

METHOD OF AND APPARATUS FOR MANUFACTURING
A CONTINUOUS SLIDE FASTENER STRINGER CHAIN
WITH ELEMENT-FREE SPACE PORTIONS

The present invention relates generally to the production of slide fasteners, and more particularly to a method of and apparatus for manufacturing a continuous slide fastener stringer chain including
5 space portions devoid of coupling elements at longitudinal intervals.

According to a known method, a continuous slide fastener stringer chain having a pair of interengaged rows of continuous coupling elements sewn to a pair of continuous

slide fastener stringer tapes along respective inner longitudinal edges, respectively, is intermittently fed in a longitudinal direction, and while the stringer chain is at rest, segments of coupling elements are cut off and removed to provide element-free space portions in the stringer chain at longitudinal intervals. With the known method, it has been observed that lines of stitching become slack at portions extending longitudinally across the element-free space portions with the result that endmost coupling elements, located next to the element-free space portions, are liable to be displaced. Such positionally unstable, endmost coupling elements hinder sliders from sliding thereover.

In another known method, a row of continuous coupling elements is intermittently supplied over one longitudinal edge of a continuous slide fastener stringer tape which is continuously fed to the sewing area of a sewing machine. The row of continuous coupling elements, while at rest, is severed into pieces of coupling elements to thereby produce element-free space portions between every adjacent pair of the pieces of coupling elements. Then the stringer tape is paired with a companion stringer tape into a continuous slide fastener stringer chain. The rows of coupling elements of severed length tend to be deformed or irregular in pitch under the influence of forces exerted thereon while they are fed before being coupled together,

resulting in mismeshing of the coupling elements, particularly those coupling elements which are located next to the element-free space portions.

5 It is believed possible by means of the present invention to provide a method and apparatus which can manufacture a continuous slide fastener stringer chain including space portions devoid of coupling elements at longitudinal intervals, substantially at a single working station.

10 It is believed possible by means of the present invention to provide a method of an apparatus for manufacturing a continuous slide fastener stringer chain including space portions devoid of coupling elements at longitudinal interval, in which endmost
15 coupling elements adjacent to the space portions are fixed in position for allowing sliders to slide smoothly thereover.

It is believed possible by means of the present invention to provide a method of and apparatus for
20 manufacturing a continuous slide fastener stringer chain, in which coupling elements are sewn to a pair of continuous slide fastener stringers along inner longitudinal edges, respectively, with uniform coupling element pitch.

25 It is believed possible by means of the present invention to provide a method and apparatus which can manufacture a continuous slide fastener stringer chain without causing mismeshing of coupling elements.

According to a first aspect of the invention,

there is provided a method of manufacturing a continuous slide fastener stringer chain including space portions devoid of coupling elements at longitudinal intervals, the method comprising the steps of:

- 5 (a) continuously feeding a pair of continuous slide fastener stringer tapes along a first longitudinal path to a sewing area of a sewing machine;
- (b) continuously driving said sewing machine;
- (c) intermittently feeding a pair of inter-engaged rows
10 of continuous coupling elements along a second longitudinal path towards said sewing area so that they come to be held on and sewn to respective inner longitudinal edges of the pair of stringer tapes, said coupling elements while being so fed moving in synchronism with
15 the tapes; and
- (d) intermittently stopping the feeding of the coupling elements towards said sewing area and cutting off a length thereof.

According to a second aspect of the invention,
20 there is provided an apparatus for manufacturing a continuous slide fastener stringer chain including space portions devoid of coupling elements at longitudinal intervals, the apparatus comprising: a sewing machine drivable to sew a pair of interengaged rows of continuous
25 coupling elements to a pair of continuous slide fastener stringer tapes along respective inner longitudinal edges, respectively; means for continuously feeding said pair of continuous slide fastener stringer tapes, in

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synchronism with said sewing machine, to a sewing area of said sewing machine along a first longitudinal path; and means for intermittently feeding said pair of interengaged rows of continuous coupling elements, in synchronism (during each feed) with said sewing machine, to said sewing area along a second longitudinal path, and for cutting off a length of coupling elements from said pair of interengaged rows of continuous coupling elements each time the latter stops moving.

