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3,247,871

METHOD OF PRODUCING ZIP FASTENERS

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2 Sheets-Sheet 2

FIG. 6 PRIOR ART

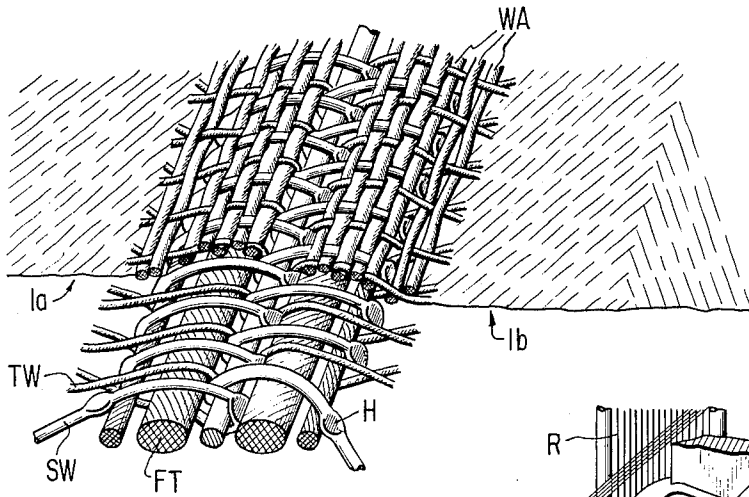


FIG. 7

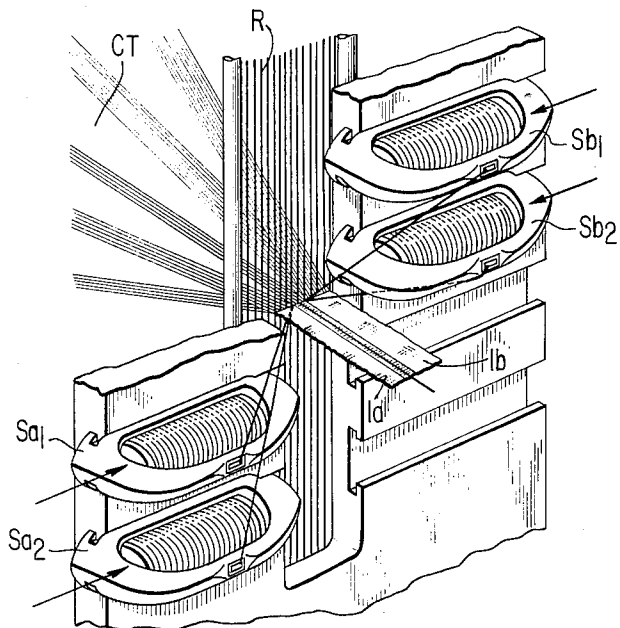
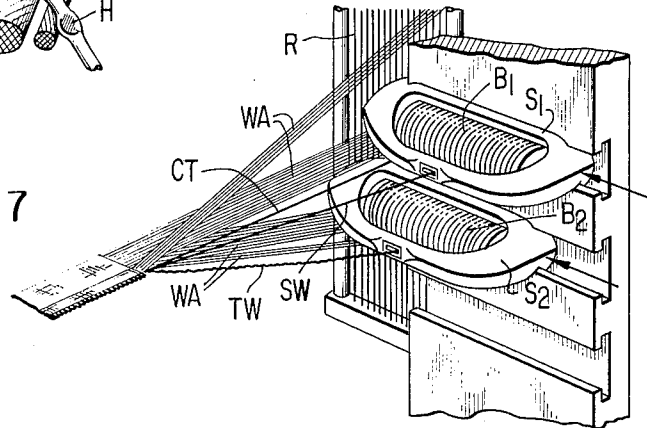


FIG. 8

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METHOD OF PRODUCING ZIP FASTENERS

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889,083, Patent 1,323,015

4 Claims. (Cl. 139—384)

The invention relates to improvements in methods of producing by weaving a zip fastener, that is, a fastener which includes a slider and whose hooking or coupling elements are incorporated, generally in the weft, on one of the edges of the fabric supporting each of the stringers making the fastener elements in the course of the weaving of these elements.

According to a known method, it is possible to produce a zip fastener of the type improperly named a "spiral" fastener which comprises hooking elements constituted, on one side, by a metal wire or a filament composed of synthetic material put into the form of circular or elliptic cylindrical helices and, on the other side, either by a metal wire each coil of which has a deformation which insures the hooking with the opposite coil or, in the case of elements composed of synthetic material, by a thread or filament which is obtained by extruding or drawing and has a constant flat or circular cross-sectional shape to which thread is imparted a special shape characterized by an alternated succession of rectilinear portions, curves and angles so as to insure the hooking with the opposite element.

