of the stringer. As the sewing needles pass through the elements and tape they arrest the oncoming portion of the stringer while the continuous tension elastically stretches the previously formed portion of the stringer. When the needles are withdrawn they allow tapes and coupling elements to elastically spring forward to assume an untensioned condition. This spring advance is just equal to the spacing between turns of the coupling elements so that the needle operation itself determines stitch length.

5 Claims, 8 Drawing Figures



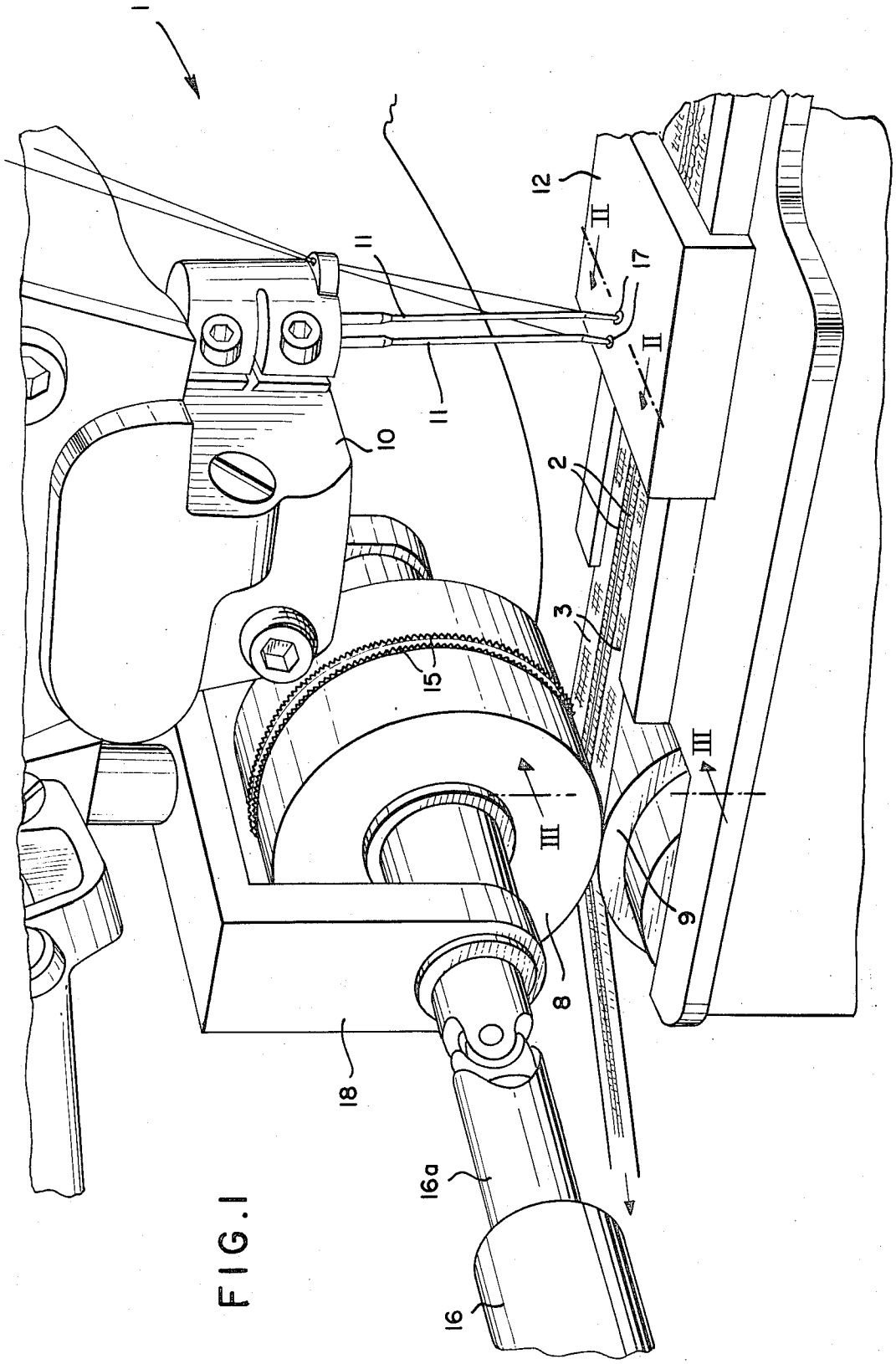
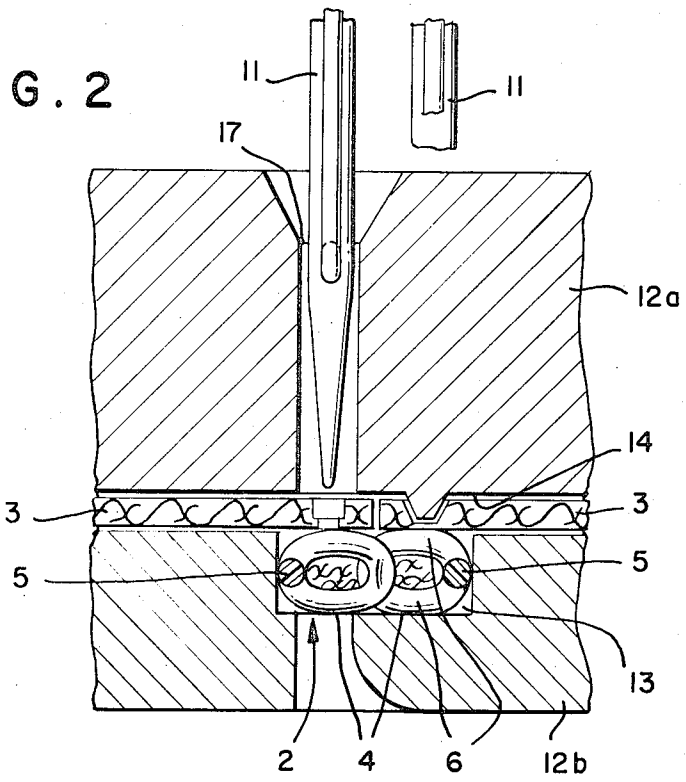


