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E. BERBERICH ET AL

3,022,803

METHOD OF PRODUCING SLIDE FASTENERS

Filed June 23, 1960

3 Sheets-Sheet 1

FIG. 1

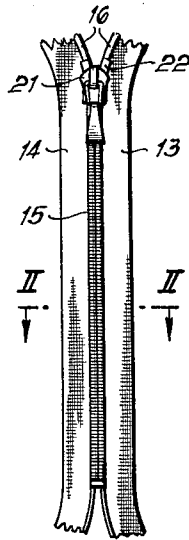
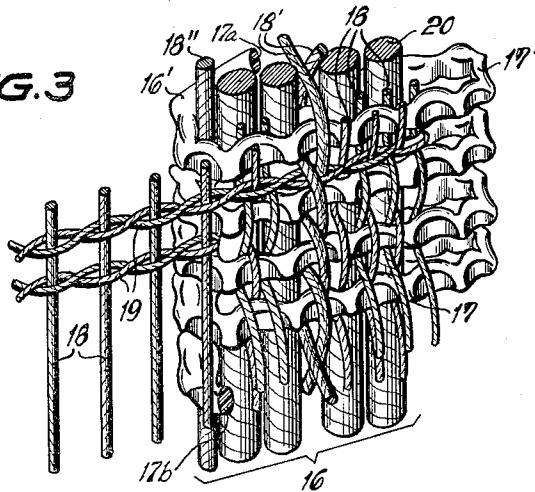


FIG. 2



FIG. 3



INVENTORS

*Erich Berberich
Johannes Gilliam
and
Fustan Frunsein
by: Michael S. Striker
Attorney*

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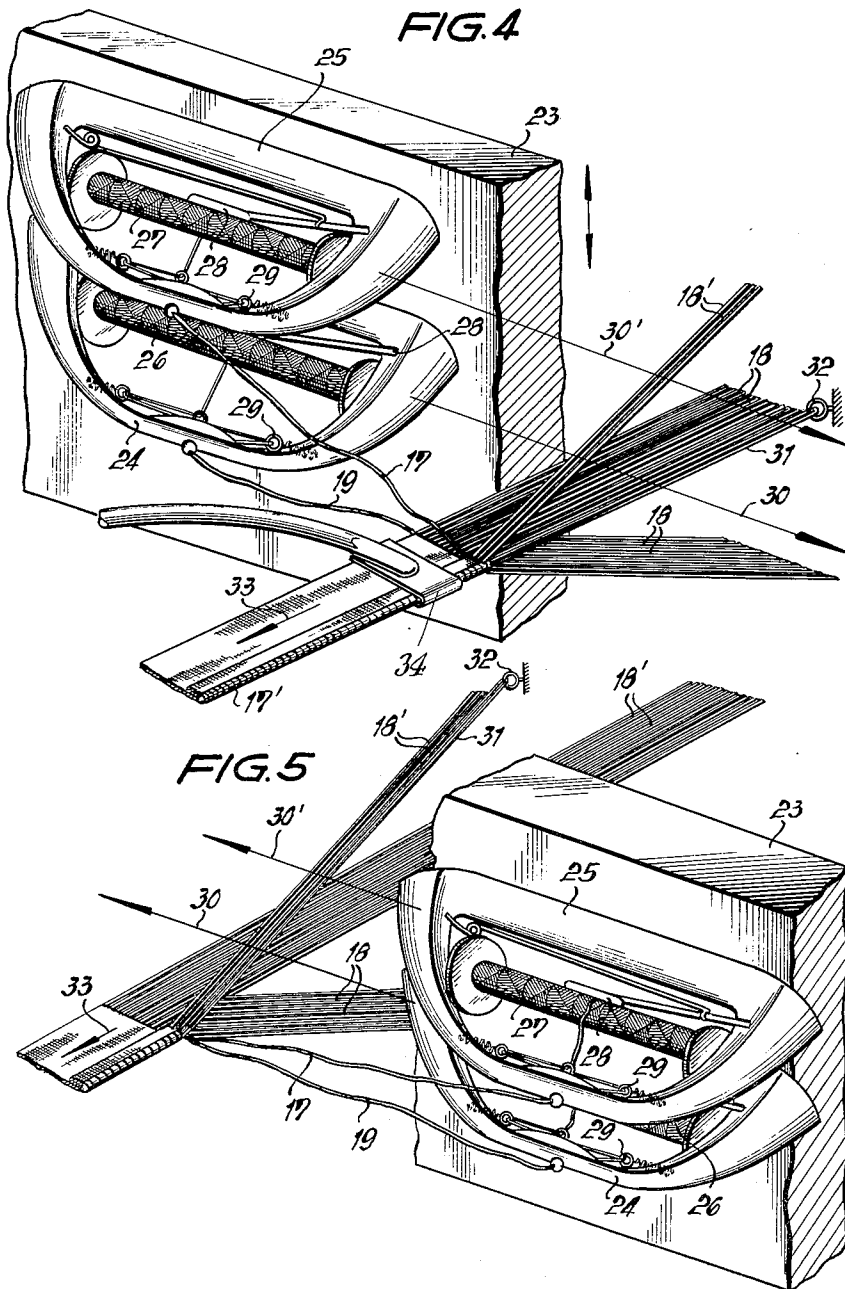
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FIG. 6

