

7990228-4

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PATENT SPECIFICATION

(11) 1 521 410

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- (21) Application No. 37149/76 (22) Filed 8 Sept. 1976
 (31) Convention Application Nos: 2 540 272 and 2 540 238
 (32) Filed 10 Sept. 1975
 (31) Convention Application No. 2 624 450
 (32) Filed 1 June 1976 in
 (33) Fed. Rep. of Germany (DE)
 (44) Complete Specification published 16 Aug. 1978
 (51) INT CL² A44B 19/12
 (52) Index at acceptance E2S 1A2A 1A2B1 1A5
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(54) IMPROVEMENTS IN OR RELATING TO
 SLIDING CLASP FASTENERS

(71) We, OPTI PATENT- FOR-
 SCHUNGS- UND FABRIKATIONS-AG,
 a Company organised under the laws of
 Switzerland, of Burgstrasse, 24, 8750 Glarus,
 Switzerland, do hereby declare the in-
 vention 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 in and by the following
 statement:—

This invention relates to sliding clasp
 fasteners, and relates in particular to such
 fasteners having helical rows of interlocking
 members formed from plastics mono-
 filament suitably secured by arms of the
 interlocking members to a support fabric.

In one known form of such fasteners,
 each interlocking member has two arms
 connected by a loop bearing an interlocking
 head, both arms lying alongside each other
 in the longitudinal plane of the sliding clasp
 fastener, there being a rearward connecting
 portion connecting one arm of one member
 with the adjacent arm of the next inter-
 locking member, the rows being secured to
 a supporting fabric with the aid of textile
 warp threads, with the loops and inter-
 locking heads projecting beyond the warp
 threads of the support fabric, and with the
 arms locked into warp-thread pockets, from
 which project the rearward connecting
 portions. Sliding clasp fasteners of this type
 must be distinguished from those with a
 similar interlocking mechanism but lacking
 the fixing arms and having the loops bearing
 interlocking heads directly attached to the
 rearward connecting portions which
 rearward connecting portions determine the
 pitch i.e. the spacing between adjacent
 interlocking heads. The limbs of the loops
 are so short that the pitch is entirely deter-
 mined by the rearward connecting portions.
 In such sliding clasp fasteners, the rows of
 interlocking members are sewn to support
 fabric which may be textile stringer tapes by
 means of a sewing thread or are woven into

the stringer tapes more or less like twill
 threads.

In known sliding clasp fasteners of the
 type to which the invention relates each arm
 of each member is attached to both the loop
 at one end and the rearward connecting
 portion at the other and both arms of each
 interlocking member are individually incor-
 porated as weft threads in a weave in which
 the warp threads act as twill threads and
 which includes additional textile weft
 threads. As a result, the arms meander like
 weft threads and do not lie directly
 alongside each other. Moreover, they do not
 directly support each other, because they
 are always separated by the textile weft
 threads and/or twill threads running be-
 tween them. Consequently, the pitch is
 unstable, i.e., dependent on the behaviour
 of the textile threads (e.g., swelling when
 moisture is absorbed, stretching under the
 influence of mechanical loads and above all
 shrinkage under the influence of humidity
 and temperature when laundered or
 chemically cleaned). The rearward connect-
 ing portions cannot act as pitch stabilisers,
 since the arms are virtually free and too
 unstable. This is the case whether the
 breadth of the support fabric is restricted to
 the length of the arms or increased to act as
 stringer tapes, and presumably explains the
 lack of commercial interest in this type of
 sliding clasp fastener. The situation is no
 different in the case of sliding clasp fasteners
 of this type having plaited support fabrics.

According to the present invention a
 sliding clasp fastener comprises rows of
 interlocking members formed from helically
 wound plastics monofilament, each inter-
 locking member having a loop on which is
 formed an interlocking head, with each loop
 having two limbs which overlap when
 viewed as a projection on the longitudinal
 plane of the fastener, one limb being ex-
 tended to form an arm which leads to a first
 rearward connecting portion lying in the

