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"SEPARABLE SLIDE FASTENER"

The present invention relates to a separable slide fastener for use on knit garments such as cardigans.

There have been proposed separable slide fasteners which have in their stringer tapes longitudinal coarse regions or openings loosely receptive of a chain of thread loops for attaching the stringer tape to a knit garment. The applicant has proposed such separable slide fasteners in British patent application Nos. 8100324 and 8110886 filed 7th January 1981 and 7th April 1981, respectively. The proposed separable slide fasteners are connected to knit garments on a knitting machine or linking machine with needles of the machine insertable into the openings in the stringer tape. The separable slide fastener as attached to the knit garment is prevented from becoming puckered or wavy since the openings in the tape that loosely accommodate the thread loops take up forces applied to the knit garment. The knit garment such as a cardigan, while worn with the slide fastener closed, is subjected to a lateral pull particularly at its hem or lower end around the wearer's waist, imposing more tension on a lower end of the slide fastener than on other parts of the latter. Therefore, an end of the chain of thread loops which extends around the lower end of the slide fastener is likely to be displaced laterally off the tape end under continued or sudden lateral stresses.

It is believed possible by means of the present invention to provide a separable slide fastener attachable to a knit garment and having means for anchoring a thread

loop stably on a lower end of the slide fastener against displacement under forces applied to the knit garment to which the slide fastener is attached.

According to the present invention, there is
5 provided a separable slide fastener comprising:

- (a) a pair of warp-knit stringer tapes each including a pair of first and second webs with a wale-free region extending longitudinally therebetween, and a connector thread interconnecting said first and
10 second webs transversely across said wale-free region at longitudinal intervals, said stringer tapes being juxtaposed with said second webs disposed adjacent to each other, said wale-free region being receptive of a chain of thread loops for connecting said stringer
15 tape to a fabric;
- (b) a pair of rows of coupling elements each mounted on said second web of one of said stringer tapes remotely from said wale-free region;
- (c) a slider movable along said pair of rows of coupling
20 elements for engaging and disengaging the latter;
- (d) a separable bottom end stop comprising a box and a box pin extending therefrom, which are mounted on one of said stringer tapes at one end thereof, and a pin mounted on the other stringer tape at one end
25 thereof and insertable into said box; and
- (e) a reinforcement member mounted on each of said stringer tapes at said one end thereof and connected to said separable bottom end stop, said reinforcement

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member including a thin film bonded to the stringer tape and a thick body extending transversely between the first and second webs across said wale-free region, said thick body being disposed around said one end of said tape, said thick body of said reinforcement member including means adjacent to said wale-free region for anchoring an end of the chain of thread loops on said reinforcement member against displacement thereof.

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

FIG. 1 is a front elevational view of a garment to which a separable slide fastener in accordance with the present invention is attached;

15 FIG. 2 is an enlarged plan view of a separable slide fastener embodying the present invention;

FIG. 3 is an enlarged fragmentary plan view of the separable slide fastener shown in FIG. 2;

20 FIG. 4 is an enlarged cross-sectional view taken along line IV-IV of FIG. 3;

FIG. 5 is a point diagram showing lapping movements for a warp-knit stringer tape of the separable slide fastener shown in FIG. 2;

25 FIGS. 6, 7 and 8 are frequency plan views of modified separable slide fasteners embodying the present invention;

FIG. 9 is an enlarged fragmentary perspective view of the separable slide fastener of FIG. 2 as attached to a knit fabric on a linking machine;

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FIG. 10 is a plan view of a separable slide fastener according to another embodiment;

FIG. 11 is an enlarged plan view of the separable slide fastener of FIGS. 10 as attached to a knit fabric;

5 FIG. 12 is an enlarged cross-sectional view taken along line XII-XII of FIG. 11;

FIG. 13 is an enlarged fragmentary perspective view of the separable slide fastener shown in FIG. 10 as attached to a knit fabric with thread loops;

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FIG. 14 is a fragmentary plan view of a modified separable slide fastener;

FIG. 15 is an enlarged cross-sectional view taken along line XV - XV of FIG. 14;