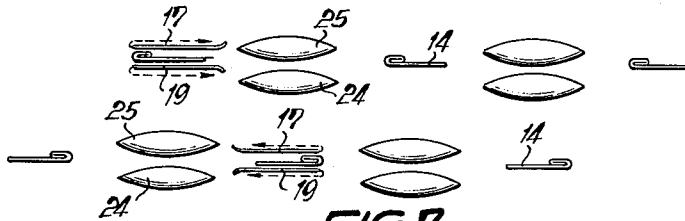


FIG. 7

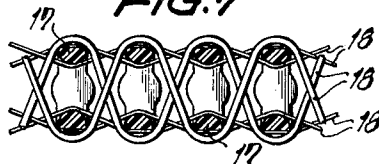


FIG. 8

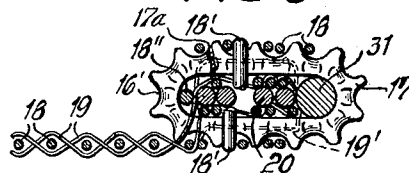


FIG. 9



FIG. 10

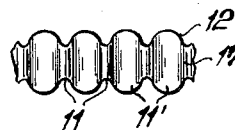


FIG. 11

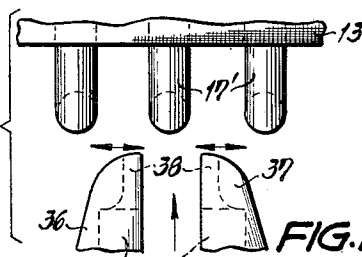


FIG. 13

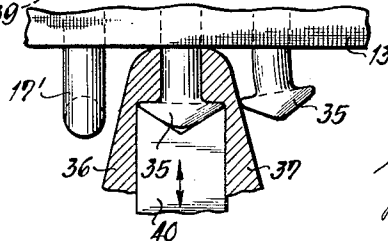
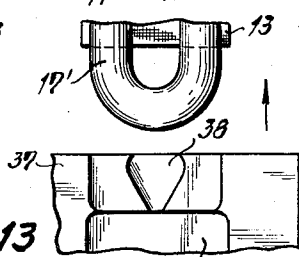


FIG. 12



INVENTORS
 Erich Berberich
 Johannes Gillmann
 and
 Gustav Fromme
 by: Michael S. Stricker
 Attorney

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METHOD OF PRODUCING SLIDE FASTENERS

Erich Berberich and Johannes Gilliam, Stolberg, Rhineland, and Gustav Frowein, Rhoden, Waldeck, Germany, assignors to William Prym-Werke K.G., Stolberg, Rhineland, Germany

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30 Claims. (Cl. 139—384)

This invention relates to a method of producing slide fasteners having tapes with coupling elements formed thereon by projecting portions of continuous weft threads or filaments from which the tapes of the fastener are woven, said projecting portions being spaced at the appropriate intervals for coupling the tapes of the fastener together.

