

WATER-RESISTANT SLIDE FASTENER AND METHOD OF MANUFACTURING
THE SAME

The present invention relates to a water-resistant slide fastener for use for example on an article such as a ski wear or a sports bag requiring protection against entrance of rain, sleet or snow, and a method
5 of manufacturing such a water-resistance slide fastener.

Slide fasteners for use on outer garments and other articles designed for outdoor activities do not require a high degree of resistance against penetration
10 of water. There has been a demand for such water-resistant slide fasteners that are relatively simple in construction, can be mass-produced, and are inexpensive to manufacture.

One know water-resistant slide fastener is
15 manufactured, as disclosed in U.S. Patent No. 3,501,816, by affixing a row of coupling elements to a slide fastener stringer tape, and the coating a sealing material on the elements and the stringer tape

with a coating device. This conventional method is disadvantageous in that the manufacturing process is complex, needs to be implemented by a large-scale apparatus, and fails to achieve satisfactory product quality and cost as products tend to be defective due to uneven coating of the sealing material. The slide fasteners manufactured by the prior process have the danger of forming a gap between seals when the stringer tape is subjected to a large transverse pull.

10 It is believed possible by means of the present invention to provide a water-resistant slide fastener which is of relatively simple construction, is less costly to manufacture, and ensures a satisfactory water-resistant capability even when a large lateral pull is
15 imposed on the slide fastener.

 It is further believed possible by means of the present invention to provide a method of manufacturing durable water-resistant slide fasteners through a simple process and without employing any newly devised apparatus.

20 According to a first aspect of the present invention, there is provided a water-resistant slide fastener comprising: (a) a pair of water-resistant transversely stretchable stringer tapes having reinforced marginal edge portions, respectively; (b) a
25 pair of rows of coupling elements mounted on said reinforced marginal edge portions, respectively, and engageable with each other across a longitudinal plane which bisects the slide fastener at a central axis thereof and is perpendicular to the general plane of the slide fastener, said

reinforced marginal edge portions having a pair of confronting edges projecting toward each other beyond said longitudinal plane when said rows of coupling elements are out of mutual engagement; and (c) each of said reinforced marginal edge portions including
5 an elastically deformable core tape.

According to a second aspect of the present invention, there is provided a method of manufacturing a water-resistant slide fastener, comprising the steps of: (a) attaching a pair of rows of coupling elements engageable with each other across
10 a longitudinal plane which bisects the slide fastener at a central axis thereof and is perpendicular to the general plane of the slide fastener, and a pair of elastically deformable core tapes to a pair of water-resistant transversely stretchable stringer tapes, respectively, in transversely spaced relationship from
15 confronting longitudinal edges of said stringer tapes, leaving a pair of marginal edge portions of said stringer tapes, respectively; (b) folding back said marginal edge portions over said core tapes, respectively, providing a pair of confronting edges projecting beyond said longitudinal plane when said rows of coupling elements
20 are out of engagement; and (c) bonding said marginal edge portions to said core tapes, respectively.

The invention will be described by way of example with reference to the accompanying drawings, wherein like references refer to like parts unless stated otherwise and wherein:-

Figure 1 is a fragmentary plan view of a water-resistant slide fastener embodying the present invention;

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

5 Figure 3 is a transverse cross-sectional view illustrative of the manner in which a folded tape edge is bonded to a stringer tape;

 Figure 4 is a transverse cross-sectional view of the water-resistant slide fastener of Figure 1, showing disengaged
10 rows of coupling elements;

 Figure 5 is a transverse cross-sectional view of one stringer of a water-resistant slide fastener according to the another embodiment of the present invention; and

 Figures 6A to 6C are transverse cross-sectional view
15 showing progressive steps of manufacturing the water-resistant slide fastener of Figure 1.

 The present invention is particularly useful when embodied in a water-resistant slide fastener generally designated by the reference numeral 10 in Figures 1 and 2.

20 The water-resistant slide fastener 10 comprises

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a pair of fastener stringers 11, 12 composed of a pair of stringer tapes 13, 14 supporting on their confronting longitudinal edges a pair of rows of helically coiled coupling elements 15, 16, respectively, sewn by sewing
5 stitches 17, 18 penetrating a pair of elongate reinforcing cores 19, 20 extending through the helically coiled coupling elements 15, 16.

