

SPECIFICATION

A woven fastener stringer

This invention relates to a sliding clasp fastener, and more particularly to a fastener stringer having a continuous plastic filament spirally formed and woven into an edge of a stringer tape during the weaving thereof.

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 row of successive elongated loops or convolutions each having a coupling head, an upper and a lower leg and a connecting portion.

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 on one hand, upon the positional stability of the filament, i.e. coupling fastener element, with respect to the stringer tape against external stresses, and on the other hand, upon smooth coupling and uncoupling of the opposed stringers by the action of a reciprocating slider.

When the filament is formed into a row of helically coiled coupling loops and mounted on a stringer tape, such loops would usually present a cross-sectionally oval shape which is not complementary with the inner guide surfaces of a slider and hence would often interfere with the sliding movement of the latter during opening and closing of the fastener stringers. With a view to eliminating this difficulty, the coupling loops were covered by covering threads over their upper and lower surfaces including their heel portions in such a manner that the covered portions of the loops present a transverse cross section complementary in shape with the guide channel of the slider, as typically disclosed in Japanese Patent Publication Nos. 38—20175 and 47—15373. However, such prior art devices have a common drawback in that due to the covering threads being soft and bulky in nature, the slider to be used for this type of stringer is required to be built slightly smaller than the over-all dimensions of the covered coupling loops taking into account the contraction of the covering threads which results from engagement with the slider. This in turn creates an increase in the resistance of the covering threads to sliding movement of the slider, resulting in disagreeable, sometimes interrupted coupling or uncoupling engagement of the cooperating stringers.

According to the invention, there is provided a woven fastener stringer comprising: a woven tape formed with foundation warp and weft threads and comprising a web section defining a major dimension of said tape and a woven filament section defining a longitudinal edge portion of said tape; a row of successively interconnected elongated loops woven into said filament section and interengageable with another row on a mating stringer by the action of a slider, each of said 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 remote from said head connected to a next adjacent one of said successive loops; a binding system securing said loops to said filament section and comprising a pair of thermoplastic yarns, one extending longitudinally of said tape in abutting engagement with the upper surface of said heel portion and the other extending longitudinally of said tape in abutting engagement with the lower surface of said heel portion and a binding weft thread continuing from said foundation weft thread and interwoven with said thermoplastic binding yarns, said thermoplastic binding yarns being deformed to assume a compressed configuration in which such yarns each have an outer peripheral surface complementary in shape with respective inner guide walls of said slider and have laterally extending portions that penetrate into respective spaces defined by the heel portions between each adjacent pair of said loops to restrain said heel portions against relative movement.

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

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

Figure 2 is a transverse cross-sectional view taken on the line II—II of Figure 1 with a slider mounted on the stringer;

Figure 3 is a transverse cross-sectional view of a stringer which appears prior to finishing according to the invention;

Figure 4 is a transverse cross-sectional view of a stringer according to another embodiment of the invention; and

Figure 5 is a diagrammatic view illustrating the operation of a sliding clasp fastener.

Referring now to Figures 1—3, 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 section W defining a major dimension of a woven tape 11 and a woven filament section W_f defining a longitudinal edge portion 12 into which a filament 13 of plastic material is woven. The filament 13 is formed from a linear blank of a suitable plastic material into a helically coiled structure having a succession of loops or elongated convolutions during the course of weaving of the tape 11.

Each loop or elongated convolution 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 remote from the head 14a connected to a 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

- 5 Figure 1 and define therebetween a longitudinally extending "tunnel" or hollow conduit through which a reinforcing string cord or core 15 is inserted.

- 10 The web section 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 such as a combination of plain weave 18 and twill weave 19, as shown, which will require no further explanation as this has no

- 15 direct bearing upon the invention.
The term "filament woven section W_f" 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. The row of coupling loops 14 is secured to the filament woven section W_f by a binding system 20 which comprises a first group of binding warp threads 21, a second group of binding warp threads, 22, a plurality of relatively large diameter thermoplastic binding yarns 23, 24 and a binding weft thread 25 which is a continuous portion of the foundation weft thread 17.

