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- (72) Inventors FRIEDRICH GLINDMEYER,
WILHELM FRIEDRICH HENNENBERG and
KARL LIMPENS



(54) METHOD AND APPARATUS FOR PRODUCING A SLIDE FASTENER STRINGER TAPE

- (71) We, WILLIAM PRYM-WERKE KG., a German Company of 5—7 Zweifallar Strasse, 5190 Stolberg, Rheinland, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 This invention relates to a method of producing a slide fastener stringer tape and apparatus for carrying out the method.
- 15 According to the present invention in one aspect there is provided a method of producing a woven slide fastener stringer tape, in which a fastener element is advanced substantially in the direction of the warp and forms the individual links of a row of fastener elements by being wound around a fixed axis and moved around and along a generated conical path surrounding said axis, some of the warp threads being brought up to partially cover the row of fastener elements, while the weft thread is picked transversely through said generated conical path and between the shed warp threads and is then beaten up onto the finished fabric of the tape, said warp threads which move along the conical zone of the generated conical path described by the fastener element engaging the upper and lower links of the row of fastener elements, and said warp threads, while the fastener element is being moved along the generated conical path being kept at a distance outside the generated conical path, but at intervals in the weaving before the weft thread is picked transversely through the generated conical path are moved to the opposite side of the picking plane of the weft thread.
- 20 is advanced in the warp direction, it is possible to obtain a high weaving speed with only one device for inserting the weft thread of the tape, and the warp threads advanced on one side of the generated conical path around which the fastener element passes only extend over the zone of the limb portions of the fastener elements which connect the loop portions of the fastener elements carrying the actual coupling surfaces of the slide fastener with rear arcuate portions of the fastener elements. In this way the rear arcuate portions of the fastener elements are free from any part of the woven fabric so that the fastener slider can be moved in the required smooth manner. Even when a short slider is used on the finished slide fastener tape produced by the method of the invention, smooth running of the slider is achieved especially as the aforementioned method of applying the warp threads results in the row of fastener elements being offset from the plane of the fabric of the tape and thus in the provision of a particularly large bearing surface for the fastener slider. Because of the absence of threads of the weave in the zone of the rear arcuate portions of the fastener elements, the resultant row of elements is not unnecessarily thickened in excess of the width necessary for forming the turns, so that no troublesome width thickened edge is created, and the strength of the tied connection of the row of fastener elements and the stability of their position are not endangered. Prior to the insertion of a weft thread of the tape, the warp threads are moved into the interior of the generated conical path produced by the fastener-element that is passed round a shaft, and the warp threads are thereby moved through the plane in which the weft thread of the tape is inserted, these warp
- 45
50
55
60
65
70
75
80
- Since the row of fastener elements is formed by a single fastener element which

(13)

threads produce the decisive additional connection between the row of fastener elements that has been formed and the weft thread of the tape, which thread likewise extends through the generated conical path around which the fastener-element is moved in the manner of a warp thread, and the weft thread of the carrier tape is thus inserted within the turns of the row of fastener elements that has been formed. Because the warp threads are held at a distance outside the generated conical path, when the fastener-element is moved, the warp threads always extend on the outside of the limbs of the row of fastener elements, so that not only is an ideal securing function achieved, but a particularly stable position of the row of fastener elements on the woven fabric of the tape, since the warp threads pass round the limbs of the elements between their aforementioned points of intersection with the weft thread of the tape, and fix the location of the individual limbs of the fastener elements in relation to the woven fabric of the tape. The element forming the fastener is termed "a warp thread" in its relationship to the woven fabric of the tape since, as mentioned above, on passing round and along the generated conical path it extends through the plane in which the weft thread of the tape is inserted, so that as this happens a shed consisting of the fastener-element is formed. On the other hand, if, in relation to the warp threads, this fastener-element, in co-operation with the individual insertions of the weft thread of the tape, performs the function of a "weft" then as mentioned above, the warp threads always extend on the outside of the limbs of the elements and in a direction opposite thereto of the tape weft insertions. Instead, the weft and warp character of the fastener-element is achieved automatically as it moves along and around the generated conical path during movement in the various segments of the generated conical path. This alteration in the travel of the fastener element leads to a particularly firm and positionally stable tying-in of the row of fastener elements.

This tying-in becomes still more intensive if two groups of such warp threads, operating in a mirror-image arrangement, are advanced on two diametrically opposite sides of the generated conical path produced, each group being introduced into the interior of the generated conical path from opposite sides of the weft insertion plan. By means of these oppositely extending warp threads the row of fastener elements are as it were tied on to the woven fabric. However, particularly effective stabilization of the position of the row of fastener elements is achieved if a stuffer thread, which is alternately moved with the one and then the other of the two

groups of warp threads through the plane in which the weft thread of the tape is inserted, is passed into the interior of the generated conical path described by the fastener-element, since then the "tying points" of the two groups of warp threads are disposed above such stuffer thread in the one case and below it in the other. In addition to this increase in the positional stability of the row of fastener elements, the stuffer thread passes between the limbs of the formed row of fastener elements and the predetermined distance between each pair of superposed element limbs is maintained in the individual turns.

In this arrangement it is advantageous to form the stuffer thread from a plurality of stuffer threads which are moved parallel to each other, and to provide one or more of the warp threads of both groups in the vertical plane between each pair of adjacent stuffer threads, since in this way the positions of the individual warp threads within the limbs of the fastener elements are accurately secured in position. This is of particular importance as regards the innermost warp thread overlying the limbs of the fastener elements, this thread facing the rear arcuate portions of the elements of the finished row; if a last thread of the stuffer thread is arranged between this innermost warp thread and the rear arcuate portions of the fastener elements and the undesirable presence of warp threads in the zone of the rear arcuate parts of the fastener elements is precluded.

According to the present invention in another aspect there is provided apparatus for carrying out the method, comprising a rotatably driven shedding rotor having a guide for the fastener element to form the generated conical path and in the zone of the axis of the rotor an element guiding mandrel having one end fixed in said zone, shed forming heald frames for forming a shed for the warp threads, and a weft picking means that can be moved through the shed, the heald frames for the warp threads which merely cover the link portions of the fastener element consisting of longitudinally movable half healds provided with frontal passage eyelets for the warp threads, the half healds being arranged on the side of the rotor facing the weft picking means and the working extent of their longitudinally directed shedding movement being arranged within a triangular area which is defined by a stop point of the fastener element which forms the first corner point of the triangle and by the two passage points of the revolving guide of the rotor with the picking plane of the weft picking means as second and third corner points of the triangle.

