

SPECIFICATION

Method and apparatus for providing space sections in a continuous slide fastener chain

5 chain

The present invention relates to a method and an apparatus for, as one process of manufacturing individual zippers or slide fasteners
10 formed of a fastener chain comprising a pair of opposed tapes carrying interlocking teeth or elements of plastic filament coils, removing a certain length of the interlocking teeth from the slide fastener chain, whereby a sequence
15 of the "space sections" which are devoid of the interlocking teeth are provided at predetermined intervals in a lengthy continuous slide fastener chain.

In order to simplify and facilitate the assembling and finishing of zipper fasteners, it nowadays is a common practice of the manufacturers to work on a single, continuous slide fastener chain consisting of a pair of opposed stringer tapes carrying thereon uninterrupted
20 rows of continuous interlocking elements, rather than on separate, individual fastener chains, and then to provide element-free sections or the so-called "space sections" in the continuous fastener chain at predetermined
25 intervals for mounting sliders and end stops and thereafter to cut the thus treated length of the chain at each space section to produce the individual zipper fasteners.

In the manufacture of the slide fasteners of the coiled plastic filament type having a lengthy, continuous slide fastener chain, there have been proposed various methods and apparatuses, in particular, for removing a certain length of interlocking elements from the slide fastener chain. However, none of them
30 have been found completely satisfactory, since the removal had to be conducted only by excessive force and tended to injure the fabric tape to which the interlocking elements are attached.
35

The removal of the interlocking elements in accordance with the prior art techniques was conducted by a combination of at least four steps as follows: (a) step of securely supporting the fastener chain in a position where
40 cutting step (c) is to be carried out, (b) step of exposing the head portions of the interlocking elements out of the opposing edges of the carrier tapes to an extent at least that the carrier tapes should not be impaired by cutting in the subsequent cutting step, (c) step of cutting off the exposed head portions by means of a cutter or a punch, and (d) step of removing the leg portions of the interlocking
45 elements or the element debris by pulling out of the sewing threads. (See, for example, U.S. Patent 3,852,869.)

The above-mentioned four steps have had to be carried out one by one, each after
50 completion of the preceding step, resulting in

low working efficiency, and the apparatus used was an assemblage of individual parts functioning for each of the steps, whereby the apparatus has no more been simplified.

70 According to one aspect of the invention there is provided a method of providing a space section in a slide fastener chain of two stringers having respectively two rows of continuously inter-engaged coupling elements of the coiled plastics filament type, which
75 method comprises the steps of:

(a) locating a section of the chain upon a face of a die with inter-engaged head portions of said coupling elements in between a cutter
80 blade of a punch and a corresponding aperture in the die, the die face having a recess of which the width is intermediate the width of the die aperture and the overall width of the two rows of inter-engaged coupling elements;

85 (b) lowering the punch to bring the cutter blade into engagement with the inter-engaged head portions of said coupling elements at said section of the chain, so as to press the head portions into the die recess whereby the
90 two rows of coupling elements become laterally inclined with the heads down and with associated leg portions of the coupling elements sloping downwardly towards the centre-line of the chain;

95 (c) further lowering the punch with its cutter blade so as to cut off the head portions at said section of the chain by means of the cutter blade and the corresponding die aperture while the two rows of coupling elements are
100 still thus laterally inclined; and

(d) removing the remaining leg portions of the two coupling elements at said section of the chain, the leg portions sloping downwardly towards the centre-line of the chain
105 until removal.

According to another aspect of the invention there is provided apparatus for providing a space section in a slide fastener chain of two stringers having respectively two continuously inter-engaged coupling elements of the coiled plastics filament type, which apparatus
110 comprises:

(a) a punch having at a bottom end thereof a cutter blade;

115 (b) a die with a die aperture corresponding to said cutter blade beneath said cutter blade, the die having a face formed with a recess of which the width is intermediate the width of the die aperture and the overall width of the
120 two inter-engaged coupling elements;

(c) a guide member mounted between the die and the punch for locating a section of the chain upon the die face with inter-engaged head portions of said coupling elements in
125 between said cutter blade and said die aperture, the guide member having a channel therein to accommodate the two inter-engaged coupling elements of said section of the chain;

