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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Method of Producing Slide Fasteners

We, HANS PRYM, AXEL PRYM and DIETER PRYM, all German Citizens, personally responsible partners of Firma WILLIAM PRYM-WERKE KOMMANDIT-GESELLSCHAFT, of 5 to 9, Zweifallerstrass, Stolberg/Rhineland, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described and by the following statement:—

This invention relates to a method of producing a slide fastener with coupling elements formed on the fastener tapes by projecting portions of continuous weft filaments of the tapes, said projecting portions being spaced at the appropriate intervals for coupling the tapes of the fastener together.

Slide fasteners of this kind have been disclosed in our Patent Specification No. 826403 and have the advantage that the coupling elements form parts of the weave and can thus be produced wholly or at least substantially in one operation with the weaving of the tape itself.

The present invention consists in a method of producing a slide fastener having coupling elements formed on the fastener tapes, the method comprising weaving the tape with two or more continuous wefts in such a manner that a continuous weft filament of the tape forms projecting loop portions at the tape edge or at a predetermined distance therefrom, these being spaced at the appropriate intervals for serving as coupling elements for coupling the tapes of the fastener together, and another continuous weft filament or thread traverses the tape without forming portions projecting therefrom.

Preferably the filament which forms the coupling elements consists of a plastically deformable material, such as nylon, whereas the weft thread or filament which serves merely for the production of the body of the tape is a thread or filament of thinner gauge which may or may not consist of the same material as the filament which forms the coupling elements.

If the body of the tape is woven from two or more wefts 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 filament which serves for forming the coupling elements consist of a stronger material than the other filament or thread used for weaving the tape and is also inserted in the form of picks either by running it off the pirn in a shuttle or by using giver and taker grippers employing catch threads or by using a pick inserting mechanism, a pick inserting member of which is movable in an arcuate path into and out of the shed. The simultaneous insertion of the picks may either be by picking from opposite sides or by 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 filament forming the coupling elements may be a filament of uniform undeformed section, and be submitted to deformation at looped portions which project from the tape edge. Such deformation may be imparted by pressure without or with the application of heat in such manner that the vertex of each loop is provided with the usual coupling formations.

Moreover, the filament which forms the coupling elements can be roughened in order to improve its frictional non-slip engagement at cross-over places with the thread or filament forming the body of the tape. The roughening can be produced in various ways. For instance it may be provided by attaching special projecting elements to the surface of

[Price 4s. 6d.]

the filament which forms the coupling elements by adhesive bonding or welding them onto the filament, or winding a thread round the filament in a manner known, for instance, in the production of so-called fancy yarns.

If the filament forming the coupling elements is a monofilar plastic filament, the desired roughening may be formed by projections integrally with the filament and produced in a known manner by machining or plastically deforming the filament. In some instances it may be sufficient, for example if it is desired to avoid further stiffening the filament, to roughen only part of the circumference of the filament which is to form the coupling elements. Partial roughening of the filament circumference may be provided by bonding thereto a strip which has an undulated shape and extends along the length of the filament or, alternatively, the filament 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.

Two tapes for jointly forming a slide fastener may be woven simultaneously in a single loom. In this case, the weft filament which is to form the coupling elements is conveniently inserted into one of the tapes to form right hand loops and the equivalent weft filament is inserted into the other tape to form left hand loops. Moreover, it is proposed to arrange the helix portion of the filament loop, that is to say, the portion providing the longitudinal advance between one coupling element and the next, adjacent the plain woven part of the tape, i.e. not in the exposed part of the loops which projects from the selvedge, but preferably on the inside edge of the bulbous selvedge. If this is done the coupling elements of the two tapes 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 filament forming the coupling elements may be looped over a freely supported wire associated with the shed in a manner known in pile weaving looms, the loops being drawn off the wire as the weaving of the tape proceeds.

Since, more particularly when using thicker monofilaments for forming the coupling elements, these 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 multi-tier loom the one above the other.

In order to prevent the tape ends of the finished woven slide fastener from being excessively stiffened by the presence of the filaments which form the coupling elements, it is proposed by the invention to discontinue the row of coupling elements formed by the filament incorporated in the 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 filaments forming the coupling elements by means of a shuttle and pirn submits the filaments to some twist, one turn being thus inserted per loop, the invention further proposes to provide the filaments with an appropriate amount of countertwist before its incorporation in the weave of the tape.

