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APPARATUS FOR SHAPING COILEDSLIDE FASTENER COUPLING ELEMENTS

The present invention relates to an apparatus for shaping a row of helically coiled slide fastener coupling elements containing a core thread extending through a longitudinal space defined in the coupling elements.

5 Japanese Patent Publication No. 46-1132 published on January 12, 1971 and U. S. Patent No. 4,002,278 issued on January 11, 1977 discloses methods of and apparatus for shaping a filamentary material into a row of helically coiled coupling elements in which a core thread is supplied
10 to a shaping position at a rate greater than the rate at which the coupling elements are formed, or it is fed positively to the shaping position while it is protected from being subjected to an excess back tension or reverse-ly directed force, whereby the core thread as received in
15 the coiled coupling elements becomes slightly slacken between adjacent ones of the coupling elements for cancel-ling out its shrinkage when the coupling elements are sewn to a slide fastener stringer tape. According to

such known methods and apparatus, however, the core thread is not stretchable enough to cancel or taken out such shrinkage. The coupling elements containing such core thread cannot be secured to the tape stably in position and is likely to become wavy. Further, the prior methods and apparatus have been found insufficient to control a degree of stretchability of the core thread as received in the coupling elements and maintain such stretchability at a constant rate throughout the length of the core thread.

According to the invention, there is provided an apparatus for shaping a row of helically coiled continuous coupling elements defining therein a longitudinal space receiving therein a continuous core thread, each coupling element having a pair of spaced legs, said apparatus comprising a mandrel adapted to wind thereon the coiled coupling elements and having a longitudinal groove for the passage therethrough of the core thread; and a pair of externally threaded cylindrical screw members disposed parallelly on opposite sides of said mandrel in lateral alignment with the same and corotatable in a common direction to feed the coupling elements and the core thread longitudinally from one end to the opposite end thereof, each said screw member having a cylindrical shank and a continuous helical thread on said shank to define therebetween a helical groove for

receiving therein one leg of each pair of spaced legs of the coupling elements, characterized in that each said screw member includes at said one end a first portion having a first pitch larger than a predetermined pitch of the coupling elements as shaped, at
5 said opposite end a second portion having a second pitch substantially equal to said predetermined pitch, and a third portion between said first and second portions, gradually reducing in pitch in a direction
10 from said one end to said opposite end.

It is possible by means of the present invention to provide an apparatus for shaping a row of helically coiled slide fastener coupling elements in which a core thread disposed longitudinally in the coiled
15 coupling elements is squeezed by the coupling elements as shaped so as to have a certain degree of stretchability which corresponds to the shrinkage of the core thread when the coupling elements are sewn to a slide fastener stringer tape.

20 It is also possible by means of the present invention to provide an apparatus having means for controlling the stretchability of a core thread and maintaining the same at a constant rate throughout the length of the core thread.

25 The invention will be described by way of example with reference to the accompanying drawings, wherein:-

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Figure 1 is a fragmentary schematic front elevational view, partly in cross section, of a portion of an apparatus for manufacturing a row of helically coiled slide fastener coupling elements, the said portion incorporating an element shaper in accordance with the present invention;

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

Figure 3 is an enlarged fragmentary front elevational view of the element shaper;

Figure 4 is a cross-sectional view taken along line IV-IV of Figure 3;

Figure 5 is a schematic front elevational view of one externally threaded cylindrical screw member of the element shaper; and

Figure 6 is an enlarged fragmentary front elevational view of a row of helically coiled coupling elements as it is being shaped by the element shaper.

As shown Figure 1, an apparatus for continuously manufacturing a row of helically coiled continuous slide fastener coupling elements comprises a coiling machine

10 and a coupling element shaper 11 in accordance with the present invention.

The coiling machine 10 includes a mandrel holder 12 supported on a frame 13 and supporting a coaxial
5 mandrel 14. The mandrel holder 12 has a through-hole 15 for the passage therethrough of a core thread 16 made for example of a textile material. As shown in Figure 4, the mandrel 14 has a generally C-shaped cross section and includes a longitudinal groove 17 for receiving therein
10 the core thread 16, the groove 17 communicating at one end with the through-hole 15 (Figure 1) in the mandrel holder 12.

