

METHOD AND APPARATUS FOR MANUFACTURING
WOVEN SLIDE FASTENER STRINGER

This invention relates to a method and apparatus for manufacturing a woven slide fastener stringer having synthetic resin fastener elements in the form of a continuous spiral. A believed possibility of the invention is to provide a method wherein the operation of weaving and securing a synthetic resin monofilament along a side edge of a fastener tape at the same time that the fastener tape is woven and while the monofilament is being formed into fastener elements is capable of being implemented at high speed without being adversely influenced by interference between monofilament hook means and a warp bunch. Another believed possibility of the invention is to provide an apparatus having a simple mechanism for practicing the foregoing method.

With the known conventional method and apparatus of the foregoing type, a synthetic resin monofilament is wound around a mandrel by using a rotor, or is wound around a flexible mandrel by deforming and driving the mandrel, thereby forming the monofilament into a spirally shaped row of fastener elements. During the forming process, the monofilament is fed into a fell.

This well-known arrangement requires such elements as a rotor, mandrel and mandrel support assembly and, hence, is mechanically complex. The arrangement is therefore disadvantageous in that adjustment, maintenance and supervision are difficult to perform.

As disclosed in, e.g. the specification of Japanese Patent Application Laid-Open No. 9343/74, there has been proposed a method and apparatus for weaving and securing a spiral fastener element row on a fastener tape while the fastener element row is formed from a synthetic resin monofilament which is supplied as a warp, this being performed without relying upon a rotor, mandrel or the like. However, with the means disclosed in this laid-open specification, the hooked end portion of a latch element traverses the warp rows with seizing the monofilament to perform the movements needed to form the fastener elements. When the latch element is moved at high speed, therefore, there is the danger that the hooked end portion thereof will snag a warp bunch other than monofilament undergoing shedding motion. Reducing the size of the hooked portion to lessen the possibility of snagging the warp bunch is disadvantageous in that the synthetic resin monofilament may not be seized.

It is believed possible by means of the present invention to provide a method and apparatus which enable formation of fastener elements with positive seizing of

a monofilament and high-speed movement without requiring a rotor, mandrel or the like, and without giving rise to any interference with a warp bunch undergoing shedding motion.

According to a first aspect of the present invention there is provided a method of manufacturing a slide fastener stringer wherein a synthetic resin monofilament for forming fastener elements is formed into spiral shaped fastener elements near a fell of a fastener tape and is woven and secured to a side edge of the fastener tape at the same time that the fastener tape is woven of the warp bunches and fillings inserted through the warp bunches, characterized by advancing said synthetic resin monofilament toward a hook on one side of the warp bunches from the other side thereof, engaging the monofilament on the hook at the advanced position, and thereafter guiding the monofilament into the fell via said one side of the warp bunches and forming the monofilament into a loop shaped fastener element, wherein said synthetic resin monofilament is advanced toward said hook by a carrier having at a distal end thereof an eye through which said monofilament is passed, said monofilament is formed into said loop shaped fastener element upon the beating action of a front reed which guides said warp bunches, and said monofilament is formed into said loop shaped fastener element by striking said monofilament by a forming plate secured to said front reed while

said monofilament is engaged on said hook.

According to a second aspect of the present invention there is provided an apparatus for manufacturing a slide fastener stringer comprising a loom equipped with a front reed for guiding the warp bunches and a first carrier for inserting a filling, characterized in that a swinging arm having a hook for engaging a monofilament for forming fastener elements is disposed on one side of the warp bunches, the swinging range of said swinging arm being a region which is at a side of the warp bunches between two defined positions, namely a first position at which the hook is situated at one side of a fell, and a second position at which the hook is situated on one side of the warp bunches and remote from the fell, and in that there is disposed on the other side of the warp bunches in said loom a second carrier through which said synthetic resin monofilament for forming fastener elements is passed, wherein when the hook occupies said second position, said second carrier goes across the warp bunches and advances said monofilament to a position where said monofilament engages said hook, wherein said second carrier includes a guide hole at a distal end thereof through which said monofilament is passed, and said front reed includes a forming plate secured thereto for deforming said monofilament engaged by said hook into said fastener element.

