

## SPECIFICATION

## A woven fastener stringer

5 This invention relates to a sliding clasp fastener, and more particularly to a fastener stringer having a row of successively interconnected elongated coupling element loops woven into an edge of a stringer tape during the weaving thereof by a needle loom.

10 There have been proposed a number of sliding clasp fasteners or zippers of the type described, which comprise a woven stringer tape and a plastic filament woven into a longitudinal edge of the tape, the filament being usually formed into a helical coil structure consisting of a succession of elongated loops each having a coupling head, an upper and a lower leg and a connecting portion.

15 Most of the known fasteners, however, have failed to meet with the requirements for the success of the so-called woven sliding clasp fasteners which largely depends upon the positional stability of the filament, i.e. coupling fastener element, with respect to the stringer tape against external stresses. When subjected to severe bending stresses in the transverse direction, the warp threads in particular holding the filament onto the tape are apt to shift out of place either toward the coupling head or toward the connecting or heel portion, which would in turn obstruct the movement of the slider and make it difficult to couple and uncouple the cooperating stringers.

20 According to the invention, there is provided a woven fastener stringer comprising a woven tape formed with foundation warp threads and foundation weft thread and consisting of a relatively wide web portion and a relatively narrow woven filament portion, the web portion taking up most of the width of the tape, the woven filament portion forming a longitudinal edge portion of said tape; a row of successively interconnected elongated coupling element loops woven into said filament section, each of said coupling element loops having a coupling head at one end thereof, an upper leg and a lower leg extending from said head in a common direction and a heel portion at the opposite end remote from said head connected to the next adjacent one of said successive coupling element loops; a plurality of stuffer warps extending longitudinally through said row of elongated coupling element loops; a binding weft thread extending substantially the full length of said leg between each adjacent pair of said coupling element loops; said binding weft thread being looped around said foundation weft thread; a first group of binding warp threads and a second group of binding warp threads both being interlaced with said binding weft thread substantially in a common plane defined by the upper surfaces of said upper legs, said first group of threads being further interlaced with said foundation weft thread underlying said lower legs of said loops, and one or more of said foundation warp threads in said woven filament section passing through the thickness of the tape towards

65 said upper legs and being interlaced with said binding weft thread.

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

70 Figure 1 is a plan view of enlarged scale of a portion of one of two identical fastener stringers according to one embodiment of the invention;

Figure 2 is a diagrammatic, partly sectional, perspective view of a segment of the portion of the fastener stringer shown in Figure 1;

75 Figure 3 is a view of the reverse side of the stringer shown in Figure 1;

Figure 4 is a view similar to Figure 1 but showing another embodiment of the invention; and

80 Figure 5 is a view of the reverse side of the stringer shown in Figure 4.

Referring now to Figures 1—3 inclusive, which illustrate a first preferred embodiment of the invention, there is shown a fastener stringer generally designated 10 which constitutes one part of a pair or two identical stringers for a sliding clasp fastener. The stringer 10 consists of a generally flat web portion W taking up most of the width of the tape and a woven filament portion W<sub>f</sub> forming a longitudinal tape edge portion 12 into which a filament 13 of plastics material is woven, the web portion W and the woven filament portion W<sub>f</sub> being wide and narrow respectively relative to each other. The filament 13 is formed from a linear blank of a suitable plastic material into a helically coiled structure having a succession of elongated coupling element loops. This is done during the course of weaving of the tape 11, for example in the manner disclosed in Japanese Laid-Open Publication No. 50—36250.

Each elongated coupling element loop 14 in the filament 13 has a coupling head 14a at one end thereof, an upper leg 14b and a lower leg 14c extending from the head 14a in a common direction and a heel portion 14d at the opposite end remote from the head 14a connected to the next adjacent one of the successive loops 14. The coupling head 14a is dimensioned to releasably couple with a corresponding head of a loop 14 on a mating stringer to open and close the fastener in the well known manner. The upper and lower legs 14b and 14c are spaced apart in substantially superimposed relation to each other as shown in Figures 1 and 3 and define therebetween a longitudinally extending "tunnel" or hollow conduit through which at least one stuffer warp 15 is inserted, two being shown.

