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3,487,510

SLIDE-FASTENER ASSEMBLY AND METHOD OF MAKING SAME

Filed March 1, 1967

2 Sheets-Sheet 1

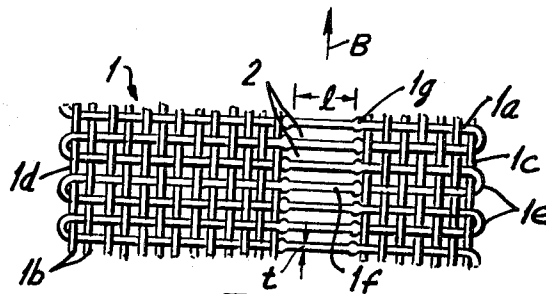


FIG. 1

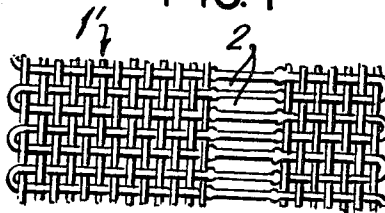


FIG. 2

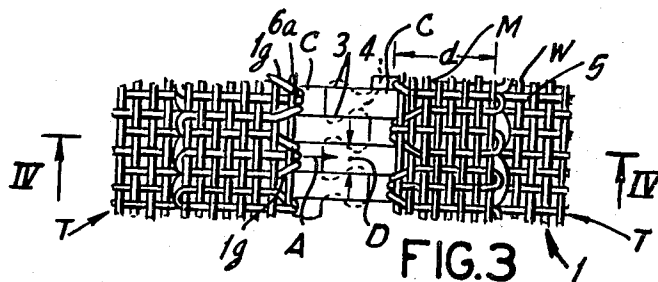


FIG. 3

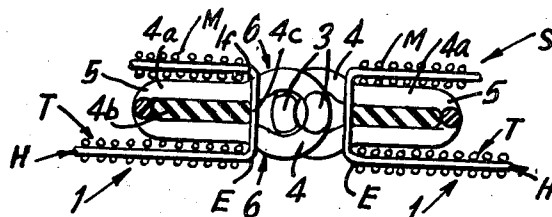


FIG. 4

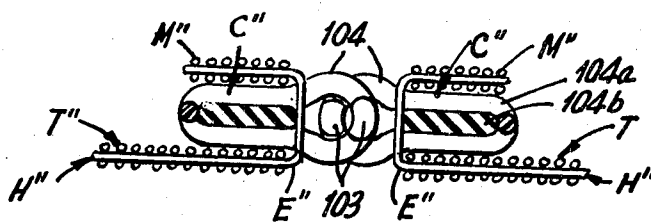


FIG. 5

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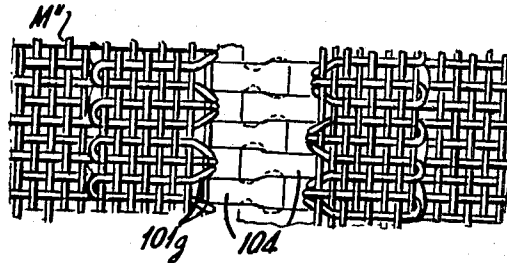


