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METHOD OF MANUFACTURING
SEPARABLE SLIDE FASTENERS

The present invention relates to a method of producing separable slide fasteners from an elongate slide fastener chain, and more particularly to a method of finishing separable slide fasteners so as to be
5 produced either individually or as an elongate product composed of such separable slide fasteners joined end to end.

Generally, there are known three methods of manufacturing separable slide fasteners from an
10 elongate slide fastener chain. One of the known methods is disclosed in U.S. Patent No. 3,081,462. According to the disclosed method, the separable slide fasteners are produced as an elongate joined product for allowing them to be sequentially sewn to garments
15 highly efficiently. More specifically, slits are formed at element-free portions in an elongate slide fastener chain, and insertion pins, box pins, sliders, and boxes are manually attached to the chain through the slits.

The other two methods are directed to the fabrication of separable slide fasteners as individual product units. According to one method which is shown in Japanese Patent Publication No. 49-44243, a slider
5 and a box integral with a box pin are attached to one of a pair of separate slide fastener stringers through the leading end thereof, whereas an insertion pin is attached to the other slide fastener stringer at the leading end thereof. Thereafter, the slide fastener
10 stringers are cut off to prescribed lengths, which are then manually combined into a separable slide fastener. Japanese Patent Publication No. 58-50721 reveals the other method in which insertion and box pins are attached to the leading ends of two slide fastener
15 stringers, and a slider is threaded over the stringers to interengage some coupling elements. With the insertion and box pins aligned with each other, a box is fitted over the pins and fixed to the box pin. Thereafter, the slide fastener stringers are severed
20 into a unit fastener product.

The conventional method for producing an elongate piece of joined separable slide fasteners is primarily performed manually, and hence the manufactured separable slide fasteners are apt to be irregular
25 in quality. The manual process is poor in efficiency. In the two methods of manufacturing individual separable slide fastener sliders, the box and insertion

pins cannot be attached properly if the severed leading ends of the slide fastener stringers are improperly shaped or otherwise deformed. These two methods have been unsatisfactory in the mass-production of uniform separable slide fasteners.

5 According to a first aspect of the present invention there is provided a method of manufacturing separable slide fasteners from an elongate slide fastener chain composed of a pair of slide fastener stringers having rows of coupling elements alternating with respective, mutually confronting element-free portions having substantially U-shaped
10 recesses defined in inner edges thereof, said method comprising the steps of:

 (a) feeding said elongate slide fastener chain under tension along a longitudinal path;

 (b) separating said slide fastener stringers from each other;

15 (c) attaching an insertion pin laterally to the inner edges of a said element-free portion of one said stringer;

 (d) attaching a box pin laterally to the inner edge of a said mutually confronting element-free portion of the other said stringer;

20 (e) threading said insertion pin and said box pin which are laterally aligned with each other through a slider until certain coupling elements of the slide fastener stringers are interengaged; and

 (f) attaching a box to said box pin.

25 According to a second aspect of the present invention there is provided a method of manufacturing a chain of separable slide fasteners from an elongate slide fastener chain composed of a pair of slide fastener stringers having pairs of initially interengaged rows of coupling elements alternating with pairs of

element-free portions having substantially U-shaped recesses defined in inner edges thereof, said method comprising the steps of separating the initially interengaged rows of coupling elements at a first station, applying an insertion-pin and a box-pin to
5 one end of each pair of rows of coupling elements at a second station, attaching a slider to each pair of rows of coupling elements at a third station, and inserting the insertion-pin and the box-pin at the end of each pair of rows of coupling elements into a box and fixing the box-pin and box together at a fourth
10 station, the chain being fed to the first station, second station, third station and fourth station in that sequence so that the chain extends unbroken from the first station to the fourth station.

It is believed possible by means of the present invention to provide a method of manufacturing separable slide fasteners uniformly as either individual product units or as an elongate
15 product composed of such separable slide fasteners that are joined end to end.