As shown in Figure 1, a tension control unit 18 is disposed upstream of the mandrel holder 12 for controlling
15 a tension on the core thread 16. The unit 18 includes a pair of guide and press rollers 19, 20 rotatably supported on the frame 13. The core thread 16 is wound in one turn around the guide roller 19 and the press roller 20 is normally urged against the guide roller 19.
20 As shown in Figure 2, the guide roller 19 has a circumferential groove 21 for receiving therein a loop or one turn of the core thread 16. The roller 19 is rotatably mounted on a collared shaft 22 journaled on a bracket 23 secured to the frame 13 (Figure 1) with a pair of friction
25 discs or rings 24, 25 disposed one on each side of

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the roller 19. The disc 24 is interposed between the roller 19 and the bracket 23 and the disc 25 is interposed between the roller 19 and a flange or collar 26 of the shaft 22, a ring washer 27 being interposed between the disc 25 and the collar 26. The shaft 22 has an externally threaded portion 28 extending from the collar 26 away from the roller 19 and a nut 29 is threaded over the portion 28. A cup-shaped spring case 30 is secured to an end of the shaft 22 remote from the threaded portion 28 by means of a bolt 31 threaded into an internally threaded bore 32 in the shaft 22. A compression spring 33 is fitted over the shaft 22 and acts between the case 30 and the bracket 23 to urge the shaft 22 toward a direction indicated by the arrow D, thereby bringing the parts 24, 19, 26 and 27 into pressed engagement with one another between the bracket 23 and the collar 26. Such pressed engagement causes the guide roller 19 to rotate under a constant braking force. Thus the core thread 16 is subjected to a uniform tension while it is passing around the guide roller 19 rotating under the constant braking force. The braking force can be adjusted by replacing the spring 33 with another spring having a different spring constant.

The coiling machine 10 shown in Figure 1 also includes a coiling rotor 34 rotatably mounted on the

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frame 13 for coiling a thermoplastic filamentary material 35 around the mandrel 14 into a row of successively formed helical coupling elements 36. The helically coiled coupling elements 36 thus formed define a space 37 (Figures 4 and 6) extending longitudinally therethrough for receiving therein the core thread 16, each coupling element 36 having a pair of spaced legs 38,39 (Figure 4) between which the core thread 16 extends. The coupling elements 36 are then introduced into the coupling element shaper 11.

As shown in Figures 1 and 3, the coupling element shaper 11 includes a pair of externally threaded cylindrical screw members 40,41 disposed parallelly on opposite sides of the mandrel 14 in lateral alignment with the same, the mandrel 14 also constituting a part of the coupling element shaper 11. The screw members 40,41 are connected to a driving mechanism (not shown) for being driven to corotate in a common direction indicated by the arrows A and B, thereby feeding the coiled coupling elements 36 longitudinally in a direction of the arrow C together with the core thread 16 disposed in the longitudinal space 37 (Figures 4 and 6) in the coupling elements 36. Each of the screw members 40,41 includes a cylindrical shank 42 and a continuous helical thread 43, there being defined a helical groove 44 between the shank

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42 and the thread 43. As better shown in Figure 4, the screw members 40,41 are spaced from each other such that one leg 38 or 39 of each pair of the spaced legs 38,39 of the coupling elements 36 is received in the groove 44 in the corresponding screw member 40 or 41.

As shown in Figure 3, each screw member 40,41 includes, at one end from which the helically coiled coupling elements 36 are successively introduced into the helical groove 44, a first portion 45 having a pitch P_1 larger than a predetermined pitch P (Figure 6) of the coupling elements 36 which has been shaped by the coupling element shaper 11. At the opposite end thereof, the screw member 40,41 includes a second portion 46 having a pitch P_2 substantially equal to the predetermined pitch P of the coupling element 36 as shaped. The screw member 40,41 further has a third portion 47 between the first and second portions 45,46, gradually reducing in pitch P_3 in a direction from said one end to the opposite end. The threads 43 are substantially square shaped and, in the first and second portions 45,46, have uniform widths W_1, W_2 , respectively. In the third portion 47, the threads 43 vary in width W_3 to reduce gradually in a direction from the first portion 45 to the second portion 46. The width W_1 is larger than each of the widths W_2 and W_3 . The helical grooves 44,44 have a uniform width W_4 throughout the

length of the respective screw members 40,41. As shown in Figure 5, the second portion 46 is longer than each of first and third portions 45,47 for accurate shaping of the coupling elements 36. The first portion 45 is longer than the third portion 47.

As shown in Figure 4, a heating means 48 (indicated by dash-and-dot lines) is disposed over at least the second portions 46,46 of the screw members 40,41 to heat-set the helically coiled coupling elements 36 while the latter is being shaped by the screw members 40,41.