A particularly precise mode of operation is achieved if a fastener-element forming mandrel, which is secured in the zone of

the axis of a rotation of the rotor, is bifurcated to form two arms which enclose between them the operating zone of the half healds, since this enables the required width of winding of the finished row of fastener elements and the position of the various threads moving along at that point to be precisely maintained. This control of the travel of the threads is still further increased if the two arms of the mandrel are each disposed on opposite sides of the operating plane of the weft-thread insertion means.

Some embodiments of the invention will now be described, by way of examples, with reference to the accompanying drawings, in which:—

Figure 1 is an enlarged perspective view, not true-to-scale, of a slide fastener stringer tape produced in accordance with the invention.

Figures 2 and 3 are diagrammatic cross-sections through this slide fastener stringer tape taken along the lines II—II and III—III respectively of Figure 1,

Figure 4 is a further cross-sectional view through another form of slide fastener stringer tape,

Figure 5 is a diagrammatic longitudinal section through the zone of the row of elements of the slide fastener stringer tape of Figure 1 and taken along the line V—V of that Figure,

Figure 6 is a corresponding longitudinal section through a further form of slide fastener stringer tape,

Figures 7a to 10a are diagrammatic plan views of the slide fastener stringer tape shown in Figures 1 and 5 in the zone where it is being woven and in four different working positions of the various threads,

Figures 7b to 10b are views, seen in the direction of the warp thread, of the position of the various threads and in the various working positions seen in the associated Figures 7a to 10a and shown in cross-sectional view, at the weaving point, on the lines VIIb—VIIb to Xb—Xb of those Figures,

Figures 11a to 14a are diagrammatic plan views, corresponding to the plan views of Figures 7a to 10a, of the working positions of the various threads during the production of another form of slide fastener stringer tape having twice the number of weft insertions per turn of the row of fastener elements, this slide fastener stringer tape being shown in longitudinal section in Figure 6,

Figures 11b to 14b are again corresponding cross-sectional views through the position of the various threads at the weaving point and for the associated working positions, these sections being seen on the lines XIIb—XIIb to XIVb—XIVb of the respective plan views,

Figure 15 is a diagrammatic side view of

an apparatus for producing a slide fastener stringer tape of the kind shown in Figure 1, only the most important components being shown,

Figure 16 is a plan view, partly in section, of the apparatus taken along the lines XVIa—XVIa and XVIIb—XVIIb of Figure 15,

Figure 17 is a corresponding plan view of a modified form of the apparatus of the invention,

Figure 18 shows, on a larger scale than that of the preceding illustrations, a plan view of the rear part of a further form of construction of the apparatus of the invention, and

Figures 19 and 20 are a side view and plan view respectively of the threads in the weaving zone of a last form of construction of the apparatus of the invention for producing a slide fastener stringer tape, the cross-section of which is shown in Figure 4 and is drawn on the line IV—IV of Figure 20.

A first embodiment of slide fastener stringer tape 10, shown in Figures 1, 2, 3 and 5, consists of a stringer tape part 25 used for attaching the slide fastener stringer tape 10 to an article of clothing or the like, and of a marginal part 13, in which, during the weaving of the stringer tape 10, a fastener-element 15 forms a row 14 of fastener elements as a result of there being imparted, to said element 15, coiling movements to be described in detail hereinafter. Warp threads 11 extend in the longitudinal direction of the weave in the stringer tape part 25. These warp threads 11 co-operate with transversely extending weft insertions 34, 34¹ of a weft thread 12 which however extends not only in the stringer-tape part 25 but also in the marginal part 13 of the slide fastener stringer tape 10. Since, as shown in the plan view of the apparatus seen in Figure 16, the weft thread 12 is inserted into the woven fabric by a weft-inserting needle 17 at the side of the row 14 of fastener elements, each of the weft insertions 34, 34¹ consists of a looped double thread which, as shown by the plan views of the woven fabric in the various stages of weaving seen in Figures 7a to 10a, forms, at the opposite selvage 35 of the woven fabric, loops 36, 36¹ which are secured, e.g. by knitting these loops 36, 36¹ within each other to form a selvage, as seen from Figures 7a to 10a. It would of course also be possible to insert the weft thread 12 as a single thread by means of a weft shuttle passed backwards and forwards through the woven fabric.

The fastener-element 15, made of a deformable filament of plastics material, forms the row 14 of fastener elements as a result of its travel along a helical path. As seen in Figures 1 to 3, the fastener-element 15

produces, during each helical turn, element loops 20 which project beyond the forward edge of the marginal part 13 and which have coupling faces 21 which, when the slide fastener is closed, engage complementary coupling faces of another stringer tape of the slide fastener. These coupling faces 21 are produced at the required places before the fastener-element 15 is woven in. Positioned on the opposite side of the row 14 of fastener elements are rear arcuate portions 26 of the fastener-element 15 which are free from any threads of the weave and which, particularly as shown in Figure 1, have substantially the same helical pitch. These element loops 20 and arcuate positions 26 of the fastener-element 15 are in each case interconnected by limbs 27, 28 which are superposed substantially vertically in pairs and extend parallel to the plane 32 of the stringer tape part 25, which plane 32 is indicated by a dash-and-dot line in each of Figures 2 and 3. The row 14 of fastener elements could also be formed by turns of a looped thread whereby likewise projecting loops 20 of the elements and limbs 27, 28 of the elements are formed, but here the rear arcuate portions do not serve to connect an upper limb 27 with a following lower limb 28, but alternately connect two adjacent upper limbs 27 and lower limbs 28 to each other. Apart from this difference, the remaining description also applies to such slide fastener. In the longitudinal direction of the row 14 of fastener elements and between the superposed pairs of limbs 27, 28, there extends a stuffer warp thread 60, and the weft insertions 34, 34¹ of the weft thread 12 alternately pass over and under the top and bottom sides of the stuffer warp thread 60. Furthermore, warp threads 18, 19 extend in the warp direction in the marginal zone 13 of the woven fabric. The warp threads 18 extend exclusively above the upper limbs 27 of the elements while the warp threads 19 extend exclusively below the lower limbs 28. In the gaps between two adjacent pairs of element limbs 27, 28, each of these warp threads 18, 19 is woven with the weft insertions 34, 34¹ of the weft thread 12, the warp threads 19 in each case being passed over a weft-thread insertion 34, 34¹, whereas each of the warp threads 18 is in each case passed below the weft insertions. The warp threads 18, 19 are thus woven to form mirror images of each other. Since the warp threads 18 and 19 are arranged respectively above and below the weft thread insertions 34, 34¹, weaving-in occurs only in co-operation with the limbs 27, 28 of the elements forming the row 14, where the warp threads 18, 19 are in each case passed round on the outside. This co-operation between the transverse limbs 27, 28 of the fastener element

and the weft insertions 34, 34¹ on the one hand and the longitudinally extending warp threads 18, 19 and the stuffer warp thread 60 on the other results in an ideal weaving-in arrangement whereby the distances between the limbs of the fastener elements are determined, as seen in Figure 5. When the warp threads 18, 19 are woven-in with the weft-thread insertions 34, 34¹ and in the gaps between the pairs 27, 28 of limbs, the warp threads engage around each individual helical turn of the row 14 of fastener elements so that not only axial displacement is prevented but also radial swinging movement of the row 14 of elements since the elements are embraced in pairs. In this arrangement the stuffer warp thread 60 fills the gap between associated pairs of limbs 27, 28, so that the level of the row 14 of elements is precisely determined. For reasons of greater clarity, the stuffer warp thread 60 is not drawn true-to-scale in Figure 5, but is shown as being smaller than it actually is.

