

SPECIFICATION

Molded coupling element assembly

The present invention relates generally to zippers or fasteners and more particularly to a coupling element assembly therefor.

Various coupling element assemblies have been proposed which have a row of discrete coupling elements inter-connected by embedded connecting threads. Examples of such coupling element assemblies are disclosed in U.S. Patent Nos. 3,414,948 and 4,033,014. Since the prior proposals employ connecting threads having a smooth surface that fails to provide a required degree of bonding strength, they make use of additional reinforcements such as widened leg portions of the coupling elements and curved portions of the connecting threads that are embedded in the coupling element leg portions, thereby strengthening the union between the coupling elements and the connecting threads.

Such reinforcing structures are disadvantageous in that their inclusion renders the overall manufacturing process complicated, and involves increased consumption of material and intricate adjustment of the tension to which the connecting threads are subjected. Another problem with the known coupling element assemblies is that the connecting threads, which are rigid enough for secure attachment of the coupling elements to a sliding clasp fastener stringer tape are not stretchable sufficiently to allow for smooth engagement and disengagement between opposed rows of coupling elements.

According to a first aspect of the invention, there is provided a coupling element assembly for sliding clasp fasteners comprising: a row of laterally spaced coupling elements each having a head portion and a pair of leg portions extending from said head portion; and a pair of warp-knit elongate webs each including at least one first thread forming a wale of chain stitches and a second thread disposed in and extending longitudinally along said wale of chain stitches, each of said warp-knit elongate webs extending transversely of said spaced coupling elements and having a longitudinal portion embedded in respective leg portions of said coupling elements to interconnect the coupling elements.

According to a second aspect of the invention, there is provided a method of producing a coupling element assembly for sliding clasp fasteners, comprising: providing a warp-knit elongate structure having a pair of parallel, spaced warp-knit elongate webs and a plurality of transverse thread portions spaced longitudinally of and interconnecting said warp-knit elongate webs; moulding an elongate blank element around one of said transverse thread portions across said warp-knit elongate webs, said elongate blank element when bent defining a coupling element; and bending said elongate blank element about its transverse central axis to form a coupling element with one of the warp-knit elongate webs overlying the other.

According to a third aspect of the invention, there is provided a method of producing a coupling element assembly for sliding clasp fasteners, comprising the steps of: providing a warp-knit elongate structure having a pair of spaced warp-knit elongate webs and a plurality of transverse thread portions spaced longitudinally of and interconnecting said warp-knit elongate webs; introducing said warp-knit elongate structure into an elongate mould cavity having the shape of a blank coupling element so that said webs extend across the elongate mould cavity at its end portions and one of said transverse thread portions is disposed longitudinally in the mould cavity at a time; moulding synthetic resin around the portion of said webs and the transverse thread portion which are disposed in the mould cavity, thereby forming a blank coupling element product which is a portion of a coupling element assembly; separating said moulded blank coupling element product from the mould cavity; and bending said moulded blank coupling element product about its transverse central axis into the shape of a U.

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

Figure 1 is a fragmentary plan view of a coupling element assembly of the present invention, as attached to a stringer tape;

Figure 2 is an end elevation view, with parts in cross section, of the coupling element assembly of Figure 1;

Figure 3 is a fragmentary perspective view, with parts broken away, of the coupling element assembly as it is spread before being bent into a U shape;

Figure 4 is a longitudinal cross-section view of a coupling element in the coupling element assembly;

Figure 5 is a point diagram for a warp-knit elongate structure in the coupling element assembly;

Figure 6 is a schematic plan view of a coupling element assembly according to the invention as it is continuously produced on a molding apparatus;

Figure 7 is a fragmentary cross-sectional view taken along section line 7—7 of Figure 6;

Figure 8 is a longitudinal cross-section view of a coupling element formed on the molding apparatus shown in Figures 6 and 7;

Figure 9 is an enlarged cross section view of a portion of a warp-knit elongate web which is located between adjacent coupling element leg portions;

Figure 10 is an end elevation view, with parts in cross section, of a modified coupling element assembly;

Figure 11 is a view similar to Figure 10, showing another modified coupling element assembly;

Figure 12 is an end elevational view, partly in cross section, of a modified coupling element assembly bonded to a sliding clasp fastener stringer tape;

Figure 13 is an end elevation view of a modified

coupling element assembly with coupling element leg portions fused together;

Figure 14 is a fragmentary cross section view of a molding apparatus for forming the coupling element assembly shown in Figure 13;

Figure 15 is an end elevation view of a coupling element assembly produced on the molding apparatus of Figure 14;

Figure 16 is an end elevation view illustrative of the way in which the coupling element leg portions are fused together;