115 The web portion W of the tape 11 may be of any known design having foundation warp threads 16 and foundation weft thread 17 interwoven in a variety of patterns, which will require no further explanation as this has no direct bearing upon the invention.

125 The term "filament woven portion W<sub>f</sub>" is used to define a longitudinal edge portion of the tape 11 into which the filament 13 serving as a coupling element for a sliding clasp fastener is woven. In addition to the foundation warp threads

and foundation weft thread in the filament woven portion  $W_f$ , there are provided a first group of binding warp threads 18 and 19 and a second group of binding warp threads 20 and 21 and a continuous binding weft thread 22 cooperating with the binding warp threads 18—21 in binding or anchoring the filament 13 firmly in place on the stringer tape 11. The binding warp threads 18—21 extend longitudinally of the tape 11 in parallel relation to one another and in interlaced relation to the binding weft thread 22. The threads 18—21 all overlie the upper legs 14b of the loops 14. The first group of binding warp threads 18 and 19 extend along a relatively deep undulation path, while the second group of binding warp threads 20 and 21 extend along a relatively shallow undulation path, as better shown in Figure 2, for reasons hereafter explained.

Each of the successive loops 14 of the coupling filament 13 had its lower leg 14c secured by the foundation warp threads 16, 16' and weft 17 onto the woven filament portion  $W_f$ . To further stabilize the positioning of the lower leg 14c to the tape 11, the foundation weft 17 is interlaced with the first group of binding warp threads 18 and 19 in the "inter-leg" spaces 24 between each pair of elongated loops 14 and in a plane defined commonly by the lowermost surfaces of the lower legs 14c, with the results that the first group threads 18 and 19 are oriented to follow a deeply undulated path in the woven filament portion  $W_f$ .

The continuous binding weft thread 22 is inserted substantially in a common plane defined by the uppermost surfaces of the upper legs 14b of the successive loops 14 and extends weftwise substantially the entire length of the leg portion 14b(14c) intermediate the coupling head 14a and the heel 14d in the spaces 24 between each adjacent pair of loops 14.

The binding weft thread 22 passes around the binding warp thread 18 adjacent to the coupling head 14a and loops around the foundation weft 17 at a position interiorly of the heel portion 14d which interconnects the upper leg 14b of one loop with the lower leg 14c of a next adjacent loop of the filament 13, i.e. within the "tunnel" or hollow conduit.

On its return trip, the binding weft thread 22 passes alternately over and under the binding warp threads 18—21 in the spaces between each adjacent pair of loops 14. The second group of binding warp threads 20 and 21 disposed between the thread 18 and the thread 19 are not interengaged with the foundation weft 17 but are interlaced only with the binding weft thread 22 in a plane nearly flush with the common plane of the upper legs 14b of the successive loops 14 so that the path of the binding threads 20 and 21 presents itself to be only slightly undulated as shown in Figure 2. The binding weft thread 22 cooperates with the binding warp threads 18—21 in binding the upper legs 14b in particular against displacement and thus preventing the loops 14 of the filament 13 as a whole from moving out of alignment when the fastener is subjected to

bending stresses. According to an important feature of the invention, the foundation warp threads 16' disposed centrally of the woven filament section  $W_f$  and extending between the second group of binding warp threads 20 and 21 are, as distinct from the rest of the foundation warp threads 16, passed upwardly towards the upper leg 14 between each adjacent pair of loops 14 and interlaced with the binding weft thread 22 in substantially the same plane where the binding warp threads 18—21 are interlaced with the binding weft thread 22. The foundation warp threads 16' are each reversed around the binding weft thread 22 to interlace with the foundation weft 17 underlying the lower leg 14c of each loop 14 and continue to run along a deeply undulated path in each "inter-leg" space 24 very much the same way as the first group of binding threads 18, 19 run. This thread weave structure at the woven filament portion  $W_f$  provides firm support for the filament 13 and ensures maintenance of the correct loop-to-loop pitch of the row of elongated coupling loops 14 against bending stresses applied particularly laterally of the stringer 11. More specifically, the center portion of each loop 14 is supported in place by the foundation warp threads 16', while the outer portion of the loop 14 adjacent the coupling head 14a and the inner portion of the loop 14 adjacent the heel portion 14d are respectively supported by the binding warp threads 18 and 19. The arrangement that the binding warp threads 18 and 19 and the foundation warp threads 16' alike extend vertically between the binding weft 22 and the foundation weft 17 in each "inter-leg" space 24, provides resistance of the woven filament portion  $W_f$  to elongation in the event the stringer 11 is flexed transversely.