As already mentioned, the rear arcuate portions 26 of the row 14 of the elements of the slide fastener stringer tape 10 according to the invention are completely free of weft threads as well as warp threads as shown not only in Figures 2 and 3 but also in Figure 1. The row 14 of fastener elements is raised on one side from the plane 32 of the stringer tape part 25 so that a good guide surface for a fastener slider (not shown) is created. The weft insertions 34, 34¹ of the stringer tape are woven with the two groups of warp threads 18, 19 in a mirror-image arrangement, and these points 37, 37¹ of weaving alternate above and below the stuffer warp thread 60. In this slide fastener stringer tape 10, only one single weft-thread insertion 34, 34¹ forms a complete helical turn which encompasses a pair of element limbs 27, 28. However, other forms of weaving are possible without departing from the scope of the invention as defined in the appended claims; one of these other forms is shown for example in the longitudinal sectional view of Figure 6, where a different embodiment of a slide fastener stringer tape 10¹ is illustrated.

The slide fastener stringer tape 10¹ differs from the one previously described mainly in that a total of two weft insertions 38, 39 and 38¹, 39¹ are made in the course of a complete helical pitch where corresponding limbs 27, 28 of the fastener elements are produced, so that the fabric of the stringer tape part 25 has twice the density of weft threads. As regards the stuffer warp thread 60 running in the interior of the elements, the contact zones 37, 37¹ of the warp threads 18 and 19, passed respectively above and below, extend alternately twice above, at 37¹, and twice below, at 37, the stuffer warp thread 60. As shown in Figure 6, a

particularly stable tying-in of the row of fastener elements is achieved since two such contact points of the weft insertions are disposed between each two adjacent upper limbs 27 and 28 of the elements, namely an upper contact point 37¹ and a lower contact point 37 for the upper limbs 27 of the elements in each case, and, in the case of the lower limbs 28 two upper engagement points 37¹, 37¹ alternating with two lower ones 37, 37. In this slide fastener stringer tape 10¹, a total of four weft insertions 38, 39 and 38¹, 39¹ is involved in the tying system in the zone of the row of fastener elements.

The tying arrangement could also be varied by for example using only one group of warp threads 18 in the slide fastener stringer tape 10, the contact points then however being disposed exclusively below the stuffer warp thread 60 as shown at 37, since all the weft insertions 34 are passed through only below the stuffer warp thread 60. It would also be possible for not all of the warp threads to contact each weft insertion; instead it would suffice if only some of the warp threads of a group were passed through the gap between each two adjacent limbs 27, 27 and 28, 28 of the fastener elements and contact a weft insertion disposed therebetween, but within a tying arrangement, each warp thread 18, 19 is passed once around one such weft insertion in the direction opposite to that of its path on the limbs of the elements, during at least one operating stage.

A woven slide fastener stringer tape of this kind can be produced by means of an apparatus, the most important components of which are shown in detail in Figures 15 and 16. To permit passage of the initially mentioned weft inserting needle 17, shown in side view in Figure 15 and in plan view in Figure 16, the warp threads 11 of the stringer tape part 25, the fastener-element thread 15 and the two groups of warp threads 18, 19 must be spread out to form a suitable shed which is shown in side view in Figure 15. In the present case normal heald shafts 22, 23 serve as the means for shedding the warp threads 11 of the stringer tape part 25. The number of these shafts will depend upon the kind of weave required, and they have healds 24, provided at the middle with guide eyes for passing the warp threads 11 of the stringer tape through. The control lever system for moving these shafts 22, 23 in the direction indicated by the arrow 29 is of a standard design and is not therefore illustrated. To the rear of the heald shafts 22, 23 are located the means for shedding the warp threads 18, 19, which means take the form of half healds 41, 42 of the required number which each have at their ends eyes 44 through which one of these warp threads 18, 19 passes. These

half healds are moved up and down in the direction of the arrow 45 in rhythm with the weaving operation by means of a known control lever system, likewise not illustrated, and during such movement the half healds pass through the working plane 49 of the weft-insertion needles 17, shown by a dot-and-dash line in Figure 15. This movement through the plane 49 has just taken place in the stage illustrated in Figure 15, since the half healds 42 for the lower warp threads 19 normally located in the lower part of the shed below the operating plane 49 through the middle of the shed, have just been raised into the upper part of the shed in Figure 15, whereas conversely, the half healds 41 for the warp threads 18 which are moved downwards, are moved through the operating plane 49 into the lower part of the shed, in a mirror-image arrangement. The warp threads 18, 19 are drawn from supply bobbins, not shown, and are guided in the weft direction as indicated by the arrow 50 around two guide rolls 48, 48¹ spaced from each other in the vertical direction.

To the rear of these half healds 41, 42 is located a driven rotor 47 which takes the form of a flat circular disc-like wheel. As seen in Figure 16, the rotor 47 is disposed diagonally to the warp direction 50 so that on that side facing the weft-insertion means 17 there is provided space in front of the rotor 47 for the half healds 41, 42. The rotor 47 is accommodated in an annular supporting housing 46 which has an internal channel in which the rotor 47 runs. This can be best seen from the sectional illustration in Figure 16 where the rotor 47 is shown in section taken along the line XVIIb of Figure 15, but in a position rotated therefrom. As shown in Figure 15, the rotor 47 has an opening 56 near its edge for guiding the fastener-element 15. In Figure 16 this opening is shown in a substantially horizontal position 56¹. Around its periphery the rotor 47 has teeth 51 which mesh with a toothed wheel 52 which is driven by a shaft 53 in the direction of the arrow 54 so that rotation is imparted to the rotor disc 47 in the direction indicated by the arrow 43. The mounting and the drive motor for the shaft 53 and the means for securing the support housing 46 are omitted from the drawings for the sake of clarity. The diameter and vertical position of the rotor 47 are such that the fastener-element thread 15 is passed from the upper part of the opened shed and then into the lower part of the shed upon further rotation.