Slide fasteners of this kind have the advantage that the coupling elements form parts of the actual weave of the tape or its fabric and can thus be produced wholly or at least substantially in one operation with the looming of the tapes itself.

It is the object of the present invention to provide a method whereby such slide fasteners can be particularly conveniently and readily produced, an object which is substantially achieved by looming the tapes with the aid of a multiple pick picking motion and forming the coupling elements from at least one group of weft threads or filaments, whereas at least one group of other weft threads or filaments traverses each tape without forming portions projecting from the loomed tape.

Preferably the group of weft threads or filaments which forms the coupling elements consist of monofilament filaments of a plastically deformable material, such as nylon, whereas the weft threads or filaments which serve merely for the production of the weave of the tapes are threads or filaments of thinner gauge which may or may not consist of the same material as the threads or filaments which form the coupling elements.

If the slide fastener has a multi-pick weave its production can be facilitated if each tape as such is formed from picks which are simultaneously inserted into sheds formed by the warp at different levels. It has been found that this can be done even if the threads or filaments which serve for forming the coupling elements consist of a stronger material than the other threads or filaments used for weaving the tape and are also inserted in the form of picks either by running them off the pick in a shuttle or by using grippers employing catch and draw threads or by using a circular picking motion. The simultaneous insertion of the picks may either be by counter-picking from opposite sides or by parallel picking from the same side. Whichever method is used the time of production can be substantially reduced, usually by about one half.

In the performance of the method according to the invention the groups of weft threads or filaments may consist of threads or filaments of uniform undeformed sections, and the threads or filaments which form the coupling elements submitted to deformation at their looped ends which project from the tape edges after they have been inserted, and which are intended to provide the interengaging coupling elements. Such deformation may be imparted to them by pressure without or with the application of heat in such manner that the vertex of each loop is provided with the usual coupling projections or recesses.

Moreover, the threads or filaments which form the coupling elements can be roughened in order to improve their frictional non-slip engagement at cross-over places with the threads or filaments forming the principal part of the texture of the tape. The roughening can be produced in various ways. For instance it may be provided by

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attaching special projecting elements to the surface of the threads or filaments which form the coupling elements, by adhesive bonding, fusing, winding, braiding, or knitting them on in a manner known, for instance, in the production of so-called fancy yarns.

If the coupling elements are formed by monofilament plastic filaments the desired roughening may be formed by projections integral with the filaments and produced in a known manner by machining or plastically deforming the filaments. In some instances it may be sufficient, for example if it is desired to avoid further stiffening the filaments, to roughen only part of the circumference of the filaments which are to form the coupling elements. Partial roughening of the filaments circumference may be provided by forming an undular strip extending along the length of the filaments or, alternatively, the filaments may if desired be easily roughened in such a way that said roughening will at the same time provide the projections required for the engagement of the coupling elements on the selvages of the two cooperating tapes of the slide fastener.

When the two tapes forming the slide fastener are woven in the manner proposed by the present invention, the weft threads or filaments which are to form the coupling elements are conveniently inserted into one of the tapes to form right hand loops and into the other tape to form left hand loops. Moreover, it is proposed to locate the pitched portion of the threads or filaments which form the coupling elements in the region of the woven part of the tape, i.e. not in the exposed part of the loops which project from the selvage, but preferably on the inside edge of the bulbous selvage. If this is done the coupling elements will be properly positioned for mutual engagement and the slide itself will be guided without undue wear. Moreover, in order to form the loops of the coupling elements the threads or filaments forming the coupling elements may be looped over a freely supported cantilever wire associated with the shed in a manner known in pile weaving looms, the loops being drawn off the wire as the looming of the tape proceeds.

