

SPECIFICATION

Slide fastener stringer

5 The present invention relates to a slide fastener stringer including a stringer tape and a series of fastener coupling elements sewn to the tape along one longitudinal edge thereof by utilizing multi-thread chain stitch or "double locked stitch".

10 In sewing a series of fastener coupling elements to a stringer tape for a slide fastener, one of the most widely used stitch types is multi-thread chain stitch or "double locked stitch", which is formed with two or more sewing threads, i.e. needle and looper threads. It has been customary to use a spun or multifilament yarn for either the needle thread or the looper thread, for such non-monofilament yarns are flexible and less stretchable and hence enable the fastener elements to be sewn to the tape tightly on a high-speed sewing machine without breakage of a sewing needle.

25 A common problem encountered with such prior art slide fastener stringer is that, because the material and fabric structure of modern stringer tapes are usually of the type having less frictional resistance, the sewing threads are liable to become loose at their cut end portions which have been cut as the fastener stringer of a continuous length has been severed into a slide fastener length. With this arrangement, when the opposed stringer tapes are laterally pulled at one end in opposite directions during threading of a pair of the interengaged fastener stringers through a slider, the extreme one or two or even more of the fastener elements on each tape may be easily displaced. Consequently, it may be difficult or sometimes impossible to mount the slider onto the interengaged fastener stringer.

U.S. Patent No. 3,783,476 discloses a slide fastener stringer having a row of fastener elements secured to a stringer tape by means of a single-needle double locked stitch formed with needle and looper threads, of which only the needle thread includes a monofilament yarn. The needle thread is disposed on the fastener-element side of the slide fastener stringer, and hence, the stitching must be done from that side. This requires a specially designed guide means to support the slide fastener stringer such that the surface of the stringer tape on which the fastener elements are to be attached faces upwardly during sewing operation. With this arrangement, a sufficient degree of tightness of the stitching is difficult to achieve. Further, because the fastener elements are held, against the stringer tape, by the monofilamentary needle thread and both the fastener elements and the needle thread have less frictional resistance, the needle thread is liable to slip on the fastener elements and hence is not likely to

keep the fastener elements stably in position on the tape. Moreover, the looper thread projects from the tape surface so that a slider is likely to wear out the looper thread.

70 U.S. Patent No. 3,768,125 discloses another slide fastener stringer having a row of fastener elements secured to a stringer tape by means of single-needle double locked stitch formed with needle and looper threads each consisting of a monofilament yarn. Such prior art slide fastener stringer has not sufficient degree of flexibility, which is one of the most important factors for slide fasteners, partly because monofilament yarns have rigidity by nature and partly because loops of the monofilamentary looper thread extend across and over the fastener elements. Further, because the fastener elements are held, against the stringer tape, by the monofilamentary looper thread and both the fastener elements and the monofilamentary looper thread have less frictional resistance, the needle thread is liable to slip on the fastener elements and hence is not likely to keep the fastener elements stably in position on the tape.

According to the invention there is provided a slide fastener stringer comprising:

- (a) a stringer tape having a pair of opposite surfaces;
- 95 (b) a series of fastener elements disposed on one of the opposite surfaces of said stringer tape along a longitudinal edge thereof; and
- (c) sewing stitches securing said fastener elements to said tape and formed with at least one needle thread and a looper thread, said needle thread comprising a thermoplastic monofilament yarn and having loops each passing through said tape from the other surface thereof and extending through a space between adjacent two of said fastener elements, said looper thread comprising a non-monofilament yarn and having loops extending across and over said fastener elements, said needle thread being interlaced and interlooped with said loops of said looper thread;
- (d) said needle thread, after stitching of said fastener elements to said tape, having been heat-set to become dimensionally stable;
- 115 (e) characterised by each of said loops of said needle thread having a constricted portion engaging with said loops of said looper thread.