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

Figure 1 is a fragmentary plan view of a continuous slide fastener stringer chain of the present invention;

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Figure 2 is an enlarged front elevational view of a portion of the slide fastener stringer chain shown in Figure 1;

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Figure 3 is a fragmentary front elevational view, partly in cross section, of an apparatus embodying the present invention;

Figure 4 is a fragmentary plan view of the apparatus shown in Figure 3, the apparatus being partly omitted for clarification;

Figure 5 is an enlarged fragmentary plan view of a coupling element feeding unit of the apparatus shown in Figure 3, a toothed wheel of the feeding unit being omitted for clarification except several teeth thereof;

5 Figure 6 is a longitudinal cross-sectional view of the feeding unit shown in Figure 5, a peripheral portion of the toothed wheel being shown;

Figure 7 is a fragmentary transverse cross-sectional view taken along the line VII - VII of Figure 5;

10 Figure 8 is a front elevational view, partly in cross section, of a combined cutting and feeding unit of the apparatus shown in Figure 3, parts of the unit being in a cutting position;

Figure 9 is an enlarged, fragmentary transverse cross-sectional view of a sewing station of a sewing machine of the apparatus shown in Figure 3; and

Figure 10 is a fragmentary front elevational view showing a modification of the apparatus.

As shown in Figures 1 and 2, a continuous slide fastener stringer chain 11 comprises
20 a pair of continuous slide fastener stringer tapes 12, 13 and a series of longitudinally spaced pairs of interengaged rows of coupling elements 14 of individual slide fastener length secured to the stringer tapes 12, 13 on and along
25 respective doubled, inner longitudinal edges as by a pair of lines of stitching 15, 15, there being space portions 16 devoid of coupling elements in the slide fastener stringer chain 10 at longitudinal intervals. As clearly shown in

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Figure 2, the line of stitching 15 tightly stitches the stringer tape 13 longitudinally across the space portions 16 (only one shown). With this arrangement, even endmost coupling elements 14E (Figure 2) adjacent to the space portion 16 are fixed in position and remain substantially the same shape and pitch as the other continuous coupling elements 14, allowing a slider (not shown) to slide smoothly over the endmost coupling elements 14E.

As shown in Figure 3 and 4, an apparatus 20 for manufacturing the slide fastener stringer chain 11 with the element-free space portions 16, generally comprises a sewing machine or mechanism 21, feed means 22 for continuously feeding the pair of continuous slide fastener stringer tapes 12,13 to a sewing area or station 23, a combined feeding and cutting unit 24 for intermittently feeding a pair of interengaged rows of continuous coupling elements 14' to the sewing area 23, and for cutting off a length of coupling elements 14 from the continuous coupling elements 14', and withdrawal means 25 for withdrawing the stringer tapes 12,13 from the sewing area 22.

The sewing machine 21 is a conventional two needle sewing machine and comprises a pair of needles 26,26 adapted to be driven to sew the interengaged rows of coupling elements 14 to the stringer tapes 12,13 along respective inner longitudinal edges, respectively. The sewing machine 21 includes a table 27 having a guide groove 28 (Figure 9) extending longitudinally therethrough across the sewing area 23 for the passage therethrough of the

coupling elements 14, and a guide plate 29 mounted on the table 27 and having a pair of needle holes 30,30 for the passage therethrough of the respective needles 26,26. The guide plate 29 further has a recess 31 (Figure 9) for the
5 passage therethrough of the stringer tapes 12,13.

The stringer tape feeding means 22 comprises a co-operating pair of drive and driven rollers 32,33 disposed upstream of the sewing machine 21. The drive roller 32 is rotatable in synchronism with the sewing machine 21 so as
10 to continuously feed the stringer tapes 12,13 to the sewing area 23 of the sewing machine 21 along a first longitudinal path 34; the path 34 being inclined with respect to the plane of the table 27.

The stringer tape withdrawal means 25 comprises an
15 adjustable drive roller 35 held in driving contact with a fixed, driven roller 36; the rollers 35,36 being disposed downstream of the sewing machine 21. The drive roller 35 is driven by a suitable driving means (not shown) to rotate in synchronism with the sewing machine 21 for continuously
20 withdrawing the stringer tapes 12,13 from the sewing area 23 of the sewing machine 21.

The combined intermittently feeding and cutting unit 24 comprises a pair of spaced stationary guide members 37,38 disposed upstream of the sewing machine 21 and having
25 respective guide grooves 39,40 extending in alignment with the guide groove 28 (Figure 9) in the table 27 of the sewing machine 21, for the passage therethrough of the interengaged rows of coupling elements 14'. Disposed

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between the stationary guide members 37,38 is a guide lever 41 pivotably supported by a pivot pin 42 substantially at the center thereof and having a longitudinal guide channel 43 for the passage therethrough of the interengaged rows of coupling elements 14'. The guide lever 41 has a slot 44 opening to the guide channel 43 for the purpose described below.