130 (d) means for lowering the punch in use to

bring the cutter blade into engagement with the inter-engaged head portions of said coupling elements at said section of the chain, so as to press the head portions into the die

5 recess whereby, in use, the two coupling elements become laterally inclined with the head portions down and with associated leg portions of the coupling elements sloping downwardly towards the centre-line of the chain and for further lowering the punch with its cutter blade in use so as to cut off the head portions at said section of the chain by means of the cutter blade and the corresponding die aperture while the two coupling elements are still laterally inclined due to the combined action of the punch with its cutter blade, the guide member and the die recess; and

20 (e) means for removing the remaining leg portions of the two coupling elements at said section of the chain in use, the punch with its cutter blade, the guide member and the die with its recess being adapted and arranged in use to keep the leg portions pointing downwardly towards the centre-line of the chain until removal.

The invention will be described by way of example with reference to the accompanying drawings, wherein:-

30 *Figure 1* is a side view of a preferred apparatus according to the present invention;

Figure 2 is a cross-sectional view on line I-I of *Fig. 1* in the direction shown by the arrows;

35 *Figure 3* is a cross-sectional view on line II-II of *Fig. 1* in the direction shown by the arrows;

Figure 4 is a cross-sectional view on line III-III of *Fig. 1* in the direction shown by the arrows;

40 *Figures 5 through 11* illustrate the operation of the apparatus of *Figs. 1 to 4* for providing a space section in a slide fastener chain according to the present invention, in which:

Figure 5 is a cross-section showing the condition of the slide fastener chain as placed on a die;

50 *Figure 6* is a cross-section showing the condition of the interlocking elements as inclined by the downward force of a lowering punch;

Figure 7 is a cross-section on line IV-IV of *Fig. 6* in the direction shown by the arrows;

55 *Figure 8* is a cross-section showing the condition under which the interlocking head portions have been cut off by means of the punch at its lowermost position;

Figure 9 is a cross-section on line V-V of *Fig. 8* in the direction shown by the arrows;

60 *Figure 10* is a plan view showing the removal of the leg portions by means of a scraper; and

65 *Figure 11* is a cross-sectional view of *Fig. 10*; and

Figure 12 is a plan view of a finished slide fastener chain which has been provided with a space section.

A preferred method and the preferred apparatus of the present invention will now be described by way of example with reference to the drawings.

Referring to *Fig. 12*, a finished slide fastener chain F is provided with a space section S, and rows of continuous interlocking fastener elements E consisting of coiled plastic filaments e in interlocked conditions join a pair of tapes t, t together, to each of which tapes a row of the fastener elements E is

80 attached and secured by yarns y sewn in. By way of a general illustration as to the provision of a space section in the slide fastener chain F in accordance with the preferred method of the present invention, the interlocking elements E placed on a die (see *Fig. 5*) become downwardly bent in a V-shaped cross-section around the head portion H when a punch, which is provided with a cutter blade at its lower end, is lowered and contacted with the head portion H (see *Fig. 6*). Then the interlocking elements E at the portions H are cut off by the cutter blade of the punch, leaving leg portions L uncut in situ, as the blade is further lowered and makes a gap

90 between the tapes t, t (see *Fig. 8*). Thereafter, the remaining leg portions L of the interlocking elements are removed by means of a scraper to form the space section S as shown in *Fig. 12*.

100 The removal of the leg portions L, in principle, is carried out by releasing them from the yarn y which have been sewn into the tapes t, t to secure the interlocking elements. Such removal, according to the preferred method of the present invention, is much facilitated by use of a scraper, while the lowering punch is kept at its lowermost position and the leg portions L remain in a raised position above the surface of the tapes t, t as shown in *Fig. 8*.