The invention will be described by way of example with reference to the accompanying drawings in which preferred embodiments of the present invention are shown by way of example, and in which:—

Figure 1 is a fragmentary top plan view of a pair of interengaged slide fastener stringers each embodying the present invention;

Figure 2 is an end elevation of the slide fastener stringers of Fig. 1;

Figure 3 is a fragmentary cross-sectional view taken along line III-III of Fig. 1;

Figure 4 is a fragmentary cross-sectional view taken along line IV-IV of Fig. 1;

Figure 5 is a fragmentary perspective view of sewing stitches of Figs. 1-4, showing the formation of needle and looper threads;

Figure 6 is a side elevational view of a loop of the needle thread;

Figure 7 is a top plan view of the needle thread loop of Fig. 6;

Figures 8 and 9 illustrate the manner in which the pair of interengaged slide fastener stringers of Fig. 1 is threaded through a slider;

Figure 10 is a transverse cross-sectional view of a slide fastener stringer according to a second embodiment;

Figure 11 is a longitudinal cross-sectional view of the slide fastener stringer of Fig. 10;

Figure 12 is a cross-sectional view similar to Fig. 10 but showing a slide fastener stringer according to a third embodiment;

Figure 13 is a fragmentary plan view of a slide fastener stringer according to a fourth embodiment;

Figure 14 illustrates various examples of cross-sectional shape of the needle thread; and

Figures 15 and 16 are comparative cross-sectional views illustrating looper thread under varying tension.

The present invention is particularly useful when embodied in a slide fastener assembly (hereinafter referred to as "slide fastener") such as shown in Figs. 1-4, generally indicated by the numeral 21.

The slide fastener 21 comprises a pair of fastener stringers 22, 23 including a pair of stringer tapes 24, 25, respectively, each supporting on and along one longitudinal edge thereof a series of fastener elements 26 in the form of a continuous filamentary coil made of a thermoplastic synthetic resin. Each series of fastener elements 26 is secured to one of the tapes 24, 25 by means of sewing stitches.

The type of the sewing stitches is multi-thread chain stitch or "double locked stitch", which is formed with a needle thread 27 and a looper thread 28. Each of the fastener elements 26 has a pair of spaced upper and lower legs 29, 30, and a coupling head 31 extending therebetween. The lower leg 30 of each fastener element lies on the top surface 33 (Figs. 2 and 3) of the stringer tape 24, 25 and is connected to the upper leg 29 of a preceding or succeeding one of the fastener elements 26 by a connecting portion 32, the upper element leg 29 being spaced away from the same tape surface 33. A core 34 in the form of a textile cord extends longitudinally through the series of fastener elements 26 and is held by the needle thread 27 against the connecting portions 32 in the interior of the fastener elements 26.

The needle thread 27 consists of a monofilament yarn made of a thermoplastic synthetic

resin such as nylon. The looper thread 28 consists of a non-monofilament yarn, i.e. a multifilament or spun yarn, which is made of a synthetic resin such as polyester.

As shown in Fig. 3, the needle thread 27 has loops 35 each passing through the tap 24, 25 from the underside thereof and extending through a space between adjacent two of the fastener elements 26, each of the needle thread loops 35 having a constricted portion 35a (Figs. 5 and 6). The loops 35 of the needle thread 27 are interlaced and interlooped with the looper thread 28 such that those interlacings and interloopings 37 are located between adjacent element legs 29. One (36) of adjacent two loops 36, 36b of the looper thread 28 extends across and over the upper element leg 29 adjacent thereto and around the constricted portion 35a of the needle thread loop 35. The other looper thread loop 36a is interlaced with that needle thread loop 35 so as to be disposed above said one looper thread loop 36. One end of the loop 36 is blended into one end of a preceding loop 36a through a connecting portion 36b, and the other end of the loop 36 is blended into the other end of a succeeding loop 36a through a connecting portion 36b. The connecting portion 36b extends through the corresponding one of the needle thread loops 35 so as to be disposed therein in intimate contact with the looper thread loop 35a. As shown in Figs. 3 and 4, the looper thread loop 36, which extends around the constricted portion 35a, is interposed between the looper thread loop 36a and the core 34. Thus, the constricted portion 35a serves to keep the looper thread loop 36 from becoming loose. The looper thread loop 36a and the connecting portion 36b extends so as to be disposed closely in the needle thread loop 35 so that the loop 36a is not likely to become loose. Further, the individual needle thread loops 35 extend upwardly beyond the topmost surfaces 36a (Fig. 4) of the looper thread 28 by a predetermined distance l (Fig. 4) so that a slider 44 (Fig. 2) is not likely to wear out the looper thread 28. The distance l is equal to the diameter of the needle thread 27 at the maximum. And the minimum value for the distance l may be nil; that is, the topmost surfaces 35b of the needle thread 35 may be flush with those of the looper thread 28.