FIG. 1

FIG. 2



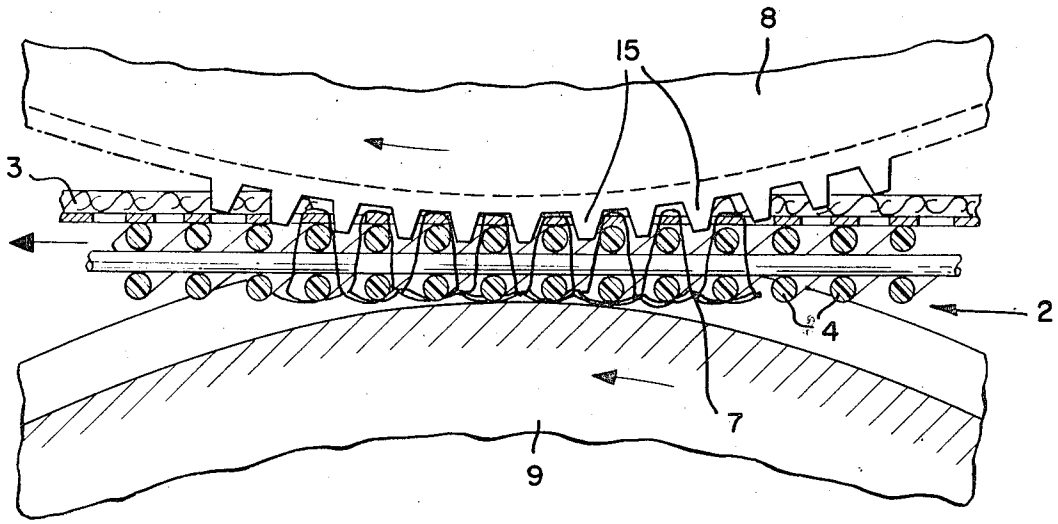


FIG. 3

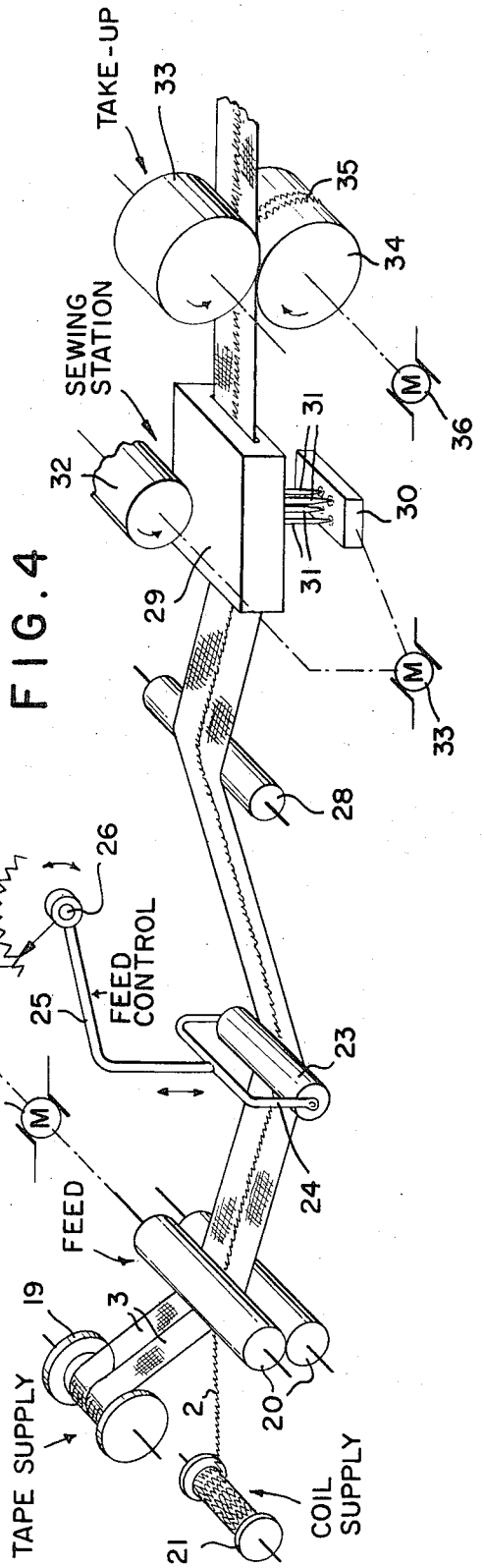


FIG. 4

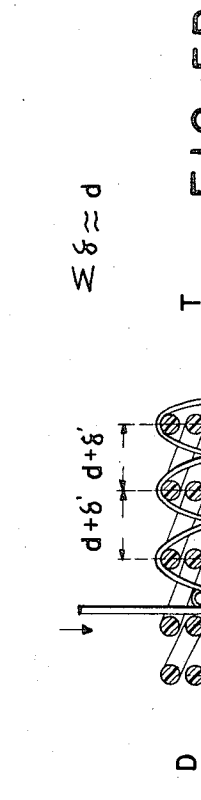


FIG. 5A

FIG. 5B

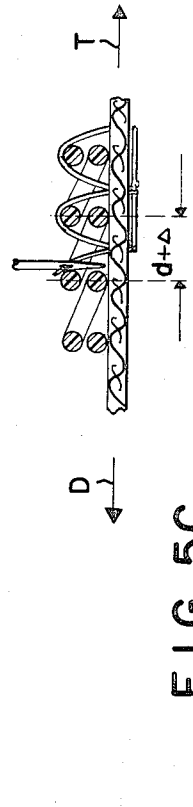


FIG. 5C

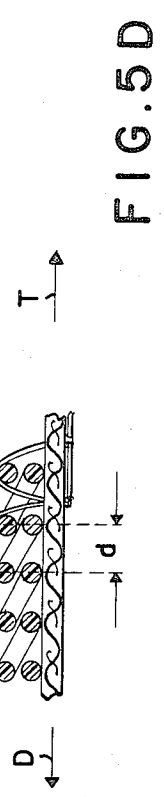


FIG. 5D

APPARATUS FOR MAKING SLIDE-FASTENER STRINGERS

FIELD OF THE INVENTION

The present invention relates to an apparatus for assembling a slide-fastener stringer. More specifically this invention concerns a sewing method and apparatus for stitching continuous coupling elements to the edge of textile support tapes in the formation of a slide-fastener stringer.

BACKGROUND OF THE INVENTION

In the manufacture of a slide-fastener stringer it is common practice to stitch continuous coupling elements, be they of the helical or meander type, to the edge of the support tapes. These coupling coils are usually made of a synthetic-resin (e.g. nylon or polyester) monofilament, and the support tapes may be made of knitted or woven fabric.

It is the customary practice to advance the juxtaposed elements and tapes through a sewing station incrementally such that, at each step, the tapes and elements are immobilized by the stepping drive, are pierced by the needles and stitched, the needles are withdrawn and the tapes and elements are only then drawn forwardly. This system is reasonably efficient for coarse slide fasteners, that is, those having a relatively large spacing between neighboring turns of the coils or neighboring coupling heads. However such an arrangement is extremely disadvantageous for closely spaced fasteners because such a stepwise advance must be carried out with a very slow speed. The rate of stitching can be rapid, but the shorter the distance covered by each stitch and advance cycle, the slower is the overall rate of advance. In general the systems for stepwise advance and synchronization thereof with the needle-reciprocation mechanism is complex and slow in operation.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved system for stitching together a slide-fastener stringer.

Another object is the provision of apparatus particularly adapted to carry out the improved method.

Yet another object is to provide an improved apparatus for assembling a slide-fastener stringer as above wherein high sewing speeds can be obtained even with fine coupling elements.

