

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO SLIDING CLASP FASTENERS

(71) We, OPTI PATENT-FORSCH-
UNGS- UND FABRIKATIONS-AG, a
Company organised under the laws of
Switzerland, of Burgstrasse 24, CH-8750,
5 Glarus, Switzerland, 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 in and by the
10 following statement:—
This invention relates to sliding clasp
fasteners having helical rows of inter-
locking members made from plastics
monofilament, in which the interlocking
15 members have connecting loops comprising
loop-forming limbs of plastics mono-
filament, interlocking heads formed on the
loops, and arms extending from the limbs,
which lie alongside each other in the plane
20 of the fastener, adjacent interlocking
members being spaced in the longitudinal
direction, with one arm of one member
being connected to a respective arm of an
adjacent member by a distant connecting
25 portion, the arms being incorporated in a
load-carrying structure by means of textile
warp threads, which form a common warp-
thread pocket for the arms of each
interlocking member. Such sliding clasp
30 fasteners can be made with stringer tapes
having sewing strips that project beyond the
connecting portions of the rows of inter-
locking members, but they can also be made
without stringer tapes, in which case the
35 sliding clasp fastener is sewn into an article
with the aid of threads which are inserted
between the pairs of arms. The term arms
embraces all elements which are incor-
porated in a woven or plaited structure, for
40 example as a weft or like a weft thread, and
thereby secured in the structure of the
support fabric. However, the term arm quite
generally embraces an arm of the
interlocking members which is attached to a
45 stringer tape by means of a sewing seam. In
general, the arms secured in the structure of
the support fabric are substantially longer

than those which are secured by a sewing
seam.

Known sliding clasp fasteners of this type 50
have proved intrinsically sound. In
particular, they meet the requirements in
respect of their resistance to tearing apart
under a transverse pull in the stretched
condition and when bent or kinked within 55
or out of the plane of the fastener. They are
however open to improvement in respect of
the more recent requirement of torsional
strength. Torsional strength denotes the
resistance of a sliding clasp fastener to
60 tearing apart when twisted about the longi-
tudinal fastener axis and therefore
subjected to a combination of longitudinal
and transverse tension together with
bending and kinking. Such loading 65
conditions do not normally arise when a
sliding clasp fastener is in its functional
environment (sewn into a garment or some
other article needing a sliding clasp
70 fastener), but can arise during spinning
operations in machines for processing
garments and the like, when for example the
garments are washed and dry cleaned, since
modern machines for these processes are
75 often equipped with spinning drums. The
improvement in torsional strength is
particularly necessary when the arms on the
rows of interlocking members are relatively
long. When a sliding clasp fastener having
80 continuous rows of interlocking members
made from plastics monofilament is
subjected to a dry cleaning or laundering
process, changes are known to take place in
each half of a fastener attached to the
85 associated article which can make it
impossible or at least difficult to open or
close the fastener subsequently.

According to the present invention a
sliding clasp fastener comprises rows of
interlocking members made from plastics 90
monofilament, in which the interlocking
members have connecting loops comprising
loop-forming limbs of plastics monofila-
ment, interlocking heads formed on the

loops and arms, extending from the limbs, which arms lie alongside each other in the longitudinal plane of the fastener, adjacent interlocking members being spaced in the longitudinal direction, with one arm of one member connected to a respective arm of an adjacent member by a distant connecting portion, the arms being incorporated in a load-carrying structure by means of textile warp threads, which form common warp-thread pockets for the arms of each interlocking member, the plastics monofilaments forming the rows of interlocking members having a substantially elliptical cross-section with a major and a minor axis, the major axis lying parallel to the longitudinal plane of the sliding clasp fastener in the vicinity of the interlocking heads and the connecting loops, and the minor axis lying parallel to the longitudinal plane of the sliding clasp fastener in the vicinity of the distant connection portions there being a transitional twist provided in the arms between the connecting loops and the distant connection portions. The transitional twist can take a very wide variety of forms and the torsion may be uniform over the entire length of the fixing arms or concentrated either near the distant connecting portions or near the connecting loops. The total angle of torsion is 90°. In one preferred embodiment of the invention, the connecting loops in each row of interlocking members have additional indented recesses behind the interlocking heads, in the direction of the distant connecting portions, to improve the three-dimensional interlocking action of an interlocking head of one row and interlocking recess formed by adjacent loops in the other row.