FIG. 6

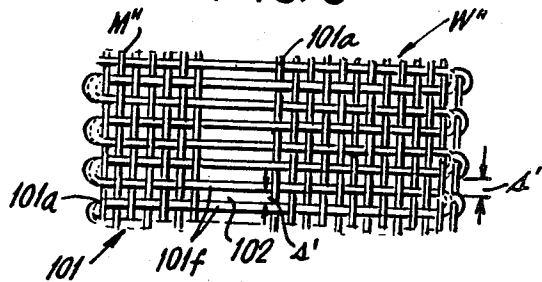


FIG. 7

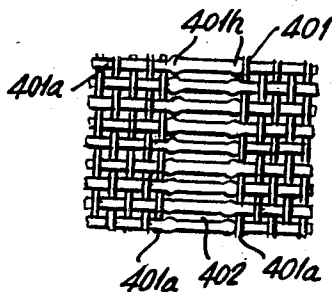


FIG. 8

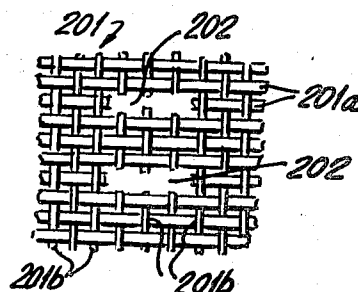


FIG. 9

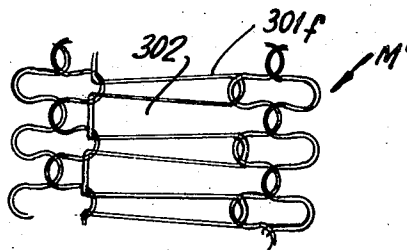


FIG. 10

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SLIDE-FASTENER ASSEMBLY AND METHOD OF MAKING SAME

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Claims priority, application Germany, Mar. 3, 1966,

O 11,484, O 11,488

Int. Cl. A44b 19/00

U.S. Cl. 24—205.1

18 Claims

ABSTRACT OF THE DISCLOSURE

Method of making a slide-fastener assembly and the slide-fastener structure made thereby wherein a pair of matingly interconnected and separable slide-fastener halves are each provided with a respective fabric tape and a helicoidal or meandering coupling element disposed along one edge of the tape, whereby the tape is composed at least in part of a shrinkable material and has a row of openings receiving the heads of the coupling elements and is thereafter shrunk to hug these heads and anchor the coupling elements to the tapes. Shrinkage is effected by heat (when the fabric is composed of thermoplastic threads) and/or by chemical treatment (when natural fibers are used). Shrinkage in the weft or transverse direction of the fabric is greater than that in the longitudinal or warp direction and the weft threads between the openings are provided with formations serving as stops for the warp threads bordering the openings. The openings are punched from the fabric or formed by omission of corresponding warp threads in the weaving process. A marginal portion of the fabric band adjoining the row of openings is turned about the coupling element and can be stretched thereon to retain the coupling element at least in part by the spring-back force of the heat-treated thermoplastic threads.

My present invention relates to an improved slide-fastened assembly and method of making same and, more particularly, to a slide-fastener arrangement wherein a pair of slide-fastener halves are each provided with a coupling element, matingly engageable with the coupling element of the other slide-fastener half, extending along one edge of a support tape and affixed thereto, whereby a slider can be drawn along the coupling elements to connect and disconnect them throughout the length of the slide fastener.

Slide-fastener assemblies conventionally have been provided with coupling elements consisting of spaced-apart coupling bodies or chains of coupling heads which are attached to the edge of a support tape by one or more securing techniques. Thus it is common, when a meandering-type coupling element or a helicoidal-coil coupling element is employed, to stitch the coupling elements directly to a fabric or foil tape inwardly of the coupling heads which are adapted to be interleaved with the coupling heads of the metallic slide-fastener element. Other techniques for attaching the coupling elements to the tape include the use of a filler cord extending along the flanks of a continuous coupling element and stitched between the coupling bodies to the support fabric. In still other arrangements, thermoplastic coupling elements are thermally fused to the tape, or adhesives are em-

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ployed to join the coupling elements to the respective support bands. When the coupling element is constituted by a chain of discrete coupling bodies, similar systems including the use of filler cords or involving the crimping of the coupling body to the tape may be employed effectively.

The term coupling element as used here is intended to designate continuous coupling chains which are molded, embossed, stamped or extruded from a synthetic-resin material and which preferably are generally helicoidal or meandering in configuration (see, for example, U.S. Patent No. 3,136,016) for the present purposes; however, the principles involved pertain also to a series of individual coupling bodies which are spaced apart along the edge of the support tape so as to appear as a coupling chain.

The aforementioned conventional methods of attaching the coupling elements to the respective tapes, along the proximal edges thereof, of a slide fastener, are disadvantageous in many respects. For example, adhesives and thermal-welding techniques increase the stiffness of the slide fastener while sewing methods, whereby the stitching needle must pass rapidly between the coupling head close to the edge of the tape, frequently reduce the strength of the latter at precisely those regions at which the coupling element is joined to its support. Furthermore, the coupling elements themselves must be designed to accommodate the stitching means while special sewing-machines and guides must be provided to assure proper positioning of the coupling elements on the tapes. Considerable skill is required for many operations whereby the coupling elements are attached to the tapes with increased labor cost and a greater tendency toward defects.

