United States Patent

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[72] Inventor **Wilhelm Uhrig**
Mannesmann Strasse 11, Wuppertal-Elberfeld, Germany

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[33] **Germany**
[31] **U13,516**

[54] METHOD OF MAKING A SLIDE FASTENER UNIT

6 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **29/410,** 24/205.1
[51] **Int. Cl.** **B23p 15/00** B21f 45/18
[50] **Field of Search** 29/410, 408, 207.5; 24/205.1

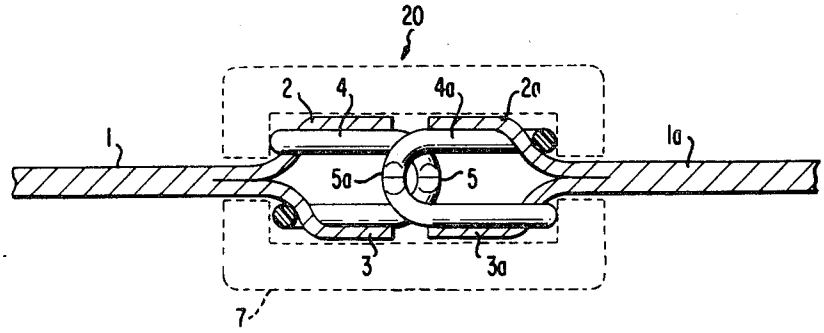
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Primary Examiner—Thomas H. Eager
Attorney—Abraham A. Saffitz

ABSTRACT: A method of making a slide fastener unit having two rows of links which are secured to the two halves of the supporting tape, each of the halves being a Y-tape with the upper and lower ends of each half partly covering the row of links at each side so that adjacent upper and lower ends form parallel longitudinal bands exposing to view the middle of the rows of links at each side where these rows come together and the individual loops of the rows of links remote from the center. These rows of links are formed by weaving a continuous length of heavy duty thermoplastic synthetic monofilament as a warp into the two short arms of the Y-tape to form loops and links in a single operation. The loops and the links which are initially in the same plane are heat deformed between the free ends of the arms of the Y-tape to form U-shaped links facing towards the edge of the tape while the loops are compression set at the part of the arm remote from the edge to form a guide for the fastener slide.