The hooking elements secured to the bands constituting the fastener are therefore dissimilar.

Slider fasteners comprising two bands or stringers and similar hooking elements incorporated in the supporting fabric have been produced by weaving a tubular band or selvage over the entire width or only over a part of the hooking elements.

Similar fasteners have also been produced in accordance with the in-and-out or meander weaving method.

In the case of weaving a fastener element, generally two spools are employed, one carrying the textile thread adapted to form the weft of the supporting band or ribbon, the other carrying the special metal wire or synthetic filament which is also mounted as a weft thread adapted to constitute the hooking element, either in the more or less regular cylindrical helical form, in the case of a tubular weaving, or in the meander form in the case of weaving in the flat state. The formation of loops constituting the hooking elements on one of the edges of the support is carried out by means of relatively rigid steel wire catch threads along which the hooking elements slide as weaving proceeds.

However, it has been found that in practice the method of weaving the fastener having helical elements has many drawbacks for the following reasons.

To form the hooking elements and to facilitate their positioning on the slide (which must be achieved with an extreme precision) it has often been necessary to pre-form the thread or filament adapted to form the hooking elements before weaving, this pre-forming resulting in projections which are evenly spaced apart along the entire length of this thread or filament. Consequently there is a certain irregularity in the unwinding of this thread, since the projections hook on to each other and hinder to a varying degree the unwinding of the spool, regulation of which therefore becomes very difficult. A similar drawback is encountered in the course of the passage of the thread through the guiding eyelets of the shuttle.

The deformations obtained by pre-forming present another serious disadvantage due to the fact that in the

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course of weaving, the thread of the hooking element undergoes a movement which, upon each stroke of the loom, is manifested by a twisting of this thread, namely by a torsional movement of this thread about its axis, which torsion has an amplitude of about 180° for each movement of the spool, that is, a complete rotation for each to-and-fro movement of the spool corresponding to the formation of a hooking element. This twisting is due to the fact that the unwinding of the spool is effected in a direction perpendicular to the axis of the spool whereas in the course of weaving, the spool moves along its axis in a helical path relative to the warp threads. The deformations resulting from the pre-forming should in fact constitute the starts of the folds facilitating the formation of the loops which constitute the hooking elements and the torsional effect should occur in the region of these fold starts but in practice the coincidence between, on the one hand, the pre-formed deformations, and, on the other hand, the points of localization of the torsion effects do not always occur with the required theoretical exactness. Thus, in the formation of the loops, irregularities occur which could result in a high percentage of production rejects which render the method uneconomical.

On the other hand, if a smooth thread of the usual type having a circular cross-sectional shape is used for the weft constituting the hooking element, the aforementioned drawbacks disappear but the loops of the slide do not in themselves constitute the hooking elements; they must undergo after weaving a treatment which creates these hooking elements by deformation. This treatment in fact constitutes a very delicate and costly operation.

In order to avoid these various drawbacks, it has been proposed to twist the weft thread forming the hooking elements in the direction opposite to that it undergoes during the weaving, or to subject the thread in the course of the weaving operation to movements of torsion compensating for the twisting. These methods, which are carried out by means of devices not described, have the drawbacks of necessitating an additional operation or additional arrangements which complicate the method or the machine and seem to be of doubtful efficiency.

It was in order to avoid the drawback of the twisting caused by the helical weaving that the meander weaving method was proposed, the thread forming the hooking elements being in this case pre-formed in such manner as to present hooking projections in planes which are alternately offset 90° thereby partly compensating for the twisting; but in this case the movement of the spools becomes so complex that the regular positioning of the hooking elements cannot be insured with all the required precision.

One of the objects of the present invention is to improve the methods of producing by tubular weaving a fastener of the helical type so as to eliminate the aforementioned drawbacks and defects.

Another object of the invention is to solve this problem by very simple means which do not present any particular inconvenience.

This method also forms the slide for guiding the slider and it is also possible to form the connection which unites the two elements of the fastener.

In the improved method according to the invention there is used as the weft thread for forming the hooking elements a filament composed of a synthetic or metallic material having a constant cross-sectional shape, said cross-section comprising in its plane two, and only two, axes of symmetry with the respective dimensions therealong being which are unequal in length, the form of these hook elements being obtained by the torsion of the filament about itself, that is about its own axis, resulting, in each stroke of the loom, from the tubular weaving procedure forming a helix out of the filament.

It is known that these axes are of necessity perpendicular and that their intersection forms the centre of symmetry of this cross-section.

