Jan. 20, 1970 A. FROHLICH 3,490,108

SLIDE FASTENER

Filed March 1, 1967 2 Sheets-Sheet 1

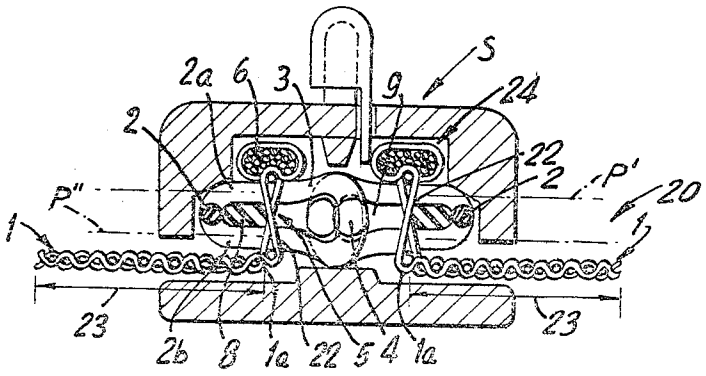

FIG. 1

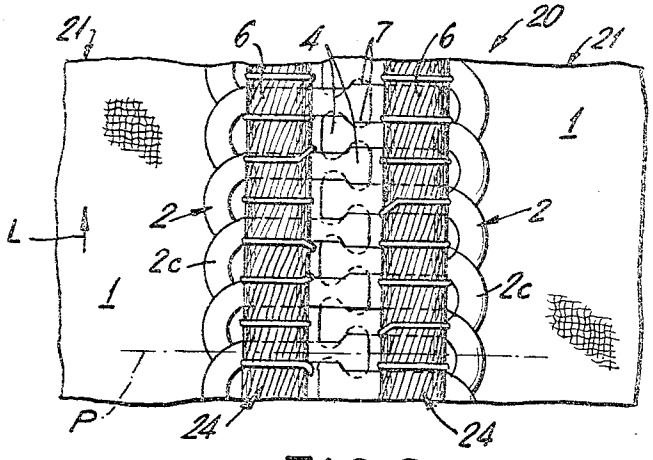

FIG. 2

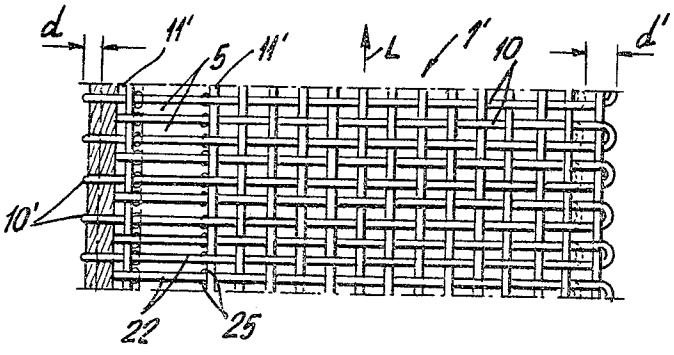

FIG. 3

INVENTOR.
ALFONS FRÖHLICH

BY

Karl G. Ross
ATTORNEY.

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SLIDE FASTENER

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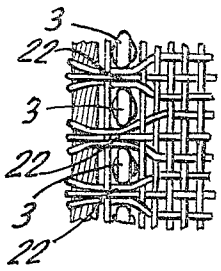

