

SPECIFICATION

Method of and apparatus for removing fastener elements from a slide fastener

This invention relates to a method of and apparatus for removing one or more fastener elements from a slide fastener chain of a type (hereinafter referred to as a "slide fastener chain of the type hereinbefore defined") comprising a carrier tape and a row of discrete fastener elements fastened to the carrier tape along one edge of the carrier tape, the carrier tape comprising a reinforcing core along said one edge, the fastener elements being formed either of die-cast metal or of injection-moulded synthetic resin, the fastener elements each being bifurcated so as to have two leg portions engaging opposite sides of the carrier tape adjacent said one edge thereof and the fastener elements each having a head portion projecting outwardly beyond said one edge of the carrier tape.

The invention is applicable to removal of several such fastener elements so as to form an element-free-gap or so-called space section in a continuous length slide fastener chain of the type hereinbefore defined, or to removal of one or more such fastener elements at an end of the row of fastener elements in the case where the slide fastener chain (of the type hereinbefore defined) has already been cut to a desired length.

It is a usual practice nowadays of manufacturers of slide fasteners that, instead of manufacturing slide fasteners of individual product lengths as such, a continuous length slide fastener chain is first manufactured by securely fastening fastener elements which have been shaped by die-casting a metal or injection-molding a plastic resin, on to the stringer core reinforcing the peripheral edge of the carrier tape to form an element row and then to form so-called space sections free of the elements by removing several elements at certain intervals followed by cutting the carrier tape within the space sections into the individual desired product lengths. Further there may often be a necessity to remove several of the fastener elements from a slide fastener of a finished product length to obtain a shortened slide fastener, for example in tailors and other users as well as in a retailer's shop according to customer's order to match the slide fastener to the design or size of clothes or other products to which the slide fastener is to be sewn.

There have heretofore been proposed various methods and related apparatuses for the production of space sections in a continuous length slide fastener chain of the above type with the above-described purpose. One of the methods known in the art is concerned with cutting the coupling head portions of the elements only off the fastener chain within the desired section and thereafter removing the leg portions of the elements left in engagement with the stringer core off the carrier tape by pulling. Another method comprises the steps of pressing fastener elements in a space length as desired into deformed,

flattened configuration and thereafter forcibly separating the thus deformed elements from the stringer core. These prior art methods, however, suffer from the drawbacks that the carrier tape or, especially, the stringer core is sometimes injured as well as that the removal of the fastener elements is sometimes incomplete because the methods involve the step of forcible plucking of the deformed elements or element debris from the stringer core.

In order to mitigate the above-described drawbacks in the prior art methods, an improved method and an apparatus have been proposed in U.S. Patent 3,958,319, in which the fastener element is cut at the head portion thereof in the direction toward the stringer core and divided into two pieces readily removable by knocking off the stringer core. This method and the apparatus therefor, however, also cannot be free from certain problems to be improved as described below.

Namely, the cutter punch for cutting the fastener elements at the head portions thereof must be provided with a plurality of cutter blades at regular intervals corresponding to the pitch and the number of the elements to be removed within the range of the desired space length and, in addition, chain support members must be provided at the position between each pair of the adjacent cutter blades in order to grip and hold the stringer core in the knocking off of the divided elements off the stringer core. Moreover, bifurcated spacer arms must be provided below the cutting punch to fix the elements at the position so as to facilitate cutting of the elements at the head portions thereof. Therefore, disadvantages are brought about by the necessity that the cutting punch, the chain support members and the spacer arms must have each an appropriate shape and size in accordance with the size and pitch of the fastener elements to be removed so that a set of these tools suitable for a fastener chain must be replaced with another set for working with another fastener chain having elements of different size and pitch.

Besides, the apparatus as a whole is relatively large so that inconvenience is unavoidable in handling the apparatus for the work of shortening slide fastener chains, for example, in a retailer's shop.

