

SPECIFICATION

Method and Apparatus for Gapping a Sliding Clasp Fastener Chain

This invention relates to a method and apparatus for gapping a sliding clasp fastener chain or removing a group of sliding clasp fastener elements from selected areas along a continuous length of sliding clasp fastener chain to provide "element-free gaps", the spacing between adjacent "gaps" largely determining the length of an individual finished sliding clasp fastener product.

Various methods and apparatus for gapping sliding clasp fasteners have been proposed heretofore. A typical example of the prior art methods and apparatus usually involves cutting the coupling head portions of the fastener elements and removing the cut pieces from the fastener tapes to leave gaps thereat free of fastener elements. To this end, the confronting, abutted edges of the tapes are required to be forced apart from each other widely enough to permit a punch to move therethrough. However, due to the tendency of the fastener tapes to resist the forcing apart or spreading open of their opposed element-carrying edges which have been brought into abutting engagement with each other, those portions of the tapes which lie between the locations of gaps to be formed and the withdrawal rollers disposed to guide the fastener chain out of the system, are prone to become elongated or stretched out. It has therefore been necessary, when predetermining the inter-gap spacing or intervals, to take into account such potential errors which may arise out of the elongation or stretching of the tapes. What makes this problem more complex is the fact that the material of the fastener tapes varies, it being a naturally occurring fiber in some instances or synthetic fibers in other instances, depending upon the garment or other articles to which the fastener is applied, or that the physical properties of the tapes also vary with whether they are woven or knitted, with the results that the rate of elongation of the tape under tensile force is variable with such varying conditions. Tape elongation is further subject to change with how rows of fastener elements are sewn to the support tapes, or even with the environmental conditions of the manufacture of fasteners. With conventional methods and apparatus, it has been difficult to determine the positions of "gaps" to be formed with reasonable accuracy, and it has been furthermore required to re-calibrate the equipment when the type of fastener chain changes.

According to one aspect of the invention, there is provided a method of producing a series of gaps free of fastener elements in and along a continuous length of sliding clasp fastener chain having a pair of oppositely disposed stringer tapes carrying along confronting longitudinal edges rows of fastener elements in inter-engaged relation, each of said elements having a coupling

head portion and a connecting portion, which method comprises the steps of preliminarily spreading apart the confronting edges of at least the parts of the tapes where gaps are to be produced without dis-interengaging said rows of fastener elements and then allowing the said confronting edges to close at least partly together again, but with a tendency to spread apart; applying constant tension to a length of said fastener chain; spreading apart again the confronting edges of the tapes to which have been imparted said tendency; gripping the connecting portions of the interengaged fastener elements; severing said interengaged coupling head portions of the fastener elements; pulling said connecting portions, while being gripped, outwardly and away from their respective tapes to remove residual element debris; and withdrawing the fastener chain intermittently along a length corresponding to the spacing between adjacent gaps to be produced.

According to another aspect of the invention, there is provided apparatus for producing a series of gaps free of fastener elements in and along a continuous length of sliding clasp fastener chain having a pair of oppositely disposed stringer tapes each carrying along confronting longitudinal edges rows of fastener elements in interengaged relation with coupling head portions and connecting portions, which apparatus comprises: a support member; a plurality of sequentially arranged processing units mounted on said support member including a feeding unit having a drive and a pressure roller for transporting the fastener chain at a predetermined speed; a prespreading unit disposed upstream of said feeding unit and having oppositely disposed guide arms, one movable relative to the other, defining therebetween a channel for the passage of the fastener chain, said prespreading unit including a member adapted to enter between and temporarily spread apart the confronting edges of the stringer tapes while the latter are being advanced and then to allow the said confronting edges to close at least partly together again; a tensioning unit for applying a constant tension to a length of fastener chain, said tensioning unit being disposed downstream of said feeding unit and including a guide rail, a weighted roller with a bearing movable along said rail and a guide roller; a gapping unit disposed downstream of said tensioning unit and having a coacting punch and die means for severing a group of fastener elements of said prespread and tensioned fastener chain length across their coupling head portions, guide means adapted for spreading apart again the confronting edges of the tapes, and a pair of grippers adapted to grip and remove the connecting portions of said group of elements from the respective tapes; and a withdrawal unit having a drive and a pressure roller for withdrawing the fastener chain from the apparatus intermittently along a length corresponding to the spacing between adjacent gaps to be produced.