FIG. 3A

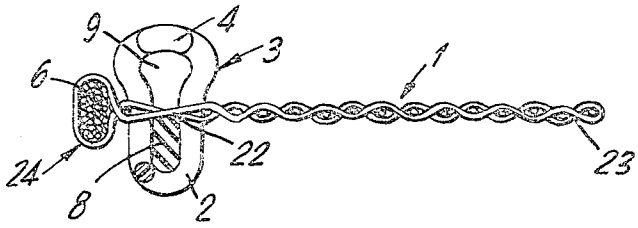

FIG. 4

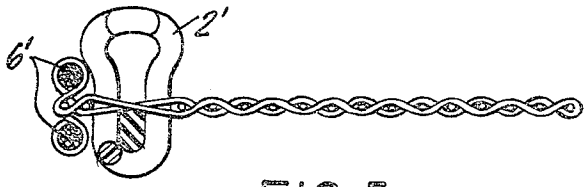

FIG. 5

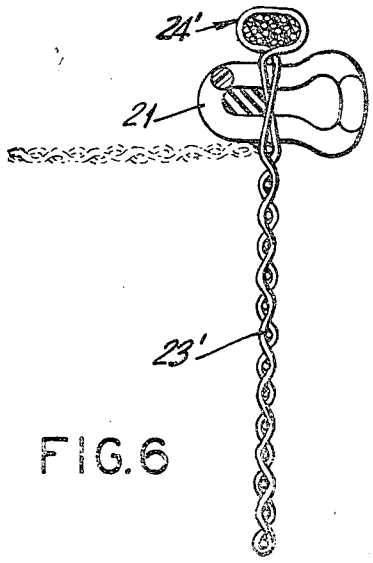

FIG. 6

INVENTOR.
ALFONS FRÖHLICH

BY

Karl G. Ross

ATTORNEY

United States Patent Office

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SLIDE FASTENER

Alfons Frohlich, Essen, Germany, assignor to Opti-Holding A.G., Glarus, Switzerland, a Swiss corporation

Filed Mar. 1, 1967, Ser. No. 624,647
Claims priority, application Germany, Mar. 3, 1966, O 11,487
Int. Cl. A44b 19/04; D03d 3/00
U.S. Cl. 24—205.1 11 Claims

ABSTRACT OF THE DISCLOSURE

A slide-fastener assembly having a pair of slide-fastener halves with fabric support tapes woven to form a row of throughgoing openings along an edge of each tape and at least one cord interwoven into the fabric along this edge so as to define a bead. Respective coupling elements, each extending along the respective tape and formed with a series of spaced-apart coupling heads interfittable with one another, are inserted through the openings of the respective tapes whereby the beads thereof lie along corresponding flanks of the coupling elements. The fabric tapes are folded at these openings so that a web portion of each tape (designed to affix the latter to a support) lies along the other flank of each coupling element. The openings are formed by omitting certain warp threads in the region of the bead while the weft threads defining the openings are thermoplastic and are provided with retaining formations limiting inward movement of the warp threads extending along each row of openings. The fabric is shrunk against the coupling element by thermal or chemical means and the coupling elements have shanks between which a flexible core of fibrous material or elastomer passes and serves as mandrels about which the tape is bent so that the bead covers a substantial portion of the flank of the coupling element.

My present invention relates to a slide-fastener assembly having a pair of interconnectable and separable slide-fastener halves each provided with a respective fabric support tape and a coupling element affixed to the tape at one edge thereof for mating engagement with the other coupling element upon movement of a slider along the tape.

In my concurrently filed copending application entitled Slide-Fastener Assembly and Method of Making Same, Ser. No. 619,833, I disclose and claim a method of making a slide-fastener assembly wherein each of the fabric tapes is formed with a row of throughgoing openings longitudinally of the tape, a continuous coupling element of the helicoidal or meandering type is mounted upon the tape by insertion of its heads through the row of openings formed along the tape, and the tape is thereafter subjected to a chemical and thermal shrinkage operation to condense the fabric at least in the direction of the weft threads (i.e. transversely of the coupling elements) to cause the weft threads defining the openings to hug the heads of the coupling elements and anchor the latter to the fabric. Shrinkage is effected by heat, when the fabric is composed of thermoplastic threads, or by chemical treatment when natural fabrics are used. Preferably 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 can be provided with formations serving as stops for the warp threads ordering these openings. Furthermore, the openings can be punched from the fabric or formed by omission of corresponding warp threads in the weaving