It is, therefore, the principal object of the present invention to provide an improved method of making slide-fastener assemblies of the aforescribed type whereby the connection of the coupling elements to the respective support tapes is simplified and facilitated.

A further object of my invention is to provide an improved slide-fastener assembly in which the fastening of the coupling elements to the support tape is reinforced or strengthened relative to conventional attachment methods and whereby the coupling heads are precisely and immovably fixed in position along the tape.

Still another object of my invention is to provide a slide-fastener assembly and method of making same whereby dislocation of the coupling heads can be limited and the manufacture of the assembly simplified and improved.

I have now found that it is possible to secure coupling elements of slide-fastener assemblies to the respective tapes in an accurate and relatively simple manner, without weakening of the junction and even without the relatively complex means hitherto necessary for such purposes, by providing the fabric support tape, usually proximal to the edge at which the coupling element is to project but inwardly of the marginal portion of the tape at this edge, with a row of openings (spaced apart a frequency sufficient to enable the head of the coupling element to pass through these openings) extending parallel to this edge. The tape or band is, advantageously, provided with shrinkable filaments or threads at least extending transversely to this row of openings and interconnecting the marginal portion of the tape with the remainder thereof, whereby the coupling element is mounted upon the tape with coupling heads passing through the respective openings,

and the assembly is thereafter treated to shrink at least the threads bordering the opening and seize the coupling element at the necks thereof which pass through the openings. Thus, the support tape is composed of a shrinkable material, i.e. is woven or knitted from shrinkable threads of the character described or contains shrinkable filaments together with, or incorporated in generally nonshrinkable threads. Alternatively, the shrinkable thread may be interspersed with nonshrinkable threads or disposed only between the openings while the balance of the threads constituting the fabric are of a nonshrinkable character. Upon shrinkage of the tape, therefore, the threads defining the openings are tightened about and hug the heads of the coupling element, while retaining the coupling element.

According to a further feature of this invention, the support tape is composed of a fabric whose threads are shrinkable in the longitudinal (i.e. warp) direction (i.e. parallel to the row of openings and the coupling elements) as well as transversely of the row of openings. In this case, the stronger shrinkage is preferably in the transverse (i.e. weft) direction. The openings may, as indicated earlier, be formed by omitting one or more threads in the weaving operation or by distending or loosening a row of loops in a knitting system.

Advantageously, the marginal portion of the support tape is of a width sufficient to enable the tape to be turned back along the row of openings so that the marginal portion of the tape overlies the coupling elements and can be affixed thereto so as to embrace the coupling elements between an underlying layer of fabric formed by the body of the tape and an overlying layer constituted of this marginal portion. The shrinkage can be effected by any conventional means so that, for example, when the shrinkable threads are composed of natural fibers shrinkable in water or chemical solutions, the shrinking operation can involve an immersion, spraying and/or steam treatment of the tape; it is also desirable, and a preferred realization of this invention, to constitute the shrinkable threads of a thermally contractile fiber or filament, such as nylon, which shrinks upon heating to hug and conform to the heads of the slide fastener. The latter preferably are of the continuous type mentioned above, i.e. meandering or helicoidal, and may be composed of a molecularly orientable synthetic resin, e.g. a nylon-type polyamide, whose coupling heads are molded onto the coupling element.

In my concurrently filed, commonly assigned copending applications Ser. No. 624,647 entitled "Slide Fastener," and in the concurrently filed copending application Ser. No. 619,768 entitled "Slide Fastener With Woven Support Tape," there are described and claimed supply-fastener assemblies based upon principles equally significant here. Thus, in the application Ser. No. 624,647, the tape is provided adjacent its marginal edge with a row of openings through which the heads of a slide-fastener coupling element project generally transversely to the plane of the fabric, while alongside the coupling element, the tape is formed with a bead, generally a filler cord woven into or stitched to the fabric, the body being drawn against the coupling element throughout its length by the shrinkage of the transverse threads of the tape. The coupling elements themselves are provided with stop formations or configurations against which the body is seated. In copending application Ser. No. 619,768, the support tape is formed along its connecting edge with a woven or knitted fabric tubular portion having lateral openings extending along this edge; the coupling element is inserted in this tube and has its coupling head projecting laterally from the tape through these openings and substantially in the plane of the body of the tube. Upon shrinkage of the fabric tape, the coupling element is anchored in place.