Since, more particularly when using thicker monofilament threads or filaments for forming the coupling elements, these threads or filaments are considerably tensioned during the weaving process, the invention proposes to submit these filaments to a treatment at the end of the weaving process for the purpose of removing the tension therefrom and thus permitting them to retain the shape imparted to them by the weaving process. The removal of tension can be economically combined with a process of dyeing the woven tapes.

According to another feature of the invention the two tapes which are provided with coupling elements in the form of right hand and left hand loops, respectively, are preferably simultaneously woven on a two-high loom the one above the other.

In order to avoid that the tape ends of the finished woven slide fastener are excessively stiffened by the presence of the threads or filaments which form the coupling elements, it is proposed by the invention to discontinue the row of coupling elements formed by filaments incorporated in the actual weave of the tape at regular intervals and in these intervals to float said filament freely across the tape ends which are not to be coupled together in the completed fastener. These free filament ends can then be easily removed by snipping them off when the continuously woven tapes are cut into individual lengths.

Since the insertion of the threads or filaments forming the coupling elements by means of a shuttle and pick submits the threads or filaments to some twist, one turn being thus inserted per loop, the invention further proposes to provide the threads or filaments with an appro-

appropriate amount or countertwist before its incorporation in the weave of the tape.

Other advantageous features of the invention will explain themselves in the course of the further description of two preferred embodiments of the invention shown in the accompanying drawings, in which:

FIG. 1 is an elevational view of a slide fastener produced by the method according to the invention;

FIG. 2 is a cross section through the slide fastener taken along the line II—II of FIG. 1;

FIG. 3 is an isomeric simplified cross section, on an enlarged scale, through a row of coupling elements;

FIGS. 4 and 5 are fragmentary perspective views of a two-high loom for multiple shedding and a pair of simultaneously traversing shuttles, shown in simplified form in two consecutive positions;

FIG. 6 shows schematically the upper and lower shuttle picking motion;

FIGS. 7 and 8 are partial longitudinal and cross sections, on a larger scale in simplified form, of the portion of tape which carries the coupling elements of the slide fastener;

FIGS. 9 and 10 are a side view and a top plan view, likewise on an enlarged scale, of a weft thread or filament for forming a coupling element;

FIGS. 11 and 12 are two relatively perpendicular views, likewise on an enlarged scale, of a portion of the tape selvage of a woven slide fastener and a die for forming coupling projections on woven coupling elements, and

FIG. 13 is a view corresponding to FIG. 8 after the die has been closed.

FIGS. 1 and 2 show a slide fastener which comprises two woven tapes 13 and 14 which, on the one hand, carry rows of coupling elements 15 and, on the other hand, serve for attaching the fastener to an article of clothing either directly or indirectly with the interposition of an intermediate tape. As will be understood by reference to the remaining figures, the coupling elements are formed by filaments 17 which are weft threads inserted into the weave only in the region of a bulbous selvage 16 of a known kind wherein these threads form a flat spiral shown in FIG. 3 wherein the broken off ends of the flat spiral are respectively designated with 17a and 17b. The remainder of each woven tape, as will be seen by reference to FIGS. 3, 7 and 8 consists of warp threads 18, weft threads 19 and thick selvage warp threads or runners 20. The weft threads 19 of the tape which do not participate in the formation of the coupling elements consist of cotton. The warp threads 18 are likewise a cotton yarn. However, in the region of the bulbous selvage 16 warp threads 18' consisting of a non-tearing nylon for binding the filaments 17 and so-called catch or draw threads 18'' are incorporated which separate the cotton threads from edge 16' of the selvage 16 which guides the slide 21 of the fastener, and they thus protect them from frictional wear when the slide 21 is moved for opening and closing the fastener, the movement of the slide being limited by end stops 22.