These structural features can be effected by selecting a particular degree of tension F of the looper thread 28 and a particular degree of tension f of the needle thread 27 in stitching. As is well known in the art, if the looper thread 28 is tensioned less strongly (under the tension F') while the needle thread 27 is tensioned strongly (under the tension f'), such that looper thread portions 28a, 28b, 28c on the upper element leg 29 are arranged in the fashion illustrated in Fig. 15, the interlacings

and interloopings 37 are retracted toward the tape 24, 25 causing the surface 35b of the needle thread loops 35 to be lowered below the surfaces 36c of the looper thread 28.

- 5 Conversely, if the looper thread 28 is tensioned strongly (under the tension F'') while the needle thread 27 is tensioned less strongly (under the tension F'), such that the looper thread portions 28a, 28b, 28c are now
10 arranged in the fashion illustrated in Fig. 16, the interlacings and interloopings 37 and hence the surfaces 35b of the needle thread loop 35 are raised above the surfaces 36c of the looper thread 28. And, such required
15 degree of tension F , f for the looper thread 28 and the needle thread 27 are defined by the following inequalities:

$$\begin{aligned} F'' &> F > F' \\ 20 \quad f' &> f > f'' \end{aligned}$$

As shown in Fig. 7, the individual needle thread loop 35 has a widened portion 35c.

- After stitching of the fastener elements 26 to the stringer tape 24, 25 as described above, the needle thread 27, which consists of a thermoplastic monofilament yarn, has been heat-set by applying a heated medium, for instance, during a dyeing process. As a
30 result, the needle thread 27 has become dimensionally stable; that is, the bent configurations 35a, 38, 39 (Figs. 3 and 4) of the needle thread 27 are maintained against further dimensional change, thereby preventing
35 the needle thread 27 as well as the looper thread 28 from becoming loose at the cut end portions 40, 41 of the slide fastener stringers 22, 23, respectively.

- More specifically, in case the needle thread 40 27 has been cut such that its cut end 42 point upwardly (Fig. 4), the needle thread 27 is not likely to become loose because the bent configuration 38 of the needle thread 27 is kept in stable. In case the needle thread 17 has been cut such that its cut end 43 point downwardly (Fig. 3), the looper thread 28 is held at its cut end portion by the extreme
45 needle thread loop 35 of which bent configuration 35a, 39 would not change. Accordingly, the extreme one or two of the fastener elements 26 can be prevented nicely from being separated apart from the tape 24, 25, no matter where the cut end of the stringer 22, 23 is located.

- 55 The interengaged slide fastener stringers 22, 23 thus constructed can be threaded through the slider 44 (Figs. 8 and 9) from its rear end mouth 45 with maximum ease. In such threading, the interengaged slide fastener stringer 22, 23 are inserted into the
60 slide from the rear end mouth 45 thereof until the leading end of the interengaged rows of fastener elements 26 reaches just in front of a slider neck 46, as shown in Fig. 8. At that
65 time, the opposed stringer tapes 24, 25 are

gripped at their respective leading ends by the fingers. Then, the opposed stringer tapes 24, 25 are pulled in the directions indicated by arrows 47, 48 (Fig. 8), respectively, to disengage the mating of the opposed rows of fastener elements 16 at their leading end portions, as shown in Fig. 9.

- Subsequently, the opposed stringer tapes 24, 25 are pulled beyond the front end 51 of the slider 44 in the directions of arrows 49, 50, respectively. Thus, the mounting of the slider 44 onto the interengaged slide fastener stringers 22, 23. During this threading operation, the extreme one or two of the fastener elements 26 on each tape 24, 25 are kept stable in position even when relatively great pulls (47, 48) act on the opposed stringer tapes 24, 25.

- According to an embodiment of Figs. 10 and 11, each fastener element 26 has a groove 52 extending across its upper leg 29, and the looper thread portions 28a, 28b, 28c are received in the groove 52 and is kept in stable. According to an embodiment of Fig. 90 12, the upper leg 29 of each fastener element 26 has corrugations 53 for receiving the looper thread portions 28a, 28b, 28c, one in each corrugation. Given such groove 52 or corrugations 53, it is possible to minimize the
95 thickness H (Fig. 11) of the slide fastener stringers 22, 23.