process. In accordance with an important aspect of the invention set forth in the above-identified application, a woven marginal portion of the fabric bands adjoining the bands of openings is turned about the shanks of the heads of the coupling element and about a core member inserted therethrough so as to overlie the inner portions of the coupling elements and expose only the heads thereof. In addition, this marginal portion forms a U-section or partially closed sleeve in which the shanks of the coupling element and the core fillet is received. When the fabric is composed partly of thermoplastic threads, the heat treatment renders the marginal portion elastic in the sense that it can be stretched about the respective coupling element and retain the latter at least in part by its spring-back force. As provided in that application and in my concurrently filed copending application Ser. No. 619,768 entitled Slide Fastener With Woven Support Tape, the shank portion of the coupling elements can be retained in a woven tubular portion of the fabric tape extending along the edges of the respective slide-fastener head such that only the heads of the coupling element emerge from the throughgoing openings therein.

It has been demonstrated, in connection with slide-fas'ener structures that it is often advantageous to provide a bead of a flexible material in an exposed position along the coupling elements as a guide for the slider, as at least partial concealment for the coupling elements and as a protective buffer preventing shagging of the fastener. Such beads have hitherto been produced by stitching a fillet, in the form of a cord or the like, adjacent the coupling element or even along the flanks thereof which may be provided with grooves for receiving this cord at least in part. Other techniques have involved the use of chain stitching (usually so-called double chain stitch) for securing the coupling element to the band and thereby concurrently forming a "bead" from the threads of the attachment stitches.

It is, therefore, the principal object of the present invention to extend the principles originally set forth in my copending application Ser. No. 619,833, filed concurrently herewith, to slide-fastener assemblies having a bead but obviating the complexities hitherto involved in the formation of such beads.

An object of this invention is to provide an improved slide-fastener assembly and method of making same whereby stitching of the coupling elements to the tape can be avoided.

This object and others which will become apparent hereinafter are attained, in accordance with the present invention, in an improved slide-fastener assembly wherein the fabric support tape of each slide-fastener half is woven with warp threads running in the longitudinal dimension of the tape and weft threads transversely thereof so as to have a row of throughgoing openings along one edge of the fabric band by omission of the corresponding warp threads, and to anchor at least one relatively thick cord or fillet to the fabric adjoining the row of openings along this edge. As set forth in the last-mentioned copending application, a continuous (i.e. helicoidal or meandering) coupling element (see U.S. Patents No. 3,136,016, No. 3,243,489 and No. 3,267,514) are inserted with their heads through the corresponding openings and are anchored to the tapes so that the heads lie along respective flanks of the coupling elements. Advantageously, these beads lie in the planes parallel to the web portions of the respective tapes (by means of which the tapes are secured to their supports) while the flanks of the coupling elements are likewise generally planar. The bead then not only serves as a guide for the slider and as a buffer and

securing means for the coupling elements, but also partly encloses those portions of the coupling elements by which they are affixed to the tape.

According to a more specific feature of this invention, the coupling elements are of pear-shaped cross-section with relatively enlarged loop-shaped heads matingly interengageable with the heads of the other coupling elements, but with shanks which lie in planes perpendicular to the webs and to the aforementioned longitudinal dimension so that the heads can be relatively closely spaced to permit of a fine seam.

The fabric is composed of a shrinkable material, i.e. is woven or knitted from shrinkable threads or contains shrinkable filaments together with or incorporated in generally nonshrinkable threads. Alternatively, the shrinkable threads may be interspersed with nonshrinkable threads or disposed only between the openings while the balance of the threads constituting the fabric is 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 elements while retaining same.

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 immersion, spraying or steam treatment of the tape. For cotton-thread fabrics, treatment by immersion in aqueous caustic solutions, e.g. sodium hydroxide solutions, is preferred. It is also desirable to constitute the shrinkable threads of thermally contractile fiber or filament, such as nylon or polyester, which shrinks upon heating at temperatures of 180° C. to 200° C. in steam or hot air for periods of 20 seconds to 2 minutes to hug and conform to the heads of the slide fastener.