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

Figure 1 is a schematic view utilized to explain the preferred general process and equipment layout for gapping a sliding clasp fastener chain according to the invention;

Figure 2 is a top plan view of a pair of coupled fastener stringers provided with a gap devoid of fastener elements;

Figure 3 is a schematic view in side elevation of an apparatus for gapping a sliding clasp fastener chain according to the invention;

Figure 4 is a schematic cross-sectional view taken on the lines IV—IV of Figure 3, which illustrates a mechanism for removing a group of fastener elements;

Figures 5 and 6 are schematic views in vertical section of the mechanism of Figure 4, illustrating its operation;

Figure 7 is a schematic cross-sectional view taken on the lines VII—VII of Figure 3; and

Figure 8 is a schematic cross-sectional view taken on the line VIII—VIII of Figure 7.

Referring now to the drawings and Figure 1 in particular, there is schematically shown the steps of the gapping operation in accordance with the invention, in which a length of continuous sliding clasp fastener chain F is gapped at predetermined intervals while being transported under constant tension in the direction of the arrow. The fastener chain F is made up of a pair of oppositely disposed stringers F_1 and F_2 , each including a support tape T_1 (T_2) having secured to its edge a row of elementary coupling elements E which may be of a meander or helical formation, the two stringers F_1 , F_2 being shown coupled together. The rows of coupling fastener elements E each having a head portion Ea and connecting portions Eb are secured by sewing threads S . On its travel in the direction of the arrow, the fastener chain F moves initially past a pre-spreading station where the two interengaged stringers F_1 , F_2 are imparted a physical tendency such that they can readily and easily spread apart when they are gapped at a later stage. The fastener chain F is then transported through a tensioning station where it is held under constant tension, and thence introduced into an element removing or gapping station where a group of fastener elements E is cut and removed from the fastener chain F , whereby the chain F is gapped; namely, provided with a tape section free of fastener elements E for purposes of the subsequent fastener finishing operation as well known in the art.

The method of gapping a fastener chain above described is implemented by an apparatus generally shown in Figure 3. The gapping apparatus generally designated at 10 comprises essentially a gapping unit 11, a feeding unit 12, a prespreading unit 13, a tensioning unit 14 and a withdrawal unit 15, all operatively associated in a manner to be described hereafter. The gapping unit 11 shown mounted on the top of the

machine frame 16 includes a pair of fastener chain guides (not shown) for holding the fastener chain F face up; namely, with an element-carrying side up, in a horizontal position, the guides having a projection adapted to spread apart again the confronting edges T' of the tapes F_1 , F_2 and abut against the fastener elements E .

The gapping unit 11 further comprises, as better shown in Figures 4 to 6 inclusive, a vertically movable cutting punch 17 having a punch head 17' and a stationary die 18 having a die groove 18', the punch head 17' constituting with the die aperture 18' of a coacting die cutter for severing the coupling head portions Ea of the fastener elements E .

The punch 17 is situated below and in vertically opposed relation to the die 18 and mounted movably within a guide member 19. It is vertically reciprocated by an actuator 20. A spring 21 is disposed in the guide member 19 for normally positioning the punch head 17' in registry with the projection of the fastener chain guide or in close proximity with the lower surface of the stringer tapes T_1 , T_2 as shown in Figure 4. The gapping unit 11 further comprises a pair of horizontally opposed grippers 22, 23 which are disposed in criss-cross or perpendicular relation to the vertically disposed punch 17 and die 18. The grippers 22, 23 are each constituted by an upper blade 22a, (23a) and a lower blade 22b, (23b) which are interconnected by a pin 24, (25). The upper blades 22a, 23a are movable toward but normally spring-biased to be away from the corresponding blades 22b, 23b.

The operation of the gapping unit 11 is illustrated in Figures 5 and 6, in which the punch 17 is moved by the actuator 20 upwardly and thrust through the coupling head portions Ea of the fastener elements E on the intermeshed stringers F_1 , F_2 , while the connecting portions Eb of the elements E are held by the grippers 22, 23. As the fastener elements E are completely severed across the interengaged coupling heads Ea , the grippers 22, 23 begin to retract horizontally away from the punch 17 and the die 18, taking along with them the residual element debris apart from the sewing threads S . The structural and functional details of such a gapping mechanism are basically well known, and hence will require no further explanation.

The feeding unit 12 essentially comprises a drive roller 26 and a pressure roller 27 for positively feeding the sliding clasp fastener chain F at a predetermined rate of speed. As better shown in Figure 1, a pair of these rollers are provided for each of the two stringers F_1 , F_2 in such a manner that they do not ride over or engage the beaded edges T' of interengaged stringers F_1 , F_2 which have been given a tendency to spread apart at the pre-spreading unit 13.

The pre-spreading unit 13 is located in advance or upstream of the feeding unit 12 and arranged to receive the fastener chain F which has been oriented by guide rollers 29, 30 to run substantially vertically with respect to the unit 13.

