United States Patent

Sohr

[15] **3,665,879**

[45] **May 30, 1972**

[54] **METHOD OF MAKING A SLIDING CLASP FASTENER**

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Feb. 18, 1969 Germany ..... P 19 08 069.4

[52] **U.S. Cl.** **112/265**
[51] **Int. Cl.** **D05b 3/12**
[58] **Field of Search** ..... 112/265, 2, 105; 24/205.1 C

[56] **References Cited**

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Primary Examiner—Patrick D. Lawson
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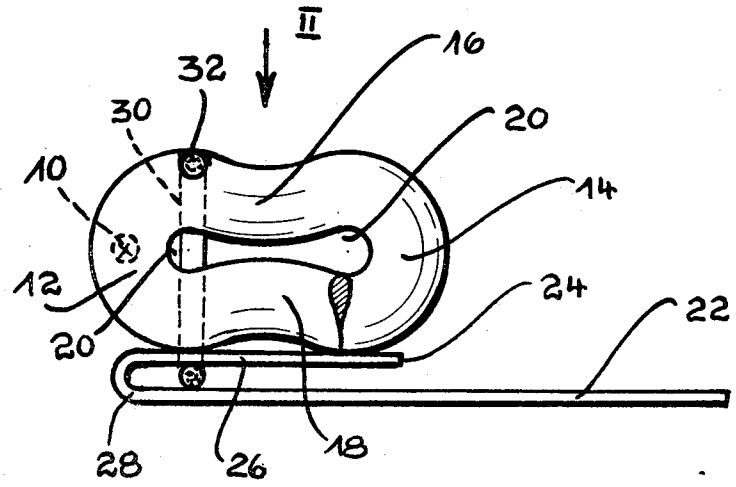
[57] **ABSTRACT**

The invention relates to a sliding clasp fastener of the concealed element type comprising series of coupling elements which are, on one side each, sewn on a carrier tape and consist of a thermo-plastics filament wound in the form of a modified helix, as well as carrier tape, which is folded back on itself on the side which is remote from the series of coupling elements.

18 Claims, 9 Drawing Figures



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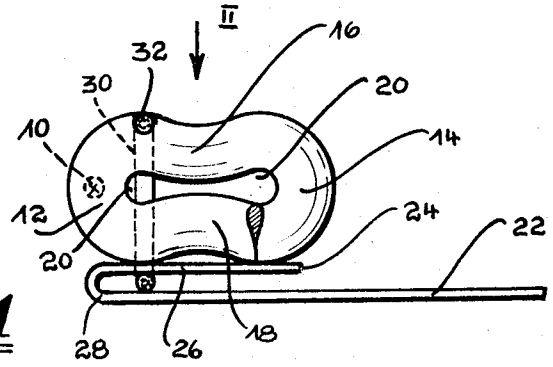

Fig.1

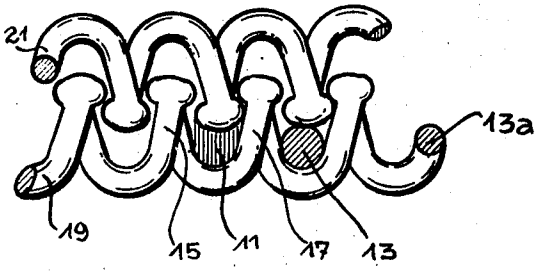

Fig.2

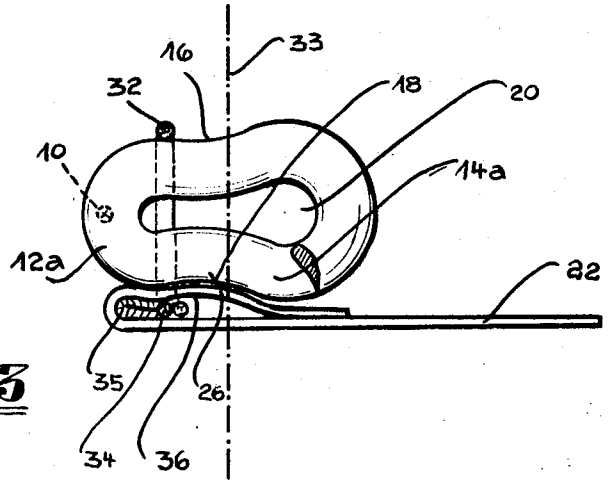

Fig.3

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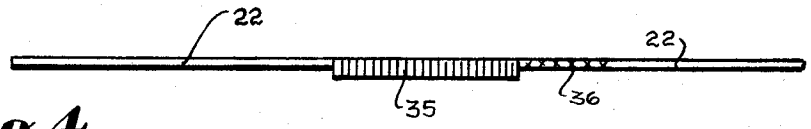