When the coulpling element is composed of a meandering or helicoidal molecularly oriented synthetic resin (e.g. a nylon-type polyamide), the shaping of the heads can be effected by heat and pressure. Coupling elements of this type are mechanically stable. When, however, dimensionally unstable resin filaments are used, e.g. in extruded coupling elements of molecularly nonoriented structure, shrinkage may occur to alter the interhead spacing. It has now been found that, when the coupling elements are anchored by shinkage methods to the tape, and the weft threads between the openings span these interhead gaps so as to form stops or spacers therefor, the normal shrinkage of the coupling element is prevented or at any rate the predetermined spacing is maintained.

According to a further feature of this invention, the weft threads defining the openings of the tape are formed, in the region of the warp threads bounding the respective row of openings on either side, with stops retaining these warp threads from movement into the openings.

The 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 view of a slide-fastener assembly in cross-section along a plane perpendicular to the web portions of the slide-fastener halves;

FIG. 2 is a plan view of the slide fastener with the slider removed;

FIG. 3 is a plan view of a fabric band forming a right-hand support tape for the slide fastener of FIGS. 1 and 2 prior to shrinkage;

FIG. 3A is a plan view thereof after insertion of the coupling element and after shrinkage.

FIG. 4 is a cross-sectional view of the support band prior to shrinkage and in accordance with one embodiment of this invention;

FIG. 5 is a cross-sectional view similar to FIG. 4 of a modified system after shrinkage; and

FIG. 6 is a cross-sectional view illustrating a portion of the slide-fastener half of FIG. 5 showing the coupling element about to be bent into position for use.

Referring first to FIGS. 1 and 2, it will be seen that a slide fastener according to the present invention is designated generally at **20** and comprises a pair of slide-fastener halves **21**, each shown fragmentarily in FIGS. 1 and 2 which respectively are comprised of fabric support tapes **1**. At the inner edge **1***a* of each tape **1**, a coupling element **2** is mounted in a manner to be described in greater detail hereinbelow. The coupling elements are formed with looped portions **3** at spaced locations along the continuous coupling chain, these looped portions being formed with heads **4** matingly interengageable with the heads of the other coupling elements as represented in FIG. 2. The couping elements **2** are here shown to be of generally helicoidal configuration and have been compressed by heat and pressure to a pear-or keyhole-shaped cross-section whereby the coupling heads **3**, **4** are interconnected by mutually parallel shanks **2***a* and **2***b* with bights **2***c* which join the shank **2***a* of one coupling head with the shank **2***b* of an adjoining coupling head of the same coupling element. Furthermore, the shanks **2***a* and **2***b* of each coupling head lie in a plane P perpendicular to the plane of the paper in FIG. 2 and to the longitudinal dimension L of the slide-fastener assembly. The fact that the shank portions of each coupling head are coplanar effectively insures a minimum spacing between the coupling heads. Furthermore, this spacing is maintained by weft threads **22** which completely bridge the adjoining heads of each coupling element and form spacers therefor when the fabric is shrunk about the respective coupling elements. The tapes **1** have web portions extending from the edges **1***a* of the tape to the extremities thereof remote from the coupling elements, these web portions being indicated at **23**.

As is also apparent from FIG. 2, the upper shank portions **2***a* and the lower shank portions **2***b* of the head of the coupling elements lie essentialy in respective planes P′ and P″ which effectively are the planes of the flanks of the coupling element and are parallel to the web portions **23**, to respective fillets **8** constituting cores within the coupling elements and to the plane of flexible filler threads **6** lying along the upper flanks of the coupling elements (FIG. 1) and forming beads **24** therealong. The cord **6** represents a twisted, braided, woven or similar filler which can be of flattened configuration as illustrated in FIG. 1, may be generally kidney-shaped or may even be a thickened band covering substantially all of the shank portion of the coupled elements. The bead is preferably formed, however, by weaving this cord **6** into the fabric via weft threads **22** which concurrently define the spaces between the openings **5** formed in the fabric.