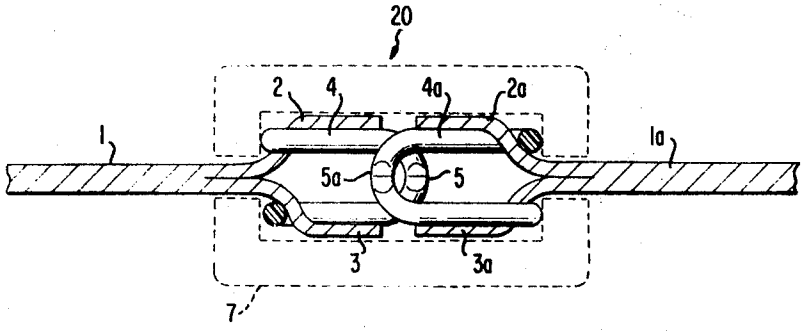


FIG. 1

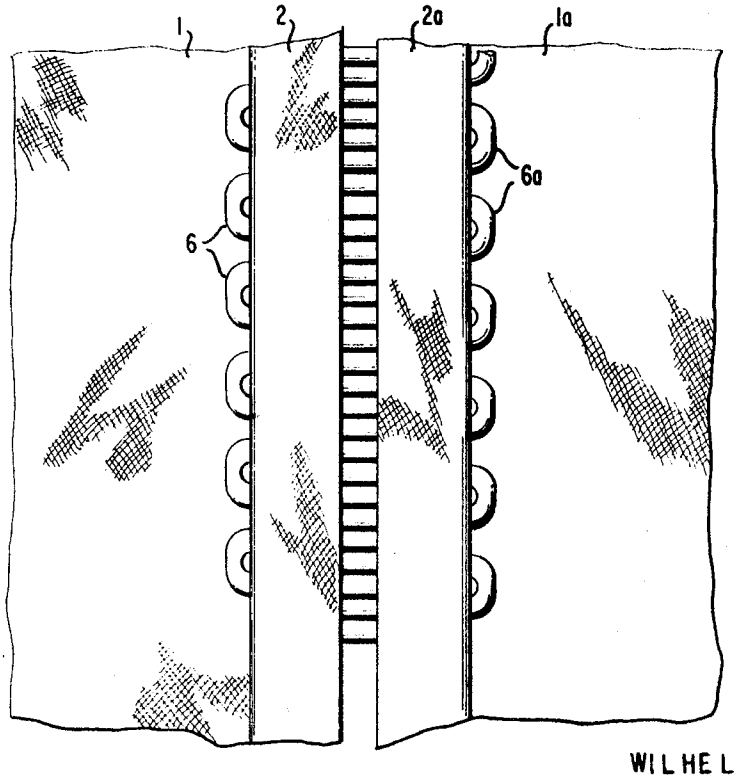


FIG. 2

INVENTOR
WILHELM UHRIG

BY Abraham A. Saffitz

ATTORNEYS

FIG. 3

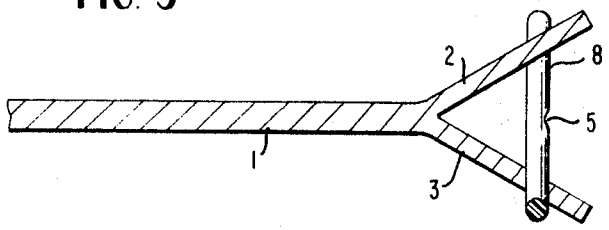
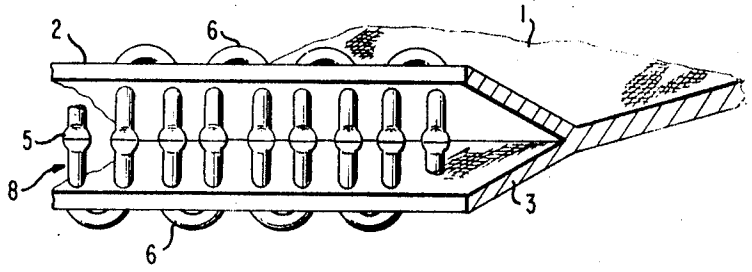


FIG. 4



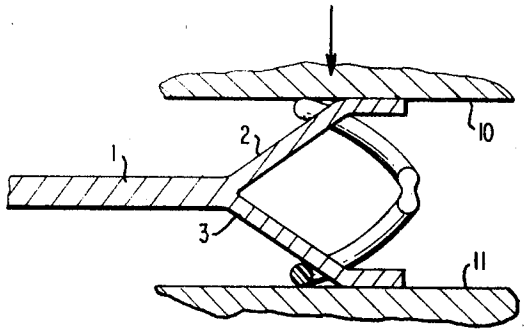


FIG. 5

INVENTOR
WILHELM UHRIG

BY Abraham A. Saffitz

ATTORNEYS

METHOD OF MAKING A SLIDE FASTENER UNIT

This application is a division of Ser. No. 698,203, filed Jan. 16, 1968, now U.S. Pat. No. 3,551,962 entitled "SLIDE FASTENER AND METHOD OF MAKING."

The present invention relates to a slide fastener having rows of links which are secured to the two halves of the supporting tape by weaving with high-strength, synthetic monofilament on a high-speed loom or on a conventional ribbon loom which can be manufactured in high quality and at low cost.

The so-called woven slide fasteners which are known are formed with finished rows of links during the weaving of each of the halves of the supporting tape. In this known type of manufacture, a strong synthetic filament which is to form the row of links is introduced into each half of the supporting tape as a weft thread, twisted into the line of threads in the supporting tape and bound in. This method of waving and binding can be effected only with two shuttles and only with a small number of picks. A higher number of picks cannot be successfully used because of the difficulty in deforming the high-strength monofilament synthetic weft thread which, because of its stiffness, resists picking as applied in the conventional ribbon loom of high-speed loom.