FIG. 16 is a fragmentary plan view of a modified separable slide fastener;

FIG. 17 is a plan view of a separable slide fastener according to still another embodiment of the present invention;

FIG. 18 is an enlarged fragmentary plan view of the separable slide fastener of FIG. 17 as mounted on a knit fabric;

FIG. 19 is an enlarged cross-sectional view taken along line XIX - XIX of FIG. 18;

FIG. 20 is an enlarged fragmentary perspective view of the separable slide fastener shown in FIG. 17 as attached to a knit fabric with thread loops;

FIG. 21 is a fragmentary/plan view of a separable slide fastener according to still another embodiment of the present invention;

FIG. 22 is an enlarged fragmentary plan view of the separable slide fastener illustrated in FIG. 21;

FIG. 23 is an end view of the separable slide fastener of FIG. 21;

FIG. 24 is a cross-sectional view taken along line XXIV - XXIV of FIG. 22;

FIG. 25 is an enlarged fragmentary perspective view of the separable slide fastener shown in FIG. 21 as attached to a knit fabric with thread loops;

FIG. 26 is a fragmentary plan view of a modified separable slide fastener;

FIG. 27 is a fragmentary plan view of another modified separable slide fastener as mounted on a knit fabric; and

FIG. 28 is an end view of the separable slide fastener illustrated in FIG. 27.

As shown in FIG. 2, a separable slide fastener 10 for use on a garment such as a cardigan having completely separable opposite edges along which the fastener is attachable, comprises a pair of warp-knit stringer tapes 11,12 each including a pair of first and second longitudinal warp-knit webs 13,14 with a wale-free coarse region 15 therebetween which is preferably devoid of one to four wales. The webs 13,14 are interconnected by a connector thread 16 extending transversely across the wale-free region 15 at longitudinal intervals, providing a plurality of rectangular openings 17 arranged longitudinally in and along the wale-free region 15. A pair of rows of coupling elements 18,19 which are made preferably of filamentary plastic material is mounted respectively on the second webs 14,14 along longitudinal opposite edges thereof. A slider 20 is slidably mounted on the rows of coupling elements 18,19 for taking the latter into and out of interdigitating engagement to open and close the slide fastener 10.

A pair of top end stops 21,22 is secured respectively to the opposed edges of the webs 14,14 and located at an upper end of the stringer tapes 11,12 to prevent the slider 20 from moving off the rows of coupling elements

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18,19 past the top end stops 21,22. A separable bottom end stop 24 is mounted on lower ends of the stringer tapes 11,12 and includes a box 25 and a box pin 26 extending therefrom, the box 25 and the box pin 26 being injection-molded on the lower end of the stringer tape 11, and a pin 27 injection-molded on the end of the stringer tape 12 and insertable into and removable from the box 25 in parallel relation to the box pin 26. The separable bottom end stop 24 is located at a lower end of the rows of coupling elements 18,19.

As best illustrated in FIG. 3, a pair of reinforcement members 28,28 of thermoplastic synthetic resin is mounted on the lower ends of the stringer tapes 11,12, respectively and connected to the separable bottom end stop 24. Each of the reinforcement members 28 includes an L-shaped thin film 29 bonded to the stringer tape and a thick body 30 injection-molded on the tape and extending transversely between the first and second webs 13,14 across the wale-free region 15, the body 30 being disposed around the lower end of the stringer tape as best shown in FIG. 4. A projection 31 extends from the reinforcement body 30 substantially in alignment with the first web 13 and projects in a direction away from the stringer tape.

The slide fastener 10 thus constructed is attached to a knit garment 33 (FIGS. 1, 3 and 4) such as a cardigan by chains of thread loops 32 along the wale-free regions 15 on a knitting machine or a linking machine, the garment 33 having a hem or lower edge portion 34 which is the most stretchable when the garment 33 is worn with the slide fastener 10 closed and to which the lower ends of

the stringer tapes 11,12 are attached. The chain of thread loops 32 includes a lowermost end loop 35 which extends around the reinforcement body 30 as shown in FIG. 4. The reinforcement body 30 has a pair of protuberances 36,37 disposed one on each side of the wale-free region 15 and projecting in a direction perpendicular to the stringer tape 11,12. The projection 31 serves to anchor the end loop 35 stably on the reinforcement body 30 against displacement thereof under forces applied via the hem 34 to the slide fastener 10. The protuberances 36,37 also prevent the end loop 35 from being displaced off the reinforcement body 30, and from being worn by repeated contact with the wearer's other clothes.

