

FASTENER CHAIN FINISHING APPARATUS

This invention relates to a fastener chain finishing apparatus and more particularly, to a fastener chain finishing apparatus in which in the production of final product fastener chains having a predetermined length from an indefinite length of semi-processed fastener chain having a number of connected elements set thereon, stops are secured to said indefinite length of fastener chain at predetermined intervals along the length of the semi-processed product chain and selected elements positioned adjacent said secured stops are removed from the semi-processed product chain to thereby form spaces in the continuous elements in the chain.

Conventionally, in the production of final product fastener chains having a definite length from an indefinite length of semi-processed product fastener chains, before the indefinite length of fastener chain is cut into final product fastener chains having a definite length, stops are secured to the indefinite length of fastener chain having a number of connected elements set thereon at predetermined intervals along the length of the fastener chain and selected elements are removed from the tape of the fastener chain in positions adjacent the secured stops to thereby form spaces where the fastener chain is cut into final products. In the securing of stops to the fastener chain, in general, a stop part feeder feeds stop parts one by one to a vertically movable punch which in turn drives the stop parts one by one to secure them to the fastener chain and the space is formed by cutting out the heads of selected elements

by a punch and a die from above and below. The stop securing and space formation are conventionally performed simultaneously or in succession in adjacent positions so that the fastener chain finishing operation can be rapidly carried out.

- 5 Especially, in the case of a fastener chain for use on trousers or the like which has a fly secured to the fastener tape, since the fly becomes a bar in the stop securing and space forming, the fly has to be bent in the processing operations. Thus, if the stop securing and space formation are
10 carried out simultaneously or in succession, it is only necessary to bend the fly once thereby simplifying the finishing operation.

- However, the above-mentioned conventional method in which the stop part feeder feeds preformed stop parts one by one
15 and the punch drives the stop parts into the fastener chain one by one is undesirably expensive. Thus it is desirable to feed a stop forming wire to the stop securing position, cut the wire to sections having predetermined length and shape by forming and cutting punches and then drive the stop onto the
20 fastener chain while forming the stop from the cut stop section by forming and cutting punches. However, when the forming die and the cutting and forming punches are positioned adjacent the space forming device as mentioned above, the remaining portions of the cut out elements after the space formation
25 strike against the element guide and spring up as the fastener chain is fed and as a result, such element portions tend to enter the clearance defined by the adjacent forming and cutting punches to thereby disable the stop securing device and/or

product unacceptable stops.

It is believed possible by means of the present invention to provide a fastener chain finishing apparatus which can prevent the remaining portions of the cut out
5 elements from entering the stop securing device and to thereby eliminate the disadvantages that the stop securing device fails to function and/or unacceptable stops are produced.

Another believed possibility of the present invention
10 is to provide a fastener chain finishing apparatus which can reduce the cost of the components while attaining the above-mentioned object.

According to the present invention there is provided a fastener chain finishing apparatus comprising a stop
15 securing device adapted to secure stops to a fastener chain of indefinite length having a number of connected elements set thereon at predetermined intervals along the length of said chain and a space forming device positioned adjacent said stop securing device for removing selected
20 elements from said fastener chain covering a predetermined distance along the length of the chain, said stop securing device including a bender provided with a forming die, a cutting punch adapted to cut a stop forming wire fed onto said forming die to predetermined length and
25 shape and a forming punch adapted to secure a stop to said fastener chain while forming said stop from said cut stop forming wire and said space forming device including a spacer punch and a spacer die adapted to cut out the

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heads of selected engaging elements, characterized in that said bender is provided with an air jet orifice adapted to spout air towards said forming die. The invention will be described by way of example with reference to the accompanying drawings, wherein:-

Fig. 1 is a fragmentary side elevational view of one apparatus embodying the present invention showing a portion thereof in cross-section;

Fig. 2 is a cross-sectional view taken along the line II - II of Fig. 1;

Fig. 3 is a perspective view of the apparatus of Fig. 1;

Figs. 4 to 7 inclusive are fragmentary views showing the operation of the apparatus of Fig. 1; and

Fig. 8 is a fragmentary view of the fastener chain processed by the apparatus of Fig. 1.