As shown in Figure 2, each of the stringer tapes 13, 14 comprises a foundation tape 21 woven with
10 elastic weft threads or knitted so that it is transversely stretchable. The foundation tape 21 is coated on at least one surface thereof with a soft sealing layer 22 of synthetic rubber or soft synthetic resin. Therefore, the stringer tapes 13, 14 are
15 laterally stretchable and resistant to passage of water therethrough. The pair of stringer tapes 13, 14 includes a pair of reinforced longitudinal marginal edge portions 23, 24, respectively, each composed of a marginal tape edge portion 25 folded on the major
20 portion of the stringer tape, as illustrated in Figure 3, with the sealing layer 22 disposed outside. A resilient core tape 26 is sandwiched between the folded marginal edge portion 25 and the major portion of the stringer tape. The core tape 26 is made of synthetic
25 rubber or synthetic resin. A folded margin 27 of the foundation tape 21 is coextensive with the reinforced marginal edge portion 25 and is bonded to the core tape

26 by an adhesive or a thermoplastic film (not shown) placed between the foundation tape's margin 27 and the core tape 26 and fused with heat and pressure. The reinforced marginal edge portions 23, 24 of the stringer tapes 13, 14 are thicker than the rest of the stringer tapes 13, 14 and support the rows of coupling elements 15, 16 respectively on the sealing-layer side of the respective stringer tape 13, 14. The reinforced marginal edge portions 23, 24 have confronting edges 28, 28 that will be elastically deformed on abutment against each other when the rows of coupling elements 15, 16 are interengaged as shown in Figure 2.

In Figures 2 and 4, each of the coupling elements 15, 16 comprises an upper leg 29, a lower leg 30 spaced from the upper leg 29, and a coupling head 31 extending between the upper and lower legs 29, 30. The reinforcement core 19, 20 is disposed between the upper and lower legs 29, 30 in transversely spaced relation to the coupling head 31. The coupling elements 15, 16 are mounted on the stringer tapes 13, 14, respectively, with the lower legs 30 held directly against the stringer tapes 13, 14. The sewing stitches 17, 18 are in the form of double locked stitches formed by two needles and one looper (described below) and passing through the reinforcement cores 19, 20, the respective major portions of the stringer tapes 13, 14, and the core tapes 26, 26, but not the marginal tape edge portion 25, in particular not the folded margin 27.

When the opposed rows of coupling elements 15, 16 are interengaged, as shown in Figure 2, the coupling heads 31, 31 are located past each other across a longitudinal plane 32 which bisects the slide fastener at a central axis thereof (the central axis being normal to the plane of Fig. 2 and mid-way up each coupling head 31 in Fig. 2). This longitudinal plane 32 is perpendicular to the general plane of the slide fastener, which is the plane of Fig. 1. (Fig. 4 shows the plane 32 twice because stringers 11 and 12 are separated). When the rows of coupling elements 15, 16 are disengaged, as illustrated in Figure 4, the confronting edges 28, 28 of the stringer tapes 13, 14 lie substantially flush with the coupling heads 31, 31 respectively, and project toward each other beyond the central vertical axis 32.

The stringer tapes 11, 12 are water-resistant against passage of water such as rain water therethrough, and the confronting edges 28, 28 are pressed against each other when the rows of coupling elements 15, 16 are interengaged, thereby preventing water such as rain water from passing through a seam-like joint 33 between the confronting edges 28, 28. Since the stringer tapes 11, 12 are transversely stretchable, any lateral force tending to pull the stringer tapes 11, 12 apart from one another is substantially taken up by the stringer tapes 11, 12 and is not directly imposed on the coupling elements 15, 16. Furthermore, the coupling elements 15, 16 mounted on the reinforced marginal edge portions 23, 24 are effectively protected from becoming positionally unstable under such lateral force. Accordingly, the confronting edges 28, 28 remain firmly pressed against

each other, ensuring good water-resistant capability.

The water-resistant slide fastener 10 is relatively simple in construction and has substantially the same appearance as that of ordinary slide fasteners.