According to one aspect of the present invention there is provided a method of removing one or more fastener elements from a slide fastener chain of the type hereinbefore defined, wherein the carrier tape is gripped between a pair of jaws the tips of which are adjacent but not gripping the leg portions of said one or more fastener elements, and driving a punch against the head portion of the or each fastener element to be removed so as to urge the head portion towards the jaws in such a manner that the fastener element splits apart, characterised in that the tips of the pair of jaws are formed as wedges with edges which are forced between the two leg portions by the action of the punch so as to separate the two leg portions apart.

According to another aspect of the present invention there is provided apparatus for removing one or more fastener elements from a slide fastener chain of the type hereinbefore defined, comprising a pair of mutually opposed gripper jaws for gripping the carrier tape with the tips of the jaws adjacent but not gripping the leg portions of said one or more fastener elements, and a punch adapted to be driven against the head portion of the or each fastener element to be removed so as to urge the head portion towards the jaws in such a manner that, in use, the fastener element splits apart, characterised in that the tips of the pair of jaws are formed as wedges with edges which, in use, are forced between the two leg portions by the action of the punch so as to separate the two leg portions apart.

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

Fig. 1a is a plan view of a continuous length slide fastener chain provided with a space section obtained by a preferred method and a preferred apparatus in accordance with the present invention;

Fig. 1b is a plan view of a slide fastener chain as cut at the space section of the continuous length slide fastener chain shown in Fig. 1a;

Fig. 2 is a plan view of the apparatus as an embodiment of the present invention;

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Fig. 3 is a cross sectional view of the apparatus shown in Fig. 2 as cut along the line III—III;

Fig. 4 to Fig. 7 are cross sectional elevational views of the main part of the apparatus illustrating the steps of removing the fastener elements according to the present invention; and

Fig. 8 and Fig. 9 are cross sectional views in the main part of an apparatus as an alternative embodiment of the present invention.

In the drawings, Fig. 1a illustrates a continuous length slide fastener chain F finished in accordance with the present invention in which fastener elements 26 are securely fixed to the stringer core of the carrier tape 25 originally in an uninterrupted row along the peripheral edge of the carrier tape 25, from which several of the elements have been removed to form a space section 31 and Fig. 1b illustrates a fastener chain F' with a somewhat elongated space section 31 formed by removing some more elements from the fastener chain obtained by cutting the continuous length fastener chain F shown in Fig. 1a.

Fig. 2 is a plan view of the main part of the preferred apparatus with omission of the punching unit and Fig. 3 is a vertical cross sectional view of the apparatus as cut along the line III—III in Fig. 2, in which a die holder 1 is mounted on a die plate 13, a fixed die jaw 2 of a gripper die secured on the die holder is positioned in a stepped recess 1a between right and left cheeks 1b, 1b by means of bolts 3, and a movable die jaw 4 is positioned oppositely to the fixed die jaw 2 and is capable of

sliding in the stepped recess 1a of the die holder 1 between the right and left cheeks 1b, 1b so as to be able to grip the slide fastener chain inserted into the gap between the fixed and movable die jaws 2 and 4 when the latter is brought close to the former. The movable die jaw 4 is provided with a guide hole 5 in which a guide bush 6 protruding from the die holder 1 is fitted with play. The movable die jaw 4 is always urged with tension springs 7, 7 in the direction apart from the fixed die jaw 2. The tips 2a and 4a of jaws 2 and 4 respectively are formed as acute-angled wedges — see Figs. 3 to 7 — with edges 2a' and 4a' which are slightly chamfered to avoid injuring the carrier tape when the carrier tape is gripped by the fixed and movable die jaws 2 and 4.

The movable die jaw 4 is moved when pushed by an operating mechanism 8 towards the fixed die jaw 2 counteracting the pulling force of the springs 7, 7 and retracted by the springs 7, 7 when the operating mechanism 8 is released. The operating mechanism 8 is composed of an eccentric cam 10 pivotally fixed to the die holder 1 by a pivot 9 and a lever 11 connected to the eccentric cam 10 for revolving the same. When the lever 11 is pulled in the direction shown by the arrow 12, the movable die jaw 4 is pushed toward the fixed die jaw 2 so that a slide fastener chain inserted into the gap between both die jaws 2 and 4 is securely gripped whereas the fastener chain can be released by pushing the lever 11 in the direction shown by the arrow 12'.