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

20 Figure 1 is a fragmentary plan view showing the manner in which various separable slide fastener parts are successively attached to an elongate slide fastener chain in a method of automatically finishing separable slide fasteners in accordance with the present invention;

25 Figure 1A is a side elevational view of a slide fastener stringer which is twisted through an angle of 90°;

Figure 2 is a plan view of a separable slide fastener of a unit length;

Figure 3 is a schematic side elevational view of a system for carrying out an automatic finishing method in accordance with the present invention;

Figure 4 is a perspective view illustrative of the manner
5 in which an insertion pin is attached to a slide fastener stringer;

Figure 5 is a perspective view showing the manner in which a slider and a box pin are attached to

slide fastener stringers;

Figure 6 is a side elevational view showing the manner in which a locking prong is formed on a box;

Figure 7 is a fragmentary perspective view of
5 the slide fastener stringers as they are gripped and released by feed rollers;

Figure 8 is a fragmentary perspective view of the slide fastener stringers as they are advanced by a pusher; and

10 Figure 9 is a perspective view of an elongate piece of joined separable slide fasteners which is supplied from a roll and sewn to a garment.

As shown in Figure 1, an elongate slide fastener chain 10 to be finished into separable slide fasteners
15 according to a method of the present invention is composed of a pair of slide fastener stringers 11, 11 having intermeshing rows of coupling elements 12 alternating with mutually confronting element-free portions 13. Each of the element-free portions 13 is reinforced with a
20 stiffening web such as a ribbon-like fabric lined with an adhesive layer or a film of synthetic resin. The slide fastener stringers 11, 11 have substantially U-shaped recesses or slots 14 defined respectively centrally in the element-free portions 13 and opening
25 at inner confronting edges of the slide fastener stringers 11, 11.

Figure 3 shows a system for automatically

finishing separable slide fasteners. The system generally includes a pin applicator 15, a slider attachment device 16, and a box applicator 17 for automatically manufacturing an elongate product
5 composed of joined separable slide fasteners. The system also has a cutter 18 for cutting off the elongate product into a plurality of separable slide fasteners of individual lengths.

More specifically, the slide fastener chain 10
10 supplied from a roll (not shown) is separated by a separation roller 19 into the slide fastener stringers 11, 11 which are then tensioned by a tensioning roller 20. The tensioned slide fastener stringers 11 are independently twisted through an angle of 90° by guide
15 rollers 21, 22 into vertical positions so that the rows of coupling elements 12 are directed downwardly, and are guided into the pin applicator 15. As shown in Figure 4, the pin applicator 15 has an insertion-pin holder 23 vertically movably disposed below one of the
20 slide fastener stringers 11 for holding an insertion pin 24 fed through a feed chute 25. When one of the element-free portions 13 on said one slide fastener stringer 11 arrives at an attachment position directly above the insertion-pin holder 23, the slide fastener
25 stringer 11 is gripped by a stringer gripper 26 and the insertion-pin holder 23 is elevated toward the dot-and-dash-line position near the inner longitudinal edge of

the slide fastener stringer 11 across the element-free portion 13. The insertion pin 24 held by the insertion-pin holder 23 is fitted transversely over the inner edge of the element-free portion 13 and clinched thereon by the insertion-pin holder 23. The attached insertion pin 24 is substantially aligned with the row of coupling elements 12 and has one end 24a projecting slightly into the recess 14 as shown in Figure 1A. The pin applicator 15 also has a box-pin holder which is of the same structure as that of the insertion-pin holder 23. The box-pin holder is disposed below the other slide fastener stringer 11 for holding a box pin 27 (Figure 1) supplied down another feed chute. The box pin 27 is attached to the element-free portion 13 of the other slide fastener stringer 11 in the same manner as the insertion pin 24. The insertion pins 24 and the box pins 27 are therefore successively attached to the respective element-free portions 13 of the elongate slide fastener chain 10. Since the slide fastener stringers 11, 11 are tensioned by the tensioning roller 20, the insertion pins 24 and the box pins 27 can accurately be applied laterally to the element-free portions 13.