5 Therefore, it can be used on articles such as garments, bags and other personal items.

Figure 5 shows a slide fastener stringer 35 constructed according to another embodiment of the present invention. The slide fastener stringer 35
10 comprises a water-resistant stringer tape 36 composed of a woven or knitted foundation tape 38 with a sealing layer 39. The stringer tape 36 has a reinforced marginal edge portion 40 including a folded marginal edge portion 41 with a knitted core tape 42 sandwiched
15 between the major portion of the stringer tape 36 and the folded marginal edge portion 41, the knitted core tape 42 having a plurality of parallel longitudinal interwale grooves 43. A row of helically coiled coupling elements 37 is mounted on the reinforced
20 marginal edge portion 40. Each of the coupling elements 37 comprises an upper leg 45, a lower leg 46, and a coupling head 46, the upper leg 45 having a recess 38. The coupling elements 37 is sewn to the reinforced marginal edge 40 by sewing threads 49
25 received in the recess 38 in the upper leg 45 and extending through a reinforcing core 50 disposed through the coupling element 37. The sewing threads 49

also penetrate the stringer tape 36 and the knitted core tape 42 where they are received in some of the interwale grooves 43. The reinforced marginal edge portion 40 has an edge 44 projecting transversely beyond a longitudinal plane 51 which corresponds to the longitudinal plane 32 of Figs. 2 and 4. According to the embodiment shown in Figure 5, the coupling element 37 is retained on the stringer tape 36 more firmly and stably since the sewing threads 49 have portions received in the recess 48 in the upper leg 45 and the interwale grooves 43.

10 A method of manufacturing the water-resistant slide fastener 10 shown in Figures 1 to 4 is described as follows in connection with Figures 6A through 6C.

A jig for holding slide fastener components while sewing coupling elements 15, 16 to stringer tapes 13, 14 comprises 15 a lower plate 55 and an upper plate 56 placed over the lower plate 55. A pair of loopers 57, 58 for guiding looper threads (not shown) is disposed below the lower plate 55, and two pairs of needles 59, 60 and 61, 62 for guiding needle threads (not shown) are disposed above the upper plate 56. The lower plate 20 55 has a pair of transversely spaced grooves 63, 64 located above the loopers 57, 58 respectively, and a pair of needle holes 65, 66 communicating with the

grooves 63, 64, respectively. The upper plate 56 has a pair of transversely spaced grooves 67, 68 and a pair of needle holes 69, 70 communicating respectively with the grooves 63, 64. The pairs of needles 59, 60 and 5 61, 62 are vertically aligned with the needle holes 69, 70, respectively. The lower plate 55 has on its upper surface a central ridge 71 positioned intermediate the grooves 63, 64 and held against a lower surface of the upper plate 56. The grooves 63, 64 in 10 the lower plate 55 are a little closer than the grooves 67, 68 in the upper plate 56 to the central ridge 71.

In operation, as shown in Figure 6A, the rows of coupling elements 15, 16 with the reinforcing cores 19 inserted therein are disposed respectively in the 15 grooves 63, 64 in the lower plate 55. The stringer tapes 13, 14 are sandwiched between the upper and lower plates 55, 56 with the sealing layers 22 held in contact with the lower plate 55 and confronting edges of the tapes 13, 14 being held against the ridge 20 71. The core tapes 26 are received respectively in the grooves 67, 68, respectively. Since the grooves 63, 64 are closer than the grooves 67, 68 to the ridge 71, the coupling elements 15, 16 are located slightly more closely than the core tapes 26 to the ridge 71. The 25 coupling elements 15, 16 and the core tapes 26 are sewn to the stringer tapes 13, 14 by unnumbered double locked stitches while the coupling elements 15, 16, the

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core tapes 26, and the stringer tapes 13, 14 are being fed along in a direction normal to the sheet of the drawings. The coupling elements 15, 16 are now securely mounted on the sealing layer 22, while the
5 core tapes 26 are securely mounted on the foundation tapes 21, leaving the marginal edge portions 25, 25 of the stringer tapes 13, 14 one on each side of the ridge 71.

Then the marginal edge portions 25 of the
10 stringer tapes 13, 14 are folded back around edges of the respective core tapes 26 over the latter as shown in Figure 6B. The folded marginal edge portions 25 and the core tapes 26 are bonded to each other by an adhesive, or joined with an adhesive film sandwiched
15 and fused therebetween with heat and pressure. The bonded marginal edge portions 25 close apertures defined in the core tapes 26 by the sewing threads 17, 18 extend, thus preventing water from finding its way through the stringer tapes 13, 14 through such
20 apertures.