Fig. 4

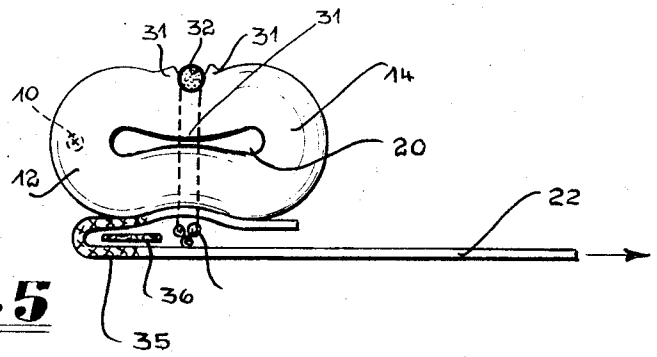

Fig. 5

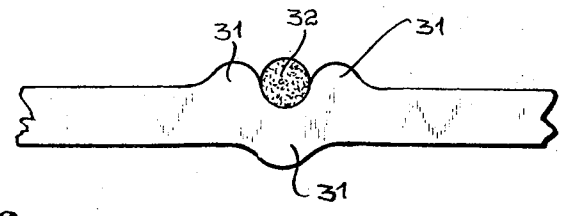

Fig. 6

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Fig. 7

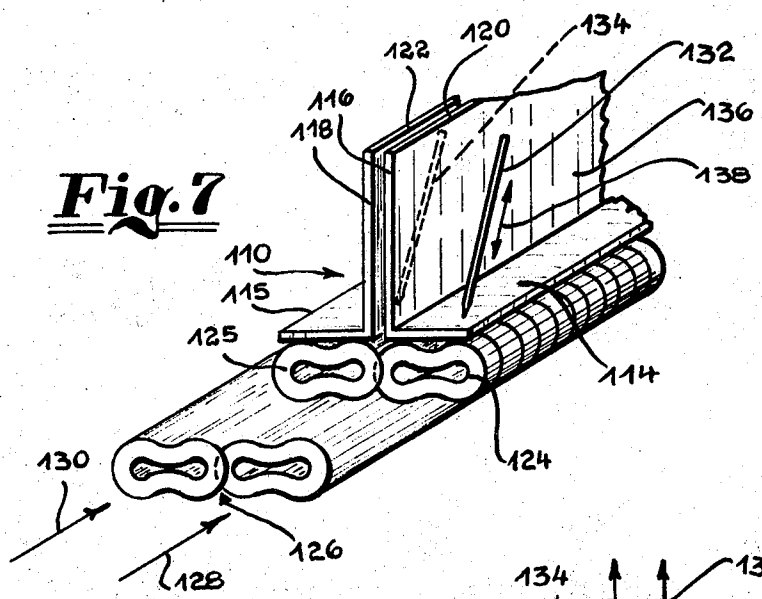


Fig. 8

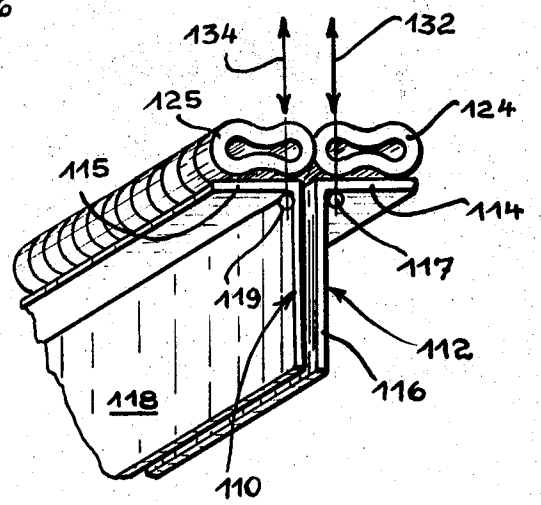
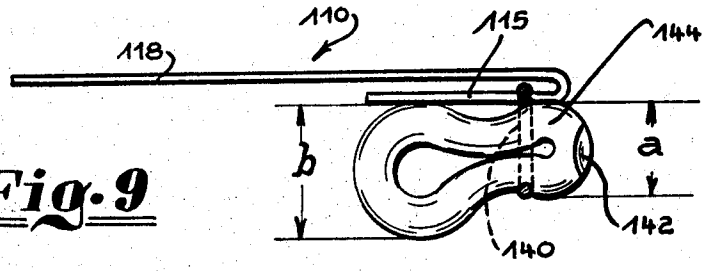


Fig. 9



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METHOD OF MAKING A SLIDING CLASP FASTENER

The invention relates also to a method of making fasteners of the said type.Sliding clasp fasteners of the concealed element type per se are well known. The problem involved with this type of sliding clasp fastener is that the coupling head portions of the series of coupling elements should be fastened as close as possible to the fold of the tape and that the interengaged head portions should be prevented from being exposed when the finished sliding clasp fastener is subject to transverse pull. British Pat. No. 1,120,935 for example, discloses a sliding clasp fastener of the concealed element type where the problem of fastening the coupling head portions of the series of coupling elements as close as possible to the edge of the carrier tape is solved by putting the head portions between the weft threads in a zone without warp threads of the carrier tape, and laying the edge of the tape, which does have warp threads on the other side of the coupling elements and fastening it there preferably by sewing. For this purpose the various well known shapes of coupling elements (oval shape, dumb-bell shape (FIG. 8), meander shape and the like) are used. The disclosed type of sliding clasp fastener, however, cannot be termed a sliding clasp fastener the series of coupling elements of which is sewn to the tape on one side only.

So far this requirement of concealing the series of coupling elements has been met rather imperfectly and — strictly speaking — the fasteners of the so-called concealed element type do not deserve this name, at least as far as those which are made of thermo-plastics filament are concerned.