In order to make the invention clearly understood, reference will now be made to the accompanying drawings which are given by way of example and in which:—

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

Fig. 2 is an isometric simplified cross section, on an enlarged scale, through a row of coupling elements;

Figs. 3 and 4 are fragmentary perspective views of a loom having a pair of simultaneously traversing shuttles, shown in simplified form in two consecutive positions;

Figs. 5 and 6 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. 7 and 8 are a side view and a top plan view, likewise on an enlarged scale, of a weft filament for forming a coupling element;

Figs. 9 and 10 are two relatively perpendicular views, likewise on an enlarged scale, of a portion of the tape selvedge of a woven slide fastener and a die for forming coupling projections on woven coupling elements;

Fig. 11 is a view corresponding to Fig. 9 after the die has been closed; and

Fig. 12 is a view showing a portion of the tape after coupling projections have been formed on the coupling elements.

Fig. 1 shows 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 of each tape

are formed by a filament 17 which forms a weft inserted into the weave only in the region of a bulbous selvedge 16 of a known kind, so as to form a flat helix. As may be seen in Fig. 12 the helix of the loop convolutions is limited to the rear portion thereof, so that the remaining parts of the coupling element are aligned. The remainder of each woven tape, as will be seen by reference to Figs. 2, 5 and 6 consists of warp threads 18, weft threads 19 and thick selvedge warp threads or stuffers 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 selvedge 16 warp threads 18^1 consisting of nylon for binding the filaments 17 and so-called catch threads 18^{11} are incorporated which separate the cotton threads from edge 16^1 of the selvedge 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 double-storied ribbon loom with a double shedding motion and twin shuttles and pirns for parallel picking. Fig. 3 shows a 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 forming the coupling elements.

Each shuttle has a weft brake 28 and 29 for the pirns 26 and 27 and the filament 17 and the weft thread 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 30^1 for the simultaneous insertion therein of two weft picks in parallel. The warp threads in the region of the bulbous selvedge 16 are associated with special healds to permit the filament 17 for forming the coupling elements to be inserted only in the region of the selvedge. For the formation of loops 17^1 of the filament 17, which loops freely project from the selvedge 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 17^1 being simultaneously withdrawn from the wire 31. At the front of the loom there is provided a stationary guide 34 which prevents the woven tape from being laterally pulled out of shape or distorted and which also ensures a clean fell.

Figs. 5 and 6 show the disposition of the cotton warp threads 18 with the nylon warp threads 18^1 in the weave. The warp threads 18 interlace with only one side of the filament 17 which form the coupling elements, whereas the nylon warp threads 18^1 are taken over both sides of the filament 17. The catch or draw threads 18^{11} draw the cotton weft threads, in the region where the slide travels along the edge of the tape, into the interior of the bulbous selvedge 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 filament 17 which form the coupling loops, is indicated by dotted lines 19^1 in Fig. 6. For the sake of clarity the thick selvedge threads 20 and catch threads 18^{11} which are included in the bulbous selvedge are not specially shown in Fig. 5.

The monofilar 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. 7 and 8 the roughening of its surface is produced by plastic deformation of the filament cross section. By the impression of a succession of recesses 11^1 into one side of filament 17 in the direction of the warp threads 18 projections 11 are formed in which the warp threads 18, 18^1 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 11^1 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 16^1 of the bulbous selvedge 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. 9 to 11, is an undeformed nylon filament, then the coupling loops 17^1 may be shaped after the weaving process in a die comprising two movable jaws 36 and 37 with dies 38 for the reception of the coupling loops 17^1 and channels 39 for guiding a ram 40 which forms coupling teeth 35 on to the end of the loops. Fig. 11 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. 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 18^1

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.

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 machining processes in which material is removed, for example stamping, milling or abrading. Moreover, the roughening may be effected over the entire periphery of the filament surface or over a greater part thereof. In the latter case, a continuous strip bonded to the filament may be provided, which extends along the length of the filament and has an undulated shape.

Furthermore, instead of forming projections and the like which are integral with the filament, these may be provided by adhesively bonding or welding suitable projections separately on to the filament, or winding a thread round the filament in the manner that is conventional in the various methods of producing so-called fancy yarns. Instead of a solid filament a hollow filament 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.

Instead of passing through the tape in the form of a helix, 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 woven in such a way that the loops are interlaced by only a single pair of crossing threads. 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 weaving of the row of coupling elements to "centre-lower" instead of to "upper-centre/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 selvedges of the tape. Also the polyamide pick might be inserted by a pick inserting mechanism, a pick inserting member of which is movable in an arcuate path into and out of the shed. In a loom the shuttles may reciprocate in opposite directions or in the same direction. 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.

Although in the described embodiment, the tape is woven by simultaneously inserting two picks into two sheds formed at different levels, more than two sheds may be formed, in which case an appropriate number of wefts are used.

In the described embodiment, the filament forming the coupling elements only extends across an edge region of the tape. Of course, this filament may alternatively extend across the entire tape width if the increased tape stiffness resulting from this is tolerable.

