Aug. 22, 1967 A. STEINGRUBNER 3,337,672

METHOD OF MAKING A SLIDE FASTENER OF THE CONTINUOUS WIRE TYPE

Original Filed May 8, 1963 2 Sheets-Sheet 1

FIG. 1.

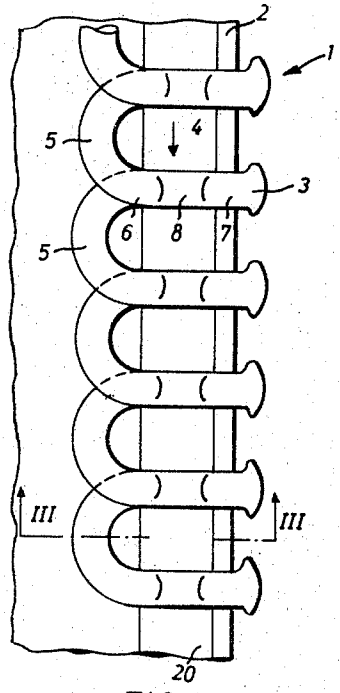


FIG. 2.

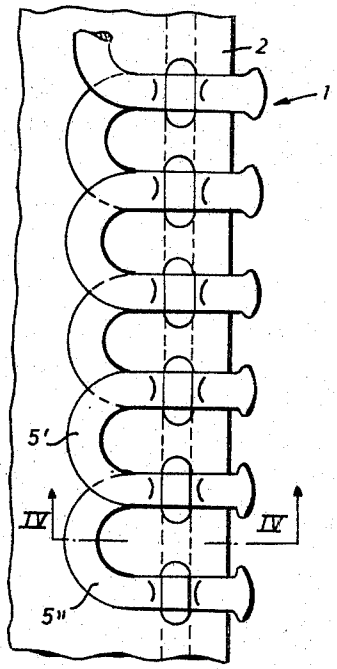


FIG. 3.

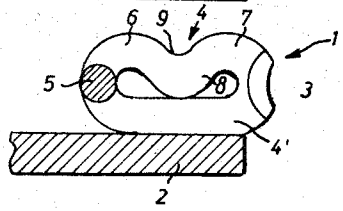
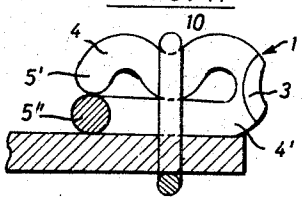


FIG. 4.



INVENTOR:
ARTHUR STEINGRUBNER
By
Kurt Kelman
AGENT

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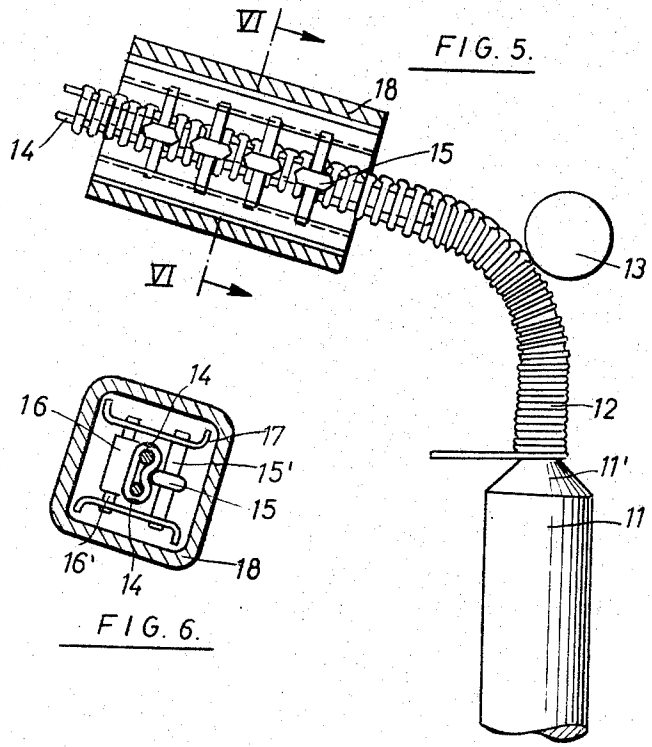


FIG. 5.