Above and other objects, features and advantages of the present invention will become more readily apparent

from the following description, reference being made to the accompanying drawing, in which:

FIG. 1 is a plan view of a portion of a support tape, according to this invention, drawn to an enlarged scale;

FIG. 2 is a view of the same tape illustrating its dimensions and configurations after a shrinkage operation in the flat stage, it being understood that only shrinkage is effected to lock the coupling elements in place;

FIG. 3 is a plan view of a portion of a slide-fastener assembly with the slide-fastener heads thereof constituted in accordance with the present invention and matingly interconnected;

FIG. 4 is an enlarged, detailed cross-sectional view taken along the line IV—IV of FIG. 3;

FIG. 5 is a cross-sectional view corresponding generally to FIG. 4 but illustrating another slide-fastener arrangement;

FIG. 6 is a plan view of the device of FIG. 5;

FIG. 7 is a view of the support tape used in the system of FIG. 5 prior to mounting of the coupling element thereof.

FIG. 8 is a view similar to FIG. 7 of still another embodiment of this invention; and

FIGS. 9 and 10 are still other views similar to FIG. 8 of support bands according to this invention.

Referring to FIGS. 3 and 4, which show a fragment of a slide-fastener assembly according to this invention, the slide fastener S comprises basically a pair of slide-fastener halves H having, along confronting edges E, of a support tape T of each half, a respective coupling element generally designated C and formed with coupling heads interengageably with the coupling heads of the element C extending along the other coupling head. The tapes T may be stitched or otherwise secured to fabrics along the opposite sides of an opening when the slide fastener is to be employed as a separable closure for this opening.

Usually, the tape T is applied to the respective fabric layer by stitching along its web W remote from the edge E and the coupling element C carried thereby. The coupling elements themselves can be coiled from a monofilament thread of a polyamide or like heat-settable thermoplastic resin or from an extruded strand of molecularly nonoriented resin having a tendency to shrink with time.

As will now be more readily apparent from FIGS. 1-4, each slide-fastener tape-half is formed from a band 1 of woven threads whose weft thread 1a is shown to extend transversely of the band while the warp threads 1b are of a somewhat smaller thickness. The band 1 is woven, rather than cut, from a woven sheet so that the longitudinal extremities 1c and 1d of the band are formed with the looped portions 1e of the weft threads 1a. According to this invention, the band 1 is provided with a row, extending in the longitudinal direction of the slider and parallel to the coupling elements C, of throughgoing openings 2 with a spacing defined essentially by the thicknesses or gauge *t* of the weft threads 1a separating the openings 2. The spacing *s* between the weft threads 1a is so designed as to permit the heads 3 of a continuous coupling element to be inserted through the openings 2; alternately, the length *l* of these openings is such that the thread portions 1f defining them can be deflected upon introduction of the heads.

As can be seen from FIG. 4, each of the coupling elements 4 is generally helicoidally wound from a synthetic resin wire 5 with a keyhole-shaped or pear-shaped cross-section so as to form a loop 4 defining each head 3. The latter may be shaped by pressing the loops 4 in a warm state of the synthetic-resin wire in the direction of arrow A (FIG. 3), as described, for example, in the commonly assigned copending applications Ser. Nos. 591,753 and 473,002 now U.S. Patent No. 3,353,233 of Nov. 21, 1967) filed Nov. 2, 1966 and July 19, 1965. The coupling elements C themselves may be produced

by the method set forth in the aforementioned patent and U.S. Patent Nos. 3,243,489 and 3,267,514. Within the coil forming each coupling element and preferably at the respective shank portions **4a**, I provide a resilient band **4b** constituting a filler about whose inner edge **4c** the thread portions **1f** of the respective tapes can be bent. Each tape is formed with a marginal portion **M** of a width *d* substantially equal to the width of the band **4b** and the shank **4a** of the respective coupling element **C** so that substantially the entire shank portion of the coupling elements can be covered over by the marginal portion **M** when the latter is folded into a U-shaped configuration (FIG. 4) to retain the coupling element. Advantageously, the projecting loop **4** extends beyond the respective edge **E** of the tape heads **T** to an extent less than the width *d*. The shanks **4a** associated with each head **3** and loop **4** are parallel and lie in a common plane perpendicular to the longitudinal direction and the tape so that the heads can be closely spaced to admit of a fine seam upon closure of the fastener.