110 The slide fastener chain F is held between a guide member 14 and die 8, die 8 being embedded and fixed in a die holder 7 on a base 6 as shown in *Fig. 3*. Facing the die 8 is a punch 12 having a cutter blade at its lower end. The punch 12 is vertically secured by a holder 11 which is fixed to a movable beam 10. The beam 10 moves up and down along a pair of guide pins 9, 9 erected on the base 6. As shown in *Fig. 5*, a groove-like recess 13 smaller in width than the interlocking elements E, but wider than the cutter blade, is formed in the upper surface of the die 8. As the punch 12 is lowered and its cutter blade end comes to touch and press the interlocking elements E at the head portions H, part of the slide fastener F including the interlocking elements E is bent and pushed into a recess 13 as shown in *Fig. 6*. As the punch 12 is further lowered, the head portions H of the

slide fastener F are cut off as shown in Fig. 8 by the cutter blade co-operating with the die aperture, that is, an aperture which corresponds to the width of the cutter blade and which is in the die 8 below the recess 13, see Figs. 5 to 8. The guide member 14 serves to hold the slide fastener chain F in co-operation with the die 8 which is located underneath, and moves along the row of the interlocking elements E in a synchronized motion with a scraper 15 so as to pick the leg portions L after the interlocking head portions H have been cut off.

The construction and movements of the guide member 14 and the scraper 15 are illustrated as follows. The base 6 and the movable beam 10 are provided with supports 17 and 16, respectively. The support 17 on the base 6 is engaged with the guide holder 20 18 which has a notched cross-section as shown in Fig. 3 and erections 18a, 18b at both ends thereof as shown in Fig. 1. The guide holder 18 is capable of sliding in the direction parallel to the cutter blade of the punch 12 as guided by the support 17 inter-engaged therewith. On the other hand, a scraper holder 19 is engaged to the support 16 fixed to the movable bench 10, and the scraper holder 19 slides together with the guide holder 18, since the scraper holder 19 is also engaged with the guide holder 18 at the erection 18a at a variable depth. The guide member 14 is connected to the guide holder 18 at the erection 18b with free up-and-down movements, but always pushed upwardly by a spring 20.

The upper surface of the guide member 14 is in press-contact with a vertical adjustment cam 21 which is a disc having a periphery partially trimmed or a disc rotating eccentrically, whereby the guide member 14 can be moved downwardly against the pushing force of the spring 20 by the rotation of the vertical adjustment cam 21 as shown in Fig. 4. The guide member 14 is in the form of a bar extending over a die 8 and provided with a notch or aperture 22 at the end thereof above the die 8 as shown in Fig. 2. The punch 12 moves up and down through the aperture 22. The guide member 14 is also provided with a groove 23 in the lower surface thereof running in the direction of and having a width fitted to the row of the interlocking elements E. The cross section of the groove 23 has a trapezoidal shape which is wider at the bottom than the top, whereby the interlocking elements E can be held always at the right position with the centre line of the interlocking elements E coplanar vertically with the center line of the die 8 when the slide fastener chain F is held between the die 8 and the guide member 14, and further when the interlocking elements E are in an inclined position by being pressed downwardly by the cutter blade of the punch 12 as shown in Fig.

6.

The scraper 15, which is shaped like a fork having a pair of claws 24 pointing in a downward direction aslant, is fixed to the scraper holder 19. Within the track through which the lower end of the scraper holder 19 moves up and down is provided an inclination cam 26 which protrudes from the base 6 with its sloping surface 25 facing (in the rightward direction in Fig. 1) the rear end of the descending scraper holder 19.

The sloping surface 25 of the inclination cam 26 is inclined at the same angle as the individual filaments e of the interlocking elements E, while the tip of each scraper claw 24 is large enough to enter between the filaments e at a similar angle, as shown in Fig. 9.

The mechanisms of the forward movement of the guide holder 18 and the scraper holder 19 in association with each other are as follows. A cylinder 28 is fixed on the base 6 with its piston rod 29 facing the guide holder 18 to the forward direction, while the guide holder 18 is always pulled to the rearward direction with a spring 30 connected to the base 6 to return to the rearmost position. On the other hand, the scraper holder 19 moves up and down with the punch holder 11. When the punch 12 has reached its lowermost position, the scraper holder 19 is pushed forwardly by the piston rod 29, while the scraper holder 19 is engaged with the guide holder 18 at the erection of the guide holder 18a in a sliding movement relative to the punch holder 11. As shown in Fig. 9, the distance between the tips of the claws 24 of the scraper 15 and the guide member 14 is somewhat smaller than the pitch of the individual elements e. Further, the punch 12 has a tapered cross-section provided with sloping surface 12a, 12a as shown in Fig. 3, the grip portion of the punch 12 being thicker than the cutter blade.