Furthermore, the prior art comprises sliding clasp fasteners of the aforementioned type with a helical filament enclosing a cord, namely a so-called filler cord, which at least partially fills the inside cross-section of the series of coupling elements and, additionally, has the function of a connecting element between the sewing thread joining the cord to the carrier tape and the series of coupling elements. As indicated by the term "filler cord" the cord should fill the inside cross-section of the series of coupling elements, namely to prevent the lines of stitching from being distorted by transverse pull exerted on the finished sliding clasp fastener. Further it is well known and common practice to fasten the sliding clasp fasteners of the so-called concealed element type of the kind mentioned above — as different from fasteners of the non-concealed element type — by at least two lines of stitching per series of coupling elements to the carrier tape (see British Pat. Nos. 1,128,413 and 1,073,424 and Swedish Pat. Nos. 213,471 and 214,277).

Surprisingly it was found that the second line of stitching is no longer required, if also the filler cord is omitted. A consideration, which might lead to an explanation of this advantageous and surprising effect may be that a filler cord itself is not sufficiently rigid but flexible so that, possibly, the filler cord contributes only a little to the rigidity of the individual coupling element. Thus the coupling element which has to be big to accommodate the filler cord would be unstable in itself and the filler cord would not improve this instability though it was expected to do so.

For a sliding clasp fastener of the concealed element type comprising series of coupling elements which are, on one side each, sewn on a carrier tape and consist of a thermo-plastics filament wound in the form of a modified helix, as well as carrier tape which is folded back on itself on the side which is remote from the series of coupling elements it is suggested according to the invention to sew each series of coupling elements by a single line of stitching to the tape without using any filler cord.