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

Fig. 1 is simplified perspective view showing only a principal portion of an apparatus embodying the present invention, wherein a swinging arm occupies a second position;

Fig. 2 is a simplified perspective view similar to Fig. 1, wherein the swinging arm occupies a first position.

Fig. 3 is an enlarged perspective view showing only a full portion illustrated in Fig. 1;

Fig. 4 is a perspective view showing the positional relationship between the monofilament, hook, forming plate and support plate immediately prior to forming of a fastener element;

Fig. 5 is a perspective view similar to that of Fig. 4 but shows the conditions existing when a fastener element is formed;

Fig. 6 is a partial plan view showing the positional relationship between a front reed, hook, stringer guide and forming plate when a fastener element is formed;

Fig. 7 is a partial side view, illustrating the above-mentioned positional relationship, with a portion thereof being shown in section;

Fig. 8 is an enlarged plan view showing an example of a slide fastener stringer produced in accordance with the present invention.

As shown in Figs. 1, 2 and 3, the arrangement is such that a shedding apparatus, not shown, forms warp bunches 1, 2, 3 into an upper shed 6 through which a first carrier 5 for introducing a filling 4 undergoes weaving motion, and a lower shed 9 through which a second carrier 8 moves back and forth for advancing a monofilament 7 made of synthetic resin. A front reed 10 for guiding the warp bunches 1, 2, 3 is disposed so as to advance and retreat toward a fell 11. The foregoing structure is similar to that of a well-known ribbon loom. Provided on the outer side of the trajectory of the front reed 10, namely on one side of the warp bunches 1, 2, 3 is a swinging arm 13 having a hook 12 on its upper end for hooking and holding the monofilament 7. The swinging arm 13 is so arranged as to be able to be capable of swinging about a shaft, not shown, in a direction similar to that in which the front reed 10 is moved, as illustrated by the arrow.

As shown in Fig. 3, the upper end of the swinging arm 13 is pyramidal in shape, as defined by inclined surfaces 15, 16, 17. The upper end is formed to include the hook 12, having substantially the shape of a square pillar formed by bending the upper end toward the fell 11 and extending parallel to the warp bunches.

The range over which the swinging arm 13 is capable of swinging is defined by a region outside the warp



rows, which region lies between a first position A, at which the hook 12 is situated at one side of the fell 11, as shown in Figs. 2 and 3, and a second position B, at which the hook 12 is situated outside the warp bunches 1, 2, 3 and remote from the fell 11, as shown in Fig. 1.

As shown in the drawings, the second carrier 8 has a distal end 18 provided with a guide hole 8a through which the monofilament 7 is passed. When the hook 12 is at the second position B, the second carrier 8 is advanced across the warp bunches through the lower shed 9 from the direction opposite the hook 12 to push the monofilament 7 out to one side of the warp bunches 1, 2, 3 between the fell 11 and front reed 10 so as to move the monofilament beyond the inclined surfaces 16, 17 of the swinging arm 13. Thus, as shown in Fig. 1, the monofilament 7 is guided to the outer side of the hook 12 and advanced to a position where it may be engaged by the hook.

As shown in Figs. 3 through 7, a forming plate 9 is secured to one side of the front reed 10, namely to the side facing the hook 12. The forming plate 19 is secured to a holder portion 20 of the front reed 10 by suitable mounting means 21 so as to be positionally adjustable back and forth. The forming plate 19 reinforces the front reed 10 and has a leading edge 22,

which is substantially flush with the leading edge of the front reed 10, for cooperating with the hook 12 to form a fastener element 23 when a beating operation is performed by the front reed, as will be set forth below.

As shown in Figs. 6 and 7, a stringer guide 24 is provided downstream of the fell 11 of the fastener stringer for guiding a fastener stringer formed by the apparatus. The stringer guide 24 includes tape guide portion 25 and a fastener element guide portion 26. (A chain guide cover plate is not shown.) As shown in Figs. 4 through 7, a support plate 27, which is oriented substantially at right angles to the direction in which the fastener stringer is guided, is secured by suitable means 28 to the upstream end of the stringer guide 24 on a portion 24a thereof, located on the same side as the hook 12. As will be described later, the support plate 27 supports a fastener element head portion to enable smooth forming of the fastener element when the element 23 is formed from the monofilament 27 by the hook 12 and forming plate 19. (In Figs. 4 and 5, a portion of the stringer guide 24 is deleted from the drawings).