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longitudinal plane of the fastener to connect the arm to the arm of an adjacent interlocking member; the other limb being connected directly to a second rearward connecting portion inclined with respect to the longitudinal plane of the fastener to connect that limb to one limb of the loop of an adjacent interlocking member, the rows of interlocking members being secured to a support fabric by means of textile warp threads, with the loops and interlocking heads projecting beyond the edge of the support fabric and with the arm of each member locked into a warp-thread pocket of the supporting fabric, the first rearward connection portion projecting out of the said pocket. In one preferred embodiment of the invention, the arrangement is such that the limbs of adjacent loops which are extended to form the arms, and the arms form a straight line at 90° to the longitudinal axis of the fastener, in a projection on the plane of the fastener, whilst the limbs of adjacent loops directly connected to a second rearward connecting portion have inclined axis which converge away from the interlocking heads when seen in a projection on the plane of the fastener. The second rearward connecting portions and adjacent parts of the associated limbs of the loops can also be enclosed in the warp-thread pockets. Alternatively, however, it is possible to adopt the arrangement in which the rearward connecting portions and associated limbs of the loops remain free, as it were in front of the warp threads in the load-carrying structure. The term "helical" in the context of this invention includes forms in which the successive interlocking members in one row are alternatively left- and right-handed, so that the arms and the attached limbs of the loops always remain coplanar.

In an alternative construction the corresponding limb of adjacent interlocking members which are extended to form the arms connected by a rearward connecting portion and part of those arms are bent inwardly such that the axes of the bent portions converge in a direction away from the interlocking heads, and the second rearward connecting portions and the corresponding portions of the limbs forming the loops bearing the interlocking heads are enclosed in common warp-thread pockets. In this case, the warp threads can cross over between adjacent arms. It is also within the scope of the invention, in this connection, to adopt the arrangement whereby the support fabric is broadened beyond the fixing arms and their return loops to form a stringer tape. The support fabric may include at least one basic textile weft thread, the return loops of which, associated with the rows of interlocking members, pass round each

second rearward connecting portion. Alternatively, however, the arrangement can be adopted in which the support fabric incorporates at least one basic textile weft thread the return loops of which, associated with the rows of interlocking members, are passed round the first rearward connecting portions.

The advantages are to be seen in that the pitch in the sliding clasp fasteners of the invention is no longer dependent on the behaviour of the support fabric. On the contrary, it is determined by the rows of interlocking members themselves, and is stable. Thus, the invention arises from the realisation that when one limb of each loop is secured to one limb of an adjacent loop by a second connecting portion as described, and not extended to form a second arm of each member, a pitch-stabilising backbone in the row of interlocking members is formed, with the consequent result that alterations in the support fabric no longer affect the pitch. A particular advantage arises from the fact that the type of fastener described is very easy to produce, since suitable rows of interlocking members can be made in mechanical automatic looms or plaiting machines, for example having needles for the plastics monofilament that function similarly to the known needles for double-weft insertion. In this sense, a sliding clasp fastener of the specified construction is made by inserting two plastics monofilaments as weft threads into a shed formed by warp threads, from opposite sides, winding them in opposite directions round a mandrel to form interlocked rows of interlocking members and securing the members in position by moving the shed of warp threads. The characterising feature in this case is that the plastics monofilaments for the rows of interlocking members are woven into a single shed as a double left and locked in position by the warp threads. Both halves of the sliding clasp fastener are made at once. Thus, a loom can be utilised consisting an automatic machine having simultaneously functioning weft needles to insert and extract the plastics monofilament threads for the rows of interlocking members and a mandrel journaled in a vertically reciprocating mandrel holder. This can be set up in a centrally disposed vertical guide and reciprocated between upper and lower positions with associated arrestors.

Several embodiments of the invention will now be described in detail with reference to the accompanying schematic drawings, in which:—

Figure 1 is a greatly enlarged plan view of part of a sliding clasp fastener of the invention, with the support fabric partly removed;

Figure 2 is a section on the line A—A of Figure 1;

Figure 3 is a front elevation, in the direction of the arrow B of Figure 1;

Figure 4 corresponds to Figure 1 but shows another embodiment of sliding clasp fastener of the invention;

Figure 5 is a section on the line C—C of Figure 4;

Figure 6 corresponds to Figure 1 but shows yet another embodiment of sliding clasp fastener of the invention, again greatly enlarged and with the support fabric partly removed;

Figure 7 is a section on the line D—D of Figure 6;

Figure 8 is a front elevation in the direction of the arrow B of Figure 6; and

Figure 9 corresponds to Figure 1 but shows yet another embodiment of sliding clasp fastener of the invention;