It is also known in the prior art to introduce the high-strength synthetic filaments which are to form the row of links in the form of warp threads. However, in this case very complicated devices are needed in the loom in order to twist and deform the stiff synthetic filaments during the weaving operation, and again it is impossible to use a high number of picks when weaving this known type of slide fastener embodying synthetic warp threads and achieve thereby high-production rates.

Slide fasteners are also known wherein ready made rows of links of synthetic fibers are employed, which fibers have been twisted or otherwise crimped and are secured by being woven by special machinery during the weaving of the halves of the supporting tape. The difficulties which arise in the manufacture of this third type of fastener, e.g. employing pretwisted filaments, result because of the resilience of the ready made rows of links which are springlike and tend to wander. It is necessary that the links be guided during weaving and that the weft threads be introduced precisely in accordance with the pitch of the row of links into the gaps which are provided. This is possible only with a small number of picks.

Accordingly, all three prior art methods permit only a small number of picks to be used.

It is the object of the present invention to provide a slide fastener which can be woven with a high number of picks, which is symmetrical with respect to the center plane of the fastener, the supporting tape and the rows of links which are in most part covered on both sides by the fabric of the supporting tape.

Starting from a slide fastener of the kind referred to wherein the halves of the supporting tape each consist of a Y-tape, the short arms of the Y-tape are brought toward each other by the method of the present invention with a high-strength synthetic monofilament which is woven on the tape itself to form the row of links and which runs backwards and forwards alternately between these two short arms.

According to the specific embodiment of the slide fastener of the invention, the high-strength synthetic monofilament is woven into the central region of the short arm and under the free ends thereof so that the free ends of the short arms cover both sides of the links to form parallel longitudinal bands above and beneath the links. The synthetic filament in this specific embodiment comprises loops of heavy duty thread which are situated at the outer faces of the short arms at the side remote from the closing teeth and thereby form a guide for the fastener slide.

According to a further feature of the invention, the two short arms may together have the same number of picks as the long arm of the supporting tape.

The slide fastener unit according to the invention offers the advantage, inter alia, that each row of links is covered at both sides by the short arms of the Y-tape and the slide which covers tops and bottoms of the halves of the tape fits readily over each row of links and the loops at the rear of the links so that the slide is, in effect, guided by the row of loops of each half. This symmetry, above and below the plane of the fastener assembly, enhances the locking strength and facilitates handling of the slide. Further, the slide fastener unit of the invention is simple and economical to manufacture on high-speed looms and on ribbon looms, the slide fastener being produced during the weaving of the Y-tape with one shuttle by binding a synthetic filament into short arms as a warp thread, e.g., alternately and at regular intervals. Preferably, the weaving step to bind in the synthetic filament is effected on a needle loom. After weaving, the woven-in synthetic filament is then deformed by heat and pressure into a row of links at the outward edge and a row of loops at the inward edge.

The woven-in synthetic filament forming the rows of links and loops is provided with a plurality of uniformly spaced medial deformations or nips transverse to the longitudinal warp thread axis, all of the nips being located at the top, or crest surface, of the nodal portion of the U to simulate, in miniature, the crater of a volcano so that all of the craters in each half of the tape are in alignment longitudinally with each half of the supporting tape. The sections of the synthetic filament are thus situated between the short arms with each section being deformed by heating and pressing to form U-shaped links facing towards the edge of the tape. This U-shaped deformation of the synthetic filaments to form links is effected in accordance with the invention after weaving by heat deformation under compression.

Although the slide fastener according to the invention may be produced on a conventional ribbon loom, it is especially advantageous that it be produced at low cost on a so-called high-speed loom, e.g., a needle loom with a very high pick capacity of well over 1,000 picks per minute.