The method for providing space sections in a slide fastener chain using the above-described apparatus of the present invention is explained in the following. The fastener chain F is placed on the die 8 with the interlocking elements E upside and held by the guide member 14 as shown in Fig. 5. The placing of the slide fastener chain F on the die 8 is facilitated by lifting the guide member 14 by aid of the vertical adjustment cam 21 and then lowering the guide member 14 onto the slide fastener chain F. Then, the punch 12 is lowered to cut off the interlocking head portions H. In this case, due to the force of the lowering punch 12, the individual interlocking filaments e consisting of head portions H and leg portions L and neighbouring portions of the tapes t are made to bend into a V-shape into the recess 13 having rigid edges and provided in the upper surface of the die 8, the edges of recess 13 serving each as a fulcrum.

More particularly the two rows of coupling elements E become laterally inclined with the head portions H down and with the associated leg portions L sloping downwardly towards the centreline of the chain F. The leg portions L remain sloping in this manner after the head portions H have been cut off, as shown in Fig. 8.

On the other hand, the scraper 15 is fixed to the scraper holder 19 also moves downwardly as engaged with the support 16. When the scraper holder 19 comes to its lower position and is brought into contact with the inclination cam 26 at the sloped surface 25, the scraper 15 moves downwardly aslant as the scraper holder 19 slides along the sloped surface 25 of the inclination cam 26. Consequently, as is shown in Figs. 7 and 9, the tips of the slaws 24 of the scraper 15 move along the arrow 27 and then enter into the looped leg portions of the filaments e to pick off the leg portions L after the head portions H have been completely cut off.

As is shown in Figs. 9 and 11, the guide member 14 also moves to the forward direction along the interlocking elements E together with the scraper 15 as it moves down aslant, whereupon the piston rod 29 of the cylinder 28 is operated forwardly to push the guide member 14 and the scraper 15 forwardly, whereby the remaining leg portions L of the filaments e are removed successively by the tips of the claws 24 of the scraper 15. During the above movements of the guide member 14 and the scraper 15, the punch 12 stays at its lowermost position after the head portions H are cut off, while the remaining leg portions L are kept sloping downwardly by the tapering surfaces 12a, 12a of the punch 12, so that the outer ends of the leg portions L are kept raised above the surface of the tapes t and the picking operation of the scraper 15 is facilitated.

A space section S is thus formed, and then the piston rod 29, the guide holder 18 and the guide member 14 as well as the scraper holder 15 are retracted to their respective original positions by the pulling force of the spring 30. At the same time, the movable bench 10 is elevated together with the punch 12 to return to their original uppermost positions.

As is described in the foregoing, the preferred method for providing space sections in a continuous slide fastener chain of the coiled plastic filament type according to the present invention includes the steps of holding the slide fastener chain on a die, cutting off the head portions of the plastic filament coils with a punch and picking off the remaining debris, i.e. the leg portions. The step of holding the slide fastener chain on the die is operated such that the interlocking filament coils become inclined as pressed downwardly by the cutter blade of the punch, thereby to automat-

ically and simultaneously widen the gap between a pair of tapes to which the interlocking elements are attached. Thus, a particular step of providing a wide longitudinal gap between the paired tapes, which has been indispensable in the prior art techniques, can be dispensed with in the method of the present invention and, as such, the speeding up of the manufacturing process as well as improvement in process efficiency can be attained.

The illustrated apparatus according to the present invention, on the other side, comprises a guide member 14 for holding the slide fastener chain, a die 8, a punch 12 for cutting off the interlocking head portions H and a scraper 15 for removing the remaining leg portions L, each in close linkage motion with the other. In the apparatus, as described above, there is no necessity for any particular means, for example, a clipper, to provide a wide gap between the paired tapes. This contributes to a great simplification of the apparatus. Further, the process efficiency is largely enhanced due to the removal of the leg portions L which is carried out by the movement of the scraper 15 along the interlocking elements E in synchronization with the guide member when the punch 12 is at its lowermost position directly succeeding the cutting step. Furthermore, the removal of the leg portions L is very much facilitated due to the operation of the scraper 15 which takes place as the leg portions L are kept raised above the surface of the tapes t while the cutting punch 12 stays at its lowermost position, thus minimizing the possibility of leaving any of the leg portions L unpicked and offering great reliability of the process.

