

METHOD OF PRODUCING A CONTINUOUS SLIDE FASTENER STRIP

The invention relates category-wise to a method of producing a continuous slide fastener strip by weaving on an automatic needle loom, warp yarns for support tape and warp yarns for tying-in being guided to form sheds, weaving
5 needles being used to pick weft yarns for the support tape and a plastics monofilament yarn, a weaving needle which reciprocates continuously between an outside position and an inside position being operative to loop the plastics monofilament yarn around a former for forming coupling
10 members, a row thereof being formed continuously from the latter yarn, the coupling members of such row each comprising a coupling head and connected arms which form a coupling loop and being joined together by connecting parts, said row also being tied into the evolving support tape by means of the
15 tying-in warp yarns and support tape weft yarns, the tension of the infed plastics monofilament yarn being adjusted by means of driven feed rolls and so influenced by the reciprocation of the weaving needle, that a tension peak is produced in the outside position of the weaving needle, in
20 which position the plastics monofilament yarn is drawn onto the former. The term "slide fastener strip" denotes the unit comprising a support tape and a row of coupling members. More particularly, for example, two slide fastener strips associated with one another for a slide fastening action can
25 be produced simultaneously with coupling member rows which are coupled together during weaving. In this case the former for the coupling members is an elongated needle-shaped component which is mounted self-supportingly (DE 2 540 272).

Another possibility disclosed by EP 0 124 129, is to use a former which is relatively short and includes, as it were, a hook disposed on a swing arm. As a rule, only a single slide fastener strip is produced in this way. A second such strip
5 is operatively associated with the first strip elsewhere and at a different time. The coupling members which have been formed on the former are continuously drawn or pushed off the same as weaving continues.

The steps known from DE 2 540 272 and from
10 EP 0 124 129 lead to closure members and rows thereof whose dimensions, including pitch, are defined with sufficient accuracy. However, tolerances of the coupling heads and coupling loops are excessive. Satisfactorily shaped coupling heads are not readily obtainable. The tolerances
15 described may impair the transverse tensile strength and the ability of a slide fastener to withstand opening when subjected to bending and kinking. So that close tolerances can be observed, more particularly as regards the coupling
- heads, it is conventional to pre-stamp coupling heads on the
20 infed plastics monofilament yarn, with detriment to the actual weaving operation and to the rate of weaving.

It is the object of the invention so to devise the method hereinbefore set out that very accurate closure members and coupling heads are produced without the pre-
25 stamping of coupling heads on the plastics monofilament yarn, leading to slide fasteners of high quality, more particularly as regards transverse tensile strength, ability not to open when subjected to bending and kinking, and to the production of flexible slide fasteners at a high weaving rate.

According to the invention, to solve this problem, a kinking former is used which is in cross-section substantially rectangular, has a thickness of from 10 to 20% less than the diameter of the plastics monofilament yarn, has a rounded part for kinking extending lengthwise on the coupling head side and is of a width greater than its thickness by a factor of approximately from 1.75 to 3, preferably approximately 2, the tension of the plastics monofilament yarn infed to the weaving station is adjusted to be of approximately from 300 to 500 grams for an approximately 0.5 mm diameter yarn, of approximately from 500 to 800 grams for an approximately 0.6 mm diameter yarn, and of approximately from 800 to 1200 grams for an approximately 0.75 mm diameter yarn, and the outside position of the weaving needle is such as to produce an increase in the tension of the plastics monofilament yarn of approximately from 1.5 to 3 times, the latter yarn bearing on the former against this tension. Kinking to form coupling heads on coupling member rows made of plastics monofilament yarn is known; the resulting coupling heads do not have a well-defined shape. The invention, however, starts from the knowledge forming part of the invention to the effect that improved kinking in the weaving method of interest here is possible first by the use of a special kinking former and second by means of special kinking tensions. The kinking former has a longitudinal kinking rounding which contributes to kinking, besides being of a special predetermined width. This width imparts to the former the geometrical moment of inertia necessary to withstand the kinking tension without