As shown in Figs. 1 and 2, the finishing apparatus 10 of the present invention includes a base 11, and a hollow frame 12 mounted on and extending uprightly from the base 11. Arranged within the frame 12 are a forming punch 13 and a cutting punch 14 which form components of a stop ~~securing~~ securing device and a spacer punch 15 which forms a component of a space forming device and these punches are adapted to be guided for upwardly and downwardly slidable movement. As shown in Fig. 3, the cutting punch 14 has a vertical groove 16 for receiving the forming punch 13 for slidable movement in the feeding direction side of a fastener chain 16 (the direction will be referred to as the downstream side, and the opposite direction will be referred to as the upstream side, respectively, hereinafter) and the cutting punch 14 also has a cross-sectional configuration suitable for cutting a stop forming wire 17 fed to the stop securing device to a predetermined shape. On the other hand, the forming punch 13 is integrally formed with the spacer punch 15 for upward and downward movement within the vertical groove 16 together with the spacer punch. The spacer punch 15 is disposed adjacent and downstream of the forming punch 13 and has the length and thickness suitable for punching out heads of a predetermined number of elements on the fastener chain 16 which has a row of connected elements which engaged each other. Although the cutting punch 14, forming punch 13 and the spacer punch 15 are carried by a single punch holder (not shown) and periodically moved upwardly and downwardly, the cutting punch 14, the forming punch 13 and the spacer punch 15 are initially moved downwardly

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integrally by a cam and link mechanism (not shown) and thereafter, the forming punch 13 and spacer punch 15 can continue to move downwardly in spite of the fact that the cutting punch 14 ceases the downward movement.

5 The frame 12 is formed with a transverse opening 19 on the upstream fastener chain feeding side and a bender 20 is slidably received within the opening 19. The bender 20 has a forming die 21 at the downstream leading end thereof for cooperating with the forming punch 13. The forming die 21 forms
10 a component of the stop securing device. The bender 20 is formed at the upstream end with a stopper 22 adapted to engage the outer surface of the frame 12 to limit the protruding position of the bender and accordingly, of the forming die 21. A spring 24 is compressed between the bender 20 and the
15 extension 23 of the frame 12 to normally urge the bender 20 to protrude. The bender is formed at the downstream end with a cam face 25 for engaging a cam face 26 on the cutting punch 14 whereby the bender 20 retracts against the force of the spring 24 as the cutting punch 14 moves downwardly. As
20 shown, the bender 20 is hollow and air under high pressure is supplied from an air pressure source (not shown) through a tube 27 and pipe 29 secured to the extension 23 by means of a bolt 28. The leading end of the pipe 29 is maintained airtight with respect to the bender 20 by a seal 30, but the
25 bender is allowed to slidably move relative to the pipe. The air introduced into the bender 20 spouts onto the forming die 21 through a jet orifice 31. A spring 32 is interposed between the leading end of the pipe 29 and the interior of the

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bender 20 to normally protrude the bender 20 in cooperation with the spring 24.

A flat guide face 33 is formed on the base 11 to form a chain guide for the fastener chain 16 to be fed to the finishing apparatus in cooperation with the undersurface of the extension of the frame 12. And a die 34 is formed on the base 11 in vertical alignment with the forming punch 13 to form a component of the stop securing device. The die 34 cooperates with the forming punch 13 to form a stop and secure the stop on the chain 16. Furthermore, a spacer die 35 is formed on the base 11 in vertical alignment with the spacer punch 15 to form a component of the spacer forming device. The spacer die 35 has a groove for receiving the spacer punch 15 to punch out the heads of a predetermined number of elements 18 to be removed in cooperation with the spacer punch 15. The spacer die 35 cooperates with the element guide 36 in forming a chain guide for the fastener chain 16 which passes through the finishing apparatus. As shown in Fig. 3, the element guide 36 is bifurcated to receive the spacer punch 15 and has one end pivoted by means of a pin 38 to a bracket 37 which is in turn secured to the frame 12. The downstream end of the element guide 36 has an angle member 39 secured thereto and the angle member 39 is urged upwardly by means of a spring 40 anchored to the frame 12, whereby the element guide 36 cooperates with the spacer die 35 in pinching the fastener chain 16 with a moderate pressure without interfering with the movement of fastener chain 16.