The high picking rate on the needle loom is made possible with the method of the invention because the stiff synthetic filament which forms the row of links is introduced in the form of a warp thread in only one place and also because the double picking has no disturbing or interfering effect during the weaving on the needle loom.

The new method of making the slide fastener and the resulting new fastener made according to the present invention will now be explained in detail and with reference to the drawing in which:

FIG. 1 shows, in cross section, an embodiment of a slide fastener according to the invention;

FIG. 2 shows the slide fastener of FIG. 1 in plan view; and

FIGS. 3, 4 and 5 are diagrammatic views which show halves of the slide fastener of FIG. 1 in intermediate stages of its manufacture.

In FIG. 1, the slide fastener **20** comprises two halves **1**, **1***a* of a supporting tape which are constructed in the form of the Y-tapes. The short arms **2**, **3** and **2***a*, **3***a* of the halves of the supporting tape are brought together by weaving the rows of links **4** and **4***a* continuously with loops **6** and **6***a*, respectively, these loops being shown in FIGS. **2** and **4**. The free ends of the arms, top **2**, bottom **3** and top **2***a*, bottom **3***a*, partly hide the rows of links **4** and **4***a*, respectively. The rows of links **4** and **4***a* are each formed to provide loops **6** and **6***a*, respectively, remote from the links, and are formed from a continuous synthetic thermoplastic filament, the loops **6** and **6***a* being set by heat as shown for the links in FIG. **5**. These links **4** and **4***a* comprise the individual fastener elements which are substantially U-shaped in the view shown in FIG. **1** and which are provided with the closing teeth **5** and **5***a* at the U-shaped arc situated at the edge of the halves **1**, **1***a* of the respective supporting tape, as also shown in FIG. **1**. The continuous length of warp thread **8**, FIG. **3**, which forms the rows of links **4** and **4***a* penetrates through the short arms **2**, **3** and **2***a*, **3***a* of the Y-tapes and forms loops of threads **6**, **6***a* at the left and right sides, respec-

tively, remote from the closing teeth 5, 5*a* as shown in FIG. 2, these loops being situated at the outer face of the arm of the tape and connecting two adjacent U-shaped fastener links in each case. The loops of thread, 6, 6*a*, form a guide for the fastener slide 7 as shown in FIG. 1.

In FIGS. 3 and 4, the intermediate stage of manufacture after the completion of the heavy filament weaving operation is shown for a half of a slide fastener. During the weaving of the Y-tape 1, the thermoplastic synthetic filament 8 is bound alternately into the two short tape arms 2, 3 at regular intervals in the form of a warp thread. Closing teeth 5, 5*a* are carried at intervals on this filament, as shown in FIG. 4. These teeth may be formed in the synthetic filament by preheating and pressing spaced portions thereof before it is woven into the tape arms, but this forming operation for the teeth also may be accomplished by heat pressing or heat stamping after the weaving operation has been completed. Broadly, the teeth are formed by heat deformation.

FIG. 5 shows the state of manufacture of the half of the slide fastener during the heat deformation operation described above and following the weaving process described in connection with FIG. 1. The two arms 2. 3 of the Y-tape, together with the synthetic filament 8 which is still merely folded in the one plane, as shown during the manufacturing stage of FIGS. 3 and 4, are now compressed between pressure plates 10, 11 under the action of heat. This action bends the sections of the filament 8 between the arms 2 and 3 outwardly into a U-shape which extends or projects from the edges of the Y-tape arms and the heating followed by subsequent cooling sets this U-shape. During this compression and heating step, the free ends of the tape arms 2 and 3 may be rigidly connected to the flat sections of the U-shaped fastener links by means of auxiliary adhesives, if desired, or by heat sealing, if suitable heat-sealable threads, coated cotton or thermoplastic are used for the tape.

It is to be understood that the nips may be provided during the manufacturing process prior to or after weaving. The geometric relationship between the depth of the nip and the diameter or denier of the filament is important; no more than 35 percent of the diameter is taken out by the depth of the nip and the nip extends laterally across the link to a distance of 50—80 percent of the entire hemicircular arc.