Pursuing the course taken by this measure and the possibilities disclosed it is suggested that the series of coupling elements without filler cord be made smaller, in particular that the inside cross-section be made smaller than it could be done as long as a filler cord was used. Preferably the passage between adjacent coupling elements for receiving the sewing thread and the needle handling the thread is so dimensioned in the direction of its larger cross-section in regard to size and shape of this cross-section that the thermo-plastics filament to be used for making the series of coupling elements can no

longer be put through this passage or can just — i.e. without play — be put through the passage. Thus the thermo-plastics filament to be used is not the filament which might be obtained from a finished series of coupling elements or a finished sliding clasp fastener, i.e. the filament which has passed all stages of production, but the unworked filament as taken from the reel supplied by the manufactures for being processed to a series of coupling elements. The needle passages of the sliding clasp fastener ready for use should be dimensioned so as to accommodate such unworked filament without play or not to accommodate it at all.

According to another feature of the invention the space, which does not contain any filler cord has definite dimensions, namely the maximum inside width measured perpendicular to the carrier tape plane of the space without any filler cord between the legs of a coupling element under consideration equals approximately half the diameter of the circular cross-section filament to be used for making the series of coupling elements. A sliding clasp fastener of the concealed element type dimensioned according to this rule has particularly advantageous strength properties.

According to a specific embodiment of the invention the coupling elements of the series of coupling elements have the so-called "dumb-bell shape" (for example according to FIG. 8 of British Pat. No. 1,120,935), i.e. — looking in the direction of the sliding clasp fastener axis of symmetry — the coupling head and coupling foot portions of each coupling element are wider than the legs or central portions linking them. Preferably the seam — if looked at from the center of a coupling element — is located closer to the head portion than to the foot portion.

Particular advantages, first of all in regard to fineness and strength, could be obtained, if the sewing thread were merely sunk into the filament surface and part of the filament material were simply displaced; this could be achieved by a heat treatment known per se which would be performed after sewing. The inserting of a sewing thread into a notch provided in the surface of the filament constituting the sliding clasp fastener is known per se, but the notch is formed by removal of part of the filament material and this must inevitably lead to weakening of the filament and a notch effect. If, on the other hand, the sewing thread is sunk into the filament surface, i.e. if material displacement effected instead of material removal, the notch effect and weakening of the filament are eliminated, since the filament volume remains unaffected. Also in regard to production this process is considerably less complicated because the sewing thread sinks itself into the filament, i.e. measures to ensure that the sewing thread moves exactly into the notch previously provided in the filament are no longer required.

Thus the invention relates further to a method of making a sliding clasp fastener of the concealed element type with series of coupling elements consisting of a plastics filament wound in the form of a modified helix and on one side each sewn on one carrier tape each in such a way that the coupling head portions of the coupling elements are remote from the tape edge which is adjacent to the portion of the tape, which supports the series of coupling elements, and that after the sewing stage, the wider portion of the tape which does not support the series of coupling elements is folded back on the line of stitching along a line which is near the coupling head portions.

This method, which is preferably provided and adapted for making a sliding clasp fastener of the concealed type and sewn by one line of stitching and without any filler cord, is characterized according to the invention by the common application of the following steps:

a. Prior the sewing, the series of coupling elements is allowed to set as much as is required for withstanding, without damage the mechanical stress which will result from subsequent treatment, and possible heating is so limited that the temperature remains below the setting temperature of the series of coupling elements and that a noticeable change in shape, in particular of the filament

length-to-thickness ratio, can be made within this temperature range below the setting temperature;

b. the series of coupling elements are then interengaged and

c. sewn on the carrier tapes while the tape portions to be folded back on the line of stitching are guided between the needles;

d. the series of coupling elements sewn on the tapes are subsequently heated to a temperature near their softening temperature in a manner known per se.

Individual steps of this procedure are prior art, partially also in combination with other claims. Thus it was disclosed earlier that series of coupling elements of the type described above can first be interengaged by pairs and only then be sewn on the tape. The inclusion of this well known step of procedure into a procedure for making a sliding clasp fastener of the concealed element type is only made reasonably applicable by the special way of guiding of the carrier tapes according to (c) of the invention. The new procedure permits to reduce the costs of production of such sliding clasp fastener of the concealed element type and to make finer ("less clumsy") fasteners; this is of special interest to the clothing industry.

The special heat treatment known per se permits to change the filament diameter-to-length ratio in order to improve the strength of the connection between filament and carrier tape.