As more clearly shown in Fig. 2, the finishing apparatus ~~of the present invention~~ comprises a wire feeding device 41

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for intermittently feeding the stop forming wire 17 onto the forming die 21. The wire feeding device includes a plurality of spaced wire guides 44 (only one wire guide is shown) arranged along a support 43 supported on a bracket 43 protruding from one side of the frame 12, a stationary lever 45 secured to the one side of the frame 12 and a rocking lever 46 for rocking by a predetermined angle in the wire feeding direction in synchronism with the upward and downward movement of the above-mentioned punch holder. The wire guide 44 smoothly guides the wire 17 through between the rolls 47, 48 held on the levers 45, 46, respectively. The stationary lever 45 has a roll guide groove 49 the width of which gradually increases from one end to the other end of the lever 45 and the opposite ends of the rolls 47 are freely received in the slot 53 in a roll holder 52 which is pivoted at the upper end by means of a pin 50 to the opposite sides of the lever 45 (only one side of the lever is shown) and connected at an intermediate point between the opposite ends thereof by means of a spring 51 to the lever 45, whereby the pair of upper and lower rolls 47 allows the wire 17 to move in the feeding direction, but prevents the movement of the wire in the opposite direction. On the other hand, the rocking lever 46 is rocked right and left as shown by arrow about a pivot (not shown) at the upper end thereof each time the punch holder is moved upwardly and downwardly by a cam mechanism (not shown). The rocking lever 46 is connected to the stationary lever 45 by a spring 53 and includes a roll guide groove 54 the width of which gradually increases from one side to the other side as in the case of the roll guide



groove in the stationary lever 45. The opposite ends of the rolls 48 are freely received in slots 58 in a roll holder 57 which is in turn pivoted at the upper end to the opposite sides of the lever 46 (only one side of the lever is shown) by a pin 55 and connected at an intermediate point between the opposite ends thereof to the lever 46 by a spring 56, whereby the pair of upper and lower rolls 48 held in the rocking lever 46 roll freely on the wire 17 as the lever 46 rocks in the opposite direction from the wire feeding direction and pinch and feed the wire 17 as the lever 46 returns to the wire feeding direction under the action of the spring 53. In this way, the levers 45, 46 intermittently feed the wire 17 in increments.

Now, the operation of the apparatus of the invention will be described. The fastener chain 16 having the row of elements 18 set thereon is guided along the guide face 33 and between and through the chain guides 35, 36 and is intermittently moved incrementally in the arrow direction as shown in Fig. 1. The intermittent movement of the fastener chain is effected by an intermittent drive means positioned on the downstream side of the apparatus. During the intermittent movement of the fastener chain, the forming punch 13 and cutting punch 14 are in their raised positions as shown in Fig. 4 and the stop forming wire 17 is fed onto the bender 20. As the intermittent drive means is operated, the punch holder carrying the forming punch 13 and the cutting punch 14 is lowered to thereby lower the punches 13, 14 and the stop forming wire 17 is cut and deformed as shown in Fig. 5 by the cutting punch 14. As the punch holder is further lowered, the cam face 26

on the cutting punch 14 comes to engage the cam face 26 on the bender 20 to retract the bender 20, where the cut and deformed stop forming wire 17' is held between the cutting punch 14 and forming punch 13. As the punch holder is still
5 further lowered, the leading end of the cutting punch 14 abuts against the tape of the fastener chain 16 on the die 34 and ceases its downward movement and only the forming punch 13 continues the downward movement. As a result, the cut stop forming wire 17' is deformed into a stop shape and secured
10 to selected elements 18 as shown in Fig. 6 by the forming punch 13 and the die 34. In synchronization with the downward movement of the forming punch 13, the spacer punch 15 also moves downwardly to cut out the heads of a predetermined number of elements positioned on the spacer die 35 as shown in Fig. 7.