Another advantage accruing from the said arrangement is that a substantially functionally symmetric woven filament portion  $W_f$  of both sides of the stringer 11 is obtained to permit the same to be used optionally on either side.

The second embodiment shown in Figures 4 and 5 is the same in all respects as the first embodiment which has been discussed, only except for a slight modification in the lay of the foundation warp threads 16'. It will be noted that a junction 23 of interlacing of these warp threads 16' with the binding weft thread 22 takes place in the "inter-leg" spaces 24 between every other pair of loops 14 of the filament 13; in other words, the threads 16' extend under the lower surfaces of the lower legs 14c of two successive loops 14 and come into interlaced engagement with the binding weft thread 22 in a next adjoining "inter-leg" space 24. This arrangement is advantageous in that thread consumption is reduced.

#### CLAIMS

1. A woven fastener stringer comprising a woven tape formed with foundation warp threads of foundation weft thread and consisting of a relatively wide web portion and a relatively narrow woven filament portion, the web portion taking



and foundation weft thread in the filament woven portion  $W_f$ , there are provided a first group of binding warp threads 18 and 19 and a second group of binding warp threads 20 and 21 and a continuous binding weft thread 22 cooperating with the binding warp threads 18—21 in binding or anchoring the filament 13 firmly in place on the stringer tape 11. The binding warp threads 18—21 extend longitudinally of the tape 11 in parallel relation to one another and in interlaced relation to the binding weft thread 22. The threads 18—21 all overlie the upper legs 14b of the loops 14. The first group of binding warp threads 18 and 19 extend along a relatively deep undulation path, while the second group of binding warp threads 20 and 21 extend along a relatively shallow undulation path, as better shown in Figure 2, for reasons hereafter explained.

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up most of the width of the tape, the woven filament portion forming a longitudinal edge portion of said tape; a row of successively interconnected elongated coupling element loops  
5 woven into said filament section, each of said coupling element loops having a coupling head at one end thereof, an upper leg and a lower leg extending from said head in a common direction and a heel portion at the opposite end remote  
10 from said head connected to a next adjacent one of said successive coupling element loops; a plurality of stuffer warps extending longitudinally through said row of elongated coupling element loops; a binding weft thread extending  
15 substantially the full length of said leg between each adjacent pair of said coupling element loops; said binding weft thread being looped around said foundation weft thread; a first group of binding warp threads and a second group of binding warp  
20 threads both being interlaced with said binding weft thread substantially in a common plane defined by the upper surfaces of said upper legs, said first group of threads being further interlaced with said foundation weft thread underlying said  
25 lower legs of said loops, and one or more of said foundation warp threads in said woven filament section passing through the thickness of the tape

towards said upper legs being interlaced with said binding weft thread.

30 2. A woven fastener stringer as defined in Claim 1 wherein one of the binding warp threads in said first group extends over said upper leg of each said coupling element loop adjacent said coupling head and another thread in said first group extends over  
35 said upper legs of said loops adjacent said heel portion.

3. A woven fastener stringer as defined in Claim 1 or 2 wherein said one or more of said foundation warp threads are interposed centrally of said  
40 coupling element loops between said second binding warp threads.

4. A woven fastener stringer as defined in Claim 1, 2 or 3 wherein said one or more of said foundation warp threads are arranged in  
45 symmetric relation to said binding warp threads in said first group to permit the stringer to be used optionally on either side.

5. A woven fastener stringer as defined in Claims 1, 2, 3 or 4 wherein said second group of  
50 binding warp threads are not interengaged with said foundation weft thread.

6. A woven fastener stringer substantially as herein described with reference to and as illustrated in the accompanying drawings.