Each of the stringer tapes 11,12 is warp-knit in patterns as illustrated in FIG. 5. The second web 14 is composed of chain stitches 40 knit in the pattern of 1-0/0-1, warp threads 41 laid in the pattern of 0-0/1-1 along an edge of the web 14 for reinforcement thereof to support a row of coupling elements, weft threads 42 laid in the pattern of 0-0/4-4, and tricot stitches 43 knit in the pattern of 1-2/1-0. The first web 13 is composed of chain stitches 44 knit in the pattern of 1-0/0-1, a weft thread 45 laid in the pattern of 0-0/4-4, and tricot stitches 46 knit in the pattern of 1-2/1-0. The chain stitches 40,44 located along the edges of the webs 14,13 are made of threads thicker than those of other chain stitches to reinforce the wales along the edges of the webs 14,13. The connector thread 16 is laid in the pattern of 0-0/1-1/0-0/1-1/0-0/0-0/4-4/3-3/4-4/3-3/4-4/4-4 across the wale-free region 15.

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The connector thread 16 is made of a plurality of twisted yarns (for example, #20) which are thicker than other foundation threads.

FIG. 6 illustrates a modified separable slide fastener 48 including a reinforcement member 49 mounted on a lower end of each stringer tape 50 and comprising a thick body 51 extending transversely across the stringer tape 50 and disposed around the lower end of the stringer tape 50. A pair of parallel projections 52,53 extends from the body 51 in a direction away from the stringer tape 50, and they are spaced transversely from each other across a wale-free region 54 in the stringer tape 50. The slide fastener 48 is attached to a knit fabric 58 by chains of thread loops 55, the lower most one of which extends around the thick body 51 and is located between the projections 52,53 against displacement off the body 51. The reinforcement body 51 has a pair of protuberances 56,57 projecting in a direction perpendicular to the stringer tape 50 and positioned substantially in alignment with the projections 52,53, respectively, in the longitudinal direction of the stringer tape 50.

According to a modified separable slide fastener 60 illustrated in FIG. 7, a reinforcement member 61 on a lower end of each stringer tape 62 comprises a thick transverse body 63 disposed around the lower end of the stringer tape 62 and having a pair of parallel spaced projections 64,65 extending away from the stringer tape 62 and disposed one on each side of a wale-free region 66 in the stringer tape 62. The projections 64,65 are interconnected by a connector 67 extending therebetween and spaced from the

reinforcement body 63. When the separable slide fastener 60 is attached to a knit fabric 71 by thread loops 68, the lowermost one of the thread loops 68 extends around the body 63 and is located between the projections 64,65. Thus, the projections 64,65 prevent the lowermost loop 68 from being displaced off the reinforcement body 63. The connector 67 serves to stabilize the lower end of the slide fastener 60 when the latter is mounted on the knit fabric 71. The reinforcement body 63 also has a pair of protuberances 69,70 which serves to prevent the lowermost thread loop 68 from being displaced and worn.

Another modified separable slide fastener 72 shown in FIG. 8 comprises a reinforcement member 73 mounted on each stringer tape 74 and including a pair of parallel spaced thick bodies 75,76, the body 75 being disposed around a lower end of the stringer tape 74 and the body 76 being spaced from the stringer tape 74. A projection 77 extends from the reinforcement body 76 in a direction away from the stringer tape 74 substantially in alignment with a web 78 of the tape 74 located outwardly of a wale-free region 79 in the tape 74. Each of the reinforcement bodies 75,76 has a pair of spaced protuberances 80,81 projecting perpendicularly to the stringer tape 74. When the separable slide fastener 72 is attached to a knit fabric 83 by chains of thread loops 82, the projection 77 and the protuberances 80,81 on the body 76 serve to prevent the lowermost thread loop from being disposed off the body 76 under forces applied via the knit fabric 83 laterally to the slide fastener 72. With the arrangement shown in

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FIG. 8, the reinforcement member 73 serves to stabilize the lower end of the slide fastener 72 on the knit fabric 83 and also to allow thread loops to be fastened around the reinforcement bodies 75,76 for dependable prevention of displacement of such thread loops.