The rotor 47 is provided with a central insert 55 which is stationary when the rotor turns in the direction of arrow 43. This insert 55 serves firstly for applying one end 31 of an element-forming mandrel 16 which is arranged always to rest on one side of the

17
aforementioned operating plane 49 of the weft-insertion means 17 i.e. in the present case below this plane 49, whereas the other free discharge end 33 of the mandrel 16 extends some distance into the interior of the row 14 of fastener elements as shown in Figures 15 and 16.

The insert 55 also has a hole 59 through which passes the stuffer warp thread 60 which is drawn from a supply bobbin 67 disposed to the rear of the rotor 47. The supply bobbin 67 is mounted on a hollow shaft 69 which has an axial bore and forms part of a rotating means 40 to be described later. The fastener-element 15 is threaded through the axial bore of the hollow shaft 69 before it reaches the hole 56 in the rotor 47. The supply reel for the fastener-element 15 is located farther to the rear of this rotating means 40 and is therefore not shown in the drawings. The threads advanced in the 19, the fastener-element 15 and the stuffer warp direction 50, i.e. the warp threads 18, warp thread 60, as well as the warp threads 11 of the stringer tape part are beaten up at the fell 57 of the fabric by a reed 30 after each weft thread 12 has been inserted and after completion of the shedding, while the reed 30 is travelling in the direction indicated by the arrow 58 from its solid-line position as shown in the drawing to the position 30' shown in dot-and-dash lines. During weaving, that portion of the fastener-element 15 located between the fell 57 and the rotor 47 executes a movement along a generated conical path about the mandrel 16 and about the stuffer warp thread 60. The base circle of this conical path is determined by the circular movement, in the direction of the arrow 43, of the hole 56 in the rotor 47. The apex of the cone is located at the fell 57 of the fastener-element 15, at the point where the row 14 of fastener elements is created.

The operating zone 49 (Figure 15) for the upward and downward movement 45 of the half healds 41, 42 is determined by this conical path as shown in more detail in Figure 16. This operating zone must lie within a triangular area which results from the insertion of the aforementioned conical path and the above-mentioned operating zone 49 of the weft-inserting means 17. In Figure 16 can be seen the two other corner points of the triangular area which forms the possible working zone for the longitudinal movement of the half healds 41, 42, since the section through the rotor 47 shown in Figure 16 lies approximately in this operating zone 49 of the weft-inserting needle 17. One of the corner points of the triangle is determined by one of the lateral positions i.e. 56' of the guide eye for the fastener-element 15 in the rotor 47, whereas the other corner point of the triangle is

determined by the diametrically opposite position 15' of the fastener-element 15 where the guide eye is in the position designated 56'' in Figure 16. The half healds 41, 42, of which more than the four shown can of course be provided if necessary, operate in this triangular area 57, 56', 56''. In the case of a slide fastener stringer tape which is intended for use on articles of clothing and which has the normal width of the finished row 14 of fastener elements, eight such half healds will be provided for eight warp threads 18, 19. When the stuffer warp thread 60 is disposed centrally in the row of fastener-elements, one half of the half healds 41, 42 is advantageously disposed on each side thereof as will be seen from Figure 16, the element-shaping mandrel 16 also extending on both sides of said stuffer warp thread 60.

Upon rotation of the rotor 47 and because of the movement of the fastener-element 15 along a conical path, the required turns about the element-shaping mandrel 16 and the stuffer warp thread 60 in fact occur in the zone of the fell 57, but when the motor turns in the direction 43 the fastener-element 15 also moves along a conical path, inverted in relation thereto, on the rear side of the rotor 47, so that there would likewise occur undesirable looping of the fastener-element 15 in the opposite direction around the stuffer warp thread 60 guided through the stationary hole 59 in the insert 55 of the rotor 47, if steps were not taken to counter this. This undesirable looping at the rear side is compensated by the rotating means 40. This compensation is achieved by means of an off-winding rod 70 which is fitted to the hollow shaft 69 of the rotating means 40 and which, as shown in Figure 15, contains a hole 72 which determines the point at which the stuffer warp thread 60 runs off the supply roll 67. Instead of or in addition to a bobbin brake, the brake spring 76 of which is shown, a toothed locking wheel 65 is coupled with the supply bobbin 67, and this wheel 65 is released at the correct moment by components mentioned below and shown in Figure 15, so that a further portion of the stuffer warp thread 60, corresponding to the amount dealt with at the fell 57, is released. The stuffer warp thread 60 passes through a further eye 73 which is loaded by a tension spring 66, one end of which is fitted to the off-winding rod 70; longitudinal displacement of this eye 73 serves to store a short portion of the stuffer warp thread 60 on the off-winding rod 70. Also secured to this rod 70 is a pivot 74 which carries an angled lever 75 one end of which carries a pawl 77, normally engaged in the locking wheel 65 since a return spring 78 engages the other end of the angled lever 75. Also linked to this end of

the angled lever 75 is a lever system 79 which the eye 73 strikes when, after the stored length of stuffer warp thread 60 has been used up, its tension spring 66 is at maximum tension. The angled lever 75 is turned by way of the lever system 79 against the action of the return spring 78, and the pawl 77 is thus lifted from the locking wheel 65 so that the supply bobbin 67 can turn freely and releases thread material. As this happens, the tension spring 66 pulls the eye 73 back again so that the pawl 77 is then returned to its locking position on the locking wheel 65 by the action of the return spring 78.

The above-mentioned compensation of the unrequired looping between the fastener-element 15 and the stuffer warp thread 60 to the rear of the rotor 47 is achieved in that the off-winding rod 70 rotates with the hollow shaft 69 in the direction indicated by the arrow 68, this rotary movement occurring synchronously with the movement of the rotor 47 in the direction 43. This results in a circular movement, in the direction of the arrow 71, of the stuffer warp thread 60 to the rear of the rotor 47, which movement prevents undesirable twisting at this point between the stuffer warp thread 60 and the fastener-element 15.

Due to the position of its guide hole 59 in the rotor insert 55, the stuffer warp thread 60 is normally disposed in the lower part of the shed below the plane 69 in which the weft-inserting needle 17 is inserted and where, as shown in Figure 15, the element-shaping mandrel 16 also always extends. Accordingly, as shown in Figure 5, the weft insertions 34¹ extend above the stuffer warp thread 60. To enable the stuffer warp thread 60 to pass to the required positions in the woven fabric above the weft insertions 34, a pusher 62 is disposed in the zone in which the shed opens, which pusher 62 is raised in the direction indicated by the arrow 63 in Figure 15 by a conventional control lever system, not illustrated, since then a notch 64 in one of the end faces of the pusher 62 engages the stuffer warp thread 60, extending in alignment therewith, and raises it into the upper part of the shed.