In one preferred embodiment of the invention, the interlocking heads take the form of deformations produced by kinking (as hereinafter defined) the monofilament with additional heat setting. The same also applies to the indented recesses, which in a preferred embodiment of the invention constitute heat setting impressions.

In order to secure optimum conditions in respect of the torsional strength, it is preferred to adopt a specific ratio between the major and minor axes, which, apart from the indented recesses is between 1 to 1.5 and 1 to 2.

The accruing advantages are to be seen primarily in the superior torsional strength of a sliding clasp fastener of the invention, which moreover also exhibits astonishing superiority in respect of its resistance to tearing apart. The improved torsional strength arises from the fact that the resilience of the individual interlocking members in a sliding clasp fastener of the

invention varies along their length, and varies continuously along the arms, while the distant connecting portions are effectively stiffened against bending loads tending to twist the sliding clasp fastener or bend it out of its plane. Nevertheless, the essential play between the interlocking parts, which determines the overall flexibility of the sliding clasp fastener, is obtained or obtainable, more particularly when the additional indented recesses already referred to are provided behind the interlocking heads. The heat setting operations already referred to provide an advantageous means of adjusting the play in the course of a simple procedure for producing the entire sliding clasp fastener. While sliding clasp fasteners of this type are usually produced from plastics monofilaments which are formed with appropriate formations at the points which become the distant connecting sections and the interlocking heads on winding the monofilament, the rows of interlocking members for a sliding clasp fastener can be made without difficulty from plastics monofilaments of an initially circular, plain, cross-section. Thus, it is within the scope of the process of the invention to start with circular-section plastics monofilaments, obviously stretched, to take the said plastics monofilaments for the two rows of interlocking members from supply spools, to form the rows at a folding station that produces interlocked rows of interlocking members and then to subject them to a heat setting process. The forming process is carried out with the aid of folding tools at a folding station for rows of interlocking members which may be part of an automatic loom or plaiting machine for the support fabric.

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

Figure 1 is a perspective view of the interlocked rows of interlocking members of a sliding clasp fastener of the invention;

Figure 2 is a plan view of the interlocked rows of Figure 1 to a smaller scale;

Figure 3 is a section on the line A—B, of Figure 2;

Figures 4, 5 and 6 are sections on the lines CD, EF and GH respectively of Figure 2;

Figure 7 corresponds to Figure 2 but shows another embodiment of the invention;

Figure 8 is a section on the line I—K of Figure 7;

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

Figure 10 is a section on the line L—M of Figure 9;

Figures 11 and 12 are sections on the lines NO and PQ respectively of Figure 9;

Figure 12 is a block diagram of the process of the invention;

Figure 14 corresponds to Figure 2 and shows the preformed rows of interlocking members formed by the process depicted by Figure 13;

Figure 15 is a section on the line R—S of Figure 14; and

Figures 16 and 18 are sections on the lines TU, VW and XY respectively of Figure 14.

In the drawings, the interlocking members of a sliding clasp fastener are constructed from helical rows 1 and 2 of interlocking members 4 made from plastics monofilaments 3. The interlocking members 4 have connecting loops 5 and comprising loop-forming limbs of plastics monofilament, interlocking heads 6 and arms 7 extending from the loop-forming limbs. The arms 7 in the individual interlocking members 4 lie alongside each other, with a longitudinal gap A between adjacent members, one arm of one member being connected to a respective arm of an adjacent member by a distant connection portion 8. The arms 7 are incorporated in a support fabric by means of textile warp threads, not shown, which form a common warp-thread pocket for each pair of adjacent arms of the interlocking members.