The sliding clasp fastener shown in Figures 1 to 5 is of the type having helical rows of interlocking members with the rows of interlocking members formed by deforming a helix. The rows of interlocking members are made from a plastics monofilament 1. Each interlocking member 2 has a loop 3 formed by superimposed limbs 4 of plastics monofilament, on which is formed an interlocking head. Each member also has a fixing arm 6 lying in the plane of the fastener. The arms 6 of adjacent members are joined together by first rearward connecting portions 7 and incorporated into a load-carrying structure by textile warp threads 8. The loops 3 project at least in part beyond the warp threads 8. As can be seen from the drawings one limb 4 of each loop 3 is extended to form the fixing arm 6. While the other limb 4 is attached to a second rearward connecting portion 10 near the loop 3, leading directly to the corresponding limb 4 of the adjacent loop 3, with the second rearward connecting portion inclined with respect to the plane of the fastener. Moreover, the arrangement is such that the arms 6 are enclosed in separate warp-thread pockets 11, from which project the first rearward connecting portions 7 lying in the plane of the fastener. In Figures 1 to 5 the limbs 4 of plastics monofilament which are extended to form the arms 6 and the arms 6 form a straight line at substantially 90° to the longitudinal axis of the fastener in a projection on the plane of the fastener (this is indicated by a dashed line 12 in Figures 1 and 4). The other limbs 4 of each loop 3 i.e., those attached to the second rearward connecting portions 10, on the other hand, have axes which run in V formations 13 between adjacent interlocking members, when seen in a projection on the plane of the fastener.

In Figures 1 to 3, the second rearward

connecting portions 10 and the adjacent parts of the limbs are also shown enclosed in the warp-thread pockets 11. The embodiment shown in Figures 4 and 5 differs in that the second rearward connecting portions 10 and consequently also the adjacent parts of the limbs 4 are not enclosed in the warp-thread pockets 11. This embodiment has a support fabric in which the warp threads 8 constitute twill threads and cross over between adjacent fixing arms 6. Alternatively, however, the warp threads 8 can constitute loop-forming threads in a plaited structure, in which case the arms 6 each lie in a single row of loops. Moreover, Figures 1 and 4 show, on the left, a so-called strip fastener in which the first rearward connecting portions 7 form the outer edges and have flats 14 to guide a slider (not shown). However, Figures 1 and 4 also show, on the right, that the woven or plaited support fabric can be broadened to serve as a stringer tape 15, beyond the fixing arms 6 and their first rearward connecting portions 7. If this alternative is used, the stringer tape must incorporate at least one basic textile weft thread 16. The return loops 17 of this basic weft thread 16, are shown in Figure 1 in engagement with the second rearward connecting portions 10. In this case it is also possible to pass the return loops 17 of the basic weft thread 16 around the fixing arms 6 at first rearward connecting portions 7.

It is within the scope of the invention to subject the warp threads 8 to a shrinkage treatment, so that the arms 6 are as it were compressed in the warp-thread pockets 11. Overall flexibility can be maintained in the fastener by providing cross-section deformations 18 on the arms 6 to reduce their stiffness in bending. In the embodiment shown, these consist of flats arranged substantially parallel to the plane of the fastener.

The sliding clasp fasteners shown in Figures 6 to 9 also incorporate basically helical rows of interlocking members 2 made from plastics monofilaments 1. The interlocking members 2 have connecting loops 3 with overlapping limbs 4 and 19 of plastics monofilament, interlocking heads 5 and arms 6. The arms 6 lie alongside each other in the plane of the fastener with one arm 6 secured to an adjacent arm 6 by the rearward connecting portions 7 and incorporated in a support fabric 20 by textile warp threads 8 with the loops 3 projecting beyond the warp threads 8. The arms 6 are enclosed in separate warp-thread pockets 11, from which project the rearward connecting portions 7 lying alongside each other in the plane of the fastener. Figure 6 and 9 show that of the two loop-forming limbs 4 and 19 in each interlocking member

2, one limb 4 is extended into a fixing arm 6, while the other and obviously shorter length 19 is attached near the loop 21 to the second rearward connecting portion 10, which incorporates a return-loop portion 22 the axis of which is inclined with respect to the longitudinal plane of the fastener. The portions 23 of the rearward connecting portions 10 and the corresponding portions of the loop-forming limbs 19 and the portions 24 of the limbs 4 associated with the arms 6, are enclosed in common warp-thread pockets 11. The loop-forming limbs 4 extended to form to the fixing arms 6, connected to one rearward connecting portion 7, are bent together with the fixing arms 6 alongside the shorter loop-forming limbs 19 of monofilament. In other words, the fixing arms 6 are bent end to end into an S formation. The shorter loop-forming limbs 19 of monofilament in each interlocking member 2, i.e., those attached to the rear connecting portions 10, run in a V-formation, when seen in a projection on the plane of the fastener between adjacent interlocking members 2. The warp threads in the embodiment shown form the twill threads 8 of a woven structure and these twill threads 8 cross over between adjacent arms 6. Because of this construction and the support it develops, the pitch T is in no way influenced by the warp threads 8 laid as described. The warp threads 8 could even comprise loop-forming threads in a plaited structure. Moreover, it is possible to provide at least one basic textile weft thread 16, as indicated in Figure 6. It will be seen that the return loops 17 of the thread 16 associated with the rows of interlocking members are passed round the second rearward connecting sections 10 individually. They could also be passed round the rearward connecting sections 7, but this is not shown. In the embodiment shown in Figures 6 to 8, the rows of interlocking members 2 are formed from a plastics monofilament 1 of circular cross-section. Figure 9 relates to an embodiment using transversely flattened plastics monofilament 1, with a more or less eye-shaped cross section.