Figure 17 is a fragmentary plan view of the coupling element assembly of Figure 13 as woven into a woven-fabric stringer tape;

Figure 18 is a transverse cross section view of the coupling element assembly of Figure 17;

Figure 19 is a fragmentary plan view of a coupling element assembly as knit into a knitted-fabric stringer tape;

Figure 20 is a cross section view taken along section line 20—20 of Figure 19;

Figures 21 to 30 inclusive are point diagrams illustrating embodiments of warp knit elongate webs;

Figure 31 is a fragmentary plan view of a sliding clasp fastener stringer;

Figure 32 is a transverse cross section view of the sliding clasp fastener stringer of Figure 31, illustrating the way in which the coupling element assembly is bent into a U shape;

Figure 33 is a point diagram for a knitted sliding clasp fastener stringer;

Figure 34 is a point diagram for a knitted sliding clasp fastener stringer;

Figure 35 is a point diagram similar to Figure 34, for another embodiment;

Figure 36 to 38 inclusive are end elevation views of different embodiments of knitted sliding clasp fastener stringer;

Figure 39 is a point diagram for another knitted sliding clasp fastener stringer;

Figure 40 is an elevation view, partly cut away, of the knitted sliding clasp fastener stringer shown in Figure 39, folding over on itself; and

Figure 41 is a schematic plan view of a plurality of the knitted sliding clasp fastener stringers of Figure 33, connected together by connecting threads.

In Figures 1 and 2, a coupling element assembly 1 includes a row of laterally spaced coupling elements 2 of synthetic resin, each having a coupling head portion 3 and a pair of leg portion 4, 5 extending from the coupling head portion 3, and a warp-knit elongate structure 6 extending transversely of the laterally spaced coupling elements 2 having longitudinal portions embedded in the coupling element 2. The coupling element assembly 1 has a substantially U-shaped cross section and is attached astride a longitudinal marginal edge portion of a sliding clasp fastener stringer tape 7 by means of a thread with sewing stitches 8. The row of coupling elements 2 is engageable with a companion row of coupling elements 2, shown in broken lines, to close a sliding clasp fastener.

As better shown in Figures 3 to 6 inclusive, the warp-knit elongate structure 6 comprises a group of first threads 9, 10, 11 and 12 forming a plurality of wales 13, 14, 15 and 16 of chain stitches, respectively, and a pair of second threads 17, 18 interlaced with the wales 13, 14 and with the wales 15, 16, respectively, thereby providing a pair of warp-knit elongate webs 19, 20 spaced laterally from each other. Each of the second threads 17, 18 has a pattern of 0—0/2—2. The warp-knit elongate structure 6 further includes a pair of sets of third threads 21, 22 interlaced with the wales 13, 14, 15 and 16 and having opposite patterns of 0—0/1—1/0—0/5—5/4—4/5—5 and 5—5/4—4/5—5/0—0/1—1/0—0, respectively.

The warp-knit elongate webs 19, 20 have longitudinal portions extending through and embedding in the leg portions 4, 5 of each of the coupling elements 2. The pair of sets of third threads 21, 22 have a plurality of parallel portions 23 spaced longitudinally on the first threads 9, 10, 11 and 12 and extending transversely of the wales 13, 14, 15 and 16. The parallel spaced portions 23 are embedded in the coupling elements 2 and extend substantially the full length of the coupling elements 2.

Thus, prior to being bent into a U shape ready for attachment to a stringer tape, the coupling element assembly 1 has a ladder-like structure. Each of the warp-knit webs 19, 20 also has a ladder-like structure which is composed of the wales 13, 14 or 15, 16 interconnected by the second thread 17 or 19. With such a ladder-like structure of the webs 19, 20, the leg portions 4, 5 of the coupling elements 2 are fastened to the webs 19, 20 with an increased degree of bonding strength. The warp-knit webs 19, 20 allow material of the coupling elements 2 to enter into their interstices, and have a roughened surface engaging the coupling elements 2 so that the coupling elements 2 can be anchored in place on the webs 19, 20.

The coupling element assembly 1 shown in Figure 3 is folded on itself about a longitudinal axis 24 before the assembly 1 is mounted on a stringer tape.

The coupling element assembly 1 is continuously produced on a molding apparatus 25 shown in Figures 6 and 7. The molding apparatus 25 has a molding wheel 26 having a plurality of elongate mold cavities 27 in its periphery. The mold cavities 27 are closed by an injection shoe 28 having a sprue or passageway 29 through which molten synthetic resin is forced into mold cavities 27. The molding wheel 26 has in its periphery a pair of annular grooves (not shown) intersecting the end portions of the elongate mold cavities 27 corresponding to the leg portions 4, 5 of the coupling elements 2 for receiving the warp-knit webs 19, 20.