As better shown in Figure 7, the pre-spreading unit 13 comprises two guide arms 31 and 32 disposed in confronting relation and defining therebetween a channel 33 for the passage of the sliding clasp fastener chain *F*. The first guide arm 31 is provided adjacent its distal end with a fastener element guide 35 adapted to guide the rows of interengaged fastener elements *E* slidably therethrough. The second guide arm 32 is pivoted at its proximate end about a pin 34 and is provided at its distal end with a wedge-shaped member 36 for spreading apart the confronting, abutted edges *T'* of the stringer tapes *T*₁, *T*₂.

The member 36, as better shown in Figure 8, is tapered off progressively in the direction of entry of the fastener chain *F* so that the abutted edges *T'* of the tapes *T*₁, *T*₂ can be easily spread apart on passing therethrough. A stem portion 36' of the member 36 is slightly greater in width than the punch head 17', so that the stringers *F*₁, *F*₂ are imparted a tendency, while moving past the member 36, to reduce their resistance to open or facilitate the spreading apart of their closed edges during the subsequent gapping operation.

Designated at 37 is a bolt-and-nut stopper which is adapted to adjustably set the clearance between the first and second guide arms 31, 32. Designated at 38 is a spring-biased clamping member adapted to hold the two arms 31, 32 in position. The pre-spreading unit 13 thus constructed is secured, as by bolt 39, to a guide bar 40 extending vertically from the frame 16.

The tensioning unit 14 is located between the feeding unit 12 and the gapping unit 11 and functions to apply and maintain a constant tension to the sliding clasp fastener chain *F* spanning between the feeding unit 12 and the withdrawal unit 15. The tensioning unit 14 comprises a vertically disposed guide rail 41 and a weighted roller 42 with a bearing 43 movable vertically along the rail 41, and further includes a guide roller 44 located adjacent the feeding unit 12. The rollers 42 and 44 are similar in construction to the drive and pressure roller pairs 26, 27 of the feeding unit 12 in that they are all arranged to engage with the web portions of the tapes *T*₁, *T*₂, not with the element-carrying beaded edges *T'* thereof which have been pre-spread.

At the extreme upper and lower ends of the guide rail 41 are provided an upper-limit sensing element 45 and a lower-limit sensing element 46, respectively.

In the event that the speed of feed of the fastener chain *F* at the unit 12 is higher than the speed of withdrawal of the chain *F* at the unit 15, the lower sensing element 46 on contact with the bearing 43 functions to cause the feed rollers 26, 27 to stop. The feed rollers 26, 27 are arranged to resume rotation when the bearing 43 of the weighted roller 42 is brought into contact with the upper sensing element 45. Thus, constant tension is applied to the fastener chain *F* by the weight of the roller 42, regardless of the drive system.

The withdrawal unit 15 comprises a drive roller 47 and a pressure roller 48 cooperating therewith in withdrawing the fastener chain *F* intermittently when a cycle of gapping operation is completed at the unit 11. The withdrawal unit 15 is movably mounted via frame member 49 on a horizontal guide bar 50 extending from the frame 16. The drive roller 47 is aligned with the guide roller 44 so that the fastener chain *F* moves properly into and out of the space between the punch 17 and the die 18 in the gapping unit 11. The position of the withdrawal unit 15 determines the spacing or distance between adjacent gaps *G* along the length of the fastener chain *F*. To set this spacing or distance, there is provided a sensing element 51 at the withdrawal unit 15 which is arranged to sense the arrival of the trailing end of the gap *G* thereby causing the drive roller 47 to stop. The distance indicated by "L" in Figure 3 measures between the center of the punch 17 and the sensing element 51 and in effect determines the spacing between adjacent gaps *G* that is desired.

Claims

1. A method of producing a series of gaps free of fastener elements in and along a continuous length of sliding clasp fastener chain having a pair of oppositely disposed stringer tapes carrying along confronting longitudinal edges rows of fastener elements in interengaged relation, each of said elements having a coupling head portion and a connecting portion, which method comprises the steps of preliminarily spreading apart the confronting edges of at least the parts of the tapes where gaps are to be produced without disinterengaging said rows of fastener elements and then allowing the said confronting edges to close at least partly together again, but with a tendency to spread apart; applying constant tension to a length of said fastener chain; spreading apart again the confronting edges of the tapes to which have been imparted said tendency; gripping the connecting portions of the interengaged fastener elements; severing said interengaged coupling head portions of the fastener elements; pulling said connecting portions, while being gripped, outwardly and away from their respective tapes to remove residual element debris; and withdrawing the fastener chain intermittently along a length corresponding to the spacing between adjacent gaps to be produced.