Described next will be the operation of the apparatus having the foregoing construction, as well as the method of its operation.

The warp bunches 1, 2, 3 passed through the front

reed 10 are put through a shedding motion by a shedding apparatus, not shown, so as to form the upper shed 6 and lower shed 9. On the other hand, the monofilament 7, which has been passed through the guide hole 8a at the distal end of the second carrier 8, is disposed on the side opposite the hook with respect to the fastener tape at a height which is approximately equivalent to the midpoint of the lower shed 9.

At the beginning of the first cycle of the method, the second carrier 8 is advanced through the lower shed 9 from the side opposite the hook 12 with respect to the fastener tape. With the monofilament 7 still penetrating the distal end 18 thereof, the second carrier is advanced to the side of the hook 12, thereby carrying the monofilament 7 beyond the inclined faces 16, 17 at the upper end of the swinging arm 13 so that the monofilament is guided to a point outside the hook 12.

At the same time, the first carrier 5 is advanced through the upper shed 6 to insert a filling 4 which is seized by a latch needle 29. Thereafter, the first and second carriers 5, 8 are retracted.

This is followed by swinging the swinging arm 13 toward the first position and, at the same time, by advancing the front reed 10 toward the fell 11.

Owing to these operations, namely the swinging motion of the swinging arm 13 and the beating action of the front reed 10, the monofilament 7 is engaged by the hook 12 and, as shown in Figs. 4, 5 and 6, a linear portion of the monofilament 7 for forming a fastener element is struck from the horizontal attitude shown in Fig. 4 to the vertical attitude shown in Fig. 5, thereby deforming the monofilament in such a manner that the upper and lower legs of the fastener element are overlapped vertically while the fastener element head 30 is supported by the support plate 27. Thus, as shown in Fig. 3, the monofilament is shaped into a loop thereby to form the fastener element 23.

Upon completion of the beating operation, the swinging arm 13 is left in position, namely in the position shown in Figs. 2 and 3, the front reed 10 is retracted and, at the same time, the sheds of the warp bunches 1, 2, 3 are changed.

Specifically, the positions of the warp bunches 1 and 3 are interchanged, and the warp bunch 2 is moved to the position of the warp bunch 1. Next, a filling is inserted by the first carrier 5, the front reed 10 is advanced again to beat in the filling, the front reed 10 and swinging arm 13 are subsequently retracted, and the sheds of the warp bunches, 1, 2, 3 are returned to the state shown in Fig. 1. This ends one operating cycle of

the present invention.

As a result of the foregoing operations, the fastener tape 31 and fastener element 23 are united and secured as shown in Fig. 3.

With the method and apparatus as set forth above, the swinging arm 13 for engaging the synthetic resin monofilament 7 and for forming the monofilament into a fastener element is moved solely through a region at the side of the warp bunches 1, 2, 3 which undergo shedding motion. Accordingly high-speed operation is possible as there is absolutely no interference between the hook 12 of the swinging arm 13 and the warp bunches 1, 2, 3 undergoing shedding motion.

Furthermore, the second carrier 8, which supplies the monofilament 7 from one side of the fastener tape to the side of the hook 12, always has the monofilament 7 passed through the guide hole 8a at the distal end thereof, so that there is no possibility of the monofilament slipping off the carrier. As a result, the monofilament 7 may be supplied reliably and engaged by the hook 12 reliably.

In the illustrated embodiment, the monofilament 7 slides on the inclined faces 16, 17 at the upper end of the swinging arm 13 as it is carried beyond the swinging

arm by the advancing second carrier 8. With such an arrangement, there is some danger of the monofilament 7 being damaged. Damage to the monofilament 7 may be prevented by adopting an arrangement in which the swinging arm 13 initially is in a lowered attitude from which the arm is raised at the instant that the monofilament 7 is thrust out by the second carrier 8, at which point the monofilament is captured by the swinging arm.

In addition, through the swinging arm 13 is designed to give the optimum mechanical and functional effects by swinging between the first and second positions, other forms of motion may be adopted.