105 CLAIMS

1. A method of providing a space section in a slide fastener chain of two stringers having respectively two rows of continuously inter-engaged coupling elements of the coiled plastics filament type, which method comprises the steps of:

(a) locating a section of the chain upon a face of a die with inter-engaged head portions of said coupling elements in between a cutter blade of a punch and a corresponding aperture in the die, the die face having a recess of which the width is intermediate the width of the die aperture and the overall width of the two rows of inter-engaged coupling elements;

(b) lowering the punch to bring the cutter blade into engagement with the inter-engaged head portions of said coupling elements at said section of the chain, so as to press the head portions into the die recess whereby the two rows of coupling elements become laterally inclined with the heads down and with associated leg portions of the coupling elements sloping downwardly towards the centre line of the chain;

(c) further lowering the punch with its cutter



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More particularly the two rows of coupling elements E become laterally inclined with the head portions H down and with the associated leg portions L sloping downwardly towards the centreline of the chain F. The leg portions L remain sloping in this manner after the head portions H have been cut off, as shown in Fig. 8.

On the other hand, the scraper 15 is fixed to the scraper holder 19 also moves downwardly as engaged with the support 16. When the scraper holder 19 comes to its lower position and is brought into contact with the inclination cam 26 at the sloped surface 25, the scraper 15 moves downwardly aslant as the scraper holder 19 slides along the sloped surface 25 of the inclination cam 26. Consequently, as is shown in Figs. 7 and 9, the tips of the slaws 24 of the scraper 15 move along the arrow 27 and then enter into the looped leg portions of the filaments e to pick off the leg portions L after the head portions H have been completely cut off.

As is shown in Figs. 9 and 11, the guide member 14 also moves to the forward direction along the interlocking elements E together with the scraper 15 as it moves down aslant, whereupon the piston rod 29 of the cylinder 28 is operated forwardly to push the guide member 14 and the scraper 15 forwardly, whereby the remaining leg portions L of the filaments e are removed successively by the tips of the claws 24 of the scraper 15. During the above movements of the guide member 14 and the scraper 15, the punch 12 stays at its lowermost position after the head portions H are cut off, while the remaining leg portions L are kept sloping downwardly by the tapering surfaces 12a, 12a of the punch 12, so that the outer ends of the leg portions L are kept raised above the surface of the tapes t and the picking operation of the scraper 15 is facilitated.

A space section S is thus formed, and then the piston rod 29, the guide holder 18 and the guide member 14 as well as the scraper holder 15 are retracted to their respective original positions by the pulling force of the spring 30. At the same time, the movable bench 10 is elevated together with the punch 12 to return to their original uppermost positions.

As is described in the foregoing, the preferred method for providing space sections in a continuous slide fastener chain of the coiled plastic filament type according to the present invention includes the steps of holding the slide fastener chain on a die, cutting off the head portions of the plastic filament coils with a punch and picking off the remaining debris, i.e. the leg portions. The step of holding the slide fastener chain on the die is operated such that the interlocking filament coils become inclined as pressed downwardly by the cutter blade of the punch, thereby to automat-

ically and simultaneously widen the gap between a pair of tapes to which the interlocking elements are attached. Thus, a particular step of providing a wide longitudinal gap between the paired tapes, which has been indispensable in the prior art techniques, can be dispensed with in the method of the present invention and, as such, the speeding up of the manufacturing process as well as improvement in process efficiency can be attained.