FIG. 6.

INVENTOR:

ARTHUR STEINGRUBNER

By

Kurt Kelman

AGENT

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METHOD OF MAKING A SLIDE FASTENER OF THE CONTINUOUS WIRE TYPE

Arthur Steingrubner, Am Buchenhang 11, Bonn, Germany

Original application May 8, 1963, Ser. No. 278,905. Divided and this application May 10, 1965, Ser. No. 465,227
2 Claims. (Cl. 264—281)

This is a division of application Ser. No. 278,905, filed May 8, 1963, now abandoned.

This invention relates to slide fasteners of the continuous wire type, and more particularly to a method of making improved interlocking members for a slide fastener stringer.

Among the objects of the invention is the provision of a slide fastener stringer in which the interlocking elements consist of a continuous, preferably thermoplastic, wire, such as polyamide wire, and are well suited for simple and secure attaching to a supporting carrier, such as a piece of fabric.

Another object is the provision of a slide fastener in which sewing threads employed for securing the interlocking members to the carrier are fully protected against frictional damage by contact with the moving slider employed for connecting and disconnecting two stringers in the usual manner.

A further object is the provision of interlocking elements specially contoured to provide guiding faces for the moving slider so as to hold the same in a precisely determined path.

Yet another object is the provision of slide fastener elements which are immune to pressures exerted during normal use in a direction perpendicular to the supporting carrier, as in ironing. More specifically, the invention aims at a fastener the interlocking members of which owe their structural strength and crushing resistance to the specific arrangement of their parts rather than to the cross sectional area of such parts, so that the fasteners of the invention may be of lighter weight for a given strength, and of greater strength when compared with conventional fasteners employing an equal weight of the same type of construction material.

An additional object is the provision of fastener members shaped so as to resist deformation under the pressures necessary during attaching to a supporting carrier by adhesives or by thermal welding. Lastly, the interlocking members of the invention are intended to guide pressure rollers and similar devices during bonding or welding to the supporting carrier.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

FIG. 1 shows a first embodiment of a slide fastener stringer of the invention in elevational view:

FIG. 2 is a corresponding view of a second embodiment of the slide fastener stringer of the invention;

FIG. 3 shows the stringer of FIG. 1 in plan section on line III—III;

FIG. 4 shows the stringer of FIG. 2 in plan section on line IV—IV;

FIG. 5 is a fragmentary partly sectional elevational view of apparatus for making the stringer of FIG. 1; and

FIG. 6 illustrates a detail of the apparatus of FIG. 5 in section on line VI—VI.

Referring now to the drawing in detail, and initially to FIG. 1, there is seen a slide fastener stringer consisting of a multiplicity of identical interlocking members 1 mounted on the edge of a carrier sheet 2 of pliable material, such as a fabric. The members 1 are successive integral portions of a length of round plastic wire and are similar to the general type of fastener members disclosed in my copending application Ser. No. 831,648, now U.S. Patent No. 3,128,518, filed Aug. 4, 1959. Each interlocking member 1 consists of a deformed turn of an original plastic wire helix, as will presently become apparent.

Each member 1 consists of a head part 3 for engagement with members of another stringer in a conventional manner, two leg parts 4, 4' and two shared connecting parts 5. The head part 3 is flattened and thereby spread in the direction of elongation of the stringer but all other parts of the members 1 have practically the original cross sectional size and configuration of the plastic wire from which they were made.

As better seen from FIG. 3, the leg part 4' of each member 1 is straight and extends from the head part 3 transversely of the stringer length. The leg part 4 extends in a common transverse plane with the leg part 4' and the head part 3 but it is arcuately curved. The terminal portions 6, 7 of the leg part 4 are spaced from the leg part 4', whereas the central portion 8 of the leg part 4 is closely adjacent the other leg part 4' and in abutting engagement therewith. The two terminal portions 6, 7 thus extend from the central portion 8 in a direction away from the leg part 4'. The two terminal leg portions 6, 7 define respective arcs the concave sides of which are adjacent the leg part 4', whereas the convex sides face away from the leg part 4'. Between the two convex faces, the outside of the leg part 4 forms a groove 9 of smoothly arcuate configuration.