WHAT WE CLAIM IS:—

1. A sliding clasp fastener comprising rows of interlocking members formed from helically wound plastics monofilament, each interlocking member having a loop on which is formed an interlocking head with each loop having two limbs which overlap when viewed as a projection on the longitudinal plane of the fastener, one limb being extended to form an arm which leads to a first rearward connecting portion lying in the longitudinal plane of the fastener to connect the arm to the arm of an adjacent interlocking member; the other limb being

connected directly to a second rearward connecting portion inclined with respect to the longitudinal plane of the fastener to connect that limb to one limb of the loop of an adjacent interlocking member, the rows of interlocking members being secured to a support fabric by means of textile warp threads, with the loops and interlocking heads projecting beyond the edge of the support fabric and with the arm of each member locked into a warp-thread pocket of the support fabric, the first rearward connecting portion projecting out of the said pocket.

2. A sliding clasp fastener as in Claim 1, wherein the limb of each loop extending to the arm and the arm form a straight line substantially at 90° to the longitudinal axis of the fastener whilst the limbs of adjacent loops directly connected to the second rearward connecting portion are oppositely inclined with axes that converge in a direction away from the interlocking heads.

3. A sliding clasp fastener as in Claim 1 or Claim 2, wherein each second rearward connecting portion and associated limbs of the loops are also enclosed in warp-thread pockets.

4. A sliding clasp fastener as in either of Claims 2 or 3, wherein each first rearward connecting portion and the adjacent end of the arm remain free in front of the warp-thread pockets.

5. A sliding clasp fastener as in any of Claims 1 to 4, wherein the warp threads constitute twill threads in a weave, and cross over between adjacent arms.

6. A sliding clasp fastener as in any of Claims 1 to 4, wherein the warp threads are loop-forming threads in a plaited structure, so laid that each arm lies in a single row of loops.

7. A sliding clasp fastener as in any of Claims 1 to 6, wherein the woven or plaited support fabric is broadened like a stringer tape beyond the arms and the first rearward connecting portions.

8. A sliding clasp fastener as in Claim 5 and Claim 7, when appended to Claim 5, wherein the stringer tape weave incorporates at least one basic textile weft thread, of which the return loops associated with the rows of interlocking members engage the second rearward connecting portions.

9. A sliding clasp fastener as in Claim 5 and Claim 7, when appended to Claim 5 wherein the support fabric weave incorporates at least one basic textile weft thread of which the return loops engage with the first rearward connecting portions.

10. A sliding clasp fastener as in any of Claims 1 to 9, wherein cross-sectional deformations are provided on the arms to reduce their resistance to bending, e.g., by



2, one limb 4 is extended into a fixing arm 6, while the other and obviously shorter length 19 is attached near the loop 21 to the second rearward connecting portion 10, which incorporates a return-loop portion 22 the axis of which is inclined with respect to the longitudinal plane of the fastener. The portions 23 of the rearward connecting portions 10 and the corresponding portions of the loop-forming limbs 19 and the portions 24 of the limbs 4 associated with the arms 6, are enclosed in common warp-thread pockets 11. The loop-forming limbs 4 extended to form to the fixing arms 6, connected to one rearward connecting portion 7, are bent together with the fixing arms 6 alongside the shorter loop-forming limbs 19 of monofilament. In other words, the fixing arms 6 are bent end to end into an S formation. The shorter loop-forming limbs 19 of monofilament in each interlocking member 2, i.e., those attached to the rear connecting portions 10, run in a V-formation, when seen in a projection on the plane of the fastener between adjacent interlocking members 2. The warp threads in the embodiment shown form the twill threads 8 of a woven structure and these twill threads 8 cross over between adjacent arms 6. Because of this construction and the support it develops, the pitch T is in no way influenced by the warp threads 8 laid as described. The warp threads 8 could even comprise loop-forming threads in a plaited structure. Moreover, it is possible to provide at least one basic textile weft thread 16, as indicated in Figure 6. It will be seen that the return loops 17 of the thread 16 associated with the rows of interlocking members are passed round the second rearward connecting sections 10 individually. They could also be passed round the rearward connecting sections 7, but this is not shown. In the embodiment shown in Figures 6 to 8, the rows of interlocking members 2 are formed from a plastics monofilament 1 of circular cross-section. Figure 9 relates to an embodiment using transversely flattened plastics monofilament 1, with a more or less eye-shaped cross section.