In operation of the molding apparatus, the warp-knit elongate structure 6 is placed in the mold cavities 27 closed by the closed shoe 28 as shown in Figure 7, and molten synthetic resin is

forced into the mold cavities 27. The injected synthetic resin is molded around the warp-knit webs 19, 20 and the transverse portions 23 of the third threads 21, 22. The coupling element assembly 1 is continuously produced as the molding wheel 26 is being rotated in the direction of the arrow 30 (Figure 6). The coupling element assembly 1, as it is formed, is discharged in the direction of the arrow 31 in timed relation with the rotation of the molding wheel 26.

The portions 32, 33 of the warp-knit elongate webs 19, 20 which are located between adjacent coupling elements 2, can be impregnated with molten synthetic resin.

A slight clearing between the molding wheel 26 and the injection shoe 28 allows a thin layer 34 of synthetic resin to be formed in an area surrounded by the web portions 32, 33 and the coupling elements 2, 2 disposed adjacent to each other.

The warp-knit structure 6 shown in Figure 2 is disposed with the wales 13, 14, 15 and 16 directed away from the stringer tape 7. A modified warp-knit structure 25 illustrated in Figure 10 has its wales 36 directed toward the stringer tape 7 and lying substantially flush with the opposed faces 37, 38 of the coupling element leg portions 4, 5.

Figure 11 shows another modification in which the wales 39 of a warp-knit structure 40 extend toward a stringer tape 41 beyond the opposed faces 42, 43 of the coupling element leg portions 4, 5. The stringer tape 41 has an elongate bulged portion 44 that is placed in a space 45 between the wales 39 on each of the leg portions 4, 5.

According to still another modification shown in Figure 12, each of coupling elements 46 has a pair of leg portions 47, 48 including opposed thickened layers 49, 50, respectively, bonded to a stringer tape 51 by welding or adhesive bonding.

Another modified coupling element assembly 52 illustrated in Figure 13 comprises a plurality of coupling elements 53 each having a pair of leg portions 54, 55 including opposed faces 56, 57, respectively, integrally fused together or bonded together by an adhesive. A warp-knit elongate structure 58 includes a pair of wales 59, 60 embedded in the coupling element leg portion 54 and a pair of wales 61, 62 embedded in the coupling element leg portion 55.

Figure 14 illustrates an injection molding apparatus 63 for forming the coupling element assembly 52 of Figure 13. The injection molding apparatus 63 includes a molding wheel 64 having in its periphery a plurality of mold cavities 65 and a pair of annular grooves 66, 67 extending across the mold cavities 65 for receiving the pairs of wales 59, 60 and 61, 62, respectively. The annular grooves 66, 67 have a bottom slanted with respect to the peripheral surface of the molding wheel 64, so that the pairs of wales 59, 60 and 61, 62 as placed in the grooves 66, 67 are inclined with the outer wales 59, 62 positioned more deeply in the mold cavities 65 than the inner

wales 60, 61. With the warp-knit structure 58 thus placed, molten synthetic resin is forced under pressure through a passageway 68 in an injection shoe 69 into the mold cavities 65, thereby forming the coupling element assembly 52 shown in Figure 13.

Each coupling element 70 of the coupling element assembly 52 of Figure 15 includes a pair of relatively thick layers 71, 72 of synthetic resin on the outer wales 59, 62. The layers 71, 72 serve to define the opposite faces 56, 57, respectively. The coupling element assembly 52 is folded on itself along its longitudinal axis with an ultrasonic welding horn 73 placed between and in contact with the layers 71, 72 (Figure 16). The ultrasonic welding horn 73 is then energized to fuse the layers 71, 72 together, where-upon the coupling element assembly 52 illustrated in Figure 13 is produced. With this arrangement the inner wales 60, 61 are impregnated less with synthetic resin than the outer wales 59, 62, and, therefore, are more stretchable longitudinally than the outer wales 59, 62. Such an increased degree of stretchability of the inner wales 60, 61 permit the coupling heads of the coupling elements 70 to shift laterally enough for smooth engagement and disengagement between a pair of interengageable rows of coupling elements.

Figures 17 and 18 show the coupling element assembly 52 of Figure 13 woven into a longitudinal edge of a woven-fabric stringer tape 74. The woven stringer tape 74 includes a weft thread 75 extending around exposed portions of the warp-knit structure 58 which are located between adjacent coupling elements 70. A core thread 76 of stranded yarns extends longitudinally through the coupling element assembly 52 and is disposed between the inner wales 60, 61 of the warp-knit structure 58. The core thread 76 is retained in position by engagement with the weft thread 75 surrounding the warp-knit structure 58.