Further, the monofilament 7 employed in the illustrated embodiment has interlocking head portions formed thereon in advance. However, it is possible to use a monofilament in the shape of a simple, round wire to avoid resistance when the monofilament is passed through the guide hole 8a at the distal end of the second carrier 8 and form the interlocking head after the monofilament is secured to the fastener tape at the opening for weaving.

One example of a slide fastener stringer obtained by the above-described method and apparatus is illustrated in Fig. 8.

In the illustrated example, the row of fastener elements 23 has the form of a continuous spiral. The length L of each fastener element 23 is decided by which of the reed marks formed by the front reed 10 are passed by the warp bunch 3.

Though a filling 32 is inserted two times with double picks by the first carrier for each pitch of the fastener elements 23, it is permissible to insert the filling only one time if the stability of the secured fastener elements allows.

Upper and lower threads 35, 36, under greater tension than the other warps and having a larger diameter, are disposed across the outer surfaces of the upper and lower legs 33, 34 of the fastener elements 23, respectively, thereby assuming the stability of the fastener element pitch.



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CLAIMS:-

1. A method of manufacturing a slide fastener stringer wherein a synthetic resin monofilament for forming fastener elements is formed into spiral shaped fastener elements near a fell of a fastener tape and is woven and secured to a side edge of the fastener tape at the same time that the fastener tape is woven of the warp bunches and fillings inserted through the warp bunches, characterized by advancing said synthetic resin monofilament toward a hook on one side of the warp bunches from the other side thereof, engaging the monofilament on the hook at the advanced position, and thereafter guiding the monofilament into the fell via said one side of the warp bunches and forming the monofilament into a loop shaped fastener element, wherein said synthetic resin monofilament is advanced toward said hook by a carrier having at a distal end thereof an eye through which said monofilament is passed, said monofilament is formed into said loop shaped fastener element upon the beating action of a front reed which guides said warp bunches, and said monofilament is formed into said loop shaped fastener element by striking said monofilament by a forming plate secured to said front reed while said monofilament is engaged on said hook.

2. A method as set forth in claim 1, wherein said monofilament is deformed by said forming plate in such a



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manner that upper and lower leg portions of the fastener element are overlapped vertically.

3. A method as set forth in claim 2, wherein said upper and lower leg portions of said fastener element are overlapped while supporting the fastener element head portion by a support plate.

4. An apparatus for manufacturing a slide fastener stringer comprising a loom equipped with a front reed for guiding the warp bunches and a first carrier for inserting a filling, characterized in that a swinging arm having a hook for engaging a monofilament for forming fastener elements is disposed on one side of the warp bunches, the swinging range of said swinging arm being a region which is at a side of the warp bunches between two defined positions, namely a first position at which the hook is situated at one side of a fell, and a second position at which the hook is situated on one side of the warp bunches and remote from the fell, and in that there is disposed on the other side of the warp bunches in said loom a second carrier through which said synthetic resin monofilament for forming fastener elements is passed, wherein when the hook occupies said second position, said second carrier goes across the warp bunches and advances said monofilament to a position where said monofilament engages said hook, wherein said second carrier includes a guide hole at a



(23)

distal end thereof through which said monofilament is passed, and said front reed includes a forming plate secured thereto for deforming said monofilament engaged by said hook into said fastener element.

5. An apparatus as set forth in claim 4, wherein said apparatus further includes a stringer guide at the downstream of said fell for guiding the fastener stringer formed by said apparatus.

6. An apparatus as set forth in claim 5, wherein said stringer guide includes a support plate at the upstream end thereof for supporting a fastener element head portion when said monofilament is deformed into said fastener element.

7. An apparatus as set forth in claim 6, wherein said support plate is oriented substantially at right angles to the direction in which said fastener stringer is guided.

8. An apparatus as set forth in any one of claims 4 to 7, wherein said swinging arm is pyramidal in shape defined by inclined surfaces.

9. An apparatus as set forth in claim 8, wherein said hook is formed at the upper end of said swinging arm and has substantially the shape of a square pillar extending in parallel to the warp bunches.

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10. A method of manufacturing a slide fastener stringer substantially as described with reference to the accompanying drawings.

11. An apparatus substantially as described with reference to and as illustrated in the accompanying drawings.