The weaving operation for producing the first form of woven slide fastener stringer tape 10 in accordance with Figures 1, 2, 3 and 5 will now be described in greater detail by reference to four working positions illustrated in Figures 7a to 10b.

In the first working position as shown in Figures 7a and 7b, a first weft insertion 34 of the weft thread 12 has just taken place from the side at which the row of fastener elements is located and in the direction indicated by the arrow 80. As shown in Figure 7b, the warp threads 11 in the stringer tape part 25 are shed in accordance with the

weave desired and a shed is also formed in the marginal part 13 to enable the weft thread 34 to pass through. As seen from the cross-sectional view in Figure 7b, the element-shaping mandrel 16 is always located in the lower part of the shed, and this also applies as regards all further working positions. The circle 81, shown as a dash-and-dot line is intended to indicate the circular movement of the fastener-element 15 illustrated in Figure 7b when this moves along the conical path that it generates. In the illustrated working position 7b the fastener-element 15, as indicated, is also located in the upper part of the shed above the weft insertion 34. If, for the purpose of indicating more precisely the particular location of the fastener-element 15 in the various rotary positions, these positions are related to the numbers on a clock, then the fastener-element 15 is at approximately two o'clock in Figure 7b. The cross-section of the stuffer warp thread 60, indicated by cross-hatching, shows that, by means of the above-mentioned pusher 62, the stuffer warp thread 60 has been moved into the upper part of the shed above the weft 34. The locations reached by the warp threads as a result of the shedding movement of the half healds 41 and 42 respectively are indicated by the arrows 41¹ and 42¹. It will be seen that the upper group of warp threads 18 are moved below the weft 34 into the lower part of the shed, whereas the lower group of warp threads 19 have been moved, in a mirror-image arrangement, through the insertion plane and into the upper part of the shed, above the weft 34. This position of the various threads will also be seen from the plan view shown in Figure 7a. In this operating stage a rear arcuate portion 26 of an element 15, which is above the weft, is just being formed along the row 14 of fastener elements.

In the two working positions shown in Figures 8a and 8b, the fastener-element 15 has moved on in the direction of the arrow 43 through more than 90° along its conical path, represented by the dash-and-dot circle 81, so that the element 15 has just reached the six o'clock position. The weft insertion 34 has been completed by the insertion needle, designated by the numeral 17 in Figure 16, and the needle 17 has been completely withdrawn from the shed. While this is happening, the loop end 36 of the weft insertion 34 is held fast and is passed through a preceding loop 36¹ to knit the selvage. The element-shaping mandrel 16 occupies its same position on the under side of the weft-thread insertion plan 49, here shown by a dash-and-dot line, i.e. said mandrel is below this plane. The shed of warp threads 11 in the zone of the stringer tape part 25 has closed again. The pusher 62 has

released the stuffer warp thread 60, so that the latter is located in its normal position below the weft-thread insertion plane 49 in which it remains during the subsequent steps of the operation as shown in Figures 9a, 9b and 10a and 10b.

While, as shown by the arrow 41¹, the warp threads 18 remain within the circle 81 of the conical path around which the fastener-element 15 passes, and as illustrated, they occupy a position that is practically unchanged from the preceding operating position of Figure 7b, the arrow 42¹ in Figure 8b shows that the warp threads 19 have been moved out of the conical path and are located at an adequate distance 82 from the fastener-element 15, the warp threads 18 located within the cone also being disposed at a sufficient distance 83 from the fastener-element 15.

Thus, when the fastener-element 15 is located on that side of the conical path 81 that faces the warp threads 19, the two sheets of warp threads 18, 19 are spread out in the manner of a shed so that there is here formed a passage 83, 82 for unimpeded movement of the fastener-element 15. In this stage of movement the fastener-element 15 forms the lower limb 28 for the next turn in the row 14 of fastener elements, as shown in Figure 8a.

In the operating position shown in Figures 9a and 9b, the fastener-element 15 has moved on through 180°, so that it has reached the twelve o'clock position. In the meantime, the stuffer warp thread 60 and the warp threads 11 have not changed their position, and the element-shaping mandrel 16 remains below the insertion plane 49, again shown by a dash-and-dot line in Figure 9b. As indicated by the arrows 41¹, 42¹ however the position of the warp threads 18, 19 has been reversed, so that the warp threads 18 are now disposed below the conical path 81 at a distance 82¹, whereas conversely the other group of covering threads 19 is disposed on the other side and preferably already occupies that position within the conical path 81 that is required for the next operating position to be described by reference to Figures 10a and 10b. Thus, a shed-like passage 82¹, 83¹ is again created by the upper group of warp threads 18 to permit the fastener-element 15 to move on in an unrestricted manner. Prior to this, the loop 20 provided with the actual coupling faces, will have been formed in the row of fastener elements on the foremost helical turn, and in this operating position as shown in Figure 9b the upper limb 27 of an element will also have been created, as can be seen from Figure 9a.

In the last operating position as shown in Figures 10a and 10b, the fastener-element 15 moves on through about 60° in the direc-

tion indicated by the arrow 43, so that the two o'clock position is again reached. The fastener-element 15 is located in the upper part of the shed, the threads of which are now again shed for permitting the next weft insertion 34¹, which can be seen from the position of the warp threads 11 in the stringer tape part 25. This time the stuffer warp thread 60 is located in the lower part of the shed together with the element-shaping mandrel 16 within the space enclosed by the conical path as indicated by the dash-and-dot circle 81. Within this space there are now also located the warp threads 18, 19, and whereas, as indicated by the arrows 42¹, the lower warp threads 19 occupy the position visible from the preceding operating position, the warp threads 18 of the upper group have been moved through the insertion plane to a position below the weft insertion 34¹. A rear arcuate element portion 26 for the next helical turn of the row 14 is then formed again. As shown in Figure 10a, as this happens, the weft loop 36¹ is again drawn through the preceding loop 36. This operating position corresponds to the first position described in connection with Figures 7a and 7b but with the difference that here the stuffer warp thread 60 is located in a lower position. The stuffer warp thread 60 is moved in the same direction as the warp threads 19 during the weft insertion 34, whereas during the following weft insertion 34¹ the stuffer warp thread 60 moves in the same direction as the other group of warp threads 18, as already explained in connection with Figure 5.

As can be seen by comparing Figures 8b and 9b on the one hand with Figures 7b and 10b on the other, the two passages 82, 83, and 82¹, 83¹ respectively extend in the direction parallel to the spread of the shed of the warp threads 11 for making the weft insertions 34, 34¹, but are offset vertically therefrom and from each other, and whereas the weft insertion 34, 34¹ takes place approximately in the zone of the longitudinal central axis of the conical path, the passages are created at the topmost and lowermost positions respectively along the circular path of movement. Furthermore, it will be seen from the sequence of the above-mentioned operating steps, that the opening of the shed of warp threads and the formation of one or other of the passages 82, 83 and 82¹, 83¹ take place one after the other chronologically.