The interlocking members 1 of the slide fastener stringer shown in FIG. 1 are adhesively secured to the pliable carrier 2 by means of a coating 20 applied to the carrier 2. It has previously been proposed to secure plastic slide fastener elements to carriers of thermoplastic fiber material by heat welding and the fastener elements 1 shown in FIGS. 1 and 3 are well suited for such a securing method because of the relatively large contact area between the carrier 2 and the leg parts 4'.

A different method of attaching interlocking members of the invention to a pliable carrier is illustrated in FIG. 2, as applied to members 1' generally similar to the members 1 except for the fact that they are formed from a plastic wire preshaped into a meander whereas the stringer of FIG. 1 is made from a wire helix. The leg parts 4, 4' and the head part 3 of each member 1' are identical with the corresponding parts of a member 1 but the connecting members 5', 5'' shown in FIG. 2 differ from the members 5 illustrated in FIG. 1. Each connecting member 5 is integrally interposed between a terminal portion 6 of a leg part 4 and a leg part 4' of an adjacent interlocking member 1. The connecting members 5' are interposed between the leg parts 4 of two adjacent members 1' and the connecting members 5'' between the corresponding leg parts 4'.

Each member 1' is secured to the carrier 2 by a sewing thread 10 laid in the grooves 9 and passing through the fabric of the carrier 2 in a conventional manner. While the stitching pattern illustrated is of the type that would

be produced by hand sewing, the interlocking elements of the invention are obviously well suited to be attached to the carrier 2 by lock stitches or the like. It will be appreciated that the methods of securing the members 1, 1' respectively illustrated in FIGS. 1 and 2 are interchangeable.

FIGS. 5 and 6 illustrate a portion of an apparatus for making the stringer of interlocking members 1 shown in FIGS. 1 and 3. A mandrel 11 of generally circular cross section has a heavy cylindrical end portion which is fixedly secured in a manner not further illustrated. A conical mandrel portion 11' tapers toward another generally cylindrical mandrel portion of smaller diameter which is obscured in the view of FIG. 5 by the turns 12 of a round plastic wire which is wound on the conical mandrel portion 11' from a non-illustrated spool mounted at a distance from the axis of the heavy mandrel for rotary movement about that axis, as is conventional in winding equipment. At a distance from the winding area at 11', the mandrel 11 is arcuately bent and carries two mandrel pins 14 transversely spaced from each other and arranged in line with longitudinal surface elements of the mandrel 11.

A heated roller 13 is arranged near the arcuately bent mandrel portion. The pins 14 pass axially through a tubular heater 18. As better seen in FIG. 6, a mounting frame 17 arranged in the heater 18 carries paired pressure rollers 15, 16 on respective shafts 15', 16' journaled in the frame 17 on opposite sides of the plane of reference defined by the axes of the two pins 14. The rolling face of the roller 15 is axially aligned with the gap between the two pins 14 and its axial width is about equal to the width of the gap. The roller 16 extends axially slightly beyond both pins 14. As shown in FIG. 5, there are four rollers 15 arranged for rotation in a common plane and there are four corresponding rollers 16 which are obscured in the view of FIG. 5.

The illustrated apparatus operates as follows:

The continuous winding of the plastic wire on the conical mandrel portion 11' causes the turns 12 of the wire helix so formed to travel in an axial direction. The turns abut against each other during their travel over the straight mandrel portion. When they enter the arcuate mandrel portion, the portions of each turn on the concave side of the mandrel remain in abutting engagement with each other but those on the longitudinally convex face of the mandrel move apart as they approach the heated roller 13. The roller flattens and spreads a portion of each helix turn in an axial direction to form the head of an interlocking member. This deformation of its cross section stiffens the head part. When the turns 12 move from the mandrel 11 to the straight pins 14, the pitch of the original helix is distorted. The head part and the adjacent portions of each turn which will later form the leg parts remain in a common plane substantially perpendicular to the length of the distorted helix whereas the axial slope of each turn is concentrated in those wire portions which are diametrically opposite the head part and which will ultimately constitute the connecting parts 5 of the members 1.