- 30 The first group of binding warp threads 21 extend longitudinally of the stringer tape 11 and overlie the upper legs 14b of successive loops 14 adjacent to the heel portions 14d. The second group of binding warp threads 22 extend longitudinally of the stringer tape 11 and underlie the lower legs 14c of successive loops 14 adjacent to the heel portions 14d. One of the thermoplastic binding yarns 23, (24) extends longitudinally of the stringer tape 11 in abutting engagement with the upper surface 14d' of the heel portion 14d of each loop 14, and the other binding yarn 24 extends longitudinally of the stringer tape 11 in abutting engagement with the lower surface 14d'' of the heel portion 14d. The binding weft thread 25 is passed around and in interlaced relation to the first and second groups of binding warp threads 21, 22 and the thermoplastic binding yarns 23, 24 and bind all of these warp materials together into an integral binding system securing the row of coupling loops 14 via cord 15 to the woven filament section W_f of the tape 11.

- 45 The thermoplastic binding yarns 23, 24 are compressed where these are interlaced or interwoven with the weft thread 25, with resultant swollen portions 26, alternating at intervals with compressed portion 27 along the length of the yarns 23, (24), as better shown in Figure 3 in which the yarns 23, 24 at the left-hand side represent the respective swollen portions 26 and those at the right-hand side represent the respective compressed portions. 27.

- 60 In accordance with the invention, the thermoplastic binding yarns 23, 24 are subjected to thermal compression molding with use of a suitable die having such a working surface that the

mass of the yarns 23, 24 is deformed to assume an outer peripheral surface complementary in shape with the inner peripheral guide walls S' of a slider S as shown in Figure 2. Deformed mass 23'

- 70 (24') penetrates into the spaces defined by the heel portions 14d between each adjacent pair of loops 14 and joins adjacent heel portions 14d together, so that the heel portions 14d, which would otherwise be movable relative to adjacent ones of successively interconnected loops 14 in a row, are held integrally together. Thus the swollen or laterally extending portions 26 penetrate into respective spaces defined by heel portions 14d between each adjacent pair of loops 14 to restrain such heel portions 14d against relative movement. This ensures not only firm fixation of the row of loops 14 to the tape 11, but also smooth, effective coupling and uncoupling operation of the two opposed stringers 10 as the neutral zone of each loop 14 which is free of both compressive and tensile stresses is maintained in close proximity to the heel portion 14d remote from the coupling head 14a so as to create an increased free area in each loop available for coupling engagement with 90 adjacent loops.

- Figure 5 is utilized to explain the behaviour of the respective rows of coupling loops 14, in which a solid line N represents the position of the neutral zone of each of successive loops 14 which lies close to the heel portion 14d according to the invention, and a chain-dotted line M represents the position of the neutral zone of the prior art loops which is shifted closely toward the coupling head 14a.

- 100 Figure 4 shows a second embodiment of this invention which is substantially the same as the first embodiment already described, except for the omission of binding warp threads 21, 22 and cord 15. This modification provides basically the same function and results is so far as the heel portions 14d between each adjacent pair of loops 14 are integrally joined together by elastically deformed mass of the thermoplastic binding yarns 23, 24.

Claims

- 110 1. A woven fastener stringer comprising: a woven tape formed with foundation warp and weft threads and comprising a web section defining a major dimension of said tape and a woven filament section defining a longitudinal edge portion of said tape; a row of successively interconnected elongated loops woven into said filament section and interengageable with another row on a mating stringer by the action of a slider, each of said 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 remote from said head connected to a next adjacent one of said successive loops; a binding system securing said loops to said filament section and comprising a pair of thermoplastic yarns, one extending longitudinally of said tape in abutting engagement with the upper surface of said heel portion and the other extending longitudinally of said tape in



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 Figure 1 and define therebetween a longitudinally extending "tunnel" or hollow conduit through which a reinforcing string cord or core 15 is inserted.

The web section 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 such as a combination of plain weave 18 and twill weave 19, as shown, which will require no further explanation as this has no direct bearing upon the invention.

The term "filament woven section W_f " 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. The row of coupling loops 14 is secured to the filament woven section W_f by a binding system 20 which comprises a first group of binding warp threads 21, a second group of binding warp threads, 22, a plurality of relatively large diameter thermoplastic binding yarns 23, 24 and a binding weft thread 25 which is a continuous portion of the foundation weft thread 17.