According to another feature of the invention the sewing machine needles operate parallel to each other, but they need not operate at a right angle to the plane formed by the carrier tape portions supporting the coupling elements at the point of sewing, if it is assumed that the tape portions are plane and rigid at the point of sewing. During the sewing process the portion of the tape held and guided between the needles forms, in fact, a right angle with this plane.

As it is usual with fasteners of the non-concealed element type, the series of coupling elements may be fed into the sewing machine below the carrier tape supporting it — if a double chain stitch seam is made — so that in case of the fastener of the concealed element type, the needles operate from their point of stitching parallel to the tape portions to be folded later on, then first pierce the tape portion supporting the series of coupling elements and finally the passages between the coupling elements.

In this way the gripper thread chain is laid on the series of coupling elements.

If it is intended to utilize the double chain stitch seam to improve the positioning of the seam near the coupling head portions substantially, the series of coupling elements is fed into the sewing machine above the carrier tape so that the needles first pierce the passages between the coupling elements and thereafter the tape portions supporting the coupling elements; the longer tape portions, which are to be folded later on are guided between the needles, which have already done the stitching. By feeding the material into the sewing machine this way the gripper thread chain is laid on the tape portions supporting the series of coupling elements, and since the gripper thread chain is a sort of bead it will produce a blunt folding edge of the longer tape portions and improve the covering of the coupling head portions as well as the positioning of the seam when the finished fastener will be subject to transverse stress.

A particularly good product is obtained by the method according to the invention, if series of coupling elements are used the legs of which joining the head and foot portions are recessed or intended from the head and foot portions. Preferably this recess or indentation is located closer to the coupling head portion than to the coupling foot portion so that the seam which lies on the rear head portion, so-to-speak on the back of the head, is located particularly close to the point where the coupling element engages its counter-element. In addition or for this purpose the foot portion may be provided with a bulge exceeding that of the head portion so that the foot portion is thicker or, related to the tape plane, higher than the head portion. The seam may be laid into a step previously provided in the filament for this purpose or prepared during the heat treatment. This is achieved preferably by making the filament and the thread of materials of different softening temperatures so that the filament moves into the thread or the thread into the filament when the material of the lower softening point yields. Preferably the materials are so selected that the filament softens first and the thread moves into the filament material.

This feature of the method can, in general, be applied to the manufacture of sliding clasp fasteners in that all the elements forming the sliding clasp fastener (for example, filament for the series of coupling elements, sewing thread and carrier tape) are caused to move into each other by appropriate heat treatment, i.e. the temperature applied is slightly below the melting temperature of one of the thermoplastic materials.

Furthermore it is intended to use threads consisting of a plastics core and cotton covering instead of cotton sewing threads or pure synthetic sewing threads. If according to the invention the temperature applied to the suggested thread is such that the plastics core shrinks like a synthetic sewing thread, it adheres very closely to the legs of the coupling elements, and during the dyeing process later on the cotton covering can have the same shade as the carrier tape, if it also consists of cotton.

If however, plastics carrier tapes are used, the step of the procedure mentioned above provides at the same time a pleat effect since the tapes are fixed in the final planeposition they will have in the garment. So far such pleat effect could not be obtained without a special aftertreatment of conventional cotton tapes and also of plastics tapes.

According to the invention sliding clasp fasteners consisting of synthetics only can be dyed all over and fast with good penetration if the thermo-setting temperature is utilized. Also individual plastics components of the sliding clasp fastener can be dyed according to this method.

According to the invention the concealing of the coupling elements by the supporting carrier tapes is also ensured by the fact that on each coupling element the distance between the coupling surface and the seam may be very short in relation to the total width of the individual coupling element, that the seam can no longer be drawn towards the foot portions by transverse pull and that the legs can thus no longer be exposed.