As shown in Figures 19 and 20, a coupling element assembly 77 may be knit into a longitudinal edge of a knit-fabric stringer tape 78. The stringer tape 78 is composed of a plurality of threads 79 forming wales of chain stitches having a pattern of 1—0/0—1, a plurality of threads 80 having a pattern of 1—0/1—2, a plurality of threads 81 having a pattern of 0—0/4—4, and a longitudinal warp cord 82 disposed between an outermost pair of wales 83, 84. The coupling element assembly 77 includes a longitudinal core thread 85 extending therethrough and is fastened in position by the outermost wale 84, a thread 86 extending between the wales 83, 84 in a pattern of 1—0/4—3, and one of the threads 81 extending between the outermost wales 83, 84.

More specifically, the portions of a warp-knit structure 87 of the coupling element assembly 77, which are positioned between adjacent coupling elements 88, are surrounded by the thread 86. The outermost wale 84 is displaced away from the coupling head portions of the coupling elements 88 and is held against a lower one of the leg

portions of each coupling element 88 by being pulled by the thread 86 and said one of the threads 81.

The threads 81 and 86 are preferably comprised of yarns of high thermal shrinkability for better fastening of the coupling elements 88 to the stringer tape 78 and for better tensioning of the outermost wale 84 against the lower leg portions of the coupling elements 88.

- 10 A warp-knit elongate structure 89 shown in Figure 21 comprises a pair of warp-knit elongate webs 90, 91 including two pairs of first threads 92, 93, 94 and 95 each forming a wale of chain stitches in a pattern of 0—1/1—0. Each of the webs 90, 91 has a second thread 96 interknitted with the wales in a pattern of 2—0/0—2. A pair of third threads 97, 98 are interlaced with the inner threads 93, 94 in opposite symmetrical patterns of 4—4/3—3/4—4/0—0/1—1/0—0 and 0—0/1—1/0—0/4—4/3—3/4—4.

- 20 A warp-knit elongate structure 99 is illustrated in Figure 22 and includes a pair of sets of third threads 100, 101 and 102, 103 interlaced with two pairs of first threads 104, 105, 106 and 107 in opposite symmetrical patterns of 5—5/4—4/5—5/0—0/1—1/0—0 and 0—0/1—1/0—0/5—5/4—4/5—5. The structure 99 has two second threads, one for each web, the same as threads 96 in Fig. 21.

- 30 According to a warp-knit elongate structure 108 shown in Figure 23, a pair of warp-knit elongate webs 109, 110 have two pairs of first threads 111, 112, 113 and 114 each forming a wale of chain stitches in a pattern of 0—1/1—0. A pair of second threads 115, 116 are interknitted with the pairs of first threads 111, 112 and 113, 114, respectively, in a pattern of 1—0/1—2. A warp thread 117 extends longitudinally in and along each of the first threads 111, 112, 113, and 114 in a pattern of 1—1/0—0. A pair of third threads 118, 119 are interlaced with the first threads 111, 112, 113, and 114 in a pattern of 5—5/4—4/5—5/0—0/1—1/0—0.

- 45 A warp-knit elongate structure 120 of Figure 24 includes a pair of warp-knit elongate webs 121, 122 comprising two pairs of first threads 123, 124, 125 and 126 having a pattern of 0—1/1—0, and a pair of second threads 127, 128 interknitted with the pairs of first threads 123, 124, and 125, 126, respectively. The warp-knit structure 120 has a pair of the third threads 129, 130 interlaced with the outer first threads 123, 126 in opposite symmetrical patterns of 0—0/6—6/6—6/0—0 and 6—6/0—0/0—0/6—6.

- 50 A warp-knit elongate structure 131 illustrated in Figure 25 is comprised of a pair of warp-knit elongate webs 132, 133 including two pairs of first threads 134, 135, 136 and 137 having a pattern of 0—1/1—0. Interknitted with each pair of the first threads 134, 135 or 136, 137 is a second thread 138 having a pattern of 2—0/0—2. A third thread 139 is interlaced with the outer first threads 134, 137 in a pattern of 6—6/5—5/6—6/0—0/1—1/0—0. A pair of

reinforced warp threads 140, 141 extend longitudinally between the pair of first threads 134, 135 and between the pair of first threads 136, 137.

- 70 A warp-knit elongate structure 142 shown in Figure 26 is similar to the structure 99 of Figure 22 and differs therefrom only in that the warp-knit structure 142 includes a pair of reinforcing warp threads 143, 144.