The first group of binding warp threads 21 extend longitudinally of the stringer tape 11 and overlie the upper legs 14b of successive loops 14 adjacent to the heel portions 14d. The second group of binding warp threads 22 extend longitudinally of the stringer tape 11 and underlie the lower legs 14c of successive loops 14 adjacent to the heel portions 14d. One of the thermoplastic binding yarns 23, (24) extends longitudinally of the stringer tape 11 in abutting engagement with the upper surface 14d' of the heel portion 14d of each loop 14, and the other binding yarn 24 extends longitudinally of the stringer tape 11 in abutting engagement with the lower surface 14d'' of the heel portion 14d. The binding weft thread 25 is passed around and in interlaced relation to the first and second groups of binding warp threads 21, 22 and the thermoplastic binding yarns 23, 24 and bind all of these warp materials together into an integral binding system securing the row of coupling loops 14 via cord 15 to the woven filament section W_f of the tape 11.

The thermoplastic binding yarns 23, 24 are compressed where these are interlaced or interwoven with the weft thread 25, with resultant swollen portions 26, alternating at intervals with compressed portion 27 along the length of the yarns 23, (24), as better shown in Figure 3 in which the yarns 23, 24 at the left-hand side represent the respective swollen portions 26 and those at the right-hand side represent the respective compressed portions. 27.

In accordance with the invention, the thermoplastic binding yarns 23, 24 are subjected to thermal compression molding with use of a suitable die having such a working surface that the

mass of the yarns 23, 24 is deformed to assume an outer peripheral surface complementary in shape with the inner peripheral guide walls S' of a slider S as shown in Figure 2. Deformed mass 23', (24') penetrates into the spaces defined by the heel portions 14d between each adjacent pair of loops 14 and joins adjacent heel portions 14d together, so that the heel portions 14d, which would otherwise be movable relative to adjacent ones of successively interconnected loops 14 in a row, are held integrally together. Thus the swollen or laterally extending portions 26 penetrate into respective spaces defined by heel portions 14d between each adjacent pair of loops 14 to restrain such heel portions 14d against relative movement. This ensures not only firm fixation of the row of loops 14 to the tape 11, but also smooth, effective coupling and uncoupling operation of the two opposed stringers 10 as the neutral zone of each loop 14 which is free of both compressive and tensile stresses is maintained in close proximity to the heel portion 14d remote from the coupling head 14a so as to create an increased free area in each loop available for coupling engagement with adjacent loops.

Figure 5 is utilized to explain the behaviour of the respective rows of coupling loops 14, in which a solid line N represents the position of the neutral zone of each of successive loops 14 which lies close to the heel portion 14d according to the invention, and a chain-dotted line M represents the position of the neutral zone of the prior art loops which is shifted closely toward the coupling head 14a.

Figure 4 shows a second embodiment of this invention which is substantially the same as the first embodiment already described, except for the omission of binding warp threads 21, 22 and cord 15. This modification provides basically the same function and results is so far as the heel portions 14d between each adjacent pair of loops 14 are integrally joined together by elastically deformed mass of the thermoplastic binding yarns 23, 24.

Claims

1. A woven fastener stringer comprising: a woven tape formed with foundation warp and weft threads and comprising a web section defining a major dimension of said tape and a woven filament section defining a longitudinal edge portion of said tape; a row of successively interconnected elongated loops woven into said filament section and interengageable with another row on a mating stringer by the action of a slider, each of said 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 remote from said head connected to a next adjacent one of said successive loops; a binding system securing said loops to said filament section and comprising a pair of thermoplastic yarns, one extending longitudinally of said tape in abutting engagement with the upper surface of said heel portion and the other extending longitudinally of said tape in



5 abutting engagement with the lower surface of
said heel portion and a binding weft thread
continuing from said foundation weft thread and
interwoven with said thermoplastic binding yarns,
said thermoplastic binding yarns being deformed
to assume a compressed configuration in which
such yarns each have an outer peripheral surface
complementary in shape with respective inner
guide walls of said slider and have laterally
10 extending portions that penetrate into respective
spaces defined by the heel portions between each
adjacent pair of said loops to restrain said heel
portions against relative movement.

15 2. A woven fastener stringer as defined in claim
1 wherein said binding system includes a first

group of binding warp threads extending
longitudinally of said tape in overlying relation to
the upper legs of said loop adjacent to said heel
portions, and a second group of binding warp
20 threads extending longitudinally of said tape in
underlying relation to the lower legs of said tape in
underlying relation to the lower legs of said loops
adjacent to said heel portions, said first and
second groups of threads being interwoven with
25 said binding weft thread.

3. A woven fastener stringer as defined in claim
1 or 2, wherein said thermoplastic binding yarns
are elastically deformed to penetrate into the
spaces defined by said heel portions between
30 each adjacent pair of said loops.