WHAT WE CLAIM IS:—

1. A method of producing a slide fastener having coupling elements formed on the fastener tapes, the method comprising of weaving the tape with two or more continuous wefts in such a manner that a continuous weft filament of the tape forms projecting loop portions at the tape edge or at a predetermined distance therefrom, these being spaced at the appropriate intervals for serving as coupling elements for coupling the tapes of the fastener together, and another continuous weft filament or thread traverses the tape without forming portions projecting therefrom.

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

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

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

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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Furthermore, instead of forming projections and the like which are integral with the filament, these may be provided by adhesively bonding or welding suitable projections separately on to the filament, or winding a thread round the filament in the manner that is conventional in the various methods of producing so-called fancy yarns. Instead of a solid filament a hollow filament 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.

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In the described embodiment, the filament forming the coupling elements only extends across an edge region of the tape. Of course, this filament may alternatively extend across the entire tape width if the increased tape stiffness resulting from this is tolerable.

WHAT WE CLAIM IS:—

1. A method of producing a slide fastener having coupling elements formed on the fastener tapes, the method comprising of weaving the tape with two or more continuous wefts in such a manner that a continuous weft filament of the tape forms projecting loop portions at the tape edge or at a predetermined distance therefrom, these being spaced at the appropriate intervals for serving as coupling elements for coupling the tapes of the fastener together, and another continuous weft filament or thread traverses the tape without forming portions projecting therefrom.

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

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

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

* C L M S *

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

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

7. A method as claimed in claim 5, wherein the roughening of the surface is produced by projections separately applied to the surface of the filament.

8. A method as claimed in claim 6, wherein the integral projections are produced by the plastic deformation of the filament forming the coupling elements.

9. A method as claimed in claim 6, wherein the integral projections are produced by machining the surface of the filament forming the coupling elements.

10. A method as claimed in claim 7, wherein the projections separately applied to the surface of the filament are formed by adhesively bonding or welding said projections to the filament, or winding a thread round the filament.

11. A method as claimed in claim 5, comprising roughening only part of the circumferential surface of the filament which is used for forming the coupling elements.

12. A method as claimed in claim 11, wherein the partial roughening consists in a separate strip attached to the filament and extending in the longitudinal direction thereof.

13. A method as claimed in any one of claims 5 to 12, wherein the roughening of the filament used for forming the coupling elements is at the same time suitable for effecting the required coupling engagement of the coupling elements with coupling elements of another similar tape.

14. A method as claimed in any one of claims 1 to 4, wherein the filament is a smooth and undeformed filament and the projecting loop portions of the filament which forms the coupling elements are deformed to provide coupling projections after they have been woven into the tape.

15. A method as claimed in claim 14, wherein the vertices of the projecting loop portions of the filament which forms the coupling elements are provided with coupling projections and recesses by their cold deformation by the application of pressure.

16. A method as claimed in any one of claims 1 to 15, wherein the filament used for forming the coupling elements is a monofilament of a permanently deformable polyamide material.

17. A method as claimed in any one of claims 1 to 16, wherein thick warp threads are provided at one edge region of the tape whereby to form a bulbous selvedge, the longitudinal advance of the weft filament forming the coupling elements being confined to a region at the inner edge of the bulbous selvedge.

18. A method as claimed in any one of claims 1 to 16, wherein the filament which forms the coupling elements is looped over a freely suspended 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 tape proceeds.

19. A method as claimed in any one of claims 1 to 18, comprising submitting the filament forming the coupling elements to a heat treatment for removing tension when the weaving process has been completed, in order to permit said filament to retain the shape imparted to it by the weaving process.

20. A method as claimed in claim 19, comprising performing the treatment simultaneously with a process of dyeing the woven tape.

21. A method as claimed in any one of claims 1 to 20, 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.

22. A method as claimed in any one of claims 1 to 21, comprising prior to weaving imparting to the filament which is to form the coupling elements a twist contrary to the twist imparted to the same by the process of helically looping the filament into the weave by a shuttle picking motion.

23. A method as claimed in any one of claims 1 to 22, wherein two tapes for jointly forming a slide fastener when fitted with a slide are simultaneously woven one above the other in such a manner that the weft filaments used to form the coupling elements form right hand loops in one of the tapes and left hand loops in the other tape.

24. A method as claimed in claim 23, wherein the tapes are simultaneously woven in a multi-tier loom.

25. A method of producing a slide fastener having coupling elements formed on the fastener tapes, substantially as hereindescribed and with reference to the accompanying drawings.

26. Slide fastener tape substantially as hereindescribed, when produced by the method claimed in any of Claims 1 to 25.

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