- 75 A warp-knitted elongate structure 145 is shown in Figure 27 as comprising a pair of warp-knit elongate webs 146, 147 including two pairs of first threads 148, 149, 150 and 151 having a pattern of 0—1/1—0. A pair of second threads 152, 153 are interknitted with the pair of first threads 148, 149 and with the pair of first threads 150, 151, respectively. The warp-knit elongate webs 146, 147 has a pair of reinforcing warp threads 154, 155 extending longitudinally between the pair of first threads 148, 149 and between the pair of first threads 150, 151, respectively. A pair of third threads 156, 157 are interknitted with the first threads 148, 149, 150 and 151 in a pattern of 4—5/0—1.

- 90 The third threads 156, 157 are preferably made of thermally shrinkable yarns. The portions 158, 159 of the third threads 156, 157 which are to be positioned between adjacent coupling elements 160, 161 are shrunk when subjected to heat during a dyeing process, with the result that the portions 158, 159 will not interfere with proper inter-engagement between a pair of rows of coupling elements.

- 100 A warp-knit elongate structure 162 shown in Figure 28 comprises a pair of warp-knit elongate webs 163, 164 including a pair of first threads 165, 166 having a pattern of 0—1/1—0. A pair of second threads 167, 168 extend longitudinally in and along the first threads 165, 166 in a pattern of 1—1/0—0. A pair of third threads 169, 170 are interlaced with the first threads 165, 166 in opposite symmetrical patterns of 0—0/1—1/0—0/4—4/3—3/4—4 and 4—4/3—3/4—4/0—0/1—1/0—0.

- 110 A warp-knit elongate structure 171 illustrated in Figure 29 includes a pair of warp-knit elongate webs 172, 173 comprising two pairs of first threads 174, 175, 176 and 177 having a pattern of 0—1/1—0. A pair of second threads 178, 179 are interknitted with the pair of first threads 174, 175 and with the pair of first threads 176, 177, respectively. The warp-knit structure 171 includes a pair of third threads 180, 181 interlaced with the first threads 174, 175 176 and 177 in a pattern of 5—5/0—0.

- 120 Figure 30 shows a warp-knit elongate web 182 comprising a pair of first threads 183, 184 having a pattern of 0—1/1—0 a second thread 185 interknitted with the first threads 183, 184 in a pattern of 2—0/0—2, and a warp thread 186 interlaced with the first threads 183, 184 in a pattern of 2—2/0—0. A pair of such warp-knit elongate webs 182 are embedded in the leg portions of a row of laterally spaced coupling elements. Although a coupling element assembly

using a pair of the warp-knit elongate webs 182 has no threads embedded longitudinally in the coupling elements, the coupling elements are securely fastened to the warp-knit webs 184 because the warp-knit webs 184 have roughened surfaces with interstices filled by material of the coupling elements.

A sliding clasp fastener stringer shown in Figures 31 and 32 has a stringer tape 187 if a warp-knit fabric interknitted with a warp-knit elongate structure 188 having portions embedded in a row of coupling elements 189 of synthetic resin. The row of coupling elements 189 is folded on itself about a longitudinal axis.

Figure 33 illustrates an embodiment of a sliding clasp fastener stringer 190 having a stringer tape 191 and a coupling element assembly 192. The stringer tape 191 is composed of a plurality of threads 193 having a pattern of 0—1/1—0, a plurality of threads 194 having a pattern of 1—0/1—2, and a plurality of threads 195 having a pattern of 4—5/1—0. The coupling element assembly 192 includes a warp-knit elongate structure 196 extending along one longitudinal edge of the stringer tape 191. The warp-knit elongate structure 196 comprises two pairs of first threads 197 having a pattern of 0—1/1—0, a pair of second threads 198 having a pattern of 1—0/1—2 interknitted with the pairs of first threads 197, and a pair of longitudinal reinforcing warp threads 199 each extending between the respective pair of first threads 197. A pair of sets of third threads 200 are interlaced with the pairs of first threads 197 in opposite symmetrical patterns of 0—0/1—1/0—0/5—5/4—4/5—5 and 5—5/4—4/5—5/0—0/1—1/0—0.

The stringer tape 191 and the warp-knit elongate structure 196 are interconnected by one of the threads 194 and two of the threads 195.

A sliding clasp fastener stringer 201 shown in Figure 34 differs from the sliding clasp fastener stringer 190 shown in Figure 33 in that the stringer 201 has no reinforcing warp threads and has two pairs of more rigid first threads 202 in its warp-knit elongate structure 203. Each of the first threads 202 is preferably composed of a thickened yarn or stranded yarns.