A fixed, rotatable toothed member or wheel 46 is disposed above the guide lever 41 adjacent to the slot 44 thereof. The wheel 46 has a pair of rows of teeth or projections 47 arranged around the periphery thereof at equal intervals. Each tooth or projection 47 has a dimension enough to project into a space between every adjacent pair of coupling elements 14'. The guide lever 41 is connected at one end to a solenoid 45 via a link 58 and has a step 48 at the opposite end thereof. The guide lever 41 is normally held in a first or horizontal position of Figure 3 in which the periphery and projections 47 of the wheel 46 extend through the slot 44 and into the guide channel 43 of the guide lever 41 so as to engage with and move the interengaged rows of coupling elements 14' along a second longitudinal path 56 upon rotation of the wheel 46, as best shown in Figure 5 and 6. As shown in Figure 4, the toothed wheel 46 is driven in synchronism with the drive roller 35 of the withdrawal means 25 by means of a belt 56 which is trained around pulleys 54,55 connected respectively to drive shafts of the wheel 46 and the drive roller 35.

The combined feeding and cutting unit 24 further comprises a movable cutter 50 disposed between the guide lever 41 and the stationary guide member 37. The movable cutter 50 is slidably received in a slot 49 extending in
5 the stationary guide member 37 transversely across the guide groove 39 and it is urged against the stepped end portion 48 of the guide lever 41, by a spring 51 acting between the cutter 50 and the guide member 37. The movable cutter 50 has a transverse slot 59 extending in alignment
10 with the guide grooves 39, 40 of the stationary guide members 37, 38 and the guide channel 43 of the guide lever 41 when the guide lever 41 is held in the position of Figure 3. The stationary guide member 37 has a die surface 52 extending transversely across the guide groove 39 for guid-
15 ing the movable cutter 50 as the latter is moved upwardly along the die surface 52 across the longitudinal path 56 to cut the coupling elements 14', in response to the pivotal movement of the guide lever 41 toward a second or tilted position of Figure 8 in which the guide lever 41 is
20 held out of engagement with the toothed wheel 46.

In operation, the slide fastener stringer tapes 12, 13 are introduced into recess 31 in the sewing area 23 of the sewing machine 21 along the path 34, and the inter-engaged rows of coupling elements 14' are also introduced
25 into the groove 28 in the sewing area 23 along the path 56 through the guide groove 40, through the guide channel 43, through the slot 59 and through the guide groove 39. In the sewing area 23, the coupling elements rows 14' and the



stringer tapes 12,13 are set in a position of Figure 9 where the former 14' are held on doubled, inner longitudinal edges of the latter.

Then the sewing machine 21 is driven to continuously
5 sew the rows of coupling elements 14' to the stringer tapes 12,13 along respective longitudinal edges at a predetermined speed of sewing. Simultaneously therewith, the drive
rollers 32,35 and the toothed wheel 46 are driven to rotate
in the clockwise direction in Figure 3 in synchronism with
10 the sewing machine 21 so that the coupling elements 14' and the stringer tapes 12,13 are fed to the sewing area 23 at the same speed as the speed of the sewing and the stringer tapes 12,13 with the coupling elements 14' sewn thereto are
withdrawn from the sewing area 23 at the same speed as the
15 speed of sewing. When a predetermined length of coupling elements 14' are fed to the sewing area 23, the solenoid 45 is energized to actuate the guide lever 41 to pivotally
move from the first, horizontal position of Figure 3 to the second, tilted position of Figure 8. Upon pivotal movement
20 of the lever 41, the rows of coupling elements 14' are brought out of engagement with the projections 47 of the toothed wheel 46 and hence the feed of the coupling elements 14' is stopped. At the same time, the movable cutter
50 slidably moves upwardly along the die surface 52 across
25 the rows of coupling elements 14' in the path 56 to cut off a length of coupling elements 14. With continued sewing of the sewing machine 21, the length of coupling elements 14 are introduced into the sewing area 23 and sewn to the

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stringer tapes 12,13 which are continuously fed to the sewing area 23 by the tape feed means 22. Upon lapsing of a predetermined interval of time, the solenoid 45 is de-energized to pivotally move or return the guide lever 41 from the tilted position of Figure 8 to the horizontal position of Figure 3. Upon pivotal movement of the guide lever 41, the rows of coupling elements 14' in the guide channel 43 are again brought into engagement with the projection 47 of the rotating toothed wheel 46 for being fed a predetermined distance to the sewing area 23. The foregoing cycle of operation is repeated to thereby produce the continuous slide fastener stringer chain 11 with element-free space portions 16 at longitudinal intervals, shown in Figure 1 and 2.

15 The combined feeding and cutting unit 24 described above may be replaced with a modified unit 60 shown in Figure 10. The unit 60 is substantially identical in construction and function to the unit 24 and hence is identified by the same reference numerals but simply with
20 ", " for similar part thereof. According to the embodiment, a guide lever 61 has on its one end an integral cutting edge 62 slidable along an arcuate die surface 64 on a stationary guide member 62 for cutting off a length of coupling elements 14, in response to the pivotal movement
25 of the guide lever 61.