The woven bands **1** (FIG. 1) which are used to form the tapes **T** of the slide-fastener halves are shrinkable by conventional fabric-treatment techniques at least 10 to 15% in the transverse direction, i.e. perpendicular to the coupling elements **C** and along the weft threads **1a**, and preferably to the same or a slightly lesser extent in the longitudinal direction (arrow *b*) along the warp threads **1a**. In the embodiment shown, the shrinkage of the web is represented at **1'** in FIG. 2 which diagrammatically indicates that, while the thicknesses of the threads remain substantially unchanged, the shrinkage step condenses the fabric in both its length and width through the 10 to 15% mentioned above. The band **1** is not, however, shrunk in its flattened state but is, rather, folded about the coupling element **C** (FIG. 3) upon insertion of the loops **4** through the openings **2** of every thread **1f** thereby permitting the threads to hug the shanks **4a** on each turn of the coupling element as represented by the threads **1g** of FIG. 3. Thus, shrinkage of the tapes **T** after insertion of the respective heads will draw the weft threads **1a** tightly around the coupling elements and conform the retaining means formed by these threads to the configurations and contours of the portions of the coupling element thereby hugged tightly.

Behind the loops **4**, the coupling elements **C** are provided with shoulders **6** sloping from the loops **4** to the shank portions **4a** to form a grippable throat **6a** about which the threads **1g** are tightened by the shrinking step.

As can be seen from FIG. 3, the spacing **D** between the loops **4** and the respective heads **3** of the coupling elements **C** is defined by the threads **1f** interposed between these heads and loops. In this system, three threads **1f** are located between each pair of loops **4** such that $D=3t$.

It will be understood that, when smaller coupling-element spacings are required, lesser numbers of threads **1f** are positioned between the heads, the threads between the openings **2** in all cases completely bridging the gaps between these heads. Thus, a lesser number of threads can be positioned between the heads to attain the spacing **D** when the thickness of these threads are correspondingly enlarged. It has been found that these threads form positive spacers for the heads which are especially significant when the coupling elements are of an extruded nonoriented resin and tend to shrink with time. The threads effectively resist narrowing of the interhead gaps.

The transverse shrinkage of the weft threads **1a** or some of them ensures the fitting-type attachment of the coupling elements whereas the longitudinal shrinkage of the thread, which is proportionally less, determines the spread of the heads. Furthermore, it is possible to form the openings **2**, through which the heads are inserted, by stamping the openings from a fabric. In FIG. 9 I show such an arrangement.

In FIG. 9, the fabric **201** is of a woven character and

has both weft threads **201a** of relatively high shrinkability and warp threads **201b** of somewhat lower shrinkability stamped or punched through at **202** to form openings adapted to receive the heads of the coupling elements as described in connection with FIGS. 1-4. In this case, the weft threads **201f** disposed between the openings **202** drape around the throats of the coupling heads and lug the later upon shrinkage of the tape to retain the heads in place and space them apart to the desired degree. The bands **1**, **201** may be composed of shrinkable natural fibers, preferably cotton, which are subjected to treatment with water or a moist atmosphere in order to effect the shrinkage step. However, it is also possible to use cotton warp threads **1b**, **201b** and heat-shrinkable weft threads **1a**, **201a** to ensure the diverse shrinkage characteristics, the thermoplastic threads being of nylon or polyester such that a heat treatment at temperatures of 180° to 200° C. in steam or hot air for periods of 20 seconds to 2 minutes are effective to shrink the fibers. Cotton fabrics may also be shrunk according to this invention by conventional preshrinking technique used in the fabric industry, e.g. a chemical treatment with sodium hydroxide or other alkaline solutions. As noted earlier, best results are obtained when the coupling elements **C** are retained in tube-like formations along the confronting edge **E** of the tape halves **H**, such formations being constituted by the U-bent marginal portions **M** (FIGS. 3 and 4). Thus the marginal portions are turned back at the openings **2**. When the fibers are composed of a synthetic resin, the shrinkage step can be effected concurrently with a bond of the marginal portion to the shanks **4a** of the coupling elements **C** and with a bonding of these shanks to the body portion of webs **W** of the tapes.