It will be seen more particularly from the sectional views in Figures 3—6, 8 and 10—12 that the plastics monofilaments 3 forming the rows 1 and 2 of interlocking members have a substantially elliptical cross-section Q, having a major axis 9 and a minor axis 10. In the vicinity of the interlocking heads 6 and the connection loops 5, the major axis 9 runs parallel to the plane of the fastener. In the vicinity of the distant connection portions 8 the major axis is at right angles to the plane of the fastener, with the minor axis 10 parallel thereto. A transitional twist 11 is provided in the arms 7 between the connecting loops 5 and the distant connection portions 8. This transitional twist 11 can extend more or less uniformly over the entire length of the fixing arms 7 or alternatively be concentrated towards the connecting loops 5, as shown in Figures 2 and 7 respectively. Conversely, the transitional twist 11 can be concentrated mainly towards the distant connection portions 8. In every case, the connection loops 5 in the individual rows 1 and 2 of interlocking members in the embodiments shown have additional indented recesses 12 behind the interlocking heads 6. The axial ratio between the major and minor axes 9 and 10 apart from at the indented recesses 12, is between 1 to 1.5 and 1 to 2. The arms 7 can be long enough for attachment by warp threads in a support fabric so that the fixing

arms are effectively integrated as weft threads into this support fabric. Alternatively, however, the arms 7 can be comparatively short, as shown in Figures 9 to 12. This form is particularly suitable when the rows 1 and 2 of interlocking members are subsequently to be attached to a stringer tape, by sewing, plaiting or weaving for example.

The process shown schematically in Figure 13 is of special significance. It will be seen that the production of the rows of interlocking members starts with stretching plastics monofilaments 3 of circular cross-section. These are taken from supply spools 13 and laid out in the form of interlocking members at a folding station 14, with the aid of folding tools that produce interlocked rows of interlocking members. They are then subjected to a heat fixing process.

However, in accordance with the invention the folding station 14 is preceded by a rolling station 15, so that before the plastics monofilaments 3 reach the folding station 14 they are continuously flattened into a substantially elliptical cross-section having a major axis longer and a minor axis shorter than ultimately required axis 17. This is illustrated in Figure 16, which also shows the axes 9 and 10. The plastics monofilaments 3 preformed e.g., with heads or connecting portions, are laid out as already described. Thus, the connecting heads 5 are laid with the major axis 16 parallel to the plane of the fastener and with interlocking heads 18, formed by kinking the monofilament, and the distant connecting portions 8 are laid with the minor axis 17 parallel to the plane of the fastener. (The term kinking denotes that a plastics monofilament 3 undergoes a broadening when bent with a small radius of curvature.) At the same time, the transitional twist 11 of almost exactly 90° is imparted between the connecting loops 5 at one end and the distant connecting portions 8 at the other. A heat setting process is then carried out in a thermal fixation unit 19. During heat setting, the major and minor axes 16 and 17 of the cross-section shrink and expand respectively to form the major and minor axes 9 and 10. These effects become particularly pronounced when the rows 1 and 2 of interlocking members are subjected to longitudinally directed forces during the heat setting process for example the shrinkage force set up in the, e.g. synthetic textile warp threads of the support fabric, in which case they must be stretched again after heat setting. The plastics monofilaments 3 of initially circular cross-section are formed cold, i.e. at a temperature lower than the glass transformation temperature of the material to

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the elliptical cross-section Q. Heat setting is brought about with thermal or ultrasonic energy.

Two plastics monofilaments are preferably inserted from opposite sides as weft threads into a shed formed by warp threads, wound in opposite directions round a mandrel to form interlocked rows of interlocking members and fixed in position by moving the shed of warp threads. In this case, it is further preferred that the plastics monofilaments for the rows of interlocking members are flattened before insertion in the shed and are inserted simultaneously as a double weft into a single shed and locked in position by the warp threads.