After the insertion pin 24 and the box pin 27 have been applied, the slide fastener stringers 11 are guided by guide rollers 28 and turned back to their horizontal positions by guide rollers 29. Then, the

slide fastener stringers 11 are tensioned by a
tensioning roller 30 and delivered into the slider
attachment device 16. As illustrated in Figure 5, the
slider attachment device 16 has a slider holder 31
5 vertically movably disposed below the path of slide
fastener stringers 11, 11 for supporting a slider 32
thereon. When the element-free portions 13 with the
insertion and box pins 24, 27 attached thereto reach a
slider attachment position immediately above the slider
10 holder 31, the slider holder 31 is moved upwardly
toward the doe-and-dash-line position for positioning
the slider 32 between the element-free portions 13, 13
of the slide fastener stringers 11, 11. The rows of
coupling elements 12 of the slide fastener stringers
15 11, 11 are guided along the grooves defined in a guide
plate (not shown) to thread the insertion and box pins
24, 27 that are laterally aligned with each other and
following coupling elements 12 into the Y-shaped guide
channel in the slider 32 through its throats until some
20 coupling elements 12 are interengaged. When the
leading ends of the insertion and box pins 24, 27 enter
the slider 32, the U-shaped recesses 14 prevent the
element-free portions 13 from being caught in the
slider 32. At the same time, the U-shaped recesses 14
25 allow the element-free portions 13 to flex to direct
the insertion and box pins 24, 27 smoothly into the
Y-shaped guide channel in the slider 32. Accordingly,

the pins 24, 27 can smoothly and easily be inserted into the slider 32. Thereafter, the slider 32 is released from the slider holder 31. Therefore, the slider 32 can then be fed with the slide fastener stringers 11.

The slide fastener stringers 11 are thereafter fed to the box attachment device 17. As illustrated in Figure 5, the box attachment device 17 has a box holder 33 vertically movably disposed below the path of slide fastener stringers 11, 11 for supporting a box 34 thereon. Upon arrival of the element-free portions 13 with the insertion and box pins 24, 27 attached thereto at a box attachment position immediately above the box holder 33, the box holder 33 is moved upwardly toward the dot-and-dash-line position for positioning the box 34 between the element-free portions 13, 13 of the slide fastener stringers 11, 11. As the slide fastener stringers 11, 11 are fed, the leading ends of the insertion and box pins 24, 27 are inserted into the box 34, at which time the insertion and box pins 24, 27 are laterally aligned with each other. Then, a vertically movable punch 35 disposed above the path of the stringers 11 substantially in vertical alignment with the box holder 33 is moved downwardly to engage the box 34. The punch 35 is lowered until a locking prong 36 is formed thereby on the box 34 and forced into biting engagement with the box pin 27, as shown in Figure 6.

The box 34 is now firmly anchored on the box pin 27. The recesses 14 prevent the element-free portions 13 from being entangled into the box 34 as it is secured to the box pin 27.

5 The slide fastener stringers 11, 11 are then fed via guide rollers 37 and a tensioning roller 38 into the cutter 18 which severs the slide fastener stringers 11, 11 along a line 39 (Figure 1) across the element-free portions 13. The cutter 18 is required for
10 cutting off the elongate slide fastener stringers 11, 11 into a plurality of separable slide fasteners. However, the cutter 18 may be dispensed with if an elongate separable slide fastener is to be desired.

As shown in Figures 7 and 8, the cutter 18
15 includes a lower cutter die 40 and an upper cutter blade 41 held substantially in vertical alignment with each other, the upper cutter blade 41 being vertically movable toward and away from the lower cutter die 40. The cutter 18 also has a pusher 42 disposed upstream of
20 the lower cutter die 40 and the upper cutter blade 41 along the path of the slide fastener stringers 11, 11. The pusher 42 is movable along the path of the slide fastener stringers 11, 11 for pushing the box 34 beyond the lower cutter die 40 and the upper cutter blade 41.
25 Downstream of the lower cutter die 40 and the upper cutter blade 41, there is positioned a pair of upper and lower feed rollers 43, 44, the upper feed roller 43.

being movable toward and away from the lower feed roller 44. When the element-free portions 13 reach a cutting position between the lower cutter die 40 and the upper cutter blade 41, the upper feed roller 43 is moved upwardly away from the lower feed roller 44 to release the slide fastener stringers 11, 11. The slide fastener stringers 11, 11 are now stopped and relieved of their longitudinal tension. Then, the upper cutter blade 41 is lowered to sever the element-free portions 13 along the straight line 39 on the lower cutter die 40, thereby producing a separable slide fastener 45 as shown in Figure 2. The produced separable slide fastener 45 is then discharged by the feed rollers 43, 44 coacting with each other. The pusher 42 is actuated to move the following slide fastener stringers 11, 11 toward the feed rollers 43, 44, which engage and feed the slide fastener stringers 11, 11 down the path thereof until the next element-free portions 13 arrive at the cutting position.