FIG. 9 is illustrative of a manner in which the separable slide fastener 10 shown in FIG. 2 is knit into a knit fabric 84 such as of a cardigan along an edge 85 thereof. The stringer tape 11,12 is fastened to the knit fabric 84 by a first row of loops 87 extending walewise through the knit fabric 84 and a row of openings 17 in the wale-free region 15 in the stringer tape 12. A linking thread 88 in the form of a row of loops or chain stitches is interlooped with the first row of loops 87 projecting through the openings 17 to connect the stringer tape 12 and the knit fabric 84 together. Such linking operation can be carried out by an ordinary knitting machine or a linking machine or looper (not shown).

FIG. 10 illustrates a separable slide fastener 100 according to another embodiment of the present invention. The separable slide fastener 100 comprises a pair of warp-knit stringer tapes 101,102 each including a pair of first and second longitudinal warp-knit webs 103,104 with a wale-free coarse region 105 therebetween. The webs 103,104 are interconnected by a connector thread 106 extending transversely across the wale-free region 105 at longitudinal intervals, providing a plurality of rectangular openings 107 arranged longitudinally in and along the wale-free region 105. A pair of rows of coupling elements 108,109

which are made preferably of filamentary plastic material is mounted respectively on the second webs 104,104 along longitudinal opposite edges thereof. A slider 110 is slidably mounted on the rows of coupling elements 108,109 for taking the latter into and out of interdigitating engagement to open and close the slide fastener 100.

The separable slide fastener 100 also includes a separable bottom end stop 112 at a lower end thereof which comprises a box 113 and box pin 114 mounted on the stringer tape 101 and a pin 115 mounted on the stringer tape 102. Each of the stringer tapes 101,102 has on its lower end a reinforcement member 116 connected to the separable bottom end stop 112 and comprising an L-shaped thin film 117 bonded to the stringer tape and a thick body 118 injection-molded around the lower end of the stringer tape. The reinforcement member 116 extends transversely across the wale-free region 105. As shown in FIGS. 10 and 11, the body 118 of each reinforcement member 116 has a bottom 119 facing away from the stringer tape and a roughened surface or a series of teeth 120 defined on the bottom and coextensive substantially widthwise with the wale-free region 105, the teeth 120 projecting longitudinally of the stringer tape 101,102. When the separable slide fastener 100 is mounted on a knit fabric 121 by chains of thread loops 122 along the wale-free regions 105, the lowermost one 123 of the thread loops 122 extends around the body 118 of each reinforcement member and engages the teeth 120 against displacement off the reinforcement body 118.

 The separable slide fastener 100 can be attached to a knit fabric 125 along an edge 126 thereof on a knitting or linking machine by interlooping a first row of thread loops 128 with a second row of loops or chain stitches 129, as illustrated in FIG. 13.

FIGS. 14 and 15 illustrate a modified separable slide fastener 130 comprising a pair of warp-knit stringer tapes 131, 132 each including a wale-free region 133 and a separable bottom end stop 134 mounted on the stringer tapes 131, 132 at lower ends thereof. Each of the stringer tapes 131, 132 has on the lower end a reinforcement member 135 comprising a thin film 136 extending transversely across the wale-free region 133 and a thick body 137 disposed around the lower end of the stringer tape. The thick body 137 has a pair of opposite surfaces 138, 139 (FIG. 15) one on each side of the stringer tape 131, 132, each of the surfaces 138, 139 having defined thereon a series of teeth 140 extending longitudinally of the stringer tape 131, 132. With the slide fastener 130 attached to a knit fabric 143 by thread loops 141, a lowermost thread loop 142 engages the teeth 140 on each reinforcement body 137 and is prevented thereby from being displaced laterally off the body 137.