Operation of the apparatus thus constructed is as follows: The thermoplastic filamentary material 35 is continuously wound by the rotor 34 around the mandrel 14 into a row of helically coiled coupling elements 36. At the same time, the core thread 16 is continuously fed around the guide roller 19 through the hole 15 into the groove 17 in the mandrel 14 and hence is inserted into the longitudinal space 37 in the formed coupling elements 36. The coupling elements 36 wound on the mandrel 14 are successively introduced in the helical grooves 44,44 in the screw members 40,41 which are rotating in the direction of the arrows A and B, and then they are fed by the screw members 40,41 in the direction of the arrow C with one leg 38 or 39 of each pair of spaced legs 38,39 of the coupling elements 36 is received in one of the

grooves 44,44 of the corresponding screw member 40 or 41 (Figure 4). The core thread 16 which is received in the groove 17 in the mandrel 14 between the legs 38 and the mandrel 14 is fed in the direction of the arrow C as the coupling elements 36 are fed by the screw members 40,41.

The coupling elements 36 while advancing through the first portions 45,45 of the screw members 40,41 is shaped to have a pitch which corresponds to the pitch P_1 of the first portions 45,45.

Due to the third portions 47,47 varying in pitch P_3 to reduce gradually in the direction of the arrow C, the coupling elements 36 are shaped to have correspondingly varying pitches while they are fed through the third portions 47,47. During that time, the core thread 16 is compressed or squeezed as at 16a of Figure 6 by adjacent legs 38 or 39 in the longitudinal direction thereof to gradually reduce its length and simultaneously to increase its thickness and width.

The coupling elements 36 are finally shaped and heat-set to have the pitch P while they pass through the heated second portions 46,46 having the pitch P_2 substantially equal to the pitch P. During that time, the core thread 16a is squeezed as at 16b of Figure 6. The core thread 16 has now been reduced its length by a distance $(P_1 - P_2)$ and simultaneously increased its thickness and

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width. The core thread 16b thus squeezed is stretchable to such an extent corresponding to the distance (P_1-P_2) so as to take out its shrinkage when the coupling elements 36 are sewn to a slide fastener stringer tape (not shown). The amount of squeezing or the stretchability of the core thread 16b is uniform throughout the entire length thereof and can be varied by changing the distance (P_1-P_2) . Fine adjustment of the stretchability can be achieved by controlling the braking force on the roller

10 19.

With the above-described arrangement, the core thread has a certain degree of stretchability which corresponds to its shrinkage when the coupling elements are sewn to the slide fastener stringer tape.

15 Such degree of stretchability can be controlled by the screw members having the respective third portions varying in pitch to gradually reduce in a direction from one end to the opposite end of the screw members. The second portions of the respective screw members, which are contiguous to the third portions and have a uniform pitch,

20 maintain the stretchability of the core thread at a constant rate throughout the entire length thereof. The coupling element shaper is simple in construction, reliable in function and easy to maintain.



Claims:-

1. An apparatus for shaping a row of helically coiled continuous coupling elements defining therein a longitudinal space receiving therein a continuous core thread, each coupling element having a pair of spaced legs, said apparatus comprising:

(a) a mandrel adapted to wind thereon the coiled coupling elements and having a longitudinal groove for the passage therethrough of the core thread; and

(b) a pair of externally threaded cylindrical screw members disposed parallelly on opposite sides of said mandrel in lateral alignment with the same and corotatable in a common direction to feed the coupling elements and the core thread longitudinally from one end to the opposite end thereof, ~~each~~ said screw member having a cylindrical shank and a continuous helical thread on said shank to define therebetween a helical groove for receiving therein one leg of each pair of



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- 5 spaced legs of the coupling elements, said screw member including at said one end a first portion having a first pitch larger than a predetermined pitch of the coupling elements as shaped, at said opposite end a second portion having a second pitch substantially equal to said predetermined pitch, and a third portion between said first and second portions, gradually reducing in pitch in a direction from said one end to said opposite end.
- 10 2. An apparatus according to claim 1, said second portion being longer than each of said first and third portion.
3. An apparatus according to claim 2, said first portion being longer than said third portion.
4. An apparatus according to claim 1, said threads being substantially square shaped.
- 15 5. An apparatus according to any preceding claim, said helical groove having a uniform width



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throughout the length of said screw member.

6. An apparatus according to any preceding claim, wherein means is disposed upstream of said mandrel for controlling a tension on the core thread, said tension
5 control means including a pair of rollers normally urged against each other, one of said roller being adapted to wind therearound the core thread in one turn, and means associated with said one roller for applying a braking force to said one roller while
10 said one roller is being rotated.

7. An apparatus according to claim 6, said applying means including a pair of friction discs disposed one on each side of said one roller, and a spring urging said friction discs and said one roller
15 into pressed engagement with one another.

8. An apparatus according to claim 7, said tension control means including a fixed bracket, a shaft



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journalled on said bracket and having a collar at one end thereof, and a spring cover secured to the opposite end of said shaft, said one roller and said friction discs being rotatably mounted on said shaft between said bracket and said collar, said spring being disposed on said shaft between said cover and said bracket and urging said one roller and said friction discs into pressed engagement with one another between said bracket and said collar.