At a lateral side of the above-mentioned die holder 1 is provided a scaled rod 14 as positioned along the line which is an extrapolation of the gap between the fixed and movable die jaws 2 and 4. An adjustable stopper holder 17 with a stopper surface 16 is mounted on the scaled rod 14 so as to be capable of sliding along the rod and capable of being fixed at a desired position by fastening with a screw 18. The surface of this scaled rod 14 may be at the same height as that of the cheek 1b of the die holder 1 but it is optional to provide a guide groove 19 in the cheek 1b of the die holder 1, the surface of the scaled rod 14 being approximately at the same height as the bottom line of this guide groove 19.

Above the die unit with the fixed and movable die jaws 2 and 4, a punching unit is provided composed of a punch 21 securely fixed to a punch plate 23 through a punch holder 22 as is shown in Fig. 3. The punch plate 23 is capable of vertical movement up and down by operating a handle (not shown in the figure) or the like.

In the following, the steps of removing the fastener elements from a slide fastener chain are illustrated with reference to Fig. 4 to Fig. 7. First, the lever 11 is pushed in the direction shown by the arrow 12' to rotate the eccentric cam 10 so that the movable die jaw 4 is retracted apart from the fixed die jaw 2 by the pulling force of the springs 7, 7 to form a gap 24 between both die jaws 2 and 4 with a width sufficiently wide for insertion of the carrier tape 25 of the fastener chain F. The carrier tape 25 of the fastener chain F

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is inserted into this gap 24 with the row of the fastener elements 26 upside so that the row of the elements 26 is in contact with the tips 2a and 4a of the die jaws 2 and 4 at the lower end thereof as is shown in Fig. 4.

Thereafter the movable die jaw 4 is pushed toward the fixed die jaw 2 by pulling the lever 11 in the direction shown by the arrow 12 so that the fastener chain F in the gap 24 is firmly gripped by the die jaws 2 and 4 at the carrier tape 25 thereof as is shown in Fig. 5. In this manner, the elements 26 are secured by the die jaws 2 and 4 gripping the carrier tape 25 just below the lower ends 27a, 27a of the leg portions 27, 27 of the elements 26, i.e. at the boundary between the lower ends 27a, 27a of the elements 26 and the carrier tape 25 adjacent the edges 2a' and 4a' of the jaw tips 2a and 4a. When the carrier tape 25 is pressed between the fixed and movable die jaws 2 and 4, the thickness of the carrier tape 25 is reduced a little so that the edges 2a' and 4a' of the jaw tips 2a and 4a are thrust inwardly, though not significantly, from the interface between the lower ends 27a, 27a of the leg portions 27, 27 of the elements 26 and the carrier tape 25 as is shown in Fig. 5. This means a very marked facilitation of the separation apart of the leg portions 27, 27 in the next step. Namely, the punch 21 is subsequently lowered to press down the elements 26 at the head portions 28 thereof whereby the elements 26 become widened at the leg portions 27, 27 thereof by the edges 2a' and 4a' of the jaw tips 2a and 4a forcibly pushed between the bifurcated leg portions 27, 27 of the elements 26 and the carrier tape 25 so that the elements are freed from the stringer core 25a to which the elements 26 had been secured as is shown in Fig. 6. By further descending of the punch 21, the elements 26 become destroyed by splitting from the lower end (see Fig. 6) to the upper end 28a of the head portions 28 as is shown in Fig. 7 to be divided into two pieces readily removable off the stringer core 25a of the carrier tape 25.

The above described separation of the bifurcated leg portions 27, 27 of the elements 26 can be done with certainty even when the edges 2a' and 4a' are chamfered a little or rounded by wearing in prolonged service because the edges 2a' and 4a' are readily pushed into the interstices between the leg portions 27, 27 and the carrier tape 25 owing to the inward thrusting of the jaw tips 2a and 4a from the inside surfaces of the leg portions 27, 27 as stated above.