Both tapes 13 and 14 together with their rows of coupling elements 15 are simultaneously produced on a two-high ribbon loom with a double shedding motion and twin shuttles and pirns for parallel picking. FIG. 4 shows a two-high sley 23 with two shuttles 24 and 25, the one above the other, in a ribbon loom of this kind. The pirn 26 in the shuttle 24 carries a cotton yarn, whereas pirn 27 in the shuttle 25 carries the polyamide filament 17, for instance a nylon weft filament, for forming the coupling elements.

Each shuttle has a weft brake 28 and 29 for the pirns 26 and 27 and the filaments 17 and the weft threads 19 which run out of the shuttles. The warp threads 18 are threaded through the mails of the heald shafts or harness for the simultaneous formation of two sheds indicated by arrows 30 and 30' for the simultaneous insertion therein of two weft picks in parallel. The warp

threads in the region of the bulbous selvage 16 are associated with special healds to permit the filaments 17 for forming the coupling elements to be inserted only in the region of the selvage. For the formation of loops 17' of the filaments 17, which loops freely project from the selvage a cantilever steel wire 31 is secured to the loom as shown at 32 in such a manner that the filament 17 will be looped over said wire. The woven tape 13 is drawn off in the direction of arrow 33, the coupling loops 17' being simultaneously withdrawn from the wire 31. At the front side of the loom there is provided a special stationary guide 34 which prevents the woven tape from being laterally pulled out of shape or distorted and which also ensures a clean feel.

The upper shedding motion of the two-high ribbon loom is schematically shown in FIG. 6 at the top and the lower shedding motion at the bottom. FIGS. 7 and 8 show the interlacing of the cotton warp threads 18 with the nylon warp threads 18' in the weave. The warp threads 18 interlace with only one side of the filaments 17 which form the coupling elements, whereas the nylon warp threads 18' are taken over both sides of the filaments 17. The catch or draw threads 18'' draw the cotton threads, in the region where the slide travels along the edge of the tape, into the interior of the bulbous selvage 16. The position of the weft threads 19 which do not participate in the formation of the coupling elements, although these are conveniently inserted into the shed at the same time as the filaments 17 which form the coupling loops, is indicated by dotted lines 19' in FIG. 8. For the sake of clarity the thick selvage threads 20 and catch threads 18'' which are included in the bulbous selvage are not specially shown in FIG. 7.

The monofilament nylon weft filament 17 which is about 0.4 mm. thick or more has an overall roughened surface in order to improve the cohesion of the weave. As will be seen particularly by reference to FIGS. 9 and 10 the roughening of its surface is produced by plastic deformation of the filament cross section. By the impression of a succession of recesses 11' into one side of filament 17 in the direction of the warp threads 18 projections 11 are formed in which the warp threads 18, 18' engage, thus securing the weft filament 17 which forms the coupling elements. At the same time their presence imparts a greater degree of flexibility to the filament. Moreover, the plastic impression of the recesses 11' widens the filament 17 in the direction of the recesses, as shown at 12, and these sections can be utilized to form the coupling teeth of the coupling elements which need not therefore be specially shaped. Furthermore, these widened sections in the region of the inner edge 16' of the bulbous selvage of the tape improve the manner in which the slide is guided and reduces frictional wear.

If the filament for forming the coupling elements, as shown in FIGS. 11 to 13, is an undeformed nylon filament, then the coupling loops 17' may be shaped after the looming process in a die comprising two movable jaws 36 and 37 with dies 38 for the reception of the coupling loops 17' and channels 39 for guiding a ram 40 which forms coupling teeth 35 on to the end of the loops. FIG. 13 shows a die when the jaws 36 and 37 have been closed and the ram 40 is in operative position.

After the coupling teeth 35 have been shaped, the tapes 13 and 14 are submitted to a heat treatment which removes any remaining tension from the nylon filament 17 which has a diameter of 0.4 mm. or more. The shape imparted during the weaving process to the filament which forms the coupling element will therefore now be retained, even if the constraining warp threads 18 and 18' were actually removed. If the slide fastener tapes 13 and 14 are to be dyed after having been woven, the treatment for consolidating their shape may be combined with the dyeing process in a bath, so that a separate treatment for consolidating the filaments will not be required.