Figure 35 shows a sliding clasp fastener stringer 204 according to another embodiment, in which a pair of third threads 205, 206 have a pattern of 4—5/1—0. The stringer 204 has first threads and second threads corresponding respectively to first threads 197 and second threads 198 of Figure 33.

As shown in Figure 36, a core material 207 is disposed between a pair of leg portions 208, 209 of each coupling element 210. The leg portions 208, 209 are sewn to the core material 207 by sewing stitches 211 such as lockstitches or double chain stitches.

Figure 37 shows a core material 212 secured between a pair of leg portions 213, 214 of each coupling element 215 by overlock stitches 216.

According to a sliding clasp fastener stringer 217 illustrated in Figure 38, a pair of leg portions

218, 219 of each coupling element 220 are fused or bonded together and are fastened together by sewing stitches 221.

The embodiments illustrated in Figures 36 to 38 inclusive are applicable to the sliding clasp fastener stringers of Figures 31 to 35 inclusive.

Figures 39 and 40 show a sliding clasp fastener stringer 222 comprising a coupling element assembly 223 having a warp-knit elongate structure 224, and a pair of warp-knit fabrics 225, 226 disposed one on each side of and interknitted with the warp-knit elongate structure 224. When the coupling element assembly 223 is folded on itself about its longitudinal axis, the warp-knit fabrics 225, 226 are superimposed on each other, forming a stringer tape 227.

A plurality of sliding clasp fastener stringers 228 each having an integral coupling element assembly 229 according to the present invention can be produced simultaneously as shown in Figure 41. The sliding clasp fastener stringers 228 are laterally connected by water-soluble connecting threads 230, so that the stringers 228 can be separated by being dipped into water as in a dyeing process.

The embedded parallel spaced portions stabilize the coupling elements positionally against any displacement particularly in the transverse direction thereof. This reinforcing arrangement is advantageous especially where the coupling elements are made of an unstretched plastic material that is easily deformable, ductile and soft.

Reference is directed to our co-pending patent application No. 7919662 (serial No. 2023714) — Ref 230P38294

CLAIMS

1. A coupling element assembly for sliding clasp fasteners comprising: a row of laterally spaced coupling elements each having a head portion and a pair of leg portions extending from said head portion; and a pair of warp-knit elongate webs each including at least one first thread forming a wale of chain stitches and a second thread disposed in and extending longitudinally along said wale of chain stitches, each of said warp-knit elongate webs extending transversely of said spaced coupling elements and having a longitudinal portion embedded in respective leg portions of said coupling elements to interconnect the coupling elements.

2. A coupling element assembly for sliding clasp fasteners according to claim 1, each of said warp-knit elongate webs including a pair of first threads forming a pair of laterally spaced wales of chain stitches.

3. A coupling element assembly for sliding clasp fasteners according to claim 2, said second thread being interlaced with said laterally spaced wales of chain stitches in each of said warp-knit elongate webs.

4. A coupling element assembly for sliding clasp fasteners according to claim 3, said second thread having a pattern of 2—2/0—0.



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using a pair of the warp-knit elongate webs 182 has no threads embedded longitudinally in the coupling elements, the coupling elements are securely fastened to the warp-knit webs 184 because the warp-knit webs 184 have roughened surfaces with interstices filled by material of the coupling elements.

A sliding clasp fastener stringer shown in Figures 31 and 32 has a stringer tape 187 if a warp-knit fabric interknitted with a warp-knit elongate structure 188 having portions embedded in a row of coupling elements 189 of synthetic resin. The row of coupling elements 189 is folded on itself about a longitudinal axis.

Figure 33 illustrates an embodiment of a sliding clasp fastener stringer 190 having a stringer tape 191 and a coupling element assembly 192. The stringer tape 191 is composed of a plurality of threads 193 having a pattern of 0—1/1—0, a plurality of threads 194 having a pattern of 1—0/1—2, and a plurality of threads 195 having a pattern of 4—5/1—0. The coupling element assembly 192 includes a warp-knit elongate structure 196 extending along one longitudinal edge of the stringer tape 191. The warp-knit elongate structure 196 comprises two pairs of first threads 197 having a pattern of 0—1/1—0, a pair of second threads 198 having a pattern of 1—0/1—2 interknitted with the pairs of first threads 197, and a pair of longitudinal reinforcing warp threads 199 each extending between the respective pair of first threads 197. A pair of sets of third threads 200 are interlaced with the pairs of first threads 197 in opposite symmetrical patterns of 0—0/1—1/0—0/5—5/4—4/5—5 and 5—5/4—4/5—5/0—0/1—1/0—0.

The stringer tape 191 and the warp-knit elongate structure 196 are interconnected by one of the threads 194 and two of the threads 195.