As can be seen from FIG. 3, the fabric member constituting the bands **1′** which, upon shrinkage, form the tapes **1** retaining the coupling elements **2**, comprise warp threads **11** extending in the longitudinal dimension L of the fabric, i.e. parallel to the cord **6** and transverse weft threads **10**. The row of openings **5** through which the heads **3**, **4** of the coupling elements are inserted is defined between a pair of limiting weft threads **11′** extending along this row on the opposite sides thereof and between sections **22** of the weft thread between the openings **5**. The weft threads **22**, moreover, are composed of thermally shrinkable synthetic resin material, e.g. nylon monofilament, and are provided with flattened portions or bulges **25** by hot pressing of the fabric to form stops preventing migration of the limiting warp thread **11′** to block the openings **5** formed by omission of certain warp threads during the weaving operation. The weft threads **10** are, moreover, looped around the cord **6**, as represented at **10′**, to anchor this cord, in the form of a fabric bead, along one longitudinal side of the band **1′** adjoining the row of openings **5**. As will be apparent from FIG. 3A, when the laterally projecting heads **7** are inserted through the openings **5**, several weft threads **22** are disposed

between the heads to form spacers establishing the interhead dimension of the coupling elements especially when the latter are composed of dimensionally unstable materials which, in the absence of these spacer threads, might shrink to lessen the interhead clearance.

As can be seen from FIGS. 3A and 4, the heads **3**, **4** of the coupling elements **2** are thrust through the openings **5** from below. Frequently it is possible, especially when the openings **5** are formed by omission of warp threads and the weft threads **22** separating the openings **25** are separated only by the normal thread gap, to retain the coupling elements on the tape **1** without shrinkage (see FIG. 4). In this case, the threads **22** are deflected by the heads **3**, **4** and retain the latter by friction. Normally, however, the fabric **1** will be shrunk (FIG. 3A) by a distance represented at *d* and *d'* in FIG. 3 to condense the openings **5** as represented in dot-dash lines and thereby anchor the heads firmly between the weft threads **22**. This technique permits firm anchoring and positioning of the coupling elements and the respective heads without any stitching operation whatever. The heads **3**, **4** are thrust into the openings **5** until the threads **22** bear against the rubber or rubberized fabric cores **8** (FIG. 4), whereupon shrinkage can be carried out by thermal or chemical means to effect a linear shrinkage at least in the weft direction of about 5 to 15%. The shrinkage in the longitudinal direction may be to a lesser extent, e.g. 5 to 10% as previously mentioned.

After shrinkage, the web portion **23** of the fabric can be folded back along the flanks of the coupling element **2** opposite that along which the bead **24** is provided. As can be seen from FIGS. 5 and 6, the bead **24'** may be generally planar although formed from a pair of cords **6'** of circular cross-section, both cords **6'** being weaved into the fabric in a plane perpendicular thereto and, upon shrinkage of the fabric, lying along the outer flank of the coupling element **2'**. Again the web portion may be folded under as represented under **23'**.

In FIG. 1, a slider for opening and closing the fastener element is represented at S. It has also been observed that, when the threads **22** hug the neck of each head just rearwardly of the looped portion **3** thereof, and a core **8** is provided between the shanks of the coupling elements, the attachment of the coupling elements to the tape is substantially nonreleasable and permanent.

The invention described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art and intended to be included in the spirit and scope of the invention.

I claim:

1. In a slide fastener assembly having a pair of slide-fastener halves, each provided with a respective support tape and a respective coupling element extending along the tape and formed with a series of spaced-apart coupling heads interfittable with the coupling heads of the other coupling element upon movement of a slider along said coupling elements, the improvement wherein:

said tapes are each formed with a respective row of throughgoing openings and with a bead adjoining said throughgoing openings and extending along the respective row;

the heads of said coupling elements project through said openings and are anchored therein to the respective tapes;

each bead lies along a respective flank of the respective coupling elements;

said tapes each have a web portion lying along the other flank of the respective coupling element;

said support tapes are constituted at least in part of a shrinkable material;

said coupling elements are anchored to said support tapes by shrunk regions of the tape surrounding each opening and hugging the respective head of the coupling elements; and

the anchorage of said coupling elements to said tapes is free from stitching independent of the tapes.