Another modified separable slide fastener 145 shown

in FIG. 16 comprises a reinforcement member 146 mounted on a lower end of each warp-knit stringer tape 147 and comprising a thin film 148 extending transversely of the stringer tape 147 and a thick body 149 disposed around the lower end of the stringer tape 147. The body 149 has a series of teeth 150 on each of its bottom 151 and opposite surfaces 152 (one shown), the teeth 150 extending longitudinally of the stringer tape 147. The teeth 150 thus defined continuously around the body 149 enables a thread loop (not shown) to be more stably anchored on the body 149 against displacement.

FIGS. 17 through 20 show a separable slide fastener 155 constructed according to still another embodiment, the slide fastener 155 having a wale-free region 156 in each warp-knit stringer tape 157 and a separable bottom end stop 158 mounted on lower ends of the stringer tapes 157. Each stringer tape 157 has on the lower end a reinforcement member 159 including a thin film 160 extending transversely of the stringer tape 157 and a thick body 161 disposed around the lower end of the stringer tape 157. The thick body 161 has in a bottom 162 thereof a recess 163 substantially aligned with the wale-free region 156 and opening away from the stringer tape 157. When the slide fastener 155 is mounted on a knit fabric 166 by chains of thread loops 164 running along the wale-free regions 156, a lowermost thread loop 165 extends around each of the reinforcement body 161 and is received in the recess 163 as best illustrated in FIG. 18. The thread loop 165 thus received in the recess 163 is stably anchored

therein without the risk of being displaced off the reinforcement body 161. As shown in FIG. 20, the separable slide fastener 155 can be attached to a knit fabric 166 along an edge 167 thereof by a series of thread loops 169 inter-looped by a chain of thread loops 170 on a knitting or linking machine.

A separable slide fastener 172 according to still another embodiment comprises, as shown in FIG. 21, a pair of warp-knit stringer tapes 173, 173 each having a wale-free region 174 and a separable bottom end stop 175 mounted on lower ends of the stringer tapes 173, 173 and located centrally of the slide fastener 172. A reinforcement member 176 is mounted on the lower end of each stringer tape 173 and connected to the separable bottom end stop 175. The reinforcement member 176/ comprises a thin film 177 bonded to the stringer tape 173 and a thick body 178 extending across the wale-free region 174 and disposed around the lower end of the stringer tape 173. The thick body 178 has, as shown in FIG. 23, a pair of opposite surfaces 179, 180 disposed one on each side of the stringer tape 173 and diverging progressively away from each other such that the body 178 increases progressively in cross section outwardly away from the separable bottom end stop 175. With the separable slide fastener 172 attached to a knit fabric 183 by chains of thread loops 181 (FIG. 22), the bodies 178 with the inclined surfaces 179, 180 prevent lowermost end loops 182 from being displaced off the bodies 178 in a direction away from the separable bottom end stop 175 as shown in FIGS. 22 and 24, even under forces tending to pull the stringer tapes 173

laterally apart. As illustrated in FIG. 25, the slide fastener 172 can be attached to the knit fabric 183 along an edge 184 thereof on a knitting or linking machine by interlooping a series of thread loops 186 with a chain of thread loops 187 both supplied from the machine.

According to a modification shown in FIG. 26, a reinforcement member 188 comprises a thin film 189 and a thick body 190 having a bottom surface 191 facing away from the stringer tape 173 at an angle of inclination. With this arrangement, a thread loop (not shown) disposed around the body 190 is prevented by the inclined bottom surface 191 from being displaced off the body 190.

FIGS. 27 and 28 illustrate still another modification in which a reinforcement member 193 on each stringer tape 194 having a wale-free region 195 comprises a thin film 196 and a thick body 197 connected to a separable end stop 198 and extending across the wale-free region 195. The thick body 197 has a central opening 199 of a substantially triangular shape which is substantially aligned with the wale-free region 195. The thick body 197 has a pair of opposite surfaces 202, 203 positioned one on each side of the stringer tape 194 and diverging away from each other such that the cross section of the body 197 increases progressively in a direction away from the separable bottom end stop 198. When attached to a knit fabric 201 by thread loops 200, lower thread loops 204 are received in the openings 199 and prevented by the inclined surfaces 202, 203 from being displaced off the bodies 197. The reinforcement bodies 197

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also serve to stabilize the lower ends of the stringer tapes 194 when mounted on the knit fabric 201.