When the wire turns enter the heater tube 18, their temperautre is initially raised to permit dissipation of residual stresses and stabilization of the shape produced by the roller 13 and maintained by the mandrel pins 14. The somewhat softened preshaped interlocking members are then passed between the pressure rollers 15, 16. The rollers 15 push the central portion of the leg part into the gap between the pins 14 whereas the wider rollers 16 act as backing rollers and straighten the leg parts 4'. The coiled wire emerges from the tubular heater 18 ready for sewing to a carrier 2 in a manner well known in itself and not requiring illustration.

The four rollers 15 are shown in FIG. 5 to be of substantially identical size and shape. This arrangement is preferred when the tube 18 is equipped for applying suitably varied temperatures to the interlocking members as they travel through the tube. One arrangement may provide for an increase in temperature from the entrance of the tube 18 to the first roller 15, constant temperature from there to the second roller 15 and then a gradual decrease in temperature so that the interlocking elements are fully stabilized and shape retaining when they leave the heater 18. The third and fourth rollers 15 prevent and/or correct distortion during cooling. Obviously, many other stabilizing arrangements will readily suggest themselves to those skilled in the art.

While the simple winding arrangement shown in FIG. 5 has much to recommend it for pre-shaping fastener elements prior to entry into the heater 18, the pre-shapes may be produced in many other known ways and then finished between the pressure rollers 15, 16 at elevated temperature. The slide fastener stringer illustrated in FIG. 2 is not capable of being preformed on the winding stand shown in FIG. 5 but those familiar with the current state of this art will have no difficulty in connecting the heater 18 and its rollers 15, 16 to conventional wire forming equipment employed for making meander preforms from thermoplastic synthetic material, such as polyamides.

Regardless of the exact nature of the pre-shapes from which they are produced, the interlocking fastener members of the invention are readily and securely attached to pliable carriers, such as the edges of a piece of fabric. Their relatively large contact area with the carrier makes adhesive bonding or thermal welding entirely practical. When this method of securing is selected, the grooves 9 in the leg parts 4 can guide the pressure elements necessarily employed in adhesive bonding or welding. When the interlocking members are attached to a carrier by sewing, the thread is firmly held in place in the groove 9 and is protected against abrasion by the terminal portions 6 and 7 adjacent the connecting parts 5, 5', 5'' and the head parts 3, respectively, as is shown in FIG. 4.

The convex faces of the terminal portions 6, 7, together with the connecting parts 5, 5', 5'', guide movement of the non-illustrated slider in a very precise manner on the chains illustrated in FIGS. 1 to 4. Deformation of the interlocking elements by pressure applied perpendicularly to the carrier surface, as in ironing, is largely prevented by the three-point support which the leg parts 4 are given by the head part 3, at the central portion 8, and by the connecting parts 5, 5', 5'', Crushing of the fastener members by such pressure is practically eliminated.

It should be understood, of course, that the foregoing disclosure relates to only preferred embodiments of the invention, and that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

What is claimed is:

1. A method of making a slide fastener stringer which comprises:

(a) winding a length of wire into a helix having an axis, and a plurality of axially juxtaposed turns;

(b) bending said helix transversely of said axis until said axis forms an arc, and respective first portions of said turns on one side of said axis are axially adjacent each other while corresponding diametrically opposite portions of said turns on the other side of said axis are axially spaced from each other;

(c) radially compressing each of said spaced second portions until a head is formed on the same by axial spreading thereof, the portions of each turn intermediate said first and second portions thereof contituting legs;

(d) inserting in said helix after the forming of said heads a first mandrel member adjacent one of said first turn portions, and a second mandrel member adjacent the corresponding second turn portion, said mandrel members being spaced from each other trans-

versely of said axis and defining a gap therebetween; and

(e) moving a portion of one of said legs inward of said gap transversely of said axis until said leg portion is bent over said mandrel members.

2. A method as set forth in claim **1**, wherein said wire is of thermoplastic material, and said material is being heated while said portion of said one leg is being moved inward of said gap, and cooled thereafter.

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ROBERT F. WHITE, *Primary Examiner.*

M. R. DOWLING, R. KUCIA, *Assistant Examiners.*