Such a cross-section can therefore form, for example, a rectangle or a diamond having straight or curved sides, an ellipse or in a general way an irregular polygon having straight or curved sides or any plane geometric shape which has in its plane only two axes of symmetry with the respective dimensions therealong being of unequal length.

Thus the circle and other shapes having more than two axes of symmetry and in particular the circle and regular polygons, for example the square, are excluded from this definition.

This filament can be obtained by extruding, drawing, rolling or any other suitable method either directly from stock material or from a filament having a cross-sectional shape unsuitable for use in the fastener of the invention.

According to another feature of the invention, in the course of weaving, the twisting of the filament between the shuttle and the woven fabric support is aided and controlled by the reed which in this loom is utilized in the known manner for pressing the pick or portion of weft between the two edges of the fabric.

In the case of the invention, the number of the reed is so chosen that one tooth is applied, at each stroke of the loom, on the pick or portion between the two edges of the fabric constituting the hooking elements; preferably the contact between said tooth and said pick must occur approximately in the middle of the pick, that is, in the middle of the weaving formed by the filament.

As will be understood from the description of one embodiment of the invention, the twisting of the filament in accordance with the invention and the positioning thereof is aided and controlled by the reed which causes the formation of a loop having such shape that this loop is particularly suitable for performing the function of a hooking element. Moreover, as the filament is smooth (since this filament has a constant section) its winding on the spool and its unwinding are carried out in a very regular manner with the same ease as with a simple textile thread.

Another object of the invention is to provide, as a new industrial product, a fastener having a slide of the helical type obtained by means of the method hereinbefore described, having the general structure of the fasteners obtained by weaving, and comprising two fastener elements each of which is formed from a row of hooking elements constituted by the loops of a weft thread consisting of a filament composed of a synthetic plastic material or a like suitable material, this fastener being so arranged that said filament has a cross-section having in its plane two, and only two, axes of symmetry with the respective dimensions therealong being of unequal length.

According to other features of the invention, each of said picks comprising one-half of each loop is twisted through 180° between its ends; preferably, the point corresponding to a twisting of 90° occurring approximately in the middle of each of said picks; the filament weft being so woven that in the untwisted end portions of the weft picks or portions between the two edges of the fabric, and in particular in the curved portions forming the loops, the largest dimension of its section is parallel with the general plane of the fastener.

Further features and advantages of the invention will be apparent from the ensuing description, with reference to the accompanying drawings, to which the invention is in no way limited.

In the drawings:

FIG. 1 is a view of a slider fastener according to the invention;

FIGS. 2a to 2d are views of four examples of cross-sections of the filaments of utility in the production of the fastener according to the invention;

FIGS. 3a and 3b represent, by way of explanation, two examples of rows of coupling elements obtained with filaments which do not conform to the filament used in the invention;

FIG. 3c represents a row of coupling elements according to the invention;

FIG. 4a represents, by way of example, two rows of coupling elements according to FIG. 3a engaged in one another but which would not produce a slide fastener, since in this case there is no hooking;

FIG. 4b represents, by way of example, two rows of coupling elements according to FIG. 3b which are hooked to one another according to known methods of production;

FIG. 4c represents two rows of coupling elements according to FIG. 3c hooked to one another in accordance with the invention, and

FIG. 5 is a diagrammatic plan view illustrating the weaving of the elements according to the invention.

FIG. 6 is a zip fastener of a known type obtained by weaving process, in which the filament weft has a circular cross-section pre-deformed at regular intervals;

FIG. 7 is a diagrammatic view of the main parts of a ribbon-weaving loom of a known type, on which a fastener element according to the invention can be manufactured by the weaving process;

FIG. 8 is a diagrammatic view of the main parts of a ribbon weaving loom on which the two fastener elements of a zip fastener according to the invention can be simultaneously obtained.

The slider fastener according to the invention comprises (FIG. 1) in the known manner two fastener elements 1a, 1b and a slider 2; each fastener element has a woven support or tape 3a or 3b and a row of hooking elements 4a or 4b each of these rows being formed in a marginal portion of the corresponding support by means of a filament of nylon or other suitable material which is weft woven, the assembly of these two portions constituting the slide along which the slider slides. Each of these two fastener elements comprises an abutment 5a or 5b and the two fastener elements are united by a connection 6.

According to the essential feature of the invention defined hereinbefore, the filament has a cross-section having in its plane two, and only two, axes of symmetry and the respective dimensions along these axes are unequal in length. Four cross-sections satisfying this definition are shown by way of example in FIGS. 2a to 2d, each of these sections having only two axes of symmetry *ab* and *cd*, the dimension along axis *ab* being longer than the dimension along axis *cd*.