SUMMARY OF THE INVENTION

The above objects are attained according to the present invention by a system wherein the tapes and elements are pulled through the sewing station by a pair of rollers which are driven continuously. These rollers are spaced downstream of the sewing station and grip the tapes and coupling elements after they are stitched together by means of teeth having a spacing advantageously corresponding to the distance between neighboring turns or coupling heads.

According to a feature of the invention the inherent elasticity of the tapes and elements is used to advance them through the sewing station. More specifically, as the two sewing needles used to sew the pair of interleaved coupling elements to the pair of parallel tapes engage through the tapes and elements they immobilize

the tapes and elements upstream of the sewing station. The rollers continue to rotate to elastically deform that stretch of the stitched-together stringer between the needles and the rollers. As soon as the needles pull out of the stringer on completion of a pair of stitches the tension in the stringer automatically advances it by a predetermined distance through the sewing station. This predetermined distance is adjusted by means of the takeup speed to correspond to the spacing between a neighboring pair of coupling heads or a multiple thereof. Thus the needles automatically and without motion-synchronization establish the requisite spacing.

DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a perspective view showing the machine according to the present invention;

FIGS. 2 and 3 are sections taken along lines II — II and III — III of FIG. 1, respectively;

FIG. 4 is a largely diagrammatic and perspective view of another embodiment of the present invention; and

FIGS. 5A – 5D are diagrams illustrating the principles of the present invention.

SPECIFIC DESCRIPTION

FIGS. 1 – 3 show a sewing machine 1 for stitching coupled together coupling elements 2 onto the edges of textile support tapes 3. The elements 2 are made of a generally helical synthetic-resin monofilament having coupling heads 4 connected via shanks 6 to connecting portions 5. The shanks 6 lie one over the other in a plane orthogonal to that of the tapes so that a clear gap is defined between each coil turn 4, 5, 6 and its neighbor. The elements 2 are stitched to the tapes by means of double-locked stitches 7 of Class 400 as defined in Federal Standard No. 751*a*. The system may, of course, be of the one-needle or two-needle (per coupling element) type, with the advance of the coupling heads being controlled accordingly.

The sewing apparatus 1 comprises withdrawal rollers 8 and 9 for the stringer. In addition there is provided at a sewing station a sewing head 10 carrying sewing needles 11 which can pierce the tapes 3 between turns of the elements 2 as they pass through a bridge or guide 12. This positioning guide 12 is formed with a guide passage 13 and a guide surface 14 for the coils 2 and tapes 3, respectively. Advantageously the bridge 12 is made of a pair of machined plates 12*a* and 12*b*, formed with a groove constituting passage 13 and with the surface 14 respectively. The upper plate 12*a* is formed with needle guide holes 17 that are flared at the top and several times longer than they are wide. The loopers for the needles 11 are situated under the guide 12 in the usual manner. Holes 17 constitute passages for guiding the needles and are a multiple of the needle thickness in height and also of a height which is a multiple of the height of the coupling element.

FIG. 3 shows that the roller 8 is provided with staggered rows of teeth 15 which can seat in the tapes 3 and engage between the shanks 6 for positive transport of the stringer. This roller 8 is driven by a variable speed transmission shaft 16 through a drive shaft 16*a* and is mounted on a downwardly biased fork 18.

The tapes 3 and elements 2 are under slight tension, here produced by feeding them up to the apparatus 1 from a supply located below this machine. In this manner the continuously rotating rollers 8 and 9, the latter idling, will stretch that portion of the tapes 3 and elements 2 extending between the sewing bridge 12 and the rollers 8 and 9. As soon as the needles 11 pull out of the stringer a stretch transport or snapping-back will take place to advance that portion of the stringer in the guide 13 and surface 14 by the distance of one stitch. The dimensions of the holes 17 prevent long-term deformation of the needles 11. It has been found that the correct rotation speed for the roller 8 may be controlled by means of the variable speed transmission to make adjustment of stitch length a simple operation. The drive for the sewing head 10 is set to run at its fastest speed and the variable-speed transmission of shaft 16 is adjusted to pull the stringer positively through the sewing station to make the stitch length correspond to the spacing between neighboring turns of the elements 2. Of course the thread tension will have some effect on the stitch length, at the beginning of a new stringer, as will the tension in the tapes and cords downstream of the sewing apparatus. However once the machine has operated for a few moments the stringer stretch downstream of the sewing station will be tensioned sufficiently to overcome the upstream tensioning and a static condition will result. The coupling elements in FIGS. 2 and 3 are shown to have a filler cord.