A sliding clasp fastener stringer 201 shown in Figure 34 differs from the sliding clasp fastener stringer 190 shown in Figure 33 in that the stringer 201 has no reinforcing warp threads and has two pairs of more rigid first threads 202 in its warp-knit elongate structure 203. Each of the first threads 202 is preferably composed of a thickened yarn or stranded yarns.

Figure 35 shows a sliding clasp fastener stringer 204 according to another embodiment, in which a pair of third threads 205, 206 have a pattern of 4—5/1—0. The stringer 204 has first threads and second threads corresponding respectively to first threads 197 and second threads 198 of Figure 33.

As shown in Figure 36, a core material 207 is disposed between a pair of leg portions 208, 209 of each coupling element 210. The leg portions 208, 209 are sewn to the core material 207 by sewing stitches 211 such as lockstitches or double chain stitches.

Figure 37 shows a core material 212 secured between a pair of leg portions 213, 214 of each coupling element 215 by overlock stitches 216.

According to a sliding clasp fastener stringer 217 illustrated in Figure 38, a pair of leg portions

218, 219 of each coupling element 220 are fused or bonded together and are fastened together by sewing stitches 221.

The embodiments illustrated in Figures 36 to 38 inclusive are applicable to the sliding clasp fastener stringers of Figures 31 to 35 inclusive.

Figures 39 and 40 show a sliding clasp fastener stringer 222 comprising a coupling element assembly 223 having a warp-knit elongate structure 224, and a pair of warp-knit fabrics 225, 226 disposed one on each side of and interknitted with the warp-knit elongate structure 224. When the coupling element assembly 223 is folded on itself about its longitudinal axis, the warp-knit fabrics 225, 226 are superimposed on each other, forming a stringer tape 227.

A plurality of sliding clasp fastener stringers 228 each having an integral coupling element assembly 229 according to the present invention can be produced simultaneously as shown in Figure 41. The sliding clasp fastener stringers 228 are laterally connected by water-soluble connecting threads 230, so that the stringers 228 can be separated by being dipped into water as in a dyeing process.

The embedded parallel spaced portions stabilize the coupling elements positionally against any displacement particularly in the transverse direction thereof. This reinforcing arrangement is advantageous especially where the coupling elements are made of an unstretched plastic material that is easily deformable, ductile and soft.

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CLAIMS

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2. A coupling element assembly for sliding clasp fasteners according to claim 1, each of said warp-knit elongate webs including a pair of first threads forming a pair of laterally spaced wales of chain stitches.

3. A coupling element assembly for sliding clasp fasteners according to claim 2, said second thread being interlaced with said laterally spaced wales of chain stitches in each of said warp-knit elongate webs.

4. A coupling element assembly for sliding clasp fasteners according to claim 3, said second thread having a pattern of 2—2/0—0.



