

SPECIFICATION

Method and Apparatus for Forming Space Sections in a Slide Fastener

The present invention relates to a method and apparatus for forming "space" sections, i.e. sections void of interlocking fastener elements, in a continuous length slide fastener chain with discrete fastener elements, by removing a number of the securely fastened elements from the carrier

tapers of the slide fastener chain.

To simplify and facilitate the assembling and finishing of slide fasteners, it is common to work on a slide fastener chain or stringer of a continuous length carrying thereon an uninterrupted row or rows of interlocking elements rather than on slide fastener chains or stringers of a definite product length. It is thus customary to provide element-free sections or so-called "space" sections in the chain at predetermined intervals for enabling the mounting of sliders and end stops, and thereafter to cut the chain or stringer into individual product lengths.

The elements to be removed are pressed and deformed at the leg portions thereof followed by abstracting the carrier tapes from the thus deformed elements.

A method for forming space sections according to the above principle is disclosed in Japanese Patent Publication SHO 48-32222. The method of this reference comprises pressing and deforming the elements at the leg portions thereof with a punch-die unit and removing the thus deformed elements from the cores of the carrier tapes by merely displacing the portions of the carrier tapes positioned in front of the punch-die unit transversely at substantially a right angle relative to the direction of the element rows. In this type of method or apparatus therefor, the abstracting angle, i.e. the angle between the row of the elements and the tape core under movement by pulling, differs from element to element being the largest for the element at the most advanced position and smaller for the succeeding elements so that the elements near or at the rear end of the section are difficult to remove. If the removal conditions are selected to match the elements at the most advanced position, then they are inadequate for the elements at the rear end. If the removal conditions are selected to match the elements at the rearmost position, then there has been needed an excessively strong force resulting in eventual breakage of the carrier tapes.

It is therefore an object of the present invention to provide a method and apparatus, according to which or by use of which space sections of a predetermined length can be made in a slide fastener chain or stringer with reliability.

Another object of the invention is to provide a method and apparatus according to which or by use of which removal of all of the elements to be removed for forming a space section can be performed under uniform conditions regardless of

the positions of the individual elements within the section.

According to one aspect of the invention there is provided a method for forming a space section in a slide fastener with interlocking elements formed as individual plastics gripping links securedly fastened to a carrier tape which comprises pressing the elements within a section at the leg portions thereof to deform the elements and displacing the carrier tape relatively to the row of the elements from the point in front of the element at the most advanced position within the section toward the obliquely rearward direction to the rearmost element within the section to separate the elements seriatim from the carrier tape within the section.

According to another aspect of the invention there is provided an apparatus for forming a space section in a slide fastener with interlocking elements formed as individual plastics gripping links by removing links one after another, said apparatus comprising a punch-die unit and a tape-abstracting mechanism positioned at opposite lateral sides of the punch-die unit and operating in linkage motion with the punch-die unit characterised in that each tape-abstracting mechanism is composed of a gripper mechanism and a driving mechanism and is movable from the point in front of the punch-die unit in the obliquely rearward direction.

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

Fig. 1 is a plan view of a finished slide fastener chain provided with a space section;

Fig. 2 is a plan view of a preferred apparatus in accordance with this invention for forming space sections, shown partially broken away;

Fig. 3 is a cross sectional view of the apparatus in Fig. 2 as sectioned along the line II—II;

Fig. 4 is a cross sectional view of the apparatus in Fig. 2 as sectioned along the line III—III;

Fig. 5 is a plan view for illustrating the principle of tape-abstracting function; and

Figs. 6(a) to 6(d) are cross sectional views illustrating the function of a punch-die unit.

Referring to the drawings, a preferred method and preferred apparatus for forming a space section in a continuous length slide fastener chain 1 as shown in Fig. 1 comprises (see Figs. 2 to 4) a punch-die unit 2 for pressing and deforming elements of plastics material, and a pair of tape-abstracting units 3, 4 for displacing the carrier tapes in the lateral directions of the punch-die unit 2.

Referring to Fig. 5, each of the carrier tapes of the slide fastener chain 1 is pulled by a gripper jaw 19 at an abstracting angle α relative to the direction of the row of elements, while the gripper jaw 19, which forms part of a gripper mechanism 16 and is held by a holder 18, moves in the direction shown by the straight chain line at an angle β relative to the direction of the row of elements to the positions shown in phantom lines. Thus the abstracting angle α is constant for

all of the elements within the section regardless of the positions of the individual elements within the section when the angle β is about a half of the angle α .

5 In the illustrated apparatus, the punch-die unit 2 is positioned at the centre of a base 4 and includes a die 5 which has a recessed groove 6 on the upper surface thereof along its centre line, a pair of vertically movable parallel element guides 10 7 being provided at both sides of the recessed groove 6, which are capable of projecting above the upper surface of the die 5 from their illustrated flush positions.