WHAT WE CLAIM IS:—

1. A sliding clasp fastener comprising rows of interlocking members formed from helically wound plastics monofilament, each interlocking member having a loop on which is formed an interlocking head with each loop having two limbs which overlap when viewed as a projection on the longitudinal plane of the fastener, one limb being extended to form an arm which leads to a first rearward connecting portion lying in the longitudinal plane of the fastener to connect the arm to the arm of an adjacent interlocking member; the other limb being

connected directly to a second rearward connecting portion inclined with respect to the longitudinal plane of the fastener to connect that limb to one limb of the loop of an adjacent interlocking member, the rows of interlocking members being secured to a support fabric by means of textile warp threads, with the loops and interlocking heads projecting beyond the edge of the support fabric and with the arm of each member locked into a warp-thread pocket of the support fabric, the first rearward connecting portion projecting out of the said pocket.

2. A sliding clasp fastener as in Claim 1, wherein the limb of each loop extending to the arm and the arm form a straight line substantially at 90° to the longitudinal axis of the fastener whilst the limbs of adjacent loops directly connected to the second rearward connecting portion are oppositely inclined with axes that converge in a direction away from the interlocking heads.

3. A sliding clasp fastener as in Claim 1 or Claim 2, wherein each second rearward connecting portion and associated limbs of the loops are also enclosed in warp-thread pockets.

4. A sliding clasp fastener as in either of Claims 2 or 3, wherein each first rearward connecting portion and the adjacent end of the arm remain free in front of the warp-thread pockets.

5. A sliding clasp fastener as in any of Claims 1 to 4, wherein the warp threads constitute twill threads in a weave, and cross over between adjacent arms.

6. A sliding clasp fastener as in any of Claims 1 to 4, wherein the warp threads are loop-forming threads in a plaited structure, so laid that each arm lies in a single row of loops.

7. A sliding clasp fastener as in any of Claims 1 to 6, wherein the woven or plaited support fabric is broadened like a stringer tape beyond the arms and the first rearward connecting portions.

8. A sliding clasp fastener as in Claim 5 and Claim 7, when appended to Claim 5, wherein the stringer tape weave incorporates at least one basic textile weft thread, of which the return loops associated with the rows of interlocking members engage the second rearward connecting portions.

9. A sliding clasp fastener as in Claim 5 and Claim 7, when appended to Claim 5 wherein the support fabric weave incorporates at least one basic textile weft thread of which the return loops engage with the first rearward connecting portions.

10. A sliding clasp fastener as in any of Claims 1 to 9, wherein cross-sectional deformations are provided on the arms to reduce their resistance to bending, e.g., by



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providing flats arranged substantially parallel to the plane of the fastener.

11. A sliding clasp fastener as in Claim 1 or Claim 2, wherein the corresponding limb of adjacent interlocking members which are extended to form the arms connected by a rearward connecting portion and part of those arms are bent inwardly such that the axes of the bent portions converge in a direction away from the interlocking heads, and the second rearward connecting portions and the corresponding portions of the limbs forming the loops bearing the interlocking heads are enclosed in common warp-thread pockets.

12. A sliding clasp fastener as in Claim 11, wherein the warp threads cross over between adjacent fixing arms.

13. A sliding clasp fastener as in Claims 11 or Claim 12, wherein the support fabric is broadened beyond the arms and their rearward connecting portions.

14. A sliding clasp fastener as in any of Claims 11 to 13, wherein the support fabric incorporates at least one basic textile weft thread, of which the return loops associated with the rows of interlocking members pass round the individual loops bearing the interlocking heads.

15. A sliding clasp fastener as in any of Claims 11 to 13, wherein the support fabric incorporates at least one basic textile weft thread, of which the return loops associated with the rows of interlocking members pass round the first rearward connecting portions.

16. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 1 to 3 of the accompanying drawings.

17. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 4 and 5 of the accompanying drawings.

18. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 6 and 8 of the accompanying drawings.

19. A sliding clasp fastener substantially as hereinbefore described with reference to Figure 9 of the accompanying drawings.

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