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5. A coupling element assembly for sliding clasp fasteners according to claim 2, said second thread being knitted with said laterally spaced wales of chain stitches in each of said warp-knit elongate webs.
6. A coupling element assembly for sliding clasp fasteners according to claim 5, said second thread having a pattern of $2-2/0-2$.
7. A coupling element assembly for sliding clasp fasteners according to claim 5, said second thread having a pattern of $1-0/1-2$.
8. A coupling element assembly for sliding clasp fasteners according to claim 1, said second thread being interlaced with said wale of chain stitches in a pattern of $1-1/0-0$.
9. A coupling element assembly for sliding clasp fasteners according to claim 2, including a third thread interlaced with the first threads in said warp-knit elongate webs and having a plurality of parallel portions spaced longitudinally on said first threads and extending transversely of said wales.
10. A coupling element assembly for sliding clasp fasteners according to claim 9, said parallel spaced portions being embedded in said coupling elements extending longitudinally along said coupling elements.
11. A coupling element assembly for sliding clasp fasteners according to claim 10, said parallel spaced portions extending substantially the full length of said coupling elements.
12. A coupling element assembly for sliding clasp fasteners according to claim 9, said third thread having a pattern of $6-6/5-5/6-6/0-0/1-1/0-0$.
13. A coupling element assembly for sliding clasp fasteners according to claim 9, said third thread having a pattern of $5-5/0-0$.
14. A coupling element assembly for sliding clasp fasteners according to claim 2, including a pair of third threads symmetrically interlaced with a selected one of the first threads in each of said warp-knit elongate webs and having a plurality of parallel portions spaced longitudinally on said first threads and extending transversely of said wales.
15. A coupling element assembly for sliding clasp fasteners according to claim 14, said parallel spaced portions being embedded in said coupling elements extending longitudinally along said coupling elements.
16. A coupling element assembly for sliding clasp fasteners according to claim 15, said parallel spaced portions extending substantially the full length of said coupling elements.
17. A coupling element assembly for sliding clasp fasteners according to claim 14, said pair of third threads comprising opposite patterns of $4-4/3-3/4-4/0-0/1-1/0-0$ and $0-0/1-1/0-0/4-4/3-3/4-4$.
18. A coupling element assembly for sliding clasp fasteners according to claim 14, said pair of third threads comprising opposite patterns of $0-0/6-6/6-6/0-0$ and $6-6/0-0/0-0/6-6$.
19. A coupling element assembly for sliding clasp fasteners according to claim 2, including a pair of sets of third threads symmetrically interlaced with said first threads in said warp-knit elongate webs and having a plurality of parallel portions spaced longitudinally on said first threads and extending transversely of said wales.
20. A coupling element assembly for sliding clasp fasteners according to claim 19, said parallel portions being embedded in said coupling elements extending longitudinally along said coupling elements.
21. A coupling element assembly for sliding clasp fasteners according to claim 20, said parallel spaced portions extending substantially the full length of said coupling elements.
22. A coupling element assembly for sliding clasp fasteners according to claim 19, said pair of sets of third threads comprising opposite patterns of $0-0/1-1/0-0/5-5/4-4/5-5$ and $5-5/4-4/5-5/0-0/1-1/0-0$.
23. A coupling element assembly for sliding clasp fasteners according to claim 2, including a pair of third thread knitted with said first threads in said warp-knit elongate webs and having a plurality of parallel portions spaced longitudinally on said first threads extending transversely of said wales.
24. A coupling element assembly for sliding clasp fasteners according to claim 23, said parallel spaced portions being embedded in said coupling elements extending longitudinally along said coupling elements.
25. A coupling element assembly for sliding clasp fasteners according to claim 24, said parallel spaced portions extending substantially the full length of said coupling elements.
26. A coupling element assembly for sliding clasp fasteners according to claim 1, including a pair of third threads symmetrically interlaced with the first threads in said warp-knit elongate webs and having a plurality of parallel portions spaced longitudinally on said first threads and extending transversely of said wales.
27. A coupling element assembly for sliding clasp fasteners according to claim 26, said parallel spaced portions being embedded in said coupling elements extending longitudinally along said coupling elements.
28. A coupling element assembly for sliding clasp fasteners according to claim 27, said parallel spaced portions extending substantially the full length of said coupling elements.
29. A coupling element assembly for sliding clasp fasteners according to claim 2, the pair of wales in one of said warp-knit elongate webs extending through one of the leg portions of each coupling element, and the other pair of wales in the other warp-knit elongate web extending through the other leg portion of each coupling element.
30. A coupling element assembly for sliding clasp fasteners according to claim 2, including a pair of core threads each extending longitudinally between the pair of wales in one of said warp-knit elongate webs.
31. A coupling element assembly according



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to claim 1 and substantially as described with reference to and as illustrated in any of the accompanying drawings.

32. A method of producing a coupling element assembly for sliding clasp fasteners, comprising: providing a warp-knit elongate structure having a pair of parallel, spaced warp-knit elongate webs and a plurality of transverse thread portions spaced longitudinally of and interconnecting said warp-knit elongate webs; moulding an elongate blank element around one of said transverse thread portions across said warp-knit elongate webs, said elongate blank element when bent defining a coupling element; and bending said elongate blank element about its transverse central axis to form a coupling element with one of the warp-knit elongate webs overlying the other.
33. A method of producing a coupling element assembly for sliding clasp fasteners, comprising the steps of: providing a warp-knit elongate structure having a pair of spaced warp-knit elongate webs and a plurality of transverse thread portions spaced longitudinally of and interconnecting said warp-knit elongate webs; introducing said warp-knit elongate structure into

- an elongate mould cavity having the shape of a blank coupling element so that said webs extend across the elongate mould cavity at its end portions and one of said transverse thread portions is disposed longitudinally in the mould cavity at a time; moulding synthetic resin around the portion of said webs and the transverse thread portion which are disposed in the mould cavity, thereby forming a blank coupling element product which is a portion of a coupling element assembly; separating said moulded blank coupling element product from the mould cavity; and bending said moulded blank coupling element product about its transverse central axis into the shape of a U.
34. A method of producing a coupling element assembly for sliding clasp fasteners, substantially as herein described with reference to the accompanying drawings.
35. A method as claimed in claim 32 or 33 wherein the coupling element assembly is a coupling element assembly as claimed in any of claims 1 to 30.
36. A coupling element assembly when produced by the method claimed in any of claims 32 to 35.