A punch assembly of the punch-die unit 2 is composed of an outer punch 8 and an inner punch 9 contained within the outer punch 8 and capable of sliding to project from the lower surface of the outer punch 8 or to retract into the outer punch 8 against the bias of a spring 10 20 disposed between the outer punch 8 and the inner punch 9. A recessed groove 11 is provided on the lower surface of the inner punch 9 along the centre line in a position in registration with the recessed groove 6 in the die 5.

25 These punches 8, 9 are fixed to a vertically movable bolster 13 by a punch holder 12, the bolster 13 being guided by guide posts 14 each having a respective guide sleeve 15.

The tape-abstracting mechanisms 3, 3 are each composed of the gripper mechanism 16 for gripping the carrier tape and a driving mechanism 30 17 for displacing the gripper mechanism 16 to ward the lateral side of the punch-die unit. Preferably a pair of the tape-abstracting mechanisms are provided at the right and left respectively of the punch-die unit.

The or each gripper mechanism 16 comprises a pair of gripper jaws 19, 19' pivotally supported within the holder 18. Between the gripper jaws 40 19, 19' there are disposed a compression spring 20 near the gripping end of the jaws and a ball 21 seated near the opposite end.

The ball 21 is disposed with play in a central opening in a movable actuating plate 22 which is 45 pivotally supported at one end, and which has a cam surface at the other end, and which extends between the gripper jaws 19, 19'. The cam surface of the actuating plate 22 is engaged with a V-shaped opening provided at the end of a link 50 26 connected to a driving rod 23 through another link 24 and a shaft 25 fixed to the links 24 and 26 and pivotally supported on the base 4.

The ball 21 is moved between the gripper jaws 19, 19' in response to the position of the 55 actuating plate 22. Upward movement of the driving rod 23 pivots the links 24, 26, the latter acting on the cam surface of the actuating plate 22 to close the gripper jaws 19, 19' against the bias of the spring 20. The spring 20 opens the 60 gripper jaws 19, 19' when the ball 21 is returned to its original position by the downward movement of the driving rod 23.

The respective driving mechanism 17 of the or each gripper converts the reciprocating

65 movement of a push rod 27 parallel to the longitudinal direction of the punch-die unit 2 into the movement of the gripper holder 18 along an oblong guide hole 28 (Fig. 2) extending from the front of the punch-die unit 2 toward an obliquely rearward position.

70 At one end of the push rod 27, a pinion 31 (Figs. 3 and 4) is pivotally supported to mesh with a rack 30 fixed to a frame 29 and a this pinion 31 is engaged with a sliding rack 33 supported for sliding movement thereof between a pair of guides 32, 32' fixed to the base 4. The sliding rack 33 is connected to a link 34 by a pin 35 and the link 34 has a guide protrusion 36 at the other end, the protrusion 36 being disposed in a groove 80 along one of the oblong guide holes 28 in a guide plate 37 in a V-wise disposition.

The gripper holder 18 is fixedly provided on the bottom surface thereof with a member having another guide protrusion 38 which is also 85 engaged with the groove along one of the oblong guide holes 28 in the guide plate 37. Both of the guide protrusions 36, 38 are connected to each other with a pin 39 penetrating the oblong guide hole 28.

90 The reciprocating movement of the pushing rod 27 is converted to the reciprocating movement of the gripper holder 18 along the oblong guide hole 28 through the pinion 31, the rack 30, the sliding rack 33 and the link 34.

95 Meanwhile the reciprocating movement of the gripper holder 18, i.e. the tape-abstracting mechanism 3, is along a straight line.

The above description relates to the formation of the space sections on a continuous length slide fastener chain, but of course this invention is also applicable to the formation of space sections on a single continuous length of slide fastener stringer.

A slide fastener chain 1 having plastics fastener elements is introduced on the die 5 from the left in Fig. 2 where the leading end portion of the slide fastener chain is disassembled into the individual stringers which are separately passed through a separator 40 to position the slide fastener chain 1. In the next step, the pair of 100 element guides 7 are raised to project above the upper surface of the die 5 followed by forward shifting of the slide fastener chain by a predetermined distance, after which the element guides 7 are lowered to place the slide fastener chain on the die (Fig. 6(a)) and the gripper mechanisms are operated to grip the carrier tapes.