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As has already been mentioned the illustrated embodiments are merely illustrative of the invention and are not intended to limit the scope of the invention in any respect. Various modified modes of performing the invention can be devised. For instance, the filaments which form the coupling elements may be roughened by a process of machining the same. Moreover, instead of only part of the surface of the filaments being roughened, the roughening may be extended over major regions or all of the filament surface. Furthermore, instead of forming projections and the like which are integral with the filament, these may be provided by adhesively bonding, welding, winding, or knitting suitable projections onto the filament in the manner that is conventional in the various methods of producing so-called fancy yarns. Instead of a solid filament a piping could also be used. The coupling elements themselves might alternatively be provided on the face instead of on the edges of the cooperating tapes, the laterally projecting tape edges being used, on the one hand, for affixing the same to an article of clothing or the like and, on the other hand, for covering the coupling of the slide fastener. Furthermore, the tape might be of Y-section, as is likewise already known to the art, one flange being used for fastening the tape and the other flange as a covering for rendering the coupling elements on the third flange invisible. Moreover, instead of being formed by the weft threads, the coupling elements might be formed by the warp threads of the tape.

Instead of passing through the tape in the form of a spiral, the filament forming the coupling elements might be worked into one or both sides of the tape, for instance by interlacing the same in a kind of meander. It may also be sufficient if the filament which forms the coupling loops is worked into the tape when the latter is being loomed in such a way that the loops are interlaced by only a single pair of crossing threads. The width of the tape behind the chain of coupling elements may be limited to adapt it to any desired method of attachment by sewing, cementing, welding, or some other method of fixing the same. The spacing of the projections and recesses formed by the roughening process may be so close that special attention to their particular position when utilizing them as coupling teeth is not required, because the large number of projections will then ensure that satisfactory cooperation and engagement between the halves of the fastener will actually always occur. The floating arrangement of the loop forming filament between the ends of the fastener which are not to be coupled can be readily achieved by suitably controlling the shedding action of the loom, i.e. by setting the shed during the looming of the row of coupling elements to "centre-lower" instead of to "upper-center lower" when the free ends of the tapes are being woven.

Instead of picking with shuttles the method could be performed on a shuttleless loom equipped with giver-and-taker-grippers. In such a case it is advisable to provide special catch or tension threads at the selvages of the tape. Also the polyamide pick might be inserted by a rotor, that is to say by a circular picking motion. Instead of parallel picking, a counter-picking motion might be employed. Moreover, since the insertion of a monofilar pick for forming the coupling elements by means of a shuttle and pirn and helical interlacing, subjects the filament to twist, one turn being imparted to the same during the formation of each loop, it is advisable to provide the filament with a twist in the opposite direction before incorporating the same in the weave.

We claim:

1. A method of producing slide fasteners having tapes with coupling elements formed thereon by projecting portions of continuous weft filaments from which the tapes of the fastener are woven, said projecting portions being spaced at appropriate intervals for coupling the tapes of the fastener together, the method comprising

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the steps of looming the tape with the aid of a multiple pirn picking motion and forming coupling elements from at least one weft filament, whereas at least one other weft filaments traverses each tape without forming portions projecting from the loomed tape.

2. The method as claimed in claim 1, comprising looming the tape by the simultaneous insertion of several picks into sheds formed by the warp at different levels.

3. The method as claimed in claim 2, comprising inserting the picks from opposite sides of the warp.

4. The method as claimed in claim 2, comprising inserting the picks from the same side of the warp.

5. The method as claimed in claim 1, wherein the surface of the weft filaments used for forming the coupling elements is roughened.

6. The method as claimed in claim 5, wherein the roughening of the surface of the filaments forming the coupling elements consists of projections which are integral with said filaments.