The illustrated apparatus according to the present invention, on the other side, comprises a guide member 14 for holding the slide fastener chain, a die 8, a punch 12 for cutting off the interlocking head portions H and a scraper 15 for removing the remaining leg portions L, each in close linkage motion with the other. In the apparatus, as described above, there is no necessity for any particular means, for example, a clipper, to provide a wide gap between the paired tapes. This contributes to a great simplification of the apparatus. Further, the process efficiency is largely enhanced due to the removal of the leg portions L which is carried out by the movement of the scraper 15 along the interlocking elements E in synchronization with the guide member when the punch 12 is at its lowermost position directly succeeding the cutting step. Furthermore, the removal of the leg portions L is very much facilitated due to the operation of the scraper 15 which takes place as the leg portions L are kept raised above the surface of the tapes t while the cutting punch 12 stays at its lowermost position, thus minimizing the possibility of leaving any of the leg portions L unpicked and offering great reliability of the process.

105 CLAIMS

1. A method of providing a space section in a slide fastener chain of two stringers having respectively two rows of continuously inter-engaged coupling elements of the coiled plastics filament type, which method comprises the steps of:

(a) locating a section of the chain upon a face of a die with inter-engaged head portions of said coupling elements in between a cutter blade of a punch and a corresponding aperture in the die, the die face having a recess of which the width is intermediate the width of the die aperture and the overall width of the two rows of inter-engaged coupling elements;

(b) lowering the punch to bring the cutter blade into engagement with the inter-engaged head portions of said coupling elements at said section of the chain, so as to press the head portions into the die recess whereby the two rows of coupling elements become laterally inclined with the heads down and with associated leg portions of the coupling elements sloping downwardly towards the centre line of the chain;

(c) further lowering the punch with its cutter



blade so as to cut off the head portions at said section of the chain by means of the cutter blade and the corresponding die aperture while the two rows of coupling elements are still thus laterally inclined; and

- 5 (d) removing the remaining leg portions of the two coupling elements at said section of the chain, the leg portions sloping downwardly towards the centre-line of the chain
- 10 until removal.

2. A method as claimed in claim 1 wherein no raising of the punch and its cutter blade occurs, once step (b) has commenced, until after step (d) has been completed.

- 15 3. A method as claimed in claim 1 or 2 wherein step (d) is carried out by means of a scraper moving along said section of the chain.

4. Apparatus for providing a space section

20 in a slide fastener chain of two stringers having respectively two continuously inter-engaged coupling elements of the coiled plastics filament type, which apparatus comprises:

- (a) a punch having at a bottom end thereof
- 25 a cutter blade;

(b) a die with a die aperture corresponding to said cutter blade beneath said cutter blade, the die having a face formed with a recess of which the width is intermediate the width of

30 the die aperture and the overall width of the two inter-engaged coupling elements;

(c) a guide member mounted between the die and the punch for locating a section of the chain upon the die face with inter-engaged

35 head portions of said coupling elements in between said cutter blade and said die aperture, the guide member having a channel therein to accommodate the two inter-engaged coupling elements of said section of

40 the chain;

(d) means for lowering the punch in use to bring the cutter blade into engagement with the inter-engaged head portions of said coupling elements at said section of the chain, so

45 as to press the head portions into the die recess whereby, in use, the two coupling elements become laterally inclined with the head portions, down and with associated leg portions of the coupling elements sloping

50 downwardly towards the centre-line of the chain, and for further lowering the punch with its cutter blade in use so as to cut off the head portions at said section of the chain by means of the cutter blade and the corresponding

55 die aperture while the two coupling elements are still laterally inclined due to the combined action of the punch with its cutter blade, the guide member and the die recess; and

(e) means for removing the remaining leg portions of the two coupling elements at said section of the chain in use, the punch with its

60 cutter blade, the guide member and the die with its recess being adapted and arranged in use to keep the leg portions pointing down-

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wardly towards the centre-line of the chain until removal.

5. Apparatus as claimed in claim 4 wherein the means for removing the leg portions comprises a scraper.
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6. Apparatus as claimed in claim 5 wherein the guide member and the scraper are adapted and arranged to move in synchronism in use in the removal of the leg

75 portions.

7. Apparatus as claimed in claim 5 or 6 wherein the scraper is guided by a cam so that part of its motion is along a slope for at least one part of the scraper to enter a space

80 adjacent similarly sloping parts of said remaining leg portions.

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