In a similar way, the weaving process for producing a slide fastener 10¹ using corresponding operating steps is illustrated in Figures 11a to 14b, the fabric also being shown in longitudinal section in Figure 6. This slide fastener 10¹ is distinguished by a double density of weft insertions. The same reference numerals as those used in the first

example are employed for designating similar parts, so that the same description applies as regards these similar parts and only the special features of this further example will be described in detail.

In the first operating position seen in Figures 11a and 11b, the fastener-element 15 is in the six o'clock position, the previously mentioned passage 82, 83 having been formed between the warp threads 18, 19. Here again, the element-shaping mandrel 16 is located below the plane 49 in which the weft thread is inserted and where the stuffer warp thread 60 is also held during the four operating positions now to be described. As seen from Figure 11a, the lower limb 28 of an element is formed as indicated at the point A in Figure 6.

While the fastener-element 15 was being moved through less than 90° along the circle 81 of the conical path in the direction indicated by the arrow 43, a first weft insertion 38 is made, while the fastener-element 15 is still in the lower part of the shed in the eight o'clock position. While the warp threads 18 remain in the previous position below the weft-insertion plane, the other warp threads 19 will have moved through the insertion plane into the interior of the conical path so that they are now located above the weft insertion 38. As shown in Figure 12a, the element loop 20 is formed around the shaping mandrel 16 during this stage.

In the operating position shown in Figures 13a and 13b, the upper passage 82¹, 83¹ has been formed for the fastener-element 15 in the zone of its twelve o'clock position, the warp threads 18 again being disposed at a distance outside the conical path. As seen in Figure 13a, the upper limb 27 of an element is formed as this happens, and is shown at B in the longitudinal section illustrated in Figure 6.

In the fourth operating position shown in Figures 14a and 14b, the fastener-element 15 has moved along its circle 81 in the direction of the arrow 43 through approximately 60° and has reached approximately the two o'clock position so that it coincides with the warp threads 11 in the upper part of the shed, and the next weft insertion 39 can pass below it. The warp threads 18, 19 are again moved through the weft-insertion plane in a mirror-image arrangement, and are disposed on opposite sides of this weft insertion 39. During this phase of the movement of the fastener-element 15, a rear arcuate portion 26 is formed in the row 14 of fastener-elements as shown in Figure 14a.

Before the entire woven connection is completed within the marginal part of this slide fastener stringer tape 10¹, the four described operating positions involving the warp threads 18, 19 and the fastener-element 15 occur again, the next element limbs 27, 28, a

rear arcuate portion 26 and a loop 20 for the coupling being formed as can also be seen from the longitudinal section shown in Figure 6, but the position of the stuffer warp thread 60 is raised as regards the weft insertions 38¹, 39¹ that now take place, in accordance with the previously described second and fourth operating positions. For this purpose the stuffer warp thread 60 is held in the raised position above the weft-insertion plane 49 by means of its pusher 62 from the second up to and including the fourth subsequent working position, this not being illustrated. Complete woven connection in the marginal zone of the slide fastener 10¹ thus involves the mode of operation illustrated in Figures 11a to 14b being carried out twice, with a total of four weft insertions 38 to 39¹. Only then is the cycle repeated.

Figure 17 shows a plan view, similar to that of Figure 16, of another form of the apparatus. Where the components are unchanged, description thereof is the same as for Figure 16. The important difference resides in the fact that the element-shaping mandrel is bifurcated to provide two arms 16¹ and 16¹¹ which enclose the above-described working zone of the longitudinal movement of the half healds 41, 42. The two mandrel arms 16 and 16¹ converge in the direction of the fell 57 of the row 14 of fastener-elements, but a gap 84 remains between the ends 33¹ and 33¹¹ of the arms, which gap corresponds to the required internal width of the row 14 of fastener elements. In this way the elements are shaped more precisely and the elements are positioned in a more accurate manner. The two arms 16 and 16¹ of the element-shaping mandrel are of course located within the conical path generated by the fastener-element 15 as will be clearly seen from the diametrically drawn positions of the element 15 and its position 15¹¹ shown in dash-and-dot lines.

Figure 18 illustrates a modified form of the components disposed to the rear of a rotor 47. The warp threads 11 advanced in the warp direction 50 and the two groups of warp threads 18, 19 are shown in their positions, but the warp threads are omitted from the drawing in the zone of the guide rollers 48, 48¹ in order to make the drawing clearer. The supply bobbin 67 for a stuffer warp thread 60 is positioned to the rear of the rotor 47 in a space within the generated conical path which is formed by the portion of the element 15 that is fed to the guide eye 56 in the rotor 47. In principle, a rotating means for preventing undesirable twisting between the fastener-element 15 and the stuffer warp thread 60 can be dispensed with in this case. However, since in the present example the stuffer warp thread 60 does not consist of a single thread but of a plurality

(2)

of stuffer warp threads 61, 61¹, 61¹¹, which are wound side by side on a common supply bobbin 67, a special positioning device 90 is provided for preventing the individual stuffer warp threads 61, 61¹¹ from becoming twisted with each other when the supply bobbin 67 delivers this thread material during the weaving process. The positioning device 90 ensures that the point at which this thread material is pulled off remains in the illustrated position, this pull-off point taking the form of a slot 85 formed in a stationary bobbin case 86.

For this purpose the supply bobbin 67 is mounted by its spindle 87 in said case 86. A brake spring 76 surrounding the free end of the bobbin spindle 86 inhibits rotation of the supply bobbin 67 through a brake disc 88. A radial flange 89 is connected to the bobbin case 86, and this flange carries on its peripheral surface a ball and roller bearing 91 on which a race ring 92 runs with as little friction as possible and in synchronism with the rotor 47. The race ring 92, which has a toothed ring 93 at its outer periphery, is driven by a gear wheel 94 which is mounted on a drive shaft 95 and is caused to rotate by a motor, not illustrated. At its outer edge the race ring 92 has a bore 97 which extends parallel to its axis and through which is threaded the fastener-element 15 which is drawn from a supply roll, not illustrated, located to the rear of the supply bobbin 67 for the stuffer warp thread 60.