FIG. 10 shows yet another modification in which the openings **302** are formed between loops **301f** of a knit fabric by omission of courses in a knitting operation. In this case, a marginal portion is formed by further knit courses or wales at **M'**, it being understood that loose loops may likewise be used to form the openings through which the heads of the coupling elements **C** are inserted.

As in the system of FIGS. 1-4, the embodiments illustrated in FIGS. 9 and 10 can have the threads **1f**, **201f** and **301f** flattened at **1h** to form projections which engage behind the necks **6** of the heads **4** and which also define the longitudinal boundaries of the row of openings **2** by forming stops for the adjoining warp threads.

In the systems of FIGS. 5-7, I show a modified arrangement wherein the fabric **101** (FIG. 7) is formed with the openings **102** between weft threads **101f** during the weaving operation by omission of warp threads **101b** in the region of the openings. In this system, the marginal portion **M''** is shown to be formed on the left hand side of the row of openings while the web portion **W''** is located on the right-hand side thereof, the band being used to form the right-hand slide-fastener half of the assembly of FIG. 5. As illustrated in the latter figure, the marginal portion **M''** of each band is turned about and overlies the shank portion **104a** of pear-shaped section whose loops **104** are formed with interlocking heads **103** and extend inwardly of the respective edge **E''** of the slide-fastener halves **H''**. In this embodiment, moreover, the tapes **T''** are formed originally with an opening width *s''* (represented in dot-dash lines in FIG. 7) greater than that necessary to cause the warp threads **101f** to hug the loops **104** of the coupling elements **C''**. Prior to insertion of the coupling elements through the openings **102**, the fabric is shrunk to its condition as indicated in dot-dash lines in FIG. 7 (e.g. through approximately 10% in linear dimension) and preferably as here shown by principally a transverse shrinkage. When the weft threads **101a** are composed of a thermoplastic material (e.g. nylon monofilament) and the fabric is shrunk by thermal treatment under the conditions stated earlier, the thermal shrinkage renders the fabric elastic in the vicinity of the openings **102** so that the threads **101g** elastically hug

the loops 104 of the coupling elements when the latter are inserted through the relatively constructed openings. The coupling elements themselves can be formed with the formations, slots or other retaining means against which the weft threads can bear to secure the coupling elements.

In the embodiments illustrated, generally helicoidal coupling elements are employed, these coupling elements being deformed to have looped heads 103, 104 and relatively parallel shanks 104a. The core 104b may also be a packing of textile material which is so positioned that the tapes are shrunk against this core as well.

In the embodiment of FIG. 8, the fabric 401 is shown to have relatively thick monofilamentary weft threads 401a provided with the flattened formation 401h which retain the warp threads 401a bonding the openings 402. The warp threads 401a can be cotton threads, the fabric here being subjected to shrinkage at elevated temperatures and in contact with shrinking solutions. Concurrently with the shrinkage treatment of systems using weft threads or by a thread treatment of the assembly at the softening temperature of the thermoplastic threads, the threads are bonded, according to this invention, to the coupling elements C, C', etc.

The invention described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the invention.

I claim:

1. A method of making a slide-fastener assembly having a pair of matingly interengageable slide-fastener halves, each provided with a respective fabric tape and a coupling element disposed along one edge of said tape while being provided with a series of spaced-apart coupling heads interfitting with the coupling heads of the other coupling element, said method comprising the steps of:

- (a) forming each of said fabric tapes with a row of throughgoing openings longitudinally of the tape;
- (b) mounting a coupling element on each of the tapes by inserting the heads of the coupling elements through corresponding openings of the respective row; and
- (c) shrinking the fabric surrounding said openings around the heads of the coupling element upon their insertion through said openings to anchor said coupling elements in the respective tapes.

2. The method defined in claim 1 wherein said fabric tapes have a greater shrinkage ratio in the transverse direction than in the longitudinal direction.

3. The method defined in claim 1 wherein said fabric is composed at least in part of a thermoplastic filamentary material and the fabric tape is shrunk in step (c) by heating the fabric tape.

4. The method defined in claim 1 wherein said fabric is composed at least in part of natural fibers and is shrunk by treating the fabric with a shrinking solution.

5. The method defined in claim 1 wherein said fabric is formed with a marginal portion along one side of the respective row of openings, said marginal portion being turned about the respective coupling element to receive the coupling element within a U-section enclosure formed by the fabric.