the former being damaged. This width of the former also defines the coupling loop. Coupling heads arise which are associated with the coupling loop and which have adequate positive securing in the coupling loops, so that the required transverse tensile strength and resistance to opening values are achieved. However, the loop is large enough for the slide fastener devised from the slide fastener strip thus produced to have completely adequate and even outstanding flexibility. The kinking tension leads to high rates of deformation, with advantages for shaping. The coupling heads produced according to the invention by tensile kinking are stabilized during thermofixing without unwanted alterations of shape. As an optimizing feature, the inwards movement of the weaving needle is such that, with the same in its inside position, the tension of the plastics monofilament yarn is increased by from 1.2 to 2.5 times, such yarn bearing on warp and/or weft yarns which extend around the previously formed connecting part. Of course the weft yarns should be correspondingly strong and the warp yarns correspondingly numerous.

More particularly, there are several possible ways of further developing and specifying the method according to the invention. Preferably, a kinking former whose edge rounding has a radius corresponding to substantially half the thickness of the kinking former is used. A very wide variety of plastics which are conventional in the production of slide fasteners having rows of coupling elements made of plastics monofilament yarns can be used, more particularly polyamide and polyester plastics. The cross-section of the

latter yarns can be circular. However, particularly well shaped coupling heads result if a plastics monofilament yarn is used which is in cross-section substantially elliptical, the ratio between the minor axis and the major axis of the ellipse being of approximately from 1 : 1.2 to 1 : 1.6. Weaving so proceeds that in the coupling heads the major axis of the elliptical cross-section extends in the slide fastener strip parallel to the longitudinal axis. Conveniently, if an elliptical cross-section plastics monofilament yarn is used, the plastics monofilament yarn has the substantially elliptical cross-section imparted to it by cold rolling as it is being infed to the weaving needle. The internal stresses left after cold rolling are advantageous for the kinking which defines the coupling heads. Of course, when elliptical cross-section plastics monofilament yarns are used, the algebraic mean of the dimension for the minor axis and the dimension for the major axis is used instead of the diameter parameters of importance for the teaching of the invention.

The invention will be described hereinafter with reference to purely diagrammatic drawings wherein:-

Fig. 1 is a plan view of part of the weaving station of an automatic needle loom devised for the method according to the invention;

Fig. 2 is a plan view similar to Fig. 1 of a different automatic needle loom;

Fig. 3 is a considerably enlarged perspective view in cross-section through a former of use for the method according to the invention;

Fig. 4 shows the former of Fig. 3 with a plastics monofilament yarn after rounding by kinking;

Fig. 5 is a view on the section line A-A of Fig. 4, and

5 Fig. 6 is a view on the section line B-B of Fig. 4.

Referring to Figs. 1 and 2, there can be seen components of an automatic loom for producing a continuous slide fastener strip 1 by weaving. Warp yarns 2 for a support tape and tying-in warp yarns 3 are guided to form
10 sheds. Weaving needles 4 are operative to pick yarns 5 for the support tape and, in the embodiment of Fig. 1, two plastics monofilament yarns 6, and in the embodiment of Fig. 2, a single plastics monofilament yarn 6.

Weaving is so devised that a weaving needle 4
15 reciprocating continuously between an outside position and an inside position moves the filament yarns 6 around a former 7 for forming coupling members, a row thereof being formed continuously from the yarn 6. Coupling members 8 each
- comprise a coupling head 9 and connected arms 11 which form a
20 coupling loop 10. They are joined together by connecting parts 12. In this connection reference should also be made to Fig. 4. Also, the row of coupling members is tied into the evolving support tape 13 by means of the tying-in warp yarns and of the support tape weft yarns 5. The tension of
25 the infed monofilament yarn 6 is adjusted by means of driven feed rolls 14a and is also so influenced by the reciprocation of the weaving needle 4 that a tension peak is produced in the outside position of the needle 4, in which position the plastics monofilament yarn 6 is drawn on to the former. A

kinking former 7 is used. Details of its construction can be gathered from a comparison between, on the one hand, Fig. 3, and, on the other hand, Figs. 4 - 6. The kinking former 7 has a substantially rectangular cross-section, a thickness of from 10 to 20% less than the diameter of the plastics monofilament yarn 6, has a rounded part for kinking extending lengthwise on the coupling head side and is of a width greater than its thickness by a factor of approximately from 1.75 to 3. This gives the former 7 a special geometrical moment of inertia and, as Fig. 6 shows, defines the size of the loops 10. For the rest, the tension of the infed yarn 6 is adjusted specially in the manner set out in Claim 1, an important factor in this connection being the compensating springs 14b which also affect the infed length.