According to the embodiment of Fig. 13, the lockstitching is formed with two needle threads 54, 55 and one looper thread 28.

- 100 To obtain an increased degree of frictional resistance, the needle thread 27 may be of a noncircular cross section, such as ellipse (a), triangle (b), square (c) or rectangle (d) (Fig. 14).
105 In any one of the embodiments described above, the needle thread 27 is disposed on the tape side of the slide fastener stringer 22, 23, while the looper thread 28 is on the fastener-element side. With such an arrangement, the slide fastener stringer can be guided in such a manner that the surface 33 of the stringer tape 24, 25 on which the fastener elements 26 are to be attached faces downwardly during stitching. This requires no
115 specially designed guide means and hence no expensive and complicated sewing machine.

CLAIMS

1. A slide fastener stringer comprising:
 - 120 (a) a stringer tape having a pair of opposite surfaces;
 - (b) a series of fastener elements disposed on one of the opposite surfaces of said stringer tape along a longitudinal edge
 - 125 thereof; and
 - (c) sewing stitches securing said fastener elements to said tape and formed with at least one needle thread and a looper thread, said needle thread comprising a thermoplastic
 - 130 monofilament yarn and having loops each



(16)

and interloopings 37 are retracted toward the tape 24, 25 causing the surface 35b of the needle thread loops 35 to be lowered below the surfaces 36c of the looper thread 28.

- 5 Conversely, if the looper thread 28 is tensioned strongly (under the tension F'') while the needle thread 27 is tensioned less strongly (under the tension f''), such that the looper thread portions 28a, 28b, 28c are now
- 10 arranged in the fashion illustrated in Fig. 16, the interlacings and interloopings 37 and hence the surfaces 35b of the needle thread loop 35 are raised above the surfaces 36c of the looper thread 28. And, such required
- 15 degree of tension F, f for the looper thread 28 and the needle thread 27 are defined by the following inequalities:

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As shown in Fig. 7, the individual needle thread loop 35 has a widened portion 35c.

- 25 After stitching of the fastener elements 26 to the stringer tape 24, 25 as described above, the needle thread 27, which consists of a thermoplastic monofilament yarn, has been heat-set by applying a heated medium, for instance, during a dyeing process. As a
- 30 result, the needle thread 27 has become dimensionally stable; that is, the bent configurations 35a, 38, 39 (Figs. 3 and 4) of the needle thread 27 are maintained against further dimensional change, thereby preventing
- 35 the needle thread 27 as well as the looper thread 28 from becoming loose at the cut end portions 40, 41 of the slide fastener stringers 22, 23, respectively.

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- 80 elements 26 on each tape 24, 25 are kept stable in position even when relatively great pulls (47, 48) act on the opposed stringer tapes 24, 25.

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- 125 thereof; and
- (c) sewing stitches securing said fastener elements to said tape and formed with at least one needle thread and a looper thread, said needle thread comprising a thermoplastic
- 130 monofilament yarn and having loops each



- passing through said tape from the other surface thereof and extending through a space between adjacent two of said fastener elements, said looper thread comprising a non-monofilament yarn and having loops extending across and over said fastener elements, said needle thread being interlaced and interlooped with said loops of said looper thread;
- (d) said needle thread, after stitching of
- 10 said fastener elements to said tape, having been heat-set to become dimensionally stable;
- (e) characterised by each of said loops of said needle thread having a constricted portion engaging with said loops of said looper
- 15 thread.
2. A slide fastener stringer according to claim 1, said each looper of said needle thread having a top surface disposed above top surfaces of said loops of said looper
- 20 thread.
3. A slide fastener stringer according to claim 1, said each loop of said needle thread having a top surface flush with top surfaces of said loops of said looper thread.
- 25 4. A slide fastener stringer according to claim 1, each of said fastener elements having at least one groove in its top surface for receiving said looper thread.
5. A slide fastener stringer according to
- 30 claim 1 or 4, said needle thread having a noncircular cross section.
6. A slide fastener stringer according to any preceding claim, wherein the constricted portion functions to keep the looper thread
- 35 from loosening at a cut end portion thereof.