WHAT WE CLAIM IS:—

1. A sliding clasp fastener comprising rows of interlocking members made from plastics monofilament, in which the interlocking members have connecting loops comprising loop-forming limbs of plastics monofilament, interlocking heads formed on the loops and arms, extending from the limbs, which arms lie alongside each other in the longitudinal plane of the fastener, adjacent interlocking members being spaced in the longitudinal direction, with one arm of one member connected to a respective arm of an adjacent member by a distant connecting portion, the arms being incorporated in a load-carrying structure by means of textile warp threads which form common warp thread pockets for the arms of each interlocking member, the plastics monofilaments forming the rows of interlocking members have a substantially elliptical cross-section with a major and a minor axis, the major axis lying parallel to the longitudinal plane of the sliding clasp fastener in the vicinity of the interlocking

heads and the connecting loops and the minor axis lying parallel to the longitudinal plane of the sliding clasp fastener in the vicinity of the distant connecting portions, there being a transitional twist provided in the arms between the connecting loops and the distant connecting portions.

2. A sliding clasp fastener as in Claim 1, wherein the connecting loops in the individual rows of interlocking members have additional indented recesses behind the interlocking heads in the direction of the distant connecting portions.

3. A sliding clasp fastener as in Claim 1 or Claim 2, wherein the interlocking heads are formed by kinking (as herein defined) and heat setting the monofilaments.

4. A sliding clasp fastener as in Claim 2 or Claim 3, wherein the indented recesses take the form of heat set impressions.

5. A sliding clasp fastener as in any of claims 1 to 4, wherein the axial ratio between the major and minor axes, apart from at the indented recesses is between 1 to 1.5 and 1 to 2.

6. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 1 to 6 of the accompanying drawings.

7. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 7 and 8 of the accompanying drawings.

8. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 9 to 12 of the accompanying drawings.

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the elliptical cross-section Q. Heat setting is brought about with thermal or ultrasonic energy.

5 Two plastics monofilaments are preferably inserted from opposite sides as weft threads into a shed formed by warp threads, wound in opposite directions round a mandrel to form interlocked rows of interlocking members and fixed in position by moving the shed of warp threads. In this case, it is further preferred that the plastics monofilaments for the rows of interlocking members are flattened before insertion in the shed and are inserted simultaneously as a double weft into a single shed and locked in position by the warp threads.

WHAT WE CLAIM IS:—

1. A sliding clasp fastener comprising rows of interlocking members made from plastics monofilament, in which the interlocking members have connecting loops comprising loop-forming limbs of plastics monofilament, interlocking heads formed on the loops and arms, extending from the limbs, which arms lie alongside each other in the longitudinal plane of the fastener, adjacent interlocking members being spaced in the longitudinal direction, with one arm of one member connected to a respective arm of an adjacent member by a distant connecting portion, the arms being incorporated in a load-carrying structure by means of textile warp threads which form common warp thread pockets for the arms of each interlocking member, the plastics monofilaments forming the rows of interlocking members have a substantially elliptical cross-section with a major and a minor axis, the major axis lying parallel to the longitudinal plane of the sliding clasp fastener in the vicinity of the interlocking

heads and the connecting loops and the minor axis lying parallel to the longitudinal plane of the sliding clasp fastener in the vicinity of the distant connecting portions, there being a transitional twist provided in the arms between the connecting loops and the distant connecting portions.

2. A sliding clasp fastener as in Claim 1, wherein the connecting loops in the individual rows of interlocking members have additional indented recesses behind the interlocking heads in the direction of the distant connecting portions.

3. A sliding clasp fastener as in Claim 1 or Claim 2, wherein the interlocking heads are formed by kinking (as herein defined) and heat setting the monofilaments.

4. A sliding clasp fastener as in Claim 2 or Claim 3, wherein the indented recesses take the form of heat set impressions.

5. A sliding clasp fastener as in any of claims 1 to 4, wherein the axial ratio between the major and minor axes, apart from at the indented recesses is between 1 to 1.5 and 1 to 2.

6. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 1 to 6 of the accompanying drawings.

7. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 7 and 8 of the accompanying drawings.

8. A sliding clasp fastener substantially as hereinbefore described with reference to Figures 9 to 12 of the accompanying drawings.

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