The outside position of the weaving needle 4 is such that in this outwards movement the tension of the plastics monofilament yarn 6 is increased by approximately from 1.5 to 3 times, the yarn 6 then bearing on the former 7 as can be gathered from Figs. 1 and 2. The inwards movement of the needle 4 is such that, with the same in its inside position, the tension of the yarn 6 is increased by from 1.2 to 2.5 times. The yarn 6 bears on warp and/or weft yarns 2, 3 and 5 respectively which extend around the previously formed connecting part 12.

In the embodiment, and preferably, the kinking former 7 has a kinking rounding 15 of a radius corresponding to approximately half the thickness of the former 7. The result of the kinking according to the invention can be gathered from Figs. 4 and 5. Clearly defined coupling heads

9 are produced with a deep and effective positive engagement. As Fig. 4 shows, between-axes ratios of approximately from 1 : 2.6 to 1 : 3.6 can be provided in the coupling heads 9, depending on former construction and upon tension. Also
5 apparent from Fig. 5 is the specified between-axes ratio of the yarns 6 when the same are in cross-section elliptical.



CLAIMS

1. A method of producing a continuous slide fastener strip by weaving on an automatic needle loom, warp yarns for support tape and warp yarns for tying-in being guided to form sheds, weaving needles being used to pick weft yarns for the support tape and a plastics monofilament yarn, a weaving
5 needle which reciprocates continuously between an outside position and an inside position being operative to loop the plastics monofilament yarn around a former for forming coupling members, a row thereof being formed continuously
10 from the latter yarn, the coupling members of such row each comprising a coupling head and connected arms which form a coupling loop and being joined together by connecting parts, said row also being tied into the evolving support tape by means of the tying-in warp yarns and support tape weft yarns,
15 the tension of the infed plastics monofilament yarn being adjusted by means of driven feed rolls and so influenced by the reciprocation of the weaving needle that a tension peak is produced in the outside position of the weaving needle, in which position the plastics monofilament yarn is drawn onto
20 the former, characterised in that a kinking former is used which is in cross-section substantially rectangular, has a thickness of from 10 to 20% less than the diameter of the plastics monofilament yarn, has a rounded part for kinking extending lengthwise on the coupling head side and is of a
25 width greater than its thickness by a factor of approximately from 1.75 to 3, the tension of the plastics monofilament yarn infed to the weaving station is adjusted to be of approximately from 300 to 500 grams for an approximately 0.5



mm diameter yarn, of approximately from 500 to 800 grams for an approximately 0.6 mm diameter yarn, and of approximately from 800 to 1200 grams for an approximately 0.75 mm diameter yarn, and the outside position of the weaving needle is such
5 as to produce an increase in the tension of the plastics monofilament yarn of approximately from 1.5 to 3 times, the latter yarn bearing on the former against this tension.

2. A method according to Claim 1, characterised in that the inwards movement of the weaving needle is such that, with the same in its inside position, the tension of the plastics monofilament yarn is increased by from 1.2 to 2.5
5 times, such yarn bearing on warp and/or weft yarns which extend around the previously formed connecting part.

3. A method according to Claim 1 and/or 2, characterised in that a kinking former whose edge rounding has a radius corresponding to substantially half the thickness of the kinking former is used.

4. A method according to any of Claims 1 - 3, characterised in that a plastics monofilament yarn is used which is in cross-section substantially elliptical, the ratio between the minor axis and the major axis of the ellipse
5 being of approximately 1 : 1.2 to 1 : 1.6.

5. A method according to Claim 4, characterised in that the plastics monofilament yarn has the substantially elliptical cross-section imparted to it by cold rolling as it is being infed to the weaving needle.

6. A method of producing a continuous slide fastener strip substantially as hereinbefore described with reference to Figures 1 to 6 of the accompanying drawings.