2. Apparatus for producing a series of gaps free of fastener elements in and along a continuous length of sliding clasp fastener chain having a pair of oppositely disposed stringer tapes each carrying along confronting longitudinal edges rows of fastener elements in interengaged relation with coupling head portions and connecting portions, which apparatus comprises: a support member; a plurality of sequentially arranged processing units mounted on said support member including a feeding unit having a drive and a pressure roller for transporting the fastener chain at a predetermined speed; a



As better shown in Figure 7, the pre-spreading unit 13 comprises two guide arms 31 and 32 disposed in confronting relation and defining therebetween a channel 33 for the passage of the sliding clasp fastener chain *F*. The first guide arm 31 is provided adjacent its distal end with a fastener element guide 35 adapted to guide the rows of interengaged fastener elements *E* slidably therethrough. The second guide arm 32 is pivoted at its proximate end about a pin 34 and is provided at its distal end with a wedge-shaped member 36 for spreading apart the confronting, abutted edges *T'* of the stringer tapes *T*₁, *T*₂.

The member 36, as better shown in Figure 8, is tapered off progressively in the direction of entry of the fastener chain *F* so that the abutted edges *T'* of the tapes *T*₁, *T*₂ can be easily spread apart on passing therethrough. A stem portion 36' of the member 36 is slightly greater in width than the punch head 17', so that the stringers *F*₁, *F*₂ are imparted a tendency, while moving past the member 36, to reduce their resistance to open or facilitate the spreading apart of their closed edges during the subsequent gapping operation.

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Claims

1. A method of producing a series of gaps free of fastener elements in and along a continuous length of sliding clasp fastener chain having a pair of oppositely disposed stringer tapes carrying along confronting longitudinal edges rows of fastener elements in interengaged relation, each of said elements having a coupling head portion and a connecting portion, which method comprises the steps of preliminarily spreading apart the confronting edges of at least the parts of the tapes where gaps are to be produced without disinterengaging said rows of fastener elements and then allowing the said confronting edges to close at least partly together again, but with a tendency to spread apart; applying constant tension to a length of said fastener chain; spreading apart again the confronting edges of the tapes to which have been imparted said tendency; gripping the connecting portions of the interengaged fastener elements; severing said interengaged coupling head portions of the fastener elements; pulling said connecting portions, while being gripped, outwardly and away from their respective tapes to remove residual element debris; and withdrawing the fastener chain intermittently along a length corresponding to the spacing between adjacent gaps to be produced.

2. Apparatus for producing a series of gaps free of fastener elements in and along a continuous length of sliding clasp fastener chain having a pair of oppositely disposed stringer tapes each carrying along confronting longitudinal edges rows of fastener elements in interengaged relation with coupling head portions and connecting portions, which apparatus comprises: a support member; a plurality of sequentially arranged processing units mounted on said support member including a feeding unit having a drive and a pressure roller for transporting the fastener chain at a predetermined speed; a

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prespreading unit disposed upstream of said feeding unit and having oppositely disposed guide arms, one movable relative to the other, defining therebetween a channel for the passage of the fastener chain, said prespreading unit including a member adapted to enter between and temporarily spread apart the confronting edges of the stringer tapes while the latter are being advanced and then to allow the said confronting edges to close at least partly together again; a tensioning unit for applying a constant tension to a length of fastener chain, said tensioning unit being disposed downstream of said feeding unit and including a guide rail, a weighted roller with a bearing movable along said rail and a guide roller; a gapping unit disposed downstream of said tensioning unit and having a coacting punch and die means for severing a group of fastener elements of said prespread and tensioned fastener chain length across their coupling head portions, guide means adapted for spreading apart again the confronting edges of the tapes, and a pair of grippers adapted to grip and remove the connecting portions of said group of elements from the respective tapes; and a withdrawal unit having a drive and a pressure roller for withdrawing the fastener chain from the

apparatus intermittently along a length corresponding to the spacing between adjacent gaps to be produced in said fastener chain.
30 3. Apparatus according to claim 2 wherein said member in said pre-spreading unit is tapered off progressively in the direction of entry of the fastener chain and has its stem portion slightly
35 wider than said punch of said gapping unit.
4. Apparatus according to claim 2 wherein said tensioning unit further includes sensing means engageable with said bearing respectively at the upper and lower ends of said rail and adapted for
40 starting and stopping said feeding unit.
5. Apparatus according to claim 2 wherein said withdrawal unit further includes means for sensing the arrival thereof of the trailing end of each gap in the fastener chain, the distance
45 between said means and the center of said punch corresponding to the spacing between adjacent gaps to be produced.
6. A method of gapping a sliding clasp fastener chain substantially as described with reference to
50 and as illustrated in the accompanying drawings.
7. Apparatus substantially as described with reference to and as illustrated in the accompanying drawings.