This filament constitutes a weft wound on its widest face on a spool which is distinct from the spool carrying the weft of the textile thread constituting the support and the lateral beading in which the filament is woven. This filament passes in the known manner around a steel wire catch, thread which is relatively rigid so as to cause the formation of an end loop. The filament bears against the catch thread through the medium of its larger face, each loop being pressed against the preceding one and by the succeeding one, its inclination on the edge of the textile band and the regularity of its shape can be properly controlled.

In the case of known methods employing a smooth cylindrical thread or a cylindrical thread which is pre-formed at regular intervals, rows of hooking elements of the type shown in FIGS. 3a and 3b, respectively, are obtained, whereas the hooking elements obtained in accordance with the invention are in the form shown in FIG. 3c making up a row 4 of separate hooking elements 4-1, 4-2, 4-3, etc. Each hooking element is constituted by a loop such as 7 (FIG. 3c or 4c) whose two portions 8, 9 (FIG. 4c) are each twisted on itself, that is about its own axis, to the extent of 180° between its ends; the extent of the torsion or twisting being 90° toward the

middle 10 or 11 of this portion. This twist is due, as well known, to the fact that the bobbin, housed in an elongated shuttle, has its axis parallel with the longitudinal axis of the shuttle, which is parallel with the alternate motion of the shuttle, while the filament unwinds perpendicularly to the bobbin axis, i.e., perpendicularly to said direction of the shuttle motion and while the shuttle passes round the catch thread. It can be seen in FIG. 4c that the interval, measured in the direction parallel with the axis XX of the fastener, is much larger at 12 between the points of maximum torsion than at 13 between the points of zero torsion. Consequently the hooking elements of two identical rows respectively pertaining to the two elements of the fastener can interpenetrate and interhook in a solid fashion, the wide portion of one hooking element engaging in the wide space 12 whereas the narrow portion passes through the narrow interval 13.

In the case of the elements shown in FIG. 3a obtained with a filament having a circular cross-sectional shape, the interpenetration (FIG. 4a) cannot result in a hooking engagement; in the case of the elements shown in FIG. 3b obtained with a pre-deformed thread, the folds P (FIG. 3b) constitute the hooking elements but when the two rows interengage (FIG. 4b) only the portions P of the thread are in contact and interlock; on the other hand, in the case of the hooking elements according to the invention, the contact between the rows occur along larger surfaces, as is clear from FIG. 4c. Therefore a particularly solid hooking is obtained and this has been demonstrated by experience.

FIG. 4c shows clearly that this result is essentially due to the fact that the cross-sectional shape of the filament employed has in its plane only two axes of symmetry and that the respective dimensions along these axes are unequal, which permits, owing to the twisting of the filament, obtaining between adjacent hooking elements spaces of special shape which are such that the distances between the elements measured in the longitudinal direction of the fastener are not constant at all points but are purposely highly variable along the length of said hooking elements, these distances varying from maximum values at 12 to minimum values at 13.

Thus it might be said that the twisting or torsion of the filament in the course of weaving which constituted a serious drawback in known methods is, on the contrary, utilized in the method according to the invention so as to obtain particular advantages of considerable importance.

Obviously, this result can not be obtained by means of a filament having a circular or square cross-sectional shape or having any cross-sectional shape; the fact that it was previously taught that such a sectional shape could be of any type merely shows that the causes of the defects observed had not been found and that the solution of the problem of eliminating these defects had not been foreseen prior to the present invention.

The present invention constitutes a remarkably simple solution since the production of this special filament presents no problem and that this special filament is introduced in a known weaving procedure on a loom of known type.

FIG. 5 shows in plan a pick portion 14A passing round a catch thread 15 during the forming of a hooking element. The loom employed comprises a reed 16 having a reed support 17 and vertical teeth 17a, 17b, 17c, etc., the reed being actuated in the known manner in synchronism with the shuttle and pressing each pick at each stroke of the shuttle.

The number of this reed (which indicates the spacing between the teeth) is so chosen that a tooth 17b bears against the pick forming the hooking element approximately toward the middle of this element. In FIG. 5, AB represents the width of the tubular part formed by the fabric, that is the selvage or edge of the woven sup-

port, and CD the length of the total tubular part including the nylon loop, that is the outside diameter of the loops as viewed in cross section, and AC the part of the loop extending beyond the woven support. FIG. 5 shows the action of the tooth 17b on the pick 14B which is subjected to the action of this tooth.