105 Then the outer punch 8 and the inner punch 9 are lowered together to deform the plastics fastener elements, especially, at the leg portions (Fig. 6(b)) and the outer punch 8 is slightly raised to release the leg portions of the elements (Fig. 6(c)). In this stage, the elements are engaged with the recessed grooves 6, 11 on the upper surface 125 of the die 5 and on the lower surface of the inner punch 9, respectively, at their deformed and raised head portions. Thereupon the gripper mechanisms 16 are moved along the oblong

guide holes 28 so that the carrier tapes are pulled and moved from the front of the punch-die unit 2 toward the obliquely rearward positions to abstract the carrier tapes from the elements within the section where the deformed elements are fixedly engaged with the inner punch 9 (Fig. 6(d)). In this case, as shown in Fig. 5, an advantage is obtained by having the angle β between the line of movement of the gripper mechanism 16 and the longitudinal centre line of the punch-die unit 2 equal to a half of the abstracting angle α so that a uniform abstracting angle α is ensured for all of the elements to be removed from the carrier tape so that the finishing of the space formation is performed under uniform operational conditions throughout the space section. Subsequently the gripper mechanisms 16 are restored to their original positions where the carrier tapes are released from the grippers and the same procedure is repeated beginning with the elevation of the element guides 7 to convey the slide fastener chain by a predetermined distance. The elements removed from the carrier tapes are discharged out of the die 5 through the element guides 7 by the moving fastener chain 1.

The disadvantages of the prior art are eliminated and even the element at the rearmost position within the section for the space can be removed reliably from the carrier tape by use of the method and apparatus of the present invention in which the abstracting angle α is an acute angle for all of the elements to be removed with small difference among the elements since the carrier tapes are pulled and moved from the front of the starting elements within the section toward obliquely rearward direction of the rearmost elements. In particular, an advantage is obtained in that all of the elements are removed under uniform conditions with a constant abstracting angle of the tape when the angle between the line of movement of the tape and the

longitudinal centre line of the punch-die unit β is equal to a half of the abstracting angle α .

45 Claims

1. A method for forming a space section in a slide fastener with interlocking elements formed as individual plastics gripping links securely fastened to a carrier tape which comprises pressing the elements within a section at the leg portions thereof to deform the elements and displacing the carrier tape relatively to the row of the elements from the point in front of the element at the most advanced position within the section toward the obliquely rearward direction to separate the elements seriatim from the carrier tape within the section.

2. A method as claimed in Claim 1 wherein the angle of the displacement of the carrier tape relative to the row of the elements is about a half of the abstracting angle of the carrier tape.

3. An apparatus for forming a space section in a slide fastener with interlocking elements formed as individual plastics gripping links by removing links one after another, said apparatus comprising a punch-die unit and a tape-abstracting mechanism positioned at opposite lateral sides of the punch-die unit and operating in linkage motion with the punch-die unit characterised in that each tape-abstracting mechanism is composed of a gripper mechanism and a driving mechanism and is movable from the point in front of the punch-die unit in the obliquely rearward direction.

4. An apparatus as claimed in Claim 3 wherein each tape-abstracting mechanism is movable along a straight line.

5. An apparatus as claimed in Claim 4 wherein the angle between the line of movement of the tape-abstracting mechanism and the longitudinal centre line of the punch-die unit is about a half of the abstracting angle of the carrier tape.



guide holes 28 so that the carrier tapes are pulled and moved from the front of the punch-die unit 2 toward the obliquely rearward positions to abstract the carrier tapes from the elements within the section where the deformed elements are fixedly engaged with the inner punch 9 (Fig. 6(d)). In this case, as shown in Fig. 5, an advantage is obtained by having the angle β between the line of movement of the gripper mechanism 16 and the longitudinal centre line of the punch-die unit 2 equal to a half of the abstracting angle α so that a uniform abstracting angle α is ensured for all of the elements to be removed from the carrier tape so that the finishing of the space formation is performed under uniform operational conditions throughout the space section. Subsequently the gripper mechanisms 16 are restored to their original positions where the carrier tapes are released from the grippers and the same procedure is repeated beginning with the elevation of the element guides 7 to convey the slide fastener chain by a predetermined distance. The elements removed from the carrier tapes are discharged out of the die 5 through the element guides 7 by the moving fastener chain 1.

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longitudinal centre line of the punch-die unit β is equal to a half of the abstracting angle α .

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3. An apparatus for forming a space section in a slide fastener with interlocking elements formed as individual plastics gripping links by removing links one after another, said apparatus comprising a punch-die unit and a tape-abstracting mechanism positioned at opposite lateral sides of the punch-die unit and operating in linkage motion with the punch-die unit characterised in that each tape-abstracting mechanism is composed of a gripper mechanism and a driving mechanism and is movable from the point in front of the punch-die unit in the obliquely rearward direction.

4. An apparatus as claimed in Claim 3 wherein each tape-abstracting mechanism is movable along a straight line.

5. An apparatus as claimed in Claim 4 wherein the angle between the line of movement of the tape-abstracting mechanism and the longitudinal centre line of the punch-die unit is about a half of the abstracting angle of the carrier tape.