Additional features of the invented clasp fastener and of two possible realizations of the invented method will result from the following specification and from the claims. In the specification reference will be made to the accompanying drawing where:

FIG. 1 is a section through one half of a sliding clasp fastener according to the invention, regarded in the direction of the fastener axis;

FIG. 2 is a plan view of two interengaged finished series of coupling elements — without carrier tape — of a sliding clasp fastener according to the invention; the view being taken perpendicular of the fastener and carrier tape planes as indicated by arrow II in FIG. 1;

FIG. 3 is a view of another embodiment of the invention corresponding to FIG. 1;

FIG. 4 is a cross-section merely through the carrier tape of the fastener according to FIG. 3 where the tape, however, is shown in the folded condition;

FIG. 5 is a view of another embodiment of the invention corresponding to FIG. 1;

FIG. 6 is an enlarged detail lateral view of the part of the plastics filament leg where the sewing thread is sunk into the filament surface;

FIG. 7 is a perspective view of the arrangement of the two carrier tapes in respect to each other,of the series of coupling elements and the needles during the sewing stage;

FIG. 8 shows an alternative method of feeding the materials to be sewn into the sewing machine, and

FIG. 9 shows a preferable design of a coupling element out of the series of coupling elements made of a continuous filament, with the preferable location of the seam and the folded

carrier tape — looking in the direction of the longitudinal axis of symmetry of the sliding clasp fastener.

As compared with an actual sliding clasp fastener, FIG. **1** shows a considerably enlarged half of such fastener. Also in regard to the ratio of coupling element size and filament thickness FIG. **1** is not according to scale.

Approximately at **10** there is the axis of symmetry of the sliding clasp fastener. The coupling element shown comprises the coupling head portion **12**, the coupling foot portion **14**, and the legs **16** and **18**. The external contour of the element is that of a dumb-bell, i.e. foot and head portions of the element are higher than the central portion or legs connecting them. The useful cross-section without filler cord is indicated by numeral **20**. According to the invention, the clear height of said cross-section should equal approximately half the diameter of the unworked filament used.

The series of coupling elements is so sewn on the carrier tape **22** that the coupling head portions **12** are remote from edge **24** of the tape which limits tape portion **26** supporting the series of coupling elements and is adjacent to the head portions. The remaining portion of carrier tape **22** is folded back on itself, namely on portion **26** supporting the series of coupling elements. Thus a fold is obtained at **28**; in the ideal case of the concealed element type fastener this fold is only half the coupling head portion depth away from the front of all coupling head portions. The sewing thread **32** of the single line of stitching **30** is located so deep in the filament forming the coupling elements that the filament covers the thread entirely or almost entirely. This special feature permits to make the concealed element type fastener still more graceful and finer.

FIG. **2** shows the needle passage **11** (shaded) which is located between two adjacent coupling elements **15** and **17** of a series of coupling elements **19** which was interengaged with its counter-series **21**. What really matters according to the invention is the maximum cross-section of the needle passage, which is not necessarily in the direction perpendicular to the carrier tape plane; in the example shown, the passage of maximum cross-section will rather be slightly inclined from the left to the right, as determined by the direction of the leg incoming at a coupling head portion and the leg outgoing there. In the case of series **19** shown in FIG. **2**, the leg incoming from the left is the upper leg and the outgoing leg is the lower leg, and since they do not lie exactly on top of each other but diverge substantially right from the coupling head portion, the needle passage of maximum cross-section is located between the upper legs slightly more to the left than between the lower legs. Thus it passes from the left top to the right bottom. This passage should be so narrow that the unworked filament which has not been subject to any forming process or heat treatment can, at most, be put through the passage without play. The passage, however, can still be narrower so that the unworked filament cannot be put therethrough. It should be noted, however, that in all cases the needle passage of the finished sliding clasp fastener sewn to the garment or the like is meant. In order to test this feature in practice, the series of coupling elements, preferably interengaged with its counter-series, should be detached from the sliding clasp fastener which is ready for sale and it should be attempted to put the unworked filament through the needle passages.

For a filament of circular cross-section the relationship between the needle passage of the finished fastener and the unworked filament **13** is as shown in FIG. **2**.

Shape and diameter of the unworked filament may be different from the cross-section of the finished filament, as shown at **13***a*.

According to FIG. **3** the tape is reinforced at the fold between tape portions **26** and **22**; the reinforcements improve the positioning of the fold at the head portion. As shown in detail in FIG. **4** a reinforcement by warp threads or films or the like is provided at **35** and at **36** plastics material or the like is woven in to reinforce the sewing thread area. Thus the tape fold possesses considerable inherent strength, and this also improves the strength of the sliding clasp fastener.