Although certain preferred embodiments have been described in detail, it should be understood that many changes and modifications may be made therein without departing from the scope of the appended claims.



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CLAIMS:-

1. A separable slide fastener comprising:

(a) a pair of warp-knit stringer tapes each including a pair of first and second webs with a wale-free region extending longitudinally therebetween, and a connector thread interconnecting said first and second webs transversely across said wale-free region at longitudinal intervals, said stringer tapes being juxtaposed with said second webs disposed adjacent to each other, said wale-free region being receptive of a chain of thread loops for connecting said stringer tape to a fabric;

(b) a pair of rows of coupling elements each mounted on said second web of one of said stringer tapes remotely from said wale-free region;

(c) a slider movable along said pair of rows of coupling elements for engaging and disengaging the latter;

(d) a separable bottom end stop comprising a box and a box pin extending therefrom, which are mounted on one of said stringer tapes at one end thereof, and a pin mounted on the other stringer tape at one end thereof and insertable into said box; and

(e) a reinforcement member mounted on each of said stringer tapes at said one end thereof and connected to said separable bottom end stop, said reinforcement



member including a thin film bonded to the stringer tape and a thick body extending transversely between the first and second webs across said wale-free region, said thick body being disposed around said one end of said tape, said thick body of said reinforcement member including means adjacent to said wale-free region for anchoring an end of the chain of thread loops on said reinforcement member against displacement thereof.

2. A separable slide fastener according to claim 1, said means comprising a projection extending from said body substantially in alignment with said first web and projecting away from said stringer tape.

3. A separable slide fastener according to claim 2, said means including a pair of protuberances disposed on said body one on each side of said wale-free region and projecting in a direction perpendicular to said stringer tape.

4. A separable slide fastener according to claim 2 or 3, said means including a second projection extending from said body parallel to said first-mentioned projection and spaced transversely from the latter, said second projection extending away from said stringer tape.

5. A separable slide fastener according to claim 4, said means including a connector extending between said projections and spaced from said body.



6. A separable slide fastener according to claim 1, ⁽¹²⁾ said reinforcement member including a second body extending transversely of said stringer tape in parallel spaced relation to the first-mentioned body, said first
5 body being disposed around said one end of the stringer tape, said second body being spaced from said one end of the stringer tape, and said means comprising a projection extending from said second body substantially in alignment with said first web and projecting away from said stringer
10 tape.
7. A separable slide fastener according to claim 6, said means including a pair of protuberances disposed on each of said bodies one on each side of said wale-free region and projecting in a direction perpendicular to said
15 stringer tape.
8. A separable slide fastener according to claim 1, said means comprising a series of teeth defined on said body and arranged longitudinally of said stringer tape.
9. A separable slide fastener according to claim 8,
20 said body including a bottom facing away from said stringer tape, said teeth being provided on said bottom.
10. A separable slide fastener according to claim 8, said body including a pair of opposite surfaces one on each side of said stringer tape, said teeth being provided
25 on each of said surfaces.
11. A separable slide fastener according to claim 8, said body including a bottom facing away from said stringer tape and a pair of opposite surfaces one on each side of



5 said stringer tape, said teeth being provided on each of
said bottom and surfaces.

12. A separable slide fastener according to claim 1,
said means comprising a recess in said body opening away
5 from said stringer tape for receiving therein the end
of the chain of thread loops.

13. A separable slide fastener according to claim 1, said
means comprising a pair of opposite surfaces of said
body which are disposed one on each side of said stringer
10 tape and diverge progressively away from each other such
that said body increases progressively in cross section
away from said separable bottom end stop.

14. A separable slide fastener according to claim 13,
said means including a surface of said body facing away
5 from said stringer tape at an angle of inclination.

15. A separable slide fastener according to claim 13,
said body having an opening receptive of a portion of the
chain of thread loops.