The filament is preferably a strong synthetic filament of the polyamide type or of the polyethylene terephthalate type.

The following methods may be used for providing the nips:

1. Weaving a filament having preformed, uniformly spaced nips;

2. Using a hot wire for indenting or nipping after weaving and before heat deformation to the U-shape;

3. Using a hot wire to indent or nip as the last step and after heat deformation to the U-shape; or

4. Pressing the nips with a punch which can be accomplished either with or without heat.

This last method, (4), is preferred. In this preferred method of manufacture, during the weaving of the Y-tape 1, a bar is located between the short arms 2, 3 which, in the vicinity of the instantaneous picking point or spot of weaving, is triangular in its cross section, analogous to the hollow triangular space shown in FIG. 3. Further away from the picking point or place of weaving the cross section of this bar becomes almost a quadrilateral as shown in FIG. 5. In this FIG. 5 stage, the nips are cold pressed with a punch brought up from the right.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the

invention. Other arrangements may be devised by those skilled in the art without departing from the spirit or scope of the invention.

I claim:

1. A method for manufacturing a fastener slide comprising: assembling two halves of supporting tape and two rows of links, each half of the tape consisting of a Y-tape; weaving a heavy duty, continuous-length, synthetic, thermoplastic filament thread into each tape half to form a warp thread which extends into each of the two short legs of the Y to alternately bind these legs and to expose the middle part of each of the rows of links as parallel longitudinal bands, with the upper and lower arms of each Y-tape remaining covered; and deforming said continuous warp thread under heat and pressure to create a plurality of uniformly spaced medial nips of U-shaped in the rows of links, the U facing towards the edge of the tape with the loops at the parts of the Y-tape arms which are remote from the edge, thereby forming a guide for the fastener slide, said medial nips being located at the top nodal portion of the U-shape with all of the nips in each half of the Y-tape being in alignment longitudinally with the ends of the supporting tape.

2. A method as claimed in claim 1, wherein said synthetic filament is woven alternately into first one and then the other of said short arms of said Y-tape, the synthetic thread moving back and forth, in the form of a wave, in a plane which is perpendicular to the median plane of the Y-tape, whereafter the two short arms are pressed together under the effect of heat to provide a predetermined spacing therebetween, thereby bending the sections of said synthetic warp thread which are secured to said U-shaped links and also bending the sections of synthetic thread which are secured to said loops.

3. A method as claimed in claim 1, wherein said synthetic filament warp thread which is woven into each of said two tape halves is in the form of a filament having preformed uniformly spaced apart nips.

4. A method as claimed in claim 1, wherein said synthetic filament warp thread which is woven into each of said two tape halves is first woven in as a smooth filament and is then deformed to produce a plurality of uniformly spaced apart nips by applying a hot wire to the medial portions between heat deformation to create the U-shaped links.

5. A method as claimed in claim 1, wherein said synthetic filament warp thread which is woven into each of said two tape halves is first woven in as a smooth filament and is then deformed to produce a plurality of uniformly spaced apart nips by applying a hot wire to the medial portions after heat deformation to create the U-shaped links.

6. A method for manufacturing a supporting tape consisting of two tape halves, each half consisting of a Y-tape for mounting a fastener slide comprising: weaving continuously said Y-tape from textile warp and weft threads, wherein a heavy duty, continuous, synthetic thermoplastic, filament thread is disposed as one of the warp threads which lies in the region of the two arms of the Y-tape, said heavy duty filament thread being alternately bound as a warp thread in the two arms to provide a row of parallel sections of the filament thread, said parallel sections lying freely between the two arms to form loops of said heavy duty filament thread, said loops lying at the outer face of the arms; and deforming said row of parallel filament sections under heat and pressure to create a plurality of uniformly spaced U-shaped filament nips, the nips facing towards the edges of the two arms and having deformations defining coupling elements at the apex of each nip.