6. The method defined in claim 5 wherein said marginal portion is relatively resilient and is drawn tightly around the coupling element to retain the coupling element by the springback force of the elastic fabric.

7. The method defined in claim 1 wherein said openings are formed by weaving the tape with warp threads running in the longitudinal dimension thereof and weft threads running transversely of said warp threads, said openings being formed by omitting warp threads along at least part of the length of the fabric intermits its longitudinal edges,

8. The method defined in claim 7 wherein at least the weft threads bounding said openings are composed of a thermoplastic material, further comprising the steps of deforming said some of said weft threads adjacent the warp threads bounding said openings to provide them with stops for the said warp threads.

9. In a slide fastener assembly having a pair of matingly interengageable slide-fastener halves, each provided with a respective fabric tape and a coupling element disposed along one edge of the tape while being formed with a series of spaced-apart coupling heads interfitting with the coupling heads of the other coupling element, the improvement wherein said fabric tapes are composed at least in part of a shrinkable material and are provided with respective rows of openings receiving corresponding heads of the respective coupling elements, and said fabric being shrunk about said heads of the coupling elements and retained upon the respective fabric tapes by contractile forces within shrunk threads hugging the heads, said fabric tapes being composed of woven material with warp threads running in the longitudinal direction of the tape and weft threads extending transversely of the longitudinal direction and said coupling elements, said coupling elements being generally continuous, the openings of said tapes being defined by omission of certain weft threads in the regions of the respective rows and between remaining weft threads interfitting between the heads of the respective coupling elements for defining and maintaining a predetermined spacing between them, each of said tapes being provided with a marginal portion adjoining the respective rows of openings and extending therealong, said marginal portions being turned about the respective coupling elements away from the respective edge for partly enclosing said coupling elements.

10. The improvement defined in claim 9 wherein said marginal portions are resiliently stressed and retain said coupling elements at least in part by spring-back force.

11. The improvement defined in claim 9 wherein said fabric tapes are composed at least in part of heat-shrinkable thermoplastic filaments.

12. The improvement defined in claim 9 wherein said fabric tapes are composed at least in part of natural fibers shrinkable by chemical treatment.

13. The improvement defined in claim 9 wherein said heads of said coupling elements are provided with necks about which the threads of said fabric are lodged, with said threads hugging said necks.

14. The improvement defined in claim 9 wherein said coupling elements are generally helicoidal with pear-shaped cross-sections from said heads being formed as loops of said coupling elements, each head having a pair of generally parallel shanks lying in a plane of the respective head perpendicular to said tapes and to said edges.

15. The improvement defined in claim 14, further comprising a flexible core extending through said coupling elements inwardly of the respective edge, said cores forming stops against which said fabric tapes are anchored.

16. The method defined in claim 1 wherein said fabric is composed at least in part of elastic threads and the tapes are stretched upon insertion of said heads through said opening, the shrinking of the fabric surrounding said openings resulting from the natural contraction of said threads upon the stretching thereof.

17. A method of making a slide-fastener assembly having a pair of matingly interengageable slide-fastener halves, each provided with a respective fabric tape with stretchable threads and a coupling element disposed along one edge of said tape while being provided with a series of spaced-apart coupling heads interfitting with the coupling heads of the other coupling element, said method comprising the steps of:

- (a) forming each of said fabric tapes with a row of throughgoing openings longitudinally of the tape;
- (b) mounting a coupling element on each of the tapes by inserting the heads of the coupling elements

through corresponding openings of the respective row;

(c) stretching the fabric of the tapes transversely to the rows of openings within the elastic limit of the fabric; and

(d) anchoring the coupling elements to the tapes by permitting the fabric surrounding said openings to shrink and contract around the heads of the coupling element upon their insertion through said openings.

18. A slide fastener assembly having a pair of matingly interengageable slide-fastener halves, each provided with a respective stretchable knitted fabric tape and a respective continuous coupling element disposed along one edge of the tape while being formed with a series of spaced-apart coupling heads interfitting with the coupling heads of the other coupling element, the knitted fabric tapes each being formed with a row of resiliently expandable openings receiving corresponding heads of the respective coupling element by omission of knitted courses of

loops whereby wale loops bridging remaining courses tightly hug said heads with natural contractile force to anchor the coupling elements to the fabric.

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BERNARD A. GELAK, Primary Examiner

U.S. Cl. X.R.

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