As shown in Figure 6B, the edges of the core tapes 26 around which the marginal edge portions 25 are folded back are positioned slightly beyond the central axis 32 of engagement. Therefore, the confronting
25 edges 28 of the stringer tapes 13, 14 project beyond the central axis 32.

The method of making the water-resistant slide

fastener 10 is primarily composed of three relatively simple steps, i.e. the step of securing the coupling elements to the stringer tapes, the step of folding back the marginal edge portions of the stringer tapes, 5 and the step of bonding the folded marginal edge portions. Therefore, the water-resistant slide fastener 10 can easily be manufactured highly efficiently and inexpensively. The water-resistant slide fastener 10 thus manufactured through the simple 10 process is stable and durable in use.

Although various minor modifications may be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon, all such embodiments as 15 reasonably and properly come within the scope of this specification.

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CLAIMS:-

1. A water-resistant slide fastener comprising:
 - (a) a pair of water-resistant transversely stretchable stringer tapes having reinforced marginal edge portions, respectively;
 - 5 (b) a pair of rows of coupling elements mounted on said reinforced marginal edge portions, respectively, and engageable with each other across a longitudinal plane which bisects the slide fastener at a central axis thereof and is perpendicular to the general plane of the slide fastener, said reinforced marginal
 - 10 edge portions having a pair of confronting edges projecting toward each other beyond said longitudinal plane when said rows of coupling elements are out of mutual engagement; and
 - (c) each of said reinforced marginal edge portions including an elastically deformable core tape.
- 15 2. A water-resistant slide fastener according to claim 1, each of said stringer tapes comprising a foundation tape and a soft sealing layer on one surface of said foundation tape, each of said reinforced marginal edge portions having a folded tape edge portion with said soft sealing layer disposed outside,
- 20 said soft sealing layer disposed outside, said core tape being sandwiched between said folded tape edge portion and a major portion of one of said stringer tapes.
3. A water-resistant slide fastener according to claim 2, said soft sealing layer being made of synthetic rubber.
- 25 4. A water-resistant slide fastener according to claim 2, said soft sealing layer being made of soft



synthetic resin.

5 5. A water-resistant slide fastener according to claim 2, 3 or 4, including sewing threads securing said rows of coupling elements respectively to the reinforced marginal edge portions, said sewing having portions penetrating said core tapes and covered by said folded tape edge portions.

10 6. A water-resistant slide fastener according to claim 5, each of said core tapes being made of a knitted fabric having interwale grooves, said portions of said sewing threads being received in said interwale grooves.

15 7. A water-resistant slide fastener according to any preceding claim the confronting edge of each said reinforced marginal edge portion lying flush with said coupling heads of a respective one of said coupling element rows.

20 8. A water-resistant slide fastener according to any one of claims 1 to 7, said core tape being made of synthetic rubber.

9. A water-resistant slide fastener according to any one of claims 1 to 7, said core tape being made of synthetic resin.

25 10. A water-resistant slide fastener according to any one of claims 1 to 7, said core tape being knitted.

11. A method of manufacturing a water-resistant slide fastener, comprising the steps of:



(a) attaching a pair of rows of coupling elements engageable with each other across a longitudinal plane which bisects the slide fastener at a central axis thereof and is perpendicular to the general plane of the slide fastener, and a pair of elastically deformable core tapes to a pair of water-resistant transversely stretchable stringer tapes, respectively, in transversely spaced relationship from confronting longitudinal edges of said stringer tapes, leaving a pair of marginal edge portions of said stringer tapes, respectively;

(b) folding back said marginal edge portions over said core tapes, respectively, providing a pair of confronting edges projecting beyond said central axis (32) when said rows of coupling elements are out of engagement; and

(c) bonding said marginal edge portions to said core tapes, respectively.

12. A method according to claim 11, said rows of coupling elements and said core tapes being sewn to said stringer tapes.

13. A water-resistant slide fastener substantially as described with reference to and as illustrated in Figures 1 to 4 modified as in Figures of the accompanying drawings.

14. A water resistant slide fastener substantially as described with reference to and as illustrated in Figures 1 to 4 modified as in Figure 5 of the accompanying drawings.

15. A method of manufacturing a water-resistant slide fastener substantially as described with reference to and as illustrated in the accompanying drawings.