7. The method as claimed in claim 6, wherein the integral projections are produced by the plastic deformation of the filaments forming the coupling elements.

8. The method as claimed in claim 6, wherein the integral projections are produced by machining the surface of the filaments forming the coupling elements.

9. The method as claimed in claim 6, wherein the roughening of the filaments used for forming the coupling elements is at the same time suitable for effecting the required coupling engagement of the two cooperating tapes of the fastener.

10. The method as claimed in claim 5, wherein the roughening of the surface is produced by projections separately applied to the surface of the filaments.

11. The method as claimed in claim 10, wherein the projections separately applied to the surface of the filaments are formed by adhesively bonding said projections to the filaments.

12. The method as claimed in claim 10, wherein the projections separately applied to the surface of the filaments are formed by welding said projections to the filaments.

13. The method as claimed in claim 10, wherein the projections separately applied to the surface of the filaments are formed by winding said projections to the filaments.

14. The method as claimed in claim 10, wherein the projections separately applied to the surface of the filaments are formed by braiding said projections to the filaments.

15. The method as claimed in claim 10, wherein the projections separately applied to the surface of the filaments are formed by knitting said projections to the filaments.

16. The method as claimed in claim 5, comprising roughening only part of the circumferential surface of the weft filaments which is used for forming the coupling elements.

17. The method as claimed in claim 16, wherein the partial roughening consists in the provision of a strip extending in the longitudinal direction of the weft filament.

18. The method as claimed in claim 1, wherein the weft filaments consist of smooth and undeformed filaments and the projecting loops of the filaments which form the coupling elements are deformed to provide coupling projections after they have been woven into the tape.

19. The method as claimed in claim 18, wherein the vertices of the projecting loops of the filaments which form the coupling elements are provided with coupling projections and recesses by their deformation by the application of pressure.

20. The method as claimed in claim 1, wherein the group of weft threads or filaments used for forming the coupling elements consist of monofilar filaments of permanently deformable plastic material, whereas the other

weft filaments are of thinner gauge and consist partly of the same material as, and partly of some other material than the weft filaments which form the coupling elements.

21. The method as claimed in claim 1, wherein groups of weft filaments and warp threads embrace thicker selvedge threads which serve to form a bulbous selvedge.

22. The method as claimed in claim 21, wherein the pitch of the weft filaments forming the coupling elements is confined to a region near the inner edge of the bulbous selvedge other than that of the projecting loops.

23. The method as claimed in claim 1, wherein the weft filaments used to form the coupling elements form right hand loops in one tape and left hand loops in an other tape.

24. The method as claimed in claim 1, wherein the filaments which form the coupling elements are looped over a freely suspended cantilever wire associated with the shed, whereby the coupling elements are formed in a manner known in pile weaving looms, the formed loops being drawn off the wire as the weaving of the tapes proceeds.

25. The method as claimed in claim 1, comprising submitting the filaments forming the coupling elements to a treatment for removing their tension when the weaving process has been completed, in order to permit said filaments to retain the shape imparted to them by the weaving process.

26. The method as claimed in claim 25, comprising performing the treatment simultaneously with a process of dyeing the woven tapes.

27. The method as claimed in claim 1, comprising at regular intervals interrupting the formation of the continuous row of coupling elements by a filament of the weave and floating said filament unbound across the portions of tape which in the completed slide fastener are intended to project beyond the ends of the coupled fastening elements.

28. The method as claimed in claim 1, comprising prior to weaving imparting to the filaments which are to form the coupling elements a twist contrary to the twist imparted to the same by the process of helically looping the filaments into the weave by a shuttle picking motion.

29. The method as claimed in claim 1, wherein the two tapes which together form a slide fastener and which are provided with left hand and right hand projecting loops to form cooperating coupling elements are simultaneously woven on a two-high loom.

30. The method as defined in claim 1 wherein groups of weft filaments and warp threads embrace thicker trimming threads which serve to form a bulbous selvedge.

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