Fig. 8 and Fig. 9 illustrate another embodiment of the apparatus in which the punch 21 has a lower surface with a correction groove 29 for keeping the elements 26 in an upright disposition, the side walls 30, 30 of this correction groove 29 partly diverging so as to be wider at the lower ends so that even an inclined element 26 can fit into the correction groove 28 in an upright disposition as the punch 21 descends being guided by the sloped walls 30, 30 of the groove 29 whereby reliability in the separation of the leg portions 27, 27 of the elements 26 is ensured.

The slide fastener chain provided with a space section 31 by the preferred method and apparatus of the invention is shown in Fig. 1a, which is to be cut in the space section 31 into slide fastener chains of an individual product length. When a fastener chain of the product length as shown in Fig. 1b is to be further shortened with an extended space section by removing some more elements at the end of the element row as shown in the figure, the stopper holder 17 is fastened to the scaled rod 14 at an appropriate position and the element 26a at the rear end of the element row is brought into contact with the stopper 16 so that exact positioning of the chain is achieved. Thus the apparatus is applicable not only to the removal of elements from a continuous length fastener chain to form a space section as in Fig. 1a but also to the removal of some additional number of the elements from a fastener chain of a definite length obtained by cutting a continuous length fastener chain to elongate the space section as shown in Fig. 1b so that the apparatus can be used with its compactness and handiness even in a retailer's shop to comply with the customer's specific order for a shortened fastener chain.

In the method and apparatus as described above, the elements to be removed are forcibly separated at the leg portions to be destroyed into two pieces so that the removal of the elements from the stringer core can be performed with reliability and the stringer core is never injured since the stringer core receives no destructive force. In addition, no specific gripper means and punching means are necessitated since punching is performed upon the head portions of the elements while the elements are held at the position by the gripping of the carrier tape at the very boundary with the leg portions of the elements so that elements of any size can be efficiently removed without replacing the die and the punch regardless of the size of the elements.

CLAIMS

1. A method of removing one or more fastener elements from a slide fastener chain of the type hereinbefore defined, wherein the carrier tape is gripped between a pair of jaws the tips of which are adjacent but not gripping the leg portions of said one or more fastener elements, and driving a punch against the head portion of the or each fastener element to be removed so as to urge the head portion towards the jaws in such a manner that the fastener element splits apart, characterised in that the tips of the pair of jaws are formed as wedges with edges which are forced between the two leg portions by the action of the punch so as to separate the two leg portions apart.

2. A method as claimed in claim 1 wherein the fastener element is held in an upright disposition during the step of forcibly pressing the head portion thereof toward the jaws.

3. Apparatus for removing one or more fastener elements from a slide fastener chain of the type hereinbefore defined, comprising a pair of mutually opposed gripper jaws for gripping the



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2. A method as claimed in claim 1 wherein the fastener element is held in an upright disposition during the step of forcibly pressing the head portion thereof toward the jaws.

3. Apparatus for removing one or more fastener elements from a slide fastener chain of the type hereinbefore defined, comprising a pair of mutually opposed gripper jaws for gripping the



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that, in use, the fastener element splits apart,
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formed as wedges with edges which, in use, are
10 forced between the two leg portions by the action
of the punch so as to separate the two leg portions
apart.

15 4. An apparatus as claimed in claim 3 wherein
the two jaws are comprised in a gripper die, one of
the jaws being fixed and the other jaw being
movable.

5. An apparatus as claimed in claim 4 wherein
means for bringing the movable jaw close to and

20 apart from the fixed jaw relatively is composed of
an eccentric cam in contact with the movable jaw
and a lever to revolve the eccentric cam.

25 6. An apparatus as claimed in claim 3, 4 or 5
wherein the punch is positioned above the jaws
and is movable vertically towards and away from
them.

30 7. The apparatus as claimed in claim 6 wherein
the punch has a lower surface provided with a
correction groove for keeping the fastener element
in an upright disposition, the side walls of the
correction groove diverging for guiding the
fastener element.

35 8. The apparatus as claimed in any one of
claims 3 to 7 wherein a scaled rod is provided
along a line which is an extrapolation of the gap
formed between the wedge edges of the two jaws.