At the side of its toothed ring 93, the race ring 92 carries further ball and roller bearing units 98 and 99 which ensure that the race ring 92 runs, as free from friction as possible, in a two-part casing 96, which in shape resembles a pair of spectacles and which, as indicated at 100 is secured to the apparatus frame, not illustrated. The casing 96 has at a point along its periphery a radial slot 101 through which extends the gear wheel 94 that drives the race ring 92 and that meshes with the toothed ring 93. This ensures that the race ring 92 rotates while the outer casing 96 is held fast and that said ring does not entrain the bobbin case 86 disposed within it. In this way, the fastener-element 15 executes, in the zone of the supply bobbin 67, a circular movement in the direction indicated by the arrow 102 around the stationary bobbin case 86. The rear conical path generated by the fastener-element 15 is thus extended since because of this synchronized arrangement the bore 97 in the race ring 92 moves in alignment with the guide eye 56 in the rotor 47, so that after a half-turn of the rotor, the fastener-element 15 also moves from the solid-line position into the dash-and-dot position 15¹¹ on the rear side of the rotor.

The various stuffer warp threads 61, 61¹, 61¹¹, after leaving the run-off point in the

slot 85 in the bobbin case 86, are each passed through a corresponding bore 59, 59¹ or 59¹¹ in a suitably shaped rotor insert 55 before they reach the front side of the rotor 47. During this circular movement, the rotor insert 55 is stationary so that if necessary it may be connected to the likewise stationary bobbin case 86. The stuffer warp threads 61 to 61¹¹ move side by side in a horizontal plane at predetermined distances apart, in the zone of the element-shaping mandrel which in the present case is preferably bifurcated to form two arms 16¹ and 16¹¹ as previously explained in connection with the foregoing example of Figure 17.

The further path taken by these stuffer warp threads 61 to 61¹¹ in the zone of the weaving point can be seen from Figures 19 and 20 which show respectively a side view and plan view of the corresponding weaving point. The same reference numerals as in the first example seen in Figures 15 and 16 are used for designating similar components. The slide fastener stringer tape 10¹¹ produced in accordance with the example illustrated in Figures 19 and 20 is also shown in cross-section in Figure 4.

Referring to Figure 20, a pair of warp threads 18, 19, binding in opposite directions to each other, are arranged in each gap between stuffer warp threads 61 to 61¹¹ disposed at predetermined distances 103 apart, and as shown in Figure 4, there is positioned on the rear arcuate portions 26 of the row 14 of fastener-elements, the innermost stuffer warp thread 61¹¹ forwardly of which there is no further upper warp thread 18 that could slide over this rear arcuate portion 26 of an element. This arrangement ensures that the rear arcuate portions of the elements are kept free from threads for the purpose of guiding the fastener slider. In Figures 19 and 20, the stuffer warp threads 61 to 61¹¹, the fastener-element 15 and the warp threads 18 and 19 occupy a position as explained in detail in connection with the operating position shown in Figures 7a and 7b. The stuffer warp threads 61 to 61¹¹ are engaged by associated pushers 62, as shown in Figure 19 and each having a notch 63 at its end face, and are raised into the upper part of the shed and over the plane 49 in which the insertion needle 17 operates. For this purpose the various pushers 62 are mounted on a common holder 104 which will have been raised in the direction indicated by the arrow 63. At this stage in the movement a rear arcuate portion 26 of an element is just being formed as shown in Figure 20. The weft-insertion needle 17 is just moving, in the direction of the arrow 80 seen in Figure 20, into the formed shed and is executing a new weft insertion 34.

It should be noted that the two arms 16¹ and 16¹¹ of the mandrel, which embrace all

the stuffer warp threads 61 to 61¹¹ and all the warp threads 18 and 19, are disposed one on each side of the working plane 49, shown by a dash-and-dot line, of the weft-inserting needle 17. Whereas one arm 16¹ of the mandrel always extends above the working plane 49, the other arm 16¹¹ is kept below this plane 49. This leads to a particularly precise weaving-in of the various threads by each of the weft insertions 34, 34¹. Furthermore the required internal width of the turns of the row 14 of fastener elements is precisely maintained in correspondence with the distance 84 between the two arms 16¹ and 16¹¹ of the mandrel.

It will be seen from Figures 1, 7a to 10a and 20 that the row of fastener elements 14 which is disposed on one side of the stringer tape fabric and which, in Figures 2 and 3, stands proud of the plane 32 of the stringer tape part 25 on one side, and in Figure 4 on the other side, are engaged by each of the connecting portions 105 between successive weft insertions 34, 34¹ at the junction with the projecting loop 20 of each element, whereas the weft insertions 34, 34¹ run through below the fastener-element 15 in the zone of the rear arcuate portion 26 of each element. These connecting portions 105 thus contribute to the strength of the weave between the row of fastener-elements and the stringer tape fabric on account of this opposite course of the weft thread on the two longitudinal edges of the row 14 of fastener-elements. This also applies as regards the slide fastener stringer tape 10¹ of Figures 11a to 14b, for which dense weft insertions 38 and 39 are used and where corresponding connecting portions 105 extend over each of the limbs 28 of the elements.

The woven slide fastener stringer tapes described above form the subject of our co-pending United Kingdom Patent Application No. 27175/1974 (acceptance No. 1,449,581).

WHAT WE CLAIM IS:—

1. A method of producing a woven slide fastener stringer tape, in which a fastener element is advanced substantially in the direction of the warp and forms the individual links of a row of fastener elements by being wound around a fixed axis and moved around and along a generated conical path surrounding said axis, some of the warp threads being brought up to particularly cover the row of fastener elements, while the weft thread is picked transversely through said generated conical path and between the shed warp threads and is then beaten up onto the finished fabric of the tape, said warp threads which move along the conical zone of the generated conical path described by the fastener element engaging the upper and lower links of the row of fastener

elements, and said warp threads, while the fastener element is being moved along the generated conical path being kept as a distance outside the generated conical path, but at intervals in the weaving before the weft thread is picked transversely through the generated conical path are moved to the opposite side of the picking plane of the weft thread.

2. The method claimed in claim 1, in which the warp threads are in two groups which are shed one on each of two diametrically opposite sides of the conical path and which are shed into the conical path in a manner equal and opposite to one another.

3. The method claimed in claim 1 or claim 2, in which for the passage of the fastener element at least some of the warp threads are moved away from one another to form a shed on diametrically opposite sides of the conical path.

4. The method claimed in claim 3, in which the movement away from one another of the warp threads is parallel as regards direction, but is offset between the movement of the remaining warp threads of the tape.

5. The method claimed in any one of claims 1 to 4, in which in the interior of the generated conical path there is guided a stuffing thread which is moved rhythmically through the picking plane of the weft thread, and before picking the weft thread at least during a working phase in the weaving repeat of the warp threads, the inserted stuffing thread is passed through the picking plane in the opposite direction to the direction of movement of the warp threads.

6. The method claimed in claim 5, in which the stuffing thread is formed by several inserted threads which are guided in parallel side by side and in the gap between neighbouring inserted threads at least one warp thread is moved to and fro through the picking plane of the weft thread of the tape.

7. The method claimed in claim 6, in which all of the inserted threads are moved simultaneously and in the same direction as one another through the picking plane of the tape weft thread.