The embodiment of the invention according to FIG. **3** furthermore shows a head portion **12** a which is lower than the foot portion **14***a*. The line of stitching consists of an upper thread **32** which is not sunk into the filament surface and a lower thread chain **34**. The recessed legs **16** and **18** are also located in front of plane **33**.

According to another advantageous embodiment of the invention and with the use of reinforced carrier tapes and the common use of chain stitch seams an additional improvement is obtained by not arranging the lower thread chain, as usual, on the coupling element series and the upper or needle thread at the carrier tape, but by arranging them in the reverse manner so that the lower thread chain, i.e. the gripper thread, which is bulkier lies below portion **26** of the carrier tape. Thus the tape reinforcement applied makes the finished fastener more resistant to transverse pull. This arrangement facilitates sinking of the less rising or bulky upper thread into the plastics filament by heat and facilitates easier sliding of the slider over the plastics coupling element surface which is no longer disturbed by elevations caused by the thread. The slide does no longer need an internal profile which would otherwise be required with a view to the lower thread chain.

FIG. **5** shows a series of coupling elements of symmetrical design with a thread arranged at the center of the leg. The upper thread is embedded in the filament without reduction of the filament volume but only with displacement of filament material. The displacement of filament material is indicated at **31**. When transverse pull is exerted on portion **22** of the carrier tape, the tape reinforcement is supported by the lower thread chain **34**.

Another advantageous feature consists in that, if cotton carrier tapes are used, a synthetic filler may be woven into the tape in the area of the needle stitches. The filler should be selected so that it will set during the heat treatment which will be performed in a manner known per se, and additionally fix the sewing thread in the weave of the carrier tape. If plastics carrier tapes are used, the filler may consist of a material, which sets at lower temperatures and earlier than the carrier tape itself.

FIG. **7** shows in a simplifiedmanner, in profile and not in entire length the carrier tapes **110** and **112** which are so fed into the sewing machine that portions **114** and **115** of each tape supporting the coupling elements are perpendicular to the remaining tape portions **116** and **118**. Edges **120** and **122** will later be the external edges of the finished fastener with its coupling elements in the interengaged state. Prior to sewing, the series of coupling elements **124** and **125** are interengaged by their coupling head portions (arrow **126**) and together fed into the sewing machine in the direction of arrows **128** and **130**. The sewing needles **132** and **134** are arranged parallel to each other; needle **134** cannot be seen because of the perspective view and is indicated by a broken line. Carrier tapes **110** and **112** are guided through the machine between the needles in the direction of arrow **136**. The needles operating parallel to each other and to the planes of tape portions **116** and **118** need not operate perpendicular to tape portions **114** and **115**, they may operate at another angle thereto. The direction of the forward and backward movements of the needles is indicated by the double arrow **138**.

FIG. **8** shows an alternative method of feeding the materials to be sewn and arranging the sewing thread.

According to FIG. **8** the interengaged series of coupling elements **124** and **125** are so fed into the sewing machine that they lie plane on tape portions **114** and **115**, whereas tape portions **116** and **118** are arranged perpendicular to portions **114** and **115**. The needles **132** and **134** (FIG. **8**) operate and move in the same direction as shown in FIG. **7**, i.e. parallel to the planes of tape portions **116** and **118** and at the same time at a right angle or at another angle to tape portions **114** and **115**. In FIG. **8**, however, the needles are on the side of the tape portions **114** and **115**, which also support the coupling element series; preferably the series of coupling elements and the needles are provided above and tape portions **116** and **118** below

the tape portions **114** and **115**. With this arrangement the gripper chain threads **117** and **119** will be located in the fold between tape portions **114** and **116** and **115** and **118** respectively.

FIG. **9** shows the convenient arrangement of seam **140** joining the coupling elements to the carrier tape. The individual coupling element has the preferably "dumb-bell" shape; in the form shown in FIG. **9** dimension *b* which is the width of the foot portion exceeds dimension *a*, the width of the head portion **142**. The arrangement of the seam between the narrowest portion approximately at the center of the element and the widest portion **144** of the coupling head portion per se need not be applied together with the other feature shown, namely the wider foot portion **146**. In general, it is sufficient to apply either of the two features.