FIG. 4 shows another embodiment of the present invention wherein a pair of tapes 3 are pulled off a spool 19 by a pair of rollers 20 along with a pair of interleaved coupling elements 2 from a spool 21. A motor 22 drives the rollers 20 which grasp the tapes 3 and elements 2 tightly. A weighted roller 23 is carried on a fork 24 at the end of an arm 25 pivoted at 26. This arm 25 is linked to a potentiometer 27 that controls the speed of motor 22 as will be described below.

Downstream in transport direction T is a guide roller 28 followed by a guide 29 essentially identical to the guide 12 except that the holes 17 are formed in a member underlying the tape. Below the guide 29 is a needle bar 30 carrying four needles 31 which cooperate with a double gripper-looper 32 above the guide 29. A motor 33 drives these sewing devices 30 and 32 to form a double-needle double-locked stitch of Type 402, with the looper threads lying against the tapes 3 and the needle threads overlying the coil turns. Downstream of the sewing station are a pair of takeup rollers 33 and 34, the lower one of which is formed with teeth 35 that engage between the coil turns. A motor 36 is coupled to both rollers 33 and 34 to turn them synchronously at the same speed.

The tension upstream of the guide 29 is determined by the speed at which the rollers 20 are rotated. This speed is in turn determined by the potentiometer 27 through the motor 22. Since the angular position of the arm 25 is determined by the upstream tension, as the roller 23 rises the motor 22 is speeded up, and as it sinks it is slowed down. In this manner the upstream tension in the tapes 3 and elements 2 is always within certain limits. The sewing machine 29–32 and the takeup rollers 33 and 34 have their own independent drives so that all of the various advance and stitching speeds can be adjusted independently.

A fastener having a spacing between the coils equal to 3 millimeters can be stitched by a sewing device capable of making 100 stitches per minute at a rate of 30 centimeters per minute. Obviously it is merely necessary to drive the rollers 33 and 34 at this rate, once the machine has run for a moment the downstream tension will exceed the upstream tension to create a balanced condition wherein even stitching will be carried out. In an apparatus such as that of FIGS. 1 – 3 where the rollers 8 and 9 are located some 15 centimeters downstream of the needles 11, the percentage of stretch imparted to the tapes 3 and coils 2 will be in the order of 1.67 percent. This is a nominal amount that will not damage the stringer. In addition the needles, being buttressed by the guides which are much longer than the needles are thick, will not be bent laterally to any significant extent.

In FIGS. 5A – 5D, the principles of the invention are shown in somewhat greater detail. In FIG. 5A, the leading unstitched coupling turn has just sprung past the needle position and has assumed its normal interturn spacing d, the needle commencing its downward stroke. When the needle pierces the tape, it retains the new leading unstitched turn while the balance of the stringer is stretched by a distance $\Sigma\,\delta = \delta + \delta' + \delta''$ etc. The major portion of this stretch $\Sigma\,\delta \approx d$ is concentrated at Δ (FIG. 5C at which the spacing is $d + \Delta$). When the needle is again withdrawn (FIG. 5D), the stringer springs ahead by this distance $\Delta \approx d$.

We claim:

1. An apparatus for assembling a slide-fastener stringer comprising:

means for feeding a pair of interdigitated coupling elements and a pair of textile support tapes to a sewing station;

a pair of needles at said station engageable through said tapes between turns of said elements;

means for reciprocating said needles through said tapes for sewing said elements to said tapes and thereby forming a stringer;

a pair of juxtaposed rollers downstream of said station, at least one of said rollers being formed with teeth engageable with said stringer, said stringer passing between said rollers;

means for continuously rotating at least one of said rollers to pull said stringer from said station; and

a variable-speed transmission for adjusting said means for rotating said rollers independently of said means for reciprocating said needles, thereby elastically stretching said elements and said tapes during passage of said needles through said tapes and permitting said tapes and elements to spring forward upon disengagement of said needles from said tapes substantially to the extent that the tapes and elements were previously stretched.

2. The apparatus defined in claim 1 wherein said coupling elements are coils and said teeth are spaced apart by a distance equal to the spacing between neighboring turns of said coils, whereby said teeth may mesh with said coils.

3. The apparatus defined in claim 2 wherein said teeth are arranged in a pair of staggered rows.

4. The apparatus defined in claim 1, further comprising a guide bridge formed with a guide passage for said coils and tapes and with at least two holes opening into said guide passage, said needles being reciprocal in said holes, said holes being of substantially greater length than width.

5. The apparatus defined in claim 4 wherein said holes are of a length substantially greater than the needle thickness.

* * * * *