2. In a slide-fastener assembly having a pair of slide fastener halves, each provided with a respective support tape and a respective coupling element extending along the tape and formed with a series of spaced-apart coupling heads interfittable with the coupling heads of the other coupling element upon movement of a slider along said coupling elements, the improvement wherein:

said tapes are each formed with a respective row of throughgoing openings and with a bead adjoining said throughgoing openings and extending along the respective row;

the heads of said coupling elements project through said openings and are anchored therein to the respective tapes;

each bead lies along a respective flank of the respective coupling elements;

said tapes each have a web portion lying along the other flank of the respective coupling element;

said support tapes are constituted at least in part of a shrinkable material; and

said coupling elements are anchored to said support tapes exclusively by shrunk regions of the tape surrounding each opening and hugging the respective head of the coupling elements.

3. The improvement defined in claim **2** wherein said support tapes are composed of fabric and said bead is formed by at least one filler cord interwoven into the fabric.

4. The improvement defined in claim **3** wherein said fabric has warp threads extending in the longitudinal dimension of said fabric and weft threads extending transversely thereof and of said cord, said openings being formed by gaps in the sequence of warp threads.

5. The improvement defined in claim **4** wherein at least one warp thread defines said openings of each tape along opposite longitudinal sides of the respective row and said openings are further defined by weft threads extending transversely of said row, the weft threads defining said openings being provided with stop formations for retaining said warp threads along the respective row.

6. The improvement defined in claim **2** wherein said bead is formed by a pair of parallel flexible cords lying in a common plane parallel to the longitudinal dimension of the respective tape and interconnected by said weft threads.

7. The improvement defined in claim **2** wherein said support tapes are composed of a shrinkable woven fabric, said bead is a flexible cord interwoven into said fabric, said coupling elements are each generally helicoidally coiled synthetic-resin filament formed with loops constituting the respective coupling heads and of generally pear-shaped cross-section whereby a pair of parallel shanks extend from each head, said shanks being covered at least in major part by said beads.

8. The improvement defined in claim **7** wherein a flexible core extends through each of said coupling elements generally parallel to the respective bead, and said tapes are bent about the respective cores.

9. A method of making a slide-fastener assembly having a pair of slide-fastener halves each provided with a respective support tape and a respective coupling element extending along the tape and formed with a series of spaced-apart coupling heads interfittable with the coupling heads of the other coupling elements, said method comprising the steps of:

(a) forming said support tapes with respective rows of throughgoing openings proximal to an edge of each of said tapes;

(b) mounting upon each of said tapes a flexible cord adjoining the respective row of openings along said edge;

(c) inserting the head of the respective coupling elements through the openings of said tapes whereby

said beads lie along respective flanks of said coupling elements; and

(d) anchoring said coupling elements to the respective tapes by shrinking said tapes around the coupling elements at least in the region of said openings.

10. The method defined in claim **9** wherein said tapes are composed of a fabric having warp threads running in the longitudinal dimension of each thread and weft threads extending transversely of said longitudinal dimension and said beads, said openings being formed during weaving of said fabric by omission of corresponding warp threads and said cord being interwoven in said fabric at least by said weft threads.

11. The method defined in claim **10** wherein said woven threads are composed of a thermoplastic material and at least two warp threads extend longitudinally along opposite sides of each row, further comprising the step of deforming said weft threads adjacent the warp threads along the rows of openings to provide retaining formations for said warp threads.

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BERNARD A. GELAK, Primary Examiner

U.S. Cl. X.R.

24—205.16; 139—384; 264—342