15. Cutting-out of the element head and securing of the stop are simultaneously performed. The remaining portions of the elements from which the heads have been cut out are ready for removal from the tape of the fastener chain. Thus, when the fastener chain 16 is fed for the next processing operation, the
20 remaining portions of the elements tend to strike against the element guide 36 and spring up whereby the element portions may be caught in the clearance defined by the forming die 21 and cutting punch 14 of the adjacent stop securing device and/or ride on the stop forming stop 17. However, ~~according to~~
25 ~~the present invention, as mentioned hereinabove,~~ since air under high pressure is spouted through the air jet orifice 31 above the forming die 21 of the bender 20 to the space forming device, the remaining portions of the elements are blown away

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from the stop securing device by the air under high pressure and prevented from entering the stop securing device. Thus, the disadvantages that the stop securing device fails to function and unacceptable stops are produced as experienced in the conventional fastener finishing apparatus are eliminated. In this way, the stop S is secured to the fastener chain 16 and a space d of suitable distance is formed on the fastener chain adjacent the stop S as shown in Fig. 8. After the stop securing and space formation, the punch holder is raised to return the forming punch 13, the cutting punch 14, the spacer punch 15 and the forming die 21 to the positions as shown in Fig. 4 ready for the next processing operation.

On the other hand, the rocking lever 46 of the wire feeding device 41 rocks in the opposite direction from the wire feeding direction as the punch holder moves downwardly. At this time, the rolls 47 associated with the stationary lever 45 grip the wire 17 against movement whereas the rolls 48 associated with the rocking lever 46 roll freely on the wire 17. As the punch holder moves upwardly after the securing of the stop S and the formation of the space d, the rocking lever 46 is returned to the position as shown in Fig. 2 under the action of the spring 53. At this time, the rolls 47 associated with the stationary lever 45 allow the movement of the wire 17 in the feeding direction whereas the rolls 48 associated with the rocking lever 46 grip the wire 17 to move the wire in the feeding direction. In this way, the wire feeding device feeds the wire by the distance corresponding to the length of one stop S each time the punch holder moves

upwardly and downwardly, that is, each time one stop S is secured to the fastener chain and the space d is formed on the fastener chain.

As mentioned hereinabove, ~~according to the present/~~
5 ~~invention,~~ since the stop is secured to the fastener chain while forming the stop from the stop forming wire, the cost of the components can be reduced and in the formation of the space, since remaining portions of the elements are blown away from the stop securing device by air under high pressure,
10 the element remaining portions are prevented from entering the stop securing device to thereby eliminate the disadvantages that the stop securing device fails to function and/or unacceptable stops are produced.



Claims:

1. A fastener chain finishing apparatus comprising a stop securing device adapted to secure stops to a fastener chain of indefinite length having a number of connected elements set thereon at predetermined intervals along the length of
5 said chain and a space forming device positioned adjacent said stop securing device for removing selected elements from said fastener chain covering a predetermined distance along the length of the chain, said stop securing device including a bender provided with a forming die, a cutting punch adapted to
10 cut a stop forming wire fed onto said forming die to predetermined length and shape and a forming punch adapted to secure a stop to said fastener chain while forming said stop from said cut stop forming wire and said space forming device including a spacer punch and a spacer die adapted to cut out
15 the heads of said selected engaging elements,
characterized in that said bender is provided with an air jet orifice adapted to spout air towards said forming die.
 2. A finishing apparatus as set forth in Claim 1, in which said air jet orifice is open towards the feeding direction
20 of said fastener chain.
 3. A finishing apparatus as set forth in Claim 1, in which said forming punch and said spacer punch are formed integral with each other.
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