In FIG. **9** the tape portions **115** and **118** are shown in their final position, i.e. in the folded state.

In case of doubt all features described and/or shown herein shall be considered essential to the invention individually or in any reasonable combination.

I claim:

1. A method of making a sliding clasp fastener of concealed element nature, said method comprising providing a pair of contractible thermoplastic filaments each having a generally helical extent and respective coupling head portions interlockable with one another, folding at least partially a pair of carrier tapes along respective elongate axes thereof to define respective fold lines which divide said tapes each into two elongate portions one of which is of greater lateral extent than the other, interlocking said coupling head portions with one another, simultaneously sewing the filaments with a pair of spaced sewing needles to the tape portions of lesser lateral extent respectively along respective stitching lines such that the interlocked coupling head portions extend along said fold lines respectively and the tape portions of greater lateral extent extend between said sewing needles, said stitching lines being sewn proximate said fold lines respectively and remote from the elongate edges of said portions of lesser lateral extent respectively, and folding said tape portions of greater lateral extent respectively along the respective stitching lines into generally superposed relation with said portions of lesser lateral extent upon which said filaments rest respectively.

2. A method according to claim **1**, wherein prior to both interlocking and sewing said filaments on said tapes respectively, said filaments are subjected to limited heating and undergo a change in length-to-thickness ratio, said limited heating being effected at temperatures below the setting temperature of said filaments and, after both interlocking and sewing said filaments on said tapes respectively, further heating said filaments to a fixation temperature wherein said filaments at least begin to soften.

3. A method according to claim **2**, wherein said limited heating is effected by a heat inducing source having a temperature greater than that of said filaments prior to heating the latter.

4. Method according to claim **2**, characterized in that the sewing needle operations are effected with needles parallel to each other.

5. Method according to claim **2**, characterized in that each series of coupling elements is fastened by sewing a single seam to its carrier tape.

6. Method according to claim **2**, characterized in that during the sewing stage the carrier tape portion which received the series of coupling elements is fed into the sewing machine approximately at a right angle to the tape portion guided between the needles.

7. Method according to claim **6**, including providing a gripper thread chain is arranged between the tape portion receiving the series of coupling elements and the folded tape portion.

8. Method according to claim **2**, characterized in that series of coupling elements are used whose legs joining the coupling head and foot portions of a coupling element under consideration are indented in relation to these coupling head and foot portions.

9. Method according to claim **8**, characterized in that the indentation of the legs of the series of coupling elements used is located closer to the coupling head portion than to the coupling foot portion.

10. Method according to claim **9**, characterized in that series of coupling elements are used where the legs starting from a common coupling head portion leave their congruence in projection on the fastener plane still prior to reaching the foot portion joining two adjacent pairs of legs.

11. Method according to claim **9**, characterized in that among bulges caused by the indentation, the bulge forming the foot portions is thicker than that forming the head portion so that the foot portion range of the series of coupling elements is thicker than the head portion range.

12. Method according to claim **11**, characterized in that a series of coupling elements is used wherein the foot portion bulge of each coupling element is provided with a step on its outer surface and on the side directed towards the indentation and that the seam is laid on this step.

13. Method according to claim **12**, characterized in that the step is formed by partial heating of the sewn sewing thread and the surrounding plastics filament area to such an extent that the thread sinks into the filament.

14. Method for making sliding clasp fasteners, in particular according to claim **13**, characterized in that if all or individual components of the sliding clasp fastener are made of different plastics, a temperature is applied which is near the melting temperature of at least one of the thermoplastic materials of which the sliding clasp fastener is composed.

15. Method according to claim **14**, characterized in that sewing threads are used which consist of a thermoplastics core and a cotton covering.

16. Method according to claim **15**, characterized in that the fixation temperature is utilized for dyeing the sliding clasp fasteners.

17. Method according to claim **16**, characterized in that the dyestuff is a substance the boiling point of which lies above that of water and which is water-soluble.

18. Method according to claim **17**, characterized in that individual plastics components of the sliding clasp fastener are thus dyed.

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