The instant fastener may be similar to the woven fasteners of the prior art. Such a known fastener is shown at FIG. 6; it comprises, in each of the two fastener elements 1a and 1b, warp threads such as WA, a textile weft TW and a synthetic filament weft SW. Each of the two elements comprises an edge portion woven according to the known tubular weaving process and encompassing a filling thread or bead FT. In this known fastener, the filament SW has a generally circular cross-section but is deformed at regularly spaced points H whereby flat portions are provided to constitute hooking elements.

This improved production method according to the invention can be applied to a weaving having one band with two shuttles or to a weaving having two bands with four shuttles and a steel wire catch thread common to the two bands.

A loom for weaving such a fastener element may be of the usual type used for ribbon-weaving; the main parts of such a loom are shown at FIG. 7; it comprises two shuttles S1 and S2, having a general longitudinal direction, each having a bobbin, B1 or B2 whose axis is arranged parallel to the longitudinal axis of the shuttle, a catch thread CT, a reed R (which is shown in its rear position). The bobbin B1 carries the synthetic weft SW, and the bobbin B2 carries the textile weft TW; warp threads are shown at WA.

In the twin loom illustrated at FIG. 8, the two fastener elements 1a and 1b are woven simultaneously by means of two pairs of shuttles Sa1-Sa2, and Sb1-Sb2, on a single catch thread CT. In this figure, the reed R is shown in its forward position.

In any case, as in the known technique, the spacing of the hooking elements, that is, the pitch of the fastener is a function of the texture of the band or ribbon and of the section of the filament. The length of the loop and its rigidity are determined by the thickness of the catch thread and the section of the filament.

The width of the fastener is determined by the number of warp threads constituting the tubular part of the fastener, and its thickness for guiding the slider by the number and thickness of the filling threads employed.

Although specific examples and embodiments of the method and device of the invention have been given, it must be understood that the scope of the invention is not limited thereto but defined in the appended claims.

Having now described our invention what we claim as new and desire to secure by Letters Patent is:

1. An improved method of weaving a slide fastener comprising two fastener elements, each of said elements comprising a flattened helical coil constituting a row of hooking elements incorporated as a weft into one of the edges of a fabric tape supporting said row, said method comprising the following steps: winding on a spool a weft filament of constant cross-sectional shape having in its plane two—and only two—axes of symmetry of unequal lengths, said winding being effected without twisting the filament, disposing said spool in a first shuttle having a generally longitudinal direction so that the filament is unwound from the spool in a direction perpendicular to said longitudinal direction, the shuttle normally moving in said longitudinal direction in a loom, disposing in a loom said first shuttle and a second shuttle containing a weft for forming said fabric, said loom further comprising warp threads forming sheds, a reed having teeth spaced a suitable distance apart, causing the two shuttles to move in a to-and-fro manner in the sheds and thereby creating for each movement in each direction of said first shuttle a twist through 180° of the filament, the sheds being so formed that the weft of the second shuttle is

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interwoven with the warp threads to form said fabric, whereas said filament is interwoven with certain threads of the edge of the warp and passes round a catch thread so as to form loops constituting the hooking elements, and feeding the thus woven fastener elements forwardly so as to withdraw the catch thread from the thus formed hooking elements; said method further comprising the step of regulating the respective movements of the first shuttle and the reed in such manner that the loops constituting the hooking elements are formed in four stages in the following manner, with the first shuttle moving towards the right, the filament passes round the catch thread flat against the latter and undergoes a twist towards the right from said catch thread, the reed being in its rear position; as the first shuttle reaches the end of its travel towards the right the reed is caused to move to its forward position and one of the teeth thereof exerts a pressure on the filament which is presented edgewise, and thus renders the degree of twist of the filament constant and contributes to the dimensional regularity of the hooking element loop; the first shuttle returns towards the left and draws the filament under the catch thread, the reed having returned to its rear position; the first shuttle reaches the end of its travel toward the left and the reed is made to return to its forward position in controlling the twisting of the filament and the dimensional regularity of the hooking element loop.

2. A method as claimed in claim 1, wherein the catch thread is so positioned as to be at equal distance from two successive teeth of the reed, whereby the tooth of the reed which controls and renders regular the twisting of

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the filament is applied at a constant distance relative to the catch thread and results in a twist of about 90°.

3. A method as claimed in claim 1, wherein the two elements of the fastener are woven at the same time, the hooking element loops of the two fastener elements are formed about a single catch thread, and the tensions of the filaments are regulated simultaneously, the filaments being unwound from the two shuttles in such a manner that the catch thread is maintained strictly in a position which is at equal distances from two teeth of the reed.

4. A method as claimed in claim 1, wherein the two fastener elements are woven at the same time in such manner that the hooking element loops of the two fastener elements are formed about the same catch thread, and each loop of a fastener element bears on the preceding loop of the opposite fastener element.

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