With the method and apparatus of the present invention, the rows of coupling elements 14' fed and cut in interengaged fashion are resistant to deformation and

remain an uniform element pitch, and the endmost coupling elements 14E adjacent element-free space positions 16 are fixed in position by the lines of stitching 15 extending tightly over the coupling element rows 14 longitudinally across the space portions 16 with the result that the sliders can be mounted smoothly on the rows of coupling elements 14 over the endmost coupling elements 14E.

We make no claim herein to apparatus as claimed in any claim of our co-pending patent application No. 8217304 (Serial No. 2 012 493) to which reference is directed.



Claims

1. A method of manufacturing a continuous slide fastener stringer chain including space portions devoid of coupling elements at longitudinal intervals, the method comprising the steps of:

- 5 (a) continuously feeding a pair of continuous slide fastener stringer tapes along a first longitudinal path to a sewing area of a sewing machine;
- (b) continuously driving said sewing machine;
- (c) intermittently feeding a pair of inter-engaged rows of continuous coupling elements along a second longitudinal path towards said sewing area so that they come to be held on and sewn to respective inner longitudinal edges of the pair of stringer tapes, said coupling elements while being so fed moving in synchronism with the tapes;
- 10 and
- (d) intermittently stopping the feeding of the coupling elements towards said sewing area and cutting off a length thereof.
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2. A method according to claim 1, further comprising the step of continuous withdrawing said pair of continuous slide fastener stringer tapes from said sewing area in synchronism with said sewing machine.

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3. An apparatus for manufacturing a continuous slide fastener stringer chain including space portions devoid of coupling elements at longitudinal intervals, the apparatus comprising:

25 (a) a sewing machine drivable to sew a pair of inter-



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engaged rows of continuous coupling elements to a pair of continuous slide fastener stringer tapes along respective inner longitudinal edges, respectively;

(b) means for continuously feeding said pair of

5 continuous slide fastener stringer tapes, in synchronism with said sewing machine, to a sewing area of said sewing machine along a first longitudinal path; and

(c) means for intermittently feeding said pair of
10 interengaged rows of continuous coupling elements, in synchronism (during each feed) with said sewing machine, to said sewing area along a second longitudinal path, and for cutting off a length of coupling elements from said pair of interengaged rows of continuous coupling elements each time the latter stops moving.

15 4. An apparatus according to claim 3, including means for continuously withdrawing said pair of continuous slide fastener stringer tapes from said sewing area in synchronism with said sewing machine.

20 5. An apparatus according to claim 3, said intermittently feeding and cutting means comprising a wheel rotatable in synchronism with said sewing machine and having on its periphery means for engaging and feeding said pair of interengaged rows of coupling elements, a pivotable lever having a longitudinal guide channel
25 for the passage therethrough of said pair of interengaged rows of coupling elements and normally held in a first position where said engaging and feeding means partly project into said guide channel, said pivotable lever



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being pivotable movable from said first position to a second position where said engaging and feeding means are out of said guide channel, and a movable cutter disposed between said sewing area and said wheel and
5 movable transversely across said second longitudinal path as a result of or in response to the pivotal movement of said pivotable lever toward said second position.

6. An apparatus according to claim 5, including
10 a pair of stationary guide member disposed one on each side of said pivotable lever and having respective guide grooves for the passage through of said pair of interengaged rows of coupling elements, said guide channel of said pivotable lever extending in alignment
15 with said guide grooves while said pivotable lever is held in said first position.

7. An apparatus according to claim 6, said movable cutter being located between said pivotable lever and one

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of said stationary guide members, said pivotal lever having portions held in engagement with said movable cutter.

8. An apparatus according to claim 7, said one stationary guide member having a die surface extending transversely across said second longitudinal path, said movable cutter sliding over said die surface in response to the pivotal movement of said movable lever toward said second position.

9. An apparatus according to claim 6, said movable cutter being integral with one end of said pivotable lever, one of said stationary guide members having a die surface extending transversely across said second longitudinal path, said movable cutter sliding over said die surface in response to the pivotal movement of said movable lever toward said second position.

10. An apparatus according to claim 9, said die surface extending arcuately across said guide groove in said one stationary guide member.

11. An apparatus according to claim 5, including means for actuating said pivotable lever to pivotally move between said first and second positions.

12. An apparatus according to claim 11, said actuating means comprising a solenoid connected to said pivotable lever.

13. An apparatus according to claim 5, said engaging and feeding means comprising at least one row of projections projecting into spaces between every adjacent pair of coupling elements of each said row of coupling elements.