8. A method of producing a woven slide fastener stringer tape as claimed in claim 1, substantially as hereinbefore described with reference to the accompanying drawings.

9. Apparatus for carrying out the method claimed in any one of claims 1 to 8, comprising a rotatably driven shedding rotor having a guide for the fastener element to form the generated conical path and in the zone of the axis of the rotor an element guiding mandrel having one end fixed in said zone, shed forming heald frames for forming a shed for the warp threads, and a weft picking means that can be moved through



the stuffer warp threads 61 to 61¹¹ and all the warp threads 18 and 19, are disposed one on each side of the working plane 49, shown by a dash-and-dot line, of the weft-inserting needle 17. Whereas one arm 16¹ of the mandrel always extends above the working plane 49, the other arm 16¹¹ is kept below this plane 49. This leads to a particularly precise weaving-in of the various threads by each of the weft insertions 34, 34¹. Furthermore the required internal width of the turns of the row 14 of fastener elements is precisely maintained in correspondence with the distance 84 between the two arms 16¹ and 16¹¹ of the mandrel.

It will be seen from Figures 1, 7a to 10a and 20 that the row of fastener elements 14 which is disposed on one side of the stringer tape fabric and which, in Figures 2 and 3, stands proud of the plane 32 of the stringer tape part 25 on one side, and in Figure 4 on the other side, are engaged by each of the connecting portions 105 between successive weft insertions 34, 34¹ at the junction with the projecting loop 20 of each element, whereas the weft insertions 34, 34¹ run through below the fastener-element 15 in the zone of the rear arcuate portion 26 of each element. These connecting portions 105 thus contribute to the strength of the weave between the row of fastener-elements and the stringer tape fabric on account of this opposite course of the weft thread on the two longitudinal edges of the row 14 of fastener-elements. This also applies as regards the slide fastener stringer tape 10¹ of Figures 11a to 14b, for which dense weft insertions 38 and 39 are used and where corresponding connecting portions 105 extend over each of the limbs 28 of the elements.

The woven slide fastener stringer tapes described above form the subject of our co-pending United Kingdom Patent Application No. 27175/1974 (acceptance No. 1,449,581).

WHAT WE CLAIM IS:—

1. A method of producing a woven slide fastener stringer tape, in which a fastener element is advanced substantially in the direction of the warp and forms the individual links of a row of fastener elements by being wound around a fixed axis and moved around and along a generated conical path surrounding said axis, some of the warp threads being brought up to particularly cover the row of fastener elements, while the weft thread is picked transversely through said generated conical path and between the shed warp threads and is then beaten up onto the finished fabric of the tape, said warp threads which move along the conical zone of the generated conical path described by the fastener element engaging the upper and lower links of the row of fastener

elements, and said warp threads, while the fastener element is being moved along the generated conical path being kept as a distance outside the generated conical path, but at intervals in the weaving before the weft thread is picked transversely through the generated conical path are moved to the opposite side of the picking plane of the weft thread.

2. The method claimed in claim 1, in which the warp threads are in two groups which are shed one on each of two diametrically opposite sides of the conical path and which are shed into the conical path in a manner equal and opposite to one another.

3. The method claimed in claim 1 or claim 2, in which for the passage of the fastener element at least some of the warp threads are moved away from one another to form a shed on diametrically opposite sides of the conical path.

4. The method claimed in claim 3, in which the movement away from one another of the warp threads is parallel as regards direction, but is offset between the movement of the remaining warp threads of the tape.

5. The method claimed in any one of claims 1 to 4, in which in the interior of the generated conical path there is guided a stuffing thread which is moved rhythmically through the picking plane of the weft thread, and before picking the weft thread at least during a working phase in the weaving repeat of the warp threads, the inserted stuffing thread is passed through the picking plane in the opposite direction to the direction of movement of the warp threads.

6. The method claimed in claim 5, in which the stuffing thread is formed by several inserted threads which are guided in parallel side by side and in the gap between neighbouring inserted threads at least one warp thread is moved to and fro through the picking plane of the weft thread of the tape.

7. The method claimed in claim 6, in which all of the inserted threads are moved simultaneously and in the same direction as one another through the picking plane of the tape weft thread.

8. A method of producing a woven slide fastener stringer tape as claimed in claim 1, substantially as hereinbefore described with reference to the accompanying drawings.

9. Apparatus for carrying out the method claimed in any one of claims 1 to 8, comprising a rotatably driven shedding rotor having a guide for the fastener element to form the generated conical path and in the zone of the axis of the rotor an element guiding mandrel having one end fixed in said zone, shed forming heald frames for forming a shed for the warp threads, and a weft picking means that can be moved through



the shed, the heald frames for the warp threads which merely cover the link portions of the fastener element consisting of longitudinally movable half healds provided with frontal passage eyelets for the warp threads, the half healds being arranged on the side of the rotor facing the weft picking means and the working extent of their longitudinally directed shedding movement being arranged within a triangular area which is defined by a stop point of the fastener element which forms the first corner point of the triangle and by the two passage points of the revolving guide of the rotor with the picking plane of the weft picking means as second and third corner points of the triangle.

10. Apparatus as claimed in claim 9, in which the link forming mandrel is bifurcated to form two arms which enclose between them the working field of the shedding movement of the half healds and the free ends of the arms in the region of the stop point are spaced apart by a distance which governs the required inner width of the row of fastener elements.

11. Apparatus as claimed in claim 10, in which the fork-like branches are arranged on opposite sides of the working plane of the weft picking means.

12. Apparatus as claimed in any one of claims 9 to 11, having a non-rotating insert in the rotor, said insert carrying the mandrel and having a passage for an inserted stuffing strand which extends into the interior of the

turns of the finished row of fastener elements.

13. Apparatus as claimed in claim 12, in which the insert has a plurality of holes arranged side by side for the passage of a plurality of individual threads forming the stuffing strand and the holes are respectively aligned with a gap formed between the paths of movement of the half healds.

14. Apparatus as claimed in any one of claims 9 to 13, provided with a supply roll for the stuffing strand arranged upstream of the rotor in the direction of feed of the warp threads, and a supply coil located at a distance behind it for the fastener element, the supply roll for the stuffing strand being arranged in a space in front of the rotor, round which moves the portion of fastener element during the rotation of the rotor.

15. Apparatus as claimed in claim 14, including a revolving ring rotatably surrounding the supply roll and supporting it, and having a drilling for the passage of the fastener element, the ring being rotatably driven synchronously with the rotor.

16. Apparatus as claimed in claim 9, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

For the Applicants,
D. YOUNG & CO.,
Chartered Patent Agents,
9 & 10 Staple Inn,
London, WC1V 7RD.