Where the cutter 18 is employed, a succession of independent separable slide fasteners 45 (Figure 2) can be produced. Where the cutter 18 is dispensed with, an elongate product 46 (Figure 9) of joined separable slide fasteners can be manufactured. The elongate product 46 may be wound around a bobbin 47 and put on the market. The purchaser who bought the elongate product 46 can sew it successively to garment fabrics

48 with two sewing machine needles 49, and then cut off the sewn product 46 into individual separable slide fasteners which have already been stitched to the garment fabrics 48. Alternatively, the elongate product 46 may be cut off into a desired number or length of separable slide fasteners upon customer's demand at a retail store. The elongate fastener product 46 as wound on the bobbin 37 can be more easily inventoried in factories and retail stores than the individual separable slide fasteners.

With the arrangement of the present invention, the various separable slide fastener parts such as insertion pins, box pins, sliders, and boxes can accurately be attached to slide fastener stringers. The method of the invention can easily be automated as a process of successive steps for producing an elongate product of joined separable slide fasteners.

The separation roller 19, the pin applicator 15, the slider attachment device 16 and the box attachment device 17 respectively form a first station, a second station, a third station and a fourth station in that sequence, the chain extending unbroken from the first station to the fourth station and to the cutter 18 (except of course at the beginning and end of the chain).



CLAIMS:-

1. A method of manufacturing separable slide fasteners from an elongate slide fastener chain composed of a pair of slide fastener stringers having rows of coupling elements alternating with respective, mutually confronting element-free portions having substantially U-shaped recesses defined in inner edges thereof, said method comprising the steps of:
 - (a) feeding said elongate slide fastener chain under tension along a longitudinal path;
 - (b) separating said slide fastener stringers from each other;
 - (c) attaching an insertion pin laterally to the inner edge of a said element-free portion of one said stringer;
 - (d) attaching a box pin laterally to the inner edge of a said mutually confronting element-free portion of the other said stringer;
 - (e) threading said insertion pin and said box pin which are laterally aligned with each other through a slider until certain coupling elements of the slide fastener stringers are interengaged; and
 - (f) attaching a box to said box pin.
2. A method according to claim 1, including the step of repeating said steps through to produce an elongate product of joined separable slide fasteners.
3. A method according to claim 2, including the step of cutting off said elongate product into a



plurality of individual separable slide fasteners.

4. A method according to claim 1, wherein the leading ends of said insertion and box pins are inserted into said box before the box is attached to said box pin.

5 5. A method according to claim 1, wherein said slide fastener stringers are twisted through an angle of substantially 90° in said longitudinal path while said insertion and box pins are attached to said inner edges of the element-free portions.

6. A method of manufacturing a chain of separable slide
10 fasteners from an elongate slide fastener chain composed of a pair of slide fastener stringers having pairs of initially interengaged rows of coupling elements alternating with pairs of element-free portions having substantially U-shaped recesses defined in inner edges thereof, said method comprising the steps
15 of separating the initially interengaged rows of coupling elements at a first station, applying an insertion-pin and a box-pin to one end of each pair of rows of coupling elements at a second station, attaching a slider to each pair of rows of coupling elements at a third station, and inserting the insertion-pin
20 and the box-pin at the end of each pair of rows of coupling elements into a box and fixing the box-pin and box together at a fourth station, the chain being fed to the first station, second station, third station, and fourth station in that sequence so that the chain extends unbroken from the first station to the fourth station.

25 7. A method according to claim 6, wherein each stringer is twisted through an angle between the first and second stations and untwisted again between the second and third stations.

8. A method according to claim 6 or 7, wherein the chain is tensioned between the first and second stations and between



the second and third stations and after the fourth station.

9. A method according to claim 6, 7 or 8, wherein the chain after leaving the fourth station is wound around a bobbin.

10. A method according to claim 6, 7 or 8, followed by
5 the step of severing the chain into individual separable slide fasteners.

11. A method of manufacturing separable slide fasteners substantially as described with reference to Figures 1 to 8 of the accompanying drawings.
